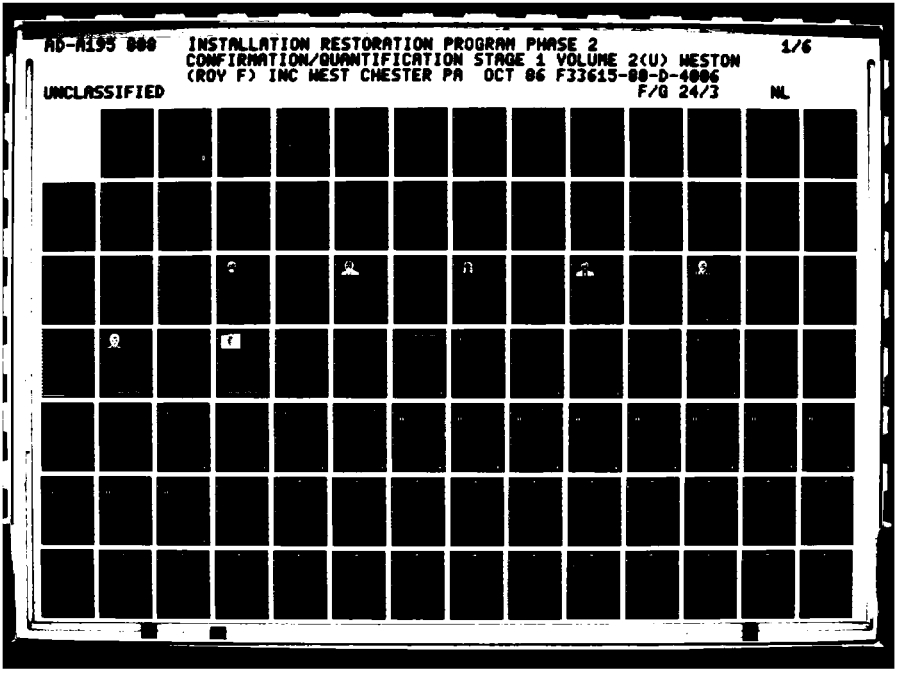
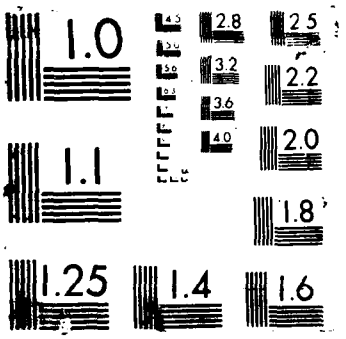
AD-A195 888 INSTALLATION RESTORATION PROGRAM PHASE 2 1/6
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-88-D-4006
UNCLASSIFIED F/G 24/3 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

AD-A195 808

DTIC FILE COPY

INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/QUANTIFICATION STAGE 1

VOLUME II

Selfridge Air National Guard Base
Macomb County, Michigan

Roy F. Weston, Inc.
West Chester, Pennsylvania 19380

OCTOBER, 1986

FINAL REPORT FOR PERIOD NOVEMBER 1984 TO OCTOBER 1986

Approved for Public Release; distribution is unlimited

DTIC
ELECTE
MAY 16 1988
S D
E

PREPARED FOR:

AIR NATIONAL GUARD SUPPORT CENTER
OFFICE OF THE AIR SURGEON (ANGSC/SGB)
ANDREWS AIR FORCE BASE, MARYLAND 20331-6008

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

88 5 2 098

INSTALLATION RESTORATION PROGRAM

PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

VOLUME II

FINAL REPORT

FOR

SELFRIDGE AIR NATIONAL GUARD BASE
MACOMB COUNTY, MICHIGAN

AIR NATIONAL GUARD SUPPORT CENTER
ANDREWS AIR FORCE BASE, MARYLAND 20331-6008

OCTOBER, 1986

PREPARED BY

ROY F. WESTON, INC.
WEST CHESTER, PENNSYLVANIA 19380

USAF CONTRACT NO: F33615-80-D-4006, DELIVERY ORDER: 49
CONTRACTOR CONTRACT NO: F33615-80-D-4006, DELIVERY ORDER 49

APPROVAL FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

USAFOEHL TECHNICAL PROGRAM MANAGER
CAPT. ROBART W. BAUER

USAF OCCUPATIONAL AND ENVIRONMENTAL
HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

APPENDIX A

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

Accession For	
NTIS GRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

QUALITY INSPECTED 4

APPENDIX A

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AF: Air Force

AFB: Air Force Base

AFESC: Air Force Engineering and Services Center

Al: Chemical symbol for aluminum

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ANGB: Air National Guard Base

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

AQUICLUDE: Poorly permeable formation that impedes groundwater movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes groundwater flow.

AROMATIC: Description of organic compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than nonaromatics.

ARTESIAN: Groundwater contained under hydrostatic pressure.

ASL: Above sea level

ASTM: American Society for Testing and Materials

AVGAS: Aviation gasoline

Ba: Chemical symbol for barium

Base: Selfridge ANGB

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by

microorganisms.

Bldg: Building

BLS: Below land surface

CA: Chemical symbol for cadmium.

CE: Civil Engineering

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

COD (Chemical Oxygen Demand): The oxygen equivalent of the organic matter in waters that can be oxidized chemically.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of groundwater.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired. There is no implication of any specific limits since the degree of permissible contamination depends on the intended end use or uses of the water.

Cr: Chemical symbol for chromium

CTTC: Chanute Technical Training Center

Cu: Chemical symbol for copper

DEQPPM: Defense Environmental Quality Program Policy Memorandum

DIP: The angle at which a stratum is inclined from the horizontal.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.
DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwater.

DOD: Department of Defense

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which groundwater flows.

DRIFT: All rock material in transport in glacier ice, all deposits made by ice, and all deposits made by glacier meltwater.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics. Dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid water discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EP: Extraction procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a 1 percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of groundwater as governed principally by the hydraulic gradient.

FLUVIAL: Pertaining to the landforms and deposits produced by river action.

FPTA: Fire Protection Training Area

FT/MIN: Feet per minute

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown organic compounds.

GLACIER: A mass of ice with definite lateral limits, with motion in a definite direction and origination from the compacting of snow by pressure.

GLACIAL TILL: Unsorted and unstratified drift consisting of

clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GPM: Gallons per minute

GROUNDWATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUNDWATER RESERVOIR: The earth materials and the intervening open spaces that contain groundwater.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and

animal nutrition in trace concentrations but which become toxic at higher concentrations.

HQ: Headquarters

HR: Hour

HWMF: Hazardous Waste Management Facility

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending on the arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

IN: Inches

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of groundwater or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

JP-4: Jet Propulsion Fuel Number Four, military jet fuel

LACUSTRINE: Pertaining to landforms on deposits produced by the growth and recession of lakes.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is

lens-shaped.

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

METALS: See "Heavy Metals"

MGD: Million gallons per day

MOGAS: Motor gasoline

MONITORING WELL: A well used to measure groundwater levels and to obtain samples.

MORAINE: Ridges of rock and earth debris around glaciers. A ridge-like accumulation of till with associated stratified drift built along the margin of a glacier.

UG/L: Micrograms per liter (equivalent to parts per billion in low density water).

UMHO/CM: Microhms per centimeter

MG/L: Milligrams per liter (equivalent to parts per million in low density water).

MGD: Million gallons per day

MS: Master of Science degree

MSL: Mean sea level

N: North

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

Ni: Chemical symbol for nickel.

No: Number

NPDES: National Pollutant Discharge Elimination System

OEHL: Occupational and Environmental Health Laboratory

O&G: Oil and grease

ORGANIC: Being, containing or relating to carbon compounds,

especially in which hydrogen is attached to carbon.

OUTWASH: Layered, washed and size-sorted deposits of sand and gravel laid down by streams coming off a melting glacier.

Pb: Chemical symbol for lead

%: Percent

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERENNIAL STREAM: Streams that flow throughout the year and from source to mouth.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

PERSISTANCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

P.G.: Registered Professional Geologist

P.HG.: Registered Professional Hydrogeologist

pH: Negative logarithm of hydrogen ion concentration

Ph.D.: Doctor of Philosophy degree

PHENOLS: Class of organic chemicals characterized by hydroxyl groups attached to an aromatic ring. May be further classified into monchydric, dihydric and poly hydric depending upon the number of hydroxyl groups.

PL: Public Law

POL: Petroleum, oils and lubricants

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIOMETRIC SURFACE: The imaginary surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

PPB: Parts per billion by weight (equivalent to ug/L in low density water).

PPM: Parts per million by weight (equivalent to mg/l in low density water).

PRECIPITATION: Rainfall

QA/QC: Quality assurance/quality control

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the groundwater system by natural or artificial processes.

RIPARIAN: Living or located on a riverbank

SANITARY LANDFILL: A land disposal site using an engineered method of disposing of solid wastes on land in a way that minimizes environmental hazards.
SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SCS: U.S. Department of Agriculture Soil Conservation Service

SLUDGE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or

agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SP: Spill area

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage treatment plant

TCE: Trichloroethylene

TILL: Unsorted, unstratified drift; may contain particles ranging in size from clay to boulders.

TOC (Total organic carbon): The total organic carbon in an aqueous sample.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of groundwater.

USAF: United States Air Force

USDA: United States Department of Agriculture

U.S. EPA: United States Environmental Protection Agency

USGS: United States Geological Survey

VOA: Volatile organics analysis.

VOC: Volatile organic compounds.

WATER TABLE: Surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

WATER TABLE MOUND: A positive feature on the water table surface attributable to the preferential accretion of recharge waters over a given area.

Zn: Chemical symbol for zinc.

APPENDIX B

Task Order 0049

REF. 85X (d1h) CONTRACTOR'S COPY

ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 14

2. PROC INSTRUMENT ID NO. (PIIN)	3. CALL/ORDER NO.	4. DATE OF ORDER*	5. REQUISITION/PURCHASE REQUEST PROJECT NO.	6. CERTIFIED FOR NATIONAL DEFENSE UNDER
F33615-80-D-4006	0049	84SEP17	FY7624-84-01679	DO-C9

Mark all packages & papers with this number.

DOC REG 2/DMS REG 1 RATING

7. ISSUED BY CODE FQ8419
DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB OH 45433
BUYER: DIANE C. CARSELLO
PHONE: (513) 255-3042

8. ADMINISTERED BY CODE S3915A
DCASMA PHILADELPHIA
P.O. BOX 7699
PHILADELPHIA PA 19101

0628-05-49
MARK
+ 140,174

9. CONTRACTOR NAME AND ADDRESS CODE 2M222 FACILITY CODE
ROY F. WESTON, INC.
WESTON WAY
WEST CHESTER PA 19380
(CHESTER COUNTY)
(215) 692-3030

MAILING DATE
SEP 18 1984

DUPLICATE ORIGINAL

10. MAIL INVOICES TO (IF "9" FOR MULTIPLE ADDRESSES SEE SECT "K")

11. DISCOUNT FOR PROMPT PAYMENT
1ST N % DAYS NET DAYS
2ND % DAYS OTHER
3RD % DAYS IF "9" SEE SECT "E"

12A. PURCHASE OFFICE POINT OF CONTACT
LQB/L58/LQB

12B. RESERVED FOR SERVICE/AGENCY USE

13. PAYMENT WILL BE MADE BY CODE S3910A (IF "9" SEE SECT "K")
DCASR PHILADELPHIA
P.O. BOX 7730
PHILADELPHIA PA 19101

RECEIVED
SEP 21 1984
Pro[illegible]

14. TYPE CONTRACTOR J

15. SECURITY A. CLAS U **B. DATE OF DD 254**

16. CONTRACT ADMINISTRATION DATA
A. PAST PAY | B. CONTRACT (1) KIND (2) TYPE | C. ABSTRACT RECIP ADP POINT | D. SPL CONT PROVISIONS | E. CONT ADMIN FUNC LMT
0 Y

17. (RESERVED)

18. SVC/AGENCY USE

19. SURV CRIT C

20. TOTAL AMOUNT
NOT-TO-EXCEED
$ 140,074.21

21. APPROPRIATION AND ACCOUNTING DATA
A. SCTY CODE U | B. AGCY AA | C. APPROPRIATION 9740810.200 | D. LIMIT SUBHEAD | SUPPLEMENTAL ACCOUNTING CLASSIFICATION E74 4308 P820 503701

F. CPN RECIPIENT DODAAD | G. OBLIGATION AMOUNT $ 140,074.21 | H. NON-CLIN/ELIN PAYMENT PROV | I. SVC AGENCY USE FY7624-84-01679**

22A. TYPE OF ORDER
DELIVERY X
PURCHASE

B. NON-DOD CONTRACT NO.
This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.

Reference your CONTRACT CATEGORY CODE: FAZ

Furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155. (EXCEPT CLAUSE NO. 13 APPLIES ONLY IF THIS BOX [ ] IS CHECKED AND NO. 15 IN THIS BOX [ ] IS CHECKED), special provisions _____ and delivery as indicated. This purchase is negotiated order authority of 10 USC 2304(a)( ) or as specified in the schedule if within the U.S., its possessions or Puerto Rico, if otherwise, under 2304(a)(6).

[ ] If checked Additional General Provisions apply; supplier shall sign Acceptance on DD form 1155, and return ___ copies.

*If quantity accepted by the Government is same as quantity ordered, indicated by ✓ mark. If different enter actual quantity accepted below quantity ordered and encircle.

23. UNITED STATES OF AMERICA Christopher D. Miller 84AUG31 (YYMMMDD)
CHRISTOPHER D. MILLER
BY: NAME OF CONTRACTING/ORDERING OFFICER AND DATE

24. TOTAL

28. DIFFERENCES

25. QUANTITY ORDERED HAS BEEN
[ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS STATED

26. SHIP NO. [ ] PARTIAL [ ] FINAL

27. D.O. VOUCHER NO.

29. INITIALS

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

30. PAYMENT [ ] COMPLETE [ ] PARTIAL [ ] FINAL

31. PAID BY

32. Amount Verified Correct For

33. CHECK NUMBER

34. BILL OF LADING NO.

35. I CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT
SIGNATURE AND TITLE OF CERTIFYING OFFICER

36. RECEIVED AT	37. RECEIVED BY	38. DATE RECEIVED	39. TOTAL CONTAINERS	40. S/R ACCOUNT NUMBER	41. S/R VOUCHER NO.

AFSC FORM 700 NOV 75

*When used as a formal contract this will be the effective date.

B1

** 1947 HSG/FMC, Pentagon, WASH DC 20330
AF Form 402, #E7-0A84-03 DTD 20 Jul 84,CH4

PART I SECTION B OF THE SCHEDULE SUPPLIES LINE ITEM DATA	1. PROC INSTRUMENT ID NO. (PIIN) F33615-80-D-4006	2. SPIIN 0049	3. PAGE 2 OF

4. ITEM NO. 0001 | 5. QUANTITY* 1 | 6. PURCH UNIT LO | 7. UNIT PRICE $ | 8. TOTAL ITEM AMOUNT* $E77,700.21

9. SCTY CLAS U | 10. ACRN AA | 11. NSN | 12. FSCM AND PART NUMBER | 13. CIRR N

14. SITE CODES A. POA D B. ACP D C. PDO D | 15. HOUR | 16. SVC/AGENCY USE

PH II, IRP STAGE 1, SELFRIDGE ANGB MI

17. PR/MIPR DATA FY7624-84-01679-0001 | 18. AUTHORIZED RATE A. PROGRESS PAY % B. RECOUP % | 19. CONTRACT PERCENT FEE % | 20. SVC ID NO. | 21. ITEM/PROJ MGR FY7624

22. 1ST DISCOUNT A. % B. DAYS | 23. 2ND DISCOUNT A. % B. DAYS | 24. 3RD DISCOUNT A. % B. DAYS | 25. NET DAYS | 26. QUANTITY VARIANCE A. OVER % B. UNDER % | 27. TYPE CONTRACT | 28. OPR

29. DESCRIPTIVE DATA

PH II IRP STAGE 1, SELFRIDGE ANGB, MI IN ACCORDANCE WITH DESCRIPTION OF TASK AS SET FORTH IN PAGES 3 - 13 HEREOF, WHICH CAN BE PERFORMED THROUGH EXPENDITURE OF THE FOLLOWING LABOR HOURS:

SENIOR PROFESSIONAL	396
MID LEVEL PROFESSIONAL	584
JUNIOR LEVEL	642
TECHNICIAN	481

DATA SHALL BE FURNISHED IN ACCORDANCE WITH ATTACHMENT #1, DD FORM 1423 OF BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI, PAGE 11 HEREOF.

IN NO EVENT SHALL THE AMOUNT PAID FOR THE NUMBER OF HOURS SPECIFIED EXCEED THE AMOUNT SPECIFIED IN BLOCK 8 ABOVE.

4. ITEM NO. 0002 | 5. QUANTITY* 1 | 6. PURCH UNIT LO | 7. UNIT PRICE $ | 8. TOTAL ITEM AMOUNT* $E62,374.00

9. SCTY CLAS U | 10. ACRN AA | 11. NSN | 12. FSCM AND PART NUMBER | 13. CIRR N

14. SITE CODES A. POA D B. ACP D C. PDO D | 15. HOUR | 16. SVC/AGENCY USE

SUPPORT

17. PR/MIPR DATA FY7624-84-01679-0002 | 18. AUTHORIZED RATE A. PROGRESS PAY % B. RECOUP % | 19. CONTRACT PERCENT FEE % | 20. SVC ID NO. | 21. ITEM/PROJ MGR FY7624

22. 1ST DISCOUNT A. % B. DAYS | 23. 2ND DISCOUNT A. % B. DAYS | 24. 3RD DISCOUNT A. % B. DAYS | 25. NET DAYS | 26. QUANTITY VARIANCE A. OVER % B. UNDER % | 27. TYPE CONTRACT | 28. OPR

29. DESCRIPTIVE DATA

SUPPORT ITEM 0001 ABOVE.

THE AMOUNT SPECIFIED IN BLOCK 8 ABOVE IS THE MAXIMUM AMOUNT WHICH MAY BE PAID FOR THIS ITEM.

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO

N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED

E = ESTIMATED
- (IN QTY AND $) = DECREASE
+ OR - (IN ITEM NO) = ADDITION OR DELETION
CIRR CONTROLLED ITEM RPT RQMT

SITE CODES: S = SOURCE, D = DESTINATION, O = INTERMEDIATE

INSTALLATION RESTORATION PROGRAM
PHASE II (Stage 1)
Selfridge ANGB MI

84 Jul 18

I. DESCRIPTION OF WORK:

The purpose of this task is to undertake a field investigation at Selfridge ANGB MI to: (1) determine the presence or absence of contamination within the specified areas of investigation; (2) if contamination exists, determine the potential for migration of those contaminants in the various environmental media; (3) identify potential enenvironmental and health risk consequences of migrating discovered pollutants; and (4) identify additional investigations necessary to determine the magnitude, extent, direction and rate of migration of discovered contaminants. Hazardous materials, wastes, Mgmt

The Phase I IRP Report (mailed under separate cover) incorporates the background and description of the sites for this task.

A. To accomplish this survey effort, the contractor shall:

1. Monitor all exploratory borehole and well drilling operations with a photo-ionization meter or equivalent organic vapor detection device to identify potential generation of hazardous and/or toxic materials. In addition the contractor shall monitor the drill cuttings for visual soil discoloration and odor. If in the process of drilling soil cuttings are suspected to be hazardous by the contractor, the cuttings shall be containerized, sampled and analyzed for EP Toxicity and Ignitability (Ref: 40 CFR Subpart C, 261.21 -Ignitability and 261.24 -EP Toxicity). All results of monitoring (detection devices, color and odor) shall be included in boring and well logs. It is estimated that five (5) samples shall be collected for EP Toxicity and Ignitablity Testing. (Analytical Detection Limits identified in Attachment 1)

2. Determine the areal extent of the sites by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared.

3. At locations where surface water samples are collected mark with permanent marker, and record on a site specific map.

4. Analyze on site, all water samples collected for pH, temperature, and specific conductance. Sampling, maximum holding time and preservation of samples for laboratory analysis shall comply strictly with the following references: Standard Methods for the Examination of Water and Wastewater, 15th Ed. (1980); ASTM Section 11, Water and Environmental Technology; and Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79-020 (1979).

5. Split all water and soil samples as part of the contractors specific Quality Assurance/Quality Control (QA/QC) protocols and procedures. One set of samples shall be analyzed by the contractor and the other set of samples shall be forwarded for analysis through overnight delivery to:

USAF OEHL/SA
Bldg 140
Brooks AFB TX 78235

The samples sent to the USAF OEHL/SA shall be accompanied by the following information:

(a) Purpose of sample (analyte)

(b) Installation name (base)

(c) Sample number (on containers)

(d) Source/location of sample

(e) Contract Task Numbers and Title of Project

(f) Method of collection (bailer, suction pump, air-lift pump, etc.)

(g) Volumes removed before sample taken

(h) Special conditions (use of surrogate standard; special nonstandard preservations, etc.)

(i) Preservatives used

This information shall be forwarded with each sample by properly completing an AF Form 2752 (copy of form and instruction on proper completion mailed under separate cover). In addition, copies of field logs documenting sample collection should accompany the samples.

Chain-of-custody records for all samples, field blanks and quality control duplicates shall be maintained.

6. Comply with U.S. EPA Publication 330/9-81-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazardous Waste Sites for monitoring well installation. Only screw type joints shall be used.

7. Drill wells to a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present. Well development shall proceed until the discharge water is clear and free of sediment to the fullest extent possible.

8. Survey elevations of all newly installed monitoring wells with respect to bench mark on base to a vertical accuracy of $\pm$0.01 feet. Between sites, monitoring well casing shall be tied into the survey bench mark to a vertical accuracy of $\pm$0.1 feet. All survey data shall be recorded on site map.

9. After well development, survey and a time to be specified by the contractor for water level stabilization, synoptic ground water level measurements shall be recorded using an electric tape, or calibrated tape with mechanical sounding device to an accuracy of $\pm$0.01 feet. Water level measurements shall be obtained at least 3 times from each well.

10. Conduct all water quality sampling events identified in site specific work once. All water quality sampling shall be conducted at same time as water level measuring periods in paragraph 9 above. Detection limits for water quality analyses are defined in Attachment 1. All contractor QA/QC sample analysis results shall be included in analytical results in draft final report.

11. Drill all monitor wells using the following specifications:

a. Each well shall be drilled with a 4 1/2-inch inside diameter hollow-stem auger equipment. Samples shall be taken for stratigraphic control purposes at 5-foot intervals, unless otherwise specified in site specific work. Each pilot boring log and well completion summaries shall be included in the Final Report (as specified in Item VI below).

b. The average depth of each of these wells shall be 25 feet. A total of twenty-five (25) wells shall be drilled; therefore, total footage of wells shall not exceed ~~525~~ 625 linear feet. Each well shall be constructed of Schedule 40 PVC casing using threaded, non-glued fittings. Each well shall be screened to 20 feet below the water-table surface (resulting in a total screening of 500 feet). The screen shall consist of two-inch diameter, stainless steel with up to 0.020 inch slots. The screen shall be capped at the bottom. All connections shall be flush-joint threaded. Each well shall be gravel-packed with washed and bagged rounded sand or gravel with a grain size distribution compatible with the screen and the formation. The pack shall be placed from the bottom of the borehole to 2 feet above the top of the screen. Granulated or pelletized bentonite shall be tremied above the sand/gravel pack to a minimum thickness of two feet. Type I Portland cement grout shall be emplaced from above the top of the bentonite seal to the land surface. Each well shall be completed with installation of a security casing of 4-inch diameter black iron with cap and locking hasp and shall be clearly numbered with an exterior paint. If well stick-up is of concern in an area (i.e., golf course), the well shall be completed flush with the land surface.

12. Develop each well with bailer, submersible pump or bladder pump until clean of suspended solids.

13. Purge all wells of at least 3-5 well volumes of water prior to sampling. Purging shall be completed by using a stainless steel submersible pump or bladder pump. All sampling shall be conducted using a Kemmerer sampler or Teflon^{R} bailer.

14. Meet all chemical analysis (water and soil) required limits of detection for applicable EPA method identified in Attachment 1.

15. Conduct second-column confirmation when detection limits exceed values identified in Attachment 2, for EPA Methods 601, 602. A maximum of 25% of the samples collected for these analyses shall require 2nd-column confirmation.

16. Plot and map all field data collect for each site according to surveyed positions. Identify or estimate the nature of contamination and the magnitude and potential for contaminant flow within each site, to receiving streams and ground waters.

B. In addition to the general items delineated in Paragraph 1-16 above, conduct the following specific efforts at the following areas and sites. All the sites and areas are identified in Figure 1.

Southwest Sanitary Landfill (SSL)

1. The contractor shall drill and install four (4) monitoring wells, one to be located along each perimeter of the landfill area on the north, south, east and west sides; in order to determine if the potential exists for ground water contamination from the site. The specific locations of the wells shall be determined by the contractor in the field.

2. The contractor shall collect one round of ground water samples from each monitor well and a maximum of three (3) ponded surface water samples (within and adjacent to the landfill) for water quality analysis identified in Table 1.

Fire Training Area-2 (FTA-2)

1. The contractor shall drill and install three (3) monitor wells around the area in order to determine if the potential exists for ground water contamination from the area. The specific locations of the wells shall be determined by the contractor in the field, but each shall generally be located such that one well is located on the west side of Fire Training Area (upgradient) and two wells are located on the east side of the Fire Training Area (downgradient).

2. The contractor shall collect one round of ground water samples from each of the three monitoring wells and a maximum of two (2) surface water samples, for water quality analysis identified in Table 1. The surface water sampling locations hsall include the ponded water within the bermed Fire Training Area and one downstream location near the discharge of the drain pipe (originating within the berm) into the drainage swale.

Fire Training Area-1 (FTA-1)

1. The contractor shall drill and install three (3) monitor wells around the area in order to determine if the potential exists for ground water contamination from the area. The specific location of the wells shall be determined by the contractor in the field, but each shall generally be located such that one well is located west of Fire Training Area (upgradient) and two wells are located on the east side of the Fire Training Area (downgradient).

2. The contractor shall collect one round of ground water samples from each of the three monitor wells for water quality analysis identified in Table 1.

West Ramp Fuel Spill and January 1984 Spill Site (WRFS and J-84 SS)

1. The contractor shall drill and install five (5) monitor wells in the area of the west ramp to determine the potential presence of fuels in soils and ground water. The specific location of the wells shall be determined by the contractor in the field, but each shall generally be located as follows:

o One well near the northeast corner of the West Ramp

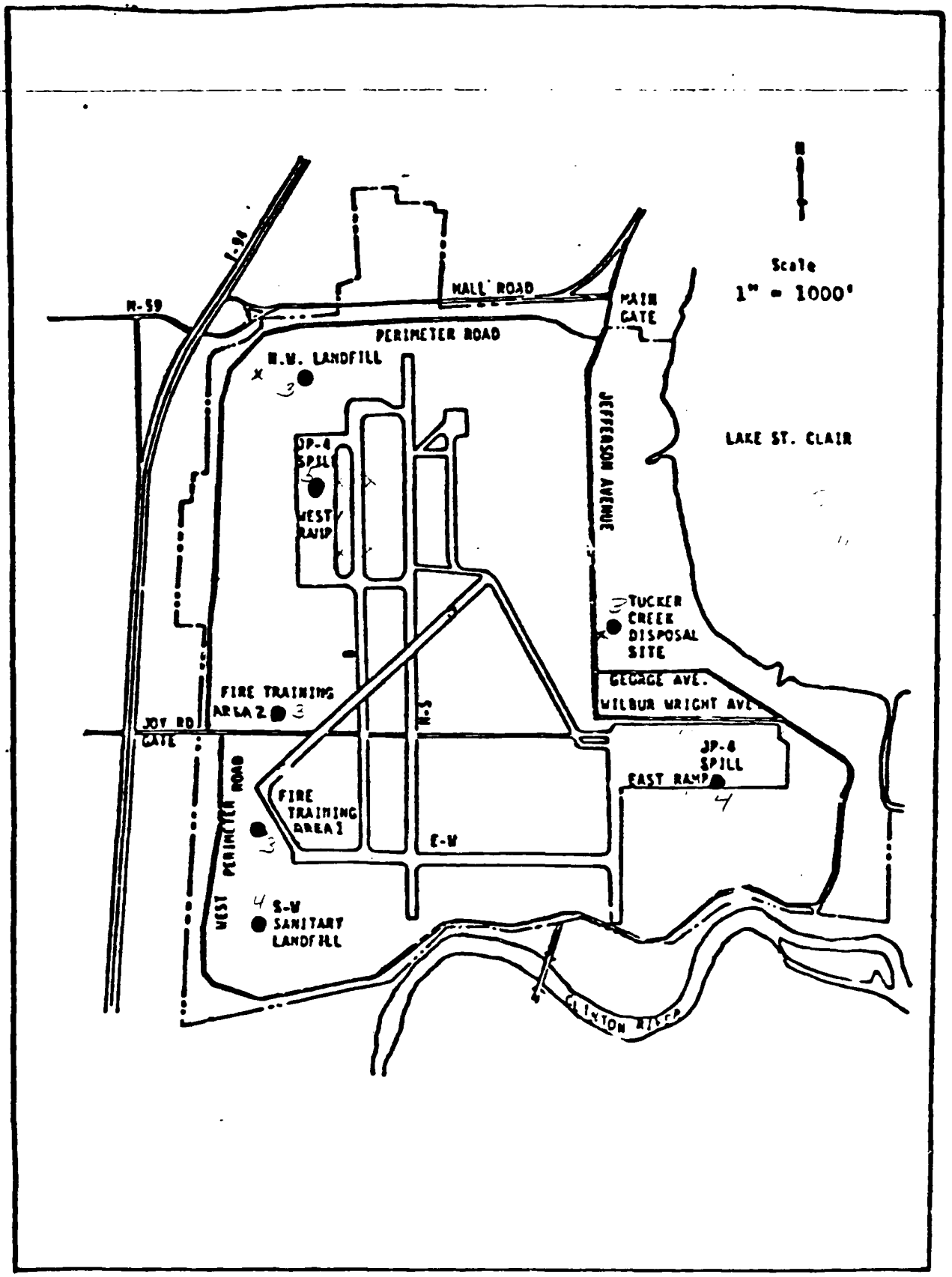


FIGURE 1: Phase II IRP Sites

- o One well near the northwest corner of the West Ramp
- o One well near the southeast corner of the West Ramp
- o One well at the southwest corner of the West Ramp within the area of the January 1984 Fuel Spill.
- o One well east of the West Ramp along the buried fuel line near the fuel value pit where the January 1984 release occured.

2. The contractor in the process of well borehole installation shall collect soil samples from each of the five well boreholes, at 2.5-foot intervals for the first 10 feet and 5-foot intervals thereafter, using split-spoon or shelby tube type samplers. The contractor shall select three (3) of the soil samples from each well borehole for analysis. The remaining soil samples shall be archived frozen (for possible future analysis) until completion of contract effort. The fifteen (15) soil samples selected by the contractor shall be analyzed as identified in Table 1.

3. The contractor shall collect one round of ground water samples from each of the five monitor wells for wells for water quality analysis identified in Table 1.

Tucker Creek Landfill (TCL)

1. The contractor shall drill and install three (3) monitor wells around the landfill to determine if the potentila exists for ground water contamiation from the site. The specific locations of the wells shall be determined by the contractor in the field, but each shall generally be located such that one will is located west of the landfill (upgradient) and two wells are located on the east side of the landfill (downgradient).

2. The contractor shall collect one round of ground water samples from each of the three monitor wells for water quality analysis identified in Table 1.

Northwest Landfill (NL)

1. The contractor shall drill and install three (3) monitor wells around the landfill to determine if the potential exists for ground water contamination from the site. The specific locations of the wells shall be determined by the contractor in the field, but each shall generally be located such that one well is located west of the landfill (upgradient) and two wells are located on the east side of the landfill (downgradient).

2. The contractor shall collect one round of ground water samples from each of the three monitor wells for water quality analysis identified in Table 1.

East Ramp Fuel Spill (ERFS)

1. The contractor shall drill and install four (4) monitor wells adjacent to the East Fuel Ramp to determine the potential presence of fuel in soil and ground water. The specific location of the wells shall be determined by the contractor in the field, but each shall generally be located as follows:

- o One well adjacent to and near the northwest portion of the East Ramp.

TABLE 1: BY SITE ANALYTICAL PROGRAM[1]

ANALYTE	METHOD	MEDIUM	SSL	FTA-2	FTA-1	WRFS and I-84 SS	TCL	NL	ERFS	QA	Total
Purgeables: Halocarbons and Aromatics	EPA 601 and 602	Groundwater	4	3	3	5	3	3	4	3	28
		Surface Water	3	2	0	0	0	0	0	1	6
TOC	EPA 415.1	Groundwater	4	3	3	5	3	3	4	3	28
		Surface Water	3	2	0	0	0	0	0	1	6
Phenols	EPA 420.1	Groundwater	4	3	3	0	3	3	0	2	18
		Surface Water	3	2	0	0	0	0	0	1	6
COD	STD 508A	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
Metals	*	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
TOX	EPA 9020	Soil	0	0	0	15	0	0	12	3	30
Petroleum Halocarbon (IR Method)	EPA 418.1	Groundwater	0	3	3	5	0	0	4	2	17
		Surface Water	0	2	0	0	0	0	0	1	3
		Soil	0	0	0	15	0	0	12	3	30
Oil and Grease	EPA 413.2	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
EP Toxicity	40 CFR 261.24	Soil	-	-	-	-	-	-	-	-	5
Ignitibility	40 CFR 261.21	Soil	-	-	-	-	-	-	-	-	5

[1]Temperature, specific conductance and pH will be measured in the field at time of sampling.

*Metals include: Cadmium (EPA 213.2), Chromium (EPA 218.1), Copper (EPA 220.1), Lead (EPA 239.2), Nickel (EPA 249.1) and Zinc (EPA 289.1).

- o One well adjacent to and near the northeast portion of the East Ramp.

- o One well adjacent to and near the southwest portion of the East Ramp.

- o One well adjacent to and near the southeast portion of the East Ramp.

2. The contractor in the process of well borehole installation shall collect soil samples from each of the four well boreholes, at 2.5-foot intervals for the first 10 feet and 5-foot intervals thereafter, using split-spoon or shelby tube type samplers. The contractor shall select three (3) of the soil samples from each borehole for analysis. The remaining soil samples shall be archived frozen (for possible future analysis) until compeltin of contract effort. The twelve (12) soil sampels selected by the contractor shall be analyzed as identified in Table 1.

C. Well and Borehole Cleanup

The well and boring area shall be cleaned following the completion of each well and boring. Drill cuttings shall be removed and the general area cleaned. If in the process of drilling hazardous wastes are generated (based upon E P Toxicity and Ignitability Testing) the contractor shall be responsible for proper containerization and identification (according to local civil engineering office requirements) for eventual government disposal. Disposal of the containers are not the responsibility of the contractor.

D. Data Review

At the completion of all analyses the contractor shall tabulate and incorporate all analytical results (including contractor Quality Assurance(QA) samples identified in Table 1) into an informal technical report (Atch 1 Sequence 3, as specified in Item VI below) prior to submission of draft report, and forwarded to the USAF OEHL for review. Analytical results shall also be forwarded as available in the next monthly R&D Status Report (as specified in Item VI below).

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL (as specified in Item VI below) for Air Force review and comment. This report shall include a discussion of the regional/site specifc hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, vertical, water quality and soil analysis results (to include contractor QA analytical results identfied in Table 1), available geohydrologic cross sections and laboratory quality assurance information. The report shall follow the USAF OEHL supplied format (mailed under separate cover).

2. The recommendation section shall address each site and list them by one of the following categories: (1) Category I shall consist of sites where no further action (including remedial action is required). Data for these sites is considered sufficient to rule out unacceptable health or environmental risks. (2) Category II sites are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. (3) Category III sites are sites that shall require remedial actions (ready for IRP Phase IV actions). In each case the

contractor shall summarize or present the results of field data, environmental or regulatory criteria, or other pertinent information supporting these conclusions.

F. Meetings

The contractors project leader shall attend two meetings with representatives of ANGSC/SGB, Selfridge ANGB/SG/DE, USAF OEHL to take place at a time to be specified by the USAF OEHL. Each meeting shall take place at Selfridge ANGB for a duration of one day (eight hours).

II. SITE LOCATION AND DATES:

Selfridge ANGB MI
Date to be established

III. BASE SUPPORT: None

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. Capt Robart W. Bauer
USAF OEHL/TSS
Brooks AFB TX 78235
(512) 536-2158/2159
AV 240-2158/2158

2. Mr Harlan Faulk
HQ MIANG Det 1/SGC
Selfridge ANGB MI 48045
(313) 466-4701
AV 273-4701

3. Lt Col Michael Washeleski
ANGSG/SGB
Andrews AFB MD 20331
(301) 981-5926
AV 858-5926

VI. In addition to sequence numbers 1*, 5 and 11 in Attachment 1 to the contract, which are applicable to all orders, the sequence numbers listed below are applicable to this order. Also shown are data applicable to this order.

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
3	O/TIME	**	**		
4	One/R	13 JUN 85	28 JUN 85	29 NOV 85	**

* Monthly R&D Status Reports shall be provided to all Government Points of Contact. (as specified in Item V)

** Upon completion of analytical effort before submission of 1st draft report.

*** Two draft reports will be required. After incorporating Air Force comments concerning each draft report, the contractor shall supply the USAF OEHL with one copy of the second Draft/Final. Upon OEHL acceptance of the second draft, the contractor shall distribute the remaining copies per an OEHL prepared distribution list. The contractor shall supply the USAF OEHL with 25 copies of each draft report and 50 copies plus the original camera ready copy of the final report.

Attachment 2

Analytical Detection Limits

ANALYTE	METHOD	LIMIT (µg/L) water, µg/g soil
Purgeable: Halocarbons and Aromatics	EPA 601 and 602	*
Petroleum Halocarbon (using IR)	EPA 418.1	
Oil & Grease (using IR)	EPA 413.2	100
Phenol	EPA 420.1	1
Total Organic Halogen (TOX)	EPA 9020	5
METALS:		
Cadmium	EPA 213.2	10
Chromium	EPA 218.1	50
Lead	EPA 239.2	20
Copper	EPA 220.1	20
Nickel	EPA 249.1	100
Zinc	EPA 289.1	50
Total Organic Carbon (TOC)	EPA 415.1	1000
Chemical Oxygen Demand (COD)	STD 508A	5000
EP Toxicity	40 CFR 261.24	**
Ignitibility	40 CFR 261.21	***

*As specified by Method 601 & 602

**Metal	µg/L of Solution
As	10
Ba	200
Cd	10
Cr	50
Pb	20
Hg	1
Se	10
Ag	10

***Find if sample is ignitable at 140 degrees F or below. If so, it is a hazardous waste.

Attachment 2

If analytes analyses exceed the detection limits identified below, 2nd column confirmation shall be required:

EPA Method 601 & 602	Detection Level (ug/L)
Benzene	0.7
Carbon	4.0
Chloroform	10
1,2 Dichloroethane	0.1
Methylene Chloride	4.0
Tetrachloroethylene	4.0
Toluene	10
1,1,1-Trichloroethane	10
Trichloroethylene	1.0
Vinyl Chloride	1.0
Dichlorobenzene isomers any	Sum greater than 10
Any other organics greater than	10

"Retention times on both columns must match before reporting positive value. If no match, it will be considered an interference."

PART I SECTION F OF THE SCHEDULE SUPPLIES SCHEDULE DATA	1. PROC INSTRUMENT ID NO. (PIIN) F33615-80-D-4006	2. SPIIN D049	3. PAGE 14 OF

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0001	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 86JAN31	A.	A. 1	U	FY7624	

	11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
B.	D.	D.	D.
C.	E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H (iv) OF BASIC CONTRACT FOR FY7624 ADDRESS.

TECHNICAL EFFORT IS TO BE COMPLETED NO LATER THAN 85 JUN 13.

DATA TO BE DELIVERED IN ACCORDANCE WITH ATTACHMENT #1, DD FORM 1423, AS IMPLEMENTED BY PARAGRAPH VI, PAGE 11 HEREOF, NO LATER THAN 85 NOV 29.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0002	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 85JUN13	A.	A. 1	U	FY7624	

	11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
B.	D.	D.	D.
C.	E.	E.	E.

*- DESCRIPTIVE DATA

SEE SECTION H (iv) OF BASIC CONTRACT FOR FY7624 ADDRESS.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A.	A.	A.			

	11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
B.	D.	D.	E
C.	E.	E.	E.

17. DESCRIPTIVE DATA

*REPRESENTS A NET INCREASE/DECREASE WHEN NO + OR - APPEARS AFTER THE ITEM NO
E = ESTIMATED
- (IN QTY) = DECREASE
+ OR - (IN ITEM NO.) = ADDITION OR DELETION

AFSC FORM JAN 80 706 PREVIOUS EDITION WILL BE USED.

AFSC — Andrews AFB Md 1979

APPENDIX C

Professional Profiles of Key Personnel

Peter J. Marks

Fields of Competence

Project management; environmental analytical laboratory analysis; hazardous waste, groundwater and soil contamination, source emissions/ambient air sampling; wastewater treatment; biological monitoring methods; and environmental engineering.

Experience Summary

Eighteen years in Environmental Laboratory and Environmental Engineering as Project Scientist, Project Engineer, Process Development Supervisor, and Manager of Environmental Laboratory with WESTON. Experience in analytical laboratory, wastewater surveys, hazardous waste, groundwater and soil contamination, DoD-specific wastes, stream surveys, process development studies, and source emission and ambient air testing. In-depth experience in pulp and paper, steel, organic chemicals, pharmaceutical, glass, petroleum, petrochemical, metal plating, food industries and DoD.

Applied research on a number of advanced wastewater treatment projects funded by Federal EPA.

Credentials

B.S., Biology—Franklin and Marshall College (1963)

M.S., Environmental Engineering and Science—Drexel University (1965)

American Society for Testing and Materials

Water Pollution Control Federation

Water Pollution Control Association of Pennsylvania

Employment History

1965-Present	WESTON
1963-1964	Lancaster County General Hospital Research Laboratory for Analytical Methods Development

Key Projects

USAF/OEHL Brooks AFB. Program Manager for this three-year BOA contract provides technical support in environmental engineering surveys, wastewater characterization programs, geological investigations, hydrogeological studies, landfill leachate monitoring and landfill siting investigations, bioassay studies, wastewater and hazardous waste treatability studies, and laboratory testing and/or field investigations of environmental instrumentation/equipment. Collection, analysis, and reporting of contaminants present in water and wastewater samples in support of Air Force Environmental Health Programs.

United States Army Toxic and Hazardous Materials Agency (USATHAMA), Aberdeen Proving Ground, Maryland. Program Manager for three-year basic ordering agreement contract to provide research and development for technology in support of the DOD Installation Restoration Program. The objective of the Program is to identify and develop treatment methods/technology for containment and/or remedial action. Technology development for remedial action is to include groundwater, soils, sediments, and sludges.

Confidential Client, Ohio. Project Manager of an on-going contract to conduct corporate environmental testing and special projects at client's U.S. and overseas plants. WESTON must be able to assign up to four professionals to a project within a two week notice.

Confidential Client (Inorganic and Organic Chemicals). Product Manager of a current contract to conduct wastewater sampling and analysis of plant effluent for priority pollutants. The project also includes a wastewater treatability study to evaluate a number of process alternatives for removal of priority pollutants from the present effluent.

Confidential Client, Utah. Technical Project Manager for in-depth wastewater survey, in-plant study, treatability study, and concept engineering study in support of the client's objectives to meet 1983 effluent limitations. WESTON had two project engineers, two chemists, five technicians and an operating laboratory in the field. Field effort is six months duration.

In conjunction with University of Delaware College, WESTON analyzed more than 500 biological and marine sediment samples for eleven constituent trace metals as part of a program to identify and trace the migration of metals from ocean dumping of sludges on the continental shelf off the coast of the State of Delaware, acted as Technical Project Manager.

Project Manager in charge of a wastewater analysis and biological treatability project for industrial client for the identification and degradation of six pesticide-containing wastewaters.

U.S. EPA Environmental Monitoring and Support Laboratory. Multi-year contract to provide reference laboratory analysis on QA/QC samples produced from the EPA Analytical Laboratory QA/QC program.

Publications

"Microbiological Inhibition Testing Procedure," Biological Methods for the Assessment of Water Quality, A.S.T.M. Publication STP 528.

"Heat Treatment of Waste Activated Sludge" (with V.T. Stack).

"Biological Monitoring in Activated Sludge Treatment Process," a joint paper with Stover/Woldman.

Walter M. Leis, P.G.

Registration

Registered Professional Geologist in the States of Georgia (No. 440) and Indiana.

Fields of Competence

Detection and abatement of groundwater contamination; design of artificial recharge wells; deep well disposal; simulation of groundwater systems; hydrogeologic evaluation of hazardous waste sites and landfills; practical applications of geophysical surveys to hydrologic systems, site investigations, and borehole geophysical surveys. Geochemical studies of acid mine drainage and hazardous wastes.

Experience Summary

Sixteen years experience as field hydrogeologist, field supervisor, project director, research director. Six years research involving two consecutive projects: 1) application of geophysical techniques in evaluating groundwater supplies in fractured rock terrain in Delaware and Pennsylvania; 2) project director for an artificial recharge and deep well disposal study. Provided consultation for waste disposal and aquifer quality problems for coastal communities.

Developed geochemical sampling techniques for deep mine sampling. Evaluated synthetic and field hydrologic data for deep formulational analysis in coal field projects.

Earlier research experience involved developing techniques for mapping subsurface regional structures having interstate hydrologic significance, and defining ore bodies by geochemical prospecting.

Credentials

B.S., Biochemistry—Albright College (1966)

M.S., Hydrogeology—University of Delaware (1975)

Cooperative Program Environmental Engineering—University of Pennsylvania

Additional special course work in Geology and Hydrology, Franklin and Marshall College and Pennsylvania State University

Remote Sensing Data Processing Training, Goddard Space Center (1978)

OWRR Research Fellow, 1973

National Water Well Association, Technical Division.

Geological Society of America, Engineering Geological Division.

Society of Economic Paleontologists and Mineralogists

Employment History

1974-Present	WESTON
1973-1974	University of Delaware Water Resources Center
1971-1973	University of Delaware
1967-1971	Pennsylvania Department of Environmental Resources

Key Projects

Definition of groundwater contamination from sanitary landfill leachate and recovery of contaminants to protect heavily used aquifer in Delaware.

Field design studies for artificial recharge and waste disposal wells.

Design and construction of hydrologic isolation systems for various class hazardous wastes.

Design and supervision of chemical and physical rehabilitation of groundwater collection systems in fractured rock and coastal plain areas.

Principal investigator for six projects involving subsurface migration of PCB's in New York, New Jersey, Pennsylvania, and Oklahoma.

Design and construction supervision of hydrocarbon recovery wells in Pennsylvania.

Geochemical evaluation of coal mine pools in West Virginia.

Geochemistry of subsurface migration of toxic substances.

Principal investigator for eight projects involving migration of volatile chlorinated hydrocarbons in groundwater.

Mineable reserve evaluations for coal, sand and gravel, limestone, clay deposits, mine reclamation, and monitoring.

Design geophysical and remote sensing assessments of hazardous waste disposal areas.

Publications

Leis, W., and R.R. Jordan, 1974, "Geologic Control of Groundwater Movement in a Portion of the Delaware Piedmont", OWRR—DEL 20.

Leis, W., 1976, "Artificial Recharge for Coastal Sussex County, Delaware", University of Delaware Press, Water Resources Center.

Leis, W., D.R. Clark, and A. Thomas, 1976, "Control Program for Leachate Affecting a Multiple Aquifer System, Army Creek Landfill, New Castle County, Delaware", National Conference on Management and Disposal of Residue on Land.

Leis, W., W.F. Beers, J.M. Davidson, and G.D. Knowles, 1978, "Migration of PCB's by Groundwater Transport—A Case Study of Twelve Landfills & Dredge Disposal Sites on the Upper Hudson Valley, New York", Proceedings of the 1st Annual Conference of Applied Research & Practice on Municipal and Industrial Waste.

Leis, W., R.D. Moose, and W.F. Beers, "Critical Area Maps, a Regional Assessment for Karst Topography", Association of Engineering Geologists 1978 Annual Meeting.

Leis, W., and W.F. Beers, "Soil Isotherm Studies to Predict PCB Migration Within Groundwater", (Abstract) ASTM 1979 Annual Meeting, Philadelphia, Pennsylvania.

Thomas, A., and W. Lein, "Physical & Chemical Rehabilitation of Contaminant Recovery Wells", Association of Engineering Geologists 1978 Annual Meeting.

Leis, W., W.F. Beers, and F. Benenati, "Migration of PCB's from Landfills and Dredge Disposal Sites in the Upper Hudson River Valley", New York Academy of Science Symposium on PCB's in the Hudson River.

Leis, W., "Subsurface Reclamation by Counter Pumping Systems: Geologic and Geotechnical Aspects of Land Reclamation", ASCE/AEG 1979 Symposium.

Leis, W., and A. Metry, "Field Characterization of Leachate Quality", Water Pollution Control Federation 1979 Annual Meeting.

Leis, W., and A. Metry, "Multimedia Pathways of Contaminant Migration", Water Pollution Control Federation 1980 Annual Meeting.

Leis, W., and K. Sheedy, "Geophysical Location of Abandoned Waste Disposal Sites", 1980 National Conference on Management of Uncontrolled Hazardous Waste Sites.

Sheedy, K., and W. Leis, 1982, "Hydrogeological Assessment in Karst Environments (chapter)."

Katherine A. Sheedy

Fields of Competence

Geologic investigation and site evaluation; environmental impact assessment, quantitative and qualitative groundwater analysis, design of groundwater monitoring systems.

Experience Summary

Nine years experience in geological investigations including environmental impact analysis in geology, groundwater, and soils; hydrogeologic investigations of hazardous waste sites, preparation and delivery of expert testimony; assessment and mitigation of low-level radioactive contamination of groundwater and soils; migration of low-level radioactive contamination of groundwater and soils; migration of radionuclides in groundwater; site stability in limestone terrains; development of evaluation criteria for site search and selection projects; pre-mine opening hydrologic investigations for surface and underground coal mines; development of clean-up strategies for hazardous and radioactive waste disposal sites; Environmental Impact Statement preparation and review; site suitability investigations of waste disposal facilities for industrial and residential developments.

Credentials

B.A.—Queens College, CUNY (1969)

M.S., Geology—University of Delaware (1975)

American Geophysical Union

Geological Society of America

National Water Well Association, Technical Division

Employment History

1974-Present	WESTON
1972-1974	University of Delaware

Key Projects

Preparation of RCRA Part B permit application for facilities in the Midwest and on the West coast.

Initial Assessment Studies to identify possible contamination resulting from past practices at military installations.

Assessment of groundwater contamination from a municipal landfill in the Atlantic Coastal Plain including aquifer simulation to determine migration 10, 20 and 30 years in the future.

Hydrogeologic assessment of a multi-source military installation. The project includes groundwater modeling for the installation and for areas outside the installation in conjunction with State and Federal agencies.

Design of monitoring systems for a large industrial complex in Montana.

Assessment of regulatory requirements for hazardous waste lagoon closure in over forty states.

Assessment and analysis of emerging trends in groundwater research as applied to the utility industry.

Preparation of EPA Remedial Action Master Plans for five uncontrolled hazardous waste sites.

Principal investigator for geology, soils and groundwater portion of an Environmental Impact Statement for the decontamination of a radioactive waste disposal site in Canonsburg, Pennsylvania.

Project manager and principal investigator on clean-up of a site contaminated by pharmaceutical wastes in New Jersey.

Project manager and principal investigator for assistance in EIS preparation for five synthetic fuel plants in east-central United States.

Evaluation of environmental impact and operation of 23 municipal landfills in the Atlantic Coastal Plain.

Hydrogeologic investigations at mine sites prior to, during and after mining operations in Illinois.

Hydrogeologic investigations to determine site suitability for landfills, sewage sludge disposal, spray irrigation and industrial waste disposal.

Principal investigator on a dredge material disposal site feasibility study for Interstate Division for Baltimore City. This project was conducted to evaluate the feasibility of specific sites for disposal of 5 million cubic yards of

material dredged from the Fort McHenry Tunnel in Baltimore. The evaluation included examination of costs, engineering feasibility, site stability, impact on biology and groundwater and ultimate use of the site as an inner-city park.

Supervision of an investigation to determine groundwater quality, delineate the extent of groundwater pollution and develop a groundwater-quality management program for a six-county area. Evaluated the adequacy of existing groundwater-quality standards and interacted with regulatory agencies.

Evaluation of groundwater quality, quantity and facilities; impact on groundwater for sites in semi-arctic environments and within the Columbia River Basin Project area.

Environmental assessment for a 200,000-BPCD refinery on a semi-arid island with extensive groundwater use in the West Indies.

Evaluation of structural stability problems in limestone solution area in Pennsylvania.

Supervision of a leachate collection system and groundwater monitoring program for an industrial landfill.

Investigation of potential sources of petroleum product found to be discharging through the subsurface, at the shore of Lake Erie.

Development of a state-of-the-art study and environmental analysis of the geothermal steam industry.

Publications

Sheedy, K. A., 1979, "Three-Phase Approach to Determination of Site Stability in Limestone". Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Schoenberger, R. J., Haderer, P., Dovey, R., 1979, "Solid Waste Disposal in the Coastal Plain: A Case Study." Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Leis, W., Thomas, A., 1980, "Land Use in Limestone Terrain, Problems and Case Study Solutions". In *Applied Geomorphology*, (The "Binghamton" symposia; 11) George Allen and Unwin, 1982.

Sheedy, K. A., Leis, W. Bopp, F., Anderson, J., "Use of Ground Penetrating Radar in Limestone Terrain". American Geographers Association, 1981.

Sheedy, K. A., "Methodology for the Selection of Low-Level Radioactive Waste Disposal Sites". American Nuclear Society, 1982.

Robert J. Karnauskas, P.G.

Registration

Certified Professional Geological Scientist and Certified Professional Geologist in the state of Indiana.

Fields of Competence

Geological aspects relating to locational and design considerations of solid and hazardous waste disposal facilities; evaluation of organic and inorganic groundwater contamination problems; aquifer restoration and rehabilitation; land disposal of municipal and industrial wastewaters and sludges; physical and chemical characterization of industrial waste materials to assess groundwater contamination potential; groundwater modeling; evaluation of hydrogeologic aspects of construction problems; and NPDES permit program coordination.

Experience Summary

Six years of professional experience in consulting environmental engineering. Project assignments have blanketed a broad range of industries including pulp and paper, solvent processing and recycling, electric power utilities, food processing, private and public solid waste operations, foundries, and agriculture. Experience includes the hydrogeologic evaluation of a wide variety of subsurface environments and groundwater contamination concerns. Research experience has included the evaluation of leachate characteristics from municipal and industrial wastes as well as the development of methods for assessing leakage rates from industrial wastewater lagoons.

Credentials

B.A., Geology and Geophysics—University of Wisconsin, Madison (1975)

M.S., Geology (Hydrogeology)—University of Wisconsin, Madison (1977)

M.S., Water Resources Management—University of Wisconsin, Madison (1977)

University of Wisconsin, Madison—Part-time graduate studies in Business Management (1983)

National Water Well Association, Technical Division

American Institute of Professional Geologists

Employment History

1983-Present	WESTON
1977-1983	Warzyn Engineering Inc.

Key Projects

Project Hydrogeologist and/or Project Manager for several major fly ash disposal facilities for Wisconsin Electric Utilities, including site selection, subsurface feasibility evaluations, technical input to engineering design, construction and groundwater monitoring.

Project Hydrogeologist and Project Manager on a major groundwater contamination study of private water supply wells from cheese manufacturing waste processes. Scope of work included identification, evaluation and mitigation of groundwater contaminant sources.

Project Hydrogeologist for the subsurface evaluation and design of a major county zone of saturation landfill, including expert testimony at regulatory licensing hearings.

Designed a detailed test monitoring area within a large fly ash disposal facility to evaluate leachate quality and quantity generated within and leaving the facility. The test program is designed to compare field results with predicted leachate quality and environmental impacts from laboratory characterization of the ash.

Project Manager on a detailed subsurface investigation evaluating PCB contamination in soils and groundwater.

Project Hydrogeologist and Project Manager investigating the scope and magnitude of solvent contamination in soils and groundwater at a solvent reprocessing facility, including liaison with local and state governmental agencies, and public relations.

Project Hydrogeologist and Project Manager investigating contamination of a municipal water supply well derived from food processing and canning wastes.

Project Hydrogeologist for a regional groundwater resource evaluation investigating agricultural water use and its effect on process water availability for a Wisconsin paper manufacturer.

Publications

Karnauskas, Robert J. and M. P. Anderson, "Groundwater Lake Relationships and Groundwater Quality in the Sand Plain Province of Wisconsin—Nepco Lake", *Groundwater Journal*, 1978.

Ham, R. K. and R. J. Karnauskas, "Leachate Production from Milled and Unprocessed Refuse", International Solid Waste Association Information Bulletin, 1974.

Karnauskas, R. J., C. E. R. Lawson and M. E. Horn, "The Feasibility of Fly Ash Utilization for FGD Scrubber Sludge Stabilization, Columbia Generating Station, Portage, Wisconsin". Proceedings of Second Annual Conference of Applied Research and Practice on Municipal and Industrial Waste, 1979.

Karnauskas, R. J. and P. J. Huettl, "Land Application of Whey", *Dairy Field*, May and June, 1981.

Jack E. Dowden

Fields of Competence

Hydrogeologic investigations; environmental impact assessments; assessment of organic, inorganic and radionuclide contamination in subsurface environments; site characterization and remediation of hazardous waste facilities; numerical simulation of groundwater flow and contaminant migration; geophysical and geochemical characterization of groundwater regimes; project management.

Experience Summary

Experience in the geological and hydrogeological aspects of geotechnical, environmental and hazardous waste management investigations. Responsibilities have included design and installation of environmental monitoring system; environmental sampling; hydrogeologic site characterization; development of remediation plans for subsurface contamination; project management and planning; and expert testimony. Projects have involved organic, inorganic and radionuclide contamination of subsurface environments; optimization of water-supply well fields; slope stability and mine dewatering; assessment of fresh water reserves on island atolls; environmental impact assessment of natural resource development; environmental audits of industrial facilities; and feasibility studies of mine closures.

Credentials

B.S., Earth Science - University of Wisconsin (1978)

M.S., Hydrogeology - University of Nevada (1981)

American Geophysical Union

National Water Well Association, Technical Division

George B. Maxey Scholar

Employment History

1984-Present	WESTON
1981-1984	Dames & Moore
1978-1981	Desert Research Institute, Water Resources Center

Key Projects

Project Hydrogeologist and Manager for an environmental monitoring and groundwater remediation program at a major electronic manufacturing facility, including the analysis of the correlation between permitted atmospheric discharges and organic concentration in local groundwater.

Project Hydrogeologist and Manager for a numerical simulation and optimization of a Third Part Remedial Investigation/Feasibility Study (RI/FS) under CERCLA, for an electronics manufacturer requiring extensive interaction with affected public, Federal, state and local regulatory agencies, corporate legal staff and insurance carriers.

Project Hydrogeologist and Numerical Modeller for the assessment of contaminant migration from a uranium mill tailings site and the evaluation of effectiveness of proposed mitigation and closure alternatives.

Project Hydrogeologist and Expert Witness for a case in which contaminated runoff and groundwater, emanating from a liquid and solid water disposal facility, adversely impacted adjacent lands and the property values thereof.

Staff Hydrogeologist on project to estimate the fresh water reserves and delineate the fresh water-salt water contact on radioactively contaminated island atolls with electrical resistivity techniques.

Staff Hydrogeologist for impact evaluation of oil-shale development on groundwater resources and the adaptation of a computerized critical path program for the efficient analysis of water supply and waste disposal issues.

Professional Profile

4/85

EARL M. HANSEN

Credentials

B.A., Chemistry — Wittenberg University (1963)

Ph.D., Chemistry — Michigan State University (1970)

Employment History

1984-Present	WESTON
1982-1984	Envirodyne Engineers, Inc.
1977-1982	Midwest Research Institute
1973-1977	Shell Environmental Group
1972-1973	Clyde E. Williams and Associates
1969-1972	Notre Dame University

Key Projects

Managed a program to analyze environmental samples for 2,3,7,8-TCDD for the U.S. EPA. This program required the analysis of over 2,000 environmental samples in 1983.

Managed a Sampling and Analysis contract for U.S. EPA at Research Triangle Park, North Carolina. This program focused on the evaluation of a volatile organic sampling train (VOST) for the collection of volatile organic compounds from the gaseous effluents of hazardous waste incinerators. Directed the construction of two VOST trains and developed a protocol for the use of VOST to evaluate the performance of hazardous waste incinerators.

Managing EEI's laboratory Quality Assurance Program.

Participated in the design and preliminary evaluation of a laboratory-scale thermal destruction system to be used to evaluate the feasibility of incineration of liquid and solid hazardous wastes. Directed a multi-task program which required quick response methods evaluation and analysis of groundwaters and soils from hazardous waste disposal sites. Samples received in this program were analyzed for substituted phenols and polynuclear aromatic hydrocarbons (PAH's) using GC/MS and HPLC.

Managed a program to analyze process wastewaters from six organic chemical manufacturing plants. This program was

conducted for the U.S. EPA to identify and quantify the presence of organic and inorganic priority pollutants in these wastewaters. The project required design of sampling plans, development and evaluation of analytical methods, and collection and analysis of over 250 samples. These data were incorporated into the data base which is to be used by EPA to establish Best Available Treatment Technology (BAT) regulations for the organic chemical manufacturing industry.

Led the evaluation, selection, and recommendation of an inductively-coupled plasma (ICP) spectrophotometer which was purchased as an addition to MRI's atomic spectroscopy instrumentation in 1981.

Directed the completion of three projects requiring chemical analysis of air, water, and solid waste effluents which were collected from the combustion of refuse-derived fuel (RDF) as a part of an environmental assessment of waste-to-energy processes. These samples were analyzed for trace inorganic and organic components using AA, SSMS, GC, and GC/MS.

Supervised field activities for collection and shipment of wastewater samples collected from a pilot-scale wastewater treatment system in support of a treatability study of acid mine drainage conducted by the U.S. EPA.

Publications

Dalton, L.R., J.D. Rynbrandt, E.M. Hansen, and J.L. Dye, "ESR and Optical Spectra of Metal Amine and Ammonia Mixtures," J. Chem. Phys., 44, 3969 (1966).

Hentz, R.R., Farhataziz and E.M. Hansen, "Pulse Radiolysis of Liquids at High Pressures. I. Absorption Spectrum of the Hydrated Electron at Pressures up to 6.3 kbar," J. Chem. Phys., 55, 4974 (1971).

Hentz, R.R., Farhataziz and E.M. Hansen, "Pulse Radiolysis of Liquids at High Pressures. II. Diffusion Controlled Reactions of the Hydrated Electron," J. Chem. Phys., 56, 4485 (1972).

Hentz, R.R., Farhataziz and E.M. Hansen, "Pulse Radiolysis of Liquids at High Pressures. III. Hydrated Electron Reactions Not Controlled by Diffusion," J. Chem. Phys., 56, 2959 (1972).

Braswell, P., K. Guter, and E.M. Hansen, "Groundwater Monitoring Made Easy," Deeds and Data (December 1975).

Hansen, E.M., "Protocol for the Collection and Analysis of Volatile POHC's Using VOST." Prepared for Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina, Contract No. 68-02-3627 (EPA-600/8-84-007, March 1984).

Papers

Dye, J.L., L.R. Dalton, and E.M. Hansen, "ESR and Optical Spectra of Metal Amine and Ammonia Mixtures," Abstracts of the 149th National Meeting of the American Chemical Society, p. 455 (April 1965).

Hentz, R.R., Farhataziz and E.M. Hansen, "Pulse Radiolysis of Liquids at High Pressures. I. Absorption Spectrum of the Hydrated Electron at Pressures up to 6.3 kbar," J. Chem. Phys., Presented at the Conference on Radiation

and Photochemistry, Whiteshell Nuclear Research Centre, Pinawa, Manitoba, Canda (November 1971).

Hentz, R.R., Farhataziz and E.M. Hansen, "Pulse Radiolysis of Liquids at High Pressures. II. Diffusion-Controlled and Nondiffusion-Controlled Reactions of the Hydrated Electron." Presented at the National Meeting of the American Chemical Society, New York (September 1972).

Cramer, P.H., E.E. Conrad, J.E. Going, and C.L. Haile, E.M. Hansen, L.S. Malone, and A. Shan, "Analysis of Volatile Organic Priority Pollutants by the Purge and Trap Method." Presented at the Chromatography Forum, sponsored by Supelco, Inc., West Chester, Pennsylvania (May 1980).

Cramer, P.H., E.E. Conrad, J.E. Going, and C.L. Haile, E.M. Hansen, L.S. Malone, and A. Shan, "Analysis of Volatile Organic Priority Pollutants by the Purge and Trap Method." Presented at the Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Philadelphia, Pennsylvania (August 1980).

Ananth, K.P., P. Gorman, and E.M. Hansen, "Trial Burn Verification Program for Hazardous Waste Incineration." Presented at the 8th Annual Research Symposium for Land Disposal Incineration and Treatment of Hazardous Waste (March 1982).

Swanson, S.E., E.M. Hansen, L. Petrie, J.L. Spigorelli, and L.M. Williams, "Priority Pollutants in POTW Sludges." Presented at WPCF Conference, St. Louis, Missouri (October 1982).

Hansen, E.M., "Preparation and Analysis of Environmental Samples for 2,3,7,8-TCDD." Presented to St. Louis Section of American Chemical Society, St. Louis, Missouri (May 1982).

Hansen, E.M., "Analytical Methods for Determination of 2,3,7,8-TCDD in Soil." Presented as part of "Panel Discussion on Dioxin Risk Assessment" St. Louis Section of American Institute of Chemical Engineers (June 1983).

Hansen, E.M., "Analytical Methods for Determination of 2,3,7,8-TCDD in Soil." Presented to Chemistry Department Seminar Program, University of Missouri-St. Louis (September 1983).

Harry M. Ricketts

Fields of Competence

Groundwater, surface water, and soil contamination field investigations; well drilling for groundwater monitoring and petroleum reservoirs; field safety and contaminant detection instrumentation; stratigraphic formation; hydrocarbon evaluation and description; geologic mapping, mineral optics and thinsectioning.

Experience Summary

Six years experience as an analytical geologist, including two years as a thinsectionist and four years as a well site geologist. Worked on location at oil and gas drilling operations along the Gulf Coast. Provided stratigraphic and structural interpretation and hydrocarbon evaluation from drill returns, isopach, and structure contour maps. Investigation of geologic and hydrologic regimes for groundwater and surface water contamination. Supervision of drilling operations and installation of groundwater monitoring wells. Interpretation of geophysical surveys.

Credentials

B.A., Geology—Southern Illinois University at Carbondale (1980)

Water Pollution Control Federation

Southern Illinois Pollution Control Board (1982-1983)

Employment History

1984-Present WESTON

Key Projects

Supervised the drilling and installation of groundwater monitoring wells for several water quality, geological, and hydrological investigations. Sampled monitoring wells for organic compounds. Interpreted site geology and provided major input in report preparation regarding geologic controls on contaminant migration.

Evaluated suspected problems associated with past hazardous material disposal sites on governmental installation. Determined the absence or presence of contamination and potential pathways for migration. Assisted in the formal reporting of findings and conclusion to the client.

Performed RCRA statistical calculations for several industrial clients to evaluate potential significant changes in downgradient groundwater quality during detection monitoring programs.

Interpreted and reported the results of geophysical (magnetometer) surveys seeking to determine the presence of buried drums at a Midwestern industrial complex.

As Senior Geologist, assisted client petroleum geologists, engineers, and drilling personnel in the planning and execution of drilling operations. Monitored, interpreted, and evaluated geologic horizons stratigraphy, structure, and hydrocarbons well site at oil and gas drilling operations.

Provided analysis of: FID gas chromatography, micro gas analysis, bulk density, pore pressure trends, sedimentary rock descriptions, API gravity of hydrocarbons, and various drilling parameters.

Prepared thinsections of sedimentary, igneous, and metamorphic rocks. Provided analysis of framework and minerology using the polorizing light microscope.

Professional Profile

David M. Stein

Fields of Competence

Geologic well logging and installation of monitor wells for groundwater pollution analysis. Testing and analysis of aquifers through groundwater sampling techniques, monitoring methods, and pump tests.

Experience Summary

Geologic investigation, including groundwater sampling, aquifer pump and recovery testing, and well logging monitoring for numerous industrial and government agencies.

Credentials

B.A., Geology - University of Delaware (1983)

Certified NAVI Open Water Diver

Employment History

1984-Present WESTON

Key Projects

Principal field geologist for monitor well installation and groundwater sampling to determine pollution migration at government facilities in Minnesota and Michigan.

Responsible for creating a groundwater sampling regime using important sampling protocol to ensure quality control at a government facility in Illinois.

Project geologist involved as a member of a field sampling crew to sample groundwater for pollution assessment at five landfills in southern Delaware.

Project geologist involved as a member of a field crew running a groundwater sampling program as well as an aquifer pump test for a firm in northern New Jersey.

Project geologist involved as a member of a field crew responsible for implementing a groundwater sampling program, as well as aquifer recovery tests at a government facility in upstate New York.

Professional Profile

APPENDIX D

Well Construction Summaries and Boring Logs

Contents

	Page
Well Construction Summaries	D1
Boring Logs	D26

WELL CONSTRUCTION SUMMARIES

Well W-1

Well Construction Summary

Location or Coords: East Ramp Selfridge ANG Base

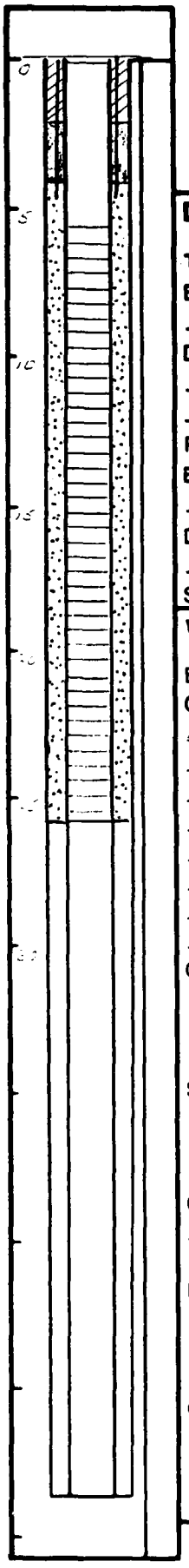
Elevation: Ground Level 576.50

Top of Casing 575.82

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ___

Casing String(s): C = Casing S = Screen

26.0'	-	6.0'	S1	___ - ___	___
6.0'	-	0.0'	C1	___ - ___	___
4.0'	-	0.0'	C2	___ - ___	___
___	-	___	___	___ - ___	___
___	-	___	___	___ - ___	___
___	-	___	___	___ - ___	___
___	-	___	___	___ - ___	___
___	-	___	___	___ - ___	___

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0' - 500 lbs medium SAND

Cement Surface → 2.0' - HURON® Type I Portland cement grout; 50 lbs

Other 2.0' - 4.0' 16 lbs Quik Gel® bentonite powder

Flush mount in plastic Nelson® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	1/28	9:22	1/28	10:32
Geophys. Logging:				
Casing: C1 and S1	1/28	10:33	1/28	10:37
C2	1/28	12:10	1/28	12:15
Filter Placement:	1/28	11:15	1/28	11:50
Cementing:	1/28	12:00	1/28	12:20
Development:				
Other:				

Well Development:

Bailed approximately 35 gallons of sediment-laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-2

Well Construction Summary

Location or Coords: East Ramp Selfridge ANG Base

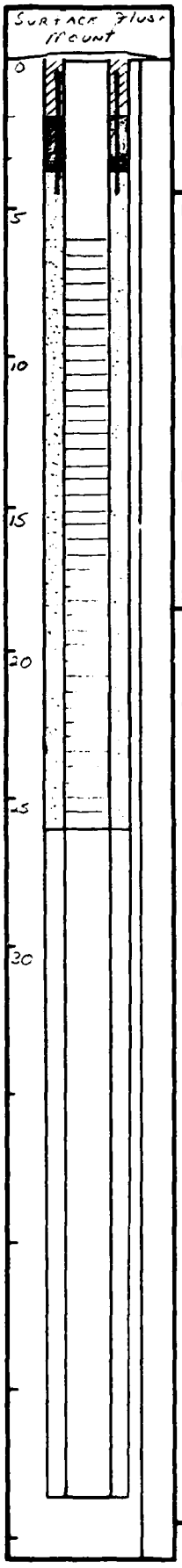
Elevation: Ground Level 576.34

Top of Casing 575.36

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ___

Casing String(s): C = Casing S = Screen

26.0'	- 6.0'	S1		-	
6.0'	- 0.0'	C1		-	
4.0'	- 0.5'	C2		-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 3.8' → 26.0', 520 lbs medium sand

Cement 0.0 → 2.0', 50 lbs Hunon® Type I Portland cement grout

Other 2.0' → 3.8', 12 lbs Quik Gel® Bentonite powder

Flush mounted within plastic NELSON® Valve Box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	1/28	12:53	1/28	14:05
Geophys. Logging:				
Casing: C1 and S1	1/28	14:10	1/28	14:15
C2	1/28	15:32	1/28	15:34
Filter Placement:	1/28	14:45	1/28	15:17
Cementing:	1/28	15:30	1/28	15:35
Development:				
Other:				

Well Development:

Bailed approximately 30 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-3

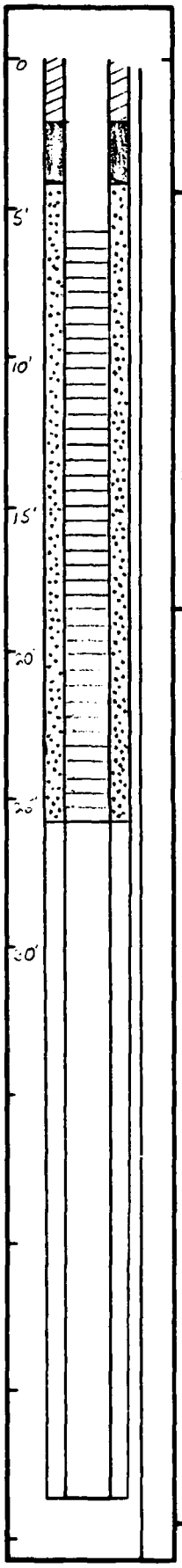
Well Construction Summary

Location or Coords: East Ramp
Selfridge ANG Base

Elevation: Ground Level 575.01
Top of Casing 574.34

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan
Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'
Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45
Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1			
6.0'	0.0'	C1			
4.0'	0.5'	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0', 320 lbs medium sand

Cement Surface → 2.6', 50 lbs Huron® Type I Portland cement grout

Other 2.6' → 4.0', 12 lbs Quik Gel® Bentonite powder

Flush mounted in plastic NELSON® Valve Boxes

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	1/29	12:38	1/29	13:40
Geophys. Logging:				
Casing: C1 and S1	1/29	14:45	1/29	1447
C2	1/29	13:05	1/29	13:10
Filter Placement:	1/29	14:45	1/29	15:00
Cementing:	1/29	15:02	1/29	15:17
Development:				
Other:				

Well Development:

Bailed approximately 30 gallons of sediment-laden water.

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-4

Well Construction Summary

Location or Coords: East Ramp Selfridge ANG Base

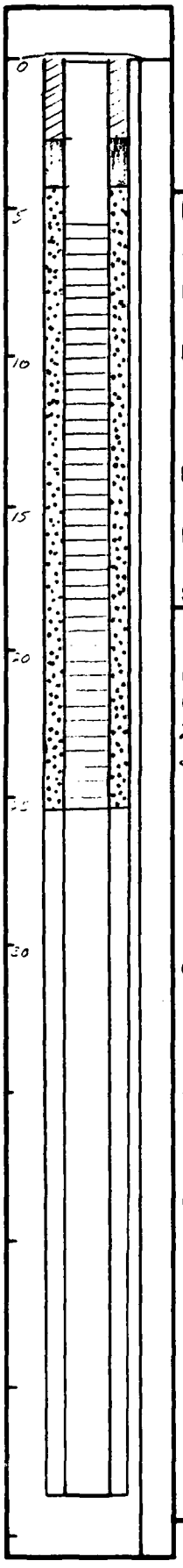
Elevation: Ground Level 575.87

Top of Casing 575.67

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.5'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

25.5'	-	5.5'	S1	____	-	____	____
5.5'	-	0.0'	C1	____	-	____	____
4.0'	-	0.5'	C2	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.3'-25.5', 480 lbs medium sand

Cement Surface → 2.7', 62 lbs Hanson® Type I Portland cement grout

Other 2.7 → 4.3', 15 lbs Quik-Set® bentonite powder

Flush mounted in plastic NELSON® Valve Box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	1/29	8:55	1/29	10:05
Geophys. Logging:				
Casing:				
C1 and S1	1/29	10:21	1/29	10:28
C2	1/29	11:27	1/29	11:28
Filter Placement:	1/29	11:04	1/29	11:20
Cementing:	1/29	11:25	1/29	11:50
Development:				
Other:				

Well Development:

Bailed approximately 32 gallons of sediment-laden water.

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-5

Well Construction Summary

Location or Coords: Tinker Creek Landfill - Selfridge ANGB

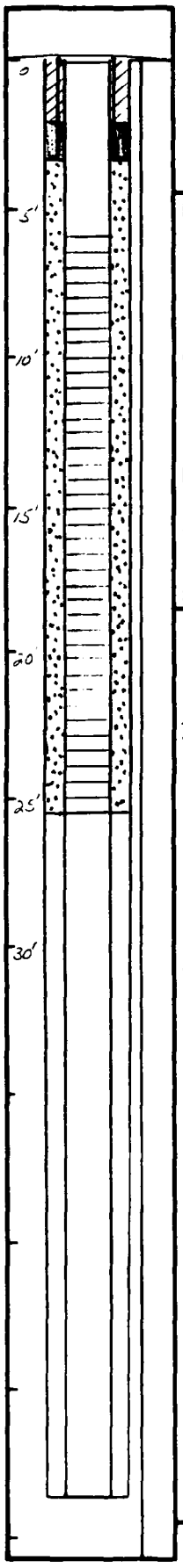
Elevation: Ground Level 579.85

Top of Casing 579.91

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	-	6.0'	S1	____	-	____	____
6.0'	-	0.0'	C1	____	-	____	____
4.0'	-	0.5'	C2	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____
____	-	____	____	____	-	____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 3.25' → 26.0', 520 lbs medium sand.

Cement 0.0' - 2.0', 30 lbs Lonex® Type I Portland cement grout

Other 2.0' - 3.25', 12 lbs Quik-Set® bentonite powder

Flush mounted in plastic WELSCO® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/7	9:25	2/7	10:18
Geophys. Logging:				
Casing:				
C1 and S1	2/7	10:21	2/7	10:23
C2	2/7	11:18	2/7	11:21
Filter Placement:	2/7	10:48	2/7	11:15
Cementing:	2/7	11:17	2/7	11:35
Development:				
Other:				

Well Development:

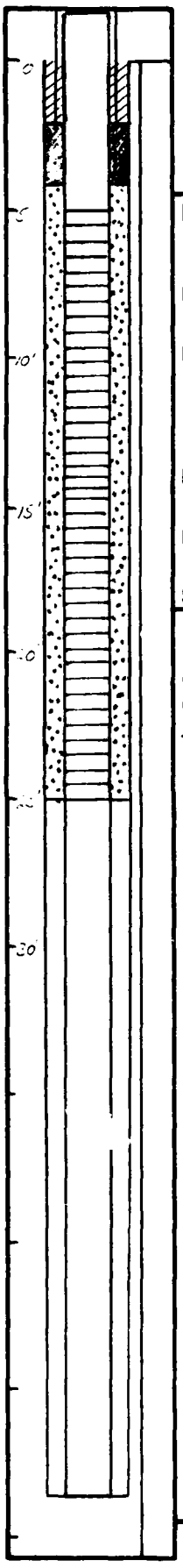
Bailed approximately 28 gallons of sediment-laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan
Personnel D. M. Stein



Well W-6

Well Construction Summary

Location or Coords: Tucker Creek Landfill - Selfridge ANG B

Elevation: Ground Level 577.24

Top of Casing 579.06

Drilling Summary:

Total Depth 25.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ___

Casing String(s): C = Casing S = Screen

25.0'	5.0'	S1	___	___	___
5.0'	2.0'	C2	___	___	___
3.0'	2.3'	C2	___	___	___

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 25.0', 480 lbs medium sand

Cement surface → 2.0', 50 lbs Huron® Type I Portland cement grout

Other 2.0' → 4.0', 12 lbs Quik-Gel® bentonite powder

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/7	12:55	2/7	14:10
Geophys. Logging:				
Casing: C1 and S1	2/7	14:14	2/7	14:16
C2	2/7	14:55	2/7	15:00
Filter Placement:	2/7	14:37	2/7	14:50
Cementing:	2/7	14:52	2/7	15:04
Development:				
Other:				

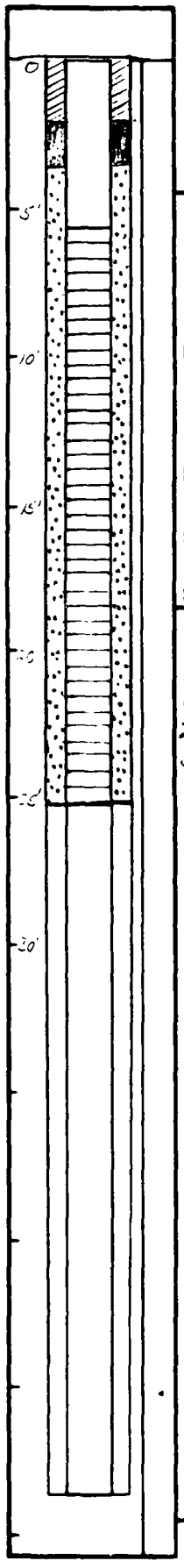
Well Development:

Bailed approximately 26 gallons of cloudy water

Comments:

WESTON DESIGNERS CONSULTANTS

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program
Location Mount Clemens, Michigan
Personnel D. M. Stein



Well W-7

Well Construction Summary

Location or Coords: Tucker Creek Landfill

Elevation: Ground Level 576.5'
Top of Casing 576.36

Drilling Summary:

Total Depth 25.5'
Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45
Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"
Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____
Casing String(s): C = Casing S = Screen

25.5'	- 5.5'	S1	____	- ____	____
5.5'	- 0.0'	C1	____	- ____	____
4.0'	- 0.0'	C2	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread
C2 DIEDRICH® 4" I.D. Protective Steel Casing
Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers
Filter Material 3.5'→25.5', 480 lbs medium sand
Cement 0.0'→2.0', 50 lbs Yuneat Type I Portland cement grout
Other 2.0→3.5', 12 lbs Quik-Gel® bentonite powder

Flushmounted in plastic NELSON® Valve Box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/8	9:05	2/8	10:02
Geophys. Logging:				
Casing: C1 and S1	2/8	10:07	2/8	10:09
C2	2/8	10:42	2/8	10:45
Filter Placement:	2/8	10:33	2/8	10:37
Cementing:	2/8	10:40	2/8	11:00
Development:				
Other:				

Well Development:

Bailed approximately 32 gallons of sediment laden water

Comments:

D7

WESTON DESIGNERS CONSULTANTS

Well GW-8

Well Construction Summary

Location or Coords: Northwest Landfill Selfridge ANG Base

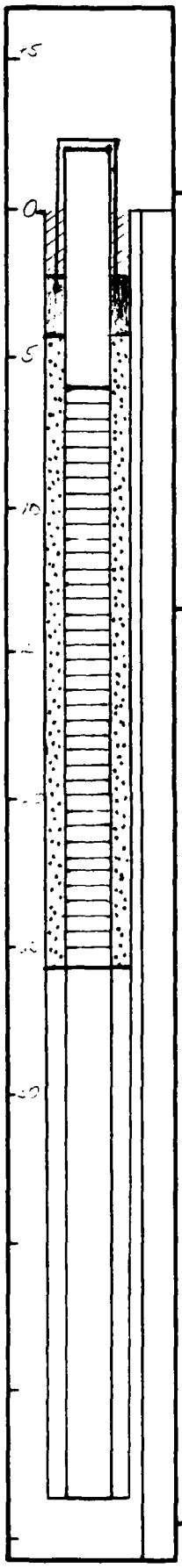
Elevation: Ground Level 587.12

Top of Casing 589.09

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1			
6.0'	+2.0	C2			
3.0'	+2.3	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0', 560 lbs medium sand

Cement Surface → 2.0', 50 lbs Huron® Iron I Portland cement grout

Other 2.0' → 4.0', 12 lbs Quik-Set® Bentonite Powder

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/4	12:10	2/4	13:35
Geophys. Logging:				
Casing: C1 and S1	2/4	13:41	2/4	13:43
C2	2/4	15:56	2/4	16:00
Filter Placement:	2/4	14:10	2/4	15:46
Cementing:	2/4	15:49	2/4	16:00
Development:				
Other:				

Well Development:

Solid approximately 3/4 gallons of cloudy water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-9

Well Construction Summary

Location or Coords: Northwest Landfill - Selfridge ANG Base

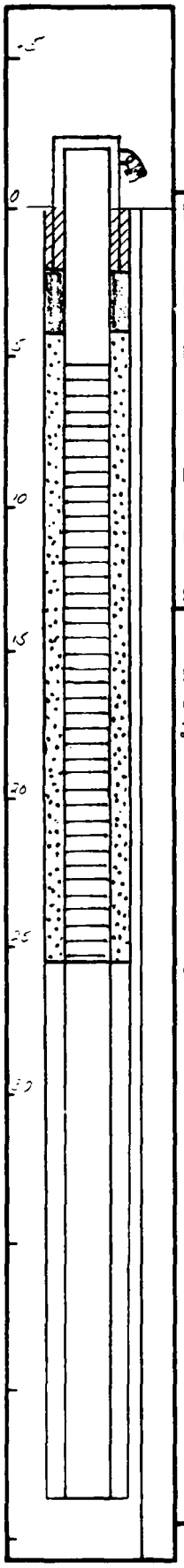
Elevation: Ground Level 581.01

Top of Casing 583.66

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1	____	____	____
6.0'	+2.0'	C1	____	____	____
3.0'	+2.3'	C2	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0', 400 lbs medium sand

Cement 0.0' → 2.0', 150 lbs Huner® Type I Portland cement grout

Other 2.0' → 4.0', 12 lbs Gel-Sea® bentonite powder

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/1	0940	2/1	1035
Geophys. Logging:				
Casing: C1 and S1	2/1	1040	2/1	1042
C2	2/1	1240	2/1	1245
Filter Placement:	2/1	1110	2/1	1225
Cementing:	2/1	1226	2/1	1250
Development:				
Other				

Well Development:

Bailed approximately 32 gallons of sediment laden water.

Comments:

A washout void exists 1-2' below land surface. A large amount of cement was used to fill this void

WESTON DESIGNERS CONSULTANTS

Well 16-10

Well Construction Summary

Location or Coords: Northwest Landfill / Selfridge ANG Base

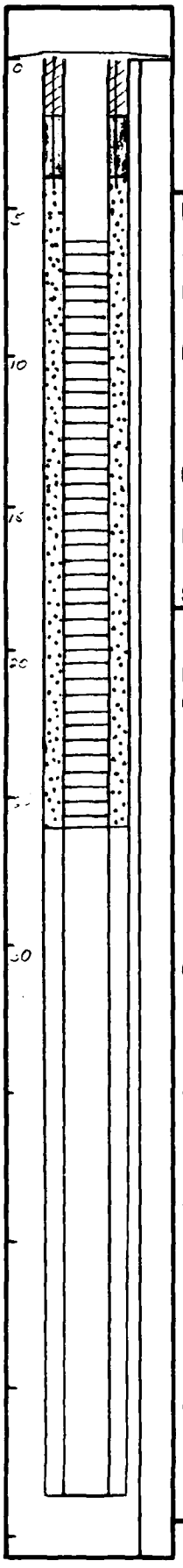
Elevation: Ground Level 581.7

Top of Casing 580.67

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1		-	
6.0'	0.0'	C1		-	
4.0'	0.0	C2		-	
	-			-	
	-			-	
	-			-	
	-			-	
	-			-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0' - 52 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs Huron Tree I Portland Cement

Other 2.0' - 4.0' lbs Quik Gel bentonite powder

Flush mount in plastic Nelson® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	1/31	1250	1/31	1350
Geophys. Logging:				
Casing: C1 and S1	1/31	1354	1/31	1406
C2	1/31	1516	1/31	1518
Filter Placement:	1/31	1433	1/31	1510
Cementing:	1/31	1510	1/31	1535
Development:				
Other:				

Well Development:

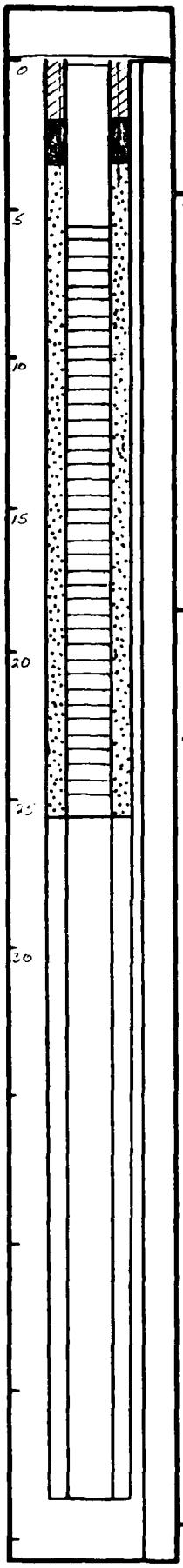
Bailed approximately 32 gallons of cloudy water

Comments:

WESTON DESIGNERS CONSULTANTS

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan
Personnel D. M. Stein



Well W-11

Well Construction Summary

Location or Coords: West Ramp Selfridge ANG Base

Elevation: Ground Level 578.83
Top of Casing 579.45

Drilling Summary:

Total Depth 25.5'
Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45
Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ___

Casing String(s): C = Casing S = Screen

25.5'	- 5.5'	S1		-	
5.5'	-	C1		-	
4.0'	- 0.0	C2		-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 3.5' → 25.5' - 40/16 medium grain sand

Cement Surface → 2.0' - 50 lbs Huron® Type I Portland Cement

Other 2.0' → 4.0', 12 lbs Quik Gel® bentonite

Flush mount in plastic Nelson® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/6	1225	2/6	1310
Geophys. Logging:				
Casing: C1 and S1	2/6	1316	2/6	1324
C2	2/6	1403	2/6	1405
Filter Placement:	2/6	1350	2/6	1400
Cementing:	2/6	1400	2/6	1420
Development:				
Other:				

Well Development:

Comments:

D11

WESTON DESIGNERS CONSULTANTS

Well W-12

Well Construction Summary

Location or Coords: West Ramp, Selfridge ANG Base

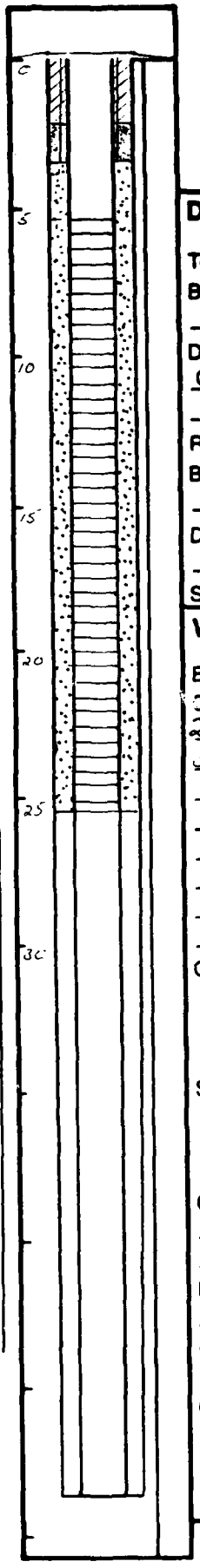
Elevation: Ground Level 587.15

Top of Casing 581.69

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.5'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

25.5'	-	5.5'	S1	-	
5.5'	-			-	
4.0'	-	0.0	C2	-	
	-			-	
	-			-	
	-			-	
	-			-	
	-			-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 3.5' → 25.5', 460 lbs medium grain sand

Cement Surface → 2.0', 50 lbs Huron® Type I Portland cement

Other 2.0' → 3.5', 12 lbs Volvo Western Clay Bentonite

Flush mount in plastic Nelson® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/6	1443	2/6	1532
Geophys. Logging:				
Casing: C1 and S1	2/6	1534	2/6	1536
C2	2/6	1611	2/6	1615
Filter Placement:	2/6	1558	2/6	1607
Cementing:	2/6	1607	2/6	1610
Development:				
Other:				

Well Development:

Bailed ~29 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-13

Well Construction Summary

Location or Coords: West Ramp Selfridge ANG Base

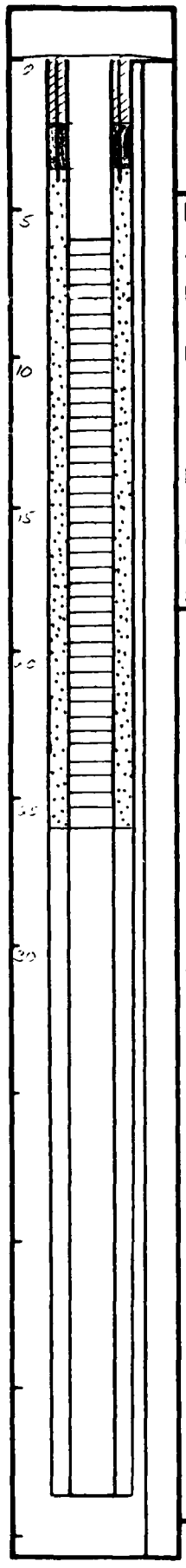
Elevation: Ground Level 581.6'

Top of Casing 581.07

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	- 6.0'	S1	-	-	
6.0'	-	C1	-	-	
4.0'	- 0.0	C2	-	-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 3.5' → 26.0' - 480 lbs of medium grain sand

Cement Surface → 2.0' - Hydro® Type I Portland cement - 75 lbs

Other 2.0' → 3.5', 18 lbs Quik Gel® bentonite powder

Flush mount in plastic Nebon® valve box

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/5	1233	2/5	1331
Geophys. Logging:				
Casing: C1 and S1	2/5	1332	2/5	1334
C2	2/5	1440	2/5	1444
Filter Placement:	2/5	1405	2/5	1424
Cementing:	2/5	1430	2/5	1446
Development:				
Other:				

Well Development:

Bailed approximately 33 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-14

Well Construction Summary

Location or Coords: West Ramp Selfridge ANG Base

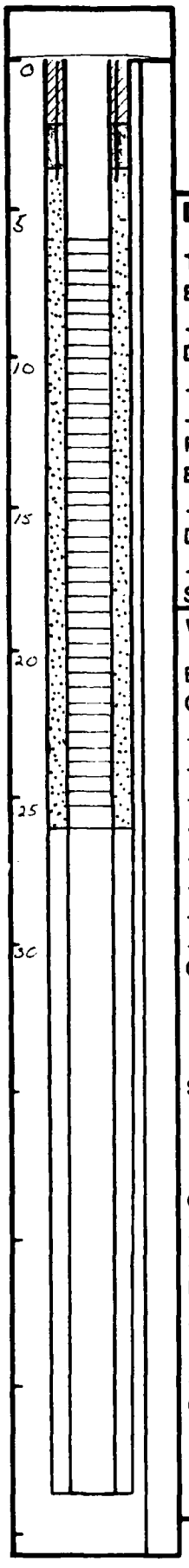
Elevation: Ground Level 581.94

Top of Casing 581.43

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log

Casing String(s): C = Casing S = Screen

26.0'	- 6.0'	S1		-	
6.0'	-	C1		-	
4.0'	- 0.0	C2		-	

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 3.5 → 26.0', 420 lbs medium grain sand

Cement Surface → 2.0', 75 lbs Huron® Type I Portland cement

Other 2.0' - 3.5', 25 lb Quik Gel bentonite powder

Construction Time Log:

Task	Start Date (1985)	Start Time	Finish Date (1985)	Finish Time
Drilling: HSA	2/5	910	2/5	1016
Geophys. Logging:				
Casing: C1 and S1	2/5	1023	2/5	1026
C2	2/5	1120	2/5	1125
Filter Placement:	2/5	1055	2/5	1110
Cementing:	2/5	1110	2/5	1130
Development:				
Other:				

Well Development:

Bailed approximately 34 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-15

Well Construction Summary

Location or Coords: West Ramp Selfridge ANG Base

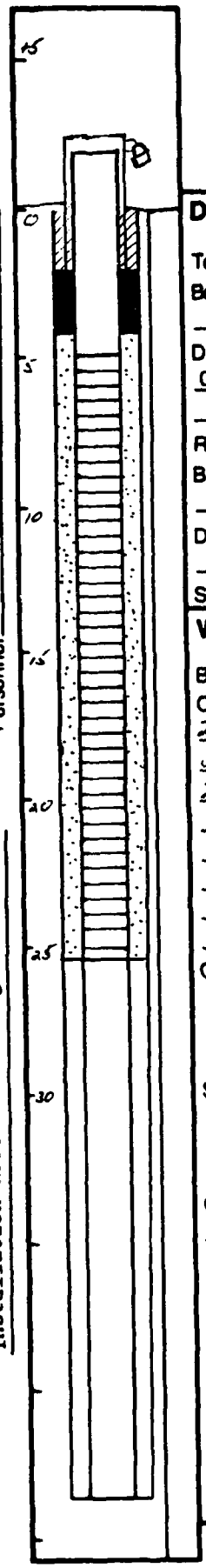
Elevation: Ground Level 582.79

Top of Casing 584.86

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.6'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

25.6	5.6	S1			
5.6	+2.0	C1			
2.7	+2.3	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 25.6' 440 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs Huron® Type I Portland cement

Other 2.0' → 4.0' 16 lbs Volvo clay Western® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	2/6	855	2/6	1025
Geophys. Logging:				
Casing: C1 and S1	2/6	1027	2/6	1029
C2	2/6	1115	2/6	1117
Filter Placement:	2/6	1053	2/6	1110
Cementing:	2/6	1110	2/6	1120
Development:				
Other:				

Well Development:

Bailed approximately 21 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-16

Well Construction Summary

Location or Coords: Fire Training Area-1, Selfridge ANG Base

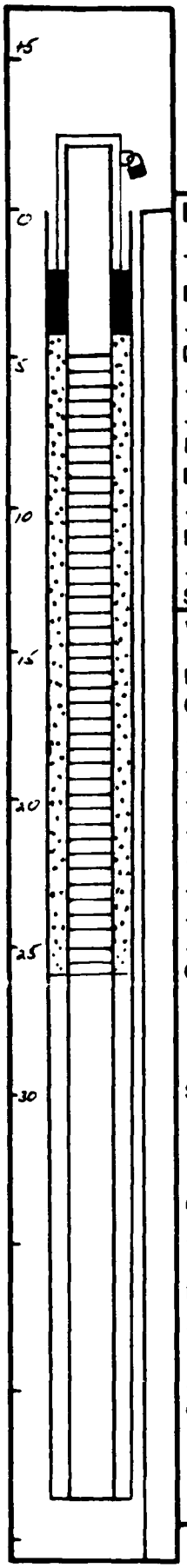
Elevation: Ground Level 577.47

Top of Casing 577.61

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1			
6.0'	+2.0'	C1			
2.7'	+2.3	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 3.5' → 26', 450 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs Huron® Type I Portland cement

Other 2.0' → 3.5' - 12 lbs Ex Cel® bentonite

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
HSA	1/23/1985	1230	1/23/1985	1325
Geophys. Logging:				
Casing:				
C1 and S1	1/23	1325	1/23	1330
C2	1/23	1450	1/23	1455
Filter Placement:	1/23	1400	1/23	1417
Cementing:	1/23	1417	1/23	1455
Development:				
Other:				

Well Development:

Bailed approximately 34 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-17

Well Construction Summary

Location or Coords: Fire Training Area 1, Selfridge ANG Base

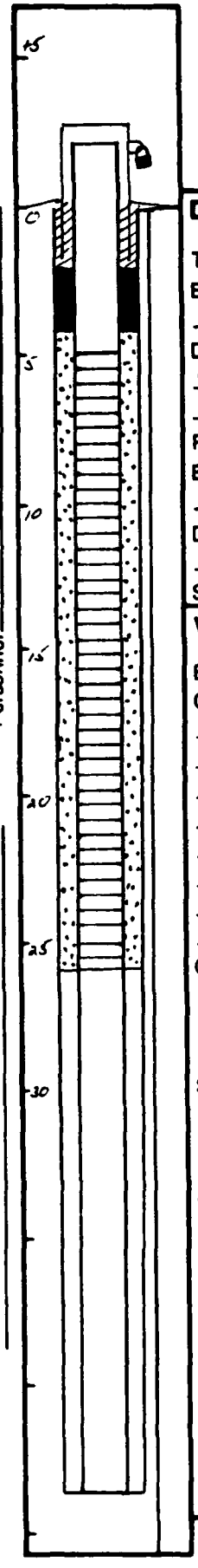
Elevation: Ground Level 577.87

Top of Casing 579.96

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	- 6.0'	S1	____	- ____	____
6.0'	- +2.0'	C1	____	- ____	____
2.5'	- +2.5'	C2	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____
____	- ____	____	____	- ____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0' - 412 lbs medium grain sand

Cement Surface → 2.0', 100 lbs Huron® Type I Portland cement

Other 2.0' → 4.0', 37 lbs Ex-Cel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/23	925	1/23	1010
Geophys. Logging:				
Casing: C1 and S1	1/23	1012	1/23	1017
C2	1/23	1125	1/23	1130
Filter Placement:	1/23	1041	1/23	1104
Cementing:	1/23	1104	1/23	1125
Development:				
Other:				

Well Development:

Bailed approximately 28 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well LW-18

Well Construction Summary

Location or Coords: East Training Area - 1 Selfridge ANG Base

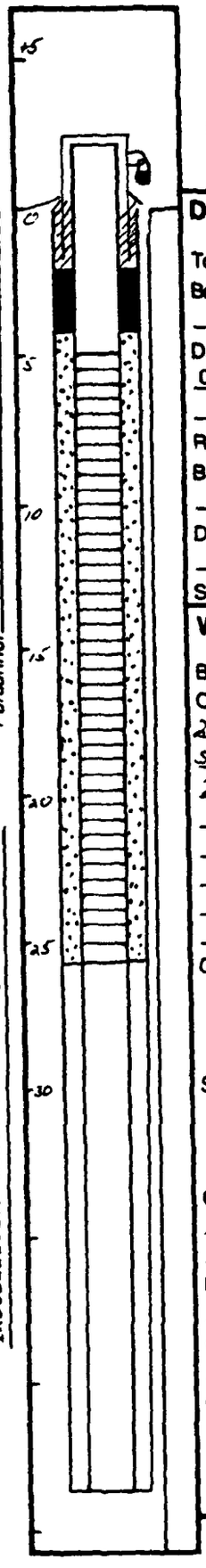
Elevation: Ground Level 578.15

Top of Casing 580.77

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.7'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid none

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ___

Casing String(s): C = Casing S = Screen

25.7'	5.7'	S1			
5.7'	+2.0'	C1			
2.5'	+2.5'	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 4.0 → 25.7', 400 lbs. medium grain sand

Cement Surface → 2.0', 50 lbs. Huron® Type I Portland cement

Other 2.0 → 4.0', 37 lbs. Ex-Cel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/22	1315	1/22	1410
Geophys. Logging:				
Casing: C1 and S1	1/22	1420	1/22	1430
C2	1/22	1545	1/22	1550
Filter Placement:	1/22	1430	1/22	1530
Cementing:	1/22	1535	1/22	1545
Development:				
Other:				

Well Development:

Bailed approximately 32 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-19

Well Construction Summary

Location or Coords: Fire Training Area-2, Selfridge ANG Base

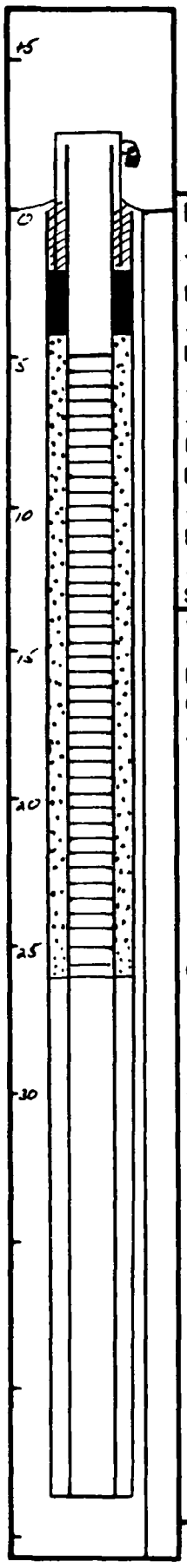
Elevation: Ground Level 580.46

Top of Casing 582.37

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S_1	____	____	____
6.0'	+2.0	C_1	____	____	____
2.6'	-2.4	C_2	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____

Casing: C_1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C_2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S_1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 4.0 → 26.0' 520 lbs medium grain sand

Cement Surface → 2.0', 50 lbs Huron® Type I Portland cement

Other 2.0' → 4.0', 25 lbs Quik Gel® Bentonite

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
HSA	1/30/1985	912	1/30/1985	1010
Geophys. Logging:				
Casing:				
C1 and S1	1/30	1017	1/30	1019
C2	1/30	1136	1/30	1138
Filter Placement:	1/30	1045	1/30	1120
Cementing:	1/30	1120	1/30	1140
Development:				
Other:				

Well Development:

Bailed approximately 33 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well MW-20

Well Construction Summary

Location or Coords: Fire Training Area 2, Selfridge ANG Base

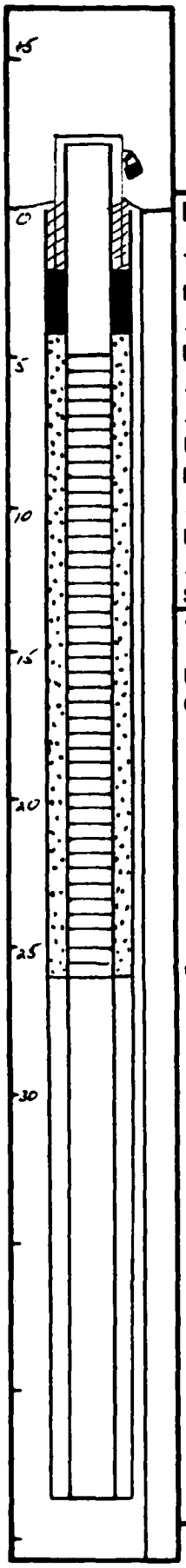
Elevation: Ground Level 579.37

Top of Casing Destroyed

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1	____	____	____
6.0'	+2.0'	C1	____	____	____
2.7'	+2.3'	C2	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None: Screen and riser casing installed through hollow-stem augers

Filter Material 4.0'→26.0' - 520 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs Huron® Type I Portland cement

Other 2.0' → 4.0' - 25 lbs Quik Gel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/30	1245	1/30	1343
Geophys. Logging:				
Casing: C1 and S1	1/30	1348	1/30	1350
C2	1/30	1508	1/30	1510
Filter Placement:	1/30	1436	1/30	1500
Cementing:	1/30	1505	1/30	1512
Development:				
Other:				

Well Development:

Bailed approximately 28 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-21

Well Construction Summary

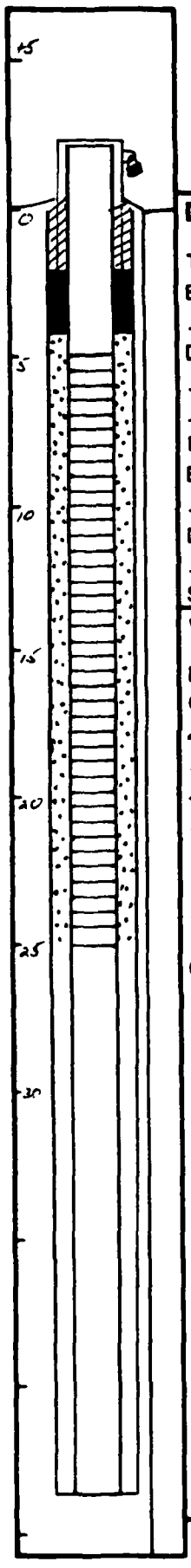
Location or Coords: Fire Training Area-2, Selfridge ANG Base Elevation: Ground Level 579.55

Top of Casing 579.46

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0'	6.0'	S1			
6.0'	+2.0'	C1			
2.5'	+2.5'	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0', 480 lbs medium grain sand

Cement Surface → 2.0', 75 lbs Huron® Type I Portland cement

Other 2.0' → 4.0', 12 lbs Gut. Gel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/31	1000	1/31	1055
Geophys. Logging:				
Casing: C1 and S1	1/31	1059	1/31	1102
C2	1/31	1156	1/31	1159
Filter Placement:	1/31	1130	1/31	1154
Cementing:	1/31	1155	1/31	1159
Development:				
Other:				

Well Development:

Bailed approximately 32 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-22

Well Construction Summary

Location or Coords: Southwest Landfill Selfridge ANG Base

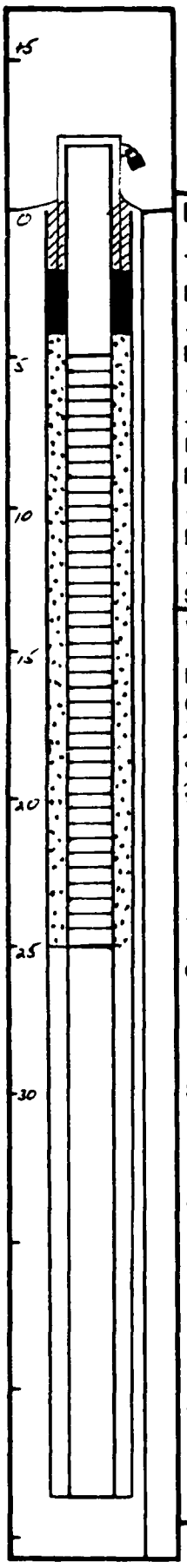
Elevation: Ground Level 582.60

Top of Casing 584.43

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid NONE

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

25.0'	5.0'	S1			
5.0'	+2.0'	C1			
2.3'	+2.5'	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 25.0' - 42 lbs medium grain sand

Cement Surface → 2.0' - 33 lbs, Huron® Type I Portland cement

Other 2.0' → 4.0', 12 lbs Quik-Gel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/24	1300	1/24	1350
Geophys. Logging:				
Casing: C1 and S1	1/24	1357	1/24	1400
C2	1/24	1524	1/24	1526
Filter Placement:	1/24	1425	1/24	1512
Cementing:	1/24	1512	1/24	1525
Development:				
Other:				

Well Development:

Bailed approximately 3 gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well W-23

Well Construction Summary

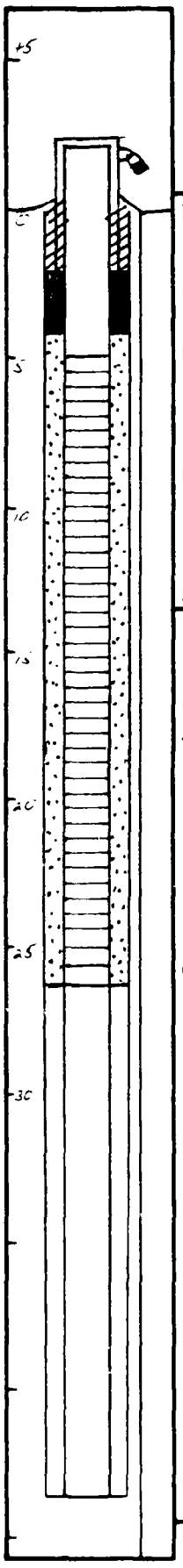
Location or Coords: Southwest Landfill, Selfridge ANGB Elevation: Ground Level 587.23

Top of Casing TOC

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log

Casing String(s): C = Casing S = Screen

26.0	6.0'	S1			
6.0'	+2.0'	C1			
2.6'	+2.4'	C2			

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0' - 880 lbs medium grain sand

Cement Surface → 2.0' - 37 lbs Huron® Type I Portland cement

Other 2.0' → 4.0' - 12 lbs Quik Gel® bentonite

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling: HSA	1/24/1985	1300	1/24/1985	1350
Geophys. Logging:				
Casing: C1 and S1	1/24	1400	1/24	1402
C2	1/24	1643	1/24	1645
Filter Placement:	1/24	1442	1/24	1635
Cementing:	1/24	1638	1/24	1643
Development:				
Other				

Well Development:

Bailed approximately — gallons of sediment laden water

Comments:

WESTON DESIGNERS CONSULTANTS

Well G-24

Well Construction Summary

Location or Coords: Southwest Landfill / Selfridge ANGB

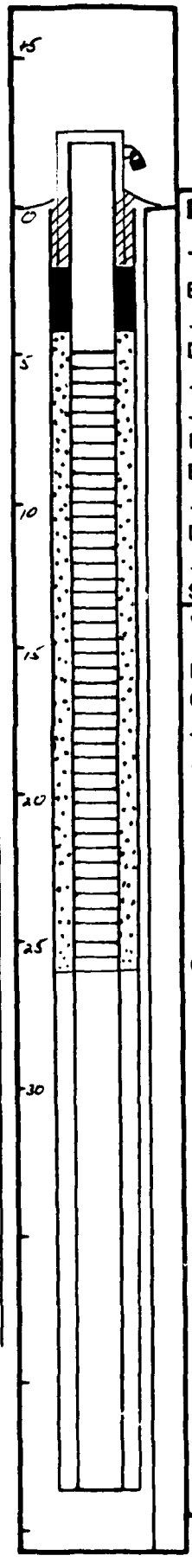
Elevation: Ground Level 585.07

Top of Casing 587.22

Project Selfridge ANG Base - Phase II Stage 1
Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 26.0'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid None

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

26.0' - 6.0'	S1		
6.0' - +2.0'	C1		
2.5 - +2.5	C2		

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0' → 26.0' - 480 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs, Huron® Type I Portland cement

Other 2.0' → 4.0' - 12 lbs. Quik Gel® bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/24	1615	1/24	1704
Geophys. Logging:				
Casing: C1 and S1	1/25	0943	1/25	0946
C2	1/25	1127	1/25	1130
Filter Placement:	1/25	1615	1/25	1115
Cementing:	1/25	1115	1/25	1120
Development:				
Other:				

Well Development:

Bailed approximately 2.9 gallons of sediment laden water

Comments:

024

WESTON DESIGNERS CONSULTANTS

Well W-25

Well Construction Summary

Location or Coords: Southwest Landfill Selfridge ANGB

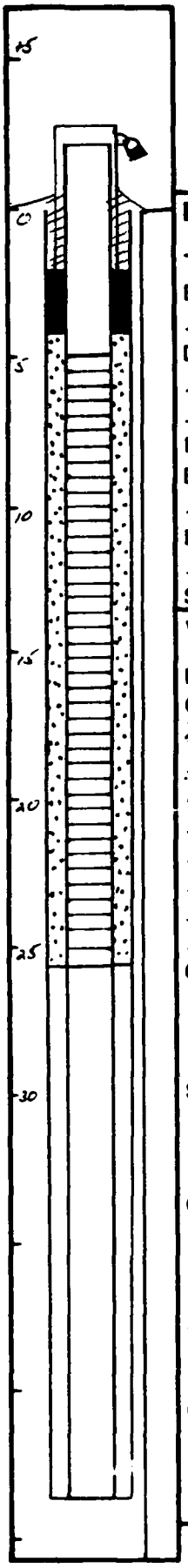
Elevation: Ground Level 584.43

Top of Casing 586.42

Project Selfridge ANG Base - Phase II Stage 1 Installation Restoration Program

Location Mount Clemens, Michigan

Personnel D. M. Stein



Drilling Summary:

Total Depth 25.6'

Borehole Diameter 8"

Driller Testing Engineers and Consultants- Troy, Michigan

Rig CME - 45

Bit(s) Hollow-Stem Auger (HSA) 3.25" x 8.0"

Drilling Fluid none

Surface Casing 4.0" I.D. Steel

Well Design:

Basis: Geologic Log XX Geophysical Log ____

Casing String(s): C = Casing S = Screen

25.6	5.6'	S1	____	____	____
5.6	2.0'	C1	____	____	____
2.4'	2.6'	C2	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____

Casing: C1 DIEDRICH® 2" I.D. PVC Schedule 40, Flush Thread

C2 DIEDRICH® 4" I.D. Protective Steel Casing®

Screen: S1 WESTERN WELL® 2" I.D. Stainless Steel, 0.010" slot size, Flush Thread

Centralizers None; Screen and riser casing installed through hollow-stem augers

Filter Material 4.0'→25.6' - 44 0 lbs medium grain sand

Cement Surface → 2.0' - 50 lbs Huron® Type I Portland cement

Other 2.0' → 4.0' - 12 lbs Quik-Gel bentonite

Construction Time Log:

Task	Start Date 1985	Start Time	Finish Date 1985	Finish Time
Drilling: HSA	1/24	0920	1/24	1015
Geophys. Logging:				
Casing: C1 and S1	1/24	1025	1/24	1028
C2	1/24	1150	1/24	1152
Filter Placement:	1/24	1055	1/24	1143
Cementing:	1/24	1143	1/24	1150
Development:				
Other:				

Well Development:

Bailed approximately 30 gallons of sediment laden water

Comments:

n25

WESTON DESIGNERS CONSULTANTS

BORING LOGS

WESTON

DRILLING LOG

WELL NUMBER: W-1 OWNER: Selfridge ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 576.50 WATER LEVEL: 13-14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-28-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold, overcast
Hnu background 4-5 ppm

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-4		1	SS	25/18"	SM: 1.0'-2.5' Brown silty sand grading into a yellow brown silty sand at 2.5', minor mottling, faint bedding, dry, firm.	1-2 ppm	
4-6		2	SS	21/18"	3.5'-5.0' Light yellow brown fine silty sand minor faint bedding, orange discoloration, silty wet clay near 5'	6 ppm	
6-9		3	SS	13/18"	CH(CL): 6.0'-7.5' Light brown, dry massive clay at 6' grading in a gray massive clay, firm.	1-2 ppm	
9-11		4	SS	8/18"	CH(CL): 9.0'-10.5' Gray, massive, damp clay, somewhat loose, slightly plastic.	BG	
11-14		5	SS	2/18"	CH: 14.0'-15.5' Same as above, wet, massive, very plastic, loose. Free water at approx. 13-14'	BG	
16-19		6	SS	1/18"	CH: 19.0'-20.5' Same as above	BG	

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-1 OWNER: Selfridge ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 24.0'
SURFACE ELEVATION: 576.56 WATER LEVEL: 13-14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-28-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		7	SS	1/18"	CH: 23.5'- 25.0'-Same as above	BG	
24							
25							

*ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-2 OWNER: Selfridge, ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 576.34 WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-28-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu
1-4		1	SS	17/18"	SM: 1.0'-2.5' Light yellowish brown silty sand, mottled, no bedding, dry, competent (firm).	2-6 ppm
5-6		2	SS	16/18"	SW(SM): 3.5'-5.0' Light brown fine well sorted (some silt) sand no bedding, wet (3').	2 ppm
7-8		3	SS	15/18"	CL: 6.0'-7.5' Brown, massive, slightly plastic clay, dry.	BG
9-11		4	SS	8/18"	CH(CL): 9.0'-10.5' Gray, massive, slightly plastic clay damp.	BG
12-14					Free water at survey 12-13'	
15-16		5	SS	7/18"	CH: 14.0'-15.5' Gray, massive, wet, fat clay loose, very plastic.	BG
17-20		6	SS	1/18"	19.0'-20.5' Same as above	BG

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-2 OWNER: Selfridge, ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 36.0'
SURFACE ELEVATION: 576.34' WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-28-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	1/18"	23.5'-25.0'-Same as above	BG	
23							
24							
25							

* A.S.T.M. D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-3 OWNER: Selfridge ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 575.0' WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-29-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu
1		1	SS	18/18"	PT: 1.0'-2.5' Black silty sand (fill) rich in organics	5 ppm
2					massive dry hard gravelly	
3		2	SS	13/18"	3.5'-5.0' Light brown fine silty clayey sand at 3.5'	8 ppm
4					grading into a massive dry bluish L/green-gray clay	
5		3	SS	14/18"	CH: 6.0'-7.5' Brown (blue/green hue) clay, massive	5 ppm
6					dry, slightly plastic.	
7						
8		4	SS	8/18"	9.0'-10.5' Same as above	3 ppm
9						
10						
11					Free water at approx. 12-13'	
12						
13		5	SS	2/18"	CH: 14.0'-15.5' Massive, highly plastic, gray (blue	3-4 ppm
14					tint) wet clay, soft, loose.	
15						
16						
17						
18		6	SS	2/18"	19.0'-20.5'-Same as above	3 ppm
19						
20						
21						

* ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-3
LOCATION: East Ramp
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 575.01
WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-29-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	1 / 18"	CH: 23.5'-25.0' Same as above	BG	
23							
24							
25							

* A.S.T.M. D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-4 OWNER: Selfridge ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.5'
SURFACE ELEVATION: 575.87 WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-29-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Hnu BG: 1 ppm

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-3		1	SS	18/18"	SW-CL: 1.0'-2.5' Light yellow brown fine sand at 1.5' grading into a gravelly dark brown clay (fill) dry.	BG	
3-6		2	SS	9/18"	3.5'-5.0' Dark brown fine silty clayey sand (fill) at 3.5'-4.0' Grading into a light yellow-grayish brown clay dry.	BG	
6-8		3	SS	14/18"	CL: 6.0'-7.5' Brown bluish clay, massive, dry, no sand or gravel, slightly plastic, hard .	5 ppm	
8-10		4	SS	7/18"	CH: 9.0'-10.5' Brown bluish green clay, damp, massive medium plasticity.	4 ppm	
10-12					First H_2O at approx. 12'-13'.		
12-15		5	SS	1/18"	CH: 14.5'-15.5' Gray, massive, wet, very plastic fat clay, soft, loose.	BG	
15-18		6	SS	1/18"	19.0'-20.5'-Same as above	BG	
18-21							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-4 OWNER: Selfridge ANGB
LOCATION: East Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.5'
SURFACE ELEVATION: 575.87 WATER LEVEL: 12-13'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-29-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	3/18"	SM--CH: 23.5'-25.0'-Same as above. At 24.8' hit a	BG	
23					silty, gravelly sand.		
24							
25							

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-5 OWNER: Selfridge ANGB
LOCATION: Tucker Creek Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 574.85' WATER LEVEL: dore 14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-7-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold, overcast

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					SM/OL: Top soil-Dark brown, organic, wet, silty,		
2					clayey sand.		
3							
4		1	SS	10/18"	SM/OL: 4.5'-6.0' Dark brown, organic rich silty/clayey	BG	
5					sand, wet, massive (fill material).		
6							
7							
8							
9		2	SS	6/18"	CL: 9.5'-11.0' Bluish silty clay, damp, massive soft,	BG	
10					slight-medium plastic.		
11							
12							
13							
14		3	SS	2/18"	CH: 14.5'-16.0' Gray, massive, wet, very plastic, soft,	BG	
15					clay. Free water above 15'		
16							
17							
18							
19		4	SS	1/18"	CH(CL): 19.5'-21.0' Gray, massive, wet, (minor) silty	BG	
20					clay, very soft, very plastic.		
21							

* ASTM D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-5 OWNER: Selfridge ANGB
LOCATION: Tucker Creek Landfill ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 579.35 WATER LEVEL: above 14
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-7-85
DRILLER: Bill Mancini HELPER: Tim Burns

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25.0' Same as above, wet.	BG	
23							
24							
25							

* ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-6
LOCATION: Tucker Creek Landfill
OWNER: Selfridge ANGB
ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 25.0'
SURFACE ELEVATION: 577.24'
WATER LEVEL: Above 14'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-7-85
DRILLER: Bill Mancini
HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-2					Top soil-fill material, cement pieces, gravel etc.		
3-4		1	SS	19/18"	CL: 4.5'-6.0'-Brown silty clayey sand; grading into a brown/blue silty clay, massive, hard, dry, slightly plastic.	BG	
5-6							
7-8							
9		2	SS	8/18"	CH: 9.5'-11.0'-Brown, soft, medium plastic, clay, damp, minor faint bedding, minor mottling.	BG	
10-11							
12-13							
14		3	SS	3/18"	CH: 14.5'-16.0'-Same as above, wet, very plastic, clay	BG	
15-16					Free water @ 14'		
17-18							
19		4	SS	4/18"	CL/CH/SW: 19.5'-21.0'-Brown silty clay, gravel present;	BG	
20-21					interbedded with lenses of sand, wet, massive for most part, soft.		

* A.S.T.M. D1586

WESTON

DRILLING LOG

WELL NUMBER: W-6
LOCATION: Tucker Creek Landfill
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.0'
SURFACE ELEVATION: 577.24
WATER LEVEL: 21½' 14'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-7-85
DRILLER: Bill Mancini
LOGGER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	127 18"	CL: 23.5'-25'-Brown extremely dense hard silty clay,	BG	
23					pebbly, with sand intermixed, dry, massive; "hardpan."		
24							
25							

*ASTM D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-7
LOCATION: Tucker Creek Landfill
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.5
SURFACE ELEVATION: 576.51
WATER LEVEL: about 14'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-8-85
DRILLER: Bill Mancini
HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					Top soil-Brown, organic fine silty sand, gravelly		
2					(fill material).		
3		1	SS	6/18"	CL: 4.5'-6.0'-Bluish gray silty clay, dry, massive	BG	
4					slight/medium plastic, soft.		
5							
6							
7							
8							
9		2	SS	13/18"	CL/CH: 9.5'-11.0'-Brown, massive, damp, minor silty	BG	
10					clay, soft, medium plasticity.		
11							
12							
13							
14		3	SS	2/18"	CH: 14.5'-16.0'- Same as above, wet, clay, soft, very	BG	
15					plastic. First water found at 14'		
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Same as above, wet, clay.	BG	
20							
21							

* A.S.T.M D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-7
LOCATION: Tucker Creek Landfill
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.5'
SURFACE ELEVATION: 576.51
WATER LEVEL: ~~dry~~ 14'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-8-85
DRILLER: Bill Mancini
HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		5	SS	38/18"	SC--CL: 23.5'-25'-Bluish gray silty sand with a trace	BG	
24					of pebble at 23', wet, massive, soft; grading into a		
25					very stiff, hard, wet, sandy clay with a trace of gravel.		

*ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-8
LOCATION: N. W. Landfill
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 587.14
WATER LEVEL: 15-16'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-4-85
DRILLER: Bill Mancini
HELPER: Bill Olmstead, David Stein
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold!!

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					Top soil-Dark brown fine silty sand, highly organic		
2					(fill) grading into a light brown fine sand at 3'-4'.		
3							
4		1	SS	27/18"	SW: 4.5'-6.0'-Light brown fine sand, no bedding some	BG	
5					orange staining, wet at 5'-6' firm.		
6							
7							
8							
9		2	SS	14/18"	CL: 9.5'-11.0'-Dark gray fine silty clay, dry, slightly	BG	
10					plastic, massive.		
11							
12							
13							
14		3	SS	7/18"	CH: 14.5'-16.0'-Brownish gray massive clay, slightly	BG	
15					plastic near 14.5' grading into a very plastic clay at		
16					15'-16' wet. Free water at 15-½'		
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Brown, gray, wet, massive very plastic	BG	
					clay, soft.		

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-8 OWNER: Selfridge ANGB
LOCATION: N. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 587.14 WATER LEVEL: 15-16'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-4-85
DRILLER: Bill Mancini HELPER: Bill Olmstead, David Stein
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25'-Same as above.	BG	
23							
24							
25							

* ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-9 OWNER: Selfridge ANGB
LOCATION: Northwest Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 581.0' WATER LEVEL: 1-2.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-1-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					Top soil-Black silty sand (fill) wet first H_2O		
2							
3					at approx. 1.0'-2.0'.		
4		1	SS	1/18"	SM: 4.5'-6.0'-Soupy olive brown fine silty sand, wet,	BG	
5					incompetent.		
6							
7							
8							
9		2	SS	12/18"	CH: 9.5'-11.0'-Brown massive, medium plasticity clay,	BG	
10					damp, competent, soft.		
11							
12							
13							
14		3	SS	2/18"	CH: 14.5'-16,0'-Very plastic, wet, same as above clay.	BG	
15							
16							
17							
18							
19		4	SS	1/18"	19.5'-21.0'-Same as above.	BG	
20							
21							

*ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-9 OWNER: Selfridge ANGB
LOCATION: N.W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0
SURFACE ELEVATION: 581.01 WATER LEVEL: 1-2'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-1-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		5	SS	1/18"	CH: 23.5'-25.0'-Same as above, gooey, clay wet.	BG	
24							
25							

* A.S.T.M D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-10 OWNER: Selfridge ANGB
LOCATION: N. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 581.76 WATER LEVEL: 12.3'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-31-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Sunny

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL/SW: Top soil-Black organic fine sand (fill).		
2							
3							
4		1	SS	14/18"	CL/CH: 4.5'-6,0'-Brown (bluish green hue) slightly	BG	
5					plastic dry, massive silty clay, firm (hard).		
6							
7							
8							
9		2	SS	8/18"	CL/CH: 9.5'-11.0'-Gray, massive, medium plastic	BG	
10					slightly silty clay, damp, slightly softer than above.		
11							
12					First H_2O at approx. 12'.		
13							
14		3	SS	2/18"	CH: 14.5'-16.0'-Clay olive gray, wet, very plastic,	BG	
15					soft.		
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Same as above	BG	
20							
21							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-10 OWNER: Selfridge ANGB
LOCATION: N. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 24.0
SURFACE ELEVATION: 581.76 WATER LEVEL: 12.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-31-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	2/18"	CH/SM/SW: 23.5'-25.0'-Same as above with a gravelly	BG	
23					silty sand interspersed throughout sample, wet.		
24							
25							

* ASTM D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-11
LOCATION: West Ramp
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.5
SURFACE ELEVATION: 578.83
WATER LEVEL: 11.5'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 2-6-85
DRILLER: Bill Mancini
HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold, snow

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1		1	SS	19/18"	CL/SM: 1'-2.5'-Brown bluish gray fine silty/clay in-	300 ppm	
2					terbedded with lens of silty/clayey sand, faint bedding,		
3					mottling, dry, firm, slightly plastic.		
4		2	SS	9/18"	SW/CL: 3.5'-5'-Dark brown (2") lens of fine sand at	50 ppm	
5					3.5' grading into a brown blue hued silty clay, faint		
6					bedding, dry, firm, slightly plastic.		
7		3	SS	7/18"	SW/CL/CH: 6'-7.5'-Dark brown (1") lens of fine sand at	BG	
8					6' grading into a slightly plastic, dry, faintly bedded		
9					silty clay grading into a wet, plastic gray clay.		
10		4	SS	3/18"	CH: 9'-10.5'-Clay grayish brown wet, very plastic,	BG	
11					soft. Free wat. at 11.5'		
12							
13		5	SS	2/18"	CH: 14'-15.5'-Same as above, wet.	BG	
14							
15							
16							
17							
18		6	SS	1/18"	CH: 19'-20.5'-Same as above.	BG	
19							
20							
21							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-11 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.5'
SURFACE ELEVATION: 578.83 WATER LEVEL: 11.5'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-6-85
DRILLER: Bill Mancini HELPER: Time Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	6/18"	CL/SM: 23.5'-25'-Gray silty/clayey fine sand with	BG	
23					gravel, no bedding, wet, soft, very plastic.		
24							
25							

* A.S.T.M D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-12 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.5'
SURFACE ELEVATION: 582.15 WATER LEVEL: 10-14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-6-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-2		1	SS	30/18"	SM: 1'-2.5'-Brown bluish gray fine silty/clayey sand,	4 ppm	
2-3					mottling present, hard, dry, faint bedding.		
3-4		2	SS	26/18"	CL: 3.5'-5'- Bluish brown silty clay, mottling, dry	BG	
4-5					firm, slightly plastic.		
5-6							
6-7		3	SS	19/18"	CL: 6'-7.5'-Same as above, slightly plastic, hard, dry.	BG	
7-8							
8-9							
9-10		4	SS	9/18"	CL: 9'-10.5'-Blue gray, less silty clay, softer than	BG	
10-11					above, damp, massive.		
11-12							
12-13							
13-14		5	SS	2/18"	CH: 14'-15.5'-Clay gray, wet, very plastic, soft,	BG	
14-15					massive. Free water @ 15-1/2'		
15-16							
16-17							
17-18							
18-19		6	SS	2/18"	CH: 19'-20.5'-Same as above	BG	
19-20							
20-21							

* A.S.T.M D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-12 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.5'
SURFACE ELEVATION: 582.15' WATER LEVEL: 4-4'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-6-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

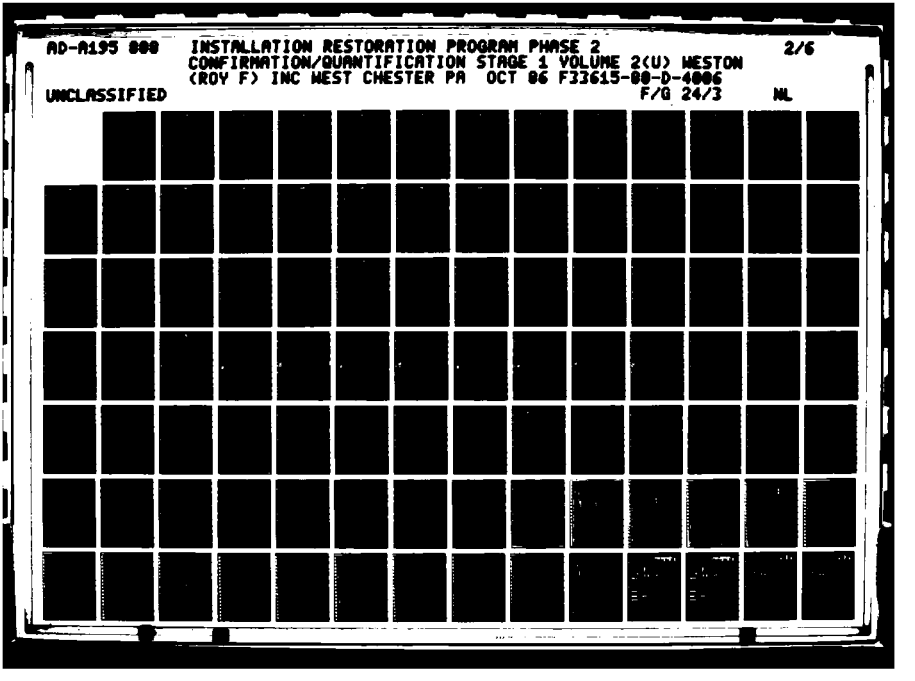
NOTES:

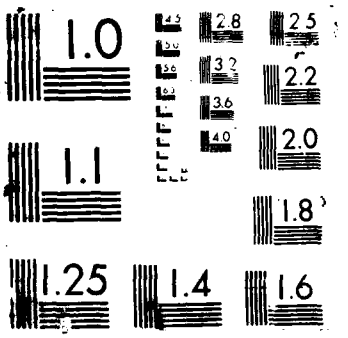
DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	5/18"	SM/CL: 23.5'-25'-Brownish gray fine silty sand, minor	BG	
23					clay, gravel present, wet, massive, soft.		
24							
25							

* A.S.T.M D1586

SHEET 2 OF ___

AD-A195 800 INSTALLATION RESTORATION PROGRAM PHASE 2 2/6
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-80-D-4006
UNCLASSIFIED F/G 24/3 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

WESTON

DRILLING LOG

WELL NUMBER: W-13 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 581.66 WATER LEVEL: 15.'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-5-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Snow, cold

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-2		1	SS	42/18"	CL: Light brown silty clay, massive dry, grading into	3-4	
3					a blue gray lens silty clay massive dry firm, hard.		
4		2	SS	45/18"	SM: Dark gray/blue silty/clayey sand grading into a	3-4	
5					fine lens silty sand, minor faint bedding, dry, hard		
6					(fill material).		
7		3	SS	19/18"	CL: Blue, green brownish gray silty clay, massive with	4	
8					minor mottling near 7.5', dry, firm.		
9		4	SS	20/18"	CL: Brownish gray silty clay, faint bedding, dry, hard	4	
10					slightly plastic, firm.		
11							
12							
13							
14							
15		5	SS	5/18"	CH: Brown, blue, damp, medium to low plasticity clay,	BG	
16					massive, soft. Free water @ 15'±		
17							
18							
19		6	SS	2/18"	CH: Brown, soft, highly plastic, wet, massive clay.	BG	
20							
21							

* A.S.T.M D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-13 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0
SURFACE ELEVATION: 581.66 WATER LEVEL: 15.
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-5-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	3/18"	CH/SM: 23.5-25'-Same as above intermixed with minor	BG	
23					fine silty sand.		
24							
25							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-14 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.0
SURFACE ELEVATION: 581.94 WATER LEVEL: 14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-5-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-2-3		1	SS	48/18"	SC-CL: 1'-2.5'-Dark brown fine silty sand interbedded with lenses of light tan brown clay, massive dry, hard firm.	4-5	
4-5-6		2	SS	23/18"	CL: 3.5'-5.0'-Brown, blue green hued, silty clay massive firm, dry, slightly plastic.	4	
6-7-8		3	SS	21/18"	CL/CH: 6.0'-7.5'-Same as above with minor faint bedding minor silt, dry, slightly plastic, firm.	BG	
8-9		4	SS	7/18"	CH: 9.0'-10.5'-Gray soft, medium plastic clay, damp.	BG	
13-14		5	SS	2/18"	CH: 14.0'-15.5'-Same as above, wet, very plastic. Free water @ 14'	BG	
18-19		6	SS	1/18"	CH: 19.0'-20.5'-Same as above, wet.	BG	

* A.S.T.M D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-14 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0
SURFACE ELEVATION: 591.90 WATER LEVEL: 14
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-5-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	2/18"	CH/SM: 23.5'-25'-Same as above intermixed with a silty,	BG	
23							
24					minor gravel sand.		
25							

* A.S.T.M D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-15 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mr. Clemens, MI
TOTAL DEPTH 25.6'
SURFACE ELEVATION: 582 MSL WATER LEVEL: 14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-6-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu
1-3		1	SS	18/18"	SM: 1'-2.5'-Brown silty clay grading into a bluish gray silty clay, hard, petroleum, dry, massive.	260 ppm
3-5		2	SS	16/18"	CL/CH: 3.5'-5.0'-Blue gray, highly mottled, silty clay, dry, firm, massive.	260 ppm
6-9		3	SS	16/18"	CL/OL: 6'-7.5'-Blue gray highly mottled, silty clay, faint bedding, dry, firm, slightly plastic, minor organic.	80 ppm
9-11		4	SS	12/18"	CL: 9'-10.5'-Bluish brown, massive, damp, silty clay, minor faint bedding, slightly plastic, firm.	BG
13-15		5	SS	2/18"	CH: 14'-15.5'-Gray, massive, wet, soft, very plastic, clay. Free water at 14'	BG
18-19		6	SS	1/18"	CH: 19'-20.5'-Same as above	BG

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-15 OWNER: Selfridge ANGB
LOCATION: West Ramp ADDRESS: Mr. Clemens, MI
TOTAL DEPTH 25.6'
SURFACE ELEVATION: 582.19 WATER LEVEL: 14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 2-6-85
DRILLER: Bill Mancini HELPER: Tim Burns

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		7	SS	1/18"	CH: 23.5'-25'-Same as above.	BG	
23							
24							
25							

* A.S.T.M D1586

SHEET 2 OF 3

WESTON

DRILLING LOG

WELL NUMBER: W-16
LOCATION: Fire Training Area 1
SURFACE ELEVATION: 577.47
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
WATER LEVEL: 12.0'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-23-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-Dark brown silty clay.		
2							
3							
4		1	SS	8/18"	CH: 4.5'-6.0'-Light brown intermixed with blue green	BG	
5					(marbling affect) clay, dry, massive.		
6							
7							
8							
9		2	SS	8/18"	CH: 9.5'-11.0'-Gray, plastic clay, dry, massive.	BG	
10							
11							
12					First trace of H_2O at 12'.		
13							
14		3	SS	2/18"	CH: 14.5'-16.0'-Same as above, wet.	BG	
15							
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Olive gray, same as above, wet.	BG	
20							
21							

* A.S.T.M D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-16 OWNER: Selfridge ANGB
LOCATION: Fire Training Area 1 ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.0
SURFACE ELEVATION: 577.47 WATER LEVEL: 12.0
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-23-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		5	SS	1/18"	CH: 23.5'-25.0'-Same as above.	BG	
24							
25							

* A.S.T.M D1586

SHEET 2 OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-17
LOCATION: Fire Training Area 1
SURFACE ELEVATION: 577.87
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
WATER LEVEL: 12'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-23-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Overcast, cold

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-Brown silty clay.		
2							
3		1	SS	11/18"	CH: 4.5'-6.0'-Light brown intermixed with bluish green	5 ppm	
4					(marbled), clay, dry, massive, slightly firm.		
5							
6							
7							
8		2	SS	8/18"	CH: 9.5'-11.0'-Darker brown, same as above, dry.	3-5 ppm	
9							
10							
11					First trace of H_2O at 12'.		
12							
13		3	SS	2/18"	CH: 14.5'-16.0'-Gray, massive clay, moisture very	BG	
14					plastic, very loose.		
15							
16							
17							
18		4	SS	1/18"	CH: 19.5'-21.0'-Same as above.	BG	
19							
20							
21							

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-17
LOCATION: Fire Training Area 1
SURFACE ELEVATION: 577.87
DRILLING COMPANY: Testing Engineers & Consultants
DRILLER: Bill Mancini
LOG BY: D. M. Stein

OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
WATER LEVEL: 12.0'
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-23-85
HELPER: Bill Pierson

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
23		5	SS	2/18"	CH: 23.5'-25.0'-Same as above, trace of moisture,	1-2 ppm	
24					very loose, plastic.		
25							

* A.S.T.M D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-18
LOCATION: Fire Training Area 1
SURFACE ELEVATION: 578.15
DRILLING COMPANY: Testing Engineers & Consultants
DRILLER: Bill Mancini
LOG BY: D. M. Stein

OWNER: Selfridge ANGB
ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 25.7'
WATER LEVEL: 12'
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-22-85
HELPER: Tim Burns

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-Dark gray silty clay.		
2							
3							
4		1	SS	8/18"	CH: 4.5'-6.0'-Light brown intermixed with blue green	1 ppm	
5					coloring, clay, massive, dry, loose.		
6							
7							
8							
9		2	SS	5/18"	CH: 9.5'-11.0'-Darker brown, same as above.	50 ppm	
10							
11							
12					First trace of H_2O at 12'.		
13							
14		3	SS	1/18"	CH: 14.5'-16.0'-Light gray clay, wet, same as above.	1 ppm	
15							
16							
17							
18							
19		4	SS	1/18"	CH: 19.5-21.0'-Same as above, wet.	1 ppm	
20							
21							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-18 OWNER: Selfridge ANGB
LOCATION: Fire Training Area 1 ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 25.7'
SURFACE ELEVATION: 578.15 WATER LEVEL: 12'
DRILLING COMPANY: Testing Engineers & Consultants DRILLING METHOD: H.S.A. DATE DRILLED: 1-22-85
DRILLER: Bill Mancini HELPER: Tim Burns
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		5	SS	2/18"	CH: 23.5'-25.0'-Same as above, wet.	1 ppm	
24							
25							

* A.S.T.M D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-19 OWNER: Selfridge ANGB
LOCATION: Fire Training Area 2 ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 22'
SURFACE ELEVATION: 580.14 WATER LEVEL: 14'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-30-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold, overcast
BG Hnu--4-5ppm

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1-3					CL: Top soil-Dark Organic silty clay grading into a light yellow silty sand at 4.5'.		
4		1	SS	14/18"	CH: 4.5'-6.0'-Bluish brown gray, massive clay, dry, firm.	BG	
5-8							
9		2	SS	5/18"	CH: 9.5'-11.0'-Dark gray, massive, damp, clay, slightly plastic, soft.	BG	
10-13							
14		3	SS	1/18"	CH: 14.5'-16.0'-Light brown silty/clayey sand lens at 14.5'(2") grading into a wet fat, highly plastic gray clay, soft. First sign of water at 14'-2"	BG	
15-18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Same as above, wet.	BG	
20-21							

* ASTM D1586

SHEET ___ OF 3

WESTON

DRILLING LOG

WELL NUMBER: W-19
LOCATION: Fire Training Area 2
OWNER: Selfridge ANGB
ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 580.14
WATER LEVEL: 14.0'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-30-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25.0'-Same as above, wet.	BG	
23							
24							
25							

*A.S.T.M D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-20 OWNER: Selfridge ANGB
LOCATION: Fire Training Area 2 ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26'
SURFACE ELEVATION: 579.37' WATER LEVEL: 12'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-30-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES: Cold, overcast

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1							
2					3'-5'-Petroleum product in soil.		
3		1	SS	13/18"	CH: 4.5'-6.0'-Greenish blue (brown hue) massive clay	70 ppm	
4					petroleum present, dry, firm, slightly plastic.		
5							
6							
7							
8		2	SS	6/18"	CH: 9.5'-11.0'-Olive gray, massive, plastic clay no	BG	
9					petroleum, damp.		
10							
11					First H_2O at approx. 12'.		
12							
13		3	SS	2/18"	CH: 14.5'-16.0'-Gray, wet, highly plastic, same as	BG	
14					above, no petroleum.		
15							
16							
17							
18		4	SS	1/18"	CH: 19.5'-21.0'-Same as above, very plastic, wet no	BG	
19					petroleum.		
20							
21							

* ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-20
LOCATION: Fire Training Area 2
OWNER: Selfridge ANGB
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 579.37
WATER LEVEL: 12.6'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-30-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25.0'-Same as above, wet, highly plastic.	BG	
23							
24							
25							

* ASTM D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-21
LOCATION: Fire Training Area 2
SURFACE ELEVATION: 579.55
OWNER: Selfridge ANGB
ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 25.0'
WATER LEVEL: 12.0'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-31-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Snowy, cold

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-Organic rich black silty clay, slight	12 ppm	
2					petroleum odor present, dry.		
3							
4		1	SS	12/18"	CL/CH: 4.5'-6.0'-Brown (greenish blue hue) clay, mas-	50 ppm	
5					sive dry, slightly plastic; petroleum present down to		
6					approx. 5.4'.		
7							
8							
9		2	SS	8/18"	CL: 9.5'-11.0'-Brownish gray silty clay, massive, dry	BG	
10					slightly plastic, no petroleum, firm, soft.		
11							
12					First H_2O at approx. 12'.		
13							
14		3	SS	3/18"	CH: 14.5'-16.0'-Gray, wet, massive clay, soft loose,	BG	
15					no petroleum.		
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Brown, same as above, wet.	BG	
20							
21							

* A.S.T.M. D1586

D66

WESTON

DRILLING LOG

WELL NUMBER: W-21
OWNER: Selfridge ANGB
LOCATION: Fire Training Area 2
ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 574.55
WATER LEVEL: 12.0'
DRILLING COMPANY: T.E.C.
DRILLING METHOD: H.S.A.
DATE DRILLED: 1-31-85
DRILLER: Bill Mancini
HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25.0'-Same as above, wet.	BG	
23							
24							
25							

* ASTM D1586

WESTON

DRILLING LOG

WELL NUMBER: W-22 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mr. Clemens, MI
TOTAL DEPTH: 25.0'
SURFACE ELEVATION: 583.68' WATER LEVEL: 3.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-3'-fill-Dark brown silty clay		
2							
3					2'-Till		
4		1	SS	25/18"	SW: 4.5'-6.0'-Yellow brown fine sand, well sorted, wet	BG	
5					(First H_2O at approx. 3') grading into a grayish brown		
6					well sorted fine sand, no gravel, no fines, firm.		
7							
8							
9		2	SS	10/18"	CL: 9.5'-11.0'-Blue gray fine silty clay, massive dry	BG	
10					for the most part (damp), no sand, no gravel, firm.		
11							
12							
13							
14		3	SS	2/18"	CH: 14.5'-16.0'-Gray highly plastic, fat clay, damp,	4-5 ppm	
15					massive.		
16							
17							
18							
19		4	SS	2/18"	CH: 19.5'-21.0'-Same as above, wet.	BG	
20							
21							

*ASTM D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: W-22 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.0'
SURFACE ELEVATION: 582.60 WATER LEVEL: 3.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22							
23		5	SS	1/18"	CH: 23.5'-25.0'-Same as above.	BG	
24							
25							

* A.S.T.M. D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-23 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 26.0'
SURFACE ELEVATION: 582.63 WATER LEVEL: 3.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-25-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					CL: Top soil-Yellow brown silty sand.		
2							
3							
4		1	SS	42/18"	CH: 4.5'-6.0'-ML--SM--SW Light yellowish brown fine	BG	
5					silt near 2.5' grading into a fine silty sand near 3.5'		
6					grading into a fine sand (no silt, or gravel), bedding		
7					apparent, mottling, brown discoloration along bedding		
8					clay near 6.0', wet at 3'.		
9		2	SS	9/18"	CH: 9.5'-11.0'-Gray, massive, plastic clay damp.	BG	
10							
11							
12							
13							
14		3	SS	2/18"	CH: 14.5'-16.0'-Gray, fat, massive clay, wet soft very	BG	
15					plastic.		
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Same as above.	3-4 ppm	
20							
21							

* A.S.T.M D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-23 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH: 26.0'
SURFACE ELEVATION: 582.63' WATER LEVEL: 3.5'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-25-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25.0'-Same as above.	BG	
23							
24							
25							

*A.S.T.M D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-24 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 36.0'
SURFACE ELEVATION: 585.07' WATER LEVEL: 6.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Drilling Start/End
1-24-85
Well Installation
1-25-85

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1							
2							
3							
4		1	SS	45/18"	SM--CL: 4.5'-6.0'-Light yellow olive brown fine silty	4-5 ppm	
5					sand grading into a darker yellowish/olive brown silty		
6					clay at approx. 6'. Massive, wet, very firm , strong		
7					septic odor		
8							
9		2	SS	22/18"	CL: 9.5'-11.0'-Massive gray silty clay no sand gravel,	BG	
10					moisture (damp).		
11							
12							
13							
14		3	SS	4/18"	CH: 14.5'-16.0'-Gray massive clay, less silty, septic	BG	
15					odor.		
16							
17							
18					First water at 17.5'		
19		4	SS	1/18"	CH: 19.5'-21.0'-Gray massive fat clay, wet.	BG	
20							
21							

* A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-24 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.0'
SURFACE ELEVATION: 585.07 WATER LEVEL: 6.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH: 23.5'-25'-Same as above, fat clay, trace of gravel.	BG	
23							
24							
25							

* A.S.T.M D1586

SHEET 2 OF 2

WESTON

DRILLING LOG

WELL NUMBER: W-25 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25'
SURFACE ELEVATION: 574.43 WATER LEVEL: 5.0'
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson
LOG BY: D. M. Stein

SKETCH MAP

NOTES: Snowy, cold

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
1					GC: Top soil-Very dark brown gravelly sand, fill.		
2							
3							
4		1	SS	14/18"	SM: 4.5'-6.0'-Bluish green fine grain silty sand no	BG	
5					apparent bedding, wetness, no gravel, slightly firm.		
6					First trace of H_2O at 5'.		
7					SW: 6'-9'/10'-Hit a fine green sand, very wet.		
8							
9		2	SS	16/18"	CL: 9.5'-11.0'-Brown greenish gray clay, no sand	BG	
10					gravel, wet, massive, more firm than above.		
11							
12							
13							
14		3	SS	4/18"	CH: 14.5'-16.0'-Brownish, olive gray, highly plastic	BG	
15					fat, wet, massive clay, sonewhat loose.		
16							
17							
18							
19		4	SS	1/18"	CH: 19.5'-21.0'-Same as above.	BG	
20							
21							

*A.S.T.M D1586

WESTON

DRILLING LOG

WELL NUMBER: W-25 OWNER: Selfridge ANGB
LOCATION: S. W. Landfill ADDRESS: Mt. Clemens, MI
TOTAL DEPTH 25.6'
SURFACE ELEVATION: 584.43 WATER LEVEL: 5.0
DRILLING COMPANY: T.E.C. DRILLING METHOD: H.S.A. DATE DRILLED: 1-24-85
DRILLER: Bill Mancini HELPER: Bill Pierson

LOG BY: D. M. Stein

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	Hnu	
22		5	SS	1/18"	CH--SM: 23.5'-25.0'-Same as above. Minor silt, minor	BG	
23					coarse sand, very loose.		
24							
25							

*A.S.T.M D1586

APPENDIX E

Sampling and Quality Assurance Plans

Contents

		Page
E-1.1	Monitoring Well Purging	E1
E-1.2	Monitor Well Sample Collection	E1
E-1.3	Soil Sampling	E3
E-2.0	LABORATORY PROCEDURES	E4
E-2.1	Quality Assurance Plan	E4
E-2.2	Container Preparation	E6
E-2.3	Verification/Validation	E6
E-2.4	Data Handling - Laboratory	E6
E-2.5	Sample Plan/Log	E7
E-2.6	Sample Results	E7
E-2.7	Chain-of-Custody	E8
E-2.8	QA/QC Officer	E8

WESTON

APPENDIX E

SAMPLING AND QA/QC PLANS

E-1.1 MONITORING WELL PURGING

All groundwater sampling was accomplished after the installed monitoring wells were properly developed and had stabilized for a period of at least two weeks. Prior to collecting samples, each well was purged by bailing or pumping a minimum of three volumes of standing water from the well using a 1 3/4-inch Teflon bailer. This ensured that a representative sample of the aquifer was collected during the sampling process. The field procedures used for monitoring well purging included the following guidelines:

1. Prior to placing any equipment into the well, the equipment was scrubbed with Alconox (detergent) and water solution and rinsed with distilled water.

2. Before purging, the depth to water from the reference measuring point on the top of the well casing was measured and recorded.

3. The volume of water to be purged based on the amount of standing water in the well casing was calculated.

4. The well was purged by bailing or pumping, removing at least three times the calculated volume of standing water in the well casing.*

5. The bailer was removed from the well. The equipment was decontaminated by scrubbing with Alconox and flushing with deionized water.

6. The protective security caps were locked.

E-1.2 MONITOR WELL SAMPLE COLLECTION

Groundwater sampling was directed toward the detection of:

1. Volatile Organics Analysis (VOA) Hydrocarbons and Aromatics

2. Total Organic Carbon (TOC)

3. Phenols

*Due to extremely slow recharge rates, removal of three volumes of standing water within many wells was not possible during the 10-11 May 1985 sampling round.

4. Chemical Oxygen Demand (COD)

5. Metals: Cadmium, Chromium, Copper, Lead, Nickel, Zinc

6. Petroleum Hydrocarbon

7. Oil and Grease

Soil sampling was directed toward the detection of:

- Oil and Grease
- Volatile Organics Analysis (VOA)

All required sample containers were prepared by WESTON Laboratories in accordance with standard U.S.EPA or U.S. Air Force supplied procedures and protocols.

After the wells were purged, sampling consisted of the following steps:

1. Sample containers for all parameters were filled directly from the Teflon bailer to avoid aeration and excessive turbulence in the sample water.

2. Appropriate containers were filled according to the analytical parameter of concern. Sample containers used were:

   - COD--100 ml plastic bottles preserved with H_2SO_4.
   - Metals--sample filtered in the field through a 0.45 micron filter, then poured into 250 ml plastic bottles preserved to pH=2 with nitric acid.
   - Phenol--1 liter amber glass bottles preserved with H_2SO_4.
   - TOC--60 ml amber glass bottles with crimping septum seals, and preserved with hydrochloric acid.
   - Oil and Grease--1 liter amber glass bottles preserved with sulfuric acid.
   - Petroleum Hydrocarbon--1 liter amber glass bottles preserved with a 1:1 H_20 and HCl solution.

- o Volatile Organics--40 ml glass vials

All glass containers have Teflon-lined caps.

3. Grab samples were taken for analyses in the lab for pH, temperature and specific conductance.

4. The sample containers were wrapped in packaging material and placed in thermal chests packed with enough ice to ensure cooling to 4°C.

E-1.3 SOIL SAMPLING

All soil sampling accomplished using a drill rig employed the Standard Penetration Test (ASTM Method 1586) using a steel split-spoon sampler. Prior to taking each sample, the following procedures were followed:

1. The split-spoon sampler was washed thoroughly with an Alconox and water solution, and rinsed in deionized water.

2. After assembly of the sampler, the sampler was lowered into the boring and the sample was taken by the Standard Penetration Test Method.

3. Upon recovery of the sampler the spoon was split and the sample examined for soil characteristics.

4. The sample was then cleaned of any smeared sample around the outside of the sampler, and the cleaned, representative sample was put in a marked and labelled 1 liter clear glass sampling jar with a Teflon lined screw cap.

5. Samples for analysis of Oil and Grease and VOA were stored for analysis in washed and baked sampled jars of amber glass, equipped with a washed aluminum foil inner seal.

Care was taken to ensure that the sample taken for analysis was as undisturbed as possible, in order that any contaminants present would not be winnowed out of the sample (in a subaqueous site). As above, only specially prepared sample jars were used for taking and storing samples for pending analyses.

Soil samples at Selfridge ANGB were taken for analyses of:

1. Oil and Grease

2. Volatile Organics Analysis (VOA)

E-2.0 LABORATORY PROCEDURES

E-2.1 QUALITY ASSURANCE PLAN

WESTON Analytical Services enforces a rigid QA/QC program toward maintenance of validity and reliability of all analytical data. The Laboratory QA/QC Manual (Table of Contents thereof is Attachment No. 1 to this appendix) outlines the specifics of the QA/QC plan. This plan is patterned after the EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories (EPA-600/4-79-019, March 1979), and is augmented by general applicable experience and interaction with the QA/QC plan of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). All methods and procedures followed by WESTON are either U.S.EPA or ASTM-approved. Any variations from such procedures, regardless of cause, are documented by the responsible analyst(s) and are documentable, and, literature-traceable. A general review of this QA/QC plan is in the following paragraphs.

Although specific QA/QC measures for each method are designated in WESTON's Laboratory Quality Assurance Manual, the general QA/QC program normally includes:

- o EPA-acceptable sample preparation and analytical methods.
- o Instrument calibration via use of Standard Analytical Reference Materials (SARMS).
- o Regular equipment maintenance and servicing.
- o Use of SARMS and QA/QC samples (spikes, laboratory blanks, replicates, and splits) to ascertain overall precision.
- o Statistical evaluation of data to delineate acceptable limits.
- o Documentation of system/operator performance.
- o Suitable chain-of-custody procedures.
- o Maintenance and archiving of all records, charts, and logs generated in the above.
- o Proper reporting.

Acceptable analyses at WESTON's Analytical Laboratory Services include, but are not limited to, the above.

In general, WESTON's QA/QC sequence follows the following diagram (Figure E-1). Documentation (as available from

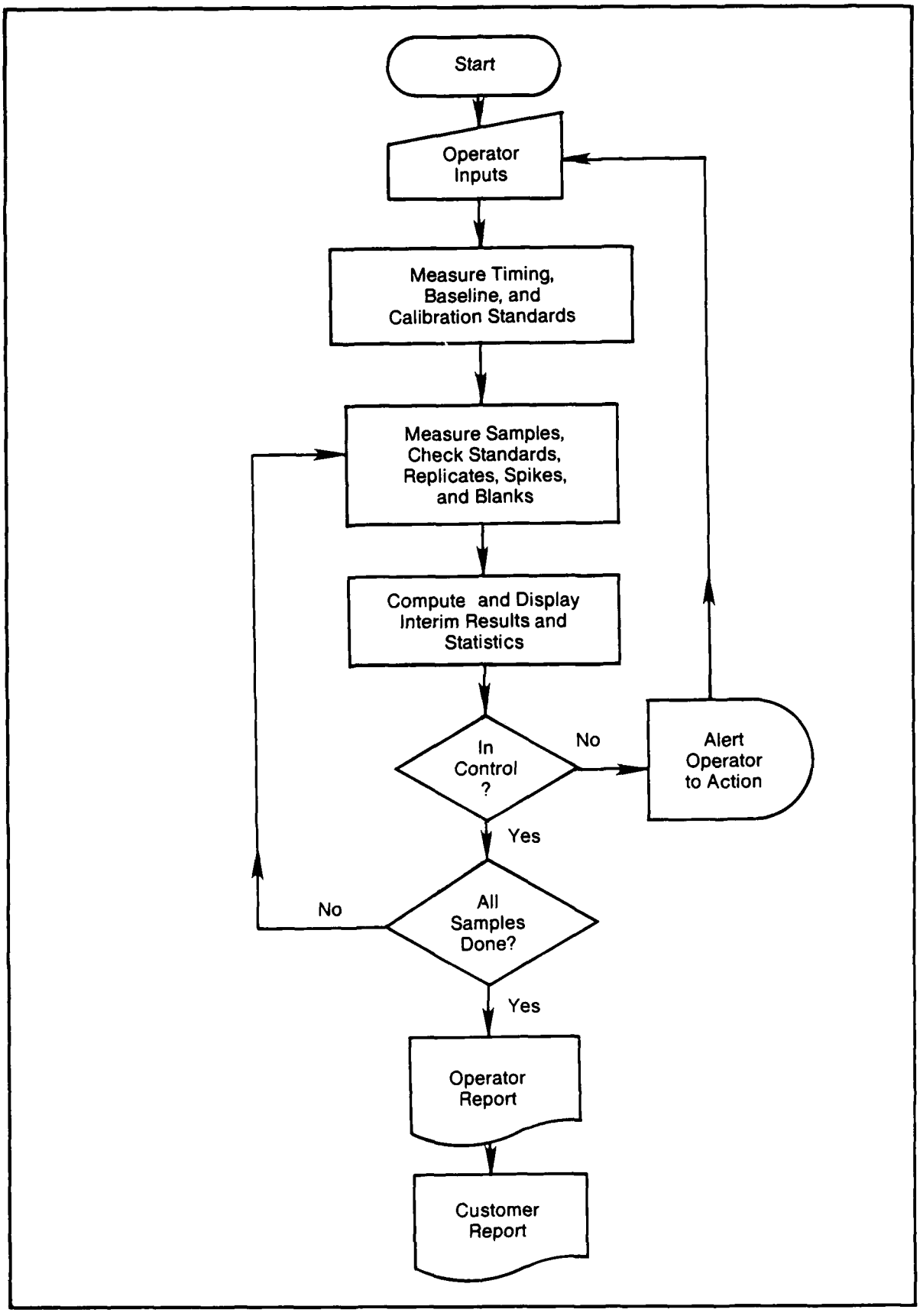


FIGURE E-1 FLOW CHART OF THE SEQUENCE OF EVENTS DURING A CONTROLLED SERIES OF LABORATORY MEASUREMENTS

instrument recordings and technicians' notebooks) is sufficient to validate each step in the sequence.

E-2.2 CONTAINER PREPARATION

Another consideration in this, or any analytical project, is that of sample container preparation. Accordingly, all appropriate sample bottles shall be cleaned in a manner mandated by the U.S.EPA to ensure maximum cleanliness (and minimal contamination(before the containers go to the field. Sufficient bottles to accommodate both laboratory and field blank requirements will be prepared in a single batch mode for each sampling requirement.

E-2.3 VERIFICATION/VALIDATION

In the laboratory, the analytical scheme begins with initial verification, which is comprised of:

- Lab Blanks - To ensure that no background level of specific analyses is introduced by laboratory procedures.
- Standard Analytical Reference Material (SARMS) - To determine the accuracy and precision of procedures.
- Spikes - To determine the percent recovery of analyte(s).

If the laboratory QA/QC program is extended to the field, it includes a fifth item:

- Field Blanks - To provide a check on contamination of containers and/or preservatives and to establish "practical" detection limits.

WESTON has used all of the above in this project. All data resulting from these verification media have been archived for future reference, retrieval, or processing.

E-2.4 DATA HANDLING - LABORATORY

Use of any analytical data should be preceded by an assessment of its quality. The assessment should be based on accuracy, precision, completeness, representativeness, and comparability. These criteria are, in turn, assessed as follows:

- Accuracy - Is it acceptable for the planned use? QA/QC shall measure the accuracy of all data.

- o Precision - Is it acceptable for the planned use? QA/QC shall reflect the reproducibility of the measurements.

- o Completeness - Are the data sufficient for the planned use? QA/QC shall identify the quantity of data needed to match the goals.

- o Representativeness - Do the data accurately reflect actual site conditions, sampling procedures, and analytical method? QA/QC shall ensure this.

- o Comparability - Is the report self-consistent in format, units, and standardization of methods used to generate it? QA/QC shall ensure this.

Additionally, statistical methods outlined in the QA/QC program have been applicable to data evaluation.

The Laboratory Supervisor and the Laboratory QA/QC Officer have been responsible for the evaluation of the above criteria and for enforcement of analytical protocols that will necessarily lead to acceptable data quality. The signature of the Supervisor and QA/QC Officer accompany each laboratory analytical report and serve to ensure the overall validity of the reported data.

E-2.5 SAMPLE PLAN/LOG

Normal protocol demands client and/or site-specific logging of all sample batches delivered to WESTON. Basic information--such as client name, address, etc.; client phone number; reporting/invoicing instructions; site descriptions; and parameter-specifications and total requirements--is initiated here. Additionally, sample storage/disposal instructions as well as turnaround requirements and sample collection requirements are addressed at this point.

The appropriate number of method blanks is also logged at this point, and in-house chain-of-custody documentation is initiated here.

E-2.6 SAMPLE RESULTS

WESTON's analytical protocols generally require five-point calibration curve plus a reagent blank as the basis for quantification analytes from a linear calibration curve. (A three point plus blank curve vs. the original five point one is acceptable if it falls within the QA/QC requirements of +3 standard deviation of the original curve.) Linear regression analysis is then performed. Method and detection

limit specific data are accessed for quantification and report-writing from each data set. For reporting accuracy, the algorithm

Linear-Regressed Raw Concentration from Calibration Curve if Solid	Solid Sample Extract Volume or Dilution Factor	Concentration Fraction	Final Concentration
Solid Sample Mass if Solid		Solids if Solid	

is used for all quantitations. (All such algorithm input data are archived for long-term storage.) Detection limits for solids are generated on a per-sample basis and calculated by replacing "LINEAR-REGRESSED RAW CONCENTRATION FROM CALIBRATION CURVE" with "DETECTION LIMIT OF ANALYTE IN LIQUID MATRIX" in the above equation.

E-2.7 CHAIN-OF-CUSTODY

Since they document the history of samples, chain-of-custody procedures are a crucial part of a sampling/analysis program. Chain-of-custody documentation enables identification and tracking of a sample from collection to analysis to reporting.

WESTON's chain-of-custody program necessitates the use of EPA-approved sample labels, secure custody, and attendant recordkeeping. Depending on the client's requirements, WESTON also offers container sealing during unattended transportation of samples.

In essence, WESTON considers a sample in custody if it: is in a WESTON employee's physical possession; it is in view of that WESTON employee; is secured by that WESTON employee in an area that is restricted to authorized personnel.

Each time a sample is relinquished from one analyst to another or from one major location to another, WESTON's analytical personnel are required to make appropriate entries. Personnel-specific initials are used as identifiers of analysts, as are location codes for various locations (refrigerators, extraction areas, analytical area, etc) within the laboratory. Each transaction for each sample is accompanied by a specific reason for transfer. Chain-of-custody documentation is given in Appendix G.

E-2.8 QA/QC OFFICER

Toward maintenance of a rigid, credible QA/QC regimen, WESTON Analytical Services maintains a full-time, in-house QA/QC officer who retains independent authority to declare

out-of-control situation, thereby precluding reporting of unacceptable data. The QA/QC officer has been available, as needed, on the project.

APPENDIX F

Sampling and Chain of Custody Documentation

Contents

	Page
Phase II, Stage 1 Sampling and Analyses	F1
Documentation, Sampling Round 1	F14
Documentation, Resampling	F90

Summary of Phase II, Stage 1 Sampling and Analyses

WESTON

APPENDIX F

Recommended Phase II Analytical Requirements

The recommended Phase II analytical requirements for groundwater and surface water sampling were amended with each succeeding IRP Report; beginning with the Phase I records Search, through the WESTON Pre-Survey Report and the Approved Scope of Work-Task Order 0049. Table F-1 documents the finalized analytical requirements to be performed during the Phase II Stage 1 investigation at Selfridge ANGB.

The required analytical protocol is summarized on Table F-2. The required detection limits were achieved for all analytes except phenol. Phenolics samples were analyzed using EPA Method 420.1 within the recommended holding time of 28 days. This method has a documented sensitivity of 5 ug/L, not the 1 ug/L requested. A detection limit of 5 ug/L was achieved as per method. COD samples were analyzed using EPA methods 410.4 for low level and high level (750 ppm) COD's respectively in place of Standard Method 508A. The required detection limit of 5000 ug/L was achieved.

A summary of sample distribution is provided in Table F-3. From discussion with Air Force personnel, it was agreed that the soil samples to be analyzed for TOX would be analyzed for VOA thereby increasing the total number of VOA samples for analysis. Soil samples to be analyzed for Petroleum Hydrocarbon were analyzed for Oil and Grease, thereby increasing the number of samples analyzed for this parameter.

Summaries of sample acquisition and analysis dates are presented in Tables F-4 and F-5. Those samples for which holding times were exceeded are shaded with a second pattern. In the initial sampling round all of the VOA samples collected exceeded the permissable holding period. Many of these were resampled on 10-11 May 1985. Those samples not included in the May 1985 resampling include: W-1, W-2, W-20, W-2A and all surface water samples. The surface water locations were not resampled for VOA as the locations had become dry since the initial environmental sampling round, 5-11 March 1985: Well W-20 had been destroyed, thus preventing resampling. The permissible holding time for VOA was exceeded on the soil samples as acquired during the construction in the East and West Ramp sites. These could not be resampled without installing additional borings. At the southwest landfill

ponds 1, 2, and 3 were sampled on March 11, 1985. Measurements of pH and conductivity were made, but because of an instrument malfunction the results of these measurements were extremely erratic. Consequently, these measurement values are not presented in this report.

Task Order 0049 called for Oil and Grease analysis of groundwater samples collected from the Southwest Sanitary Landfill. Wells W-22, W-24, and W-25 however, were analyzed for the Petroleum Hydrocarbon parameter. Only well W-23 was analyzed for Oil and Grease. This error increased the number of Petroleum Hydrocarbon samples specified in Task Order 0049.

In the process of drilling wells W-11 and W-15, soil cuttings from surface to approximately 11 feet BLS were suspected of being hazardous. This was based upon anomalously high photoionization meter (Hnu) readings of approximately 300 ppm. As per Task Order 0049, these soil cuttings were sampled, containerized, and submitted for analysis of EP Toxicity and Ignitability (Ref: 40 CFR Subpart C, 261.21 - Ignitability, and 261.24-EP Toxicity - Metals) on 21 June 1985. The results will be included in the Final Report.

All other analytes for soils, groundwater, and surface water were analyzed within the recommended holding times listed in Table F-3.

WESTON
DESIGNERS CONSULTANTS

WESTON WAY
WEST CHESTER, PA. 19380
PHONE: (215) 692-3030
TELEX: 83-5348

June 21, 1985

RECEIVED
JUN 24 19
ROY F. WESTON, INC.
BANNOCKBURN OFFICE

Roy F. Weston, Inc.
100 Corporate North
Suite 101
Bannockburn, ILL. 60015

ATTN: Skip Ricketts

Dear Skip:

With regard to our discussions on the difference between analyses for oil and grease by infrared (IR) spectroscopy (EPA Method 413.2) and petroleum hydrocarbons by IR (EPA Method 418.1), very little difference exists from a procedural point of view. Both methods measure the concentration of hydrocarbons in a sample. The petroleum hydrocarbon method measures only the mineral oils in the sample whereas the oil and grease method measures the total hydrocarbons (including the mineral oils) in the sample. The difference between the two values is interpreted as the amount of biodegradable animal greases and vegetable oils that may be naturally occurring. Since the oil and grease measurement represents a total quantity, a measurement of petroleum hydrocarbons must be less than or, at most, equal to the oil and grease concentration.

I hope this clarifies the situation and resolves your concerns. If the laboratory can be of further assistance, please do not hesitate to contact us.

Very truly yours,

ROY F. WESTON, INC.

Les Eng
Inorganic Laboratory Manager
WESTON Analytical Laboratories

LE:bms

Table F-1 By Site Analytical Program[1]
Summary of Recommended Phase II Analytical Requirements
Approved Scope of Work - Task Order 0049

ANALYTE	METHOD	MEDIUM	SSL	FTA-2	FTA-1	WRFS and I-84 SS	TCL	NL	EHFR	QA	Total
Purgeables: Halocarbons and Aromatics	EPA 601 and 602	Groundwater	4	3	3	5	3	3	4	3	28
		Surface Water	3	2	0	0	0	0	0	1	6
TOC	EPA 415.1	Groundwater	4	3	3	5	3	3	4	3	28
		Surface Water	3	2	0	0	0	0	0	1	6
Phenols	EPA 420.1	Groundwater	4	3	3	0	3	3	0	2	18
		Surface Water	3	2	0	0	0	0	0	1	6
COD	STD 508A	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
Metals	•	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
TOX	EPA 9020	Soil	0	0	0	15	0	0	12	3	30
Petroleum Halocarbon (IR Method)	EPA 418.1	Groundwater	0	3	3	5	0	0	4	2	17
		Surface Water	0	2	0	0	0	0	0	1	3
		Soil	0	0	0	15	0	0	12	3	30
Oil and Grease	EPA 413.2	Groundwater	4	0	0	0	3	3	0	1	11
		Surface Water	3	0	0	0	0	0	0	1	4
EP Toxicity	40 CFR 261.24	Soil	-	-	-	-	-	-	-	-	5
Ignitibility	40 CFR 261.21	Soil	-	-	-	-	-	-	-	-	5

[1]Temperature, specific conductance and pH will be measured in the field at time of sampling.

•Metals include: Cadmium (EPA 213.2), Chromium (EPA 218.1), Copper (EPA 220.1), Lead (EPA 239.2), Nickel (EPA 249.1) and Zinc (EPA 289.1).

F3615-80-D-4006, 0049

ROY F. WESTON, INC.

WESTON

DESIGNERS CONSULTANTS

Table F-2
Summary of Analytical Methods, Required Detection Limits
and Required Holding Times
Selfridge ANGB

Parameter	Medium	Method	Detection Limit (ug/L)	Holding Period (days)	Number of Specified Samples
Volatile Organic Analysis (VOA)	GW	EPA 601 and 602	a	14	28
	SW				6
	Soil e				30
Total Organic Carbon TOC	GW	EPA 415.1	500	28	28
	SW		b		6
Phenol	GW	EPA 420.1	5	28	18
	SW		c		6
Chemical Oxygen Demand (COD)	GW	EPA 410.1d and 410.4d	5000	28	11
	SW				4
Cadmium	GW	EPA 213.2	10	180	11
	SW				4
Chromium	GW	EPA 218.1	50	180	11
	SW				4
Copper	GW	EPA 220.1	20	180	11
	SW				4
Lead	GW	EPA 239.2	20	180	11
	SW				4
Nickel	GW	EPA 249.1	100	180	11
	SW				4
Zinc	GW	EPA 289.1	50	180	11
	SW				4
Petroleum Hydrocarbon	GW	EPA 418.1	100	28	17
	SW				3
	Soil				30
Oil and Grease	GW	EPA 413.2	100	28	11
	SW				4
	Soile				30
EP Toxicity	Soil	40CFR 261.24	f	180	5
Ignitability	Soil	40CFR 261.21	g	180	5

a. Detection limits for Volatile Organic Compounds shall be as specified for the compounds by EPA Methods 601-602 (Federal Register, Vol. 44, No. 233, pp. 69468-69473).

b. Detection Limits for TOC must be 3 times the noise level of the instrument, laboratory distilled water must show no response; if it shows a response, corrections of positive results must be made.

c. EPA Method 420.1 has an associated detection limit of 5 ug/l instead of the 1 ug/l requested in the Task Order.

d. These samples were analyzed by EPA Methods 410.1 and 410.4 for the low level and high level (>50ppm) COD's respectively in place of Standard Method 508A. The requested detection limit of 5000 ug/l was achieved.

e. Refer to contract modification presented in Appendix B.

f.

Metal	As	Ba	Cd	Cr	Pd	Hg	Se	Ag
Detection Limit (ug/l)	10	200	10	50	20	1	10	10

g. Determine if sample is ignitable at 140 F or below. If so, it is a hazardous waste.

TABLE F-3
SUMMARY OF SAMPLES OBTAINED AT SELFRIDGE ANGB

Analytes	Round	Number of Samples GW	SW	Soil	Number of QA Samples GW Splits	SW Splits	Soil Splits	Field and Trip Blanks	Lab Blanks	2nd Column	Total Samples	Comments
VOA	1st	25	7	27	4	0	4	3	5	5	34	Exceeded all holding times on 1st round. Surfacewaters not resampled and no duplicates taken.
	RS	22	0	0	0	0	0	2	1	1		
	Total	47	7	27	4	0	4	5	6	6	106	
TOC	1st	25	7	0	2	0	0	3	1	0	34	
Phenol	1st	16	7	0	1	0	0	5	1	0	28	
COD	1st	10	4	0	0	0	0	2	0	0	15	
Cadmium	1st	11	4	0	2	0	0	2	0	0	15	
Chromium	1st	11	4	0	2	0	0	2	0	0	15	
Copper	1st	11	4	0	2	0	0	2	0	0	15	
Lead	1st	11	4	0	2	0	0	2	0	0	15	
Nickel	1st	11	4	0	2	0	0	2	0	0	15	
Zinc	1st	11	4	0	2	0	0	2	0	0	15	
Petroleum Hydrocarbon	1st	25	7	0	1	0	0	3	0	0	50	The task order called for 27 soil samples to be analyzed for this parameter and were mistakenly analyzed for Oil and Grease.
Oil and Grease	1st	8	4	27	0	0	0	0	0	0	39	
EP Toxicity	1st	0	0	32	0	0	0	0	0	0	2	Soil borings from wells W-11 and W-15 were suspected as being contaminated based upon Hnu readings.
EP Ignitability	1st	0	0	32	0	0	0	0	0	0	2	

RS - Resample

Table F-4
Summary of Sample Acquisition and Analysis Schedule
Water Quality Samples
Selfridge ANGB

Analytes	Maximum Holding Time (days)	Well Number: East Ramp W-1 SD	W-1 AD	W-2 SD	W-2 AD	W-3* SD	W-3* AD	W-4* SD	W-4* AD	Tucker Creek Landfill W-5* SD	W-5* AD	W-6* SD	W-6* AD	W-7* SD	W-7* AD
VOA	14	4/8	4/25	4/8	4/25	5/11	5/20	5/11	5/20	5/11	5/20	5/11	5/20	5/11	5/20
TOC	28	4/8	4/25	4/8	4/25	3/9	3/20	3/9	3/18	3/8	3/18	3/9	3/20	3/9	3/20
Phenols	28	NR		NR		NR		NR		3/8	3/13	3/9	3/20	3/9	3/20
COD	28	NR		NR		NR		NR		3/8	4/1	3/9	3/19	3/9	3/19
Cadmium	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Chromium	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Copper	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Lead	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Nickel	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Zinc	180	NR		NR		NR		NR		3/8	5/22	3/9	5/22	3/9	5/22
Petroleum Hydrocarbon	28	4/8	5/3	4/8	5/3	3/9	3/20	3/9	3/18	NR		NR		NR	
Oil and Grease	28	NR		NR		NR		NR		3/8	3/16	3/9	3/16	3/9	3/16

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested
* Well Resampled

Table F-4 (cont.)

Analytes	Maximum Holding Time (days)	Northwest Landfill						West Ramp									
		W-8*		W-9*		W-10*		W-11*		W-12*		W-13*		W-14*		W-15*	
		SD	AD	SD	AD	SD	AD	SD	AD	SD	AD	SD	AD	SD	AD	SD	AD
VOA	14	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	5/11	5/20
TOC	28	3/8	3/18	3/8	3/18	3/8	3/18	3/10	3/18	3/10	3/18	3/11	3/18	3/11	3/18	3/10	3/20
Phenols	28	3/8	3/13	3/8	3/13	3/8	3/13	NR		NR		NR		NR		NR	
COD	28	3/8	4/1	3/8	4/1	3/8	4/1	NR		NR		NR		NR		NR	
Cadmium	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Chromium	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Copper	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Lead	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Nickel	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Zinc	180	3/8	5/22	3/8	5/22	3/8	5/22	NR		NR		NR		NR		NR	
Petroleum Hydrocarbon	28	NR		NR		NR		3/10	3/18	3/10	3/18	3/11	3/16	3/11	3/16	3/10	
Oil and Grease	28	3/8	3/16	3/8	3/16	3/8	3/16	NR		NR		NR		NR		NR	

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested
* Well Resampled

Table F-4 (cont.)

Analytes	Maximum Holding Time (days)	Well Number: FTA - 1 W-16* SD	W-16* AD	W-17* SD	W-17* AD	W-18* SD	W-18* AD	W-19* SD	W-19* AD	FTA - 2 W-20 SD	W-20 AD	W-20A SD	W-20A AD	W-21* SD	W-21* AD
VOA	14	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	3/6	4/11	3/6	4/11	5/10	5/20
TOC	28	3/6	3/11	3/6	3/11	3/6	3/11	3/6	3/11	3/6	3/11	3/6	3/11	3/6	3/11
Phenols	28	3/6		3/6	3/13	3/6	3/13	3/6	3/13	3/6	3/13	3/6	3/13	3/6	3/13
COD	28		NR		NR		NR		NR		NR		NR		NR
Cadmium	180		NR		NR		NR		NR		NR		NR		NR
Chromium	180		NR		NR		NR		NR		NR		NR		NR
Copper	180		NR		NR		NR		NR		NR		NR		NR
Lead	180		NR		NR		NR		NR		NR		NR		NR
Nickel	180		NR		NR		NR		NR		NR		NR		NR
Zinc	180		NR		NR		NR		NR		NR		NR		NR
Petroleum Hydrocarbon	28	3/6	3/18	3/6	3/18	3/6	3/18	3/6	3/18	3/6	3/18	3/6	3/18	3/6	3/18
Oil and Grease	28		NR		NR		NR		NR		NR		NR		NR

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested
* Well Resampled

Table F-4 (cont.)

Analytes	Maximum Holding Time (days)	Well Number: Southwest Landfill W-22* SD	W-22* AD	W-23* SD	W-23* AD	W-24* SD	W-24* AD	W-25* SD	W-25* AD	FTA - 2 Pond A SD	Pond A AD	Pond B SD	Pond B AD	Pond C SD	Pond C AD
VOA	14	5/10	5/20	5/10	5/20	5/10	5/20	5/10	5/20	3/10	4/15	3/10	4/15	3/10	4/15
TOC	28	3/7	3/12	3/7	3/18	3/7	3/12	3/7	3/12	3/10	3/18	3/10	3/18	3/10	3/18
Phenols	28	3/7	3/13	3/7	3/13	3/7	3/13	3/7	3/13	3/10	3/20	3/10	3/20	3/10	3/20
COD	28	3/7	4/1	3/7	4/1	3/7	3/19	3/7	4/1		NR		NR		NR
Cadmium	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Chromium	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Copper	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Lead	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Nickel	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Zinc	180	3/7	5/22	3/7	5/22	3/7	5/22	3/7	5/22		NR		NR		NR
Petroleum Hydrocarbon	28		3/18		NR		3/18		3/18	3/10	3/18	3/10	3/18	3/10	3/18
Oil and Grease	28	3/7		3/7	3/16	3/7		3/7			NR		NR		NR

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested
* Well Resampled

Table F-4 (cont.)

Analytes	Maximum Holding Time (days)	Southwest Landfill							
		Pond 1		Pond 2		Pond 3		Pond 4	
		SD	AD	SD	AD	SD	AD	SD	AD
VOA	14	3/11	4/15	3/11	4/15	3/11	4/15	3/11	4/15
TOC	28	3/11	3/20	3/11	3/20	3/11	3/20	3/11	3/20
Phenols	28	3/11	3/20	3/11	3/20	3/11	3/20	3/11	3/20
COD	28	3/11	4/1	3/11	4/1	3/11	4/1	3/11	4/1
Cadmium	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Chromium	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Copper	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Lead	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Nickel	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Zinc	180	3/11	5/22	3/11	5/22	3/11	5/22	3/11	5/22
Petroleum Hydrocarbon	28	NR		NR		NR		NR	
Oil and Grease	28	3/11	3/16	3/11	3/16	3/11	3/16	3/11	3/16

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested
* Well Resampled

Table P-5
Summary of Sample Aquisition and Analysis
Soil Samples
Selfridge ANGB

Analytes	Maximum Holding Time (days)	East Ramp							
		W-1		W-2		W-3		W-4	
		7.5-15.5-25.5 SD	AD	7.5-15.5-25.5 SD	AD	7.5-15.5-25.5 SD	AD	7.5-15.5-25.5 SD	AD
VOA	14	1/28	3/17	1/28	3/17	1/28	3/17	1/28	3/17
Oil & Grease	28	1/28	2/11	1/28	2/11	1/29	2/11	1/29	2/11
EP Toxicity	180	NR		NR		NR		NR	
Ignitability	180	NR		NR		NR		NR	

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested

F12

Table F-5 (cont.)

West Ramp									
W-11		W-12		W-13		W-14		W-15	
2.5-7.5-10.5		2.5-7.5-10.5		2.5-7.5-10.5		2.5-7.5-10.5		2.5-7.5-10.5	
SD	AD	SD	AD	SD	AD	SD	AD	SD	AD
2/6	3/19	2/6	3/19	2/6	3/19	2/6	3/19	NR	
2/6	2/27	2/6	2/27	2/5	2/27	2/5	2/27	NR	
2/6	6/28	NR		NR		NR		2/6	6/28
2/6	7/18	NR		NR		NR		2/6	7/18

SD - Sample Acquisition Date (All Dates 1985)
AD - Sample Analysis Date (All Dates 1985)
NR - Not Requested

ROUND I

Environmental Sampling

Contents

	Page
Sampling Sheets	F-14
WESTON Chain of Custody Forms	F-39
AF Chain of Custody Form 2752	F-54

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-1

Mt Clemens, MI DATE: 4/17/85

SAMPLED BY: L. Weyer TIME: 1:15 AM (PM)

W.O. #: 06280549 WEATHER: Sunny & 80°

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? YES (NO)

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.64 ft REFERENCE CASING: (PVC) STEEL

TOTAL WELL DEPTH: 26.0 ft

VOLUME IN CASING: 3.8 gal VOLUME EVACUATED BEFORE SAMPLING 13 gal

SAMPLING

EVACUATION BY: BAILING (PUMPING) OTHER _____

SAMPLING BY: BAILING (PUMPING) OTHER _____

COMMENTS: Well Bailed Dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
~~[illegible]~~	P/G		~~[illegible]~~	~~[illegible]~~
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES (NO)

FIELD MEASUREMENTS

TEMP. 14 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W2

Mt Clemens, MI DATE: 4/17/85

SAMPLED BY: L Weyer TIME: 11:00 (AM)/PM

W.O. #: 06280549 WEATHER: Sunny & warm

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? ~~YES~~/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.86' ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 26.0 ft

VOLUME IN CASING: 3.8 gal VOLUME EVACUATED BEFORE SAMPLING ~27 gal

SAMPLING

EVACUATION BY: ~~BAILING~~/(PUMPING)/OTHER _____

SAMPLING BY: BAILING/(PUMPING)/OTHER _____

COMMENTS: Removed approximately 25 liters before sampling.

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
	~~P/G~~			
	P/G			VOA
	P/G			TOC
	P/G			Phenolics
	P/G		HCl	Total Petr. Hydrocarbons
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. 15 °C pH 6.5 CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-3

Mt Clemens, Mi DATE: 3/9/85

SAMPLED BY: Stein/Weijer TIME: 1133 AM/PM

W.O. #: _____ WEATHER: Sunny, Cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 1.50 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 26 ft

VOLUME IN CASING: 4.00 gal VOLUME EVACUATED BEFORE SAMPLING 11.7 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurement taken on 6/6
Bailed 3 times, waited for recharge, ran sample

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-3	P/G	1000ml	1:1 HCl/H2O	Petroleum hydrocarbon
"	P/G	60ml	H2SO4	TOC
"	P/G	250ml	↓	Phenol
"	P/G	40ml	Cool	VOA
↓	P/G			
	P/G			
	P/G			

FILTERED: YES/(NO)

FIELD MEASUREMENTS

TEMP. 11 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: LW-4
Mt Clemens, Mich DATE: 3 19 85
SAMPLED BY: Stein/Vogel TIME: 1045 AM/PM
W.O. #: _____ WEATHER: Sunny 50°

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____
LOCKED? YES/NO
CONCRETE: INTACT DAMAGED: _____
WELL DIAMETER: 2 in.
DEPTH TO WATER: 2.60 ft REFERENCE CASING: PVC/STEEL
TOTAL WELL DEPTH: 25.5 ft
VOLUME IN CASING: 3.7 gal VOLUME EVACUATED BEFORE SAMPLING 10.9 gal

SAMPLING

EVACUATION BY: ~~BAILING~~/PUMPING/OTHER _____
SAMPLING BY: BAILING/PUMPING/OTHER _____
COMMENTS: Purged one casing volume then let well bailed to sample. Went dry, waited to sample then sampled

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
LW-2	P/G	1 quart	HCL to pH 2	Petroleum hydrocarbons
"	P/G	1 Quart	HCL	TOC
"	P/G	250 ml	"	Phenol
"	P/G	40 ml	Cool	VOA
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 10 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: IW-5
Mt. Clemens Mi DATE: 3/8/85
SAMPLED BY: Stein/Weijers TIME: _____ AM/PM
W.O. #: _____ WEATHER: Sunny Cool

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____
LOCKED? YES/NO
CONCRETE: INTACT DAMAGED: _____
WELL DIAMETER: 2 in.
DEPTH TO WATER: 0 ft REFERENCE CASING: PVC/STEEL
TOTAL WELL DEPTH: 26 ft
VOLUME IN CASING: 4.3 gal VOLUME EVACUATED BEFORE SAMPLING 12.4 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____
SAMPLING BY: BAILING/PUMPING/OTHER _____
COMMENTS: Field Blank taken at IW-5
Bailed 3 times the next day, went to waste then sampled.

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
IW-5	P/G	1000 ml		
	P/G	500 ml		
	P/G	500 ml		
	P/G	1 liter		
V	P/G	250 ml		
	P/G	40 ml		
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 12 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-6

Mt Clemens, Mi DATE: 3/9/85

SAMPLED BY: Stein / Weyer TIME: 915 (AM)/PM

W.O. #: _____ WEATHER: Sunny, Cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 7.57 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 25 ft

VOLUME IN CASING: 2.8 gal VOLUME EVACUATED BEFORE SAMPLING 5.5 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurements taken as well bailed 25 times, went dry, waited to recover, then sampled

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-6	P/G	1000ml	Cool	TOC
	P/G	60 ml	H2SO4	TOX
	P/G	125ml	"	COD
	P/G	1000ml		Phenols
	P/G	250ml	HNO3	Metals
	P/G	40ml	Cool	VOA
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 12 °C pH _____ CONDUCTANCE _____ umhos/cm

RJN 6/27/84

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-7

VAT Cleaners Site DATE: 3/9/85

SAMPLED BY: Stein/Weyers TIME: 0900 AM/PM

W.O. #: _____ WEATHER: Sunny, Cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.27 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 25.5 ft

VOLUME IN CASING: 3.8 gal VOLUME EVACUATED BEFORE SAMPLING 11.1 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurements taken in lab
Bailed 15 times, went dry, waited to recover then sampled

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-7	P/(G)	1000ml	Cool	O/G
↓	P/(G)	60ml	Dark	Fec
	(P)/G	100ml	↓	Fec
	P/(G)	125ml		Fenols
↓	(P)/G	2	HNO3	Metals
	P/(G)	4	Cool	V.O.C.
	P/G			

FILTERED (YES)/NO

FIELD MEASUREMENTS

TEMP. 10 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Jeffrey AWG B WELL NO.: W-8

Mt. Olympus Mt. DATE: 3/5/85

SAMPLED BY: Stein / Wright TIME: _____ AM/PM

W.O. #: _____ WEATHER: Sunny Cool

WELL CONDITION

PROTECTIVE CASING: ~~INTACT~~ DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.93 ft REFERENCE CASING: ~~PVC~~/STEEL

TOTAL WELL DEPTH: 26.6 ft

VOLUME IN CASING: 3.5 gal VOLUME EVACUATED BEFORE SAMPLING 11.4 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Field measurements taken on 1-
Bailer is dedicated to each well. [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-8	P/G		HNO3	TOC
	P/G			
	(P)/G			Cond
	P/G			Temp
	(B)/G		NO3	Alk
	P/G		Cool	VOC
	P/G			

FILTERED (YES)/NO

FIELD MEASUREMENTS

TEMP. 8 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: S. Weymouth ANGB WELL NO.: W-9
Mt. Clemens, Mi DATE: 3/8/85
SAMPLED BY: Stein/Wing TIME: 1C 39 AM/PM
W.O. #: _____ WEATHER: sunny, cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____
LOCKED? (YES)/NO
CONCRETE: (INTACT) DAMAGED: _____
WELL DIAMETER: 2 in.
DEPTH TO WATER: 4.22 ft REFERENCE CASING: (PVC)/STEEL
TOTAL WELL DEPTH: 24.C ft
VOLUME IN CASING: 4.C gal VOLUME EVACUATED BEFORE SAMPLING 14.C gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____
SAMPLING BY: (BAILING)/PUMPING/OTHER _____
COMMENTS: Field measurement taken in lab because time would not allow to warm to room temp.

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-9	P/G	40 ml	HCl	OA
	P/G	40 ml		TOC
	P/G	125 ml		CGI
	P/G	250 ml		TPH
	P/G	250 ml	HNO3	Metals
	P/G	4 liter	Cool	VOA
	P/G			

FILTERED (YES)/NO

FIELD MEASUREMENTS

TEMP. 9 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: S. Hiddy ANGB WELL NO.: W-10
W. Chester, Ills DATE: 3/8/85
SAMPLED BY: Steve Wynn TIME: _____ AM/PM
W.O. #: _____ WEATHER: Sunny, Cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____
LOCKED? (YES)/NO
CONCRETE: (INTACT) DAMAGED: _____
WELL DIAMETER: 2 in.
DEPTH TO WATER: 2.35 ft REFERENCE CASING: (PVC)/STEEL
TOTAL WELL DEPTH: 26 ft
VOLUME IN CASING: 23.5 gal VOLUME EVACUATED BEFORE SAMPLING 11.3 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____
SAMPLING BY: (BAILING)/PUMPING/OTHER _____
COMMENTS: First measurement taken at low
Total 4 Liters water = 25' and the 1 Liter sample

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-10	P/G	1 Liter	None	Cl-
	P/G	500 ml		TOC
	P/G	500 ml		
	P/G	250 ml		
1	P/G	250 ml		
	P/G	4 ml		
	P/G			

FILTERED (YES)/NO

FIELD MEASUREMENTS

TEMP. 8 °C pH _____ CONDUCTANCE _____ umhos/cm

RJH 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: [redacted] Selma AWS — WELL NO.: W-11

Mt. Clemens, Mi — DATE: 3/10/85

SAMPLED BY: Stein/Weyer — TIME: _____ AM/PM

W.O. #: _____ WEATHER: Sunny, Cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: Surface ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 25 ft

VOLUME IN CASING: 4.2 gal VOLUME EVACUATED BEFORE SAMPLING 4.2 gal

SAMPLING

EVACUATION BY: ~~BAILING~~/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurement taken in car

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	100ml	[illegible]	Field measurements
	P/G	40ml	"	VOX
	P/G	1 gal	none	
	P/G	250ml	"	Phenols
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. 10 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANG WELL NO.: GW-12

Mt Clemens MI DATE: 3/10/85

SAMPLED BY: Steinhauser TIME: _____ AM/PM

W.O. #: _____ WEATHER: sunny cool

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 23 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 25.5 ft

VOLUME IN CASING: 4.0 gal VOLUME EVACUATED BEFORE SAMPLING 15 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurements taken in lab

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
GW-12	P/G	1 liter	cool	Priority Pollutants
	P/G	4 liter	cool	TOX
	P/G	500 ml	cool	TOC
	P/G	250 ml	cool	Cyanide
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. 11 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Jefferies Ferry Rd. Mt. Clemens, Mi. WELL NO.: W13

DATE: 3/11/85

SAMPLED BY: [illegible] TIME: _____ AM/PM

W.O. #: _____ WEATHER: Rainy/Damp

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 3 [illegible] ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 26 ft

VOLUME IN CASING: 3.7 gal VOLUME EVACUATED BEFORE SAMPLING 11 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: _____

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	[illegible]	[illegible]	[illegible]
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 11 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-14

Mt. Clemens, Mi DATE: 3/11/85

SAMPLED BY: Stein/Vesper TIME: 855 AM PM

W.O. #: _____ WEATHER: Rainy, Overcast

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 1.67 ft REFERENCE CASING: PVC STEEL

TOTAL WELL DEPTH: 25 ft

VOLUME IN CASING: 4.0 gal VOLUME EVACUATED BEFORE SAMPLING 16 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-14	P/G	1000 ml	HNO3	OC
	P/G	750 ml		
	P/G	40 ml		
✓	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES NO

FIELD MEASUREMENTS

TEMP. 6 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-15
Mt Clemens, Mi. DATE: 3/10/85

SAMPLED BY: Steve Wenger TIME: _____ AM/PM

W.O. #: _____ WEATHER: Sunny Cool

WELL CONDITION

PROTECTIVE CASING: ~~INTACT~~ DAMAGED: _____

LOCKED? YES/NO

CONCRETE: ~~INTACT~~ DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 3 8.5 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 25.6 ft

VOLUME IN CASING: 3.5 gal VOLUME EVACUATED BEFORE SAMPLING 12.4 gal

SAMPLING

EVACUATION BY: ~~BAILING~~/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: For measurements taken in the Bedrock Zone
Well [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-15	P/G	1000 ml	HNO3	Petroleum hydrocarbons
	P/G	40 ml		TOC
	P/G	Glass		
	P/G	250 ml		
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 9 °C pH _____ CONDUCTANCE _____ umhos/cm

RJr. 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-16

Mt Clemens Mi DATE: 3 16 195

SAMPLED BY: Steve Wagner TIME: 1250 AM/PM

W.O. #: _____ WEATHER: Clear, Cool, Cloudy

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.12 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 26 ft

VOLUME IN CASING: 4.1 gal VOLUME EVACUATED BEFORE SAMPLING 11.9 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: For [illegible]

[illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-16	P/G	1 liter	HCl	[illegible]
	P/G	1 liter	[illegible]	
	P/G	40 ml	[illegible]	
	P/G	4 oz	[illegible]	
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. [illegible] °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Del. Tel AMG WELL NO.: W-17

Mt Cenis, NH DATE: 3 16 85

SAMPLED BY: Steve Wright TIME: [illegible] AM/PM

W.O. #: _____ WEATHER: Clear, sunny

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: [illegible] ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: [illegible] ft

VOLUME IN CASING: 3.9 gal VOLUME EVACUATED BEFORE SAMPLING [illegible] gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	[illegible]	[illegible]	[illegible]
	P/G			
	P/G			
	P/G	2		
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 5 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Delfield RNGE WELL NO.: W-14

Mt Clemens, Mi DATE: 3/6/85

SAMPLED BY: [illegible] TIME: 1420 AM/PM

W.O. #: _____ WEATHER: [illegible]

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 128 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 257 ft

VOLUME IN CASING: 3.8 gal VOLUME EVACUATED BEFORE SAMPLING: [illegible] gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]		TOC
	P/G	[illegible]		[illegible]
	P/G	[illegible]		[illegible]
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. [illegible] °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-19

Mt Clemens, Mi DATE: 3/6/85

SAMPLED BY: Stein/Weyer TIME: 957 AM/PM

W.O. #: _____ WEATHER: Clear, Cold

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 3.4 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 26.1 ft

VOLUME IN CASING: 3.7 gal VOLUME EVACUATED BEFORE SAMPLING 7.5 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurements taken after [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-19	P/G	1000 ml	HNO3	Total Recoverable Inorganics
	P/G	60 ml	None	TOC
	P/G	40 ml	conc	VOA
	P/G	250 ml	None	Phenol
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. [illegible] °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: W Selfridge ANGB WELL NO.: W-20

Mt Clemens, Mi. DATE: 3 16 85

SAMPLED BY: Stein/Weyer TIME: 9 AM/PM

W.O. #: _____ WEATHER: Clear, Cold

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 4.72 ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: 26 ft

VOLUME IN CASING: 3.5 gal VOLUME EVACUATED BEFORE SAMPLING 7.22 gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Field measurement taken in Lab
Duplicate Taken @ 22-E
Blue + 25 [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-20/22A	P/G	1 Hand	1:1 HCl to pH 2	Total Recoverable Petroleum Hydrocarbons
	P/G	60 ml	[illegible]	[illegible]
	P/G	40 ml	Cool	[illegible]
	P/G	250 ml	[illegible]	Phenol
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. 8 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W-21

Mt. Clemens, Mi DATE: 3/6/85

SAMPLED BY: Stein/Weyer TIME: 3 . AM/PM

W.O. #: _____ WEATHER: Clear, Cold

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in

DEPTH TO WATER: 2 47 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 24 ft

VOLUME IN CASING: 4.6 gal VOLUME EVACUATED BEFORE SAMPLING 17 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Field measurement taken in the [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-21	P/G	1000ml	[illegible]	Total Coliform & Fecal Coliform
	P/G	40ml	[illegible]	[illegible]
	P/G	40ml	[illegible]	[illegible]
✓	P/G	250ml	[illegible]	Lead
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 7 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTERN

FIELD SAMPLING SHEET

SITE LOCATION: Lethbridge AB/Mt Vernon WELL NO.: MW-2R

DATE: 5/7/85

SAMPLED BY: Steve Wilson TIME: 920 AM/PM

W.O. #: _____ WEATHER: Warm/Cold

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 2.72 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 25 ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING 6.6 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Field measurement Taken in Bailed Sample

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
MW-2R	P/G	1x1 ml	HNO3	2
	P/G			
	P/G			
	P/G	2		
	P/G	2x40 ml		
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 5 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Letterkenny Army Depot WELL NO.: W-27
Mt. Elmira Rd DATE: 2/7/85

SAMPLED BY: Steve Wagner TIME: _____ AM/PM

W.O. #: _____ WEATHER: Overcast Cold

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: [illegible] ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: [illegible] ft

VOLUME IN CASING: [illegible] gal VOLUME EVACUATED BEFORE SAMPLING [illegible] gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	[illegible]	[illegible]	[illegible]
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 5 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Sel. Ag ANGB WELL NO.: W-24

W. Jefferson, N. DATE: 5/7/85

SAMPLED BY: Ste. Wilson TIME: _____ AM/PM

W.O. #: _____ WEATHER: Overcast Cold

WELL CONDITION

PROTECTIVE CASING: ~~INTACT~~ DAMAGED: _____

LOCKED? ~~YES~~/NO

CONCRETE: ~~INTACT~~ DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 3.97 ft REFERENCE CASING: ~~PVC~~/STEEL

TOTAL WELL DEPTH: 16.62 ft

VOLUME IN CASING: 1.7 gal VOLUME EVACUATED BEFORE SAMPLING 2.5 gal

SAMPLING

EVACUATION BY: ~~BAILING~~/PUMPING/OTHER _____

SAMPLING BY: ~~BAILING~~/PUMPING/OTHER _____

COMMENTS: [illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
[illegible]	P/G	[illegible]	[illegible]	[illegible]
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED ~~YES~~/~~NO~~

FIELD MEASUREMENTS

TEMP. 4 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Sel Field, AFB WELL NO.: MW-25

McClellan, Ca. DATE: 3/21/85

SAMPLED BY: Steve/Wayne TIME: 850 AM/PM

W.O. #: _____ WEATHER: Sunny, Cold

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: 370 ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: 254 ft

VOLUME IN CASING: 3.6 gal VOLUME EVACUATED BEFORE SAMPLING 4.5 gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Full recovery [illegible]
[illegible]

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
MW-25	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]	[illegible]	[illegible]
	P/G	[illegible]	[illegible]	[illegible]
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. 5 °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

001

Custody Transfer Record/Lab Work Request

Received By K. Pardue
Date 2/1/85
Assigned to

Client Selfridge A.F.B.
Client Contact Rich Johnson
Phone

RFW Contact Judy Poeta
Date Due 1/28/85
Project Number 0628-0549

8B3-122-

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preserv	8/81 TOX
W-10010	0628	Soil 7.5'	1/28/85	1000 ml/HNO3	
W-10020		15.5'	1/28/85		
W-10030		25'	1/28/85		
W-2 40		7.5'	1/28/85		
W-2 50		15.5'	1/28/85		
W-2 60		25'	1/28/85		
W-3 70		7.5'	1/29/85		
W-3 80		15.5'	1/29/85		
W-3 90		25'	1/29/85		
W-40100		7.5'	1/29/85		
W-40110		15.5'	1/29/85		
W-40120		25'	1/29/85		

SPECIAL INSTRUCTIONS

Are there any "Hazardous" compounds in samples? (Initial) DMS Yes ___ No ✓ UNKNOWN ___ If "yes" list on back

Items Transferred	Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer
12 Soil Samples	David M. Stein	1/31/85	6:00	K. Pardue	2/1/85	1145	Storage

WESTON 002

Custody Transfer Record/Lab Work Request

Received By YCA
Date 2/8/85
Assigned to

Client Schriever A.F.B.
Client Contact Ruth Johnson
Phone

RFW Contact Judy Porter
Date Due 1/28/85
Project Number 06028-05-49

8502-150

SAMPLE IDENTIFICATION

Sample No.	Client ID No.	Description	Date Collected	Container/Preserv
W-11	0626	0010 2.5' · Soil	2/6/85	1000ML/AMBER COOL
W-11		20 7.5' ·		
W-11		30 10.5' ·		
W-12		40 2.5' ·		
W-12		50 7.5' ·		
W-12		60 10.5' ·		
W-15		70 2.5' ·		
W-15		80 7.5' ·		
W-15		90 10.5' ·		
W-13		100 2.5' ·	2/5/85	
W-13		110 7.5' ·		
W-13		0120 10.5' ·		
W-14		0130 2.5' ·		
W-14		0140 7.5' ·		
W-14		0150 10.5' ·		

ANALYSES REQUESTED

O/G Toxicity = EP Tox

add metals

EP Tox METALS (AS SE BA CD CR Hg Pb Ag) Logged IN as soluble metals for each sample.

SPECIAL INSTRUCTIONS

Are there any "Hazardous" compounds in samples? (Initial) D.M.S Yes ___ No ✓ UNKNOWN ___ If "yes" list on back

Items Transferred	Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer
15 Soil Samples	D. M. Stein	2/7/85	6:00pm				

WESTON
05

Custody Transfer Record/Lab Work Request

Received By W.B. Darrington
Date 3/6/85 - 3/7/85
Assigned to

Client Selfridge ANG. Base
Client Contact
Phone

RFW Contact Judy Porta
Date Due 3/25/85
Project Number 0628-05-49

803-254-

SAMPLE IDENTIFICATION

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative
W-16	0628	Groundwater Samples 0010	3/6/85	1000 ml g 60 ml g 40 ml g 250 ml g
W-17	0628	Groundwater Samples 0020	3/6/85	1000 ml g 60 ml g 40 ml g 250 ml g
W-18	0628	Groundwater Samples 0030	3/6/85	1000 ml g 60 ml g 40 ml g 250 ml g
W-19	0628	Groundwater Samples 0040	3/6/85	1000 ml g 60 ml g 40 ml g 250 ml g

ANALYSES REQUESTED

O/G	Method 418.1		
TOC	Method 415.1		
VOA		601 + 602	
Phenol		420.1	Priority pollutants
O/G		418.1	
TOC		415.1	
VOA		601 + 602	
Phenol		420.1	
O/G		418.1	
TOC		415.1	
VOA		601 + 602	
Phenol		420.1	
O/G		418.1	
TOC		415.1	
VOA		601 + 602	
Phenol		420.1	

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
3 liters for [illegible]	P.M. Hein	Emery	3/6/85	6pm					

Custody Transfer Record/Lab Work Request

WESTON CONSULTANTS

Received By _____
Date 3/6/85
Assigned to _____

Client Selfridge Air National
Client Contact _____
Phone _____

RFW Contact Judy Porta
Date Due _____
Project Number 3[illegible]49

8[illegible]-254-

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	EPA Method						
W-20	0628	Grab Surface Sample	3/6/85	1000 ml g	O/G		418.1				
				60 ml g	Phen		415.1				
		0050		40 ml g	VOA		601 + 602				
				750 ml g	Cond		420.1				
W-21	0629	Grab Surface Sample	3/6/85	1000 ml g	O/G		418.1				
				60 ml g	Phen		415.1				
		0060		40 ml g	VOA		601 + 602				
				750 ml g	Cond		420.1				
W-16	0624	0010 Grab Surface	3/6/85	350 ml p	Ph, Spec. Cond., Temp						
W-17		20									
W-18		30									
W-19		40									
W-20		50									
W-21		60									
W-20A		0070			O/G TOC VOA Phen [redacted]						

F42

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
6-M [illegible]	RMH/CBi	Emery	3/6/85	6pm					

WESTON

Custody Transfer Record/Lab Work Request

004

Received By Emery
Date 3/7/85
Assigned to D.M. Flein

Client Selfridge ANGB
Client Contact H. Faulk
Phone

RFW Contact J. Porta
Date Due
Project Number 0628-05-49

805-26-

SAMPLE IDENTIFICATION					ANALYSES REQUESTED		
Sample No.	Client ID No.	Description	Date Collected	Container/Preservative		Analytical Methods	
W-22	0628	Ground Water Samples 0010	3/7/85	1000 ml g	O/G	EPA 418.1	
				60 ml p	TOC	415.1	
				100 ml p	COD	STD 508A	
				250 ml p	Metals	See Judy	
				150 ml g	Phenols	420.1	
				40 ml g	VOA	601+602	
W-24	0628	Ground water Samples 0020	3/7/85	1000 ml g	O/G	EPA 418.1	
				60 ml p	TOC	415.1	
				100 ml p	COD	STD 508A	
				250 ml p	Metals	See Judy	
				150 ml g	Phenols	420.1	
				40 ml g	VOA	601+602	
W-25	0628	Groundwater Samples 0050	3/7/85	1000 ml g	O/G	EPA 418.1	
				60 ml p	TOC	415.1	
				100 ml p	COD	STD 508A	
				250 ml p	Metals	See Judy	
				150 ml g	Phenols	601+602	
				40 ml g	VOA		

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
BTEX Ground Water Samples	D.M. Flein	Emery	3/7/85	6pm					
		[illegible]	3/8/85	1415					

WESTON
005

Custody Transfer Record/Lab Work Request

Received By Atmeny
Date 3/8/85
Assigned to D M Stein

Client Jeffrie Geo/NUS
Client Contact N. Faulk
Phone

RFW Contact J. Porta
Date Due
Project Number 0628-05-49

8305-265-

SAMPLE IDENTIFICATION

ANALYSES REQUESTED

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	Analytical Methods						
W-8	0628	G.W. Samples	3/8/85	1000ml Glass	O/G	413.2					
				40ml H2SO4	TOC	415.1					
				100ml H2SO4	COD	STD 508A					
				250ml H2SO4	Phenol	420.1					
		0010		250ml HNO3	Metals	See Judy					
				40ml Glass	VOA	601+602					
W-5	0628	G.W. Samples	3/8/85	1000ml Glass	O/G	413.2					
				40ml H2SO4	TOC	415.1					
				100ml H2SO4	COD	STD 508A					
				250ml H2SO4	Phenol	420.1					
		0020		250ml HNO3	Metals	See Judy					
				40ml Glass	VOA	601+602					
W-23	0628	G.W. Samples	3/7/85 3/8/85	250ml Glass	Ph, Temp, Spec Cond						
W-10											
W-9											
W-5											
W-5											

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Bottles for GW Samples	D M Stein	Emery	3/8/85	6pm					

WESTON
005

Custody Transfer Record/Lab Work Request

Received By Emery
Date 3/9/95
Assigned to D.M. Stein

Client Fetterman AMG
Client Contact H Faulk
Phone

RFW Contact J. Porta
Date Due
Project Number 0628-05-419

863

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative		Analytical Methods				
W-23	0628	G.W. Samples	3/7/95	1000ml poly	O/G	413.2				
				60ml H_2SO_4	TOC	415.1				
				100ml H_2SO_4	COD	STD 508A				
				750ml H_2SO_4	Phenols	420.1				
				250ml HNO3	Metals	See Judy				
				40ml Vial	VOA	624+602				
W-10	0628	G.W. Samples	3/8/95	1000ml poly	O/G	413.2				
				60ml H_2SO_4	TOC	415.1				
				100ml H_2SO_4	COD	STD 508A				
				750ml H_2SO_4	Phenols	420.1				
				250ml HNO3	Metals	See Judy				
				40ml Vial	VOA	624+602				
W-9	0628	G.W. Samples	3/8/95	1000ml poly	O/G	413.2				
				60ml H_2SO_4	TOC	415.1				
				100ml H_2SO_4	COD	STD 508A				
				750ml H_2SO_4	Phenols	420.1				
				250ml HNO3	Metals	See Judy				
				40ml Vial	VOA	624+602				

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Bottled G.W. Samples	D.M. Stein	Emery	3/8/95	6pm					

WESTON
006

Custody Transfer Record/Lab Work Request

Received By Emery
Date 3/11/85
Assigned to D.M. Stein

Client Lehigh #1 GOB
Client Contact H. Faulk
Phone

RFW Contact J. Porta
Date Due
Project Number 0628-05-49

8503-273-

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative		Analytical Methods				
W-13	0628	6 W. Samples	3/11/85	1000ml 1:1 HCl/Hno3	O/G	413.1				
W-14	"	0010	"	40ml H_2SO_4	TOC	415.1				
		0020		750ml H_2SO_4	Phenols	420.2				
				40ml Cool	VOA	601 + 602			pH 500	
FPTA #2	0628	Surface Water	3/10/85	1000ml 1:1 HCl/Hno3	O/G	413.1				
Comb A B C	0050	Samples		60ml H_2SO_4	TOC	415.1				
0050	0040			750ml H_2SO_4	Phenols	420.1				
				40ml Cool	VOA	601+602				
W-42	0628	6 W. Samples	3/10/85		NPDES					
W-43	0060			1000ml Cool	O/G	413.1				
0070				1000ml 1:1 HCl/Hno3	O/G	413.2				
				60ml H_2SO_4	TOC	415.1				
				100ml "	COD	STD 508A				
				250ml H_2SO_4	Metals	See Guide				
				750ml H_2SO_4	Phenol	420.1				
				40ml Cool	VOA	601+602				

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Duplicate G.W. Samples	D.M. Stein	Emery	3/11/85	6pm			Victoria K. Drake	3/12/85	1300

WESTON 008

Custody Transfer Record/Lab Work Request

Received By Emery
Date 3/11/85
Assigned to D.M. Stein

Client Jefferson AAGB
Client Contact H. Faulk
Phone

RFW Contact J. Porta
Date Due
Project Number 0628-05-49

8505-273

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative		Analytical Methods				
W-4	0628	G. W. samples 0080	3/9/85	1000ml 1:1 HCl/H2O	O/G	418.1				
				60ml H_2SO_4	TOC	415.1				
				750ml H_2SO_4	Phenols	420.1				
				40ml Cool	VOA	601+602			pH 8	
W-11	0628	G. W. samples 0090	3/10/85	1000ml 1:1 HCl/H2O	O/G	418.1				
				60ml H_2SO_4	TOC	415.1				
				750ml H_2SO_4	Phenols	420.1				
				40ml Cool	VOA	601+602			pH 8	
W-12	0628	G. W. samples 0100	3/10/85	1000ml 1:1 HCl/H2O	O/G	418.1				
				60ml H_2SO_4	TOC	415.1				
				750ml H_2SO_4	Phenols	420.1				
				40ml Cool	VOA	601+602			pH 8	
W-41	0628	G. W. samples 0110	3/10/85	1000ml 1:1 HCl/H2O	O/G	418.1				
				60ml H_2SO_4	TOC	415.1				
				750ml H_2SO_4	Phenols	420.1				
				40ml Cool	VOA	601+602			pH 8	

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Blk for G.W. samples	D.M. Stein	Emery	3/11/85	6pm					

P47

WESTON 008

Custody Transfer Record/Lab Work Request

Received By Emery
Date 3/11/85
Assigned to D.M. Stein

Client Jeffryes/AWARE
Client Contact H. Faulk
Phone

RFW Contact Judy Porta
Date Due
Project Number 0628-05-49

803-273-

SAMPLE IDENTIFICATION

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	ANALYSES REQUESTED							
						Analytical Methods						
W-6	0628	G.W. Samples	3/9/85	1000 ml Cool	O/G	413.2						
				60 ml H_2SO_4	TOC	415.1						
				100 ml	COD	STD SOSA						
		0120		75 ml	Phenols	420.1						
				250 ml HNO$_3$	Metals	See Judy						
				40 ml Cool	VOA	601+602				pH 5-9		
W-7	0628	G.W. Samples	3/9/85	1000 ml Cool	O/G	413.2						
				60 ml H_2SO_4	TOC	415.1						
				100 ml	COD	STD SOSA						
		0130		75 ml	Phenols	420.1						
				250 ml HNO$_3$	Metals	See Judy						
				40 ml Cool	VOA	601+602				pH 5-9		
W-3	0628	G.W. Samples	3/9/85	1000 ml [illegible]	Petroleum Hydrocarbons					418.1		
				60 ml H_2SO_4	TOC	415.1						
		0140		75 ml H_2SO_4	Phenols	420.1						
				40 ml Cool	VOA	601+602				pH 5-9		

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Bottled G.W. Samples	D.M. Stein	Emery	3/11/85	6pm					

WESTON
008

Custody Transfer Record/Lab Work Request

Received By E Emery
Date 3/12/05
Assigned to D M Stein

Client Letterkenny ANGB
Client Contact A Faulk
Phone

RFW Contact J Porta
Date Due
Project Number 0628-05-49

805-275-

SAMPLE IDENTIFICATION

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	ANALYSES REQUESTED
Ponds 1, 2, 3, 4	0628	Surface Waters Samples	3/11/05	1000 ml Cool 60 ml H_2SO_4 100 ml HNO_3 250 ml HNO_3 750 ml H_2SO_4 40 ml Cool	O&G TOC COD Metals Phenols VOA
Pond 1	0150				
2	0160				
3	0170				
4	0180				
W-5	0190				HCl VOA TOC Phen pH SO4

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Surface Waters Samples	D M Stein	E Emery	3/12/05	2pm					

F49

Custody Transfer Record/Lab Work Request

WESTON

Received By: Emery
Date: 3/11/85
Assigned to: D.M. Stein

Client: Eltridge AFB
Client Contact: H. Faulk
Phone:

RFW Contact: J. Porta
Date Due: 3/29
Project Number: D828.05-49

273

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative								
W-2	0129	G.W. Douglas	3/9/85	2 1 Oml Glass	pH, Temp, spec cond							
W-4			3/9/85									
W-6			3/9/85									
W-7			3/9/85									
W-11			3/10/85									
W-12			3/10/85									
W-13			3/11/85									
W-14			3/11/85									
W-41			3/11/85									

F50

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Bottles & Ice Supplied	D.M. Stein	Emery	3/11/85	6pm					

WESTON
DESIGNERS CONSULTANTS

Custody Transfer Record/Lab Work Request

007

804-422

Received By L Weyer 4/18/85 4/19/85
Date
Assigned to

Client USAF - Selfridge
Client Contact H Faulk
Phone

RFW Contact J Dowden
Date Due 5/9/85
Project Number 06280549

SAMPLE IDENTIFICATION

ANALYSES REQUESTED

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	ANALYSES REQUESTED
W01	0010	groundwater	4/18/85	40ml/none	VOA
				~~1 liter/none~~	~~O+G~~
				½ liter/H_2SO_4	phenolics
				8oz/H_2SO_4	TOC
				1 liter/HCl	Total Recov. Hydrocarb
				~~500ml/none~~	pH 5.5

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
1 cooler	Laura Weyer	Federal Express	4/18/85	4:30					
Samples	Fed. Express	Victor Dalmo	4/19/85	9:15					

WESTON
007

Custody Transfer Record/Lab Work Request

Received By L Weeges
Date 4/18/85
Assigned to

Client USAF - Selfridge
Client Contact H Faulk
Phone

RFW Contact J Dowden
Date Due
Project Number 062805.49

8504-422-

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	ANALYSES REQUESTED
W02	0020	groundwater	4/18/85	40 ml/none	VOA
				~~1 liter/none~~	O&G
				½ liter/	Phenolics
				8 oz/	TOX
				1 Liter/HCl	Total Recoverable Hydrocarb
				250 ml/none	pH

F52

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Laura Wagner	Fed Ex	4/18/85	4:30					
Samples	Fed. Express	Victoria L. Dales	4/19/85	9:15					

WESTON

OCG

Custody Transfer Record/Lab Work Request

Received By V.K. Dadoo
Date 6/4/85
Assigned to

Client Selfridge AFB
Client Contact S. Wichtes
Phone

RFW Contact
Date Due 7/2/85
Project Number 0238-05-49

8506-141-

SAMPLE IDENTIFICATION

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative
0010		W-11 2.5'	6/4/85	
20		W-11 7.5'		
30		W-11 10.5'		
40		W-15 2.5'		
50		W-15 7.5'		
60		W-15 10.5'		
70		Trip Blank 0010		
80		" 20		
90		" 30		
100		" 40		
110		" 50		
120		" 60		

ANALYSES REQUESTED

Tpet BTXE GAS

RECEIVED
JUN 20 1985
ROY F. WESTON, INC.
RANNOCKBURN OFFICE

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time

F53

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA WO1

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W1 East Ramp

DATE COLLECTION BEGAN (YYMMDD): 851011

TIME COLLECTION BEGAN (24 hour clock): 1315

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376 USAF HQMIANGDET 1/56C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): L. Weyer

SIGNATURE: Laura Weyer

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8001

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T	
	Ammonia	00610	Iron	01045	✓	Residue, Volatile	00505		Bromoform	32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane	32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride	32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform	32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane	34418
✓	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane	32105
✓	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride	34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene	34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane	34506
			Sodium	00929		GROUP H			Trichloroethylene	39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes	82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs	39516
	Cyanide, Free	00722				DDT Isomers	39370			
						Dieldrin	39380			
	GROUP E		GROUP G			Endrin	39390			
✓	Phenols	32730	Acidity, Total	70508		Heptachlor	39410			
			Alkalinity, Total	00410		Heptachlor Epoxide	39420			
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782			
	Antimony	01097	Bromide	71870		Methoxychlor	39480			
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400			
	Barium	01007	Chloride	00940		2,4-D	39730			
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760			
	Boron	01022	Fluoride	00951		2,4,5-T	39740			
	Cadmium	01027	Iodide	71865						
	Calcium	00916	Odor	00086						
	Chromium, Total	01034	Residue, Total	00500						
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J				
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745			

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS (METHOD OF ANALYSIS): VOA EPA 601+602 Phenols EPA 420.1; TOC EPA 415.1 O+G EPA 413.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W02

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W2 East Ramp

DATE COLLECTION BEGAN (YYMMDD): 880411

TIME COLLECTION BEGAN (24 hour clock): 1030

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376 USAFHQMIANGDET 1/SGC Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): L. Weyer

SIGNATURE: Laura Weyer

AUTOVON:

REASON FOR SUBMISSION: O (A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify))

BASE SAMPLE NUMBER: 6W 85 8002

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720		✓ Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
✓	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
✓	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				
									Residue, Settleable 50086						
✓									Residue, Volatile 00505						
									Silica 00955						
									Specific Conductance 00095						
									Sulfate 00945						
									Sulfite 00740						
									Surfactants -MBAS 38260						
									Turbidity 00076						

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS METHODS OF ANALYSIS: VOA EPA 601+602; Phenols EPA 420.1; TOC EPA 415.1; O+G EPA 418.1

AF FORM 2752 JAN 81

F55

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W03

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W3 East Ramp

DATE COLLECTION BEGAN (YYMMDD): 850310

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed):
- ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376 USAF HQMIANGDET 1/S6C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC):

SIGNATURE:

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8001

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: Method of Analysis
VOA EPA 624/624 Phenols EPA 420.1
TOC EPA Program 415.1 O+G EPA 413.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W@4

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W4 East Ramp

DATE COLLECTION BEGAN (YYMMDD): 18,5|0|3|0|9|

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL	0253	USAF OEHL/TSS Brooks AFB, Tx 78235
COPY 1	0376	USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC):

SIGNATURE:

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8002

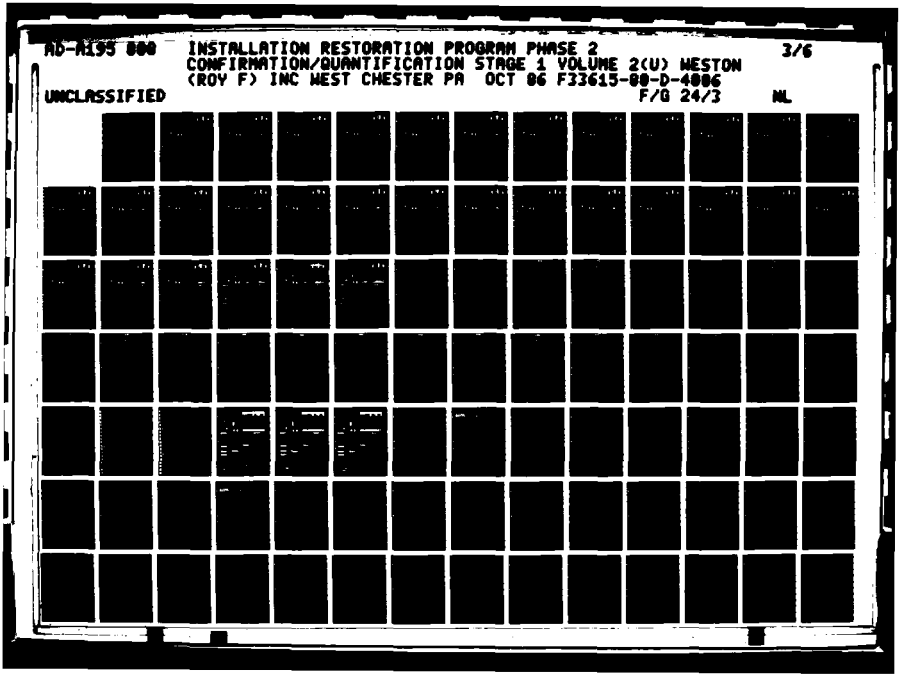
OEHL PID:

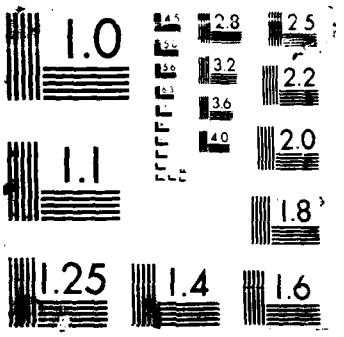
ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: Method of Analysis,
VOA ~~SID~~ EPA 601+602 Phenols EPA 420.1
~~Base~~ ~~STD EPA~~ O+G EPA 413.1

AF FORM JAN 81 2752 TOC EPA 415.1


AD-A195 888
INSTALLATION RESTORATION PROGRAM PHASE 2
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-80-D-4006
3/6
UNCLASSIFIED
F/G 24/3
NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W05

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W5 Tucker Creek Landfill

DATE COLLECTION BEGAN (YYMMDD): 810310

TIME COLLECTION BEGAN (24 hour clock): 1200

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQMIANGDET 1/56C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8005

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625	X					Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560	X					Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				
									Residue, Settleable 50086						
									Residue, Volatile 00505	X					
									Silica 00955						
									Specific Conductance 00095						
									Sulfate 00945						
									Sulfite 00740						
									Surfactants -MBAS 38260						
									Turbidity 00076						

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS Method of Analysis
O+G EPA 413.1 COD: STD 508A VOA EPA ~~415.1~~ 601 + 602
Phenols EPA 420.1 TOC EPA 415.1 Cadmium EPA 213.2
Copper EPA 220.1
Lead EPA 239.2 Chromium EPA 218.1
Nickel EPA 249.1 Zinc EPA 289.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W6

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W6 Tucker Creek Landfill

DATE COLLECTION BEGAN (YYMMDD): 18,510,310,91

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC):

SIGNATURE:

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN-85-8006

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F
	Ammonia 00610		Cyanide, Total 00720		Phenols 32730		Antimony 01097
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002
	Kjeldahl Nitrogen 00625						Barium 01007
	Nitrate 00620						Beryllium 01012
	Nitrite 00615						Boron 01022
X	Oil & Grease 00560						Cadmium 01027
X	Organic Carbon 00680						Calcium 00916
	Orthophosphate 00671						Chromium, Total 01034
	Phosphorus, Total 00665						Chromium VI 01032
							Copper 01042

			GROUP G		GROUP H		GROUP T
	Hardness 00900		Acidity, Total 70508		BHC Isomers 39340		Bromoform 32104
	Iron 01045		Alkalinity, Total 00410		Chlordane 39350		Bromodichloromethane 32101
X	Lead 01051		Alkalinity, Bicarbonate 00425		DDT Isomers 39370		Carbon Tetrachloride 32102
	Magnesium 00927		Bromide 71870		Dieldrin 39380		Chloroform 32106
	Mercury 71900		Carbon Dioxide 00405		Endrin 39390		Chloromethane 34418
X	Nickel 01067		Chloride 00940		Heptachlor 39410		Dibromochloromethane 32105
	Potassium 00937		Color 00080		Heptachlor Epoxide 39420		Methylene Chloride 34423
	Selenium 01147		Fluoride 00951		Lindane 39782		Tetrachloroethylene 34475
	Silver 01077		Iodide 71865		Methoxychlor 39480		1,1,1-Trichloroethane 34506
	Sodium 00929		Odor 00086		Toxaphene 39400		Trichloroethylene 39180
	Thallium 01059		Residue, Total 00500		2,4-D 39730		Trihalomethanes 82080
X	Zinc 01092		Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760		PCBs 39516
			Residue, Nonfilterable 00530		2,4,5-T 39740		

	Residue, Settleable 50086						
X	Residue, Volatile 00505						
	Silica 00955						
	Specific Conductance 00095						
	Sulfate 00945						
	Sulfite 00740						
	Surfactants -MBAS 38260						
	Turbidity 00076						

	GROUP J
	Sulfides 00745

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Method of Analysis
O&G EPA 413.2 COD STD 508A VOA EPA 601 + 602
Phenols EPA 420.1 TOC EPA 415.1 Cadmium EPA 213.2
Chromium EPA 218.1
Copper EPA 220.1 Nickel 249.1
Lead EPA 239.2 Zinc 289.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 WA W7

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W7 Tucker Creek Landfill

DATE COLLECTION BEGAN (YYMMDD): 18,510,310,91

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TS, Brooks AFB, TX 78235
- COPY 1 0376: USAF HQMIANGDET 1/126C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name,Grade,AFSC):

SIGNATURE:

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN85 8007

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue,Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue,Volatile	00505		Bromoform 32104
X	Chemical Oxygen Demand	00340	X Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	X Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	X Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
X	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
X	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
X	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS METHOD OF ANALYSIS
O+G EPA 413.2
Phenols EPA 420.1
VOA EPA ~~624~~ 601 + 602
VOA EPA 415.1
COD STD 508A

AF FORM 2752 JAN 81

Copper EPA 220.1 Lead EPA 239.2
Chromium EPA 218.1 Nickel EPA 249.1
Cadmium EPA 213.2 Zinc EPA 289.1

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA WO8

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W-8 NW Landfill

DATE COLLECTION BEGAN (YYMMDD): 10,3,1,0,8,8,5

TIME COLLECTION BEGAN (24 hour clock): 1024

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL: 0235 USAF OEHL/TSS Brooks AFB TX 78235
- COPY 1: 0376 USAF HQ MIANG DET 1/SGE Selfridge ANGB, MI 48045
- COPY 2:

SAMPLE COLLECTED BY (Name, Grade, AFSC): D. M. Stein

SIGNATURE: David Stein

AUTOVON:

REASON FOR SUBMISSION: D

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN85 8008

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39430				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA WO9

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W-9 N.W. Landfill

DATE COLLECTION BEGAN (YYMMDD): 850815

TIME COLLECTION BEGAN (24 hour clock): 1035

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0235 USAF OEHL/TSL Brooks AFB TX 78235
- COPY 1 0376 USAF HQ MIANG DET 1/SGC Selfridge, Mi. 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON:

REASON FOR SUBMISSION: D

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8009

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP H		GROUP T
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		BHC Isomers 39340		Bromoform 32104
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Chlordane 39350		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625				GROUP G		Barium 01007		DDT Isomers 39370		Carbon Tetrachloride 32102
	Nitrate 00620		GROUP H		Acidity, Total 70508		Beryllium 01012		Dieldrin 39380		Chloroform 32106
	Nitrite 00615		Hardness 00900		Alkalinity, Total 00410		Boron 01022		Endrin 39390		Chloromethane 34418
X	Oil & Grease 00560	X	Iron 01045		Alkalinity, Bicarbonate 00425	X	Cadmium 01027		Heptachlor 39410		Dibromochloromethane 32105
X	Organic Carbon 00680		Lead 01051		Bromide 71870		Calcium 00916		Heptachlor Epoxide 39420		Methylene Chloride 34423
	Orthophosphate 00671		Magnesium 00927		Carbon Dioxide 00405	X	Chromium, Total 01034		Lindane 39782		Tetrachloroethylene 34475
	Phosphorus, Total 00665		Manganese 01055		Chloride 00940		Chromium VI 01032		Methoxychlor 39480		1,1,1-Trichloroethane 34506
			Mercury 71900		Color 00080	X	Copper 01042		Toxaphene 39400		Trichloroethylene 39180
		X	Nickel 01067		Fluoride 00951		Residue, Total 00500		2,4-D 39730		Trihalomethanes 82080
			Potassium 00937		Iodide 71865		Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760		PCBs 39516
			Selenium 01147		Odor 00086		Residue, Nonfilterable 00530		2,4,5-T 39740		
			Silver 01077		Residue, Settleable 50086		GROUP J				
			Sodium 00929	X	Residue, Volatile 00505		Sulfides 00745				
			Thallium 01059		Silica 00955						
		X	Zinc 01092		Specific Conductance 00095						
					Sulfate 00945						
					Sulfite 00740						
					Surfactants -MBAS 38260						
					Turbidity 00076						

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Analytical Methods - O/G - 418.1 Phenols - 420.1 TOC - 415.1 Cd - 213.2 Pb - 239.2 VOA - 601+602 COD Std 508A Cr - 218.1 Ni - 249.1 Zn - 289.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA WIO

BASE WHERE SAMPLE COLLECTED: Lethbridge ANG Base

SAMPLING SITE DESCRIPTION: W-10 N.W. Landfill

DATE COLLECTION BEGAN (YYMMDD): 870815

TIME COLLECTION BEGAN (24 hour clock): 0927

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed):
- ORIGINAL 0235: USAF OEHL/TSJ Brooks AFB TX 78235
- COPY 1 0376: USAF HQ MIANG DET 1/SGC Lethbridge, Mi 480
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Peter

SIGNATURE: D.M. Peter

AUTOVON:

REASON FOR SUBMISSION: A

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN85601D

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425
	Nitrate 00620						Beryllium 01012		Bromide 71870
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940
X	Organic Carbon 00680						Calcium 00916		Color 00080
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865
							Copper 01042		Odor 00086
									Residue, Total 00500
									Residue, Filterable (TDS) 70300
									Residue, Nonfilterable 00530

	Hardness 00900		Residue, Settleable 50086
	Iron 01045	X	Residue, Volatile 00505
X	Lead 01051		Silica 00955
	Magnesium 00927		Specific Conductance 00095
	Manganese 01055		Sulfate 00945
	Mercury 71900		Sulfite 00740
X	Nickel 01067		Surfactants -MBAS 38260
	Potassium 00937		Turbidity 00076
	Selenium 01147		
	Silver 01077		
	Sodium 00929		
	Thallium 01059		
X	Zinc 01092		

	GROUP H		GROUP J
	BHC Isomers 39340		Sulfides 00745
	Chlordane 39350		
	DDT Isomers 39370		
	Dieldrin 39380		
	Endrin 39390		
	Heptachlor 39410		
	Heptachlor Epoxide 39420		
	Lindane 39782		
	Methoxychlor 39480		
	Toxaphene 39400		
	2,4-D 39730		
	2,4,5-TP-Silvex 39760		
	2,4,5-T 39740		

	GROUP T
	Bromoform 32104
	Bromodichloromethane 32101
	Carbon Tetrachloride 32102
	Chloroform 32106
	Chloromethane 34418
	Dibromochloromethane 32105
	Methylene Chloride 34423
	Tetrachloroethylene 34475
	1,1,1-Trichloroethane 34506
	Trichloroethylene 39180
	Trihalomethanes 82080
	PCBs 39516

ON SITE ANALYSES		
Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Analytical Methods
O/G - 418.1 VOA - 601 + 602
TOC - 415.1 Phenols - 420.1 Cd - 213.2 Pb - 239.2
(C.) - Std 508A Cu - 220.1 N - 249.1
Cr - 219.1 Zn - 289.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W11

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W11 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 810131

TIME COLLECTION BEGAN (24 hour clock): 1200

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQMIANGDET 1/56C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6M85 8011

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		✓
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: O&G 418.1 TOC EPA 415.1
VOA EPA 601+602 Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA WIZ

BASE WHERE SAMPLE COLLECTED: Selfridge ANG BASE

SAMPLING SITE DESCRIPTION: WIZ West Ramp

DATE COLLECTION BEGAN (YYMMDD): 850311,0

TIME COLLECTION BEGAN (24 hour clock): 0900

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQ MTANGDET 1/SGC Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8012 | OEHL PID: —

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: O&G 418.1 TOC EPA 415.1
VOA EPA 601+602 Phenol EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 03 76 NA W13

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W13 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 18 10 31

TIME COLLECTION BEGAN (24 hour clock): 0900

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0576 USAFHQ AMIANGOFT 1/SGC Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: C

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6M 85 8013 | OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: O&G 418.1 TOC EPA 415.1
VOA EPA 601+602 Phenol EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 VA W14

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W14 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 861031

TIME COLLECTION BEGAN (24 hour clock): 0800

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS, Brooks AFB, TX 78235
- COPY 1 0376: USAF HQ MIANG/DET 1/S6C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GM 89 8014 OEHL PID: —

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: O&G EPA 418.1; Phenols EPA 420.1; VOA EPA 601+602; TOC SM 415.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 037C VA W15

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W15 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 18,5,10,3,1,01

TIME COLLECTION BEGAN (24 hour clock): 0900

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQMIANGDET1/SGC Selfridge ANGB MI, 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: B — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: GM85801S

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: VOA EPA 601+602 Phenols EPA 420.1
TOC EPA 415.1 O+G EPA 418.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W16

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W16 FPTA 1

DATE COLLECTION BEGAN (YYMMDD): 851031

TIME COLLECTION BEGAN (24 hour clock): 0161

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL	0253	USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1	0376	USAF HQ MIANG DET 1/56c Selfridge ANG Base, Mi 48045
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC): D. M. Stein

SIGNATURE: D. M. Stein

AUTOVON: [redacted]

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify) IPP

BASE SAMPLE NUMBER: GN8580116

OEHL PID: —

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720		X Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

	GROUP K		GROUP L		GROUP M		GROUP N		GROUP O		GROUP P		GROUP Q		GROUP R
	Residue, Settleable 50086		Residue, Volatile 00505		Silica 00955		Specific Conductance 00095		Sulfate 00945		Sulfite 00740		Surfactants -MBAS 38260		Turbidity 00076

ON SITE ANALYSES		
Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Oil+Grease method: EPA 413.1 Organic Carbon EPA 415.1
Phenols method: EPA 420.1 Re: 1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA WI7

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: WI7 FPTA 1

DATE COLLECTION BEGAN (YYMMDD): 850103

TIME COLLECTION BEGAN (24 hour clock): 1061

COLLECTION METHOD: [x] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed):
ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1 0376 USAF HQ MIANG DET 1/SGC Selfridge ANG Base, MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D. M. Stein

SIGNATURE: D. M. Stein

AUTOVON:

REASON FOR SUBMISSION: O
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8017

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: METHODS OF ANALYSIS
OIL + GREASE: EPA 413.1
PHENOLS: EPA 420.1
Organic Carbon: Combustion-Infrared, Purgeable Volatile EPA Guidelines (VOA)

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA W18

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W18 FPTA 1

DATE COLLECTION BEGAN (YYMMDD): 850306

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1 0376 USAF HQ MIANG DET 1/FGC Selfridge ANG Base MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N 85 8018

OEHL FID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T	
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform	32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane	32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride	32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform	32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane	34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane	32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride	34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene	34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane	34506
			Sodium	00929		GROUP H			Trichloroethylene	39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes	82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs	39516
	Cyanide, Free	00722				DDT Isomers	39370			
						Dieldrin	39380			
	GROUP E		GROUP G			Endrin	39390			
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410			
			Alkalinity, Total	00410		Heptachlor Epoxide	39420			
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782			
	Antimony	01097	Bromide	71870		Methoxychlor	39480			
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400			
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES	
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter	Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050	mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060	mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300	mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400	units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010	°C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745			

COMMENTS: Methods of Analysis: Oil & Grease EPA 413.1 Organic Carbon (TOC) EPA 415.1 Phenols EPA 420.1 Residue, Volatile (Nonfilterable) Gravimetric

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

ORSL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W19

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W19 FPTA II

DATE COLLECTION BEGAN (YYMMDD): 850319

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
ORIGINAL 0253: USAF OEHL/TS, Brooks AFB, TX 78235
COPY 1 0276: USAFHQ ANANG DET 1/56 Selfridge ANG Base MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON:

REASON FOR SUBMISSION: O — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8019

ORSL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T	
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform	32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane	32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride	32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform	32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane	34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane	32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride	34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene	34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane	34506
			Sodium	00929		GROUP H			Trichloroethylene	39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes	82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs	39516
	Cyanide, Free	00722				DDT Isomers	39370			
						Dieldrin	39380			
	GROUP E		GROUP G			Endrin	39390			
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410			
			Alkalinity, Total	00410		Heptachlor Epoxide	39420			
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782			
	Antimony	01097	Bromide	71870		Methoxychlor	39480			
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400			
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES	
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter	Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050	mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060	mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300	mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400	units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010	°C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745			

COMMENTS: Method of Analysis - Organic Carbon (TOC) EPA 415.1
Oil & Grease - EPA 413.1
Phenol - EPA 420.1
Residue, Volatile (VOA) EPA 160.4

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W20

BASE WHERE SAMPLE COLLECTED: Selfridge ANG B

SAMPLING SITE DESCRIPTION: W-20 FPTA #2

DATE COLLECTION BEGAN (YYMMDD): 10,3,0,6,8,5

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [✓] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL: 0252 USAF OEHL/TSS Brooks AFB TX 78235
- COPY 1: 0376 USAF HQ MIANG OET 1/SGE Selfridge ANG, MT 48045
- COPY 2:

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON:

REASON FOR SUBMISSION: D — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: 6N85 8020

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425
	Nitrate 00620						Beryllium 01012		Bromide 71870
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940
X	Organic Carbon 00680						Calcium 00916		Color 00080
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865
							Copper 01042		Odor 00086

	Hardness 00900		Residue, Settleable 50086		GROUP T
	Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Lead 01051		Silica 00955		Bromodichloromethane 32101
	Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Manganese 01055		Sulfate 00945		Chloroform 32106
	Mercury 71900		Sulfite 00740		Chloromethane 34418
	Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
	Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Selenium 01147				Tetrachloroethylene 34475
	Silver 01077				1,1,1-Trichloroethane 34506
	Sodium 00929		GROUP H		Trichloroethylene 39180
	Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Zinc 01092		Chlordane 39350		PCBs 39516
			DDT Isomers 39370		
			Dieldrin 39380		
			Endrin 39390		
			Heptachlor 39410		
			Heptachlor Epoxide 39420		
			Lindane 39782		
			Methoxychlor 39480		
			Toxaphene 39400		
			2,4-D 39730		
			2,4,5-TP-Silvex 39760		
			2,4,5-T 39740		
			GROUP J		
			Sulfides 00745		

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: O/G - Method 413.1 Phenols - Method 420.1
TOC - " 415.1 VOA - Method 624 + 625

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA W20

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W20 (Duplicate) FPTA II

DATE COLLECTION BEGAN (YYMMDD): 18 10 31 06

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQMIANGDET1/SGC Selfridge ANG Base, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): P. M. Stein

SIGNATURE: P M Stein

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8040

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: Method of Analyses
Oil & Grease - EPA 413.1
Phenols - EPA 420.1
Organic Carbon (TOC) EPA 415.1
Residue, Volatile (VOA) EPA 160.4

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA WZ1

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: WZ1 EPTA II

DATE COLLECTION BEGAN (YYMMDD): 810130

TIME COLLECTION BEGAN (24 hour clock):

COLLECTION METHOD: [✓] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAFHQMIANGUET 1/SGC Selfridge ANG Base, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON:

REASON FOR SUBMISSION: A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8040

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720		X Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

ON SITE ANALYSES	
Parameter	Value
Flow 50050	mgd
Chlorine, Total 50060	mg/l
Dissolved Oxygen 00300	mg/l
pH 00400	units
Temperature 00010	°C

COMMENTS: Method of Analysis
Oil & Grease - EPA 413.1
Phenols - EPA 420.1
Organic Carbon (TOC) EPA 415.1
Residue, Volatile (VOA) EPA 160.4

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA W22

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W22 Southwest Landfill

DATE COLLECTION BEGAN (YYMMDD): 18,510,310,71

TIME COLLECTION BEGAN (24 hour clock): 0920

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1 0376 USAF HQ MIANGOET 1/SGE Selfridge ANGB, MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON:

REASON FOR SUBMISSION: O
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8022

OEHL PID:

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
X	Chemical Oxygen Demand 00340	X	Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560	X	Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720	X	Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
X	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
X	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
X	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: Method of Analysis COD: 5103 EPA
Oil and Grease: EPA 413.1 Organic Carbon (TOC) EPA 415.1
Phenols: EPA 420.1 Residue, Volatile (VOA) EPA 160.4

AF FORM 2752 JAN 81

Cadmium EPA 213.2 Copper EPA 220.1 Nickel EPA 249.1
Chromium EPA 218.1 Lead EPA 239.2 Zinc EPA 289.1

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W23

BASE WHERE SAMPLE COLLECTED: Selfridge ANGB

SAMPLING SITE DESCRIPTION: W-23 S.W. Landfill

DATE COLLECTION BEGAN (YYMMDD): 870317

TIME COLLECTION BEGAN (24 hour clock): 1200

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 02<3: USAF OEHL/TSC Brooks AFB TX 78235

COPY 1 0376: USAF HQ MIANGDET 1/SGC Selfridge ANG, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D M Stein

AUTOVON

REASON FOR SUBMISSION: A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 80L3

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720		[X] Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
[X]	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
[X]	Oil & Grease 00560						[X] Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
[X]	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						[X] Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							[X] Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
	Hardness 00900						Iron 01045		Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
	Iron 01045						[X] Lead 01051		Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
	Magnesium 00927						Magnesium 00927		Residue, Nonfilterable (SS) 00530		2,4,5-T 39740				
	Manganese 01055						Manganese 01055								
	Mercury 71900						Mercury 71900								
	[X] Nickel 01067						[X] Nickel 01067								
	Potassium 00937						Potassium 00937								
	Selenium 01147						Selenium 01147								
	Silver 01077						Silver 01077								
	Sodium 00929						Sodium 00929								
	Thallium 01059						Thallium 01059								
	[X] Zinc 01092						[X] Zinc 01092								
	Residue, Settleable 50086														
[X]	Residue, Volatile 00505														
	Silica 00955														
	Specific Conductance 00095														
	Sulfate 00945														
	Sulfite 00740														
	Surfactants -MBAS 38260														
	Turbidity 00076														

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Analytical Methods - O/G - EPA 413.1; Phenl - EPA 420.1; TOC - 415.1; VOA - EPA 624.1; COD - SM 508A; Cd - EPA 213.2; Cr - EPA 218.2; Cu - EPA 220.2; Pb - EPA 239.2; Ni - EPA 249.1; Zn - EPA 289.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 WA W24

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W-24 S.W. Landfill

DATE COLLECTION BEGAN (YYMMDD): 810127

TIME COLLECTION BEGAN (24 hour clock): 1115

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0235 USAF OEHL/TSS Brook AFB TX 78235

COPY 1 0376 USAF HQ MIANG DET 1/S6C Selfridge ANGB, Mi 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): D.M. Stein

SIGNATURE: D.M. Stein

AUTOVON

REASON FOR SUBMISSION: D

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8024

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720		X Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						X Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						X Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							X Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

	Residue, Settleable 50086		Residue, Volatile 00505		Silica 00955		Specific Conductance 00095		Sulfate 00945		Sulfite 00740		Surfactants -MBAS 38260		Turbidity 00076
		X													

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Analytical Methods: TOC EPA 415.1 O/G-EPA 418.1 TOD EPA STD 508A VOA-EPA 624 Phen.-EPA 420.1 Cd-EPA 213.2 Cr-EPA 218.1 Cu-EPA 220.1 Pb EPA 239.1 Ni-EPA 249.1

AF FORM 2752 JAN 81

Y602

F79

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 WA W25

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: WZZ Southwest Landfill

DATE COLLECTION BEGAN (YYMMDD): 18,510,310,71

TIME COLLECTION BEGAN (24 hour clock): 1000

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL	0253	USAF OEHL/TSS Brooks AFB, TX
COPY 1	0376	USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: 6N 85 8025

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
X	Chemical Oxygen Demand	00340	X Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	X Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	X Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
X	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
X	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
X	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: Methods of analysis
Oil and Grease EPA 413.1
Phenols EPA 420.1
Organic Carbon (TOC) 415.1 EPA
VOA (Residue, Volatile) EPA 601+602
COD STD 508A

AF FORM 2752 JAN 81

Cadmium EPA 213.2 Lead EPA 239.2
Chromium EPA 218.1 Nickel EPA 249.1
Copper EPA 220.1 Zinc EPA 289.1

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA 530

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: FPTA II Surface Water A

DATE COLLECTION BEGAN (YYMMDD): 18,510,311,01

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQ MIANGDET 1/SGC Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: 6M85 8036 OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		
	Boron 01022		Fluoride 00951		2,4,5-T 39740		
	Cadmium 01027		Iodide 71865				
	Calcium 00916		Odor 00086				
	Chromium, Total 01034		Residue, Total 00500				
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Method of Analysis
O&G EPA 413.2 TOC SM 5310 C
O&G EPA 600/4-82 Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 WA 531

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: FPTA II Surface Water B

DATE COLLECTION BEGAN (YYMMDD): 810310

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQMIANGUSET 1/56C Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N 85 80311

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform 32104
	Chemical Oxygen Demand	00340	Lead	01051		Silica	00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen	00625	Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride 32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform 32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane 34418
X	Oil & Grease	00560	Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane 32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride 34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene 34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane 34506
			Sodium	00929		GROUP H			Trichloroethylene 39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes 82080
	Cyanide, Total	00720	Zinc	01092		Chlordane	39350		PCBs 39516
	Cyanide, Free	00722				DDT Isomers	39370		
						Dieldrin	39380		
	GROUP E		GROUP G			Endrin	39390		
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410		
			Alkalinity, Total	00410		Heptachlor Epoxide	39420		
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782		
	Antimony	01097	Bromide	71870		Methoxychlor	39480		
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400		
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter / Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050 mgd
	Cadmium	01027	Iodide	71865					Chlorine, Total 50060 mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300 mg/l
	Chromium, Total	01034	Residue, Total	00500					pH 00400 units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010 °C
	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745		

COMMENTS: Method of Analysis
O+G EPA 413.2 TOC EPA 415.1
OVA EPA 601+602 Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA 532

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: EPA II Surface Water C

DATE COLLECTION BEGAN (YYMMDD): 18510131/101

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed):
- ORIGINAL: 02 53 USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1: 03 76 USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045
- COPY 2:

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: D — A-ACCIDENT/INCIDENT, R-ROUTINE/PERIODIC, C-COMPLAINT, N-NPDES, F-FOLLOWUP/CLEANUP, O-OTHER (specify)

BASE SAMPLE NUMBER: 6W 85 8032 OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G
	Ammonia 00610		Cyanide, Total 00720		X Phenols 32730		Antimony 01097		Acidity, Total 70508
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425
	Nitrate 00620						Beryllium 01012		Bromide 71870
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940
X	Organic Carbon 00680						Calcium 00916		Color 00080
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865
							Copper 01042		Odor 00086
									Residue, Total 00500
									Residue, Filterable (TDS) 70300
									Residue, Nonfilterable 00530

			GROUP H		GROUP T
	Residue, Settleable 50086		BHC Isomers 39340		Bromoform 32104
X	Residue, Volatile 00505		Chlordane 39350		Bromodichloromethane 32101
	Silica 00955		DDT Isomers 39370		Carbon Tetrachloride 32102
	Specific Conductance 00095		Dieldrin 39380		Chloroform 32106
	Sulfate 00945		Endrin 39390		Chloromethane 34418
	Sulfite 00740		Heptachlor 39410		Dibromochloromethane 32105
	Surfactants -MBAS 38260		Heptachlor Epoxide 39420		Methylene Chloride 34423
	Turbidity 00076		Lindane 39782		Tetrachloroethylene 34475
			Methoxychlor 39480		1,1,1-Trichloroethane 34506
			Toxaphene 39400		Trichloroethylene 39180
	GROUP J		2,4-D 39730		Trihalomethanes 82080
	Sulfides 00745		2,4,5-TP-Silvex 39760		PCBs 39516
			2,4,5-T 39740		

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Method of Analysis
O&G EPA 413.2
OVA EPA 601 & 602
TLC EPA 415.1
Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA S33

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: SW Landfill Surface Water 1

DATE COLLECTION BEGAN (YYMMDD): 850131

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB TX 78235
- COPY 1 0376: USAF HQ MIANG/DET 1/56C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: Q
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 8033

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
X	Chemical Oxygen Demand 00340	X	Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560	X	Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720	X	Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
X	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
X	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
X	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: method of analysis
VOA EPA 601 + 602 — TOC EPA 415.1 — Cadmium EPA 213.2
VOA ~~EPA~~ STD 508A — O+G EPA 418.1 — Copper EPA 220.1
Nickel EPA 249.1 — Chromium EPA 218.1
Zinc EPA 289.1 — Lead EPA 239.2

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA 534

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: SW Landfill Surface Water 2

DATE COLLECTION BEGAN (YYMMDD): 851013

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL: 0253 USAF OEHL/TSS Brooks AFB TX, 78235
- COPY 1: 0376 USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045 1
- COPY 2:

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N 85 8034 | OEHL PID: —

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness	00900		Residue, Settleable	50086		GROUP T	
	Ammonia	00610	Iron	01045	X	Residue, Volatile	00505		Bromoform	32104
X	Chemical Oxygen Demand	00340	X Lead	01051		Silica	00955		Bromodichloromethane	32101
	Kjeldahl Nitrogen	00625	X Magnesium	00927		Specific Conductance	00095		Carbon Tetrachloride	32102
	Nitrate	00620	Manganese	01055		Sulfate	00945		Chloroform	32106
	Nitrite	00615	Mercury	71900		Sulfite	00740		Chloromethane	34418
X	Oil & Grease	00560	X Nickel	01067		Surfactants -MBAS	38260		Dibromochloromethane	32105
X	Organic Carbon	00680	Potassium	00937		Turbidity	00076		Methylene Chloride	34423
	Orthophosphate	00671	Selenium	01147					Tetrachloroethylene	34475
	Phosphorus, Total	00665	Silver	01077					1,1,1-Trichloroethane	34506
			Sodium	00929		GROUP H			Trichloroethylene	39180
	GROUP D		Thallium	01059		BHC Isomers	39340		Trihalomethanes	82080
	Cyanide, Total	00720	X Zinc	01092		Chlordane	39350		PCBs	39516
	Cyanide, Free	00722				DDT Isomers	39370			
						Dieldrin	39380			
	GROUP E		GROUP G			Endrin	39390			
X	Phenols	32730	Acidity, Total	70508		Heptachlor	39410			
			Alkalinity, Total	00410		Heptachlor Epoxide	39420			
	GROUP F		Alkalinity, Bicarbonate	00425		Lindane	39782			
	Antimony	01097	Bromide	71870		Methoxychlor	39480			
	Arsenic	01002	Carbon Dioxide	00405		Toxaphene	39400			
	Barium	01007	Chloride	00940		2,4-D	39730		ON SITE ANALYSES	
	Beryllium	01012	Color	00080		2,4,5-TP-Silvex	39760		Parameter	Value
	Boron	01022	Fluoride	00951		2,4,5-T	39740		Flow 50050	mgd
X	Cadmium	01027	Iodide	71865					Chlorine, Total 50060	mg/l
	Calcium	00916	Odor	00086					Dissolved Oxygen 00300	mg/l
X	Chromium, Total	01034	Residue, Total	00500					pH 00400	units
	Chromium VI	01032	Residue, Filterable (TDS)	70300		GROUP J			Temperature 00010	°C
X	Copper	01042	Residue, Nonfilterable	00530		Sulfides	00745			

COMMENTS: method of analysis
VOA 601+602 TOC EPA 415.1 Phenols EPA 420.1
COD STD 508A O+G EPA 418.1 Cadmium EPA 213.2
Nickel EPA 249.1 Copper EPA 220.1
Zinc EPA 289.1 Chromium EPA 218.1
Lead EPA 239.2

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA S35

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: SW Landfill Surface Water

DATE COLLECTION BEGAN (YYMMDD): 18,5101311101

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: [✓] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N 85 8035

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00515	X					Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034	X	Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042	X	Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

	Residue, Settleable 50086		Residue, Volatile 00505		Silica 00955		Specific Conductance 00095		Sulfate 00945		Sulfite 00740		Surfactants -MBAS 38260		Turbidity 00076
		X													

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Method of Analysis
O+G EPA 413.1 COD SM 5220B VOA 6014 602
Phenols EPA 420.1 TOC EPA 415.1 Cadmium EPA 213.2
Copper EPA 220.1
Lead EPA 239.2 Chromium EPA 218.1
Nickel EPA 249.1 Zinc EPA 289.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

ORNL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA 536

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: Southwest Land Fill FRTA II Surface Water

4

DATE COLLECTION BEGAN (YYMMDD): 851031

TIME COLLECTION BEGAN (24 hour clock): 1300

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376: USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GM 85 8036

ORNL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F
	Ammonia 00610		Cyanide, Total 00720		Phenols 32730		Antimony 01097
X	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002
	Kjeldahl Nitrogen 00625						Barium 01007
	Nitrate 00620						Beryllium 01012
	Nitrite 00615						Boron 01022
X	Oil & Grease 00560						Cadmium 01027
X	Organic Carbon 00680						Calcium 00916
	Orthophosphate 00671						Chromium, Total 01034
	Phosphorus, Total 00665						Chromium VI 01032
							Copper 01042

	Hardness 00900		Residue, Settleable 50086		GROUP T
	Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
X	Lead 01051		Silica 00955		Bromodichloromethane 32101
	Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Manganese 01055		Sulfate 00945		Chloroform 32106
	Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
	Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Selenium 01147				Tetrachloroethylene 34475
	Silver 01077				1,1,1-Trichloroethane 34506
	Sodium 00929		GROUP H		Trichloroethylene 39180
	Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
X	Zinc 01092		Chlordane 39350		PCBs 39516
			DDT Isomers 39370		
			Dieldrin 39380		
	GROUP G		Endrin 39390		
	Acidity, Total 70508		Heptachlor 39410		
	Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	Alkalinity, Bicarbonate 00425		Lindane 39782		
	Bromide 71870		Methoxychlor 39480		
	Carbon Dioxide 00405		Toxaphene 39400		
	Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Iodide 71865				Chlorine, Total 50060 mg/l
	Odor 00086				Dissolved Oxygen 00300 mg/l
	Residue, Total 00500				pH 00400 units
	Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS Method of Analysis

O&G EPA 413.2 COD STD508A VOA 601+602 Cadmium EPA 213.2

Phenols EPA 420.1 TOC EPA 415.1 Copper EPA 220.1

Lead EPA 239.2 Chromium EPA 218.1

Nickel EPA 249.1 Zinc EPA 289.1

AF FORM 2752 JAN 81

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

GENL USE ONLY

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W41

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W41 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 850131

TIME COLLECTION BEGAN (24 hour clock): 0800

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQM/ANGDET 1/SGC Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GW 85 8041 | GENL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS Method of Analysis
O&G 418.2
TOC EPA 415.1
VOA EPA 601+602
Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W4Z

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W4Z West Ramp

DATE COLLECTION BEGAN (YYMMDD): 810131

TIME COLLECTION BEGAN (24 hour clock): 0800

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
- ORIGINAL 0253: USAF OEHL/TSS Brooks AFB, TX 78235
- COPY 1 0376: USAF HQMIANGIDET 1/56C Selfridge ANGB, MI 48045
- COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN85804Z

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		GROUP D		GROUP E		GROUP F		GROUP G		GROUP H		GROUP J		GROUP T
	Ammonia 00610		Cyanide, Total 00720	X	Phenols 32730		Antimony 01097		Acidity, Total 70508		BHC Isomers 39340		Sulfides 00745		Bromoform 32104
	Chemical Oxygen Demand 00340		Cyanide, Free 00722				Arsenic 01002		Alkalinity, Total 00410		Chlordane 39350				Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625						Barium 01007		Alkalinity, Bicarbonate 00425		DDT Isomers 39370				Carbon Tetrachloride 32102
	Nitrate 00620						Beryllium 01012		Bromide 71870		Dieldrin 39380				Chloroform 32106
	Nitrite 00615						Boron 01022		Carbon Dioxide 00405		Endrin 39390				Chloromethane 34418
X	Oil & Grease 00560						Cadmium 01027		Chloride 00940		Heptachlor 39410				Dibromochloromethane 32105
X	Organic Carbon 00680						Calcium 00916		Color 00080		Heptachlor Epoxide 39420				Methylene Chloride 34423
	Orthophosphate 00671						Chromium, Total 01034		Fluoride 00951		Lindane 39782				Tetrachloroethylene 34475
	Phosphorus, Total 00665						Chromium VI 01032		Iodide 71865		Methoxychlor 39480				1,1,1-Trichloroethane 34506
							Copper 01042		Odor 00086		Toxaphene 39400				Trichloroethylene 39180
									Residue, Total 00500		2,4-D 39730				Trihalomethanes 82080
									Residue, Filterable (TDS) 70300		2,4,5-TP-Silvex 39760				PCBs 39516
									Residue, Nonfilterable 00530		2,4,5-T 39740				

	Residue, Settleable 50086
X	Residue, Volatile 00505
	Silica 00955
	Specific Conductance 00095
	Sulfate 00945
	Sulfite 00740
	Surfactants -MBAS 38260
	Turbidity 00076

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: Method OF Analyses
O&G H18.1 (EPA) VOA EPA 601+602
TOC EPA 415.1 Phenols EPA 420.1

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

OEHL USE ONLY

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 NA W43

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION: W43 West Ramp

DATE COLLECTION BEGAN (YYMMDD): 850131

TIME COLLECTION BEGAN (24 hour clock): 0800

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE ____ HOURS

MAIL REPORTS TO (circle if changed)

ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235

COPY 1 0376 USAF HQMIANGDET 1/SGC Selfridge ANGB, MI 48045

COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC) | SIGNATURE | AUTOVON

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N85 8043

OEHL PID

ANALYSES REQUESTED (check appropriate blocks)

	GROUP A		Hardness 00900		Residue, Settleable 50086		GROUP T
	Ammonia 00610		Iron 01045	X	Residue, Volatile 00505		Bromoform 32104
	Chemical Oxygen Demand 00340		Lead 01051		Silica 00955		Bromodichloromethane 32101
	Kjeldahl Nitrogen 00625		Magnesium 00927		Specific Conductance 00095		Carbon Tetrachloride 32102
	Nitrate 00620		Manganese 01055		Sulfate 00945		Chloroform 32106
	Nitrite 00615		Mercury 71900		Sulfite 00740		Chloromethane 34418
X	Oil & Grease 00560		Nickel 01067		Surfactants -MBAS 38260		Dibromochloromethane 32105
X	Organic Carbon 00680		Potassium 00937		Turbidity 00076		Methylene Chloride 34423
	Orthophosphate 00671		Selenium 01147				Tetrachloroethylene 34475
	Phosphorus, Total 00665		Silver 01077				1,1,1-Trichloroethane 34506
			Sodium 00929		GROUP H		Trichloroethylene 39180
	GROUP D		Thallium 01059		BHC Isomers 39340		Trihalomethanes 82080
	Cyanide, Total 00720		Zinc 01092		Chlordane 39350		PCBs 39516
	Cyanide, Free 00722				DDT Isomers 39370		
					Dieldrin 39380		
	GROUP E		GROUP G		Endrin 39390		
X	Phenols 32730		Acidity, Total 70508		Heptachlor 39410		
			Alkalinity, Total 00410		Heptachlor Epoxide 39420		
	GROUP F		Alkalinity, Bicarbonate 00425		Lindane 39782		
	Antimony 01097		Bromide 71870		Methoxychlor 39480		
	Arsenic 01002		Carbon Dioxide 00405		Toxaphene 39400		
	Barium 01007		Chloride 00940		2,4-D 39730		ON SITE ANALYSES
	Beryllium 01012		Color 00080		2,4,5-TP-Silvex 39760		Parameter / Value
	Boron 01022		Fluoride 00951		2,4,5-T 39740		Flow 50050 mgd
	Cadmium 01027		Iodide 71865				Chlorine, Total 50060 mg/l
	Calcium 00916		Odor 00086				Dissolved Oxygen 00300 mg/l
	Chromium, Total 01034		Residue, Total 00500				pH 00400 units
	Chromium VI 01032		Residue, Filterable (TDS) 70300		GROUP J		Temperature 00010 °C
	Copper 01042		Residue, Nonfilterable 00530		Sulfides 00745		

COMMENTS: Method of analysis
O+G 418.1 VOA EPA 601+602
PC EPA 415.1 Phenols EPA 420.1

AF FORM 2752 JAN 81

ENVIRONMENTAL RESAMPLING ROUND

Contents

	Page
Sampling Sheets	F90
WESTON Chain of Custody Forms	F112
AF Chain of Custody Forms 2752	F114

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W3
Mt Clemens, MI DATE: 5/1/85

SAMPLED BY: LWeyer, RBalmes TIME: 7:00 (AM)/PM

W.O. #: 0628-05-49 WEATHER: Sunny & hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) (DAMAGED): _____

LOCKED? (YES)/NO

CONCRETE: INTACT (DAMAGED): cracked

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-3	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

F00

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W4
Mt Clemens, MI DATE: 5/11/85

SAMPLED BY: Lueyer, R Balmer TIME: 7:00 (AM)/PM

W.O. #: 0628-05-49 WEATHER: Sunny & hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W5
Mt Clemens, MI DATE: 5/11/85

SAMPLED BY: Weyer, R Balmus TIME: 6:30 (AM)/PM

W.O. #: 0628-05-49 WEATHER: Sunny & hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Seltridge ANGB WELL NO.: W6
Mt Clemens, MI DATE: 5/11/85

SAMPLED BY: Lauren Palmer TIME: 6:30 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny & hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: Cracked

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Initial dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

F03

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W7
Mt Clemens, MI DATE: 5/1/85

SAMPLED BY: Weyer K'Balozi TIME: 7:30 (AM)/PM

W.O. #: 0628-05-49 WEATHER: Sunny & hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: buried clay

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40 ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

F04

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W8
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: LWeyer, RBalmer TIME: 8:30 AM/PM

W.O. #: 0628-05-49 WEATHER: clear, warm

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: baled dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Seltridge ANGB WELL NO.: W9
Mt Clemens, MI DATE: 5/16/85

SAMPLED BY: Lukyer, EBalmer TIME: 8:30 AM/PM

W.O. #: 0628-05-49 WEATHER: Clear, warm

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Dated tag

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: IW10
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: Lwieyer, KBalmer TIME: 8:00 (AM)/PM

W.O. #: 0628-05-49 WEATHER: clear, warm

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: Duplicate Dup

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Seltridge ANGB WELL NO.: W11
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: LWeyer, RBalmes TIME: 10:30 AM (PM)

W.O. #: 0628-05-49 WEATHER: clear, warm

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES/NO)

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC/STEEL)

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING/PUMPING/OTHER) _____

SAMPLING BY: (BAILING/PUMPING/OTHER) _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P/G)	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W12
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: WKeyes, RBalmer TIME: 10:30 AM/PM

W.O. #: 0628-05-49 WEATHER: clear, warm

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Tested duy

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

F00

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W13
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: L Weyer TIME: 1:00 AM/PM

W.O. #: 0628-05-49 WEATHER: sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Dried dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB Mt Clemens, MI WELL NO.: W14

DATE: 5/10/85

SAMPLED BY: E Weyer TIME: 1:30 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, brit

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: baled dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W15
Mt Clemens, MI DATE: 5/1/85

SAMPLED BY: L Weyer R Balmer TIME: 10:30 (AM)/PM

W.O. #: 0628-05-49 WEATHER: sunny, hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W16
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: L Weyer R Balmy TIME: 5:00 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Failed day

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W17
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: LWeyer RBalmer TIME: 5:00 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal 65 bails

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: ~~bailed dry~~ recharged almost immediately

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W1-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W18
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: L Wieger R Balmer TIME: 5:00 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W19
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: Wiegers & Balmes TIME: 5:30 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: Baled dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W21
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: LWeyer KBalmer TIME: 5:30 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES/NO)

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC/STEEL)

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING/PUMPING/OTHER) _____

SAMPLING BY: (BAILING/PUMPING/OTHER) _____

COMMENTS: Humid day

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P/G)	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Seltridge ANGB WELL NO.: W22
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: Lilley & Balmer TIME: 6:00 AM/PM

W.O. #: 0628-05-49 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal
bb bails

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: could not get bailer down well, recharge & sample immediately

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40 ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W23
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: L Weyer, P Palmer TIME: 16:00 AM/PM

W.O. #: 0628-05-99 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: INTACT DAMAGED: _____

LOCKED? YES/NO

CONCRETE: INTACT DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: PVC/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: BAILING/PUMPING/OTHER _____

SAMPLING BY: BAILING/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/NO

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W24
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: Lisieux E Balmes TIME: 6:30 AM/PM

W.O. #: 0628-05-49 WEATHER: sunny, hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES)/NO

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC)/STEEL

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING)/PUMPING/OTHER _____

SAMPLING BY: (BAILING)/PUMPING/OTHER _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	(P)/G	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON

FIELD SAMPLING SHEET

SITE LOCATION: Selfridge ANGB WELL NO.: W25
Mt Clemens, MI DATE: 5/10/85

SAMPLED BY: LWiegen RBalmer TIME: 700 AM/PM

W.O. #: 0628-05-99 WEATHER: Sunny, hot

WELL CONDITION

PROTECTIVE CASING: (INTACT) DAMAGED: _____

LOCKED? (YES/NO)

CONCRETE: (INTACT) DAMAGED: _____

WELL DIAMETER: 2 in.

DEPTH TO WATER: _____ ft REFERENCE CASING: (PVC/STEEL)

TOTAL WELL DEPTH: _____ ft

VOLUME IN CASING: _____ gal VOLUME EVACUATED BEFORE SAMPLING _____ gal

SAMPLING

EVACUATION BY: (BAILING/PUMPING/OTHER) _____

SAMPLING BY: (BAILING/PUMPING/OTHER) _____

COMMENTS: bailed dry

SAMPLE BOTTLE LABEL	TYPE	VOLUME	PRESERVATIVE	PARAMETERS
W-	P/(G)	40ml	none	VOA
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			
	P/G			

FILTERED YES/(NO)

FIELD MEASUREMENTS

TEMP. _____ °C pH _____ CONDUCTANCE _____ umhos/cm

RJK 6/27/84

WESTON
008

Custody Transfer Record/Lab Work Request

Received By V.K. Dudus
Date May 10, 1985
Assigned to

Client USAF Selfridge
Client Contact H Faulk
Phone (313) 466 4701

RFW Contact J Dowden
Date Due 5/17/85
Project Number 0628 0549

8505-501-

SAMPLE IDENTIFICATION

ANALYSES REQUESTED

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	VOA	EPA 601+602
W23	0010	groundwater (40ml) (environmental)	5/10/85	none	VOA	EPA 601+602
W24	20					
W25	30					
W22	40					
W16	50					
W17	60					
W18	70					
W19	80					
W21	90					
W13	100					
W14	110					
W11	120					
W12	130					
W8	140					
W9	150					
W10	160					

SPECIAL INSTRUCTIONS: DUE MAY 17 !!!

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
VOA samples for 16 wells	L. Weyer	Fed Express	5/11/85	12:00 pm					
VOA	FED EXPRESS	Victoria F. Dudus	5/13/85	915					

F112

WESTON
008

Custody Transfer Record/Lab Work Request

Received By K. Durkin
Date 5/9/85
Assigned to

Client USAF Selfridge
Client Contact H Faulk
Phone (313) 466 4701

RFW Contact J Dowden
Date Due May 18, 1985
Project Number 0a280549

8505-501-

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	ANALYSES REQUESTED
W-5	0170	groundwater environmental (40ml bottles)	5/11/85	40ml VOA/ none	VOA EPA 601 & 602
W-6	180				
W-7	190				
W-3	200				
W-4	210				
W-15	220				
	230	Field Blank			
	240	Trip Blank			

SPECIAL INSTRUCTIONS: DUE MAY 18!!

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
VOA samples for 6 wells VOA	L Weyer	Fed Exp	5/11/85	1200					
	FED EXP	Victoria K. Durkin	5/9/85	915					

F113

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA [redacted] M211

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION:

DATE COLLECTION BEGAN (YYMMDD): 851101

TIME COLLECTION BEGAN (24 hour clock): 1500

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
ORIGINAL 0253 [redacted] USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1 0376 [redacted] USAF HQMIANGDET 1/SGC Selfridge ANGB MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): Laura Lee Weyer

SIGNATURE: Laura Weyer

AUTOVON:

REASON FOR SUBMISSION: [redacted]O
A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: 6N85 [redacted]

ANALYSES REQUESTED (check appropriate blocks)

GROUP A		GROUP A (cont.)		GROUP D		GROUP E		GROUP F		GROUP G	
Ammonia	00610	Hardness	00900	Cyanide, Total	00720	Phenols	32730	Antimony	01097	Acidity, Total	70508
Chemical Oxygen Demand	00340	Iron	01045	Cyanide, Free	00722			Arsenic	01002	Alkalinity, Total	00410
Kjeldahl Nitrogen	00625	Lead	01051					Barium	01007	Alkalinity, Bicarbonate	00425
Nitrate	00620	Magnesium	00927					Beryllium	01012	Bromide	71870
Nitrite	00615	Manganese	01055					Boron	01022	Carbon Dioxide	00405
Oil & Grease	00560	Mercury	71900					Cadmium	01027	Chloride	00940
Organic Carbon	00680	Nickel	01067					Calcium	00916	Color	00080
Orthophosphate	00671	Potassium	00937					Chromium, Total	01034	Fluoride	00951
Phosphorus, Total	00665	Selenium	01147					Chromium VI	01032	Iodide	71865
		Silver	01077					Copper	01042	Odor	00086
		Sodium	00929							Residue, Total	00500
		Thallium	01059							Residue, Filterable (TDS)	70300
		Zinc	01092							Residue, Nonfilterable	00530

GROUP A (cont.)		GROUP H		GROUP T	
Residue, Settleable	50086	BHC Isomers	39340	Bromoform	32104
Residue, Volatile	00505 ✓	Chlordane	39350	Bromodichloromethane	32101
Silica	00955	DDT Isomers	39370	Carbon Tetrachloride	32102
Specific Conductance	00095	Dieldrin	39380	Chloroform	32106
Sulfate	00945	Endrin	39390	Chloromethane	34418
Sulfite	00740	Heptachlor	39410	Dibromochloromethane	32105
Surfactants -MBAS	38260	Heptachlor Epoxide	39420	Methylene Chloride	34423
Turbidity	00076	Lindane	39782	Tetrachloroethylene	34475
		Methoxychlor	39480	1,1,1-Trichloroethane	34506
		Toxaphene	39400	Trichloroethylene	39180
		2,4-D	39730	Trihalomethanes	82080
		2,4,5-TP-Silvex	39760	PCBs	39516
		2,4,5-T	39740		
		GROUP J			
		Sulfides	00745		

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: VOA ~~VOAS~~ EPA 601+602

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 WA W24

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION:

DATE COLLECTION BEGAN (YYMMDD): 851031

TIME COLLECTION BEGAN (24 hour clock): 1600

COLLECTION METHOD: ☑ GRAB ☐ COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed)
ORIGINAL 0253 USAF OEHL/TSS Brooks AFB TX 78235
COPY 1 0376 USAF HQMIANGDET 1/SGC Selfridge ANGB MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): Laura Lee Weyer

SIGNATURE: Laura Weyer

AUTOVON:

REASON FOR SUBMISSION: 6

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GN 85 4024

ANALYSES REQUESTED (check appropriate blocks)

GROUP A		GROUP D		GROUP E		GROUP F	
Ammonia	00610	Cyanide, Total	00720	Phenols	32730	Antimony	01097
Chemical Oxygen Demand	00340	Cyanide, Free	00722			Arsenic	01002
Kjeldahl Nitrogen	00625					Barium	01007
Nitrate	00620					Beryllium	01012
Nitrite	00615					Boron	01022
Oil & Grease	00560					Cadmium	01027
Organic Carbon	00680					Calcium	00916
Orthophosphate	00671					Chromium, Total	01034
Phosphorus, Total	00665					Chromium VI	01032
						Copper	01042

		GROUP G	
Hardness	00900	Acidity, Total	70508
Iron	01045	Alkalinity, Total	00410
Lead	01051	Alkalinity, Bicarbonate	00425
Magnesium	00927	Bromide	71870
Manganese	01055	Carbon Dioxide	00405
Mercury	71900	Chloride	00940
Nickel	01067	Color	00080
Potassium	00937	Fluoride	00951
Selenium	01147	Iodide	71865
Silver	01077	Odor	00086
Sodium	00929	Residue, Total	00500
Thallium	01059	Residue, Filterable (TDS)	70300
Zinc	01092	Residue, Nonfilterable	00530

		GROUP H	
Residue, Settleable	50086	BHC Isomers	39340
Residue, Volatile	00505	Chlordane	39350
Silica	00955	DDT Isomers	39370
Specific Conductance	00095	Dieldrin	39380
Sulfate	00945	Endrin	39390
Sulfite	00740	Heptachlor	39410
Surfactants -MBAS	38260	Heptachlor Epoxide	39420
Turbidity	00076	Lindane	39782
		Methoxychlor	39480
		Toxaphene	39400
		2,4-D	39730
		2,4,5-TP-Silvex	39760
		2,4,5-T	39740
		GROUP J	
		Sulfides	00745

GROUP T	
Bromoform	32104
Bromodichloromethane	32101
Carbon Tetrachloride	32102
Chloroform	32106
Chloromethane	34418
Dibromochloromethane	32105
Methylene Chloride	34423
Tetrachloroethylene	34475
1,1,1-Trichloroethane	34506
Trichloroethylene	39180
Trihalomethanes	82080
PCBs	39516

ON SITE ANALYSES		
Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: VOA: ~~GAS~~ EPA 601+602

AF FORM JAN 81 2752

ENVIRONMENTAL SAMPLING DATA

(Use this space for mechanical imprint)

SAMPLING SITE IDENTIFIER (AFR 19-7): 0376 MA WI 1

BASE WHERE SAMPLE COLLECTED: Selfridge ANG Base

SAMPLING SITE DESCRIPTION:

DATE COLLECTION BEGAN (YYMMDD): 851101

TIME COLLECTION BEGAN (24 hour clock): 2200

COLLECTION METHOD: [X] GRAB [ ] COMPOSITE _____ HOURS

MAIL REPORTS TO (circle if changed):
ORIGINAL 0253 USAF OEHL/TSS Brooks AFB, TX 78235
COPY 1 0376 USAF HQMIANGDET 1/SGC Selfridge ANGB MI 48045
COPY 2

SAMPLE COLLECTED BY (Name, Grade, AFSC): Laura Lee Weyer

SIGNATURE: Laura Weyer

AUTOVON:

REASON FOR SUBMISSION: O

A-ACCIDENT/INCIDENT R-ROUTINE/PERIODIC C-COMPLAINT N-NPDES F-FOLLOWUP/CLEANUP O-OTHER (specify)

BASE SAMPLE NUMBER: GM 85 401 1

ANALYSES REQUESTED (check appropriate blocks)

GROUP A		GROUP D		GROUP E		GROUP F	
Ammonia	00610	Cyanide, Total	00720	Phenols	32730	Antimony	01097
Chemical Oxygen Demand	00340	Cyanide, Free	00722			Arsenic	01002
Kjeldahl Nitrogen	00625					Barium	01007
Nitrate	00620					Beryllium	01012
Nitrite	00615					Boron	01022
Oil & Grease	00560					Cadmium	01027
Organic Carbon	00680					Calcium	00916
Orthophosphate	00671					Chromium, Total	01034
Phosphorus, Total	00665					Chromium VI	01032
						Copper	01042

		GROUP G	
Hardness	00900	Acidity, Total	70508
Iron	01045	Alkalinity, Total	00410
Lead	01051	Alkalinity, Bicarbonate	00425
Magnesium	00927	Bromide	71870
Manganese	01055	Carbon Dioxide	00405
Mercury	71900	Chloride	00940
Nickel	01067	Color	00080
Potassium	00937	Fluoride	00951
Selenium	01147	Iodide	71865
Silver	01077	Odor	00086
Sodium	00929	Residue, Total	00500
Thallium	01059	Residue, Filterable (TDS)	70300
Zinc	01092	Residue, Nonfilterable	00530

		GROUP H	
Residue, Settleable	50086	BHC Isomers	39340
Residue, Volatile	00505	Chlordane	39350
Silica	00955	DDT Isomers	39370
Specific Conductance	00095	Dieldrin	39380
Sulfate	00945	Endrin	39390
Sulfite	00740	Heptachlor	39410
Surfactants -MBAS	38260	Heptachlor Epoxide	39420
Turbidity	00076	Lindane	39782
		Methoxychlor	39480
		Toxaphene	39400
		2,4-D	39730
		2,4,5-TP-Silvex	39760
		2,4,5-T	39740
GROUP J			
Sulfides	00745		

GROUP T	
Bromoform	32104
Bromodichloromethane	32101
Carbon Tetrachloride	32102
Chloroform	32106
Chloromethane	34418
Dibromochloromethane	32105
Methylene Chloride	34423
Tetrachloroethylene	34475
1,1,1-Trichloroethane	34506
Trichloroethylene	39180
Trihalomethanes	82080
PCBs	39516

ON SITE ANALYSES

Parameter		Value
Flow	50050	mgd
Chlorine, Total	50060	mg/l
Dissolved Oxygen	00300	mg/l
pH	00400	units
Temperature	00010	°C

COMMENTS: VOA: ~~624~~ EPA 601+602

AF FORM 2752 JAN 81

APPENDIX G

Analytical Protocol

Contents

	Page
Volatile Organic Compounds (Purgeables)	G1
Phenolics	G12
Chemical Oxygen Demand	G16
Cadmium	G22
Chromium	G24
Copper	G26
Lead	G28
Nickel	G30
Zinc	G32
Petroleum Hydrocarbon	G34
Oil & Grease	G36

United States
Environmental Protection
Agency

Environmental Monitoring and
Support Laboratory
Cincinnati OH 45268

Research and Development

EPA

RECEIVED
JAN 16 1985
ROY F. WESTON, INC.
BANNOCKBURN OFFICE

Test Method

Purgeable Halocarbons—Method 601

1. Scope and Application

1.1 This method covers the determination of 29 purgeable halocarbons. The following parameters may be determined by this method:

Parameter	STORET No.	CAS No.
Bromodichloromethane	32101	75-27-4
Bromoform	32104	75-25-2
Bromomethane	34413	74-83-9
Carbon tetrachloride	32102	56-23-5
Chlorobenzene	34301	108-90-7
Chloroethane	34311	75-00-3
2-Chloroethylvinyl ether	34576	100-75-8
Chloroform	32106	67-66-3
Chloromethane	34418	74-87-3
Dibromochloromethane	32105	124-48-1
1,2-Dichlorobenzene	34536	95-50-1
1,3-Dichlorobenzene	34566	541-73-1
1,4-Dichlorobenzene	34571	106-46-7
Dichlorodifluoromethane	34668	75-71-8
1,1-Dichloroethane	34496	75-34-3
1,2-Dichloroethane	34531	107-06-2
1,1-Dichloroethene	34501	75-35-4
trans-1,2-Dichloroethene	34546	156-60-5
1,2-Dichloropropane	34541	78-87-5
cis-1,3-Dichloropropene	34704	10061-01-5
trans-1,3-Dichloropropene	34699	10061-02-6
Methylene chloride	34423	75-09-2
1,1,2,2-Tetrachloroethane	34516	79-34-5
Tetrachloroethene	34475	127-18-4
1,1,1-Trichloroethane	34506	71-55-6
1,1,2-Trichloroethane	34511	79-00-5
Trichloroethene	39180	79-01-6
Trichlorofluoromethane	34488	75-69-4
Vinyl chloride	39175	75-01-4

1.2 This is a purge and trap gas chromatographic method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1. When this method is used to analyze unfamiliar samples for any or all of the compounds above, compound identification should be supported by at least one additional qualitative

technique. This method describes analytical conditions for a second gas chromatographic column that can be used to confirm measurements made with the primary column. Method 624 provides gas chromatograph/mass spectrometer (GC/MS) conditions appropriate for the qualitative and quantitative confirmation of results for most of the parameters listed above.

1.3 The method detection limit (MDL, defined in Section 12.1)[1] for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed, depending upon the nature of interferences in the sample matrix.

1.4 Any modification of this method, beyond those expressly permitted, shall be considered as major modifications subject to application and approval of alternate test procedures under 40 CFR 136.4 and 136.5.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of a purge and trap system and a gas chromatograph and in the interpretation of chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method using the procedure described in Section 8.2.

2. Summary of Method

2.1 An inert gas is bubbled through a 5-mL water sample contained in a specially-designed purging chamber at ambient temperature. The halocarbons are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the halocarbons are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the halocarbons onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the halocarbons which are then detected with a halide-specific detector.[2,3]

2.2 The method provides an optional gas chromatographic column that may be helpful in resolving the compounds of interest from interferences that may occur.

3. Interferences

3.1 Impurities in the purge gas and organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks as described in Section 8.5. The use of non-TFE plastic tubing, non-TFE thread sealants, or flow controllers with rubber components in the purging device should be avoided.

3.2 Samples can be contaminated by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A field reagent blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

3.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. To reduce carry-over, the purging device and sample syringe must be rinsed with reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination. For samples containing large amounts of water-soluble materials, suspended solids, high boiling compounds or high organohalide levels, it may be necessary to wash out the purging device with a detergent solution, rinse it with distilled water, and then dry it in a 105 °C oven between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4. Safety

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material data handling sheets should also be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available and have been identified[4-6] for the information of the analyst.

4.2 The following parameters covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: carbon tetrachloride, chloroform, 1,4-dichlorobenzene, and vinyl chloride. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5. Apparatus and Materials

5.1 Sampling equipment, for discrete sampling.

5.1.1 Vial—25-mL capacity or larger, equipped with a screw cap with hole in center (Pierce #13075 or equivalent). Detergent wash, rinse cap with tap and distilled water, and dry at 105 °C before use.

5.1.2 Septum—Teflon-faced silicone (Pierce #12722 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 °C for one hour before use.

5.2 Purge and trap device—The purge and trap device consists of three separate pieces of equipment: the sample purger, trap, and the desorber. Several complete devices are now commercially available.

5.2.1 The sample purger must be designed to accept 5-mL samples with a water column at least 3 cm deep. The gaseous head space between the water column and the trap must have a total volume of less than 15-mL. The purge gas must pass through the water column as finely divided bubbles with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. The sample purger, illustrated in Figure 1, meets these design criteria.

5.2.2 The trap must be at least 25 cm long and have an inside diameter of at least 0.105 inch. The trap must be packed to contain the following minimum lengths of adsorbents: 1.0 cm of methyl silicone coated backing (Section 6.3.3), 7.7 cm of 2,6-diphenylene oxide polymer (Section 6.3.2), 7.7 cm of silica gel, 7.7 gm of coconut charcoal (Section 6.3.1). If it is not necessary to analyze for dichlorodifluoromethane, the charcoal can be eliminated, and the polymer section lengthened to 15 cm. The minimum specifications for the trap are illustrated in Figure 2.

5.2.3 The desorber must be capable of rapidly heating the trap to 180 °C. The polymer section of the trap should

not be heated higher than 180 °C and the remaining sections should not exceed 220 °C. The desorber design, illustrated in Figure 2, meets these criteria.

5.2.4 The purge and trap device may be assembled as a separate unit or be coupled to a gas chromatograph as illustrated in Figures 3 and 4.

5.3 Gas chromatograph—An analytical system complete with a temperature programmable gas chromatograph suitable for on-column injection and all required accessories including syringes, analytical columns, gases, detector, and strip-chart recorder. A data system is recommended for measuring peak areas.

5.3.1 Column 1—8 ft long × 0.1 in ID stainless steel or glass, packed with 1% SP-1000 on Carbopack B (60/80 mesh) or equivalent. This column was used to develop the method performance statements in Section 12. Guidelines for the use of alternate column packings are provided in Section 10.1.

5.3.2 Column 2—6 ft long × 0.1 in ID stainless steel or glass, packed with chemically bonded n-octane on Porasil-C (100/120) mesh or equivalent.

5.3.3 Detector—Electrolytic conductivity or microcoulometric. These types of detectors have proven effective in the analysis of wastewaters for the parameters listed in the scope. The electrolytic conductivity detector was used to develop the method performance statements and MDL listed in Tables 1 and 2. Guidelines for the use of alternate detectors are provided in Section 10.1.

5.4 Syringes—5-mL glass hypodermic with Luerlok tip (two each), if applicable to the purging device.

5.5 Micro syringes—25 μL, 0.006 in ID needle.

5.6 Syringe valve—2-way, with Luer ends (three each).

5.7 Syringe—5-mL, gas-tight with shut-off valve.

5.8 Bottle—15-mL, screw cap, with Teflon cap liner.

5.9 Balance—Analytical, capable of accurately weighing 0.0001 g.

6. Reagents

6.1 Reagent water—Reagent water is defined as a water in which an interferent is not observed at the MDL of the parameters of interest.

6.1.1 Reagent water can be generated by passing tap water through a carbon filter bed containing about 1 lb. of activated carbon (Filtrasorb-300 or equivalent (Calgon Corp.)).

6.1.2 A water purification system (Millipore Super-Q or equivalent) may be used to generate reagent water.

6.1.3 Reagent water may also be prepared by boiling water for 15 minutes. Subsequently, while maintaining the temperature at 90 °C, bubble a contaminant-free inert gas through the water for one hour. While still hot, transfer the water to a narrow mouth screw-cap bottle and seal with a Teflon-lined septum and cap.

6.2 Sodium thiosulfate—(ACS) Granular.

6.3 Trap Materials

6.3.1 Coconut charcoal (6/10 mesh sieved to 26 mesh), (Barnaby Chaney, CA-580-26 lot # M-2649 or equivalent).

6.3.2 2,6-Diphenylene oxide polymer—Tenax, (60/80 mesh), chromatographic grade or equivalent.

6.3.3 Methyl silicone packing—3% OV-1 on 60/80 mesh Chromosorb-W or equivalent.

6.3.4 Silica gel—35/60 mesh, Davison, grade-15 or equivalent.

6.4 Methyl Alcohol—Pesticide quality or equivalent.

6.5 Stock standard solutions—Stock standard solutions may be prepared from pure standard materials or purchased as certified solutions. Prepare stock standard solutions in methyl alcohol using assayed liquids or gas cylinders as appropriate. Because of the toxicity of some of the organohalides, primary dilutions of these materials should be prepared in a hood. A NIOSH/MESA approved toxic gas respirator should be used when the analyst handles high concentrations of such materials.

6.5.1 Place about 9.8 mL of methyl alcohol into a 10-mL ground glass stoppered volumetric flask. Allow the flask to stand, unstoppered, for about 10 minutes or until all alcohol wetted surfaces have dried. Weigh the flask to the nearest 0.1 mg.

6.5.2 Add the assayed reference material:

6.5.2.1 Liquids—Using a 100-μL syringe, immediately add two or more drops of assayed reference material to the flask, then reweigh. Be sure that the drops fall directly into the alcohol without contacting the neck of the flask.

6.5.2.2 Gases—To prepare standards for any of the six halocarbons that boil below 30 °C (bromomethane, chloroethane, chloromethane, dichlorodifluoromethane, trichlorofluoromethane, vinyl chloride), fill a 5-mL valved gas-tight syringe with the reference standard to the 5.0-mL mark. Lower the needle to 5 mm above the methyl alcohol meniscus. Slowly introduce the reference standard above the surface of the liquid (the heavy gas will rapidly dissolve into the methyl alcohol).

6.5.3 Reweigh, dilute to volume, stopper, then mix by inverting the flask several times. Calculate the concentration in micrograms per microliter from the net gain in weight. When compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. Commercially prepared stock standards can be used at any concentration if they are certified by the manufacturer or by an independent source.

6.5.4 Transfer the stock standard solution into a Teflon-sealed screw-cap bottle. Store, with minimal headspace, at −10 to −20 °C and protect from light.

6.5.5 Prepare fresh standards weekly for the six gases and 2-chloroethylvinyl ether. All other standards must be replaced after one month, or sooner if comparison with check standards indicate a problem.

6.6 Secondary dilution standards—Using stock standard solutions, prepare secondary dilution standards in methyl alcohol that contain the compounds of interest, either singly or mixed together. The secondary dilution standards should be prepared at concentrations such that the aqueous calibration standards prepared in Sections 7.3.1 or 7.4.1 will bracket the working range of the analytical system. Secondary dilution standards should be stored with minimal headspace and should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them. Quality control check standards that can be used to determine the accuracy of calibration standards will be available from the U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, in Cincinnati, Ohio.

7. Calibration

7.1 Assemble a purge and trap device that meets the specifications in Section 5.2. Condition the trap overnight at 180 °C by backflushing with an inert gas flow of at least 20 mL/min. Prior to use, daily condition traps 10 minutes while backflushing at 180 °C.

7.2 Connect the purge and trap device to a gas chromatograph. The gas chromatograph must be operated using temperature and flow rate parameters equivalent to those in Table 1. Calibrate the purge and trap-gas chromatographic system using either the external standard technique (Section 7.3) or the internal standard technique (Section 7.4).

7.3 External standard calibration procedure:

7.3.1 Prepare calibration standards at a minimum of three concentration levels for each parameter by carefully adding 20.0 μL of one or more secondary dilution standards to 100, 500, or 1000 mL of reagent water. A 25-μL syringe with a 0.006 inch ID needle should be used for this operation. One of the external standards should be at a concentration near, but above, the method detection limit (See Table 1) and the other concentrations should correspond to the expected range of concentrations found in real samples or should define the working range of the detector. These aqueous standards can be stored up to 24 hours, if held in sealed vials with zero headspace as described in Section 9.2. If not so stored, they must be discarded after one hour.

7.3.2 Analyze each calibration standard according to Section 10, and tabulate peak height or area responses versus the concentration in the standard. The results can be used to prepare a calibration curve for each compound. Alternatively, if the ratio of response to concentration (calibration factor) is a constant over the working range (≤10% relative standard deviation, RSD), linearity through the origin can be assumed and the average ratio or calibration factor can be used in place of a calibration curve.

7.3.3 The working calibration curve or calibration factor must be verified on each working day by the measurement of one or more calibration standards. If the response for any parameter varies from the predicted response by more than ± 10%, the test must be repeated using a fresh calibration standard. Alternatively, a new calibration curve or calibration factor must be prepared for that parameter.

7.4 Internal standard calibration procedure. To use this approach, the analyst must select one or more internal standards that are similar in analytical behavior to the compounds of interest. The analyst must further demonstrate that the measurement of the internal standard is not affected by method or matrix interferences. Because of these limitations, no internal standard can be suggested that is applicable to all samples. The compounds recommended for use as surrogate spikes in Section 8.7 have been used successfully as internal standards, because of their generally unique retention times.

7.4.1 Prepare calibration standards at a minimum of three concentration levels for each parameter of interest as described in Section 7.3.1.

7.4.2 Prepare a spiking solution containing each of the internal standards using the procedures described in Sections 6.5 and 6.6. It is recommended that the secondary dilution standard be prepared at a concentration of 15 μg/mL of each internal standard compound. The addition of 10 μL of this standard to 5.0 mL of sample or calibration standard would be equivalent to 30 μg/L.

7.4.3 Analyze each calibration standard, according to Section 10, adding 10 μL of internal standard spiking solution directly to the syringe (Section 10.4). Tabulate peak height or area responses against concentration for each compound and internal standard, and calculate response factors (RF) for each compound using equation 1.

$$\text{Eq. 1} \quad RF = (A_s C_{is})/(A_{is} C_s)$$

where:

A_s = Response for the parameter to be measured.
A_{is} = Response for the internal standard.
C_{is} = Concentration of the internal standard.
C_s = Concentration of the parameter to be measured.

If the RF value over the working range is a constant (≤10% RSD), the RF can be assumed to be invariant and the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios, A_s/A_{is}, vs. RF.

7.4.4 The working calibration curve or RF must be verified on each working day by the measurement of one or more calibration standards. If the response for any parameter varies from the predicted response by more than ± 10%, the test must be repeated using a fresh calibration standard. Alternatively, a new calibration curve must be prepared for that compound.

8. Quality Control

8.1 Each laboratory that uses this method is required to operate a formal quality control program. The minimum requirements of this program consist of an initial demonstration of laboratory capability and the analysis of spiked samples as a continuing check on performance. The laboratory is required to maintain performance records to define the quality of data that is generated. Ongoing performance checks must be compared with established performance criteria to determine if the results of analyses are within accuracy and precision limits expected of the method.

8.1.1 Before performing any analyses, the analyst must demonstrate the ability to generate acceptable accuracy and precision with this method. This ability is established as described in Section 8.2.

8.1.2 In recognition of the rapid advances that are occurring in chromatography, the analyst is permitted certain options to improve the separations or lower the cost of measurements. Each time such modifications are made to the method, the analyst is required to repeat the procedure in Section 8.2.

8.1.3 The laboratory must spike and analyze a minimum of 10% of all samples to monitor continuing laboratory performance. This procedure is described in Section 8.4.

8.2 To establish the ability to generate acceptable accuracy and precision, the analyst must perform the following operations.

8.2.1 Select a representative spike concentration for each compound to be measured. Using stock standards, prepare a quality control check sample concentrate in methyl alcohol 500 times more concentrated than the selected concentrations. Quality control check sample concentrates, appropriate for use with this method, will be available from the U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

8.2.2 Using a syringe, add 10 μL of the check sample concentrate to each of a minimum of four 5-mL aliquots of reagent water. A representative waste-

water may be used in place of the reagent water, but one or more additional aliquots must be analyzed to determine background levels, and the spike level must exceed twice the background level for the test to be valid. Analyze the aliquots according to the method beginning in Section 10.

8.2.3 Calculate the average percent recovery, (R), and the standard deviation of the percent recovery (s), for the results. Wastewater background corrections must be made before R and s calculations are performed.

8.2.4 Using Table 2, note the average recovery (X) and standard deviation (p) expected for each method parameter. Compare these to the calculated values for R and s. If $s > 2p$ or $|X - R| > 2p$, review potential problem areas and repeat the test.

8.3 The analyst must calculate method performance criteria and define the performance of the laboratory for each spike concentration and parameter being measured.

8.2.5 The U.S. Environmental Protection Agency plans to establish performance criteria for R and s based upon the results of interlaboratory testing. When they become available, these criteria must be met before any samples may be analyzed.

8.3.1 Calculate upper and lower control limts for method performance:

Upper Control Limit (UCL) = R + 3s
Lower Control Limit (LCL) = R − 3s

where R and s are calculated as in Section 8.2.3. The UCL and LCL can be used to construct control charts[7] that are useful in observing trends in performance. The control limits above must be replaced by method performance criteria as they become available from the U.S. Environmental Protection Agency.

8.3.2 The laboratory must develop and maintain separate accuracy statements of laboratory performance for wastewater samples. An accuracy statement for the method is defined as R ± s. The accuracy statement should be developed by the analysis of four aliquots of wastewater as described in Section 8.2.2, followed by the calculation of R and s. Alternately, the analyst may use four wastewater data points gathered through the requirement for continuing quality control in Section 8.4. The accuracy statements should be updated regularly.[7]

8.4 The laboratory is required to collect a portion of their samples in duplicate to monitor spike recoveries. The frequency of spiked sample analysis must be at least 10% of all samples or one sample per month, whichever is greater. One aliquot of the sample must be spiked and analyzed as described in Section 8.2. If the recovery for a particular parameter does not fall within the control limits for method performance, the results reported for that parameter in all samples processed as part of the same set must be qualified as described in Section 11.3. The laboratory should monitor the frequency of data so qualified to ensure that it remains at or below 5%.

8.5 Each day, the analyst must demonstrate through the analysis of reagent water, that interferences from the analytical system are under control.

8.6 It is recommended that the laboratory adopt additional quality assurance practices for use with this method. The specific practices that are most productive depend upon the needs of the laboratory and the nature of the samples. Field duplicates may be analyzed to monitor the precision of the sampling technique. When doubt exists over the identification of a peak on the chromatogram, confirmatory techniques such as gas chromatography with a dissimilar column, specific element detector, or mass spectrometer must be used. Whenever possible, the laboratory should perform analysis of standard reference materials and participate in relevant performance evaluation studies.

8.7 The analyst should maintain constant surveillance of both the performance of the analytical system and the effectiveness of the method in dealing with each sample matrix by spiking each sample, standard and blank with surrogate halocarbons. A combination of bromochloromethane, 2-bromo-1-chloropropane, and 1,4-dichlorobutane is recommended to encompass the range of the temperature program used in this method. From stock standard solutions prepared as above, add a volume to give 7500 μg of each surrogate to 45 mL of reagent water contained in a 50-mL volumetric flask, mix and dilute to volume (15 ng/μL). If the internal standard calibration procedure is being used, the surrogate compounds may be added directly to the internal standard spiking solution (Section 7.4.2). Add 10 μL of this surrogate spiking solution directly into the 5-mL syringe with every sample and reference standard analyzed. Prepare a fresh surrogate spiking solution on a weekly basis.

9. Sample Collection, Preservation, and Handling

9.1 All samples must be iced or refrigerated from the time of collection until extraction. If the sample contains free or combined chlorine, add sodium thiosulfate preservative (10 mg/40 mL is sufficient for up to 5 ppm Cl_2) to the empty sample bottle just prior to shipping to the sampling site. USEPA methods 330.4 and 330.5 may be used for measurement of residual chlorine.[8] Field test kits are available for this purpose.

9.2 Grab samples must be collected in glass containers having a total volume of at least 25 mL. Fill the sample bottle just to overflowing in such a manner that no air bubbles pass through the sample as the bottle is being filled. Seal the bottle so that no air bubbles are entrapped in it. If preservative has been added, shake vigorously for one minute. Maintain the hermetic seal on the sample bottle until time of analysis.

9.3 All samples must be analyzed within 14 days of collection.

10. Sample Extraction and Gas Chromatography

10.1 Table 1 summarizes the recommended operating conditions for the gas chromatograph. Included in this Table are estimated retention times and method detection limits that can be achieved by this method. An example of the separations achieved by Column 1 is shown in Figure 5. Other packed columns, chromatographic conditions, or detectors may be used if the requirements of Section 8.2 are met.

10.2 Calibrate the system daily as described in Section 7.

10.3 Adjust the purge gas (nitrogen or helium) flow rate to 40 mL/min. Attach the trap inlet to the purging device, and set the device to purge. Open the syringe valve located on the purging device sample introduction needle.

10.4 Allow sample to come to ambient temperature prior to introducing it to the syringe. Remove the plunger from a 5-mL syringe and attach a closed syringe valve. Open the sample bottle (or standard) and carefully pour the sample into the syringe barrel to just short of overflowing. Replace the

syringe plunger and compress the sample. Open the syringe valve and vent any residual air while adjusting the sample volume to 5.0 mL. Since this process of taking an aliquot destroys the validity of the sample for future analysis, the analyst should fill a second syringe at this time to protect against possible loss of data. Add 10.0 μL of the surrogate spiking solution (8.7) and 10.0 μL of the internal standard spiking solution (Section 7.4.2), if applicable, through the valve bore, then close the valve.

10.5 Attach the syringe-syringe valve assembly to the syringe valve on the purging device. Open the syringe valves and inject the sample into the purging chamber.

10.6 Close both valves and purge the sample for 11.0 ± .1 minutes at ambient temperature.

10.7 After the 11-minute purge time, attach the trap to the chromatograph, adjust the device to the desorb mode, and begin to temperature program the gas chromatograph. Introduce the trapped materials to the GC column by rapidly heating the trap to 180 °C while backflushing the trap with an inert gas between 20 and 60 mL/min for four minutes. If rapid heating of the trap cannot be achieved, the gas chromatographic column must be used as a secondary trap by cooling it to 30 °C (subambient temperature, if poor peak geometry or random retention time problems persist) instead of the initial program temperature of 45 °C.

10.8 While the trap is being desorbed into the gas chromatograph, empty the purging chamber using the sample introduction syringe. Wash the chamber with two 5-mL flushes of reagent water.

10.9 After desorbing the sample for four minutes recondition the trap by returning the purge and trap device to the purge mode. Wait 15 seconds then close the syringe valve on the purging device to begin gas flow through the trap. The trap temperature should be maintained at 180 °C. After approximately seven minutes turn off the trap heater and open the syringe valve to stop the gas flow through the trap. When cool the trap is ready for the next sample.

10.10 The width of the retention time window used to make identifications should be based upon measurements of actual retention time variations of standards over the course of a day. Three times the standard deviation of a retention time for a compound can be used to calculate a suggested window size; however, the experience of the analyst should weigh heavily in the interpretation of chromatograms.

10.11 If the response for the peak exceeds the working range of the system, prepare a dilution of the sample with reagent water from the aliquot in the second syringe and reanalyze.

11. Calculations

11.1 Determine the concentration of individual compounds in the sample.

11.1.1 If the external standard calibration procedure is used, calculate the concentration of material from the peak response using the calibration curve or calibration factor determined in Section 7.3.2.

11.1.2 If the internal standard calibration procedure was used, calculate the concentration in the sample using the response factor (RF) determined in Section 7.4.3 and equation 2.

Eq. 2.

Concentration $\mu g/L = (A_s C_{is})/(A_{is})(RF)$

where:

A_s = Response for the parameter to be measured.

A_{is} = Response for the internal standard.

C_s = Concentration of the internal standard.

11.2 Report results in micrograms per liter. When duplicate and spiked samples are analyzed, report all data obtained with the sample results.

11.3 For samples processed as part of a set where the spiked sample recovery falls outside of the control limits which were established according to Section 8.3, data for the affected parameters must be labeled as suspect.

12. Method Performance

12.1 The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero.[1] The MDL concentrations listed in Table 1 were obtained using reagent water.[9] Similar results were achieved using representative wastewaters. The MDL actually achieved in a given analysis will vary depending on instrument sensitivity and matrix effects.

12.2 This method is recommended for use in the concentration range from the MDL up to 1000 × MDL. Direct aqueous injection techniques should be used to measure concentration levels above 1000 × MDL.

12.3 In a single laboratory (Monsanto Research), using reagent water and wastewaters spiked at or near background levels, the average recoveries presented in Table 2 were obtained[9]. The standard deviation of the measurement in percent recovery is also included in Table 2[9].

12.4 The U.S. Environmental Protection Agency is in the process of conducting an interlaboratory method study to fully define the performance of this method.

References

1. See Appendix A.
2. Bellar, T.A., and Lichtenberg, J.J. *Journal American Water Works Association, 66*, 739, (1974).
3. Bellar, T.A., and Lichtenberg, J.J. "Semi-Automated Headspace Analysis of Drinking Waters and Industrial Waters for Purgeable Volatile Organic Compounds," Proceedings from Symposium on Measurement of Organic Pollutants in Water and Wastewater, American Society for Testing and Materials, STP 686, C.E. Van Hall, editor, 1978.
4. "Carcinogens—Working With Carcinogens," Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Publication No. 77-206, Aug. 1977.
5. "OSHA Safety and Health Standards, General Industry," (29 CFR 1910), Occupational Safety and Health Administration, OSHA 2206, (Revised, January 1976).
6. "Safety in Academic Chemistry Laboratories," American Chemical Society Publication, Committee on Chemical Safety, 3rd Edition, 1979.
7. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," EPA-600/4-79-019, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory—Cincinnati, Ohio 45268, March 1979.
8. "Methods 330.4 (Titrimetric, DPD-FAS) and 330.5 (Spectrophotometric, DPD) for Chlorine, Total Residual," Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, U.S. Environmental Protection Agency,

Environmental Monitoring and Support Laboratory—Cincinnati, Ohio 45268, March 1979.
9. "EPA Method Validation Study 23, Method 601 (Purgeable Halocarbons)," Report for EPA Contract 68-03-2856 (In preparation).

Table 1. Chromatographic Conditions and Method Detection Limits

Parameter	Retention Time (min.) Column 1	Retention Time (min.) Column 2	Method Detection Limit µg/L
Chloromethane	1.50	5.28	0.08
Bromomethane	2.17	7.05	1.18
Dichlorodifluoromethane	2.62	nd	1.81
Vinyl chloride	2.67	5.28	0.18
Chloroethane	3.33	8.68	0.52
Methylene chloride	5.25	10.1	0.25
Trichlorofluoromethane	7.18	nd	nd
1,1-Dichloroethene	7.93	7.72	0.13
1,1-Dichloroethane	9.30	12.6	0.07
trans-1,2-Dichloroethene	10.1	9.38	0.10
Chloroform	10.7	12.1	0.05
1,2-Dichloroethane	11.4	15.4	0.03
1,1,1-Trichloroethane	12.6	13.1	0.03
Carbon tetrachloride	13.0	14.4	0.12
Bromodichloromethane	13.7	14.6	0.10
1,2-Dichloropropane	14.9	16.6	0.04
trans-1,3-Dichloropropene	15.2	16.6	0.34
Trichloroethene	15.8	13.1	0.12
Dibromochloromethane	16.5	16.6	0.09
1,1,2-Trichloroethane	16.5	18.1	0.02
cis-1,3-Dichloropropene	16.5	18.0	0.20
2-Chloroethylvinyl ether	18.0	nd	0.13
Bromoform	19.2	19.2	0.20
1,1,2,2-Tetrachloroethane	21.6	nd	0.03
Tetrachloroethene	21.7	15.0	0.03
Chlorobenzene	24.2	18.8	0.25
1,3-Dichlorobenzene	34.0	22.4	0.32
1,2-Dichlorobenzene	34.9	23.5	0.15
1,4-Dichlorobenzene	35.4	22.3	0.24

nd = not determined

Column 1 conditions: Carbopack B 60/80 mesh coated with 1% SP-1000 packed in an 8 ft × 0.1 in ID stainless steel or glass column with helium carrier gas at 40 mL/min flow rate. Column temperature held at 45 °C for 3 min. then programmed at 8 °C/min. to 220° and held for 15 min.

Column 2 conditions: Porasil-C 100/120 mesh coated with n-octane packed in a 6 ft × 0.1 in ID stainless steel or glass column with helium carrier gas at 40 mL/min flow rate. Column temperature held at 50°C for 3 min then programmed at 6 °C/min to 170° and held for 4 min.

Table 2. *Single Operator Accuracy and Precision*

Parameter	Average Percent Recovery	Standard Deviation %	Spike Range (µg/L)	Number of Analyses	Matrix Types
Bromodichloromethane	100.9	5.0	0.43-46.7	21	3
Bromoform	89.5	9.0	1.45-50	20	3
Bromomethane	105.0	17.3	3.39-49.2	21	3
Carbon tetrachloride	82.5	25.6	0.55-50	19	3
Chlorobenzene	93.9	8.9	2.21-50	20	3
Chloroethane	91.5	22.4	3.95-50	21	3
2-Chloroethylvinyl ether	96.3	9.9	4.39-133	20	3
Chloroform	101.7	20.6	0.44-50	20	3
Chloromethane	91.4	13.4	0.55-23.9	21	3
Dibromochloromethane	98.3	6.5	0.75-93.0	21	3
1,2-Dichlorobenzene	10.20	2.0	4.89-154	21	3
1,3-Dichlorobenzene	91.6	4.3	2.94-46.7	21	3
1,4-Dichlorobenzene	97.5	9.3	2.99-51.6	21	3
Dichlorodifluoromethane	87.8	18.0	2.18-43.4	21	3
1,1-Dichloroethane	102.3	5.5	0.44-46.7	21	3
1,2-Dichloroethane	97.8	4.8	0.44-46.7	21	3
1,1-Dichloroethene	101.1	21.7	0.37-50	19	3
trans-1,2-Dichloroethene	91.0	19.3	0.44-98.0	20	3
1,2-Dichloropropane	97.7	8.8	0.29-39.0	21	3
cis-1,3-Dichloropropene	86.7	6.0	0.44-46.7	21	3
trans-1,3-Dichloropropene	73.5	17.2	0.43-50	20	3
Methylene chloride	97.9	2.6	0.73-46.7	21	3
1,1,2,2-Tetrachloroethane	91.9	15.0	0.46-46.7	21	3
Tetrachloroethene	94.1	18.1	0.50-35.0	21	3
1,1,1-Trichloroethane	75.1	12.5	0.37-29.0	21	3
1,1,2-Trichloroethane	91.0	25.1	0.45-50	21	3
Trichloroethene	106.1	7.4	0.38-46.7	21	3
Trichlorofluoromethane	89.3	13.9	149	14	2
Vinyl chloride	101.9	11.4	0.82-32.3	21	3

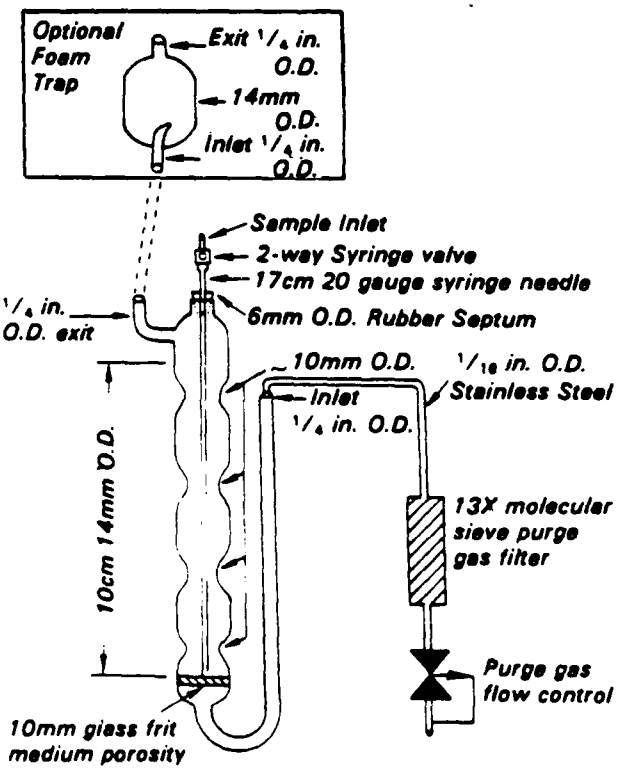


Figure 1. *Purging device*

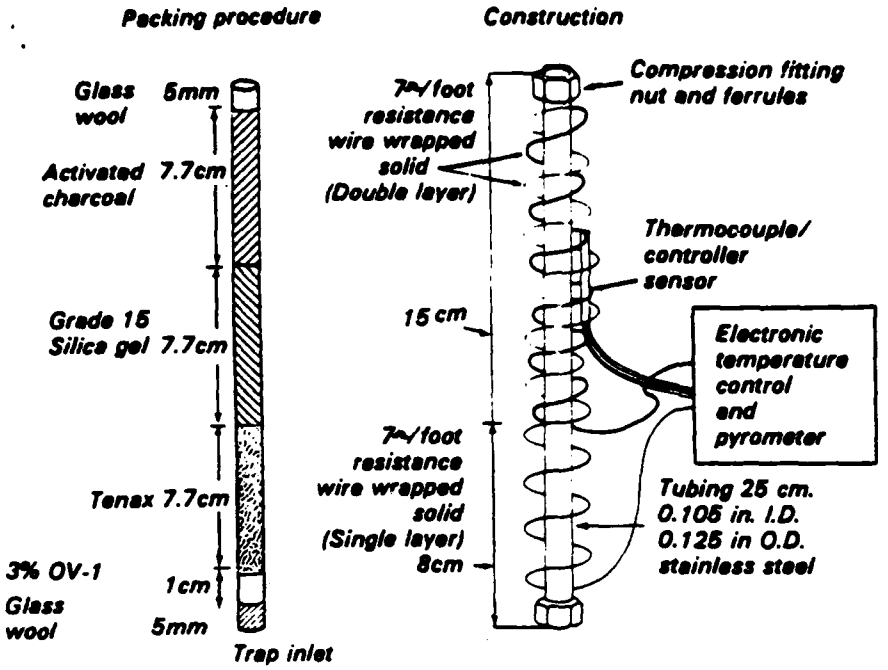


Figure 2. *Trap packings and construction to include desorb capability*

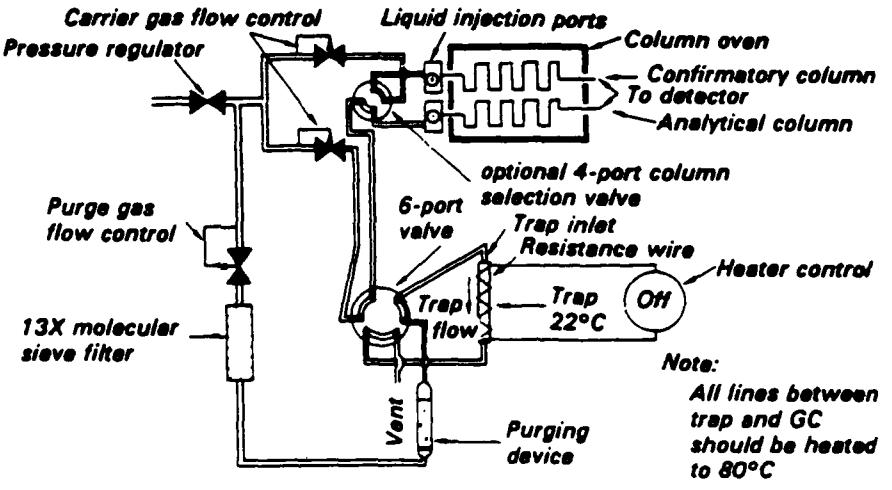


Figure 3. *Schematic of purge and trap device — purge mode*

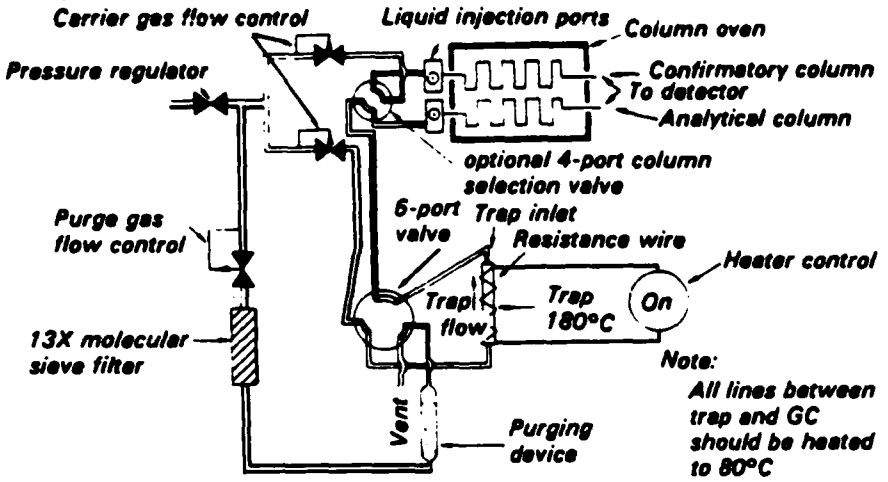


Figure 4. *Schematic of purge and trap device — desorb mode*

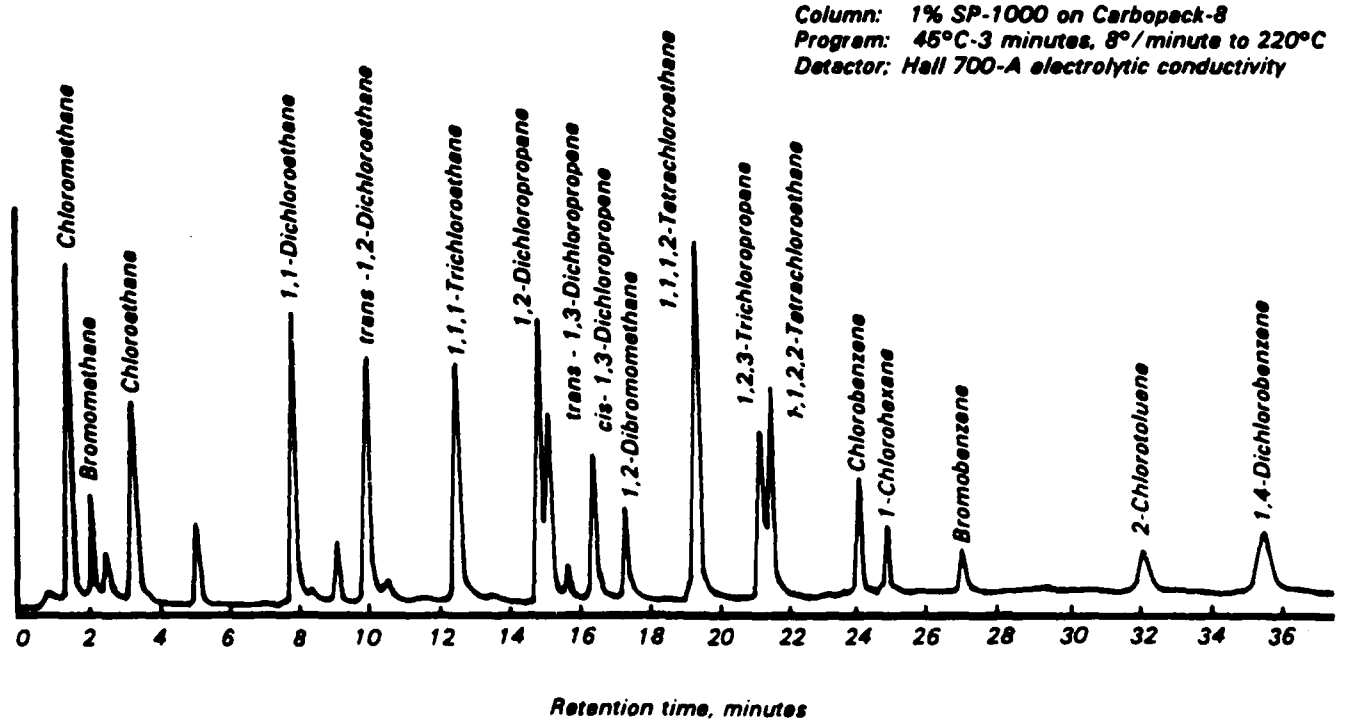


Figure 5. *Gas chrometogram of purgeable halocarbons*

United States
Environmental Protection
Agency

Environmental Monitoring and
Support Laboratory
Cincinnati OH 45268

Research and Development

EPA

Test Method

Purgeable Aromatics—Method 602

1. Scope and Application

1.1 This method covers the determination of various purgeable aromatics. The following parameters may be determined by this method:

Parameter	STORET No.	CAS No.
Benzene	34030	71-43-2
Chlorobenzene	34301	108-90-7
1,2-Dichlorobenzene	34536	95-50-1
1,3-Dichlorobenzene	34566	541-73-1
1,4-Dichlorobenzene	34571	106-46-7
Ethylbenzene	34371	100-41-4
Toluene	34010	108-88-3

1.2 This is a purge and trap gas chromatographic method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1. When this method is used to analyze unfamiliar samples for any or all of the compounds above, compound identifications should be supported by at least one additional qualitative technique. This method describes analytical conditions for a second gas chromatographic column that can be used to confirm measurements made with the primary column. Method 624 provides gas chromatograph/mass spectrometer (GC/MS) conditions appropriate for the qualitative and quantitative confirmation of results for all of the parameters listed above.

1.3 The method detection limit (MDL, defined in Section 12.1[1]) for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed depending upon the nature of interferences in the sample matrix.

1.4 Any modification of this method, beyond those expressly permitted, shall be considered as major modifications subject to application and approval for alternate test procedures under 40 CFR 136.4 and 136.5

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of a purge and trap system and a gas chromatograph and in the interpretation of chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method using the procedure described in Section 8.2.

2. Summary of Method

2.1 An inert gas is bubbled through a 5-mL water sample contained in a specially-designed purging chamber at ambient temperature. The aromatics are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the aromatics are trapped. After

PHENOLICS, TOTAL RECOVERABLE

Method 420.1 (Spectrophotometric, Manual 4-AAP with Distillation)

STORET NO. 32730

1. Scope and Application
   - 1.1 This method is applicable to the analysis of drinking, surface and saline waters, domestic and industrial wastes.
   - 1.2 The method is capable of measuring phenolic materials at the 5 *ug/1* level when the colored end product is extracted and concentrated in a solvent phase using phenol as a standard.
   - 1.3 The method is capable of measuring phenolic materials that contain more than 50 *ug/1* in the aqueous phase (without solvent extraction) using phenol as a standard.
   - 1.4 It is not possible to use this method to differentiate between different kinds of phenols.
2. Summary of Method
   - 2.1 Phenolic materials react with 4-aminoantipyrine in the presence of potassium ferricyanide at a pH of 10 to form a stable reddish-brown colored antipyrine dye. The amount of color produced is a function of the concentration of phenolic material.
3. Comments
   - 3.1 For most samples a preliminary distillation is required to remove interfering materials.
   - 3.2 Color response of phenolic materials with 4-amino antipyrine is not the same for all compounds. Because phenolic type wastes usually contain a variety of phenols, it is not possible to duplicate a mixture of phenols to be used as a standard. For this reason phenol has been selected as a standard and any color produced by the reaction of other phenolic compounds is reported as phenol. This value will represent the minimum concentration of phenolic compounds present in the sample.
4. Sample Handling and Preservation
   - 4.1 Biological degradation is inhibited by the addition of 1 g/1 of copper sulfate to the sample and acidification to a pH of less than 4 with phosphoric acid. The sample should be kept at 4°C and analyzed within 24 hours after collection.
5. Interference
   - 5.1 Interferences from sulfur compounds are eliminated by acidifying the sample to a pH of less than 4 with H_3PO_4 and aerating briefly by stirring and adding $CuSO_4$.
   - 5.2 Oxidizing agents such as chlorine, detected by the liberation of iodine upon acidification in the presence of potassium iodide, are removed immediately after sampling by the addition of an excess of ferrous ammonium sulfate (~~6.5~~ 7.5). If chlorine is not removed, the phenolic compounds may be partially oxidized and the results may be low.

Approved for NPDES
Issued 1971
Editorial revision 1978

6. Apparatus
   - 6.1 Distillation apparatus, all glass consisting of a 1 liter pyrex distilling apparatus with Graham condenser.
   - 6.2 pH meter.
   - 6.3 Spectrophotometer, for use at 460 or 510 nm.
   - 6.4 Funnels.
   - 6.5 Filter paper.
   - 6.6 Membrane filters.
   - 6.7 Separatory funnels, 500 or 1,000 ml.
   - 6.8 Nessler tubes, short or long form.
7. Reagents
   - 7.1 Phosphoric acid solution, 1 + 9: Dilute 10 ml of 85% H_3PO_4 to 100 ml with distilled water.
   - 7.2 Copper sulfate solution: Dissolve 100 g $CuSO_4 \cdot 5H_2O$ in distilled water and dilute to 1 liter.
   - 7.3 Buffer solution: Dissolve 16.9 g NH_4Cl in 143 ml conc. NH_4OH and dilute to 250 ml with distilled water. Two ml should adjust 100 ml of distillate to pH 10.
   - 7.4 Aminoantipyrine solution: Dissolve 2 g of 4AAP in distilled water and dilute to 100 ml.
   - 7.5 Potassium ferricyanide solution: Dissolve 8 g of $K_3Fe(CN)_6$ in distilled water and dilute to 100 ml.
   - 7.6 Stock phenol solution: Dissolve ~~1.0 g~~ 1.00g phenol in freshly boiled and cooled distilled water and dilute to 1 liter. 1 ml = 1 mg phenol.
   - 7.7 Working solution A: Dilute 10 ml stock phenol solution to 1 liter with distilled water. 1 ml = 10 *ug* phenol.
   - 7.8 Working solution B: Dilute 100 ml of working solution A to 1000 ml with distilled water. 1 ml = 1 *ug* phenol.
   - 7.9 Chloroform
8. Procedure
   - 8.1 Distillation
     - 8.1.1 Measure 500 ml sample into a beaker. Lower the pH to approximately 4 with 1 + 9 H_3PO_4 (7.1), add 5 ml $CuSO_4$ solution (7.2) and transfer to the distillation apparatus. Omit adding H_3PO_4 and $CuSO_4$ if sample was preserved as described in 4.1.
     - 8.1.2 Distill 450 ml of sample, stop the distillation, and when boiling ceases add 50 ml of warm distilled water to the flask and resume distillation until 500 ml have been collected.
     - 8.1.3 If the distillate is turbid, filter through a prewashed membrane filter.
   - 8.2 Direct photometric method
     - 8.2.1 Using working solution A (7.7), prepare the following standards in 100 ml volumetric flasks.

ml of working solution A	Conc. ug/l
0	0.0
0.5	50.0
1.0	100.0
2.0	200.0
5.0	500.0
8.0	800.0
10.0	1000.0

8.2.2 To 100 ml of distillate or an aliquot diluted to 100 ml and/or standards, add 2 ml of buffer solution (7.3) and mix. The pH of the sample and standards should be 10 ±0.2.

8.2.3 Add 2.0 ml aminoantipyrine solution (7.4) and mix.

8.2.4 Add 2.0 ml potassium ferricyanide solution (7.5) and mix.

8.2.5 After 15 minutes read absorbance at 510 nm.

8.3 Chloroform extraction method

8.3.1 Using working solution B (7.8), prepare the following standards. Standards may be prepared by pipetting the required volumes into the separatory funnels and diluting to 500 ml with distilled water.

ml of working solution B	Conc. ug/l
0.0	0.0
3.0	6.0
5.0	10.0
10.0	20.0
20.0	40.0
25.0	50.0

8.3.2 Place 500 ml of distillate or an aliquot diluted to 500 ml in a separatory funnel. The sample should not contain more than 25 ug phenol.

8.3.3 To sample and standards add 10 ml of buffer solution (7.3) and mix. The pH should be 10 ±0.2.

8.3.4 Add 3.0 ml aminoantipyrine solution (7.4) and mix.

8.3.5 Add 3.0 ml potassium ferricyanide solution (7.5) and mix.

8.3.6 After three minutes, extract with 25 ml of chloroform (7.9). Shake the separatory funnel at least 10 times, let $CHCl_3$ settle, shake again 10 times and let chloroform settle again.

8.3.7 Filter chloroform extracts through filter paper. Do not add more chloroform.

8.3.8 Read the absorbance of the samples and standards against the blank at 460 nm.

9. Calculation

9.1 Prepare a standard curve by plotting the absorbance value of standards versus the corresponding phenol concentrations.

9.2 Obtain concentration value of sample directly from standard curve.

10. Precision and Accuracy

10.1 Using the extraction procedure for concentration of color, six laboratories analyzed samples at concentrations of 9.6, 48.3, and 93.5 *ug*/1. Standard deviations were ±0.99, ±3.1 and ±4.2 *ug*/1, respectively.

10.2 Using the direct photometric procedure, six laboratories analyzed samples at concentrations of 4.7, 48.2 and 97.0 mg/1. Standard deviations were ±0.18, ±0.48 and ±1.58 mg/1, respectively.

Bibliography

1. Annual Book of ASTM Standards, Part 31, "Water", Standard D1783–70, p553 (1976).
2. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p574–581, Method 510 through 510C, (1975).

CHEMICAL OXYGEN DEMAND

Method 410.1 (Titrimetric, Mid-Level)

STORET NO. 00340

1. Scope and Application
   - 1.1 The Chemical Oxygen Demand (COD) method determines the quantity of oxygen required to oxidize the organic matter in a waste sample, under specific conditions of oxidizing agent, temperature, and time.
   - 1.2 Since the test utilizes a specific chemical oxidation the result has no definite relationship to the Biochemical Oxygen Demand (BOD) of the waste or to the Total Organic Carbon (TOC) level. The test result should be considered as an independent measurement of organic matter in the sample, rather than as a substitute for the BOD or TOC test.
   - 1.3 The method can be applied to domestic and industrial waste samples having an organic carbon concentration greater than 50 mg/1. For lower concentrations of carbon such as in surface water samples, the Low Level Modification should be used. When the chloride concentration of the sample exceeds 2000 mg/1, the modification for saline waters is required.
2. Summary of Method
   - 2.1 Organic and oxidizable inorganic substances in the sample are oxidized by potassium dichromate in 50% sulfuric acid solution at reflux temperature. Silver sulfate is used as a catalyst and mercuric sulfate is added to remove chloride interference. The excess dichromate is titrated with standard ferrous ammonium sulfate, using orthophenanthroline ferrous complex as an indicator.
3. Sampling and Preservation
   - 3.1 Collect the samples in glass bottles, if possible. Use of plastic containers is permissible if it is known that no organic contaminants are present in the containers.
   - 3.2 Biologically active samples should be tested as soon as possible. Samples containing settleable material should be well mixed, preferably homogenized, to permit removal of representative aliquots.
   - 3.3 Samples should be preserved with sulfuric acid to a pH < 2 and maintained at 4°C until analysis.
4. Interferences
   - 4.1 Traces of organic material either from the glassware or atmosphere may cause a gross, positive error.
     - 4.1.1 Extreme care should be exercised to avoid inclusion of organic materials in the distilled water used for reagent preparation or sample dilution.
     - 4.1.2 Glassware used in the test should be conditioned by running blank procedures to eliminate traces of organic material.

Approved for NPDES
Issued 1971
Editorial revision 1978

4.2 Volatile materials may be lost when the sample temperature rises during the sulfuric acid addition step. To minimize this loss the flask should be cooled during addition of the sulfuric acid solution.

4.3 Chlorides are quantitatively oxidized by dichromate and represent a positive interference. Mercuric sulfate is added to the digestion flask to complex the chlorides, thereby effectively eliminating the interference on all but brine and estuarine samples.

5. Apparatus

5.1 Reflux apparatus: Glassware should consist of a 500 ml Erlenmeyer flask or a 300 ml round bottom flask made of heat-resistant glass connected to a 12 inch Allihn condenser by means of a ground glass joint. Any equivalent reflex apparatus may be substituted provided that a ground-glass connection is used between the flask and the condenser.

6. Reagents

6.1 Distilled water: Special precautions should be taken to insure that distilled water used in this test be low in organic matter.

6.2 Standard potassium dichromate solution (0.250 N): Dissolve 12.259 g $K_2Cr_2O_7$, primary standard grade, previously dried at 103°C for two hours, in distilled water and dilute to 1000 ml.

6.3 Sulfuric acid reagent: Conc. H_2SO_4 containing 23.5g silver sulfate, Ag_2SO_4, per 4.09kg bottle. With continuous stirring, the silver sulfate may be dissolved in about 30 minutes.

6.4 Standard ferrous ammonium sulfate (0.25 N): Dissolve 98.0 g of $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$ in distilled water. Add 20 ml of conc. H_2SO_4 (6.8), cool and dilute to 1 liter. This solution must be standardized daily against standard $K_2Cr_2O_7$ solution (6.2).

6.4.1 Standardization: To approximately 200 ml of distilled water add 25.0 ml of 0.25 N $K_2Cr_2O_7$ (6.2) solution. Add 20 ml of H_2SO_4 (6.8) and cool. Titrate with ferrous ammonium sulfate (6.4) using 1 drop of ferroin indicator (6.6). The color change is sharp, going from blue-green to reddish-brown.

$$\text{Normality} = \frac{(\text{ml } K_2Cr_2O_7)(0.25)}{\text{ml Fe } (NH_4)_2 (SO_4)_2}$$

6.5 Mercuric sulfate: Powdered $HgSO_4$.

6.6 Phenanthroline ferrous sulfate (ferroin) indicator solution: Dissolve 1.48 g of 1–10 (ortho) phenanthroline monohydrate, together with 0.70 g of $FeSO_4 \cdot 7H_2O$ in 100 ml of water. This indicator may be purchased already prepared.

6.7 Silver sulfate: Powdered Ag_2SO_4.

6.8 Sulfuric acid (sp. gr. 1.84): Concentrated H_2SO_4.

7. Procedure

7.1 Place several boiling stones in the reflux flask, followed by 50.0 ml of sample or an aliquot diluted to 50.0 ml and 1 g of $HgSO_4$ (6.5). Add 5.0 ml conc. H_2SO_4 (6.8); swirl until the mercuric sulfate has dissolved. Place reflux flask in an ice bath and slowly add, with swirling, 25.0 ml of 0.25 N $K_2Cr_2O_7$ (6.2). Now add 70 ml of sulfuric acid-silver

sulfate solution (6.3) to the cooled reflux flask, again using slow addition with swirling motion.

Caution: Care must be taken to assure that the contents of the flask are well mixed. If not, superheating may result, and the mixture may be blown out of the open end of the condenser.

7.1.1 If volatile organics are present in the sample, use an allihn condenser and add the sulfuric acid-silver sulfate solution through the condenser, while cooling the flask, to reduce loss by volatilization.

7.2 Apply heat to the flask and reflux for 2 hours. For some waste waters, the 2-hour reflux period is not necessary. The time required to give the maximum oxidation for a wastewater of constant or known composition may be determined and a shorter period of refluxing may be permissible.

7.3 Allow the flask to cool and wash down the condenser with about 25 ml of distilled water. If a round bottom flask has been used, transfer the mixture to a 500 ml Erlenmeyer flask, washing out the reflux flask 3 or 4 times with distilled water. Dilute the acid solution to about 300 ml with distilled water and allow the solution to cool to about room temperature. Add 8 to 10 drops of ferroin indicator (6.6) to the solution and titrate the excess dichromate with 0.25 N ferrous ammonium sulfate (6.4) solution to the end point. The color change will be sharp, changing from a blue-green to a reddish hue.

7.4 Blank–Simultaneously run a blank determination following the details given in (7.1) and (7.2), but using low COD water in place of sample.

8. Calculation

8.1 Calculate the COD in the sample in mg/1 as follows:

$$\text{COD, mg/liter} = \frac{(A - B)N \times 8{,}000}{S}$$

where:

A = milliliters of $Fe(NH_4)_2(SO_4)_2$ solution required for titration of the blank,

B = milliliters of $Fe(NH_4)_2(SO_4)_2$ solution required for titration of the sample,

N = normality of the $Fe(NH_4)_2(SO_4)_2$ solution, and

S = milliliters of sample used for the test.

9. Precision and Accuracy

9.1 Eighty-six analysts in fifty-eight laboratories analyzed a distilled water solution containing oxidizable organic material equivalent to 270 mg/1 COD. The standard deviation was ±17.76 mg/1 COD with an accuracy as percent relative error (bias) of -4.7%. (EPA Method Research Study 3).

Bibliography

1. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 550, Method 508 (1975).
2. Annual Book of ASTM Standards, Part 31, "Water", Standard D1252–67, p 473 (1976).

CHEMICAL OXYGEN DEMAND

Method 410.4 (Colorimetric, Automated; Manual)

STORET NO. 00340

1. Scope and Application
   - 1.1 This method covers the determination of COD in surface waters, domestic and industrial wastes.
   - 1.2 The applicable range of the automated method is 3–900 mg/1 and the range of the manual method is 20 to 900 mg/1.
2. Summary of Method
   - 2.1 Sample, blanks and standards in sealed tubes are heated in an oven or block digestor in the presence of dichromate at 150°C. After two hours, the tubes are removed from the oven or digestor, cooled and measured spectrophotometrically at 600 nm.
3. Sample Handling and Preservation
   - 3.1 Collect the samples in glass bottles if possible. Use of plastic containers is permissible if it is known that no organic contaminants are present in the containers.
   - 3.2 Samples should be preserved with sulfuric acid to a pH < 2 and maintained at 4°C until analysis.
4. Interferences
   - 4.1 Chlorides are quantitatively oxidized by dichromate and represent a positive interference. Mercuric sulfate is added to the digestion tubes to complex the chlorides.
5. Apparatus
   - 5.1 Drying oven or block digestor, 150°C
   - 5.2 Corning culture tubes, 16 x 100 mm or 25 x 150 mm with Teflon lined screw cap
   - 5.3 Spectrophotometer or Technicon AutoAnalyzer
   - 5.4 Muffle furnace, 500°C.
6. Reagents
   - 6.1 Digestion solution: Add 10.2 g $K_2Cr_2O_7$, 167 ml conc. H_2SO_4 and 33.3 g $HgSO_4$ to 500 ml of distilled water, cool and dilute to 1 liter.
   - 6.2 Catalyst solution: Add 22 g Ag_2SO_4 to a 4.09kg bottle of conc. H_2SO_4. Stir until dissolved.
   - 6.3 Sampler wash solution: Add 500 ml of conc H_2SO_4 to 500 ml of distilled water.
   - 6.4 Stock potassium acid phthalate: Dissolve 0.850 g in 800 ml of distilled water and dilute to 1 liter. 1 ml = 1 mg COD
     - 6.4.1 Prepare a series of standard solutions that cover the expected sample concentrations by diluting appropriate volumes of the stock standard.
7. Procedure
   - 7.1 Wash all culture tubes and screw caps with 20% H_2SO_4 before their first use to prevent contamination. Trace contamination may be removed from the tubes by igniting them in a muffle oven at 500°C for 1 hour.

Issued 1978

7.2 Automated

7.2.1 Add 2.5 ml of sample to the 16 x 100 mm tubes.

7.2.2 Add 1.5 ml of digestion solution (6.1) and mix.

7.2.3 Add 3.5 ml of catalyst solution (6.2) carefully down the side of the culture tube.

7.2.4 Cap tightly and shake to mix layers.

7.2.5 Process standards and blanks exactly as the samples.

7.2.6 Place in oven or block digestor at 150°C for two hours.

7.2.7 Cool, and place standards in sampler in order of decreasing concentration. Complete filling sampler tray with unknown samples.

7.2.8 Measure color intensity on AutoAnalyzer at 600 nm.

7.3 Manual

7.3.1 The following procedure may be used if a larger sample is desired or a spectrophotometer is used in place of an AutoAnalyzer.

7.3.2 Add 10 ml of sample to 25 x 150 mm culture tube.

7.3.3 Add 6 ml of digestion solution (6.1) and mix.

7.3.4 Add 14 ml of catalyst solution (6.2) down the side of culture tube.

7.3.5 Cap tightly and shake to mix layers.

7.3.6 Place in oven or block digestor at 150°C for 2 hours.

7.3.7 Cool, allow any precipitate to settle and measure intensity in spectrophotometer at 600 nm. Use only optically matched culture tubes or a single cell for spectrophotometric measurement.

8. Calculation

8.1 Prepare a standard curve by plotting peak height or percent transmittance against known concentrations of standards.

8.2 Compute concentration of samples by comparing sample response to standard curve.

9. Precision and Accuracy

9.1 Precision and accuracy data are not available at this time.

Bibliography

1. Jirka, A. M., and M. J. Carter, "Micro-Semi-Automated Analysis of Surface and Wastewaters for Chemical Oxygen Demand." Anal. Chem. 47:1397, (1975).

	10	
std:	25	100
	50	250
	75	500
	100	750
		900

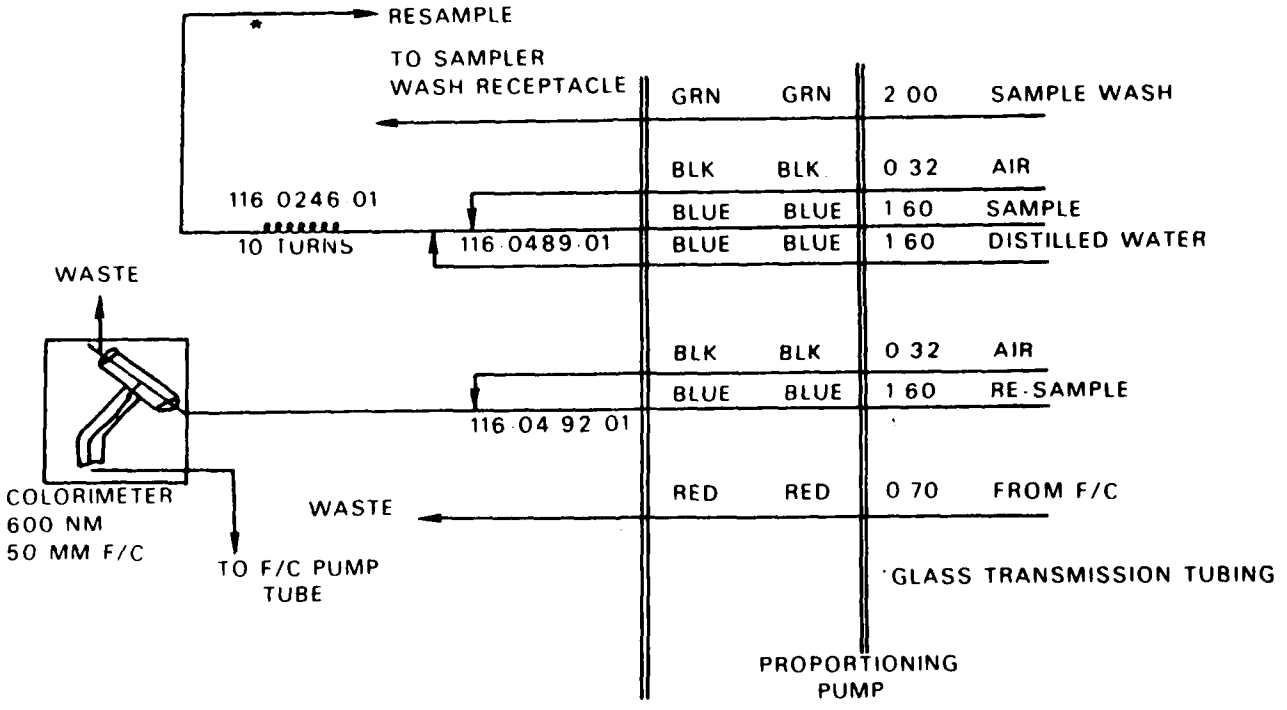


FIGURE 1 C O D MANIFOLD AA1 OR AA 11

Figure 1. Purging device

CADMIUM

Method 213.2 (Atomic Absorption, furnace technique)

STORET NO. 01027
Dissolved 01025
Suspended 01026

Optimum Concentration Range: 0.5–10 ug/l
Detection Limit: 0.1 ug/l

Preparation of Standard Solution

1. Stock solution: Prepare as described under "direct aspiration method".
2. Ammonium Phosphate solution (40%): Dissolve 40 grams of ammonium phosphate, $(NH_4)2HPO_4$ (analytical reagent grade) in deionized distilled water and dilute to 100 ml.
3. Prepare dilutions of the stock cadmium solution to be used as calibration standards at the time of analysis. To each 100 ml of standard and sample alike add 2.0 ml of the ammonium phosphate solution. The calibration standards should be prepared to contain 0.5% (v/v) HNO_3.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. Prepare as described under "direct aspiration method". Sample solutions for analysis should contain 0.5% (v/v) HNO_3.

Instrument Parameters (General)

1. Drying Time and Temp: 30 sec–125°C.
2. Ashing Time and Temp: 30 sec–500°C.
3. Atomizing Time and Temp: 10 sec–1900°C.
4. Purge Gas Atmosphere: Argon
5. Wavelength: 228.8 nm
6. Other operating parameters should be set as specified by the particular instrument manufacturer.

Analysis Procedure

1. For the analysis procedure and the calculation, see "Furnace Procedure" part 9.3 of the Atomic Absorption Methods section of this manual.

Approved for NPDES and SDWA
Issued 1978

Notes

1. The above concentration values and instrument conditions are for a Perkin-Elmer HGA-2100, based on the use of a 20 ul injection, continuous flow purge gas and non-pyrolytic graphite. Smaller size furnace devices or those employing faster rates of atomization can be operated using lower atomization temperatures for shorter time periods than the above recommended se ngs.
2. The use of backgrouna correction is recommended.
3. Contamination from the work area is critical in cadmium analysis. Use of pipet tips which are free of cadmium is of particular importance. (See part 5.5.7 of the Atomic Absorption Methods section of this manual.)
4. For every sample matrix analyzed, verification is necessary to determine that method of standard addition is not required (see part 5.2.1 of the Atomic Absorption Methods section of this manual).
5. If method of standard addition is required, follow the procedure given earlier in part 8.5 of the Atomic Absorption Methods section of this manual.
6. For quality control requirements and optional recommendations for use in drinking water analyses, see part 10 of the Atomic Absorption Methods section of this manual.
7. Data to be entered into STORET must be reported as ug/1.

Precision and Accuracy

1. In a single laboratory (EMSL), using Cincinnati, Ohio tap water spiked at concentrations of 2.5, 5.0 and 10.0 ug Cd/1, the standard deviations were ±0.10, ±0.16 and ±0.33, respectively. Recoveries at these levels were 96%, 99% and 98%, respectively.

CHROMIUM

Method 218.1 (Atomic Absorption, direct aspiration)

STORET NO. Total 01034
Dissolved 01030
Suspended 01031

Optimum Concentration Range: 0.5–10 mg/1 using a wavelength of 357.9 nm
Sensitivity: 0.25 mg/1
Detection Limit: 0.05 mg/1

Preparation of Standard Solution

1. Stock Solution: Dissolve 1.923 g of chromium trioxide (CrO_3, reagent grade) in deionized distilled water. When solution is complete, acidify with redistilled HNO_3 and dilute to 1 liter with deionized distilled water. 1 ml = 1 mg Cr (1000 mg/1).
2. Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. The procedures for preparation of the sample as given in parts 4.1.1 thru 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

Instrumental Parameters (General)

1. Chromium hollow cathode lamp
2. Wavelength: 357.9 nm
3. Fuel: Acetylene
4. Oxidant: Nitrous oxide
5. Type of flame: Fuel rich

Analysis Procedure

1. For analysis procedure and calculation, see "Direct Aspiration", part 9.1 of the Atomic Absorption Methods section of this manual.

Approved for NPDES and SDWA
Issued 1971
Editorial revision 1974 and 1978

Notes

1. The following wavelengths may also be used:
   359.3 nm Relative Sensitivity 1.4
   425.4 nm Relative Sensitivity 2
   427.5 nm Relative Sensitivity 3
   428.9 nm Relative Sensitivity 4

2. The fuel rich air–acetylene flame provides greater sensitivity but is subject to chemical and matrix interference from iron, nickel, and other metals. If the analysis is performed in a lean flame the interference can be lessened but the sensitivity will also be reduced.
3. The suppression of both Cr (III) and Cr (VI) absorption by most interfering ions in fuel rich air-acetylene flames is reportedly controlled by the addition of 1% ammonium bifluoride in 0.2% sodium sulfate [Talanta 20, 631 (1973)]. A 1% oxine solution is also reported to be useful.
4. For levels of chromium between 50 and 200 *ug*/1 where the air-acetylene flame can not be used or for levels below 50 *ug*/1, either the furnace procedure or the extraction procedure is recommended. See Method 218.2 for the furnace procedure and Method 218.3 for the chelation–extraction procedure.
5. For quality control requirements and optional recommendations for use in drinking water analyses, see part 10 of the Atomic Absorption Methods section of this manual.
6. Data to be entered into **STORET** must be reported as *ug*/1.

Precision and Accuracy

1. An interlaboratory study on trace metal analyses by atomic absorption was conducted by the Quality Assurance and Laboratory Evaluation Branch of EMSL. Six synthetic concentrates containing varying levels of aluminum, cadmium, chromium, copper, iron, manganese, lead and zinc were added to natural water samples. The statistical results for chromium were as follows:

Number of Labs	True Values *ug*/liter	Mean Value *ug*/liter	Standard Deviation *ug*/liter	Accuracy as % Bias
74	370	353	105	–4.5
76	407	380	128	–6.5
72	74	72	29	–3.1
70	93	84	35	–10.2
47	7.4	10.2	7.8	37.7
47	15.0	16.0	9.0	6.8

COPPER

Method 220.1 (Atomic Absorption, direct aspiration)

STORET NO. Total 01042
Dissolved 01040
Suspended 01041

Optimum Concentration Range: 0.2–5 mg/1 using a wavelength of 324.7 nm
Sensitivity: 0.1 mg/1
Detection Limit: 0.02 mg/1

Preparation of Standard Solution

1. Stock Solution: Carefully weigh 1.00 g of electrolyte copper (analytical reagent grade). Dissolve in 5 ml redistilled HNO_3 and make up to 1 liter with deionized distilled water. Final concentration is 1 mg Cu per ml (1000 mg/1).
2. Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. The procedures for preparation of the sample as given in parts 4.1.1 thru 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

Instrumental Parameters (General)

1. Copper hollow cathode lamp
2. Wavelength: 324.7 nm
3. Fuel: Acetylene
4. Oxidant: Air
5. Type of flame: Oxidizing

Analysis Procedure

1. For analysis procedure and calculation, see "Direct Aspiration", part 9.1 of the Atomic Absorption Methods section of this manual.

Approved for NPDES
Issued 1971
Editorial revision 1974 and 1978

Notes

1. For levels of copper below 50 *ug/1*, either the Special Extraction Procedure, given in part 9.2 of the Atomic Absorption Methods section or the furnace technique, Method 220.2, is recommended.
2. Numerous absorption lines are available for the determination of copper. By selecting a suitable absorption wavelength, copper samples may be analyzed over a very wide range of concentration. The following lines may be used:
   327.4 nm Relative Sensitivity 2
   216.5 nm Relative Sensitivity 7
   222.5 nm Relative Sensitivity 20
3. Data to be entered into **STORET** must be reported as *ug/1*.
4. The 2,9-dimethyl-1, 10-phenanthroline colorimetric method may also be used (Standard Methods, 14th Edition, p. 196).

Precision and Accuracy

1. An interlaboratory study on trace metal analyses by atomic absorption was conducted by the Quality Assurance and Laboratory Evaluation Branch of EMSL. Six synthetic concentrates containing varying levels of aluminum, cadmium, chromium, copper, iron, manganese, lead and zinc were added to natural water samples. The statistical results for copper were as follows:

Number of Labs	True Values *ug/liter*	Mean Value *ug/liter*	Standard Deviation *ug/liter*	Accuracy as % Bias
91	302	305	56	0.9
92	332	324	56	-2.4
86	60	64	23	7.0
84	75	76	22	1.3
66	7.5	9.7	6.1	29.7
66	12.0	13.9	9.7	15.5

LEAD
Method 239.2 (Atomic Absorption, furnace technique)

STORET NO. Total 01051
Dissolved 01049
Suspended 01050

Optimum Concentration Range: 5–100 *ug/l*
Detection Limit: 1 *ug/l*

Preparation of Standard Solution

1. Stock solution: Prepare as described under "direct aspiration method".
2. Lanthanum Nitrate Solution: Dissolve 58.64 g of ACS reagent grade La_2O_3 in 100 ml conc. HNO_3 and dilute to 1000 ml with deionized distilled water. 1 ml = 50 mg La.
3. Working Lead Solution: Prepare dilutions of the stock lead solution to be used as calibration standards at the time of analysis. Each calibration standard should contain 0.5% (v/v) HNO_3. To each 100 ml of diluted standard add 10 ml of the lanthanum nitrate solution.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. Prepare as described under "direct aspiration method". Sample solutions for analysis should contain 0.5% (v/v) HNO_3.
2. To each 100 ml of prepared sample solution add 10 ml of the lanthanum nitrate solution.

Instrument Parameters (General)

1. Drying Time and Temp: 30 sec–125°C.
2. Ashing Time and Temp: 30 sec–500°C.
3. Atomizing Time and Temp: 10 sec–2700°C.
4. Purge Gas Atmosphere: Argon
5. Wavelength: 283.3 nm
6. Other operating parameters should be set as specified by the particular instrument manufacturer.

Analysis Procedure

1. For the analysis procedure in the calculation see "Furnace Procedure", part 9.3 of the Atomic Absorption Methods section of this manual.

Approved for NPDES and SDWA
Issued 1978

Notes

1. The above concentration values and instrument conditions are for a Perkin-Elmer HGA-2100, based on the use of a 20 *ul* injection, continuous flow purge gas and non-pyrolytic graphite. Smaller size furnace devices or those employing faster rates of atomization can be operated using lower atomization temperatures for shorter time periods than the above recommended settings.
2. The use of background correction is recommended.
3. Greater sensitivity can be achieved using the 217.0 nm line, but the optimum concentration range is reduced. The use of a lead electrodeless discharge lamp at this lower wavelength has been found to be advantageous. Also a lower atomization temperature (2400°C) may be preferred.
4. To suppress sulfate interference (up to 1500 ppm) lanthanum is added as the nitrate to both samples and calibration standards. (Atomic Absorption Newsletter Vol. 15, No. 3, p 71, May-June 1976.)
5. Since glassware contamination is a severe problem in lead analysis, all glassware should be cleaned immediately prior to use, and once cleaned, should not be open to the atmosphere except when necessary.
6. For every sample matrix analyzed, verification is necessary to determine that method of standard addition is not required (see part 5.2.1 of the Atomic Absorption Methods section of this manual).
7. For quality control requirements and optional recommendations for use in drinking water analyses, see part 10 of the Atomic Absorption Methods section of this manual.
8. If method of standard addition is required, follow the procedure given earlier in part 8.5 of the Atomic Absorption Methods section of this manual.
9. Data to be entered into STORET must be reported as *ug*/1.

Precision and Accuracy

1. In a single laboratory (EMSL), using Cincinnati, Ohio tap water spiked at concentrations of 25, 50, and 100 *ug* Pb/1, the standard deviations were ±1.3, ±1.6, and ±3.7, respectively. Recoveries at these levels were 88%, 92%, and 95% respectively.

NICKEL

Method 249.1 (Atomic Absorption, direct aspiration)

STORET NO. Total 01067
Dissolved 01065
Suspended 01066

Optimum Concentration Range: 0.3–5 mg/l using a wavelength of 232.0 nm
Sensitivity: 0.15 mg/l
Detection Limit: 0.04 mg/l

Preparation of Standard Solution

1. Stock Solution: Dissolve 4.953 g of nickel nitrate, $Ni(NO_3)_2 \cdot 6H_2O$ (analytical reagent grade) in deionized distilled water. Add 10 ml of conc. nitric acid and dilute to 1 liter with deionized distilled water. 1 ml = 1 mg Ni (1000 mg/l).
2. Prepare dilutions of the stock nickel solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. The procedures for preparation of the sample as given in parts 4.1.1 thru 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

Instrumental Parameters (General)

1. Nickel hollow cathode lamp
2. Wavelength: 232.0 nm
3. Fuel: Acetylene
4. Oxidant: Air
5. Type of Flame: Oxidizing

Analysis Procedure

1. For analysis procedure and calculation, see "Direct Aspiration", part 9.1 of the Atomic Absorption Methods section of this manual.

Approved for NPDES
Issued 1974
Editorial revision 1978

Interferences

1. The 352.4 nm wavelength is less susceptible to spectral interference and may be used. The calibration curve is more linear at this wavelength; however, there is some loss of sensitivity.

Notes

1. For levels of nickel below 100 *ug*/1, either the Special Extraction Procedure, given in part 9.2 of the Atomic Absorption Methods section or the furnace technique, Method 249.2, is recommended.
2. Data to be entered into **STORET** must be reported as *ug*/1.
3. The heptoxime method may also be used (Standard Methods, 14th Edition, p 232).

Precision and Accuracy

1. In a single laboratory (EMSL), using a mixed industrial-domestic waste effluent at concentrations of 0.20, 1.0 and 5.0 mg Ni/1, the standard deviations were ±0.011, ±0.02 and ±0.04, respectively. Recoveries at these levels were 100%, 97% and 93%, respectively.

ZINC

Method 289.1 (Atomic Absorption, direct aspiration)

STORET NO. Total 01092
Dissolved 01090
Suspended 01091

Optimum Concentration Range: 0.05–1 mg/l using a wavelength of 213.9 nm
Sensitivity: 0.02 mg/l
Detection Limit: 0.005 mg/l

Preparation of Standard Solution

1. Stock Solution: Carefully weigh 1.00 g of zinc metal (analytical reagent grade) and dissolve cautiously in 10 ml HNO_3. When solution is complete make up to 1 liter with deionized distilled water. 1 ml = 1 mg Zn (1000 mg/l).
2. Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing.

Sample Preservation

1. For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

Sample Preparation

1. The procedures for preparation of the sample as given in parts 4.1.1 thru 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

Instrumental Parameters

1. Zinc hollow cathode lamp
2. Wavelength: 213.9 nm
3. Fuel: Acetylene
4. Oxidant: Air
5. Type of flame: Oxidizing

Analysis Procedure

1. For the analysis procedure and the calculation, see "direct aspiration" part 9.1 of the Atomic Absorption Methods section of this manual.

Approved for NPDES
Issued 1971
Editorial revision 1974

Notes

1. High levels of silicon may interfere.
2. The air-acetylene flame absorbs about 25% of the energy at the 213.9 nm line.
3. The sensitivity may be increased by the use of low-temperature flames.
4. Some sample container cap liners can be a source of zinc contamination. To circumvent or avoid this problem, the use of polypropylene caps is recommended.
5. The dithizone colorimetric method may also be used (Standard Methods, 14th Edition, p 265).
6. For concentrations of zinc below 0.01 mg/1, either the Special Extraction Procedure given in part 9.2 of the Atomic Absorption Methods section or the furnace procedure, Method 289.2, is recommended.
7. Data to entered into Storet must be reported as *ug*/1.

Precision and Accuracy

1. An interlaboratory study on trace metal analyses by atomic absorption was conducted by the Quality Assurance and Laboratory Evaluation Branch of EMSL. Six synthetic concentrates containing varying levels of aluminum, cadmium, chromium, copper, iron, manganese, lead and zinc were added to natural water samples. The statistical results for zinc were as follows:

Number of Labs	True Values *ug*/liter	Mean Value *ug*/liter	Standard Deviation *ug*/liter	Accuracy as % Bias
86	281	284	97	1.2
89	310	308	114	-0.7
82	56	62	28	11.3
81	70	75	28	6.6
62	7	22	26	206
61	11	17	18	56.6

PETROLEUM HYDROCARBONS, TOTAL RECOVERABLE

Method 418.1 (Spectrophotometric, Infrared)

STORET NO. 45501

1. Scope and Application
   - 1.1 This method is for the measurement of fluorocarbon-113 extractable petroleum hydrocarbons from surface and saline waters, industrial and domestic wastes.
   - 1.2 The method is applicable to measurement of light fuels, although loss of about half of any gasoline present during the extraction manipulations can be expected.
   - 1.3 The method is sensitive to levels of 1 mg/l and less, and may be extended to ambient monitoring.
2. Summary of Method
   - 2.1 The sample is acidified to a low pH (< 2) and serially extracted with fluorocarbon-113 in a separatory funnel. Interferences are removed with silica gel adsorbant. Infrared analysis of the extract is performed by direct comparison with standards.
3. Definitions
   - 3.1 As in the case of Oil and Grease, the parameter of Petroleum Hydrocarbons is defined by the method. The measurement may be subject to interferences and the results should be evaluated accordingly.
   - 3.2 Oil and Grease is a measure of biodegradable animal greases and vegetable oils along with the relative non-biodegradable mineral oils. Petroleum hydrocarbons is the measure of only the mineral oils. Maximum information may be obtained using both methods to measure and characterize oil and grease of all sources.
4. Sampling and Storage
   - 4.1 A representative sample of 1 liter volume should be collected in a glass bottle. Because losses of grease will occur on sampling equipment, the collection of a composite sample is impractical. The entire sample is consumed by this test; no other analyses may be performed using aliquots of the sample.
   - 4.2 A delay between sampling and analysis of greater than 4 hours requires sample preservation by the addition of 5 ml HCl (6.1). A delay of greater than 48 hours also requires refrigeration for sample preservation.
5. Apparatus
   - 5.1 Separatory funnel, 2000 ml, with Teflon stopcock.
   - 5.2 Filter paper, Whatman No. 40, 11 cm.
   - 5.3 Infrared spectrophotometer, scanning or fixed wavelength, for measurement around 2950 cm^{-1}.
   - 5.4 Cells, 10 mm, 50 mm, and 100 mm pathlength, sodium chloride or infrared grade glass.
   - 5.5 Magnetic stirrer, with Teflon coated stirring bars.
6. Reagents
   - 6.1 Hydrochloric acid, 1:1. Mix equal volumes of conc HCl and distilled water.

Issued 1978

6.2 Fluorocarbon-113,(1,1,2-trichloro-1,2,2-trifluroethane), b.p. 48°C.

6.3 Sodium sulfate, anhydrous crystal.

6.4 Silica gel, 60–200 mesh, Davidson Grade 950 or equivalent. Should contain 1–2% water as defined by residue test at 130°C. Adjust by overnight equilibration if needed.

6.5 Calibration mixtures:

6.5.1 Reference oil: Pipet 15.0 ml n-hexadecane, 15.0 ml isooctane, and 10.0 ml chlorobenzene into a 50 ml glass stoppered bottle. Maintain the integrity of the mixture by keeping stoppered except when withdrawing aliquots.

6.5.2 Stock standard: Pipet 1.0 ml reference oil (6.5.1) into a tared 200 ml volumetric flask and immediately stopper. Weigh and dilute to volume with fluorocarbon-113.

6.5.3 Working standards: Pipet appropriate volumes of stock standard (6.5.2) into 100 ml volumetric flasks according to the cell pathlength to be used. Dilute to volume with fluorocarbon-113. Calculate concentration of standards from the stock standard.

7. Procedure

7.1 Mark the sample bottle at the water meniscus for later determination of sample volume. If the sample was not acidified at time of collection, add 5 ml hydrochloric acid (6.1) to the sample bottle. After mixing the sample, check the pH by touching pH-sensitive paper to the cap to insure that the pH is 2 or lower. Add more acid if necessary.

7.2 Pour the sample into a separatory funnel.

7.3 Add 30 ml fluorocarbon-113 (6.2) to the sample bottle and rotate the bottle to rinse the sides. Transfer the solvent into the separatory funnel. Extract by shaking vigorously for 2 minutes. Allow the layers to separate.

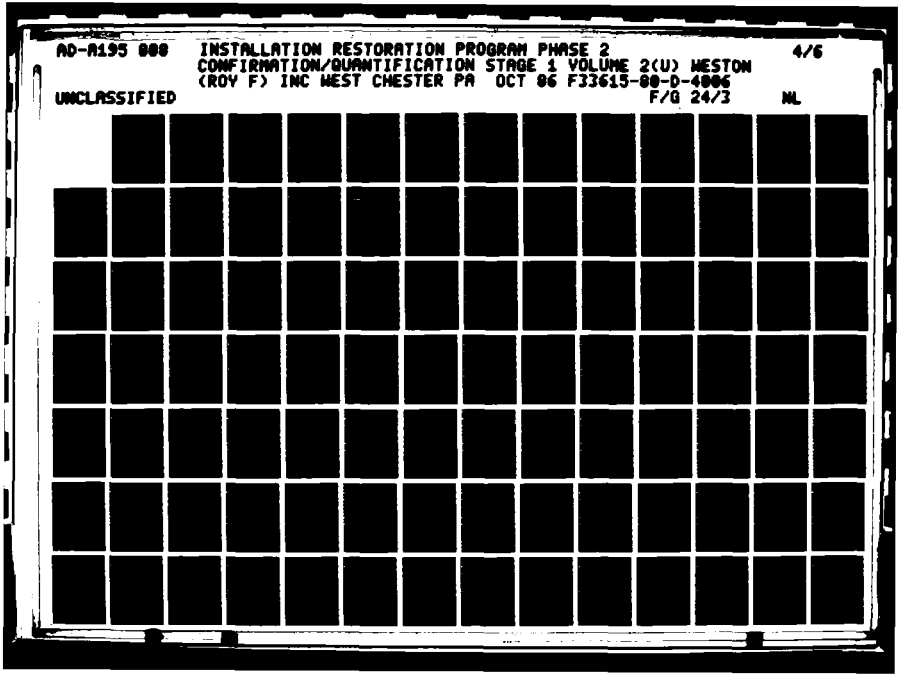
7.4 Filter the solvent layer through a funnel containing solvent-moistened filter paper into a 100 ml volumetric flask.

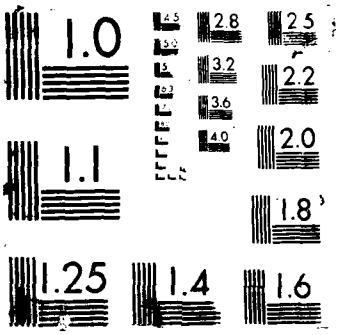
NOTE 1: An emulsion that fails to dissipate can be broken by pouring about 1 g sodium sulfate (6.3) into the filter paper cone and slowly draining the emulsion through the salt. Additional 1 g portions can be added to the cone as required.

7.5 Repeat (7.3 and 7.4) twice more with 30 ml portions of fresh solvent, combining all solvent into the volumetric flask.

7.6 Rinse the tip of the separatory funnel, filter paper, and the funnel with a total of 5–10 ml solvent and collect the rinsings in the flask. Dilute the extract to 100 ml. If the extract is known to contain greater than 100 mg of non-hydrocarbon organic material, pipet an appropriate portion of the sample to a 100 ml volumetric and dilute to volume.

7.7 Discard about 5–10 ml solution from the volumetric flask. Add 3 g silica gel (6.4) and a stirring bar; stopper the volumetric flask, and stir the solution for a minimum of 5 min on a magnetic stirrer.


AD-A195 000
INSTALLATION RESTORATION PROGRAM PHASE 2
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-80-D-4006
4/6
UNCLASSIFIED
F/G 24/3
NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

OIL AND GREASE, TOTAL RECOVERABLE

Method 413.2 (Spectrophotometric, Infrared)

STORET NO. 00560

1. Scope and Application
   - 1.1 This method includes the measurement of fluorocarbon-113 extractable matter from surface and saline waters, industrial and domestic wastes. It is applicable to the determination of hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases and related matter.
   - 1.2 The method is applicable to measurement of most light petroleum fuels, although loss of about half of any gasoline present during the extraction manipulations can be expected.
   - 1.3 The method covers the range from 0.2 to 1000 mg/1 of extractable material.
   - 1.4 While this method can be used to obtain an estimate of the oil and grease that would be measured gravimetrically, in many cases the estimate more accurately describes the parameter, as it will measure volatiles more effectively and is not susceptible to interferences such as extractable sulfur. It can be used with the Petroleum Hydrocarbon procedure to obtain an oil and grease value and a petroleum hydrocarbon value on the same sample.
2. Summary of Method
   - 2.1 The sample is acidified to a low pH (< 2) and extracted with fluorocarbon-113. The oil and grease is determined by comparison of the infrared absorbance of the sample extract with standards.
3. Definitions
   - 3.1 The definition of oil and grease is based on the procedure used. The source of the oil and/or grease, and the presence of extractable non-oily matter will influence the material measured and interpretation of results.
4. Sampling and Storage
   - 4.1 A representative sample of 1 liter volume should be collected in a glass bottle. If analysis is to be delayed for more than a few hours, the sample is preserved by the addition of 5 ml HCl (6.1) at the time of collection and refrigerated at 4°C.
   - 4.2 Because losses of grease will occur on sampling equipment, the collection of a composite sample is impractical. Individual portions collected at prescribed time intervals must be analyzed separately to obtain the average concentration over an extended period.
5. Apparatus
   - 5.1 Separatory funnel, 2000 ml, with Teflon stopcock.
   - 5.2 Infrared spectrophotometer, scanning. Non-scanning instruments may also be used but can be subject to positive interferences in complex chemical wastewaters.
   - 5.3 Cells, 10 mm, 50 mm, and 100 mm path length, sodium chloride or infrared grade glass.
   - 5.4 Filter paper, Whatman No. 40, 11 cm.

Issued 1974
Editorial revision 1978

6. Reagents

6.1 Hydrochloric acid, 1:1. Mix equal volumes of conc. HCl and distilled water.

6.2 Fluorocarbon-113, (1,1,2-trichloro-1,2,2-trifluoroethane), b. p. 48°C.

6.3 Sodium sulfate, anhydrous crystal.

6.4 Calibration mixtures:

6.4.1 Reference oil: Pipet 15.0 ml n-hexadecane, 15.0 ml isooctane, and 10.0 ml chlorobenzene into a 50 ml glass stoppered bottle. Maintain the integrity of the mixture by keeping stoppered except when withdrawing aliquots.

6.4.2 Stock standard: Pipet 1.0 ml reference oil (6.4.1) into a tared 200 ml volumetric flask and immediately stopper. Weigh and dilute to volume with fluorocarbon-113.

6.4.3 Working standards: Pipet appropriate volumes of stock standard (6.4.2) into 100 ml volumetric flasks according to the cell pathlength to be used. Dilute to volume with fluorocarbon-113. Calculate concentration of standards from the stock standard.

7. Procedure

7.1 Mark the sample bottle at the water meniscus for later determination of sample volume. If the sample was not acidified at time of collection, add 5 ml hydrochloric acid (6.1) to the sample bottle. After mixing the sample, check the pH by touching pH-sensitive paper to the cap to insure that the pH is 2 or lower. Add more acid if necessary.

7.2 Pour the sample into a separatory funnel.

7.3 Add 30 ml fluorocarbon-113 (6.2) to the sample bottle and rotate the bottle to rinse the sides. Transfer the solvent into the separatory funnel. Extract by shaking vigorously for 2 minutes. Allow the layers to separate.

7.4 Filter the solvent layer into a 100 ml volumetric flask through a funnel containing solvent-moistened filter paper.

NOTE: An emulsion that fails to dissipate can be broken by pouring about 1 g sodium sulfate (6.3) into the filter paper cone and slowly draining the emulsion through the salt. Additional 1 g portions can be added to the cone as required.

7.5 Repeat (7.3 and 7.4) twice more with 30 ml portions of fresh solvent, combining all solvent in the volumetric flask.

7.6 Rinse the tip of the separatory funnel, filter paper, and the funnel with a total of 5–10 ml fluorocarbon-113 and collect the rinsings in the flask. Dilute the extract to 100 ml, and stopper the flask.

7.7 Select appropriate working standards and cell pathlength according to the following table of approximate working ranges:

Pathlength	Range
10 mm	2–40 mg
50 mm	0.4–8 mg
100 mm	0.1–4 mg

7.8 Scan standards and samples from 3200 cm^{-1} to 2700 cm^{-1} with fluorocarbon-113 in the reference beam and record the results on absorbance paper. The absorbances of samples

and standards are measured by constructing a straight baseline over the range of the scan and measuring the absorbance of the peak maximum at 2930 cm^{-1} and subtracting the baseline absorbance at that point. For an example of a typical oil spectrum and baseline construction, see Gruenfeld[3]. Non-scanning instruments should be operated according to manufacturer's instructions, although calibration must be performed using the standards described above (6.4). If the absorbance exceeds 0.8 for a sample, select a shorter pathlength or dilute as required.

7.9 Use a calibration plot of absorbance vs. mg oil prepared from the standards to determine the mg oil in the sample solution.

8. Calculation

8.1 $$\text{mg/l total oil and grease} = \frac{R \times D}{V}$$

where:

R = oil in solution, determined from calibration plot, in milligrams.
D = extract dilution factor, if used.
V = volume of sample, determined by refilling sample bottle to calibration line and correcting for acid addition if necessary, in liters.

9. Precision and Accuracy

9.1 The two oil and grease methods in this manual were tested by a single laboratory (EMSL) on sewage. This method determined the oil and grease level in the sewage to be 17.5 mg/l. When 1 liter portions of the sewage were dosed with 14.0 mg of a mixture of #2 fuel oil and Wesson oil, the recovery was 99% with a standard deviation of ±1.4 mg/l.

Bibliography

1. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 516, Method 502B, (1975).
2. American Petroleum Institute, "Manual on Disposal of Refinery Wastes", Vol. IV, Method 733–58 (1958).
3. Gruenfeld, M., "Extraction of Dispersed Oils from Water for Quantitative Analysis by Infrared Spectroscopy", Environ. Sci. Technol. 7, 636 (1973).

APPENDIX H

Analytical Laboratory Data

Contents

	Page
Results, Sampling Round 1	H1
Results, Resampling	H98

RESULTS

Sampling Round 1

inter-office memorandum

TO: [redacted]
ROBERT KARNAUSKAS
KASS SHEEDY
RICH JOHNSON

DATE: MAY 31, 1985

RECEIVED

ORIGINAL

FROM: JUDY PORTA

SUBJECT: SELFRIDGE A.F.B.
RESULTS FOR WATER SAMPLES

W. O. No.: 0628-05-49

Enclosed is the analytical report for analyses of water samples for the above-referenced client. The results for VOA resamples will be available by June 7, 1985.

DATE OF REPORT: MAY 22, 1985

SELFRIDGE A.F.B.
WATER SAMPLES
SUMMARY REPORT
W.O. NO. 0628-05-49

I. pH ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	pH
8504-422-0010	W-1	4-18-85	4-19-85	4-22-85	7.0
-0020	W-2	4-18-85	4-19-85	4-22-85	7.1
-0020R	W-2 (DUP)	4-18-85	4-19-85	4-22-85	7.1
8503-273-0140	W-3	3-09-85	3-13-85	3-14-85	7.4
-0080	W-4	3-09-85	3-13-85	3-14-85	7.1
8503-263-0020	W-5	3-08-85	3-11-85	3-11-85	7.0
8503-273-0120	W-6	3-09-85	3-13-85	3-14-85	7.0
-0130	W-7	3-09-85	3-13-85	3-14-85	6.9
8503-263-0010	W-8	3-08-85	3-11-85	3-11-85	6.8
-0050	W-9	3-08-85	3-11-85	3-11-85	7.5
-0040	W-10	3-08-85	3-11-85	3-11-85	7.5
8503-273-0090	W-11	3-10-85	3-13-85	3-14-85	7.1
-0100	W-12	3-10-85	3-13-85	3-14-85	7.1
-0010	W-13	3-11-85	3-13-85	3-14-85	6.8
-0020	W-14	3-11-85	3-13-85	3-14-85	7.2
-0190	W-15	3-11-85	3-13-85	3-14-85	7.4
8503-254-0010	W-16	3-06-85	3-07-85	3-08-85	6.7
-0020	W-17	3-06-85	3-07-85	3-08-85	6.8
-0030	W-18	3-06-85	3-07-85	3-08-85	7.2
-0040	W-19	3-06-85	3-07-85	3-08-85	7.5
-0050	W-20	3-06-85	3-07-85	3-08-85	7.4
-0070	W-20A	3-06-85	3-07-85	-------	NOT REQUESTED
-0060	W-21	3-06-85	3-07-85	3-08-85	7.1
8503-256-0010	W-22	3-07-85	3-08-85	3-12-85	6.9
8503-263-0030	W-23	3-07-85	3-11-85	3-11-85	7.1
8503-256-0020	W-24	3-07-85	3-08-85	3-12-85	6.2
-0030	W-25	3-07-85	3-08-85	3-12-85	7.2
8503-273-0110	W-41	3-10-85	3-13-85	3-14-85	7.2

b) Ideally, pH measurements should be determined in the field. These readings serve to confirm any field measurements. There are no specific requirements for pH determination in this task order so pH measurements were taken using a Beckman Expandomatic SS-2 pH meter.

II. SPECIFIC CONDUCTANCE ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	SP. COND uMHOS/CM
8504-422-0010	W-1	4-18-85	4-19-85	4-22-85	758
-0020	W-2	4-18-85	4-19-85	4-22-85	534
-0020R	W-2 (DUP)	4-18-85	4-19-85	4-22-85	537
8503-273-0140	W-3	3-09-85	3-13-85	3-14-85	1,140
-0080	W-4	3-09-85	3-13-85	3-14-85	839
8503-263-0020	W-5	3-08-85	3-11-85	3-11-85	2,630
-0020R	W-5 (DUP)	3-08-85	3-11-85	3-11-85	2,610
8503-273-0120	W-6	3-09-85	3-13-85	3-14-85	2,590
-0120R	W-6	3-09-85	3-13-85	3-14-85	2,630
-0130	W-7	3-09-85	3-13-85	3-14-85	3,700
-0130R	W-7	3-09-85	3-13-85	3-14-85	3,770
8503-263-0010	W-8	3-08-85	3-11-85	3-11-85	1,450
-0050	W-9	3-08-85	3-11-85	3-11-85	983
-0040	W-10	3-08-85	3-11-85	3-11-85	404
8503-273-0090	W-11	3-10-85	3-13-85	3-14-85	777
-0100	W-12	3-10-85	3-13-85	3-14-85	1,300
-0010	W-13	3-11-85	3-13-85	3-14-85	1,150
-0020	W-14	3-11-85	3-13-85	3-14-85	1,110
-0190	W-15	3-11-85	3-13-85	3-14-85	1,010
8503-254-0010	W-16	3-06-85	3-07-85	3-08-85	1,080
-0020	W-17	3-06-85	3-07-85	3-08-85	1,110
-0030	W-18	3-06-85	3-07-85	3-08-85	1,080
-0040	W-19	3-06-85	3-07-85	3-08-85	3,290
-0050	W-20	3-06-85	3-07-85	3-08-85	8,600
-0060	W-21	3-06-85	3-07-85	3-08-85	1,580
8503-256-0010	W-22	3-07-85	3-08-85	3-12-85	1,630
8503-263-0030	W-23	3-07-85	3-08-85	3-11-85	1,320
8503-256-0020	W-24	3-07-85	3-08-85	3-12-85	7,010
-0030	W-25	3-07-85	3-08-85	3-12-85	1,190
3503-273-0110	W-41	3-10-85	3-13-85	3-14-85	1,020

inter-office memorandum

TO: Skip Ricketts — Kass Sheedy
~~Jack Bowden~~ — Rich Johnson
Bob Kaurnauskas — Earl Hansen

DATE: June 19, 1985

FROM: JUDY PORTA

SUBJECT: SELFRIDGE A.F.B.
ADD'N PETROLEUM HYDROCARBON RESULT

W. O. No.: 0628-05-49

This result was inadvertantly omitted from the May 22, 1985 report of analysis for Petroleum Hydrocarbon.

R.F.W. NO:	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	THC, mg/L
8503-273-0190	W-15	3-11-85	3-12-85	3-18-85	1.0

II. SPECIFIC CONDUCTANCE (CON'T.)

b) These samples were analyzed by EPA Method 120.1 within the EPA recommended holding time of 28 days from date of collection to date of analysis. A detection limit of 5 µMHOS/CM was achieved.

III. PETROLEUM HYDROCARBON ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	THC, mg/L
8504-422-0010	W-1	4-18-85	4-19-85	5-03-85	0.7
-0020	W-2	4-18-85	4-19-85	5-03-85	0.8
8503-273-0140	W-3	3-09-85	3-13-85	3-20-85	9.2
-0080	W-4	3-09-85	3-13-85	3-18-85	0.6
8503-273-0090	W-11	3-10-85	3-13-85	3-18-85	1.3
-0100	W-12	3-10-85	3-13-85	3-18-85	1.0
-0010	W-13	3-11-85	3-13-85	3-16-85	1.9
-0020	W014	3-11-85	3-13-85	3-16-85	2.4
8503-254-0010	W-16	3-06-85	3-07-85	3-18-85	0.7
-0020	W-17	3-06-85	3-07-85	3-18-85	0.3
-0030	W-18	3-06-85	3-07-85	3-18-85	1.0
-0040	W-19	3-06-85	3-07-85	3-18-85	1.1
-0050	W-20	3-06-85	3-07-85	3-18-85	2.0
-0070	W-20A	3-06-85	3-07-85	3-18-85	1.5
-0060	W-21	3-06-85	3-07-85	3-18-85	2.4
8503-256-0010	W-22	3-07-85	3-08-85	3-18-85	0.4
-0020	W-24	3-07-85	3-08-85	3-18-85	113
-0030	W-25	3-07-85	3-08-85	3-18-85	0.8
8503-273-0110	W-41	3-10-85	3-11-85	3-18-85	1.3
-0060	W-42	3-10-85	3-13-85	3-18-85	0.1
-0070	W-43	3-10-85	3-13-85	3-18-85	0.1
-0030	FPTA #2 POND A	3-10-85	3-13-85	3-16-85	4.5
-0040	FPTA #2 POND B	3-10-85	3-13-85	3-18-85	69
-0050	FPTA #2 POND C	3-10-85	3-13-85	3-18-85	0.1

III. PETROLEUM HYDROCARBON ANALYSIS (CON'T.)

b) These samples were analyzed using EPA METHOD 418.1 within the EPA recommending holding time of 28 days. A detection limit of 100 ug/L was achieved.

IV. OIL AND GREASE ANALYSIS

a) R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	O/G mg/L
8503-263-0020	W-5	3-08-85	3-11-85	3-16-85	1.17
8503-273-0120	W-6	3-09-85	3-13-85	3-16-85	0.44
-0130	W-7	3-09-85	3-13-85	3-16-85	0.77
8503-263-0010	W-8	3-08-85	3-11-85	3-16-85	0.32
-0050	W-9	3-08-85	3-11-85	3-16-85	1.55
-0040	W-10	3-08-85	3-11-85	3-16-85	3.70
8503-273-0190	W-15	3-11-85	3-13-85	NOT REQUESTED	
8503-263-0030	W-23	3-07-85	3-08-85	3-16-85	1.38
8503-273-0150	POND 1	3-11-85	3-13-85	3-16-85	0.10
-0160	POND 2	3-11-85	3-13-85	3-16-85	0.10
-0170	POND 3	3-11-85	3-13-85	3-16-85	0.20
-0180	POND 4	3-11-85	3-13-85	3-16-85	0.11

b) These samples were analyzed using EPA METHOD 413.2 within the EPA recommended holding time of 28 days. A detection limit of 100 ug/L was achieved.

DATE OF REPORT: MAY 22, 1985

SELFRIDGE A.F.B. (WATER SAMPLES - CON'T.) PG. 5

V. TOTAL PHENOLICS ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	TOTAL PHENOLICS, mg/L
8504-422/	LAB BLANK	DNA	DNA	4-26-85	<0.005
8503-263-0020	W-5	3-08-85	3-11-85	3-13-85	0.010
8503-273-0120	W-6	3-09-85	3-13-85	3-20-85	<0.005
-0130	W-7	3-09-85	3-13-85	3-20-85	<0.005
8503-263-0010	W-8	3-08-85	3-11-85	3-13-85	0.015
-0050	W-9	3-08-85	3-11-85	3-13-85	0.013
-0040	W-10	3-08-85	3-11-85	3-13-85	<0.005
8503-254-0010	W-16	3-06-85	3-07-85	BOTTLE BROKEN ON ROUTE	
-0020	W-17	3-06-85	3-07-85	3-13-85	< 0.005
-0030	W-18	3-06-85	3-07-85	3-13-85	0.007
-0040	W-19	3-06-85	3-07-85	3-13-85	0.008
-0050	W-20	3-06-85	3-07-85	3-13-85	0.017
-0070	W-20A	3-06-85	3-07-85	3-13-85	0.007
-0060	W-21	3-06-85	3-07-85	3-13-85	0.007
8503-256-0010	W-22	3-07-85	3-08-85	3-13-85	0.022
8503-263-0030	W-23	3-07-85	3-08-85	3-13-85	0.005
8503-256-0020	W-24	3-07-85	3-08-85	3-13-85	0.435
-0030	W-25	3-07-85	3-08-85	3-13-85	<0.005

SELFRIDGE A.F.B. (WATER SAMPLES - CON'T) PG. 6

V. TOTAL PHENOLICS ANALYSIS (CON'T.)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	TOTAL PHENOLICS, mg/L
8503-273-0110	W-41	3-10-85	3-13-85	3-20-85	<0.005
-0060	W-42	3-10-85	3-13-85	3-20-85	<0.005
-0070	W-43	3-10-85	3-13-85	3-20-85	<0.005
-0030	FPTA #2 POND A	3-10-85	3-13-85	3-20-85	0.147
-0040	FPTA #2 POND B	3-10-85	3-13-85	3-20-85	0.096
-0050	FPTA #2 POND C	3-10-85	3-13-85	3-20-85	<0.005
8503-273-0150	POND 1	3-11-85	3-13-85	3-20-85	0.029
-0160	POND 2	3-11-85	3-13-85	3-20-85	<0.005
-0170	POND 3	3-11-85	3-13-85	3-20-85	0.047
-0180	POND 4	3-11-85	3-13-85	3-20-85	0.051

b) These samples were analyzed using EPA METHOD 420.1 within the EPA recommended holding time of 28 days. This method has a documented sensitivity of 5 ug/L, not the 1 ug/L requested. We achieved a 5ug/L detection limit as per the method.

VI. TOTAL ORGANIC CARBON (TOC) ANALYSIS

a) R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	TOC, mg/L
8504-422-0010	W-1	4-18-85	4-19-85	4-25-85	9.8
-0020	W-2	4-18-85	4-19-85	4-25-85	3.1
8504-422/	LAB BLANK	DNA	DNA	4-25-85	<0.5
8503-273-0140	W-3	3-09-85	3-13-85	3-20-85	5.1
-0080	W-4	3-09-85	3-13-85	3-18-85	6.3
8503-263-0020	W-5	3-08-85	3-11-85	3-18-85	8.0
8503-273-0120	W-6	3-09-85	3-13-85	3-20-85	16.4
-0130	W-7	3-09-85	3-13-85	3-20-85	11.1
8503-263-0010	W-8	3-08-85	3-11-85	3-18-85	22.9
-0050	W-9	3-08-85	3-11-85	3-18-85	12.2
-0040	W-10	3-08-85	3-11-85	3-18-85	52.0
8503-273-0090	W-11	3-10-85	3-13-85	3-18-85	11.2
-0100	W-12	3-10-85	3-13-85	3-18-85	8.2
-0100R	W-12 (DUP)	3-10-85	3-13-85	3-18-85	8.6
-0010	W-13	3-11-85	3-13-85	3-18-85	9.4
-0020	W-14	3-11-85	3-13-85	3-18-85	11.3
-0190	W-15	3-11-85	3-13-85	3-20-85	12.0
8503-254-0010	W-16	3-06-85	3-07-85	3-11-85	5.2
-0020	W-17	3-06-85	3-07-85	3-11-83	5.7
-0030	W-18	3-06-85	3-07-85	3-11-85	4.3
-0040	W-19	3-06-85	3-07-85	3-11-85	8.5
-0050	W-20	3-06-85	3-07-85	3-11-85	37.5
-0070	W-20A	3-06-85	3-07-85	3-11-85	38.5
-0060	W-21	3-06-85	3-07-85	3-11-85	28.1
8503-256-0010	W-22	3-07-85	3-08-85	3-12-85	6.2
8503-263-0030	W-23	3-07-85	3-08-85	3-18-85	8.0
8503-256-0020	W-24	3-07-85	3-08-85	3-12-85	1,670
-0020R	W-24 (DUP)	3-07-85	3-08-85	3-12-85	1,700

SELFRIDGE A.F.B. (WATER SAMPLES - CON'T.) PG. 8

VI. TOTAL ORGANIC CARBON (TOC) (CON'T.)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	TOC, mg/L
8503-256-0030	W-25	3-07-85	3-08-85	3-12-85	13.5
8503-273-0110	W-41	3-10-85	3-13-85	3-20-85	11.6
-0060	W-42	3-10-85	3-13-85	3-18-85	<0.5
-0070	W-43	3-10-85	3-13-85	3-18-85	1.8
-0030	FPTA#2 POND A	3-10-85	3-13-85	3-18-85	165
-0040	FPTA#2 POND B	3-10-85	3-13-85	3-18-85	93.0
-0050	FPTA#2 POND C	3-10-85	3-13-85	3-18-85	0.7
-0150	POND 1	3-11-85	3-13-85	3-20-85	11.5
-0160	POND 2	3-11-85	3-13-85	3-20-85	9.3
-0170	POND 3	3-11-85	3-13-85	3-20-85	6.8
-0180	POND 4	3-11-85	3-13-85	3-20-85	0.6

b) These samples were analyzed by EPA METHOD 415.2 using a DOHRMANN DC 80 CARBON ANALYZER within the EPA recommended holding time of 28 days. The limit for this method is 500 µg/L.

VII. CHEMICAL OXYGEN DEMAND (COD) ANALYSIS

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE REC'D	DATE ANALYZED	COD, mg/L
8503-263-0020	W-5	3-8-85	3-11-85	4-1-85	194
8503-273-0120	W-6	3-9-85	3-13-85	3-19-85	218
-0130	W-7	3-9-85	3-13-85	3-19-85	688
8503-263-0010	W-8	3-8-85	3-11-85	4-1-85	63
-0050	W-9	3-8-85	3-11-85	4-1-85	565
-0040	W-10	3-8-85	3-11-85	4-1-85	320
8503-256-0010	W-22	3-7-85	3-8-85	4-1-85	32
8503-263-0030	W-23	3-7-85	3-11-85	4-1-85	41
8503-256-0020	W-24	3-7-85	3-8-85	3-19-85	3,150
-0030	W-25	3-7-85	3-8-85	4-1-85	134
8503-273-0060	W-42	3-10-85	3-13-85	4-1-85	<5
-0070	W-43	3-10-85	3-13-85	4-1-85	<5
-0150	POND 1	3-11-85	3-13-85	4-1-85	42
-0160	POND 2	3-11-85	3-13-85	4-1-85	33
-0170	POND 3	3-11-85	3-13-85	4-1-85	27
-0180	POND 4	3-11-85	3-13-85	4-1-85	<5

b) These samples were analyzed by EPA METHODS 410.1 and 410.4 for low level and high level (>50 ppm) COD'S respectively in place of Standard Method 508A. The requested detection limit of 5000 ug/L was achieved.

VIII. SOLUBLE METALS ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	SOLUBLE Cd µg/L	Cr µg/L	Cu µg/L	Pb µg/L	Ni µg/L	Zn µg/L
8503-263-0020	W-5	14	<10	1,900	44	<100	<20
-0020R	W-5DUP	29	<10	N.R.	45	<100	N.R.
8503-273-0120	W-6	<10	<10	14	<10	<100	<20
-0130	W-7	<10	<10	32	<10	<100	<20
-0130R	W-7DUP	<10	<10	34	<10	<100	<20
8503-263-0010	W-8	<10	<10	<10	24	<100	<20
-0050	W-9	<10	<10	1,100	<10	<100	<20
-0040	W-10	<10	<10	1,600	11	<100	<20
8503-256-0010	W-22	<10	<10	<10	<10	<100	40
8503-263-0030	W-23	<10	<10	<10	20	<100	<20
8503-256-0020	W-24	19	<10	1,100	<10	<100	<20
8503-273-0060	W-42	<10	<10	14	<10	<100	<20
-0070	W-43	<10	<10	12	<10	<100	<20
-0150	POND 1	<10	<10	34	<10	<100	<20
-0160	POND 2	<10	<10	13	<10	<100	<20
-0170	POND 3	<10	<10	29	<10	<100	<20
-0180	POND 4	<10	<10	<10	<10	<100	<20

N.R. = NOT REPLICATED

b) These samples were analyzed as follows within the EPA recommended holding time of six months.

METAL	EPA METHOD	REQUESTED DETECTION LIMIT	DETECTION LIMIT ACHIEVED
CADMIUM (Cd)	213.2	10µg/L	10µg/L
CHROMIUM (Cr)	218.1	50µg/L	10µg/L
COPPER (Cu)	220.1	20µg/L	10µg/L
LEAD (Pb)	239.2	20µg/L	10µg/L
NICKEL (Ni)	249.1	100µg/L	100µg/L
ZINC (Zn)	289.1	50µg/L	20µg/L

inter-office memorandum

TO: [redacted] Kass Sheedy
Jack Dowden Rich Johnson
Bob Karnauskas Earl Hansen

DATE: June 14, 1985

RECEIVED
JUN 17 1985
ROY F. WESTON, INC.
BANNOCKBURN OFFICE

FROM: Judy Porta jp

SUBJECT: SELFRIDGE A.F.B.
ADD'N METALS ANALYSIS

W. O. No.: 0628-05-49

This result was inadvertantly omitted from the May 22, 1985 report of analysis for SOLUBLE METALS ANALYSIS.

R.F.W. NO.	SAMPLE DESCRIPTION	SOLUBLE					
		Cd ug/L	Cr ug/L	Cu ug/L	Pb ug/L	Ni ug/L	Zn ug/L
8503-256-0030	W-25	< 10	< 10	< 10	< 10	< 100	< 20
DATE OF ANALYSIS		3-13-85	3-13-85	3-12-85	3-12-85	3-25-85	3-25-85

JP/eb

WESTON

DATE OF REPORT: May 22, 1985

SELFRIDGE A.F.B. (CON'T) WATER SAMPLES

IX. VOLATILE ORGANIC ANALYSIS (VOA)

a) REPORTS ARE ATTACHED

b) For all but samples 8504-422-0010 and 0020 the EPA recommended holding time of 14 days between date of collection and date of analysis was exceeded. As of the date of this report, Wells 3-25 and 41-43 have been resampled. The VOA results for the resampled wells will be provided as a separate report.

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: April 18, 1985

DATE RECEIVED: April 19, 1985

RFW NO.: 8504-422-0010

DATE ANALYZED: April 25, 1985

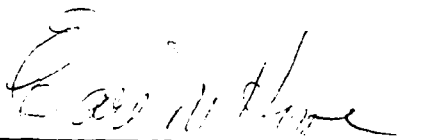
SAMPLE DESCRIPTION: W-1

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	9.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: April 18, 1985

RFW NO.: 8504-422-0020

SAMPLE DESCRIPTION: W-2

DATE RECEIVED: April 19, 1985

DATE ANALYZED: April 25, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	4.9
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 9, 1985

DATE RECEIVED: March 13, 1985

RFW NO.: 8503-273-0140

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: W-3

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: _____

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 9, 1985

RFW NO.: 8503-273-0080

SAMPLE DESCRIPTION: W-4

DATE RECEIVED: March 13, 1985

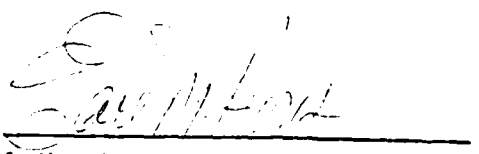
DATE ANALYZED: April 15, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	6.1
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 8, 1985

DATE RECEIVED: March 11, 1985

RFW NO.: 8503-263-0020

DATE ANALYZED: April 12, 1985

SAMPLE DESCRIPTION: W-5

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.3
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By:

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H19

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 9, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0120

SAMPLE DESCRIPTION: W-6

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.2
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: _____

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 9, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0130

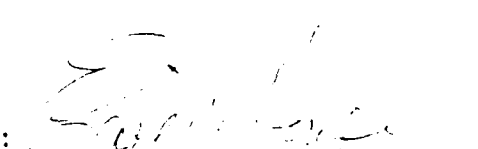
SAMPLE DESCRIPTION: W-7

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	4.7
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 8, 1985

DATE RECEIVED: March 11, 1985

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263-0010

SAMPLE DESCRIPTION: W-8

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By:

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 8, 1985

DATE RECEIVED: March 11, 1985

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263-0050

SAMPLE DESCRIPTION: W-9

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.1
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 8, 1985

DATE RECEIVED: March 11, 1985

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263-0050 DUP

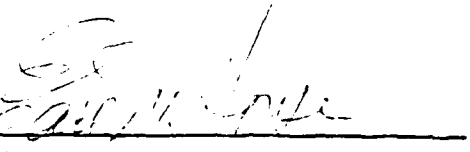
SAMPLE DESCRIPTION: W-9 DUPLICATE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.6
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 8, 1985

DATE RECEIVED: March 11, 1985

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263-0040

SAMPLE DESCRIPTION: W-10

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

RFW NO.: 8503-273-0090

SAMPLE DESCRIPTION: W-11

DATE RECEIVED: March 13, 1985

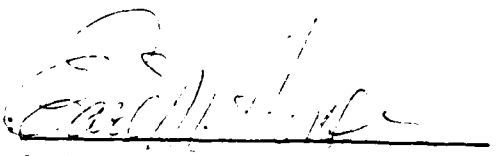
DATE ANALYZED: April 15, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0100

SAMPLE DESCRIPTION: W-12

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	7.9
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORODETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0010

SAMPLE DESCRIPTION: W-13

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.7
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

RFW NO.: 8503-273-0020

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: W-14

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	17
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0190

SAMPLE DESCRIPTION: W-15

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	9.6
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: _____

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

RFW NO.: 8503-273-0190 DUP

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: LAB DUPLICATE a-15

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	9.3
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H31

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

RFW NO.: 8503-254-0010

DATE ANALYZED: May 11, 1985

SAMPLE DESCRIPTION: W-16

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By:

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

RFW NO.: 8503-254-0020

DATE ANALYZED: April 11, 1985

SAMPLE DESCRIPTION: W-17

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	6.1
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-254-0030

SAMPLE DESCRIPTION: W-18

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.6
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-254-0040

SAMPLE DESCRIPTION: W-19

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-254-0050

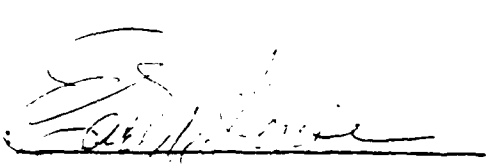
SAMPLE DESCRIPTION: W-20

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.2
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

RFW NO.: 8503-254-0070

DATE ANALYZED: April 11, 1985

SAMPLE DESCRIPTION: W-20A

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	6.6
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.4
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 6, 1985

DATE RECEIVED: March 7, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-254-0060

SAMPLE DESCRIPTION: W-21

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	3.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	3.2
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H38

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 7, 1985

DATE RECEIVED: March 8, 1985

RFW NO.: 8503-256-0010

DATE ANALYZED: April 11, 1985

SAMPLE DESCRIPTION: W-22

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 7, 1985

DATE RECEIVED: March 8, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-256-0010 DUP

SAMPLE DESCRIPTION: W-22 DUPLICATE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 7, 1985

DATE RECEIVED: March 11, 1985

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263-0030

SAMPLE DESCRIPTION: W-23

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.2
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 7, 1985

DATE RECEIVED: March 8, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-256-0020

SAMPLE DESCRIPTION: W-24

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	53
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	17
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	<2.0	TRICHLOROETHYLENE	5.1
DICHLORODIFLUOROMETHANE	40	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	28
1,1-DICHLOROETHANE	2.0	TOLUENE	34
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	2.9
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H42

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 7, 1985

DATE RECEIVED: March 8, 1985

DATE ANALYZED: April 11, 1985

RFW NO.: 8503-256-0030

SAMPLE DESCRIPTION: W-25

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	3.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H43

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0110

SAMPLE DESCRIPTION: W-41

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	9.4
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H44

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0060

SAMPLE DESCRIPTION: W-42

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	6.5
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

T45

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0070

SAMPLE DESCRIPTION: W-43

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	6.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

RFW NO.: 8503-273-0030

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: FPTA #2 POND A

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	13
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	4.9
CHLOROFORM	6.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	3.0
DICHLORODIFLUOROMETHANE	3.8	TRICHLOROFLUOROMETHANE	6.0
1,2-DICHLOROBENZENE	14	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	16
1,1-DICHLOROETHANE	< 2.0	TOLUENE	34
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H47

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0040

SAMPLE DESCRIPTION: FPTA #2 POND B

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	8.5
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	5.6	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	3.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	14	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	5.5
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

1148

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 10, 1985

RFW NO.: 8503-273-0050

SAMPLE DESCRIPTION: FPTA #2 POND C

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	9.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	2.8	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	3.0
1,1-DICHLOROETHANE	< 2.0	TOLUENE	9.4
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0150

SAMPLE DESCRIPTION: Pond 1

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0160

SAMPLE DESCRIPTION: POND 2

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.7
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

1151

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

DATE ANALYZED: April 15, 1985

RFW NO.: 8503-273-0170

SAMPLE DESCRIPTION: POND 3

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.8
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H52

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: March 11, 1985

DATE RECEIVED: March 13, 1985

RFW NO.: 8503-273-0180

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: POND 4

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	5.2
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8503-254, 256/

DATE ANALYZED: April 11, 1985

SAMPLE DESCRIPTION: LAB BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8503-254,256/SPIKE

DATE ANALYZED: April 11, 1985

SAMPLE DESCRIPTION: BLANK SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE *	82% RECOVERY
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE *	95% RECOVERY	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM *	105% RECOVERY	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE *	87% RECOVERY
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE *	110% RECOVERY
1,1-DICHLOROETHANE	< 2.0	TOLUENE *	130% RECOVERY
1,2-DICHLOROETHANE*	116% RECOVERY	ETHYL BENZENE *	103% RECOVERY
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

* SPIKED COMPOUND

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

DATE ANALYZED: April 12, 1985

RFW NO.: 8503-263/

SAMPLE DESCRIPTION: LAB BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8503-263/SPIKE

DATE ANALYZED: April 12, 1985

SAMPLE DESCRIPTION: BLANK SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE *	88% RECOVERY	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM *	98% RECOVERY	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE *	102% RECOVER
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE *	88% RECOVER
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE*	83% RECOVERY
1,1-DICHLOROETHANE	< 2.0	TOLUENE*	95% RECOVERY
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE *	80% RECOVERY
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

* SPIKED COMPOUND

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8503-273/

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: LAB BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8503-273/SPIKE

DATE ANALYZED: April 15, 1985

SAMPLE DESCRIPTION: BLANK SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE *	83% RECOVERY	1,2 TRANS DICHLOROETHYLENE	* 90% RECOVER
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE *	83% RECOVERY
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE*	94% RECOVERY
1,1-DICHLOROETHANE	< 2.0	TOLUENE*	108% RECOVERY
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE *	84% RECOVERY	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

* SPIKED COMPOUND

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8504-422/

DATE ANALYZED: April 25, 1958

SAMPLE DESCRIPTION: LAB BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8504-422/SPIKE

DATE ANALYZED: April 25, 1985

SAMPLE DESCRIPTION: BLANK SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE *	96% RECOVERY	1,2 TRANS DICHLOROETHYLENE*	120% RECOVER
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE*	95% RECOVERY
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE *	96% RECOVERY
1,1-DICHLOROETHANE *	118% RECOVERY	TOLUENE *	96% RECOVERY
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE *	97% RECOVERY
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H61

inter-office memorandum

TO: J[redacted]/R. Karnauskas (Chicago)
Kass Sheedy
Rich Johnson

DATE: May 22, 1985

RECEIVED
ROY F. WESTON, INC.
LOCKBURN OFFICE

For:
FROM: Earl M. Hansen CPH

SUBJECT: LABORATORY CHARGES
SELFRIDGE A.F.B. - SOIL SAMPLES
REC'D FEB. 1 & FEB. 7, 1985

W. O. No.: 0628-05-49

Enclosed are the results of OIL & GREASE and VOA analysis of the soil samples described above. Laboratory charges will be billed through timesheets for the week ending May 24, 1985.

EMH/eb

WESTON

DATE OF REPORT: MARCH 22, 1985

SELFRIDGE A.F.B.
OIL & GREASE SUMMARY REPORT
FOR
SOIL SAMPLES RECEIVED
FEBRUARY 1, 1985

EPA METHOD 413.2

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	OIL & GREASE MG/KG
8502-122-0010	W-1 SOIL 7.5'	1/28/85	2/11/85	110
-0020	W-1 SOIL 15.5'	1/28/85	2/11/85	121
-0030	W-1 SOIL 25'	1/28/85	2/11/85	203
-0040	W-2 SOIL 7.5'	1/28/85	2/11/85	118
-0050	W-2 SOIL 15.5'	1/28/85	2/11/85	150
-0060	W-2 SOIL 25'	1/28/85	2/11/85	203
-0070	W-3 SOIL 7.5'	1/29/85	2/11/85	92
-0080	W-3 SOIL 15.5'	1/29/85	2/11/85	229
-0090	W-3 SOIL 25'	1/29/85	2/11/85	163
-0100	W-4 SOIL 7.5'	1/29/85	2/11/85	69
-0110	W-4 SOIL 15.5'	1/29/85	2/11/85	148
-0120	W-4 SOIL 25'	1/29/85	2/11/85	91

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

WESTON

DATE OF REPORT: MARCH 22, 198

SELFRIDGE A.F.B.
OIL & GREASE SUMMARY REPORT
FOR
SOIL SAMPLES RECEIVED
FEBRUARY 7, 1985

EPA METHOD 413.2

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	OIL & GREASE MG/KG
8502-150-0010	W-11 SOIL 2.5'	2/6/85	2/27/85	145
-0020	W-11 SOIL 7.5'	2/6/85	2/27/85	191
-0030	W-11 SOIL 10.5'	2/6/85	2/27/85	177
-0040	W-12 SOIL 2.5'	2/6/85	2/27/85	65
-0050	W-12 SOIL 7.5'	2/6/85	2/27/85	197
-0060	W-12 SOIL 10.5'	2/6/85	2/27/85	208
-0070	W-15 SOIL 2.5'	2/6/85	2/27/85	17,900
-0080	W-15 SOIL 7.5'	2/6/85	2/27/85	223
-0090	W-15 SOIL 10.5'	2/6/85	2/27/85	133
-0100	W-13 SOIL 2.5'	2/5/85	2/27/85	107
-0110	W-13 SOIL 7.5'	2/5/85	2/27/85	176
-0120	W-13 SOIL 10.5'	2/5/85	2/27/85	172
-0130	W-14 SOIL 2.5'	2/5/85	2/27/85	92
-0140	W-14 SOIL 7.5'	2/5/85	2/27/85	181
-0150	W-14 SOIL 10.5'	2/5/85	2/27/85	215

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0010

SAMPLE DESCRIPTION: W-1 7.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	1,500
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	2,100
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	880
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	60
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H65

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0020

SAMPLE DESCRIPTION: W-1 15.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	1,500
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	2,100
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	3,600
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	58
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0030

SAMPLE DESCRIPTION: W-1 25'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	1,900
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	1,700
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]

for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H67

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17, 1985

RFW NO.: 8502-122-0030 DUP.

SAMPLE DESCRIPTION: W-1 25' (LAB DUPLICATE) METHOD 602 ONLY

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 602

REPORTING UNITS: µg/g

BROMOMETHANE	N.D.	1,3-TRANS DICHLOROPROPENE	N.D.
BROMOFORM	N.D.	1,3-CIS DICHLOROPROPENE	N.D.
CARBON TETRACHLORIDE	N.D.	METHYLENE CHLORIDE	N.D.
CHLOROBENZENE	N.D.	1,1,2,2 TETRACHLOROETHANE	N.D.
CHLORODIBROMOMETHANE	N.D.	TETRACHLOROETHYLENE	N.D.
CHLOROETHANE	N.D.	1,2 TRANS DICHLOROETHYLENE	N.D.
2-CHLOROETHYLVINYL ETHER	N.D.	1,1,1 TRICHLOROETHANE	N.D.
CHLOROFORM	N.D.	1,1,2 TRICHLOROETHANE	N.D.
DICHLOROBROMOMETHANE	N.D.	TRICHLOROETHYLENE	N.D.
DICHLORODIFLUOROMETHANE	N.D.	TRICHLOROFLUOROMETHANE	N.D.
1,2-DICHLOROBENZENE	N.D.	VINYL CHLORIDE	N.D.
1,3-DICHLOROBENZENE	N.D.		
1,4-DICHLOROBENZENE	N.D.	BENZENE	< 5
1,1-DICHLOROETHANE	N.D.	TOLUENE	< 5
1,2-DICHLOROETHANE	N.D.	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	N.D.		
1,2-DICHLOROPROPANE	N.D.	OTHER	
CHLOROMETHANE	N.D.		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

N.D. = NOT DUPLICATED

Approved By: Earl M. Hansen

FOR Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

RFW NO.: 8502-122-0040

SAMPLE DESCRIPTION: W-2 7.5'

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10
BROMOFORM	< 10
CARBON TETRACHLORIDE	< 10
CHLOROBENZENE	< 10
CHLORODIBROMOMETHANE	< 10
CHLOROETHANE	< 10
2-CHLOROETHYLVINYL ETHER	< 10
CHLOROFORM	< 10
DICHLOROBROMOMETHANE	< 10
DICHLORODIFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10
1,3-DICHLOROBENZENE	< 10
1,4-DICHLOROBENZENE	< 10
1,1-DICHLOROETHANE	< 10
1,2-DICHLOROETHANE	< 10
1,1-DICHLOROETHYLENE	< 10
1,2-DICHLOROPROPANE	< 10
CHLOROMETHANE	< 10

1,3-TRANS DICHLOROPROPENE	< 10
1,3-CIS DICHLOROPROPENE	< 10
METHYLENE CHLORIDE	10
1,1,2,2 TETRACHLOROETHANE	< 10
TETRACHLOROETHYLENE	< 10
1,2 TRANS DICHLOROETHYLENE	< 10
1,1,1 TRICHLOROETHANE	11
1,1,2 TRICHLOROETHANE	< 10
TRICHLOROETHYLENE	550
TRICHLOROFLUOROMETHANE	17
VINYL CHLORIDE	< 10
BENZENE	< 5
TOLUENE	< 5
ETHYL BENZENE	< 5
OTHER	

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

P69

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0050

SAMPLE DESCRIPTION: W-2 15.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	140
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	48	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	1,400
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Hansen

for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H70

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 28, 1985

DATE RECEIVED: FEB. 1, 1958

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0060

SAMPLE DESCRIPTION: W-2 25'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	300
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]

For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratori

H71

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1958

DATE RECEIVED: FEB. 1, 1985

RFW NO.: 8502-122-0070

DATE ANALYZED: MARCH 17-18, 1985

SAMPLE DESCRIPTION: W-3 7.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	150
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	59
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Earl Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H72

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 18, 1985

RFW NO.: 8502-122-0070 DUPLICATE

SAMPLE DESCRIPTION: W-3 7.5' (DUPLICATE) METHOD 601 ONLY

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	110
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	N.D
1,1-DICHLOROETHANE	< 10	TOLUENE	N.D
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	N.D
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

N.D. = NOT DUPLICATED

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H73

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0080

SAMPLE DESCRIPTION: W-3 15.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	1,200
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	160	1,1,2 TRICHLOROETHANE	1,100
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	6,600
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

P74

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

DATE RECEIVED: FEB. 1, 1985

RFW NO.: 8502-122-0090

DATE ANALYZED: MARCH 17-18, 1985

SAMPLE DESCRIPTION: W-3 25'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	1,800
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	380
CHLOROFORM	490	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	6,800
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]

for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

1175

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

RFW NO.: 8502-122-0100

SAMPLE DESCRIPTION: W-4 7.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	15
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	280
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	14
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

P76

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

DATE RECEIVED: FEB. 1, 1985

RFW NO.: 8502-122-0110

DATE ANALYZED: MARCH 17-18, 1985

SAMPLE DESCRIPTION: W-4 15.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	62
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	19
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	107
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	22
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Pruitt
For Earl M. Hansen, Ph.D.
Manager
H77 WESTON Analytical Laboratories

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: JAN. 29, 1985

RFW NO.: 8502-122-0120

SAMPLE DESCRIPTION: W-4 25'

DATE RECEIVED: FEB. 1, 1985

DATE ANALYZED: MARCH 17-18, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	26
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	20
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	4,000
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	28
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H78

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 3502-122/SPIKE

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: LAB D.I. SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM *	119% RECOVERY	1,3-CIS DICHLOROPROPENE *	84% RECOVERY
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE *	91% RECOVERY
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	< 10
DICHLORODIFLUOROMETHANE *	125% RECOVERY	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE *	85% RECOVERY
1,1-DICHLOROETHANE	< 10	TOLUENE *	85% RECOVERY
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE *	95% RECOVERY
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE *	98% RECOVERY	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

*SPIKED COMPOUNDS

Approved By: Earl M. Hansen, Ph.D.
For Manager
WESTON Analytical Laboratories

H79

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0010 (SEE NOTE BELOW)

SAMPLE DESCRIPTION: W-11 2.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/g

BROMOMETHANE	< 10
BROMOFORM	< 10
CARBON TETRACHLORIDE	< 10
CHLOROBENZENE	< 10
CHLORODIBROMOMETHANE	< 10
CHLOROETHANE	< 10
2-CHLOROETHYLVINYL ETHER	< 10
CHLOROFORM	< 10
DICHLOROBROMOMETHANE	< 10
DICHLORODIFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10
1,3-DICHLOROBENZENE	< 10
1,4-DICHLOROBENZENE	< 10
1,1-DICHLOROETHANE	< 10
1,2-DICHLOROETHANE	< 10
1,1-DICHLOROETHYLENE	< 10
1,2-DICHLOROPROPANE	< 10
CHLOROMETHANE	< 10

1,3-TRANS DICHLOROPROPENE	< 10
1,3-CIS DICHLOROPROPENE	< 10
METHYLENE CHLORIDE	< 10
1,1,2,2 TETRACHLOROETHANE	< 10
TETRACHLOROETHYLENE	< 10
1,2 TRANS DICHLOROETHYLENE	< 10
1,1,1 TRICHLOROETHANE	< 10
1,1,2 TRICHLOROETHANE	< 10
TRICHLOROETHYLENE	60
TRICHLOROFLUOROMETHANE	< 10
VINYL CHLORIDE	< 10
BENZENE	24
TOLUENE	320
ETHYL BENZENE	INTERFERENCE
OTHER	

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

NOTE: THIS SAMPLE CONTAINS HIGH LEVELS OF OTHER HYDROCARBONS THUS MAKING QUANTIFICATION OF BENZENE AND TOLUENE DIFFICULT. ETHYL BENZENE COULD NOT BE QUANTIFIED.

Approved By: [signature]
For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

1980

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0010 (DUP.)

DATE ANALYZED: MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-11 2.5' (DUPLICATE) 601 ANALYSIS

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	52
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	N.D.
1,1-DICHLOROETHANE	< 10	TOLUENE	N.D.
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	N.D.
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

N.D. = NOT DUPLICATED

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H81

DATE OF REPORT: MAY 22,1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0020

SAMPLE DESCRIPTION: W-11 7.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	52
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	11	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	640
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	15
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	16
1,1-DICHLOROETHANE	< 10	TOLUENE	10
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	5.2
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Carlton
For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

1182

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0030

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-11 10.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	43
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	13	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	730
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	14
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen, Ph.D.
For Manager
WESTON Analytical Laboratorie

H83

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0040

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-12 2.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	15
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	620
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE I DICATED BY
"LESS THAN" SIGNS

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H84

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0050

SAMPLE DESCRIPTION: W-12 7.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	45
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	6.1
CHLOROFORM	13	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	1,000
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	12
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H85

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0060

SAMPLE DESCRIPTION: W-12 10.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	98
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	4.4
CHLOROFORM	11	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	410
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	19
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY
"LESS THAN" SIGNS

Approved By: Earl Hansen
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

P86

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0070 (SEE NOTE BELOW)

SAMPLE DESCRIPTION: W-15 2.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	82
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	25,000
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	INTERFERENCE
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

NOTE: THIS SAMPLE CONTAINS HIGH LEVELS OF OTHER HYDROCARBONS THUS MAKING QUANTIFICATION OF TOLUENE DIFFICULT. ETHYL BENZENE COULD NOT BE QUANTIFIED.

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H87

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0080 (SEE NOTE BELOW)

SAMPLE DESCRIPTION: W-15 7.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	17
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	100
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	104,000
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	INTERFERENCE
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

NOTE: THIS SAMPLE CONTAINS HIGH LEVELS OF OTHER HYDROCARBONS THUS MAKING QUANTIFICATIO OF TOLUENE DIFFICULT. ETHYL BENZENE COULD NOT BE QUANTIFIED.

Approved By: Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H88

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 6, 1985

RFW NO.: 8502-150-0090

SAMPLE DESCRIPTION: W-15 10.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	27
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	.210
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H89

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0100

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-13 2.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	23
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	240
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Hansen

For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

B90

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0110

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-13 7.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

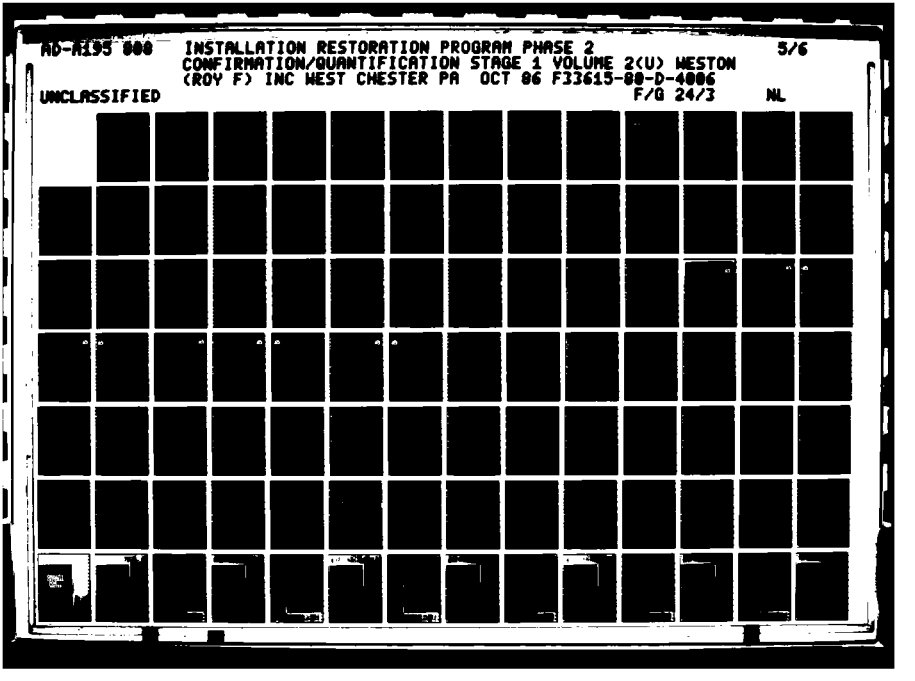
REPORTING UNITS: µg/g

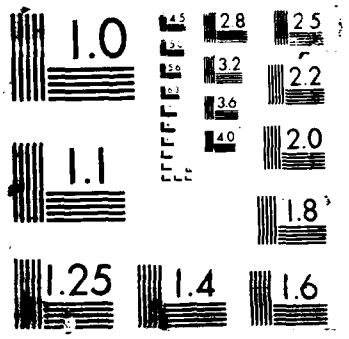
BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	60
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H91


AD-A195 888
INSTALLATION RESTORATION PROGRAM PHASE 2
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-88-D-4006
5/6
UNCLASSIFIED
F/G 24/3
NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0120

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-13 10.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	350
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY
"LESS THAN" SIGNS

Approved By: Earl M. Hansen
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H92

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0120 (DUP)

DATE ANALYZED: MARCH 4, 1985

SAMPLE DESCRIPTION: W-13 10.5' (DUPLICATE) 602 ANALYSIS

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	N.D.	1,3-TRANS DICHLOROPROPENE	N.D.
BROMOFORM	N.D.	1,3-CIS DICHLOROPROPENE	N.D.
CARBON TETRACHLORIDE	N.D.	METHYLENE CHLORIDE	N.D.
CHLOROBENZENE	N.D.	1,1,2,2 TETRACHLOROETHANE	N.D.
CHLORODIBROMOMETHANE	N.D.	TETRACHLOROETHYLENE	N.D.
CHLOROETHANE	N.D.	1,2 TRANS DICHLOROETHYLENE	N.D.
2-CHLOROETHYLVINYL ETHER	N.D.	1,1,1 TRICHLOROETHANE	N.D.
CHLOROFORM	N.D.	1,1,2 TRICHLOROETHANE	N.D.
DICHLOROBROMOMETHANE	N.D.	TRICHLOROETHYLENE	N.D.
DICHLORODIFLUOROMETHANE	N.D.	TRICHLOROFLUOROMETHANE	N.D.
1,2-DICHLOROBENZENE	N.D.	VINYL CHLORIDE	N.D.
1,3-DICHLOROBENZENE	N.D.		
1,4-DICHLOROBENZENE	N.D.	BENZENE	< 5
1,1-DICHLOROETHANE	N.D.	TOLUENE	< 5
1,2-DICHLOROETHANE	N.D.	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	N.D.		
1,2-DICHLOROPROPANE	N.D.	OTHER	
CHLOROMETHANE	N.D.		

N.D. = NOT DUPLICATED

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

for Earl M. Hansen, Ph.D.
Manager
H93 WESTON Analytical Laboratorie

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0130

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-14 2.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	11
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	31	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	1,500
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
H94 WESTON Analytical Laboratorie

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

DATE RECEIVED: FEB. 7, 1985

RFW NO.: 8502-150-0140

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: W-14 7.5'

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	64
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	520
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

P95

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: FEB. 5, 1985

RFW NO.: 8502-150-0150

SAMPLE DESCRIPTION: W-14 10.5'

DATE RECEIVED: FEB. 7, 1985

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	52
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	11
CHLOROFORM	13	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	1,300
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	29
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	8.5
1,1-DICHLOROETHANE	< 10	TOLUENE	5.5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Carter Earl Hansen

For Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: MAY 22, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8502-150/

DATE ANALYZED: MARCH 4, 1985 (602)
MARCH 19, 1985 (601)

SAMPLE DESCRIPTION: LAB BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: µg/g

BROMOMETHANE	< 10	1,3-TRANS DICHLOROPROPENE	< 10
BROMOFORM	< 10	1,3-CIS DICHLOROPROPENE	< 10
CARBON TETRACHLORIDE	< 10	METHYLENE CHLORIDE	< 10
CHLOROBENZENE	< 10	1,1,2,2 TETRACHLOROETHANE	< 10
CHLORODIBROMOMETHANE	< 10	TETRACHLOROETHYLENE	< 10
CHLOROETHANE	< 10	1,2 TRANS DICHLOROETHYLENE	< 10
2-CHLOROETHYLVINYL ETHER	< 10	1,1,1 TRICHLOROETHANE	< 10
CHLOROFORM	< 10	1,1,2 TRICHLOROETHANE	< 10
DICHLOROBROMOMETHANE	< 10	TRICHLOROETHYLENE	< 10
DICHLORODIFLUOROMETHANE	< 10	TRICHLOROFLUOROMETHANE	< 10
1,2-DICHLOROBENZENE	< 10	VINYL CHLORIDE	< 10
1,3-DICHLOROBENZENE	< 10		
1,4-DICHLOROBENZENE	< 10	BENZENE	< 5
1,1-DICHLOROETHANE	< 10	TOLUENE	< 5
1,2-DICHLOROETHANE	< 10	ETHYL BENZENE	< 5
1,1-DICHLOROETHYLENE	< 10		
1,2-DICHLOROPROPANE	< 10	OTHER	
CHLOROMETHANE	< 10		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: [signature]
for Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

197

RESULTS

Resampling

WESTON DESIGNERS CONSULTANTS

inter-office memorandum

FILE COPY

TO: JACK DOWDEN/BOB KARNAUSKAS
KASS SHEEDY
RICH JOHNSON
cc: EARL HANSEN
CARTER NULTON

DATE: APRIL 30, 1985

FROM: JUDY PORTA

SUBJECT: SELFRIDGE A.F.B.
SAMPLES HELD BEYOND HOLDING TIMES

W. O. No.: 0628-05-49

The following samples were held beyond the 14 day EPA recommended holding time for VOA analysis and therefore re-sampling is necessary:

W3-25 (Including W-20A), W-41 to 43, Ponds A-C and Ponds 1-4. (Total of 34 Samples).

If you have any questions, please don't hesitate to call.

RECEIVED
MAY 6 1985
ROY F. WESTON, INC.
BANNOCKBURN OFFICE

WESTON DESIGNERS CONSULTANTS

inter-office memorandum

TO: Jack Dowden
[redacted]
Kass Sheedy
Rich Johnson

DATE: May 31, 1985

FROM: Judy Porta

SUBJECT: SELFRIDGE A.F.B.
VOA RESAMPLES SUBMITTED MAY 13, 1985

W. O. No.: 0628-05-49

Enclosed are the results promised you. This completes all in-house analytical work for SELFRIDGE AFB. If you have any questions, please don't hesitate to call.

JP/eb

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0200

SAMPLE DESCRIPTION: W-3

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H100

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0210

SAMPLE DESCRIPTION: W-4

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H101

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0170

SAMPLE DESCRIPTION: W-5

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.2
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H102

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0180

SAMPLE DESCRIPTION: W-6

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.4
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0190

SAMPLE DESCRIPTION: W-7

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	3.1
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0140

SAMPLE DESCRIPTION: W-8

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.2
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0150

SAMPLE DESCRIPTION: W-9

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0160

SAMPLE DESCRIPTION: W-10

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H107

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0120

SAMPLE DESCRIPTION: W-11

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.3
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0130

SAMPLE DESCRIPTION: W-12

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0100

SAMPLE DESCRIPTION: W-13

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0110

SAMPLE DESCRIPTION: W-14

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	4.7
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.5
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

RFW NO.: 8505-501-0220

SAMPLE DESCRIPTION: W-15

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0220 DUP

SAMPLE DESCRIPTION: W-15 LAB DUPLICATE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0050

SAMPLE DESCRIPTION: W-16

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0060

SAMPLE DESCRIPTION: W-17

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H115

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0070

SAMPLE DESCRIPTION: W-18

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0080

SAMPLE DESCRIPTION: W-19

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0090

SAMPLE DESCRIPTION: W-21

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H119

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985
DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0040

SAMPLE DESCRIPTION: W-22

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H119

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0010

SAMPLE DESCRIPTION: W-23

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hans

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0020

SAMPLE DESCRIPTION: W-24

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	84
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	71
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLOROETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	6.7
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	45
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	51
1,1-DICHLOROETHANE	< 2.0	TOLUENE	52
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	44
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H121

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 10, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0030

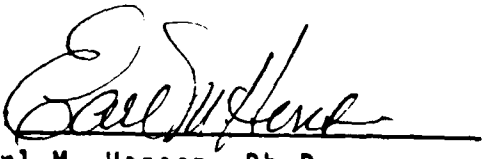
SAMPLE DESCRIPTION: W-25

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By 

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H122

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: May 11, 1985

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501-0230

SAMPLE DESCRIPTION: FIELD BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

H123

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE PREPARED: ?

RFW NO.: 8505-501-0240

SAMPLE DESCRIPTION: TRIP BLANK

DATE RECEIVED: May 13, 1985

DATE ANALYZED: May 20, 1985

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	< 2.0
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H124

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

DATE ANALYZED: May 20, 1985

RFW NO.: 8505-501/

SAMPLE DESCRIPTION: LAB D.I. WATER BLANK

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 3.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE	< 2.0	1,2 TRANS DICHLOROETHYLENE	< 2.0
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE	
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE	< 2
1,1-DICHLOROETHANE	< 2.0	TOLUENE	< 2
1,2-DICHLOROETHANE	< 2.0	ETHYL BENZENE	< 2
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

H125

DATE OF REPORT: May 31, 1985

DATA SUMMARY FOR: SELFRIDGE A.F.B.

DATE SAMPLE COLLECTED: DNA

DATE RECEIVED: DNA

RFW NO.: 8505-501/SPIKE

DATE ANALYZED: May 20, 1985

SAMPLE DESCRIPTION: LAB D.I.WATER SPIKE

GC ANALYSIS
VOLATILE COMPOUNDS
EPA METHOD 601, 602

REPORTING UNITS: ug/L

BROMOMETHANE	< 4.0	1,3-TRANS DICHLOROPROPENE	< 6.0
BROMOFORM	< 8.0	1,3-CIS DICHLOROPROPENE	< 2.0
CARBON TETRACHLORIDE	< 2.0	METHYLENE CHLORIDE	< 2.0
CHLOROBENZENE	< 2.0	1,1,2,2 TETRACHLOROETHANE	< 2.0
CHLORODIBROMOMETHANE	< 2.0	TETRACHLOROETHYLENE	< 4.0
CHLOROETHANE *	93% RECOVERY	1,2 TRANS DICHLOROETHYLENE*	84% RECOVERY
2-CHLOROETHYLVINYL ETHER	< 2.0	1,1,1 TRICHLOROETHANE	< 2.0
CHLOROFORM	< 2.0	1,1,2 TRICHLORDETHANE	< 2.0
DICHLOROBROMOMETHANE	< 2.0	TRICHLOROETHYLENE *	98% RECOVERY
DICHLORODIFLUOROMETHANE	< 4.0	TRICHLOROFLUOROMETHANE	< 3.0
1,2-DICHLOROBENZENE	< 3.0	VINYL CHLORIDE	< 4.0
1,3-DICHLOROBENZENE	< 3.0		
1,4-DICHLOROBENZENE	< 3.0	BENZENE*	98% RECOVERY
1,1-DICHLOROETHANE	< 2.0	TOLUENE*	100% RECOVERY
1,2-DICHLOROETHANE *	91% RECOVERY	ETHYL BENZENE*	100% RECOVERY
1,1-DICHLOROETHYLENE	< 2.0		
1,2-DICHLOROPROPANE	< 2.0	OTHER	
CHLOROMETHANE	< 4.0		

DETECTION LIMITS ARE INDICATED BY "LESS THAN" SIGNS

* SPIKED COMPOUND

Approved By: Earl M. Hansen

Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratorie

APPENDIX I

Federal and State Drinking Water and Human Health Standards Applicable in the State of Michigan

Contents

	Page
Guide to Ground-Water Standards of the United States	I1
Environmental Protection Agency National Interim Primary Drinking Water Regulations	I12
Quality Criteria for Water	I46
Federal Register Par V, 12 June 1984, p.p. 24330-24335	I69
Department of Natural Resources Water Resources Commission General Rules	I95
Federal Register, Part V, 13 November 1984,	I125

GUIDE TO GROUND-WATER STANDARDS OF THE UNITED STATES

API PUBLICATION 4366

JULY 1983

Prepared by
Ecological Analysts, Inc.
15 Loveton Circle
Sparks, Maryland 21152

3. *FEDERAL PROTECTION OF GROUND-WATER QUALITY*

The federal programs dealing with the protection of ground-water quality are administered largely by the Environmental Protection Agency (EPA). The federal programs which provide the framework for state regulations are summarized in this section.

3.1 GROUND-WATER PROTECTION POLICY

At this writing, February 1983, U.S. EPA's final policy on ground-water protection, scheduled for September 1982 release, has not been published. Based on the proposed strategy published by EPA in November 1980 and recent press releases, it appears that EPA will be implementing a policy that would give the states lead responsibility in the protection of ground-water quality. EPA's efforts apparently will be focused in three major areas:

1. Development of an internally consistent federal approach to ground-water protection
2. Monitoring, research and development efforts directed toward more comprehensive problem definition and new detection, controls, and clean-up technology development
3. Guidance, coordination, and assistance to states in the development of state policies

A significant component of EPA's policy is expected to be a ground-water classification system which could be used to determine the degree of protection needed for various types of ground water. Ground-water classification is discussed in Chapter 4.

3.2 CLEAN WATER ACT

This statute refers to ground-water protection in municipal waste water treatment, planning, and research programs. Its principal regulatory programs, however, focus on surface water. Section 303 empowers EPA to approve states' water quality standards which are based on the states' classification of rivers and streams. Many states have included ground water in their definition of "waters of the state" for purposes of this act (state summaries). On this basis the National (state) Pollutant Discharge Elimination System (NPDES/SPDES) permitting process may be invocable for purposes of ground-water protection. In addition the act empowers EPA to

1. Develop a comprehensive program for ground-water pollution control [Section 102(a)]
2. In cooperation with states, equip and maintain a surveillance system for monitoring ground-water quality [Section 104(a)(5)]
3. Provide grants to states and area-wide agencies to develop ground-water quality management plans to identify salt water intrusion and control disposal of pollutants in subsurface excavations, and control disposition of wastes. (May include authority for comprehensive ground-water management plans, including conjunctive use with surface water) [Section 102(c), 208(b)]
4. Require development of Best Management Practices (BMP) to control nonpoint source pollution problems to ground-water quality [Section 208(b)]
5. Develop criteria for ground-water quality considering kind and extent of effects on health and welfare from the presence of pollutants [Section 304(a)]
6. Determine information necessary to restore and maintain chemical, physical, and biological integrity of ground water [Section 304(a)]
7. Issue information on the factors necessary to restore and maintain chemical, physical, and biological integrity of ground water [Sections 304(a)(2)]

3.3 SAFE DRINKING WATER ACT

This statute authorizes EPA to set maximum contaminant l[illegible]els (MCLs) and monitoring requirements for public water systems and provides for the protection of underground sources of drinking water. The MCLs regulate the quality of "finished" water, i.e., water as delivered, not the quality of the source water. As discussed below, the MCLs have been utilized by EPA and the states as the basis for other regulations dealing with ground-water quality and protection.

3.3.1 National Interim Primary Drinking Water Regulations

EPA initiated a detailed study of the health effects of various contaminants in water soon after the Safe Drinking Act (SDWA) was signed into law. So that the regulations could include the findings of this and other studies, the primary drinking water regulations were to be developed in two stages: an interim version and a final version. The interim version of the regulation became effective 24 June 1977. SDWA provides for delegation of authority to the states. State Primary Drinking Water Regulations must be at least as stringent as the federal regulations.

The National Interim Primary Drinking Water Regulations define Maximum Contaminant Level as the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system, except in the case of turbidity (applicable to surface water only) where the maximum permissible level is measured at the point of entry to the distribution system. The MCLs are provided with the state summaries.

3.3.2 National Secondary Drinking Water Regulations

These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist as well as aesthetic degradation. The National Secondary Drinking Water Regulations are not federally enforceable but are intended as guidelines for the states.

Secondary Maximum Contaminant Levels (SMCLs) are defined as the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Federal and state SMCLs are provided in the state summaries. The states may establish higher or lower levels which may be appropriate depending upon local conditions such as unavailability of alternate sources of water or other compelling factors, provided the public health and welfare are not adversely affected.

3.3.3 Sole Source Aquifer

The Sole Source Aquifer provisions of SDWA allow EPA to designate an aquifer as the sole source of drinking water for an area thereby guaranteeing protection from contamination by federally assisted activities. Local, regional, or state agencies can petition EPA for sole source designation. The EPA Administrator may designate an aquifer which is a sole or principal drinking water source if its contamination would create a significant hazard to public health. If the designation is made, no federal money or financial commitment may be made for any project which the Administrator determines may contaminate the designated aquifer through its recharge zone.

At this writing, February 1983, EPA has designated the following ten sole source aquifers:

Biscayne Aquifer - Florida
Buried Valley Aquifer - New Jersey
Edwards Aquifer - Texas
Camano Island—Whidbey Island Aquifer - Washington
Spokane-Rathdrum Aquifer - Washington and Idaho
Nassau and Suffolk counties - New York
Cape Cod - Massachusetts
Fresno - California
Ten Mile Creek - Maryland
Northern Guam Lens - Guam

The following eighteen are under consideration:

Arizona
- Santa Cruz, Upper Santa Cruz, Aura-Altar Basins

California
- Scotts Valley

Delaware
- New Castle County

Florida
- Volusia - Floridan Aquifer

Idaho
- Snake River Plain

Louisiana
- Baton Rouge
- DeSota Parish

New Jersey
- Coastal Plain
- Ridgewood
- Upper Rockaway

New York
- Kings and Queens counties
- Sardinia
- Schenectady
- Vestal

Pennsylvania
- Seven Valleys

Texas
- Carrizo-Wilcox Aquifer

Texas and New Mexico
- Delaware Basin

Wisconsin
- Niagara Aquifer

3.3.4 Underground Injection Control

The Underground Injection Control (UIC) program regulates the uses of underground injection wells to protect an underground source of drinking water (USDW). USDW means an aquifer or its portion which

1. supplies any public water system or contains a sufficient quantity of ground water to supply a public water system;
2. currently supplies drinking water for human consumption or contains less than 10,000 mg/liter total dissolved solids; and
3. is not an exempted aquifer (40 CFR 146.04 provides criteria for exemption).

SDWA requires any state designated by EPA as requiring a UIC program to develop and submit a state UIC program for EPA approval. EPA has designated each of the fifty states.

The federal program classifies injection wells as follows:

Class I—Wells used to inject hazardous waste, or other industrial and municipal disposal wells which inject fluids beneath the lower-most formation containing a USDW within one-quarter mile of the well bore.

Class II—Wells that inject fluids

1. which are brought to the surface as part of conventional oil or natural gas production and may be mixed with production waste waters from gas plants, unless those waters are classified as a hazardous waste at the time of injection;
2. for enhanced recovery of oil or natural gas; and
3. for storage of hydrocarbons which are liquid at standard temperature and pressure.

Class III—Wells that inject for extraction of minerals including

1. mining of sulfur by the Frasch process;
2. in situ production of uranium or other metals. This category includes only in situ production from ore bodies which have not been conventionally mined. Solution mining of conventional mines such as stopes leaching is included in Class V; and
3. solution mining of salts or potash.

Class IV—Wells used to dispose of hazardous or radioactive waste into or above a formation which contains a USDW within one-quarter mile of the well. Also, wells used to inject hazardous waste that cannot be classified as Class I or Class IV under the above criteria are Class IV wells.

Class V—All other injection wells (40 CFR 146.05(e) and 146.51 provide specific information and exemptions).

Underground injection is controlled through the permitting process. Construction, operation, monitoring and reporting activities are controlled. Individual state programs are based upon, and must be essentially equivalent to, the federal criteria and standards (40 CFR 146).

3.4 TOXIC SUBSTANCE CONTROL ACT

This statute (TSCA) authorizes EPA to restrict or prohibit the manufacture, distribution, and use of products which may result in unreasonable risk to health and the environment. Although ground water is not specifically named in the Act, EPA has taken the position that the protection of health and the environment includes the protection of ground water.

3.5 FEDERAL INSECTICIDE, FUNGICIDE, RODENTICIDE ACT

This statute (FIFRA) gives EPA the responsibility to control the sale and use of all pesticides to prevent unreasonable adverse environmental and health effects. The use and disposal of pesticide packages and containers is also regulated. In deciding whether to register, cancel, suspend, or change the classification of a pesticide, EPA considers a broad range of environmental impacts including those affecting ground water.

3.6 RESOURCE CONSERVATION AND RECOVERY ACT

The Solid Waste Disposal Act and the Resource Recovery Act of 1970, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), require EPA to establish a national program to regulate the management of waste materials.

3.6.1 Solid Waste

Subtitle D of RCRA established a broad-based national program to improve solid waste management through the development of state and regional solid waste management plans. The act offered federal financial assistance to states interested in developing and implementing a solid waste management plan. The state plans, under federal guidelines, identify respective responsibilities of local, state, and regional authorities, and encourage resource recovery and conservations and the application and enforcement of environmentally sound disposal practices.

A major element of the Subtitle D program is the open dump inventory. Section 4005 of RCRA prohibits open dumping. Federal criteria for classifying solid waste management facilities are provided in 40 CFR 257. EPA cannot approve a state solid waste management program with less stringent criteria. Solid waste management facilities failing to satisfy the criteria are considered open dumps. In order to satisfy these criteria, a facility or practice (in addition to other environmental considerations) shall not contaminate an underground drinking water source beyond the solid waste boundary or beyond an alternative boundary established by the state or in court persuant to the stipulations of 40 CFR 257.3-4. The federal criteria define contamination as an exceedence of the MCLs provided in the National Interim Primary Drinking Water Regulations or an increase in concentration of any parameter for which the ambient concentration exceed the MCL.

3.6.2 Hazardous Waste

EPA has issued a series of hazardous waste regulations under Subtitle C of RCRA (40 CFR 260 to 267 and 122 to 124). On 19 May 1980, EPA issued a comprehensive set of standards for generators and transporters of hazardous waste and "interim status" standards for facilities in existence on 19 November 1980, that treat, store, or dispose of hazardous waste. Such facilities were allowed to operate under interim status until they received an RCRA permit. Subsequently, EPA issued standards for granting RCRA permits to treatment and storage facilities. Standards for land disposal facilities were issued on 26 July 1982—virtually completing the program for controlling hazardous waste under RCRA.

The standards for permitting land disposal facilities were issued after a wide range of regulatory options were considered. Over a period of several years, EPA proposed two different sets of land disposal standards and solicited comments on various issues. On 13 February 1981, EPA issued temporary standards for new land disposal facilities. The 26 July regulations replace those temporary standards except for Class I underground injection wells. These will remain subject to the temporary standards until final standards are issued.

The regulations consist primarily of two complementary sets of performance standards:

1. A set of design and operating standards tailored to each of four types of facilities
2. Ground-water monitoring and response regulations applicable to all land disposal facilities

The design and operating standards implement a liquids management strategy that has two goals:

1. Minimize leachate generated at the facility
2. Remove leachate generated to minimize its chance of reaching ground water

The major requirements include

1. Liner
   - *Requirement: design to prevent migration of waste out of the facility during its active life*
   - Applicability: landfills, surface impoundments, and waste piles
2. Leachate collection and removal
   - Requirement: collect and remove leachate from the facility and ensure that leachate depth over the liner does not exceed 30 centimeters (1 foot)
   - Applicability: landfills and waste piles

3. Run-on and runoff control systems
   - Requirement: design to control flow during at least 25-year storm
   - Applicability: landfills, waste piles, land treatment
4. Wind dispersal controls
   - Requirement: cover waste or otherwise manage unit to control wind dispersal
   - Applicability: landfills, waste piles, and land treatment units that contain particulate matter
5. Overtopping controls
   - Requirement: prevent overtopping or overfilling
   - Applicability: surface impoundments
6. Disposal unit closure
   - Requirement: final cover (cap) over waste unit designed to minimize infiltration of precipitation
   - Applicability: landfills and surface impoundments (if used for disposal)
7. Storage unit closure
   - Requirement: remove waste and decontaminate
   - Applicability: surface impoundments used for treatment or storage and waste piles
8. Postclosure Care
   - Maintain effectiveness of final cover
   - Operate leachate collection and removal system
   - Maintain ground-water monitoring system (and leak detection system where double liner is used)
   - Continue 30 years after closure

The goal of the ground-water monitoring and response program is to detect and correct any ground-water contamination. There are four main elements:

1. A detection monitoring program which requires the permittee to install a system to monitor ground water in the uppermost aquifer to determine if a leachate plume has reached the edge of the waste management area.
2. A ground-water protection standard is set when a hazardous constituent is detected. The standard specifies concentration limits, compliance point, and compliance period.
3. A compliance monitoring program determines if the facility is complying with its ground-water protection standard.
4. Corrective action is required when the ground-water protection standard is violated. The permittee must either remove the contamination or treat it in place to restore ground-water quality.

Until hazardous waste management facilities are issued permits, existing facilities will continue to operate under interim status standards. Facilities operating under interim status will be required to file Part B applications for final permits.

Under Subtitle C of RCRA, EPA approves state hazardous waste management programs in two phases. Phase I authorization gives states the right to control transportation and generation of hazardous wastes within their borders and to regulate existing treatment, storage, and disposal facilities. Phase II authorization includes the permitting of new facilities.

3.7 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

This statute (CERCLA), commonly referred to as Superfund, authorizes EPA to respond to releases or threatened releases into the environment, including ground water, of any hazardous substance which may present an imminent and substantial danger to public health. The act provides funds for emergency action and has cost recovery provisions.

4. REGULATORY CONCEPTS AND TERMINOLOGY

Regulatory terminology varies from state to state. The concepts are discussed in this section in order to provide the basis for the use of consistent terminology throughout the state summaries.

4.1 GROUND-WATER CLASSIFICATION

The classification of ground water by the states encompasses a variety of forms and intended functions for regulatory authority of both ground-water quality and quantity. The focus of discussion of classification systems in this manual is directed toward those classification scenarios which have been developed for the application of ground-water quality standards and criteria.

A most basic form of classification relative to ground-water quality protection that most states have adopted is the inclusion of ground water or underground water within the definition of "state waters" within general water pollution control laws. This concept extends the legal authority through which states may ultimately develop more specific regulatory control that may include the adoption of some specific form of classification and/or water quality standards.

For the most part, those states that have developed ground-water classification systems have done so in anticipation of an EPA ground-water protection policy which incorporates the concept of variable levels of protection appropriate to aquifers of variable existing quality and existing or potential use. These classification systems are generally found to encompass consideration of water quality for specific ground-water uses, and to a lesser degree may include other hydrogeologic properties such as yield, transmissibility, or permeability.

To a large extent the term "aquifer" classification may be considered a misnomer in that this terminology implies that classification systems have focused on delineating specific aquifers or geologic formations according to a specific category. While the ultimate goal may be classification of specific aquifers, it is not apparent that this has been done to any significant degree. It is also perceived that difficulties may arise in applying the concept of classifying specific aquifers because it must be recognized that aquifers can vary in the quality and quantity of water produced over their areal extent. Depending on the system in use, a particular geologic formation might be classified differently in different parts of a state.

Although a variety of classification systems have been adopted, a common factor among those in existence and proposed is the inclusion of reference to suitability of ground water for use as drinking water. Beyond this point the variability becomes pronounced. The range of classifications may simply be from "all other ground water" to the establishment of many other classes typically based on other categories of use. While it is generally the intent to classify ground water in the "highest" possible or "best use" category, the establishment of other use categories is developed largely through recognition of geographic, economic, and/or technical considerations.

4.2 STANDARDS/CRITERIA

For the most part, state regulations pertaining to ground-water quality appear to more frequently use the term "standards" as opposed to "criteria." "Criteria" generally represent guidelines for allowable concentrations of specific constituents. "Standards" generally represent allowable concentrations of specific constituents that are not to be exceeded under enforcement penalty. Standards are often applied within a particular classification of ground water according to its suitability for a specific use or the maintenance of existing quality for the particular use. The establishment and application of standards function for controlling discharges into ground water, but flexibility may be provided through the allowance of mixing zones and/or through recognition that natural ground-water quality may exceed standards that have been established for a particular class of ground water.

Standards may be numerical or narrative. The simplest form of standards to an extent represents a combination of both; that is, standards for a particular class(es) of ground water are referenced to the state's drinking water standards. Blanket application of drinking water standards as ground-water quality standards poses some problems. Drinking water standards were initially set forth to protect public health by applying these standards to finished water in public drinking water systems and to provide for variances depending on whether ground water or surface water supplies were utilized, the type and degree of treatment provided, the frequency with which testing was conducted, and/or the number of individuals or connections served by the system. While in many cases natural ground-water quality would be expected to meet at least the primary drinking water standards, the carry over of these standards to raw ground water does not always directly address the provisions of these potential

variances. To this end some states have established numerical ground-water standards within independent regulations which may specifically address these variances. Also, some states have gone beyond the federal drinking water regulations by establishing numerical standards for additional parameters and/or by setting forth some more stringent numerical standards for drinking water and/or other classes of ground-water use.

Narrative standards may take several forms. Nondegradation or antidegradative clauses may prohibit any alteration of existing ground-water quality whether or not specific parameters and standards for ground-water are provided. Narrative discussions of acceptable ranges for individual parameters based on specific conditions may be provided, and additional numerical standards may be implied through reference to other published materials. Only a few narrative discussions prescribe that numerical standards apply to total versus dissolved fractions of the stated constituents.

4.3 MONITORING

The focus of this study concerning ground-water monitoring was to determine if and to what degree specific ground-water monitoring requirements have been established for particular types of activities that may conceivably impact ground-water quality, and if such monitoring requirements exit, what is their relationship to state ground-water quality standards. It has become apparent that generally there are few regulations directed toward specific monitoring requirements for such activities. The general approach of existing regulations of ground-water monitoring is directed toward the provision that monitoring is or may be required and that monitoring requirements are determined by the regulating agency on a case-by-case basis. This permits the flexibility of establishing what may be viewed as practical approaches to monitoring requirements dependent upon case-specific conditions, rather than indiscriminant or blanket application of water quality standards or criteria.

Those activities for which more specific monitoring requirements are most frequently set forth are in the areas of waste management. For hazardous waste facilities, through the relationship of state programs with RCRA, requirements for ground-water monitoring at new facilities (and facilities filing Part B Permit Applications) are established on a case-by-case basis through the permitting process. The requirements for facilities currently operating under interim status permits (Section 3.6.2.) are indicated in the state summaries. Although the interim status monitoring requirements largely encompass the federal primary drinking water standards parameter list, there is no legal provision within the interim status regulations stating that the MCLs must not be exceeded. Rather, monitoring requirements are founded primarily on the establishment of background water quality and upgradient-downgradient comparisons for determination of non-compliance. For facilities operating under the final permit rules, the MCLs for metals and pesticides will be incorporated into the site's Ground-Water Protection Standard if the need to apply a Ground-Water Protection standard arises (40 CFR 264.94).

For other solid waste programs (non-hazardous), most state regulations are less specific in terms of monitoring requirements. While most states have developed solid waste regulations, they are seen to apply more directly to facility siting requirements for the maintenance and protection of ground-water quality. Beyond this there is considerable variation. Most state solid waste regulations include the provision of the requirement for ground-water monitoring and the establishment of specific monitoring requirements on a case-by-case basis. Few states provide specific monitoring parameters or frequency requirements. It must be noted however, that the federal guidelines (Section 3.6.1) for identifying open (illegal) dumps include contamination of an underground drinking water source. In this instance the definition of contamination is based on the MCLs provided in the National Interim Primary Drinking Water Regulations (40 CFR 257.3-4).

4.4 MANAGEMENT POLICIES AND APPROPRIATION

The concepts of ground-water law establish the fundamental approaches to the management of ground-water quantities and allocations. The right to use ground water may be either a riparian right (the right of the landowner to use underlying water) or the water right may be separate and distinct from property ownership.

The concept of riparian right may take several forms. The most prevalent form is that of the reasonable use doctrine or the American Rule. Under this system the landowner may withdraw ground water in any amount for uses which are necessary and beneficial to the enjoyment and use of the property without liability to adjacent property owners. The rights of adjacent property owners are considered in that the diversion or use of the water on property other than that from which it is withdrawn may constitute an unreasonable use. Bordering on obsolescence is the absolute use doctrine or English Rule which provides that a landowner has absolute ownership of the ground water beneath the property and may withdraw ground water in any amount for any

purpose without any liability to adjacent property owners. An emerging riparian concept is that of correlative rights which provide the landowner the right to withdraw ground water as long as it is applied to a reasonable use and that the withdrawal does not exceed recharge to the aquifer in relation to the size of the property.

The concept of water rights being distinct from property ownership is manifest in the doctrine of prior appropriation. The doctrine of prior appropriation is most prevalently applied in the western regions of the United States. It designates that the water right is established and maintained on the basis of first use primary or senior authority and that additional successive rights have and receive decreasing or junior levels of priority in order of their designation. Under the doctrine of prior appropriation the water right is considered to be separate from property ownership, and is not necessarily held by the riparian property owner. Conceivably, the riparian property owner may not have a water right, although priorities for the type of usage may be established to allow for minor uses such as domestic consumption without obtaining a water right.

Regulatory approaches to the management of ground-water quantity and allocation may include permit systems for appropriations, registration, and/or reporting requirements for withdrawals or uses of ground water. These requirements may be applied on a statewide basis or to specific areas where ground-water use is controlled in response to localized factors such as depletion of supplies or salt water encroachment. Permitting requirements may be applied to all ground-water withdrawals or may be restricted only to large withdrawals (greater than a designated rate of flow in gallons per minute or gallons per day). Certain uses of ground water (domestic, agricultural, or municipal water supplies) may be exempted from the permit requirements.

MICHIGAN

Classification–Ground water is defined as "underground water within the zone of saturation," as found in Part 22 of the Water Resources Commission General Rules. Aquifers have been classified as being "usable" or not. A usable aquifer is capable of providing water in sufficient quantity and satisfactory quality to serve one or more "protected uses": individual, public, industrial, or agricultural water supply.

Quality Standards–The local background ground-water quality serves as the non-degradation standard for all usable aquifers. Discharges into ground water of material at concentrations that exceed the maximum contaminant levels specified in the National Interim Primary Drinking Water Regulations are prohibited.

Drinking Water Standards–The Department of Health has adopted the federal drinking water standards.

Appropriations–Ground-water use is governed by the reasonable use system in Michigan. There are no permit requirements, and all users are treated equally.

Controlled Use Areas–There are none at present.

Well Construction–All well drillers must be licensed and certified by local Public Health Departments and follow construction regulations of the Department of Natural Resources. Permits for oil and gas, mineral and injection wells must be obtained from the Department of Natural Resources.

Underground Injection Control–Michigan is not seeking primacy under the Federal UIC program. Currently, underground injection is regulated by NPDES permits issued by the Department of Natural Resources. Deep well injection is regulated by the Department of Natural Resources under the Mineral Wells Act of 1969.

Waste Management Facilities–The solid and hazardous waste management programs are administered by the Department of Natural Resources.

Solid Waste–The Ground-Water Quality Division of the Department of Natural Resources administers the Solid Waste Regulations. Landfills are required to install a ground-water monitoring system; quarterly monitoring is also required. The quality of ground water at the site boundary shall not exceed the standards described in 40 CFR 257.3–4.

Hazardous Waste–Michigan has received primacy for its RCRA Phase I program and is seeking Phase II authority. The Michigan Hazardous Waste Regulations have adopted EPA ground-water monitoring requirements (40 CFR 265, F) by reference.

Sole Source Aquifers–There are none at present.

Geological Surveys–

Geological Survey Division
Department of Natural Resources
Box 30028
Lansing, MI 48909
517-373-5014
State Geologist:
Mr. R. Thomas Segall

Water Resources Division
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48910
517-377-1608
District Chief:
T.R. Cummings

References–

Michigan Water Resources Commission
General Rules
(MAC Part 22)

Michigan Solid Waste Regulations
(MAC, R 299–4101–4807)

Michigan Hazardous Waste Regulations
(MAC, R 299.6101–7305)

Contacts–

Mr. Andy Hogarth
Water Resources Commission
Department of Natural Resources
P.O. Box 30028
Lansing, MI 48909
517-373-8147

Approved by Mr. Andy Hogarth in a letter received March 1983.

MICHIGAN

Parameter (mg/l unless noted)	Drinking Water Standards		Quality Standards	Monitoring Requirements	
	Federal	State		Solid Waste	Hazardous Waste
Arsenic	0.05	0.05			M
Barium	1.0	1.0			M
Cadmium	0.010	0.010			M
Chromium	0.05	0.05			M
Lead	0.05	0.05			M
Mercury	0.002	0.002			M
Selenium	0.01	0.01			M
Silver	0.05	0.05			M
Fluoride	1.4–2.4	1.4–2.4			M
Nitrate (as N)	10	10			M
Endrin	0.0002	0.0002			M
Lindane	0.004	0.004			M
Methoxychlor	0.1	0.1			M
Toxaphene	0.005	0.005			M
2,4-D	0.1	0.1			M
2,4,5-TP Silvex	0.01	0.01			M
Trihalomethanes	0.1	0.1			
Turbidity (TU)	1.0	1.0			
Coliform bacteria — membrane filter test (#/100 ml)	1.0	1.0			M
Gross alpha (pCi/l)	15.0	15.0			M
Combined Radium 226 and Radium 228 (pCi/l)	5.0	5.0			M
Beta and photon particle activity (mrem/yr)	4.0	4.0			M
Sodium	M	M			M
Chloride	250				M
Color (units)	15				
Copper	1.0				
Corrosivity	Noncorrosive				
Foaming agents	0.5				
Iron	0.3				M
Manganese	0.05				M
Odor (threshold no.)	3.0				
pH (units)	6.5–8.5				M
Sulfate	250				M
Total dissolved solids	500				
Zinc	5.0				
Phenols					M
Specific conductance					M
Total organic carbon					M
Total organic halogen					M

Note: "M" denotes monitoring requirement. See text and Section 4.3.

ENVIRONMENTAL PROTECTION AGENCY NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

(40 CFR 141; 40 FR 59565, December 24, 1975; Amended by 41 FR 28402, July 9, 1976; 44 FR 68641, November 29, 1979; Corrected by 45 FR 15542, March 11, 1980; 45 FR 57342, August 27, 1980; 47 FR 8998, March 3, 1982; Corrected by 47 FR 10998, March 12, 1982)

Title 40—Protection of Environment
CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY
SUBCHAPTER D—WATER PROGRAMS
PART 141—NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

Subpart A—General

Sec.
141.1 *Applicability.*
141.2 Definitions.
141.3 Coverage.
141.4 Variances and exemptions.
141.5 Siting requirements.
141.6 Effective dates.

Subpart B—Maximum Contaminant Levels

141.11 Maximum contaminant levels for inorganic chemicals.
141.12 Maximum contaminant levels for organic chemicals.
141.13 Maximum contaminant levels for turbidity.
141.14 Maximum microbiological contaminant levels.
141.15 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems.
141.16 Maximum contaminant levels for beta particle and photon radioactivity from man-made *radionuclides* in community water systems.

Subpart C—Monitoring and Analytical Requirements

141.21 *Microbiological contaminant* sampling and analytical requirements.
141.22 Turbidity sampling and analytical requirements.
141.23 Inorganic chemical sampling and analytical requirements.
141.24 Organic chemicals other than total trihalomethanes, sampling and analytical requirements.
141.25 Analytical Methods for Radioactivity.
141.26 Monitoring Frequency for Radioactivity in Community Water Systems.
141.27 Alternative analytical techniques.
141.28 Approved laboratories.
141.29 Monitoring of consecutive public water systems
141.30 Total trihalomethanes sampling, analytical and other requirements.

Appendices A — C

Subpart D—Reporting Public Notification, and Record-keeping

141.31 *Reporting requirements.*
141.32 Public notification of variances, exemptions, and non-compliance with regulations.
141.33 Record maintenance.

Subpart E—Special Monitoring Regulations for Organic Chemicals

141.41 Special monitoring for sodium.
141.42 Special monitoring for corrosivity characteristics.

Authority: Secs. 1412, 1414, 1445, and 1450 of the Public Health Service Act, 88 Stat. 1660 (42 U.S.C. 300g-1, 300g-3, 300j-4, and 300j-9).

Subpart A—General

§ 141.1 Applicability.

This part establishes primary drinking water regulations pursuant to section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Pub. L. 93-523); and related regulations applicable to public water systems.

§ 141.2 Definitions.

As used in this part, the term:

(a) "Act" means the Public Health Service Act, as amended by the Safe Drinking Water Act, Pub. L. 93-523.

(b) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(c) "Maximum contaminant level" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

(d) "Person" means an individual, corporation, company, association, partnership, State, municipality, or Federal agency.

(e) "Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a "community water system" or a "noncommunity water system."

(i) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

(ii) "Non-community water system" means a public water system that is not a community water system.

(f) "Sanitary survey" means an onsite review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

(g) "Standard sample" means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

(h) "State" means the agency of the State government which has jurisdiction over public water systems. During any period when a State does not have primary enforcement responsibility pursuant to Section 1413 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

(i) "Supplier of water" means any person who owns or operates a public water system.

(j) "*Dose equivalent*" *means the product* of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

(k) "Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is 1/1000 of a rem.

(l) "Picocurie (pCi)" means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

(m) "Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

(n) "Man-made beta particle and photon emitters" means all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium-232, uranium-235 and uranium-238.

(o) "Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

(p) "Halogen" means one of the chemical elements chlorine, bromine or iodine.

(q) "Trihalomethane" (THM) means one of the family of organic compounds, named as derivatives of methane,

8-19-83 Published by THE BUREAU OF NATIONAL AFFAIRS INC., Washington, D.C. 20037

wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

(r) "Total trihalomethanes" (TTHM) means the sum of the concentration in milligrams per liter of the trihalomethane compounds trichloromethane [chloroform], bromochloromethane, bromodichloromethane and tribromomethane [bromoform]), rounded to two significant figures.

(s) "Maximum Total Trihalomethane Potential (MTP)" means the maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after 7 days at a temperature of 25° C or above.

(t) "Disinfectant" means any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

§ 141.3 Coverage.

This part shall apply to each public water system, unless the public water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) Does not sell water to any person; and

(d) Is not a carrier which conveys passengers in interstate commerce.

§ 141.4 Variances and exemptions.

Variances or exemptions from certain provisions of these regulations may be granted pursuant to Sections 1415 and 1416 of the Act by the entity with primary enforcement responsibility. Provisions under Part 142, *National Interim Primary Drinking Water Regulations Implementation*—Subpart E (Variances) and Subpart F (Exemptions)—apply where EPA has primary enforcement responsibility.

§ 141.5 Siting requirements.

Before a person may enter into a financial commitment for or initiate construction of a new public water system or increase the capacity of an existing public water system, he shall notify the State and, to the extent practicable, avoid locating part or all of the new or expanded facility at a site which:

(a) Is subject to a significant risk from earthquakes, floods, fires or other disasters which could cause a breakdown of the public water system or a portion thereof; or

(b) Except for intake structures, is within the floodplain of a 100-year flood or is lower than any recorded high tide where appropriate records exist. The U.S. Environmental Protection Agency will not seek to override land use decisions affecting public water systems siting which are made at the State or local government levels.

§ 141.6 Effective dates.

(a) Except as provided in paragraph (b) of this section, the regulations set forth in this part shall take effect on June 24, 1977.

(b) The regulations for total trihalomethanes set forth in § 141.12(c) shall take effect 2 years after the date of promulgation of these regulations for community water systems serving 75,000 or more individuals, and 4 years after the date of promulgation for communities serving 10,000 to 74,999 individuals.

[141.6(c) corrected by 47 FR 10998, March 12, 1982]

(c) The regulations set forth in 141.11(a), (d) and (e); 141.14(a)(1); 141.14(b)(1)(i); 141.14(b)(2)(i); 141.14 (d); 141.21(a),(c) and (i); 141.22(a) and (e); 141.23(a)(3) and (a)(4); 141.23(f); 141.24(a)(3); 141.24(e) and (f); 141.25 (e); 141.27(a); 141.28(a) and (b); 141.31(a), (d) and (e); 141.32(b)(3); and 141.32(d) shall take effect immediately upon promulgation.

(d) The regulations set forth in 141.41 shall take effect 18 months from the date of promulgation. Suppliers must complete the first round of sampling and reporting within 12 months following the effective date.

(e) The regulations set forth in 141.42 shall take effect 18 months from the date of promulgation. All requirements in 141.42 must be completed within 12 months following the effective date.

Subpart B—Maximum Contaminant Levels

§ 141.11 Maximum contaminant levels for inorganic chemicals.

(a) The MCL for nitrate is applicable to both community water systems and non-community water systems except as provided by in paragraph (d). The levels for the other inorganic chemicals apply only to community water systems. Compliance with MCLs for inorganic chemicals is calculated pursuant to § 141.23.

[141.11(a) amended by 45 FR 57342, August 27, 1980; corrected by 47 FR 10998, March 12, 1982]

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

Contaminant	Level, milligrams per liter
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

(c) When the annual average of the maximum daily air temperatures for the location in which the community water system is situated is the following, the maximum contaminant levels for fluoride are:

Temperature degrees Fahrenheit	Degrees Celsius	Level, milligrams per liter
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

Fluoride at optimum levels in drinking water has been shown to have beneficial effects in reducing the occurrence of tooth decay.

[141.11(c) corrected by 47 FR 10998, March 12, 1982]

(d) At the discretion of the State, nitrate levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the State that:

(1) Such water will not be available to children under 6 months of age; and

(2) There will be continuous posting of the fact that nitrate levels exceed 10 mg/l and the potential health effects of exposure; and

(3) Local and State public health authorities will be notified annually of nitrate levels that exceed 10 mg/l; and

(4) No adverse health effects shall result.

§ 141.12 Maximum contaminant levels for organic chemicals.

The following are the maximum contaminant levels for organic chemicals. The maximum contaminant levels for organic chemicals in paragraphs (a) and (b) of this section apply to all community water systems. Compliance with the maximum contaminant levels in paragraphs (a) and (b) is calculated pursuant to § 141.24. The maximum comtaminant level for total trihalomethanes in paragraph (c) of this section applies only to community water systems which serve a population of 10,000 or more

individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the maximum contaminant level for total trihalomethanes is calculated pursuant to § 141.30.

	Level, milligrams per liter
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10, 10-hexachloro-6,7-epoxy-1,4, 4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene).	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer).	0.004
Methoxychlor (1,1,1-Trichloro-2, 2-bis [p-methoxyphenyl] ethane).	0.1
Toxaphene ($C_{10}H_{10}Cl_8$-Technical chlorinated camphene, 67-69 percent chlorine).	0.005
(b) Chlorophenoxys:	
2,4-D, (2,4-Dichlorophenoxyacetic acid).	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01

(c) Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform) 0.10 mg/l.

§ 141.13 Maximum contaminant levels for turbidity.

The maximum contaminant levels for turbidity are applicable to both community water systems and non-community water systems using surface water sources in whole or in part. The maximum contaminant levels for turbidity in drinking water, measured at a representative entry point(s) to the distribution system, are:

(a) One turbidity unit (TU), as determined by a monthly average pursuant to § 141.22, except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:

(1) Interfere with disinfection;

(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or

(3) Interfere with microbiological determinations.

(b) Five turbidity units based on an average for two consecutive days pursuant to § 141.22.

§ 141.14 Maximum microbiological contaminant levels.

The maximum contaminant levels for coliform bacteria, applicable to community water systems and non-community water systems, are as follows:

(a) When the membrane filter technique pursuant to § 141.21(a) is used, the number of coliform bacteria shall not exceed any of the following:

[141.14(a)(1) revised by 45 FR 57342, August 27, 1980]

(1) One per 100 milliliters as the arithmetic mean of all samples examined per compliance period pursuant to § 141.21(b) or (c), except that, at the primacy Agency's discretion systems required to take 10 or fewer samples per month may be authorized to exclude one positive routine sample per month from the monthly calculation if: (i) as approved on a case-by-case basis the State determines and indicates in writing to the public water system that no unreasonable risk to health existed under the conditions of this modification. This determination should be based upon a number of factors not limited to the following: (A) the system provided and had maintained an active disinfectant residual in the distribution system, (B) the potential for contamination as indicated by a sanitary survey, and (C) the history of the water quality at the public water system (e.g. MCL or monitoring violations); (ii) the supplier initiates a check sample on each of two consecutive days from the same sampling point within 24 hours after notification that the routine sample is positive, and each of these check samples is negative; and (iii) the original postive routine sample is reported and recorded by the supplier pursuant to § 141.31(a) and § 141.33(a). The supplier shall report to the State its compliance with the conditions specified in this paragraph and a summary of the corrective action taken to resolve the prior positive sample result. If a positive routine sample is not used for the monthly calculation, another routine sample must be analyzed for compliance purposes. This provision may be used only once during two consecutive compliance periods.

(2) Four per 100 milliliters in more than one sample when less than 20 are examined per month; or

(3) Four per 100 milliliters in more than five percent of the samples when 20 or more are examined per month.

(b) (1) When the fermentation tube method and 10 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

[141.14(b)(1)(i) revised by 45 FR 57342, August 27, 1980]

(i) More than 10 percent of the portions (tubes) in any one month pursuant to § 141.21 (b) or (c) except that, at the State's discretion, systems required to take 10 or fewer samples per month may be authorized to exclude one positive routine sample resulting in one or more positive tubes per month from the monthly calculation if: (A) as approved on a case-by-case basis the State determines and indicates in writing to the public water system that no unreasonable risk to health existed under the conditions of this modification. This determination should be based upon a number of factors not limited to the following: (*1*) the system provided and had maintained an active disinfectant residual in the distribution system, (*2*) the potential for contamination as indicated by a sanitary survey, and (*3*) the history of the water quality at the public water system (e.g. MCL or monitoring violations); (B) the supplier initiates a check sample on each of two consecutive days from the sampling point within 24 hours after notification that the routine sample is positive, and each of these check samples is negative; and (C) the original positive routine sample is reported and recorded by the supplier pursuant to § 141.31(a) and § 141.33(a). The supplier shall report to the State its compliance with the conditions specified in this paragraph and report the action taken to resolve the prior positive sample result. If a positive routine sample is not used for the monthly calculation, another routine sample must be analyzed for compliance purposes. This provision may be used only once during two consecutive compliance periods.

(ii) three or more portions in more than one sample when less than 20 samples are examined per month; or

(iii) three or more portions in more than five percent of the samples when 20 or more samples are examined per month.

(2) When the fermentation tube method and 100 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

[141.14(b)(2)(i) revised by 45 FR 57342, August 27, 1980]

(i) More than 60 percent of the portions (tubes) in any month pursuant to *§ 141.21 (b) or (c), except that, State* discretion, systems required to take 10 or fewer samples per month may be authorized to exclude one positive routine sample resulting in one or more positive tubes per month from the monthly calculation if: (A) as approved on a case-by-case basis the State determines and indicates in writing to the public water system that no unreasonable risk to health existed under the conditions of this modification. This determination should be based upon a number of factors not limited to the following: (*1*) the system provided and had maintained an active disinfectant residual in the distribution system, (*2*) the potential for contamination as indicated by a sanitary survey, and (iii) the history of the water quality at the public water system (e.g. MCL or monitoring violations); (B) the supplier initiates two consecutive daily check samples from the same sampling point within 24 hours after notification that the routine sample is positive, and each of these check samples is negative; and (C) the original positive routine sample is reported and recorded by the supplier pursuant to § 141.31(a) and § 141.33(a). The supplier shall report to the State its compliance with the conditions specified in this paragraph and a summary of the corrective action taken to resolve the prior positive sample result. If a positive routine sample is not used for the

[Sec. 141.14(b)(2)(i)]

monthly calculation, another routine sample must be analyzed for compliance purposes. This provision may be used only once during two consecutive compliance periods.

(ii) five portions in more than one sample when less than five samples are examined per month; or

(iii) five portions in more than 20 percent of the samples when five or more samples are examined per month.

(c) For community or non-community systems that are required to sample at a rate of less than 4 per month, compliance with paragraphs (a), (b)(1), or (b)(2) of this section shall be based upon sampling during a 3 month period, except that, at the discretion of the State, compliance may be based upon sampling during a one-month period.

(d) If an average MCL violation is caused by a single sample MCL violation, then the case shall be treated as one violation with respect to the public notification requirements of § 141.32.

[141.14(d) added by 45 FR 57342, August 27, 1980]

§ 141.15 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems.

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

(a) Combined radium-226 and radium-228—5pCi/l.

(b) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15pCi/l.

§ 141.16 Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems.

(a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(b) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "*Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure,*" NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

TABLE A.—*Average annual concentrations assumed to produce a total body or organ dose of 4 mrem/yr*

Radionuclide	Critical organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

Subpart C—Monitoring and Analytical Requirements

§ 141.21 Microbiological contaminant sampling and analytical requirements.

(a) Suppliers of water for community and non-community water systems shall analyze or use the services of an approved laboratory for coliform bacteria to determine compliance with § 141.14. Analyses shall be conducted in accordance with the analytical recommendations set forth in "Standard Methods for the Examination of Water and Wastewater," American Public Health Association, 14th Edition, Method 908A, Paragraphs 1, 2 and 3—pp. 916–918; Method 908D, Table 908: I—p. 923; Method 909A, pp. 928–935, or "Microbiological Methods for Monitoring the Environment, Water and Wastes," U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268—EPA–600/8–78–017, December 1978. Available from ORD Publications, CERI, U.S. EPA, Cincinnati, Ohio 45268. Part III, Section B 1.0 through 2.6.2, pp. 108–112; 2.7 through 2.7.2(c), pp. 112–113; Part III, Section B 4.0 through 4.6.4(c), pp. 114–118, except that a standard sample size shall be employed. The standard sample used in the membrane filter procedure shall be 100 milliliters. The standard sample used in the 5 tube most probable number (MPN) procedure (fermentation tube method) shall be 5 times the standard portion. The standard portion is either 10 milliliters or 100 milliliters as described in § 141.14 (b) and (c). The samples shall be taken at points which are representative of the conditions within the distribution system.

[141.21(a) revised by 45 FR 57342, August 27, 1980]

(b) The supplier of water for a community water system shall take coliform density samples at regular time intervals, and in number proportionate to the population served by the system. In no event shall the frequency be less than as set forth below:

Population served:	Minimum number of samples per month
25 to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 9,400	10
9,401 to 10,300	11
10,301 to 11,100	12
11,101 to 12,000	13
12,001 to 12,900	14
12,901 to 13,700	15
13,701 to 14,600	16
14,601 to 15,500	17
15,501 to 16,300	18
16,301 to 17,200	19
17,201 to 18,100	20
18,101 to 18,900	21
18,901 to 19,800	22
19,801 to 20,700	23
20,701 to 21,500	24
21,501 to 22,300	25
22,301 to 23,200	26
23,201 to 24,000	27
24,001 to 24,900	28
24,901 to 25,000	29
25,001 to 28,000	30
28,001 to 33,000	35
33,001 to 37,000	40
37,001 to 41,000	45
41,001 to 46,000	50
46,001 to 50,000	55
50,001 to 54,000	60
54,001 to 59,000	65
59,001 to 64,000	70
64,001 to 70,000	75
70,001 to 76,000	80
76,001 to 83,000	85
83,001 to 90,000	90
90,001 to 96,000	95
96,001 to 111,000	100
111,001 to 130,000	110
130,001 to 160,000	120
160,001 to 190,000	130
190,001 to 220,000	140
220,001 to 250,000	160
250,001 to 290,000	160
290,001 to 320,000	170
320,001 to 360,000	180
360,001 to 410,000	190
410,001 to 450,000	200
450,001 to 500,000	210
500,001 to 550,000	220
550,001 to 600,000	230
600,001 to 660,000	240
660,001 to 720,000	250
720,001 to 780,000	260
780,001 to 840,000	270
840,001 to 910,000	280
910,001 to 970,000	290
970,001 to 1,050,000	300
1,050,001 to 1,140,000	310
1,140,001 to 1,230,000	320
1,230,001 to 1,320,000	330
1,320,001 to 1,420,000	340
1,420,001 to 1,520,000	350
1,520,001 to 1,630,000	360
1,630,001 to 1,730,000	370
1,730,001 to 1,850,000	380
1,850,001 to 1,970,000	390
1,970,001 to 2,060,000	400
2,060,001 to 2,270,000	410
2,270,001 to 2,510,000	420
2,510,001 to 2,750,000	430
2,750,001 to 3,020,000	440
3,020,001 to 3,320,000	450
3,320,001 to 3,620,000	460
3,620,001 to 3,960,000	470
3,960,001 to 4,310,000	480
4,310,001 to 4,690,000	490
4,690,001 or more	500

Based on a history of no coliform bacterial contamination and on a sanitary survey by the State showing the water system to be supplied solely by a protected ground water source and free of sanitary defects, a community water system serving 25 to 1,000 persons, with written permission from the State, may reduce this sampling frequency except that in no case shall it be reduced to less than one per quarter.

(c) The supplier of water for a non-community water system shall be responsible for sampling coliform bacteria in each calendar quarter that the system provides water to the public. Such sampling shall begin within two years after promulgation. The State can adjust the monitoring frequency on the basis of a sanitary survey, the existence of additional safeguards such as a protective and enforced well code, or accumulated analytical data. Such frequency shall be confirmed or modified on the basis of subsequent surveys or data. The frequency shall not be reduced until the non-community water system has performed at least one coliform analysis of its drinking water and shown to be in compliance with § 141.14.

[141.21(c) revised by 45 FR 57342, August 27, 1980]

(d)(1) When the coliform bacteria in a single sample exceed four per 100 milliliters (§ 141.14(a)), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show less than one coliform bacterium per 100 milliliters.

(2) When coliform bacteria occur in three or more 10 ml portions of a single sample (§ 141.14(b)(1)), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show no positive tubes.

(3) When coliform bacteria occur in all five of the 100 ml portions of a single sample (§ 141.14(b)(2)), at least two daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the State, until the results obtained from at least two consecutive check samples show no positive tubes.

(4) The location at which the check samples were taken pursuant to paragraphs (d) (1), (2), or (3) of this section shall not be eliminated from future sampling without approval of the State. The results from all coliform bacterial analyses performed pursuant to this subpart, except those obtained from check samples and special purpose samples, shall be used to determine compliance with the maximum contaminant level for coliform bacteria as established in § 141.14. Check samples shall not be included in calculating the total number of samples taken each month to determine compliance with § 141.21 (b) or (c).

(e) When the presence of coliform bacteria in water taken from a particular sampling point has been confirmed by any check samples examined as directed in paragraphs (d) (1), (2), or (3) of this section, the supplier of water shall report to the State within 48 hours.

(f) When a maximum contaminant level set forth in paragraphs (a), (b) or (c) of § 141.14 is exceeded, the supplier of water shall report to the State and notify the public as prescribed in § 141.31 and § 141.32.

(g) Special purpose samples, such as those taken to determine whether disinfection practices following pipe placement, replacement, or repair have been sufficient, shall not be used to determine compliance with § 141.14 or § 141.21 (b) or (c).

(h) A supplier of water of a community water system or a non-community water system may, with the approval of the State and based upon a sanitary survey, substitute the use of chlorine residual monitoring for not more than 75 percent of the samples required to be taken by paragraph (b) of this section, *Provided*, That the supplier of water takes chlorine residual samples at points which are representative of the conditions within the distribution system at the frequency of at least four for each substituted microbiological sample. There shall be at least daily determinations of chlorine residual. When the supplier of water exercises the option provided in this paragraph (h) of this section, he shall maintain no less than 0.2 mg/l free chlorine throughout the public water distribution system. When a particular sampling point has been shown to have a free chlorine residual less than 0.2 mg/l, the water at that location shall be retested as soon as practicable and in any event within one hour. If the original analysis is confirmed, this fact shall be reported to the State within 48 hours. Also, if the analysis is confirmed, a sample for coliform bacterial analysis must be collected from that sampling point as soon as practicable and preferably within one hour, and the results of such analysis reported to the State within 48 hours after the results are known to the supplier of water. Analyses for residual chlorine shall be made in accordance with "Standard Methods for the Examination of Water and Wastewater," 13th Ed., pp. 129–132. Compliance with the maximum contaminant levels for coliform bacteria shall be determined on the monthly mean or quarterly mean basis specified in § 141.14, including those samples taken as a result of failure to maintain the required chlorine residual level. The State may withdraw its approval of the use of chlorine residual substitution at any time.

(i) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[141.21(i) added by 45 FR 57342, August 27, 1980]

§ 141.22 Turbidity sampling and analytical requirements.

(a) Samples shall be taken by suppliers of water for both community and non-community water systems at a representative entry point(s) to the water distribution system at least once per day, for the purposes of making turbidity measurements to determine compliance with § 141.13. If the State determines that a reduced sampling frequency in a non-community will not pose a risk to public health, it can reduce the required sampling frequency. The option of reducing the turbidity frequency shall be permitted only in those public water systems that practice disinfection and which maintain an active residual disinfectant in the distribution system, and in those cases where the State has indicated in writing that no unreasonable risk to health existed under the circumstances of this option. The turbidity measurements shall be made by the Nephelometric Method in accordance with the recommendations set forth in "Standard Methods for Examination of Water and Wastewater," American Public Health Association, 14th Edition, pp. 132–134; or "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, March 1979, Method 180.1—Nephelometric Method. Calibration of the turbidimeter shall be made either by the use of a formazin standard as specified in the cited references or a styrene divinylbenzene polymer standard (Amco-AEPA-1 Polymer) commercially available from Amco Standards International, Inc., 230 Polaris Avenue, No. C, Mountain View, California 94043.

[141.22(a) revised by 45 FR 57342, August 27, 1980; 47 FR 8998, March 3, 1982; corrected by 47 FR 10998, March 12, 1982]

(b) If the result of a turbidity analysis indicates that the maximum allowable limit has been exceeded, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour. If the repeat sample confirms that the maximum allowable limit has been exceeded, the supplier of water shall report to the State within 48 hours. The repeat sample shall be the sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum allowable limit, or if the average of two samples taken on consecutive days exceeds 5 TU, the supplier of water shall report to the State and notify the public as directed in § 141.31 and § 141.32.

(c) Sampling for non-community water systems shall begin within two years after the effective date of this part.

(d) The requirements of this § 141.22 shall apply only to public water systems which use water obtained in whole or in part from surface sources.

(e) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[141.22(e) added by 45 FR 57342, August 27, 1980]

§ 141.23 Inorganic chemical sampling and analytical requirements.

(a) Analyses for the purpose of determining compliance with § 141.11 are required as follows:

(1) Analyses for all community water systems utilizing surface water sources shall be completed within one year following the effective date of this part. These analyses shall be repeated at yearly intervals.

(2) Analyses for all community water systems utilizing only ground water sources shall be completed within two years following the effective date of this part. These analyses shall be repeated at three-year intervals.

(3) For non-community water systems, whether supplied by surface or ground sources, analyses for nitrate shall be completed by December 24, 1980. These analyses shall be repeated at intervals determined by the State.

[141.23(a) amended by 45 FR 57342, August 27, 1980]

(4) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

[141.23(a)(4) added by 45 FR 57342, August 27, 1980]

(b) If the result of an analysis made pursuant to paragraph (a) indicates that the level of any contaminant listed in § 141.11 exceeds the maximum contaminant level, the supplier of water shall report to the State within 7 days and initiate three additional analyses at the same sampling point within one month.

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall notify the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) The provisions of paragraphs (b) and (c) of this section notwithstanding, compliance with the maximum contaminant level for nitrate shall be determined on the basis of the mean of two analyses. When a level exceeding the maximum contaminant level for nitrate is found, a second analysis shall be initiated within 24 hours, and if the mean of the two analyses exceeds the maximum contaminant level, the supplier of water shall report his findings to the State pursuant to § 141.31 and shall notify the public pursuant to § 141.32.

(e) For the initial analyses required by paragraph (a)(1), (2) or (3) of this section, data for surface waters acquired within one year prior to the effective date and data for ground waters acquired within 3 years prior to the effective date of this part may be substituted at the discretion of the State.

(f) Analyses conducted to determine compliance with § 141.11 shall be made in accordance with the following methods:

[141.23(f)(1)(9) revised by 45 FR 57342, August 27, 1980]

(1) Arsenic—Method [1] 206.2, Atomic Absorption Furnace Technique; or Method [1] 206.3, or Method [4] D2972-78B, or Method [2] 301.A VII, pp. 159–162, or Method [3] I-1062-78, pp. 61–63, Atomic Absorption—Gaseous Hydride; or Method [1] 206.4, or Method [4] D-2972-78A, or Method [2] 404-A and 404-B(4), Spectrophotometric, Silver Diethyldithiocarbamate.

[141.23(f)(1) corrected by 47 FR 10998, March 12, 1982]

(2) Barium—Method [1] 208.1, or Method [2] 301-A IV, pp. 152–155, Atomic Absorption—Direct Aspiration; or Method [1] 208.2, Atomic Absorption Furnace Technique.

(3) Cadmium—Method [1] 213.1, or Method [4] D-3557-78A or B, or Method [2] 301-A II or III, pp. 148–152, Atomic Absorption—Direct Aspiration; or Method [1] 213.2, Atomic Absorption Furnace Technique.

[141.23(f)(3) corrected by 47 FR 10998, March 12, 1982]

(4) Chromium—Method [1] 218.1, or Method [4] D-1687-77D, or Method [2] 301-A II or III, pp. 148–152, Atomic Absorption—Direct Aspiration; or Chromium—Method [1] 213.2, Atomic Absorption Furnace Technique.

(5) Lead—Method [1] 239.1, or Method [4] D-3559-78A or B, or Method [2] 301-A II or III, pp. 148–152, Atomic Absorption—Direct Aspiration; or Method [1] 239.2, Atomic Absorption Furnace Technique.

(6) Mercury—Method [1] 245.1, or Method [4] D-3223-79, or Method [2] 301-A VI, pp. 158–159, Manual Cold Vapor Technique; or Method [1] 245.2, Automated Cold Vapor Technique.

(7) Nitrate—Method [1] 352.1, or Method [4] D-992-71, or Method [2] 419-D, pp. 427–429, Colorimetric Brucine; or Method [1] 353.3, or Method [4] D-3867-79B, or Method [2] 419-C, pp. 423–427, Spectrometric, Cadmium Reduction; Method [1] 353.1, Automated Hydrazine Reduction; or Method [1] 353.2, or Method [4] D-3867-79A, or Method [2] 605, pp. 620–624, Automated Cadmium Reduction.

(8) Selenium—Method [1] 270.2, Atomic Absorption Furnace Technique; or Method [1] 270.3; or Method [3] I-1667-78, pp. 237–239, or Method [4] D-3859-79, or Method [2] 301-A VII, pp. 159–162, Hydride Generation—Atomic Absorption Spectrophotometry.

[141.23(f)(8) corrected by 47 FR 10998, March 12, 1982]

(9) Silver—Method [1] 272.1, or Method [2] 301-A II, pp. 148–151, Atomic Absorption—Direct Aspiration; or Method [1] 272.2, Atomic Absorption Furnace Technique.

[141.23(f)(9) corrected by 47 FR 10998, March 12, 1982]

(10) "Fluoride — Method [1] 340.1, Method [2] 414-A and 414-C, or Method [4] D-1179-72A, Colorimetric Method with Preliminary Distillation; or Method [1] 340.2, Method [2] 414-B, or Method [4] D-1179-72B, Potentiometric Ion Selective Electrode; or Method [3] I-3325-78, pp. 365–367, Colorimetric Eriochrome Cyanine R Method; or Method [1] 340.3, Method [2] 603, Automated Complexone Method

[1] "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/4-79-020), March 1979. Available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268. For approved analytical procedures for metals, the technique applicable to total metals must be used.

[2] "Standard Methods for the Examination of Water and Wastewater," 14th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1976.

[3] Techniques of Water—Resources Investigation of the United States Geological Survey, Chapter A-1, "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," Book 5, 1979. Stock #024-001-03177-9. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

[4] Annual Book of ASTM Standards, part 31, Water, American Society for Testing and Materials, 1916, Race Street, Philadelphia, Pennsylvania 19103.

[Footnote 4 corrected by 47 FR 10998, March 12, 1982]

(Alizarin Fluoride Blue), pp. 614–616; or Industrial Method #129–71W, Fluoride in Water and Wastewater, Technicon Industrial Systems, Tarrytown, NY 10591, Dec. 1972; or Industrial Method #380–75WE, Automated Electrode Method, Fluoride in Water and Wastewater, Technicon Industrial Systems, Tarrytown, NY, February 1976."

[141.23(f)(10) revised by 45 FR 57342, August 27, 1980; 47 FR 10998, March 12, 1982]

§ 141.24 Organic chemicals other than total trihalomethanes, sampling and analytical requirements.

(a) An analysis of substances for the purpose of determining compliance with § 141.12(a) and § 141.12 (b) shall be made as follows:

[141.24(a) amended by 44 FR 68641, November 29, 1979]

(1) For all community water systems utilizing surface water sources, analyses shall be completed within one year following the effective date of this part. Samples analyzed shall be collected during the period of the year designated by the State as the period when contamination by pesticides is most likely to occur. These analyses shall be repeated at intervals specified by the State but in no event less frequently than at three year intervals.

(2) For community water systems utilizing only ground water sources, analyses shall be completed by those systems specified by the State.

(3) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

[141.24(a)(3) added by 45 FR 57342, August 27, 1980]

(b) If the result of an analysis made pursuant to paragraph (a) of this section indicates that the level of any contaminant listed in § 141.24(a) and (b) exceeds the maximum contaminant level, the supplier of water shall report to the State within 7 days and initiate three additional analyses within one month.

[141.24(b) amended by 44 FR 68641, November 29, 1979]

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall report to the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) For the initial analysis required by paragraph (a) (1) and (2) of this section, data for surface water acquired within one year prior to the effective date of this part and data for ground water acquired within three years prior to the effective date of this part may be substituted at the discretion of the State.

(e) Analysis made to determine compliance with § 141.12(a) shall be made in accordance with "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water," available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268; or "Organochlorine Pesticides in Water," Annual Book of ASTM Standards, part 31, Water, Method D-3086-79; or Method 509-A, pp. 555-565;[2] or Gas Chromatographic Methods for Analysis of Organic Substances in Water,[3] USGS, Book 5, Chapter A-3, pp. 24-39.

[141.24(e) revised by 45 FR 57342, August 27, 1980; corrected by 47 FR 10998, March 12, 1982]

(f) Analysis made to determine compliance with § 141.12(b) shall be conducted in accordance with "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water," available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268; or "Chlorinated Phenoxy Acid Herbicides in water," Annual Book of ASTM Standards, part 31, Method D-3478-79; or Method 509-B, pp. 565-569;[2] or Gas Chromatographic Methods for Analysis of Organic Substances in Water,[3] USGS, Book 5, Chapter A-3, pp. 24-39.

[141.24(f) revised by 45 FR 57342, August 27, 1980; corrected by FR 10998, March 12, 1982]

§ 141.25 Analytical Methods for Radioactivity.

(a) The methods specified in *Interim Radiochemical Methodology for Drinking Water*, Environmental Monitoring and Support Laboratory, EPA–600/4–75–008, USEPA, Cincinnati, Ohio 45268, or those listed below, are to be used to determine compliance with §§ 141.15 and 141.16 (radioactivity[1] except in cases where alternative methods have been approved in accordance with § 141.27.

(1) Gross Alpha and Beta—Method 302 "Gross Alpha and Beta Radioactivity in Water" *Standard Methods for the Examination of Water and Wastewater*, 13th Edition, American Public Health Association, New York, N.Y., 1971.

(2) Total Radium—Method 304 "Radium in Water by Precipitation" Ibid.

(3) Radium-226—Method 305 "Radium-226 by Radon in Water" Ibid.

(4) Strontium-89,90 — Method 303 "Total Strontium and Strontium-90 in Water" Ibid.

(5) Tritium—Method 306 "Tritium in Water" Ibid.

(6) Cesium-134 — ASTM D–2459 "Gamma Spectrometry in Water," *1975 Annual Book of ASTM Standards, Water and Atmospheric Analysis*, Part 31, American Society for Testing and Materials, Philadelphia, PA. (1975).

(7) Uranium—ASTM D–2907 "Microquantities of Uranium in Water by Fluorometry," Ibid.

(b) When the identification and measurement of radionuclides other than those listed in paragraph (a) is required, the following references are to be used, except in cases where alternative methods have been approved in accordance with § 141.27.

(1) *Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions*, H. L. Krieger and S. Gold, EPA–R4–73–014, USEPA, Cincinnati, Ohio, May 1973.

(2) *HASL Procedure Manual*, Edited by John H. Harley. HASL 300, ERDA Health and Safety Laboratory, New York, N.Y., 1973.

(c) For the purpose of monitoring radioactivity concentrations in drinking water, the required sensitivity of the radioanalysis is defined in terms of a detection limit. The detection limit shall be that concentration which can be counted with a precision of plus or minus 100 percent at the 95 percent confidence level (1.96σ where σ is the standard deviation of the net counting rate of the sample).

(1) To determine compliance with § 141.15 (a) the detection limit shall not exceed 1 pCi/l. To determine compliance with § 141.15(b) the detection limit shall not exceed 3 pCi/l.

(2) To determine compliance with § 141.16 the detection limits shall not exceed the concentrations listed in Table B.

TABLE B.—DETECTION LIMITS FOR MAN-MADE BETA PARTICLE AND PHOTON EMITTERS

Radionuclide	*Detection limit*
Tritium	1,000 pCi/l
Strontium-89	10 pCi/l
Strontium-90	2 pCi/l
Iodine-131	1 pCi/l
Cesium-134	10 pCi/l
Gross beta	4 pCi/l
Other radionuclides	1/10 of the applicable limit

(d) To judge compliance with the maximum contaminant levels listed in sections 141.15 and 141.16, averages of

---

[*Editor's note:* For text of footnotes 1-4, see Section 141.23(f).]

[3] Techniques of Water—Resources Investigation of the United States Geological Survey, Chapter A-3, "Methods for Analysis of Organic Substances in Water," Book 5, 1972. Stock #2401-1227. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

data shall be used and shall be rounded to the same number of significant figures as the maximum contaminant level for the substance in question.

(e) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[141.25(e) added by 45 FR 57342, August 27, 1980]

§ 141.26 Monitoring Frequency for Radioactivity in Community Water Systems.

(a) Monitoring requirements for gross alpha particle activity, radium-226 and radium-228.

(1) Initial sampling to determine compliance with § 141.15 shall begin within two years of the effective date of these regulations and the analysis shall be completed within three years of the effective date of these regulations. Compliance shall be based on the analysis of an annual composite of four consecutive quarterly samples or the average of the analyses of four samples obtained at quarterly intervals.

(i) A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis *Provided*, That the measured gross alpha particle activity does not exceed 5 pCi/1 at a confidence level of 95 percent (1.65σ where σ is the standard deviation of the net counting rate of the sample). In localities where radium-228 may be present in drinking water, it is recommended that the State require radium-226 and/or radium-228 analyses when the gross alpha particle activity exceeds 2 pCi/1.

(ii) When the gross alpha particle activity exceeds 5 pCi/1, the same or an equivalent sample shall be analyzed for radium-226. If the concentration of radium-226 exceeds 3 pCi/1 the same or an equivalent sample shall be analyzed for radium-228.

(2) For the initial analysis required by paragraph (a)(1), data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) Suppliers of water shall monitor at least once every four years following the procedure required by paragraph (a)(1). At the discretion of the State, when an annual record taken in conformance with paragraph (a)(1) has established that the average annual concentration is less than half the maximum contaminant levels established by § 141.15, analysis of a single sample may be substituted for the quarterly sampling procedure required by paragraph (a)(1).

(i) More frequent monitoring shall be conducted when ordered by the State in the vicinity of mining or other operations which may contribute alpha particle radioactivity to either surface or ground water sources of drinking water.

(ii) A supplier of water shall monitor in conformance with paragraph (a)(1) within one year of the introduction of a new water source for a community water system. More frequent monitoring shall be conducted when ordered by the State in the event of possible contamination or when changes in the distribution system or treatment processing occur which may increase the concentration of radioactivity in finished water.

(iii) A community water system using two or more sources having different concentrations of radioactivity shall monitor source water, in addition to water from a free-flowing tap, when ordered by the State.

(iv) Monitoring for compliance with § 141.15 after the initial period need not include radium-228 *except when* required by the State, *Provided*, That the average annual concentration of radium-228 has been assayed at least once using the quarterly sampling procedure required by paragraph (a)(1).

(v) Suppliers of water shall conduct annual monitoring of any community water system in which the radium-226 concentration exceeds 3 pCi/1, when ordered by the State.

(4) If the average annual maximum contaminant level for gross alpha particle activity or total radium as set forth in § 141.15 is exceeded, the supplier of a community water system shall give notice to the State pursuant to § 141.31 and notify the public as required by § 141.32. Monitoring at quarterly intervals shall be continued until the annual average concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(b) Monitoring requirements for man-made radioactivity in community water systems.

(1) Within two years of the effective date of this part, systems using surface water sources and serving more than 100,000 persons and such other community water systems as are designated by the State shall be monitored for compliance with § 141.16 by analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. Compliance with § 141.16 may be assumed without further analysis if the average annual concentration of gross beta particle activity is less than 50 pCi/1 and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table A, *Provided*, That if both radionuclides are present the sum of their annual dose equivalents to bone marrow shall not exceed 4 millirem/year.

(i) If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) Suppliers of water shall conduct additional monitoring, as ordered by the State, to determine the concentration of man-made radioactivity in principal watersheds designated by the State.

(iii) At the discretion of the State, suppliers of water utilizing only ground waters may be required to monitor for man-made radioactivity.

(2) For the initial analysis required by paragraph (b)(1) data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) After the initial analysis required by paragraph (b)(1) suppliers of water shall monitor at least every four years following the procedure given in paragraph (b)(1).

(4) Within two years of the effective date of these regulations the supplier of any community water system designated by the State as utilizing waters contaminated by effluents from nuclear facilities shall initiate quarterly monitoring for gross beta particle and iodine-131 radioactivity and annual monitoring for strontium-90 and tritium.

(i) Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former is recommended. If the gross beta particle activity in a sample exceeds 15 pCi/1, the same or an equivalent sample shall be analyzed for strontium-89 and cesium-134. If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) For iodine-131, a composite of five consecutive daily samples shall be analyzed once each quarter. As ordered by the State, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

(iii) Annual monitoring for strontium-90 and tritium shall be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure is recommended.

(iv) The State may allow the substitution of environmental surveillance data taken in conjunction with a nuclear facility for direct monitoring of man-made radioactivity by the supplier of water where the State determines such data is applicable to a particular community water system.

(5) If the average annual maximum contaminant level for man-made radioactivity set forth in § 141.16 is exceeded, the operator of a community water system shall give notice to the State pursuant to § 141.31 and to the public as required by § 141.32. Monitoring at monthly intervals shall be continued until the concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

§ 141.27 Alternative analytical techniques.

(a) With the written permission of the State, concurred in by the Administrator of the U.S. EPA, an alternate analytical technique may be employed. An alternate technique shall be accepted only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any MCL. The use of the alternate analytical technique shall not decrease the frequency of monitoring required by this part.

§ 141.28 Approved laboratories.

(a) For the purpose of determining compliance with § 141.21 through § 141.27, §§ 141.41 and 141.42 samples may be considered only if they have been analyzed by a laboratory approved by the State except that measurements for turbidity, free chlorine residual, temperature and pH may be performed by any person acceptable to the State.

[141.28(a) corrected by 47 FR 10998, March 12, 1982]

(b) Nothing in this Part shall be construed to preclude the State or any duly designated representative of the State from taking samples or from using the results from such samples to determine compliance by a supplier of water with the applicable requirements of this Part.

§ 141.29 Monitoring of consecutive public water systems.

When a public water system supplies water to one or more other public water systems, the State may modify the monitoring requirements imposed by this part to the extent that the interconnection of the systems jusifies treating them as a single system for monitoring purposes. Any modified monitoring shall be conducted pursuant to a schedule specified by the State and concurred in by the Administrator of the U.S. Environmental Protection Agency.

§ 141.30 Total trihalomethanes sampling, analytical and other requirements.

(a) Community water system which serve a population of 10,000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process shall analyze for total trihalomethanes in accordance with this section. For systems serving 75,000 or more individuals, sampling and analyses shall begin not later than 1 year after the date of promulgation of this regulation. For systems serving 10,000 to 74,999 individuals, sampling and analyses shall begin not later than 3 years after the date of promulgation of this regulation. For the purpose of this section, the minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples. All samples taken within an established frequency shall be collected within a 24-hour period.

(b)(1) For all community water systems utilizing surface water sources in whole or in part, and for all community water systems utilizing only ground water sources that have not been determined by the State to qualify for the monitoring requirements of paragraph (c) of this section, analyses for total trihalomethanes shall be performed at quarterly intervals on at least four water samples for each treatment plant used by the system. At least 25 percent of the samples shall be taken at locations within the distribution system reflecting the maximum residence time of the water in the system. The remaining 75 percent shall be taken at representative locations in the distribution system, taking into account number of persons served, different sources of water and different treatment methods employed. The results of all analyses per quarter shall be arithmetically averaged and reported to the State within 30 days of the system's receipt of such results. Results shall also be reported to EPA until such monitoring requirements have been adopted by the State. All samples collected shall be used in the computation of the average, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in paragraph (e) of this section.

(2) Upon the written request of a community water system, the monitoring frequency required by paragraph (b)(1) of this section may be reduced by the State to a minimum of one sample analyzed for TTHMs per quarter taken at a point in the distribution system reflecting the maximum residence time of the water in the system, upon a written determination by the State that the data from at least 1 year of monitoring in accordance with paragraph (b)(1) of this section and local conditions demonstrate that total trihalomethane concentrations will be consistently below the maximum contaminant level.

(3) If at any time during which the reduced monitoring frequency prescribed under this paragraph applies, the results from any analysis exceed 0.10 mg/l of TTHMs and such results are confirmed by at least one check sample taken promptly after such results are received, or if the system makes any significant change to its source of water or treatment program, the system shall immediately begin monitoring in accordance with the requirements of paragraph (b)(1) of this section, which monitoring shall continue for at least 1 year before the frequency may be reduced again. At the option of the State, a system's monitoring frequency may and should be increased above the minimum in those cases where it is necessary to detect variations of TTHM levels within the distribution system.

(c)(1) Upon written request to the State, a community water system utilizing only ground water sources may seek to have the monitoring frequency required by subparagraph (1) of paragraph (b) of this section reduced to a minimum of one sample for maximum TTHM potential per year for each treatment plant used by the system taken at a point in the distribution system reflecting maximum residence time of the water in the system. The system shall submit to the State the results of at least one sample analyzed for maximum TTHM potential for each treatment plant used by the system taken at a point in the distribution system reflecting the maximum residence time of the water in the system. The system's monitoring frequency may only be reduced upon a written determination by the State that, based upon the data submitted by the system, the system has a maximum TTHM potential of less than 0.10 mg/l and that, based upon an assessment of the local conditions of the system, the system is not likely to approach or exceed the maximum contaminant level for total TTHMs. The results of all analyses shall be reported to the State within 30 days of the system's receipt of such results. Results shall also be reported to EPA until such monitoring requirements have been adopted by the State. All samples collected shall be used for determining whether the system must comply with the monitoring requirements of paragraph (b) of this section, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in paragraph (e) of this section.

(2) If at any time during which the reduced monitoring frequency prescribed under paragraph (c)(1) of this

section applies, the results from any analysis taken by the system for maximum TTHM potential are equal to or greater than 0.10 mg/l, and such results are confirmed by at least one check sample taken promptly after such results are received, the system shall immediately begin monitoring in accordance with the requirements of paragraph (b) of this section and such monitoring shall continue for at least one year before the frequency may be reduced again. In the event of any significant change to the system's raw water or treatment program, the system shall immediately analyze an additional sample for maximum TTHM potential taken at a point in the distribution system reflecting maximum residence time of the water in the system for the purpose of determining whether the system must comply with the monitoring requirements of paragraph (b) of this section. At the option of the State, monitoring frequencies may and should be increased above the minimum in those cases where this is necessary to detect variation of TTHM levels within the distribution system.

(d) Compliance with § 141.12(c) shall be determined based on a running annual average of quarterly samples collected by the system as prescribed in subparagraphs (1) or (2) of paragraph (b) of this section. If the average of samples covering any 12 month period exceeds the Maximum Contaminant Level, the supplier of water shall report to the State pursuant to § 141.31 and notify the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(e) Sampling and analyses made pursuant to this section shall be conducted by one of the following EPA approved methods:

(1) "The Analysis of Trihalomethanes in Drinking Waters by the Purge and Trap Method," Method 501.1, EMSL, EPA Cincinnati, Ohio.

(2) "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction," Method 501.2, EMSL, EPA Cincinnati, Ohio.

Samples for TTHM shall be dechlorinated upon collection to prevent further production of Trihalomethanes, according to the procedures described in the above two methods. Samples for maximum TTHM potential should not be dechlorinated, and should be held for seven days at 25° C or above prior to analysis, according to the procedures described in the above two methods.

(f) Before a community water system makes any significant modifications to its existing treatment process for the purposes of achieving compliance with § 141.12(c), such system must submit and obtain State approval of a detailed plan setting forth its proposed modification and those safeguards that it will implement to ensure that the bacteriological quality of the drinking water served by such system will not be adversely affected by such modification. Each system shall comply with the provisions set forth in the State-approved plan. At a minimum, A State approved plan shall require the system modifying its disinfection practice to:

(1) Evaluate the water system for sanitary defects and evaluate the source water for biological quality;

(2) Evaluate its existing treatment practices and consider improvements that will minimize disinfectant demand and optimize finished water quality throughout the distribution system;

(3) Provide baseline water quality survey data of the distribution system. Such data should include the results from monitoring for coliform and fecal coliform bacteria, fecal streptococci, standard plate counts at 35° C and 20° C, phosphate, ammonia nitrogen and total organic carbon. Virus studies should be required where source waters are heavily contaminated with sewage effluent;

(4) Conduct additional monitoring to assure continued maintenance of optimal biological quality in finished water, for example, when chloramines are introduced as disinfectants or when pre-chlorination is being discontinued. Additional monitoring should also be required by the State for chlorate, chlorite and chlorine dioxide when chlorine dioxide is used. Standard plate count analyses should also be required by the State as appropriate before and after any modifications;

(5) Consider inclusion in the plan of provisions to maintain an active disinfectant residual throughout the distribution system at all times during and after the modification.

APPENDIX A—SUMMARY OF PUBLIC COMMENTS AND EPA RESPONSES ON PROPOSED AMENDMENTS TO THE NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS FOR CONTROL OF TRIHALOMETHANES IN DRINKING WATER

[Omitted]

APPENDIX B—SUMMARY OF MAJOR COMMENTS (FOR RESPONSES, SEE APPENDIX A)

[Omitted]

[*Editor's note*: Appendices A and B were comments published in the Federal Register on November 29, 1979 (44 FR 68642).]

APPENDIX C—ANALYSIS OF TRIHALOMETHANES

PART I: THE ANALYSIS OF TRIHALOMETHANES IN DRINKING WATER BY THE PURGE AND TRAP METHOD

1. *Scope*

1.1 This method (1) is applicable in the determination of four trihalomethanes, i.e. chloroform, dichlorobromomethane, dibromochloromethane, and bromoform in finished drinking water, raw source water, or drinking water in any stage of treatment. The concentration of these four compounds is totaled to determine total trihalomethanes (TTHM).

1.2 For compounds other than the above-mentioned trihalomethanes, or for other sample sources, the analyst must demonstrate the usefulness of the method by collecting precision and accuracy data on actual samples as described (2).

1.3 Although the actual detection limits are highly dependent upon the gas chromatographic column and detector employed, the method can be used over a concentration range of approximately 0.5 to 1500 micrograms per liter.

1.4 Well in excess of 100 different water supplies have been analyzed using this method. Supplementary analyses using gas chromatography mass spectrometry (GC/MS) have shown that there is no evidence of interference in the determination of trihalomethanes (3). For this reason, it is not necessary to analyze the raw source water as is required with the Liquid/Liquid Extraction Method (4).

2. *Summary*

2.2 Trihalomethanes are extracted by an inert gas which is bubbled through the aqueous sample. The trihalomethanes, along with other organic constituents which exhibit low water solubility and a vapor pressure significantly greater than water, are efficiently transferred from the aqueous

[Appendix C]

phase to the gaseous phase. These compounds are swept from the purging device and are trapped in a short column containing a suitable sorbent. After a predetermined period of time, the trapped components are thermally desorbed and backflushed onto the head of a gas chromatographic column and separated under programmed conditions. Measurement is accomplished with a halogen specific detector such as electrolytic conductivity or microcoulometric titration.

2.3 Confirmatory analyses are performed using dissimilar columns, or by mass spectrometry (5).

2.4 Aqueous standards and unknowns are extracted and analyzed under identical conditions in order to compensate for extraction losses.

2.5 The total analysis time, assuming the absence of other organohalides, is approximately 35 minutes per sample.

3. *Interferences*

3.1 Impurities contained in the purge gas and organic compounds outgasing from the plumbing ahead of the trap usually account for the majority of contamination problems. The presence of such inteferences are easily monitored as a part of the quality control program. Sample blanks are normally run between each set of samples. When a positive trihalomethane response is noted in the sample blank, the analyst should analyze a method blank. Method blanks are run by charging the purging device with organic-free water and analyzing in the normal manner.

If any trihalomethane is noted in the method blank in excess of 0.4 μg/l, the analyst should change the purge gas source and regenerate the molecular sieve purge gas filter. *Subtracting the blank values is not recommended.* The use of non-TFE plastic tubing, non-TFE thread sealants, or flow controllers with rubber components should be avoided since such materials generally out-gas organic compounds which will be concentrated in the trap during the purge operation. Such out-gasing problems are common whenever new equipment is put into service; as time progresses, minor outgasing problems generally cure themselves.

3.2 Several instances of accidental sample contamination have been noted and attributed to diffusion of volatile organics through the septum seal and into the sample during shipment and storage. The sample blank is used as a monitor for this problem.

3.3 For compounds that are not efficiently purged, such as bromoform, small variations in sample volume, purge time, purge flow rate, or purge temperature can affect the analytical result. Therefore, samples and standards must be analyzed under identical conditions.

3.4 Cross-contamination can occur whenever high-level and low-level samples are sequentially analyzed. To reduce this likelihood, the purging device and sample syringe should be rinsed twice between samples with organic-free water. Whenever an unusually concentrated sample is encountered, it is highly recommended that it be followed by a sample blank analysis to ensure that sample cross contamination does not occur. For samples containing large amounts of water soluble materials, it may be necessary to wash out the purging device with a soap solution, rinse with distilled water, and then dry in a 105°C oven between analyses.

3.5 Qualitative misidentifications are a problem in using gas chromatographic analysis. Whenever samples whose qualitative nature is unknown are analyzed, the following precautionary measures should be incorporated into the analysis.

3.5.1 Perform duplicate analyses using the two recommended columns (4.2.1 and 4.2.2) which provide different retention order and retention times for the trihalomethanes and other organohalides.

3.5.2 Whenever possible, use GC/MS techniques which provide unequivocal qualitative identifications (5).

4. *Apparatus*

4.1 The purge and trap equipment consists of three separate pieces of apparatus: the purging device, trap, and desorber. Construction details for a purging device and an easily automated trap-desorber hybrid which has proven to be exceptionally efficient and reproducible are shown in Figures 1 through 4 and described in 4.1.1. through 4.1.3. An earlier acceptable version of the above-mentioned equipment is described in (1).

4.1.1 Purging Device—Construction details are given in Figure 1 for an all-glass 5 ml purging device. The glass frit installed at the base of the sample chamber allows finely divided gas bubbles to pass through the sample while the sample is restrained above the frit. Gaseous volumes above the sample are kept to a minimum to eliminate dead volume effects, yet allowing sufficient space for most foams to disperse. The inlet and exit ports are constructed from heavy-walled ¼-inch glass tubing so that leak-free removable connections can be made using "finger-tight" compression fittings containing Teflon ferrules. The removable foam trap is used to control samples that foam.

4.1.2 Trapping Device—The trap (Figure 2) is a short gas chromatographic column which at < 35 C retards the flow of the compounds of interest while venting the purge gas and, depending on which sorbent is used, much of the water vapor. The trap should be constructed with a low thermal mass so that it can be heated to 180° C in less than 1 minute for efficient desorption, then rapidly cooled to room temperature for recycling. Variations in the trap ID, wall thickness, sorbents, sorbent packing order, and sorbent mass could adversely affect the trapping and desorption efficiencies for compounds discussed in this text. For this reason, it is important to faithfully reproduce the trap configurations recommended in Figure 2. Traps containing Tenax only, or combinations of Tenax and other sorbents are acceptable for this analysis.

4.1.3 Desorber assembly—Details for the desorber are shown in Figures 3, and 4. With the 6-port valve in the Purge Sorb position (Figure 3), the effluent from the purging device passes through the trap where the flow rate of the organics is retarded. The GC carrier gas also passes through the 6-port valve and is returned to the GC. With the 6-port valve in the Purge-Sorb position, the operation of the GC is in no way impaired; therefore, routine liquid injection analyses can be performed using the gas chromatograph. After the sample has been purged, the 6-port valve is turned to the desorb position (Figure 4). In this configuration the trap is coupled in series with the gas chromatographic column allowing the carrier gas to backflush the trapped materials into the analytical column. Just as the valve is actuated, power is turned on to the resistance wire wrapped around the trap. The power is supplied by an electronic temperature controller. Using this device, the trap is rapidly heated to 180° C and then maintained at 180° C with minimal temperature overshoot. The trapped compounds are released as a "plug" to the gas chromatograph. Normally, packed columns with theoretical efficiencies near 500 plates/foot under programmed temperature conditions can accept splitless desorb injections without altering peak geometry. Substituting a non-controlled power supply, such as a manually-operated variable transformer, will provide nonreproducible retention times and poor quantitative data unless Injection Procedure (8.9.2) is used.

4.1.4 Several Purge and Trap Devices are now commercially available. It is recommended that the following be taken into consideration if a unit is to be purchased:

a. Be sure that the unit is completely compatible with the gas chromatograph to be used for the analysis.

b. Use a 5-ml purging device similar to that shown in Figure 1.

c. Be sure the Tenax portion of the trap meets or exceeds the dimensions shown in Figure 2.

d. With the exception of sample introduction, select a unit that has as many of the purge trap functions automated as possible.

4.2 Gas chromatograph—The chromatograph must be temperature programmable and equipped with a halide specific detector.

4.2.1 Column I is an unusually efficient column which provides outstanding separations for a wide variety of organic compounds. Because of its ability to resolve trihalomethanes from other organochlorine compounds, column I should be used as the primary analytical column (see Table 1 for retention data using this column).

4.2.1.1 Column I parameters: Dimensions—8 feet long x 0.1 inch ID stainless steel or glass tubing. Packing—1% SP-1000 on Carbopack-B (60/80) mesh. Carrier Gas—helium at 40 ml/minute. Temperature program sequence: 45° C isothermal for 3 minutes, program at 8° C/minute to 220°, then hold for 15 minutes or until all compounds have eluted.

NOTE: It has been found that during handling, packing, and programming, active sites are exposed on the Carbopack-B packing. This results in tailing peak geometry

[Appendix C]

and poor resolution of many constituents. To correct this, pack the first 5 cm of the column with 3% SP-1000 on Chromosorb-W 80/80 followed by the Carbopack-B packing. Condition the precolumn and the Carbopack columns with carrier gas flow at 220° C overnight. Pneumatic shocks and rough treatment of packed columns will cause excessive fracturing of the Carbopack. If pressure in excess of 60 psi is required to obtain 30 ml/minute carrier flow, then the column should be repacked.

4.2.1.2 Acceptable column equivalent to column I: Dimensions—8 feet long x 0.1 inch ID stainless steel or glass tubing. Packing—0.2% Carbowax 1500 on Carbopack-C (80/100) mesh. Carrier Gas—helium at 40 ml/minute. Temperature program sequence—60° C isothermal for 3 minutes, program at 8° C /minute to 160° C, then hold for 2 minutes or until all compounds have eluted.

NOTE: It has been found that during handling, packing, and programming, active sites are exposed on the Carbopack-C packing. This results in poor resolution of constituents and poor peak geometry. To correct this, place a 1 ft. 0.125 in. OD x 0.1 in. ID stainless steel column packed with 3% Carbowax 1500 on Chromosorb-W 60/80 mesh in series before the Carbopack-C column. Condition the precolumn and the Carbopack columns with carrier gas flow at 190° C overnight. The two columns may be retained in series for routine analyses. Trihalomethane retention times are listed in Table 1.

4.2.2 Column II provides unique organohalide-trihalomethane separations when compared to those obtained from Column I (see Figures 5 and 6). However, since the resolution between various compounds is generally not as good as those with Column I, it is recommended that Column II be used as a qualitative confirmatory column for unknown samples when GC/MS confirmation is not possible.

4.2.2.1 Column II parameters: Dimensions—6 feet long x 0.1 inch ID stainless steel or glass. Packing—n-octane on Porisil-C (100/120 mesh). Carrier Gas—helium at 40 cc/minute. Temperature program sequence—50° C isothermal for 3 minutes, program at 6°/minute to 170° C, then hold for 4 minutes or until all compounds have eluted. Trihalomethane retention times are listed in Table 1.

5.8 Organic-free water is defined as water free of interference when employed in the purge and trap analysis.

5.8.1 Organic-free water is generated by passing tap water through a carbon filter bed containing about 1 lb. of activated carbon. Change the activated carbon bed whenever the concentration of any trihalomethane exceeds 0.4 μg/l.

5.8.2 A Millipore Super-Q Water System or its equivalent may be used to generate organic-free water.

5.8.3 Organic-free water may also be prepared by boiling water for 15 minutes. Subsequently, while maintaining the temperature at 90° C, bubble a contaminant-free inert gas through the water for one hour. While still hot, transfer the water to a narrow-mouth screw-cap bottle with a Teflon seal.

5.8.4 Test organic free water each day it is used by analyzing according to Section 8.

5.9 Standards.*

5.9.1 Bromoform—96%—available from Aldrich Chemical Company.

5.9.2 Bromodichloromethane 97%—available from Aldrich Chemical Company.

5.9.3 Chlorodibromomethane—available from Columbia Chemical Inc., Columbia, S.C.

5.9.4 Chloroform—99%—available from Aldrich Chemical Company.

5.10 Standard Stock Solutions

5.10.1 Place about 9.8 ml of methyl alcohol into a ground glass stoppered 10 ml volumetric flask.

5.10.2 Allow the flask to stand unstoppered about 10 minutes or until all alcohol wetted surfaces have dried.

5.10.3 Weigh the flask to the nearest 0.1 mg.

5.10.4 Using a 100 μl syringe, immediately add 2 drops of the reference standard to the flask, then reweigh. *Be sure that the 2 drops fall directly into the alcohol without contacting the neck of the flask.*

5.10.5 Dilute to volume, stopper, then mix by inverting the flask several times.

5.10.6 Transfer the solution to a dated and labeled 15 ml screw cap bottle with a Teflon cap liner.

NOTE: Because of the toxicity of trihalomethanes, it is necessary to prepare primary dilutions in a hood. It is further recommended that a NIOSH/MESA approved toxic gas respirator be used when the analyst handles high concentrations of such materials.

5.10.7 Calculate the concentration in micrograms per microliter from the net gain in weight.

5.10.8 Store the solution at 4° C.

NOTE: All standard solutions prepared in methyl alcohol are stable up to 4 weeks when stored under these conditions. They should be discarded after that time has elapsed.

5.11 Aqueous Calibration Standard Precautions.

5.11.1 In order to prepare accurate aqueous standard solutions, the following precautions must be observed.

a. Do not inject more than 20 μl of alcoholic standards into 100 ml of organic-free water.

b. Use of 25 μl Hamilton 702N microsyringe or equivalent. (Variations in needle geometry will adversely affect the ability to deliver reproducible volumes of methanolic standards into water.)

c. Rapidly inject the alcoholic standard into the expanded area of the filled volumetric flask. Remove the needle as fast as possible after injection.

d. Mix aqueous standards by inverting the flask three times only.

e. Discard the contents contained in the neck of the flask. Fill the sample syringe from the standard solution contained in the expanded area of the flask as directed in Section 8.5.

f. Never use pipets to dilute or transfer samples or aqueous standards.

g. Aqueous standards when stored with a headspace are not stable and should be discarded after one hour.

h. Aqueous standards can be stored according to Sections 6.4 and 8.6.

5.11.2 Prepare, from the standard stock solutions, secondary dilution mixtures in methyl alcohol so that a 20 μl injection into 100 ml or organic-free water will generate a calibration standard which produces a response close (±10%) to that of the sample (See 9.1).

5.11.3 Purge and analyze the aqueous calibration standards in the same manner as the samples.

5.11.4 Other calibration procedures (3) which require the delivery of less than 20 μl of a methanolic standard into a 5.0 ml volume of water already contained in the sample syringe are acceptable only if the methanolic standard is delivered by the solvent flush technique (6).

5.12 Quality Check Standard (2.0 μg/l)

5.12.1 From the standard stock solutions, prepare a secondary dilution in methyl alcohol containing 10 ng/μl of each trihalomethane (See Section 5.10.8 Note).

5.12.2 Daily, inject 20.0 μl of this mixture into 100.0 ml of organic-free water ana analyze according to Section 8.

6. *Sample Collection and Handling*

6.1. The sample containers should have a total volume of at least 25 ml.

6.1.1 Narrow mouth screw cap bottles with the TFE fluorocarbon face silicone sepata cap liners are strongly recommended.

6.2 Sample Bottle Preparation

6.2.1 Wash all sample bottles and TFE seals in detergent. Rinse with tap water and finally with distilled water.

6.2.2 Allow the bottles and seals to air dry at room temperature, then place in a 105° C oven for one hour, then allow to cool in a area known to be free of organics.

NOTE: Do not heat the TFE seals for extended period of time (>1 hour) because the silicone layer slowly degrades at 105° C.

6.2.3 When cool, seal the bottles using the TFE seals that will be used for sealing the samples.

6.3 Sample Stabilization—A chemical reducing agent (Section 5.6) is added to the sample in order to arrest the formation of trihalo-methanes after sample collection (3, 7). *Do not add the reducing agent to samples when data on maximum trihalomethane formation is desired.* If chemical stabilization is employed, the reagent is also added to the blanks. The chemical agent (2.5 to 3 mg/40 ml) is added to the empty sample bottles just prior to shipping to the sampling site.

6.4 Sample Collection

6.4.1 Collect all samples in duplicate.

*As a precautionary measure, all standards must be checked for purity by boiling point determinations or GC/MS assays (5).

[Appendix C]

6.4.2 Fill the sample bottles in such a manner that no air bubbles pass through the sample as the bottle is filled.

6.4.3 Seal the bottles so that no air bubbles are entrapped in it.

6.4.4 Maintain the hermetic seal on the sample bottle until analysis.

6.4.5 Sampling from a water tap.

6.4.5.1 Turn on water and allow the system to flush until the temperature of the water has stabilized. Adjust the flow to about 500 ml/minute and collect duplicate samples from the flowing stream.

6.4.6 Sampling from an open body of water.

6.4.6.1 Fill a 1-quart wide-mouth bottle with sample from a representative area. Carefully fill duplicate sample bottles from the 1-quart bottle as noted in 6.4.2.

6.4.7 If a chemical reducing agent has been added to the sample bottles, fill with sample just to overflowing, seal the bottle, and shake vigorously for 1 minute.

6.4.8 Sealing practice for septum seal screw cap bottles.

6.4.8.1 Open the bottle and fill to overflowing, place on a level surface, position the TFE side of the septum seal upon the convex sample meniscus and seal the bottle by screwing the cap on tightly.

6.4.8.2 Invert the sample and lightly tap the cap on a solid surface. The absence of entrapped air indicates a successful seal. If bubbles are present, open the bottle, add a few additional drops of sample and reseal the bottle as above.

6.4.9 Blanks.

6.4.9.1 Prepare blanks in duplicate at the laboratory by filling and sealing sample bottles with organic-free water just prior to shipping the sample bottles to the sampling site.

6.4.9.2 If the sample is to be stabilized, add an identical amount of stabilization reagent to the blanks.

6.4.9.3 Ship the blanks to and from the sampling site along with the sample bottles.

6.4.9.4 Store the blanks and the samples collected at a given site (sample set) together. A sample set is defined as all the samples collected at a given site (i.e., at a water treatment plant, the duplicate raw source waters, the duplicate finished waters and the duplicate blank samples comprise the sample set).

6.5 When samples have been collected according to Section 6, no measurable loss of trihalomethanes has been detected over extended periods of storage time (3). It is recommended that all samples be analyzed within 14 days of collection.

7. *Conditioning Traps*

7.1 Condition newly packed traps overnight at 180 C with an inert gas flow of at least 20 ml/min.

7.1.1 Vent the trap effluent to the room, not to the analytical column.

7.2 Prior to daily use, condition traps 10 minutes while backflushing at 180 C. It may be beneficial to routinely condition traps overnight while backflushing at 180 C.

7.2.1 The trap may be vented to the analytical column; however, after conditioning, the column must be programmed prior to use.

8. *Extraction and Analysis*

8.1 Adjust the purge gas (nitrogen or helium) flow rate to 40 ml/min.

8.2 Attach the trap inlet to the purging device. Turn the valve to the purge-sorb position (Figure 3).

8.3 Open the syringe valve located on the purging device sample introduction needle.

8.4 Remove the plungers from two 5 ml syringes and attach a closed syringe valve to each.

8.5 Open the sample bottle and carefully pour the sample into one of the syringe barrels until it overflows. Replace the syringe plunger and compress the sample. Open the syringe valve and vent any residual air while adjusting the sample volume to 5.0 ml. Close the valve.

8.6 Fill the second syringe in an identical manner from the same sample bottle. This second syringe is reserved for a duplicate analysis, if necessary (See Sections 9.3 and 9.4).

8.7 Attach the syringe-valve assembly to the syringe valve on the purging device.

8.8 Open the syringe valve and inject the sample into the purging chamber. Close both valves. Purge the sample for 11.0±.05 minutes.

8.9 After the 11-minute purge time, attach the trap to the chromatograph (turn the valve to the desorb position) and introduce the trapped materials to the GC column by rapidly heating the trap to 180°C while backflushing the trap with an inert gas between 20 and 60 ml/min for 4 minutes.

8.9.1 If the trap can be rapidly heated to 180°C and maintained at this temperature, the GC analysis can begin as the sample is desorbed, i.e., the column is at the initial 45°C operating temperature. The equipment described in Figure 4 will perform accordingly.

8.9.2 With other types of equipment (see Section 4.1.4 and Reference 1) where the trap is not rapidly heated or is not heated in a reproducible manner, it may be necessary to transfer the contents of the trap into the analytical column at <30°C where it is once again trapped. Once the transfer is complete (4 minutes), the column is rapidly heated to the initial operating temperature for analysis.

8.9.3 If injection procedure 8.9.1 is used and the early eluting peaks in the resulting chromatogram have poor geometry or variable retention times, then Section 8.9.2 should be used.

8.10 After the extracted sample is introduced into the gas chromatograph, empty the gas purging device using the sample introduction syringe, followed by two 5-ml flushes of organic-free water. When the purging device is emptied, leave the syringe valve open allowing the purge gas to vent through the sample introduction needle.

8.11 Analyze each sample and sample blank from the sample set in an identical manner (see Section 6.4.9.4) on the same day.

8.12 Prepare calibration standards fr[om] the standard stock solutions (Section 5.10) in organic-free water that are close to the unknown in trihalomethane composition and concentration (Section 9.1). The concentrations should be such that only 2[%] or less of the secondary dilution need be added to 100 ml of organic-free water to produce a standard at the same level as the unknown.

8.13 As an alternative to Section 8.12, prepare a calibration curve for each trihalomethane containing at least 3 points, two of which must bracket the unknown.

9. *Analytical Quality Control*

9.1 Analyze the 2 μg/l check sample d[aily] before any samples are analyzed. Instrument status checks and lower limit of detection estimations based upon response factor calculations at five times the noise level, [are] obtained from these data. In addition, [the] sponse factor data obtained from the 2 [μg/l] check standard can be used to estimate the concentration of the unknowns. From this information, the appropriate standard dilutions can be determined.

9.2 Analyze the sample blank to mon[itor] for potential interferences as described in Sections 3.1, 3.2, and 3.4.

9.3 Spiked Samples

9.3.1 For laboratories analyzing m[ore] than 10 samples a day, each 10th sam[ple] should be a laboratory generated spike which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare [the] spiked sample in organic-free water as [de]scribed in Section 5.11.

9.3.2 For laboratories analyzing less than 10 samples daily, each time the analysis is performed, analyze at least 1 laborat[ory] generated spike sample which closely du[pli]cates the average finished drinking wate[r in] trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in Section 5.11.

9.4 Randomly select and analyze 10% [of] all samples in duplicate.

9.4.1 Analyze all samples in duplicate which appear to deviate more than 30% from any established norm.

9.5 Maintain an up-to-date log on the [ac]curacy and precision data collected in [Sec]tions 9.3 and 9.4. If results are significantly different than those cited in Section 11.1, the analyst should check out the entire analyses scheme to determine why the laboratory's precision and accuracy limits are greater.

9.6 Quarterly, spike an EMSL-Cincinnati trihalomethane quality control sample into organic-free water and analyze.

9.6.1 The results of the EMSL trihalomethane quality control sample should agree within 20% of the true value for each trihalomethane. If they do not then the analyst must check each step in the standard generation procedure to solve the problem (Section 5.9, 5.10, and 5.11).

9.7 Maintain a record of the retention times for each trihalomethane using data gathered from spiked samples and standards.

[Appendix C]

9.7.1 Daily calculate the average retention time for each trihalomethane and the variance encountered for the analyses.

9.7.2 If individual trihalomethane retention time varies by more than 10% over an eight hour period or does not fall with 10% of an established norm, the system is "out of control." The source of retention data variation must be corrected before acceptable data can be generated.

10. *Calculations*

10.1 Locate each trihalomethane in the sample chromatogram by comparing the retention time of the suspect peak to the data gathered in 9.7.1. The retention time of the suspect peak must fall within the limits established in 9.7.1 for single column identification.

10.2 Calculate the concentration of the samples by comparing the peak height or peak areas of the samples to the standard peak height (8.12). Round off the data to the nearest μg/l or two significant figures.

$$\mu g/l = \frac{\text{peak height sample}}{\text{peak height standard}} \times (\text{conc. std. } \mu g/l)$$

10.3 Report the results obtained from the lower limit of detection estimates along with the data for the samples.

10.4 Calculate the total trihalomethane concentration (TTHM) by summing the 4 individual trihalomethane concentrations in μg/l. TTHM (μg/l)=(Conc. $CHCl_3$)+(Conc. $CHBrCl_2$)+(Conc. $CHBr_2Cl$)+(Conc. $CHBr_3$).

10.5 Calculate the limit of detection (LOD) for each trihalomethane not detected using the following criteria:

$$LOD\ (\mu g/l) = \frac{A \times ATT}{B \times ATT} (2\ \mu g/l)$$

where B=peak height (mm) of 2 μg/l quality check standard

A=5 times the noise level in (mm) at the exact retention time of the trihalomethane or the baseline displacement in (mm) from the theoretical zero at the exact retention time of the trihalomethane.

ATT=*Attenuation factor*

11. *Accuracy and Precision*

11.1 One liter of organic-free water was spiked with the trihalomethanes and used to fill septum seal vials which were stored under ambient conditions. The spiked samples were randomly analyzed over a 2-week period of time. The single laboratory data listed in Table II reflect the errors due to the analytical procedure and storage.

References

1. Bellar, T. A., J. J. Lichtenberg, Determining Volatile Organics at the Microgram per Litre Levels by Gas Chromatography, Journal AWWA., 66, 739 (December 1974).

2. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," Analytical Quality Control Laboratory, National Environmental Research Center, Cincinnati, Ohio, June 1972.

3. Brass, H. J., et al., "National Organic Monitoring Survey: Sampling and Purgeable Organic Compounds, Drinking Water Quality Through Source Protection," R. B. Pojasek, Editor, Ann Arbor Science, p. 398, 1977.

4. "The Analysis of Trihalomethanes in Finished Water by the Liquid/Liquid Extraction Method, Method 501.2" Environmental Monitoring and Support Labortory, Environmental Research Center, Cincinnati, Ohio, 45268, May 15, 1979.

5. Budde, W. L. and J. W. Eichelberger, "Organics Analysis Using Gas Chromatography-Mass Spectrometry," Ann Arbor Science, Ann Arbor, Michigan, 1979.

6. White, L. D. et al., "Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere," AIHA Journal, Vol. 31, p. 225, 1970.

7. Kopfler, F. C., et al. "GC/MS Determination of Volatiles for the National Organics Reconnaissance Survey (NORS) or Drinking Water, Identification and Analysis of Organic Pollutants in Water," L. H. Keith, Editor, Ann Arbor Science, p. 87, 1976.

TABLE I—*Retention Data for Trihalomethanes*

Trihalomethane	Retention time minutes: Column I 1% sp1000 Carbopack B	Acceptable Alternative to column I 0.4% Carbowax Carbopack	Column II n-octane Porasil-C
Chloroform	10.7	8.2	12.2
Bromodichloromethane	13.7	10.8	14.7

TABLE I—*Retention Data for Trihalomethanes*

Trihalomethane	Retention time minutes: Column I 1% sp1000 Carbopack B	Acceptable Alternative to column I 0.4% Carbowax Carbopack	Column II n-octane Porasil-C
Chlorodibromomethane (Dibromochloromethane)	16.5	13.2	16.6
Bromoform	19.2	15.7	19.2

TABLE II—*Single Laboratory Accuracy and Precision for Trihalomethanes*

Spike μg/l	Number samples	Mean μg/l	Precision standard deviation	Accuracy percent recovery
		Chloroform		
1.2	12	1.2	0.14	100
12.0	8	11	0.16	92
119.0	11	105	7.9	88
		Bromodichloromethane		
1.6	12	1.5	0.05	94
16.0	8	15	0.39	94
160.0	11	145	10.2	91
		Chlorodibromomethane		
2.0	12	1.9	0.09	95
20.0	8	19	0.70	95
196.0	11	185	10.6	94
		Bromoform		
2.3	12	2.3	0.16	100
23.0	8	23	1.38	100
231.0	11	223	16.3	97

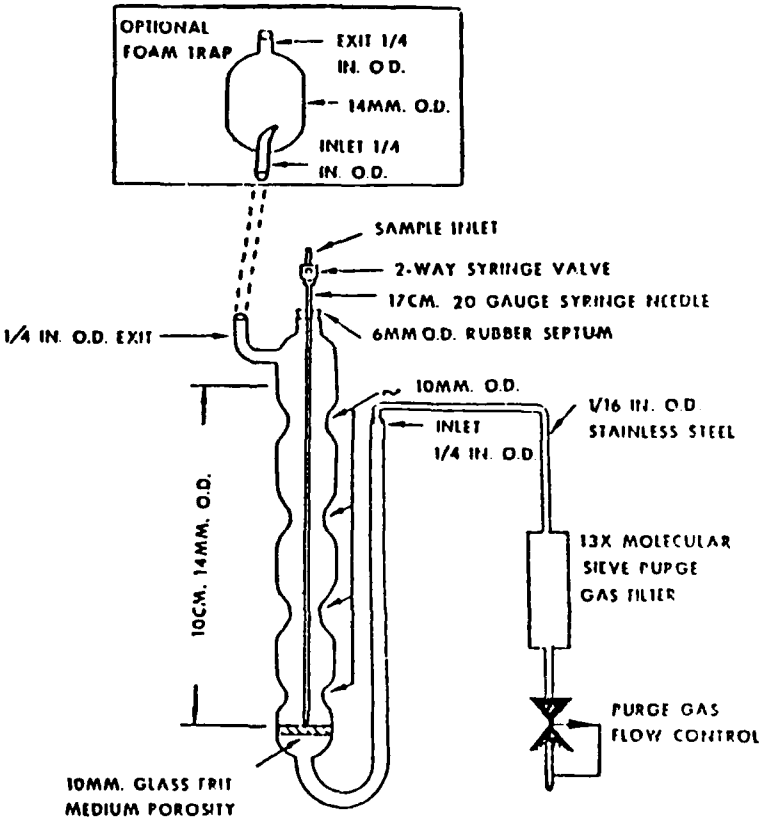


FIGURE 1. PURGING DEVICE

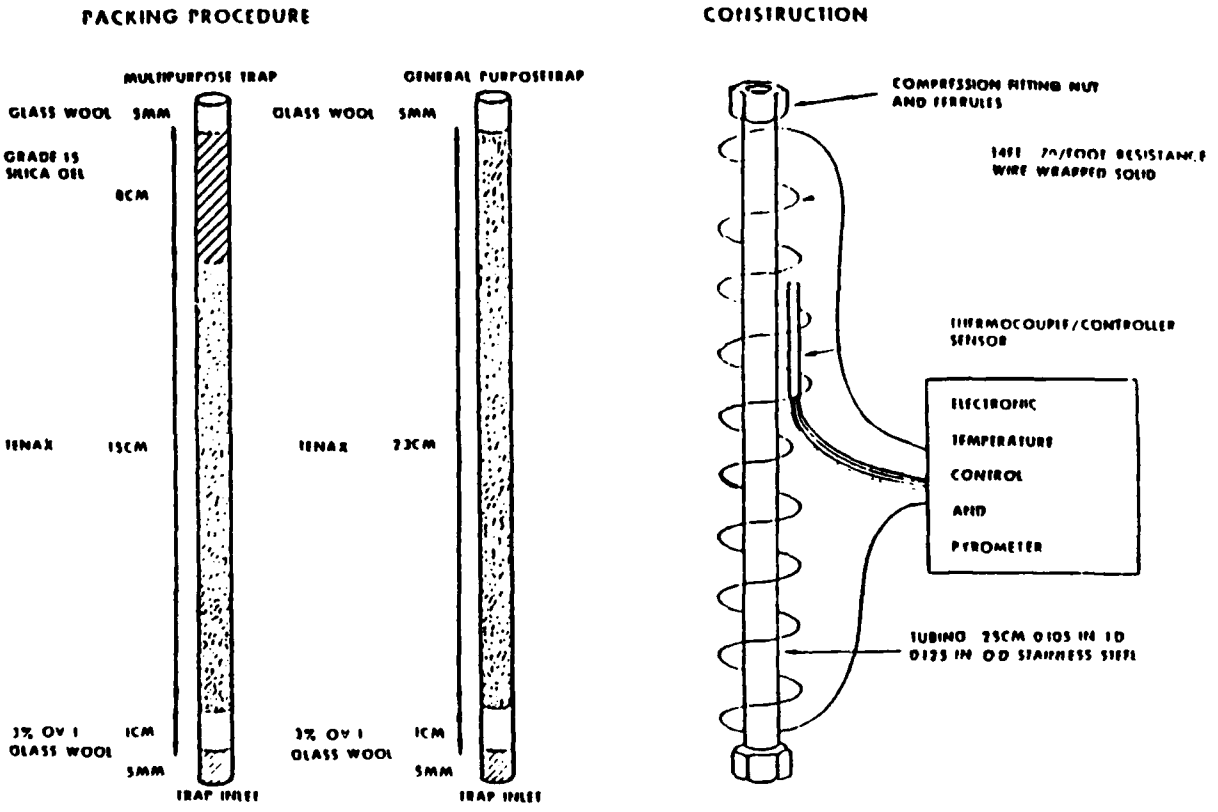


FIGURE 2 TRAP

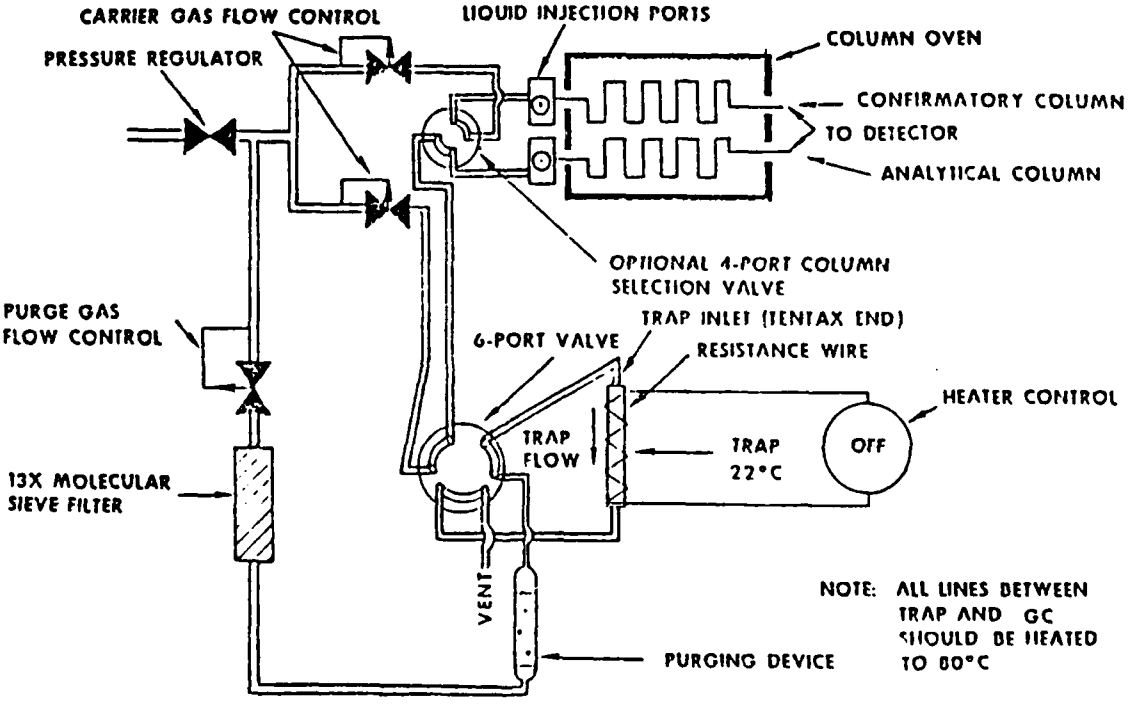


FIGURE 3 PURGE-TRAP SYSTEM (PURGE-SORB MODE)

[Appendix C]

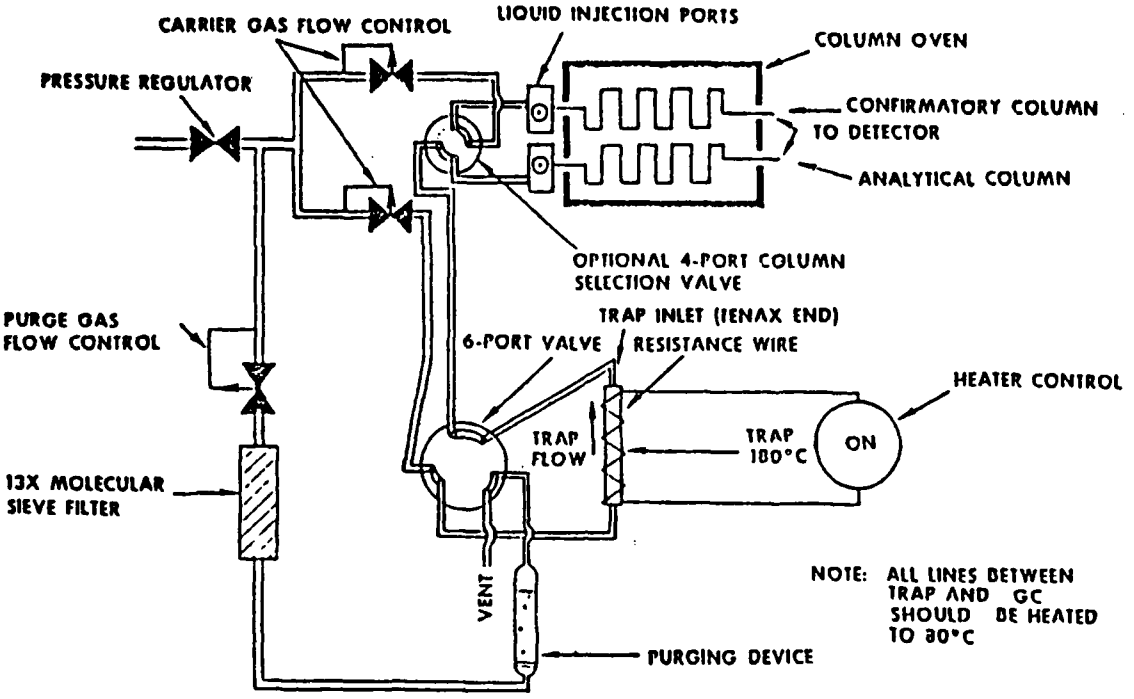


FIGURE 4 PURGE-TRAP SYSTEM (DESORB MODE)

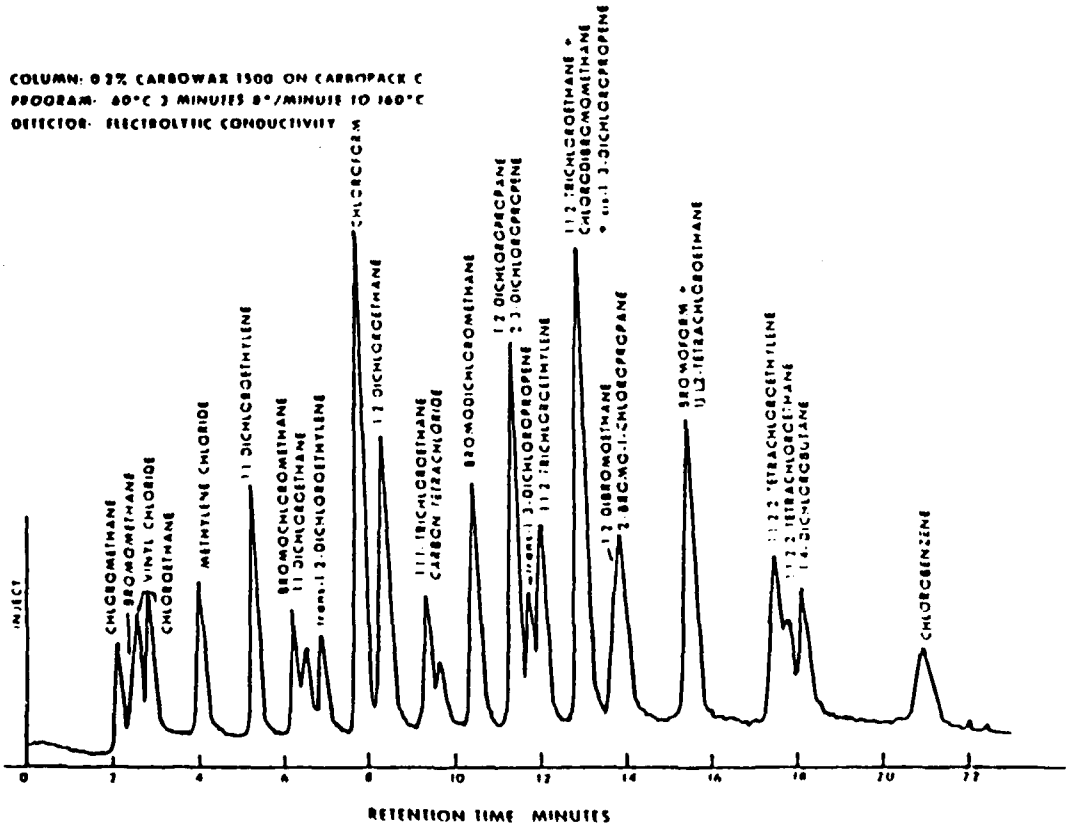


FIGURE 5 CHROMATOGRAM OF ORGANOHALIDES

[Appendix C]

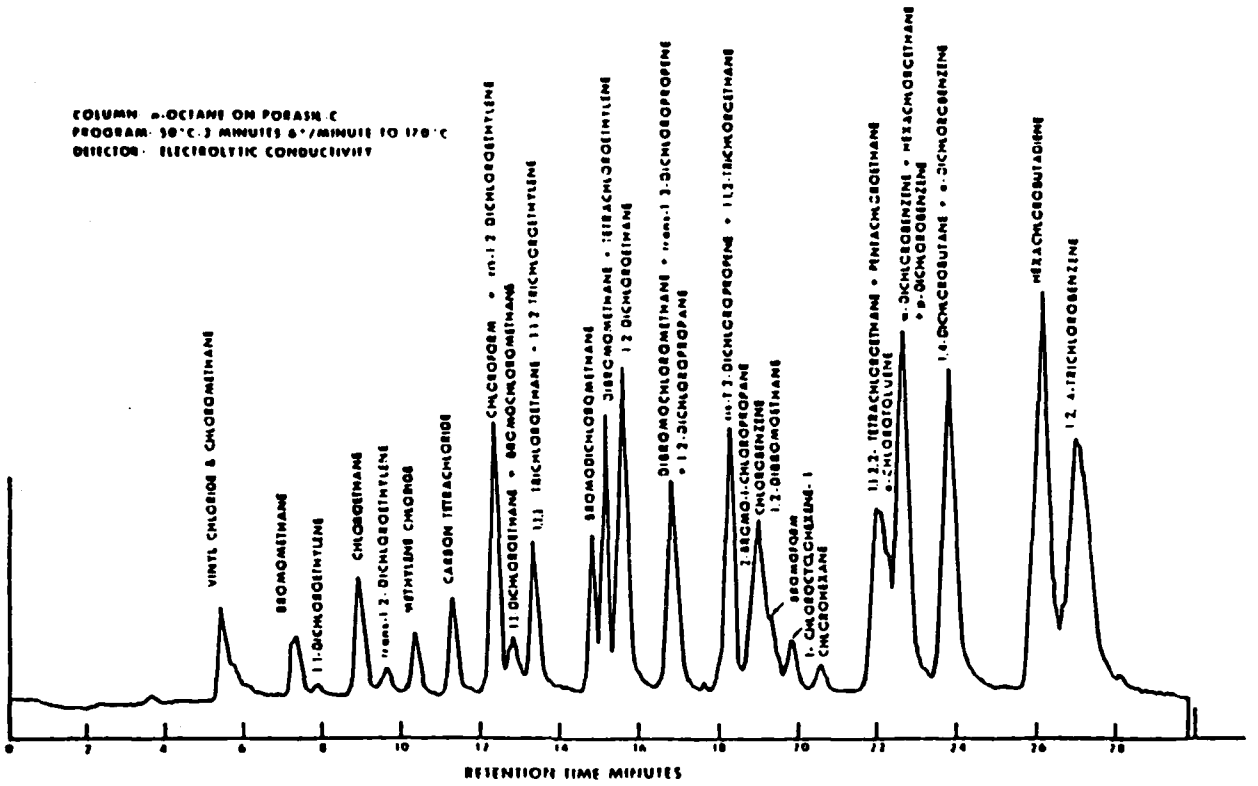


FIGURE 6 CHROMATOGRAM OF ORGANOHALIDES

PART II: ANALYSIS OF TRIHALOMETHANES IN DRINKING WATER BY LIQUID/LIQUID EXTRACTION

1. *Scope.*

1.1 This method (1,2) is applicable only to the determination of four trihalomethanes, i.e., chloroform, bromodichloromethane, chlorodibromomethane, and bromoform in finished drinking water, drinking water during intermediate stages of treatment, and the raw source water.

1.2 For compounds other than the above-mentioned trihalomethanes, or for other sample sources, the analyst must demonstrate the usefulness of the method by collecting precision and accuracy data on actual samples as described in (3) and provide qualitative confirmation of results by Gas Chromatography/Mass Spectrometry (GC/MS) (4).

1.3 Qualitative analyses using GC/MS or the purge and trap method (5) must be performed to characterize each raw source water if peaks appear as interferences in the raw source analysis.

1.4 The method has been shown to be useful for the trihalomethanes over a concentration range from approximately 0.5 to 200 μg/l. Actual detection limits are highly dependent upon the characteristics of the gas chromatographic system used.

2. *Summary*

2.1 Ten milliliters of sample are extracted one time with 2 ml of solvent. Three μl of the extract are then injected into a gas chromatograph equipped with a linearized electron capture detector for separation and analysis.

2.2 The extraction and analysis time is 10 to 50 minutes per sample depending upon the analytical conditions chosen. (See Table 1 and Figures 1, 2, and 3.)

2.3 Confirmatory evidence is obtained using dissimilar columns and temperature programming. When component concentrations are sufficiently high (>50 μg/l), halogen specific detectors may be employed for improved specificity.

2.4 Unequivocal confirmatory analyses at high levels (>50 μg/l) can be performed using GC/MS in place of the electron capture detector. At levels below 50 μg/l, unequivocal confirmation can only be performed by the purge and trap technique using GC/MS (4, 5).

2.5 Standards dosed into organic f[illegible] water and the samples are extracted and analyzed in an identical manner in order to compensate for possible extraction losses.

2.6 The concentration of each trihalomethane is summed and reported as to[illegible] trihalomethanes in μg/l.

3. *Interferences*

3.1 Impurities contained in the extracting solvent usually account for the major[illegible] of the analytical problems. Solvent blanks should be analyzed before a new bottle of solvent is used to extract samples. Indirect daily checks on the extracting solvent are obtained by monitoring the sample blank (6.4.10). Whenever an interference is noted in the sample blank, the analyst should reanalyze the extracting solvent. The extraction solvent should be discarded whenever a high level (>10 μg/l) of interfering compounds are traced to it. Low level interferences generally can be removed by distillation or column chromatography (6); however, it is generally more economical to obtain a new source of solvent or select one of the approved alternative solvents listed in Section 5.1. Interference free solvent is defined as a solvent containing less than 0.4

[Appendix C]

µg/l individual trihalomethane interference. Protect interference-free solvents by storing in a non-laboratory area known to be free of organochlorine solvents. *Subtracting blank values is not recommended.*

3.2 Several instances of accidental sample contamination have been attributed to diffusion of volatile organics through the septum seal on the sample bottle during shipment and storage. The sample blank (6.4.10) is used to monitor for this problem.

3.3 This liquid/liquid extraction technique efficiently extracts a wide boiling range of non-polar organic compounds and, in addition, extracts the polar organic components of the sample with varying efficiencies. In order to perform the trihalomethane analysis as rapidly as possible with sensitivities in the low µg/l range, it is necessary to use the semi-specific electron capture detector and chromatographic columns which have relatively poor resolving power. Because of these concessions, the probability of experiencing chromatographic interferences is high. Trihalomethanes are primarily products of the chlorination process and generally do not appear in the raw source water. The absence of peaks in the raw source water analysis with retention times similar to the trihalomethanes is generally adequate evidence of an interference-free finished drinking water analysis. Because of these possible interferences, in addition to each finished drinking water analysis, a representative raw source water (6.4.5) must be analyzed. When potential interferences are noted in the raw source water analysis, the alternate chromatographic columns must be used to reanalyze the sample set. If interferences are still noted, qualitative identifications should be performed according to Sections 2.3 and 2.4. If the peaks are confirmed to be other than trihalomethanes and add significantly to the total trihalomethane value in the finished drinking water analysis, then the sample set must be analyzed by the purge and trap method (5).

4. *Apparatus*

4.1 Extraction vessel—A 15 ml total volume glass vessel with a Teflon lined screw cap is required to efficiently extract the samples.

4.1.1 For samples that do not form emulsions 10 ml screw-cap flasks with a Teflon faced septum (total volume is ml) are recommended. Flasks and caps—Pierce—#13310 or equivalent. Septa—Teflon silicone—Pierce #12718 or equivalent.

4.1.2 For samples that form emulsions (turbid source water) 15 ml screw cap centrifuge tubes with a Teflon cap liner are recommended. Centrifuge tube—Corning 8062-15 or equivalent.

4.2 Sampling containers—40 ml screw cap sealed with Teflon faced silicone septa. Vials and caps—Pierce #13075 or equivalent. Septa—Pierce #12722 or equivalent.

4.3 Micro syringes—10, 100 µl.

4.4 Micro syringe—25 µl with a 2-inch by 0.006-inch needle—Hamilton 702N or equivalent.

4.5 Syringes—10 ml glass hypodermic with luerlok tip (2 each).

4.6 Syringe valve—2-way with luer ends (2 each)—Hamilton #86570—1FM1 or equivalent.

4.7 Pipette—2.0 ml transfer.

4.8 Glass stoppered volumetric flasks—10 and 100 ml.

4.9 Gas chromatograph with linearized electron capture detector. (Recommended option—temperature programmable. See Section 4.12.)

4.10 Column A—4 mm ID x 2m long glass packed with 3% SP-1000 on Supelcoport (100/120 mesh) operated at 50°C with 60 ml/min flow. (See Figure 1 for a sample chromatogram and Table 1 for retention data.)

4.11 Column B—2 mm ID x 2m long glass packed with 10% squalane on Chromosorb WAW (80/100 mesh) operated at 67°C with 25 ml/min flow. This column is recommended as the primary analytical column. Trichloroethylene, a common raw source water contaminate, coelutes with bromodichloromethane. (See Figure 2 for a sample chromatogram and Table 1 for retention data.)

4.12 Column C—2 mm ID x 3m long glass packed with 6% OV-11/4% SP-2100 on Supelcoport (100/120 mesh) temperature program 45°C for 12 minutes, then program at 1°/minute to 70°C with a 25 ml/min flow. (See Figure 3 for a sample chromatogram and Table I for retention data.)

4.13 Standard storage containers—15 ml amber screw-cap septum bottles with Teflon faced silicone septa. Bottles and caps—Pierce #19830 or equivalent. Septa—Pierce #12716 or equivalent.

5. *Reagents*

5.1 Extraction solvent—(See 3.1). Recommended—Pentane*. Alternative—hexane, methylcyclohexane or 2,2,4-trimethylpentane.

5.2 Methyl alcohol—ACS Reagent Grade.

5.3 Free and combined chlorine reducing agents—Sodium thiosulfate ACS Reagent Grade—sodium sulfite ACS Reagent Grade.

5.4 Activated carbon—Filtrasorb—200, available from Calgon Corporation, Pittsburgh, PA, or equivalent.

5.5 Standards.**

5.5.1 Bromoform 96%—available from Aldrich Chemical Company.

5.5.2 Bromodichloromethane 97%—available from Aldrich Chemical Company.

5.5.3 Chlorodibromomethane—available from Columbia Chemical, Incorporated, Columbia, S.C.

5.5.4 Chloroform 99%—available from Aldrich Chemical Company.

5.6 Organic-free water—Organic-free water is defined as water free of interference when employed in the procedure described herein.

5.6.1 Organic-free water is generated by passing tap water through a carbon filter bed containing carbon. Change the activated carbon whenever the concentration of any trihalomethane exceeds 0.4 µg/l.

5.6.2 A Millipore Super-Q Water System or its equivalent may be used to generate organic-free deionized water.

5.6.3 Organic-free water may also be prepared by boiling water for 15 minutes. Subsequently, while maintaining the temperature at 90° C, bubble a contaminant free inert gas through the water at 100 ml/minute for one hour. While still hot, transfer the water to a narrow mouth screw cap bottle with a Teflon seal.

5.6.4 Test organic free water each day it is used by analyzing it according to Section 7.

5.7 Standard stock solutions.

5.7.1 Fill a 10.0 ml ground glass stoppered volumetric flask with approximately 9.8 ml of methyl alcohol.

5.7.2 Allow the flask to stand unstoppered about 10 minutes or until all alcohol wetted surfaces dry.

5.7.3 Weigh the unstoppered flask to the nearest 0.1 mg.

5.7.4 Using a 100 µl syringe, immediately add 2 to 3 drops of the reference standard to the flask, then reweigh. *Be sure that the reference standard falls directly into the alcohol without contacting the neck of the flask.*

5.7.5 Dilute to volume, stopper, then mix by inverting the flask several times.

5.7.6 Transfer the standard solution to a dated and labeled 15 ml screw-cap bottle with a Teflon cap liner.

NOTE: Because of the toxicity of trihalomethanes, it is necessary to prepare primary dilutions in a hood. It is further recommended that a NIOSH/MESA-approved toxic gas respirator be used when the analyst handles high concentrations of such materials.

5.7.7 Calculate the concentration in micrograms per microliter from the net gain in weight.

5.7.8 Store the solution at 4° C.

NOTE: All standard solutions prepared in methyl alcohol are stable up to 4 weeks when stored under these conditions. They should be discarded after that time has elapsed.

5.8 Aqueous calibration standard precautions.

5.8.1 In order to prepare accurate aqueous standard solutions, the following precautions must be observed:

* Pentane has been selected as the best solvent for this analysis because it elutes, on all of the columns, well before any of the trihalomethanes. High altitudes or laboratory temperatures in excess of 75°F may make the use of this solvent impractical. For these reasons, alternative solvents are acceptable; however, the analyst may experience baseline variances in the elution areas of the trihalomethanes due to coelution of these solvents. The degree of difficulty appears to be dependent upon the design and condition of the electron capture detector. Such problems should be insignificant when concentrations of the coeluting trihalomethane are in excess of 5 µg/l.

** As a precautionary measure, all standards must be checked for purity by boiling point determinations or GC/MS assays.

[Appendix C]

a. Do not inject more than 20 µl of alcoholic standards into 100 ml of organic-free water.

b. Use a 25 µl Hamilton 702N microsyringe or equivalent. (Variations in needle geometry will adversely affect the ability to deliver reproducible volumes of methanolic standards into water.)

c. Rapidly inject the aloholic standard into the expanded area of the filled volumetric flask. Remove the needle as fast as possible after injection.

d. Mix aqueous standards by inverting the flask three times only.

e. Discard the contents contained in the neck of the flask. Fill the sample syringe from the standard solution contained in the expanded area of the flask as directed in Section 7.

f. Never use pipets to dilute or transfer samples and aqueous standards.

g. Aqueous standards, when stored with a headspace, are not stable and should be discarded after one hour. Aqueous standards can be stored according to Sections 6.4.9 and 7.2.

5.9 Calibration standards.

5.9.1 Prepare, from the standard stock solutions, a multicomponent secondary dilution mixture in methyl alcohol so that a 20 µl injection into 100 ml of organic-free water will generate a calibration standard which produces a response close (± 25%) to that of the unknown. (See 8.1.)

5.9.2 Alternative calibration procedure.

5.9.2.1 Construct a calibration curve for each trihalomethane containing a minimum of 3 different concentrations. Two of the concentrations must bracket each unknown.

5.9.3 Extract and analyze the aqueous calibration standards in the same manner as the unknowns.

5.9.4 Other calibration procedures (7) which require the delivery of less than 20 µl of methanolic standards to 10.0 ml volumes of water contained in the sample syringe are acceptable only if the methanolic standard is delivered by the solvent flush technique (8).

5.10 Quality Check Standard Mixture.

5.10.1 Prepare, from the standard stock solutions, a secondary dilution mixture in methyl alcohol that contains 10.0 ng/µl of each compound. (See 5.7.6 and 5.7.8.)

5.10.2 Daily, prepare and analyze a 2.0 µg/l aqueous dilution from this mixture by dosing 20.0 µl into 100 ml of organic-free water (See Section 8.1).

6. *Sample Collection and Handling.*

6.1 The sample containers should have a total volume of at least 25 ml.

6.1.1 Narrow-mouth screw-cap bottles with the TFE fluorocarbon faced silicone septa cap liners are strongly recommended.

6.2 Glassware Preparation.

6.2.1 Wash all sample bottles, TFE seals, and extraction flasks in detergent. Rinse with tap water and finally with distilled water.

6.2.2 Allow the bottles and seals to air dry, then place in an 105° C oven for 1 hour, then allow to cool in an area known to be free of organics.

NOTE: Do not heat the TFE seals for extended periods of time (>1 hour) because the silicone layer slowly degrades at 105° C.

6.2.3 When cool, seal the bottles using the TFE seals that will be used for sealing the samples.

6.3 Sample stabilization—A chemical reducing agent (Section 5.3) is added to all samples in order to arrest the formation of additional trihalomethanes after sample collection (7,9) and to eliminate the possibility of free chlorine reacting with impurities in the extraction solvent to form interfering organohalides. *DO NOT ADD THE REDUCING AGENT TO SAMPLES AT COLLECTION TIME WHEN DATA FOR MAXIMUM TRIHALOMETHANE FORMATION IS DESIRED.* If chemical stabilization is employed, then the reagent is also added to the blanks. The chemical agent (2.5 to 3 mg/40 ml) is added in crystalline form to the empty sample bottle just prior to shipping to the sampling site. If chemical stabilization is not employed at sampling time then the reducing agent is added just before extraction.

6.4 Sample Collection.

6.4.1 Collect all samples in duplicate.

6.4.2 Fill the sample bottles in such a manner that no air bubbles pass through the sample as the bottle is filled.

6.4.3 Seal the bottle so that no air bubbles are entrapped in it.

6.4.4 Maintain the hermetic seal on the sample bottle until analysis.

6.4.5 The raw source water sample history should resemble the finished drinking water. The average retention time of the finished drinking water within the water plant should be taken into account when sampling the raw source water.

6.4.6 Sampling from a water tap.

6.4.6.1 Turn on the water and allow the system to flush until the temperature of the water has stabilized. Adjust the flow to about 500 ml/minute and collect duplicate samples from the flowing stream.

6.4.7 Sampling from an open body of water.

6.4.7.1 Fill a 1-quart wide-mouth bottle with sample from a representative area. Carefully fill duplicate sample bottles from the 1-quart bottle as in 6.4.

6.4.8 If a chemical reducing agent has been added to the sample bottles, fill with sample just to overflowing, seal the bottle, and shake vigorously for 1 minute.

6.4.9 Sealing practice for septum seal screw cap bottles.

6.4.9.1 Open the bottle and fill to overflowing. Place on a level surface. Position the TFE side of the septum seal upon the convex sample meniscus and seal the bottle by screwing the cap on tightly.

6.4.9.2 Invert the sample and lightly tap the cap on a solid surface. The absence of entrapped air indicates a successful seal. If bubbles are present, open the bottle, add a few additional drops of sample, then reseal bottle as above.

6.4.10 Sample blanks.

6.4.10.1 Prepare blanks in duplicate at the laboratory by filling and sealing sample bottles with organic-free water just prior to shipping the sample bottles to the sampl site.

6.4.10.2 If the sample is to be stabilized, add an identical amount of reducing agent to the blanks.

6.4.10.3 Ship the blanks to and from sampling site along with the sample bott

6.4.10.4 Store the blanks and the samples, collected at a given site (sample set), together in a protected area known to be free from contamination. A sample set is fined as all the samples collected at a gi site (i.e., at a water treatment plant, du cate raw source water, duplicate finished water and the duplicate sample blanks comprise the sample set).

6.5 When samples are collected stored under these conditions, no meas able loss of trihalomethanes has been detected over extended periods of time (7). It is recommended that the samples be lyzed within 14 days of collection.

7. *Extraction and Analysis.*

7.1 Remove the plungers from two 10-ml syringes and attach a closed syringe valve to each.

7.2 Open the sample bottle[1] (or sta ard) and carefully pour the sample into of the syringe barrels until it overflows. Replace the plunger and compress the sample. Open the syringe valve and vent any resi air while adjusting the sample volume 10.0 ml. Close the valve.

7.3 Fill the second syringe in an identical manner from the same sample bottle. This syringe is reserved for a replicate analysis (see 8.3 and 8.4).

7.4 Pipette 2.0 ml of extraction solv into a clean extraction flask.

7.5 Carefully inject the contents of the syringe into the extraction flask.

7.6 Seal with a Teflon faced septum.

7.7 Shake vigorously for 1 minute.

7.8 Let stand until the phases separ (∫60 seconds).

7.8.1 If the phases do not separate on standing then centrifugation can be used facilitate separation.

7.9 Analyze the sample by injecting 3.4 (solvent flush technique, (8)) of the upper (organic) phase into the gas chromatograph.

8. *Analytical Quality Control.*

8.1 A 2 µg/l quality check standard (5.10) should be extracted and analyzed each day before any samples are analyzed. Instrument status checks and lower limit detection estimations based upon respo factor calculations at 5 times the noise le are obtained from these data. In addition, the data obtained from the quality check standard can be used to estimate the concentration of the unknowns. From this formation the appropriate standards can determined.

8.2 Analyze the sample blank and the raw source water to monitor for potential

[1] If for any reason the chemical reduc agent has not been added to the sample, then it must be added just prior to analyses at the rate of 2.5 to 3 mg/40 ml or by add 1 mg directly to the sample in the extr tion flask.

[Appendix C]

Interferences as described in Sections 3.1, 3.2, and 3.3.

8.3 Spiked samples.

8.3.1 For those laboratories analyzing more than 10 samples a day, each 10th sample analyzed should be a laboratory-generated spike which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in section 5.9.

8.3.2 In those laboratories analyzing less than 10 samples daily, each time the analysis is performed, analyze at least one laboratory generated spike sample which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in section 5.9.

8.3.3 Maintain an up-to-date log on the accuracy and precision data collected in Sections 8.3 and 8.4. If results are significantly different than those cited in Section 10.1, the analyst should check out the entire analysis scheme to determine why the laboratory's precision and accuracy limits are greater.

8.4 Randomly select and analyze 10% of all samples in duplicate.

8.5 Analyze all samples in duplicate which appear to deviate more than 30% from any established norm.

8.6 Quarterly, spike an EMSL-Cincinnati trihalomethane quality control sample into organic-free water and analyze.

8.6.1 The results of the EMSL trihalomethane quality control sample should agree within 20% of the true value for each trihalomethane. If they do not, the analyst must check each step in the standard generation procedure to solve the problem.

8.7 It is important that the analyst be aware of the linear response characteristics of the electron capture system that is utilized. Calibration curves should be generated and rechecked quarterly for each trihalomethane over the concentration range encountered in the samples in order to confirm the linear response range of the system. Quantitative data cannot be calculated from non-linear responses. Whenever non-linear responses are noted, the analyst must dilute the sample for reanalysis.

8.8 Maintain a record of the retention times for each trihalomethane using data gathered from spiked samples and standards.

8.8.1 Daily calculate the average retention time for each trihalomethane and the variance encountered for the analyses.

8.8.2 If individual trihalomethane retention time varies by more than 10% over an eight hour period or does not fall within 10% of an established norm, the system is "out of control." The source of retention data variation must be corrected before acceptable data can be generated.

9. *Calculations.*

9.1 Locate each trihalomethane in the sample chromatogram by comparing the retention time of the suspect peak to the data gathered in 8.8.1. The retention time of the suspect peak must fall within the limits established in 8.8.1 for a single column identification.

9.2 Calculate the concentration of each trihalomethane by comparing the peak heights or peak areas of the samples to those of the standards. Round off the data to the nearest μg/l or two significant Figures.

Concentration, μg/l = sample peak height/standard peak height × standard concentration, μg/l.

9.3 Calculate the total trihalomethane concentration (TTHM) by summing the 4 individual trihalomethane concentrations in μg/l: TTHM (μg/l) = (conc. $CHCl_3$) + (conc. $CHBrCl_2$) + (conc. $CHBr_2Cl$) + (conc. $CHBr_3$)

9.4 Calculate the limit of detection (LOD) for each trihalomethane not detected using the following criteria:

$$\text{LOD } (\mu g/l) = \frac{(AXATT)}{(BXATT) \times (2\ \mu g/l)}$$

Where:

B = peak height (mm) of 2 μg/l quality check standard

A = 5 times the noise level in mm at the exact retention time of the trihalomethane or the base line displacement in mm from theoretical zero at the exact retention time for the trihalomethane.

ATT = attenuation factor.

9.5 Report the results obtained from the lower limit of detection estimates along with the data for the samples.

10. *Precision and Accuracy*

10.1 Single lab precision and accuracy. The data in Table II were generated by spiking organic-free water with trihalomethanes as described in 5.9. The mixtures were analyzed by the analyst as true unknowns.

TABLE 1—*Retention Times for Trihalomethanes*

Trihalomethane	Retention time minutes		
	Column A	Column B	Column C
Chloroform	1.0	1.3	4.9
Bromodichloromethane	1.5	*2.5	11.0
Chlorodibromomethane (Dibromochloromethane)	2.6	5.6	23.1
bromoform	5.5	10.9	39.4

*On this column trichloroethylene, a common raw source water contaminate coelutes with bromodichloromethane

Table II—*Single Laboratory Accuracy and Precision*

	Dose level μg/l	Number of samples	Mean μg/l	Precision relative standard deviation, percent	Accuracy percent recovery
Compound:					
$CHCl_3$	9.1	5	10	11	110
$CHCl_3$	59	3	73	5.3	106
$CHBrCl_2$	1.2	5	1.3	9.8	108
$CHBrCl_2$	12	2	15	1.4	125
$CHBr_2Cl$	2.7	5	2.0	17	74
$CHBr_2Cl$	17	3	16	9.9	94
$CHBr_3$	2.9	5	2.2	10	76
$CHBr_3$	14	3	16	12	114

References

1. Mieure, J. P., "A Rapid and Sensitive Method for Determining Volatile Organohalides in Water," *Journal AWWA, 69*, 60, 1977.

2. Reding, R., et al. "THM's in Drinking Water: Analysis by LLE and Comparison to Purge and Trap", Organics Analysis in Water and Wastewater. STP 686 ASTM, 1979.

3. "Handbook for Analytical Quality Control in Water and Waste water Laboratories." Analytical Quality Control Laboratory, National Environmental Research Center, Cincinnati, Ohio, June 1972.

4. Budde, W. L., J. W. Eichelberger, "Organic Analysis Using Gas Chromatography-Mass Spectrometry," Ann Arbor Science, Ann Arbor, Michigan, 1979.

5. "The Analysis of Trihalomethanes in Finished Water by the Purge and Trap Method." Environmental Monitoring and Support Laboratory, Environmental Research Center, Cincinnati, Ohio, 45268, May 15, 1979.

6. Richard J. J.; G. A. Junk, "Liquid Extraction for Rapid Determination of Halomethanes in Water, *Journal AWWA, 69* 62, January 1977.

7. Brass, H. J., et al., "National Organic Monitoring Survey: Sampling and Purgeable Organic Compounds, Drinking Water Quality Through Source Protection," R. B. Pojasek, Editor, Ann Arbor Science, p. 398, 1977.

8. White, L. D., et al. "Convenient Optimized Method for the Analysis of Selected Solvent Vapors in Industrial Atmosphere," AIHA Journal, Vol. 31, p. 225, 1970.

9. Kopfler, F. C., et al. "GC/MS Determination of Volatiles for the National Organics Reconnaissance Survey (NORS) or Drinking Water, Identification and Analysis of Organic Pollutants in Water," L. H. Keith, Editor, Ann Arbor Science, p. 87, 1976.

[Appendix C]

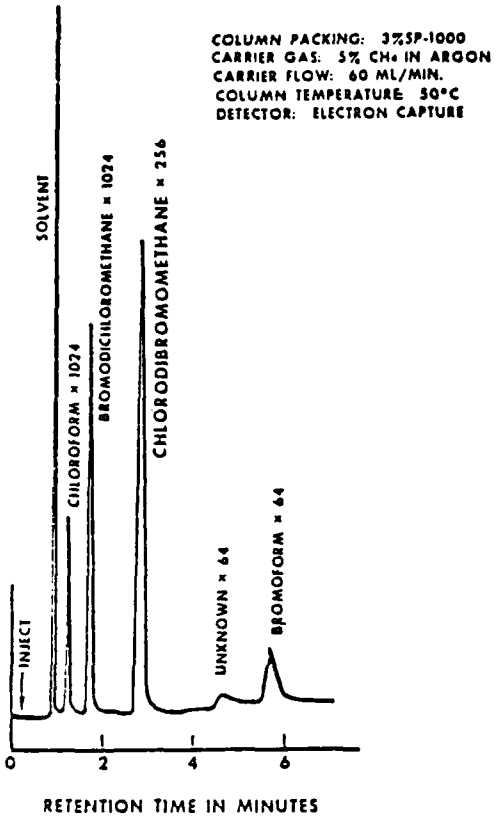


FIGURE 1. FINISHED WATER EXTRACT

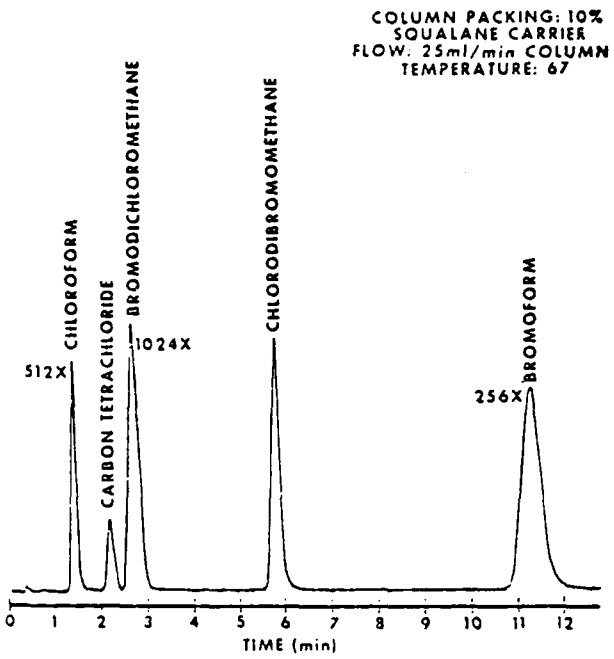


FIGURE 2. EXTRACT OF STANDARD

[Appendix C]

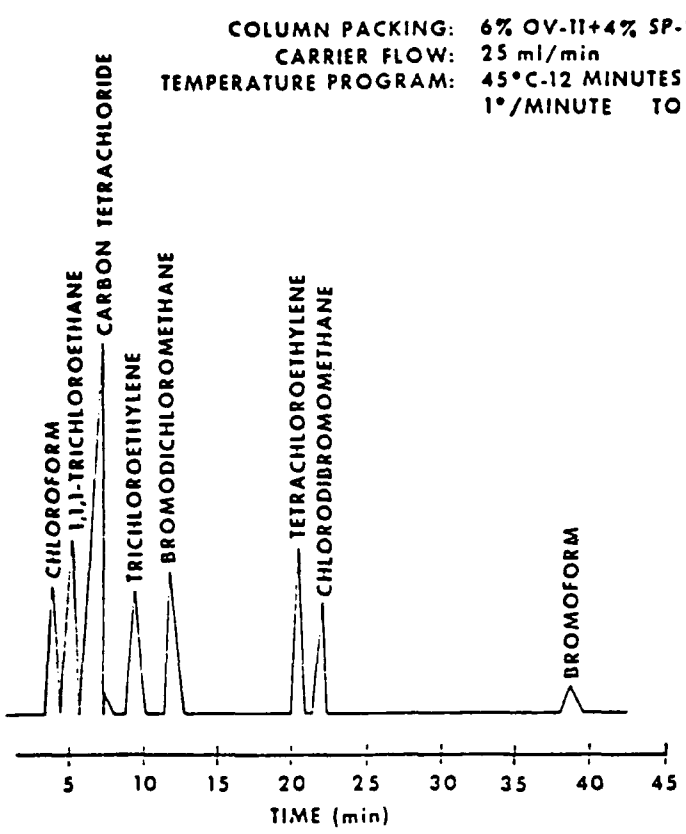


FIGURE 3. EXTRACT OF STANDARD

PART III—DETERMINATION OF MAXIMUM TOTAL TRIHALOMETHANE POTENTIAL (MTP)

The water sample used for this determination is taken from a point in the distribution system that reflects maximum residence time. Procedures for sample collection and handling are given in EMSL Methods 501.1 and 501.2. No reducing agent is added to "quench" the chemical reaction producing THMs at the time of sample collection. The intent is to permit the level of THM precursors to be depleted and the concentration of the THMs to be maximized for the supply being tested.

Four experimental parameters affecting maximum THM production are pH, temperature, reaction time and the presence of a disinfectant residual. These parameters are dealt with as follows:

Measure the disinfectant residual at the selected sampling point. Proceed only if a measurable disinfectant residual is present. Collect triplicate 40 ml water samples at the pH prevailing at the time of sampling, and prepare a method blank according to the EMSL methods. Seal and store these samples together for 7 days at 25°C or above. After this time period, open one of the sample containers and check for disinfectant residual. Absence of a disinfectant residual invalidates the sample for further analyses. Once a disinfectant residual has been demonstrated, open another of the sealed samples and determine total THM concentration using either of the EMSL analytical methods.

Subpart D—Reporting, Public Notification and Record Keeping

§ 141.31 Reporting requirements.

(a) Except where a shorter period is specified in this part, the supplier of water shall report to the State the results of any test measurement or analysis required by this part within (A) the first ten days following the month in which the result is received or (B) the first ten days following the end of the required monitoring period as stipulated by the State, whichever of these is shortest.

(b) The supplier of water shall report to the State within 48 hours the failure to comply with any primary drinking water regulation (including failure to comply with monitoring requirements) set forth in this part.

(c) The supplier of water is not required to report analytical results to the State in cases where a State laboratory performs the analysis and reports the results to the State office which would normally receive such notification from the supplier.

[*Editor's note:* EPA August 27, 1980, amended 141.31(c), however, the text of the amendment was not published (45 FR 57345).]

(d) The water supply system, within ten days of completion of each public notification required pursuant to § 141.32, shall submit to the State a representative copy of each type of notice distributed, published, posted, and/or made available to the persons served by the system and/or to the media.

(e) The water supply system shall submit to the State within the time stated in the request copies of any records required to be maintained under § 141.33 hereof or copies of any documents then in existence which the State or the Administrator is entitled to inspect pursuant to the authority of § 1445 of the Safe Drinking Water Act or the equivalent provisions of State law.

§ 141.32 *Public notification.*

(a) If a community water system fails to comply with an applicable maximum contaminant level established in Subpart B, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable maximum contaminant level, fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, or fails to perform any monitoring required pursuant to Section 1445 (a) of the Act, the supplier of water shall notify persons served by the system of the failure or grant by inclusion of a notice in the first set of water bills of

[Sec. 141.32(a)]

the system issued after the failure or grant and in any event by written notice within three months. Such notice shall be repeated at least once every three months so long as the system's failure continues or the variance or exemption remains in effect. If the system issues water bills less frequently than quarterly, or does not issue water bills, the notice shall be made by or supplemented by another form of direct mail.

(b) If a community water system has failed to comply with an applicable maximum contaminant level, the supplier of water shall notify the public of such failure, in addition to the notification required by paragraph (a) of this section, as follows:

(1) By publication on not less than three consecutive days in a newspaper or newspapers of general circulation in the area served by the system. Such notice shall be completed within fourteen days after the supplier of water learns of the failure.

(2) By furnishing a copy of the notice to the radio and television stations serving the area served by the system. Such notice shall be furnished within seven days after the supplier of water learns of the failure.

(3) Except that the requirements of this subsection (b) may be waived by the State if it determines that the violation has been corrected promptly after discovery, the cause of the violation has been eliminated, and there is no longer a risk to public health.

(c) If the area served by a community water system is not served by a daily newspaper of general circulation, notification by newspaper required by paragraph (b) of this section shall instead be given by publication on three consecutive weeks in a weekly newspaper of general circulation serving the area. If no weekly or daily newspaper of general circulation serves the area, notice shall be given by posting the notice in post offices within the area served by the system.

(d) If a non-community water system fails to comply with an applicable MCL established in Subpart B of this part, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable MCL, fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, or fails to perform any monitoring requirement pursuant to section 1445(a) of the Act, the supplier of water shall give notices by continuous posting of such failure or granting of a variance or exemption to the persons served by the system as long as the failure or granting of a variance or exemption continues. The form and manner for such notices shall be prescribed by the State and shall ensure that the public using the system is adequately informed of the failure or granting of the variance or exemption.

(e) Notices given pursuant to this section shall be written in a manner reasonably designed to inform fully the users of the system. The notice shall be conspicuous and shall not use unduly technical language, unduly small print or other methods which would frustrate the purpose of the notice. The notice shall disclose all material facts regarding the subject including the nature of the problem and, when appropriate, a clear statement that a primary drinking water regulation has been violated and any preventive measures that should be taken by the public. Where appropriate, or where designated by the State, bilingual notice shall be given. Notices may include a balanced explanation of the significance or seriousness to the public health of the subject of the notice, a fair explanation of steps taken by the system to correct any problem and the results of any additional sampling.

(f) Notice to the public required by this section may be given by the State on behalf of the supplier of water.

(g) In any instance in which notification by mail is required by paragraph (a) of this section but notification by newspaper or to radio or television stations is not required by paragraph (b) of this section, the State may order the supplier of water to provide notification by newspaper and to radio and television stations when circumstances make more immediate or broader notice appropriate to protect the public health.

§ 141.33 Record maintenance.

Any owner or operator of a public water system subject to the provisions of this part shall retain on its premises or at a convenient location near its premises the following records:

(a) Records of bacteriological analyses made pursuant to this part shall be kept for not less than 5 years. Records of chemical analyses made pursuant to this part shall be kept for not less than 10 years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

(1) The date, place, and time of sampling, and the name of the person who collected the sample;

(2) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;

(3) Date of analysis;

(4) Laboratory and person responsible for performing analysis;

(5) The analytical technique/method used; and

(6) The results of the analysis.

(b) Records of action taken by the system to correct violations of primary drinking water regulations shall be kept for a period not less than 3 years after the last action taken with respect to the particular violation involved.

(c) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the system itself, by a private consultant, or by any local, State or Federal agency, shall be kept for a period not less than 10 years after completion of the sanitary survey involved.

(d) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than 5 years following the expiration of such variance or exemption.

Subpart E—Special Monitoring Regulations for Organic Chemicals and Otherwise Unregulated *Contaminants*

§ 141.41 Special monitoring for sodium.

(a) Suppliers of water for community public water systems shall collect and analyze one sample per plant at the entry point of the distribution system for the determination of sodium concentration levels; samples must be collected and analyzed annually for systems utilizing surface water sources in whole or in part, and at least every three years for systems utilizing solely ground water sources. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples. The supplier of water may be required by the State to collect and analyze water samples for sodium more

[Sec. 141.41(a)]

frequently in locations where the sodium content is variable.

(b) The supplier of water shall report to EPA and/or the State the results of the analyses for sodium within the first 10 days of the month following the month in which the sample results were received or within the first 10 days following the end of the required monitoring period as stipulated by the State, whichever of these is first. If more than annual sampling is required the supplier shall report the average sodium concentration within 10 days of the month following the month in which the analytical results of the last sample used for the annual average was received. The supplier of water shall not be required to report the results to EPA where the State has adopted this regulation and results are reported to the State. The supplier shall report the results to EPA where the State has not adopted this regulation.

(c) The supplier of water shall notify appropriate local and State public health officials of the sodium levels by written notice by direct mail within three months. A copy of each notice required to be provided by this paragraph shall be sent to EPA and/or the State within 10 days of its issuance. The supplier of water is not required to notify appropriate local and State public health officials of the sodium levels where the State provides such notices in lieu of the supplier.

(d) Analyses for sodium shall be performed by the flame photometric method in accordance with the procedures described in "Standard Methods for the Examination of Water and Wastewater," 14th Edition, pp. 250–253; or by Method 273.1, Atomic Absorption—Direct Aspiration or Method 273.2, Atomic Absorption—Graphite Furnace, in "Methods for Chemical Analysis of Water and Waste," EMSL, Cincinnati, EPA, 1979; or by Method D1428–64(a) in Annual Book of ASTM Standards, part 31, Water.

§ 141.42 Special monitoring for corrosivity characteristics.

(a) Suppliers of water for community public water systems shall collect samples from a representative entry point to the water distribution system for the purpose of analysis to determine the corrosivity characteristics of the water.

(1) The supplier shall collect two samples per plant for analysis for each plant using surface water sources wholly or in part or more if required by the State; one during mid-winter and one during mid-summer. The supplier of the water shall collect one sample per plant for analysis for each plant using ground water sources or more if required by the State. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples.

(2) Determination of the corrosivity characteristics of the water shall include measurement of pH, calcium hardness, alkalinity, temperature, total dissolved solids (total filterable residue), and calculation of the Langelier Index in accordance with paragraph (c) below. The determination of corrosivity characteristics shall only include one round of sampling (two samples per plant for surface water and one sample per plant for ground water sources). However, States may require more frequent monitoring as appropriate. In addition, States have the discretion to require monitoring for additional parameters which may indicate corrosivity characteristics, such as sulfates and chlorides. In certain cases, the Aggressive Index, as described in paragraph (c), can be used instead of the Langelier Index; the supplier shall request in writing to the State and the State will make this determination.

(b) The supplier of water shall report to EPA and/or the State the results of the analyses for the corrosivity characteristics within the first 10 days of the month following the month in which the sample results were received. If more frequent sampling is required by the State, the supplier can accumulate the data and shall report each value within 10 days of the month following the month in which the analytical results of the last sample was received. The supplier of water shall not be required to report the results to EPA where the State has adopted this regulation and results are reported to the State.

(c) Analyses conducted to determine the corrosivity of the water shall be made in accordance to the following methods:

(1) Langelier Index—"Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 203, pp. 61–63.

(2) Aggressive Index—"AWWA Standard for Asbestos-Cement Pipe, 4 in. through 24 in. for Water and Other Liquids," AWWA C400–77, Revision of C400–75, AWWA, Denver, Colorado.

(3) Total Filtrable Residue—"Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 208B, pp. 92–93; or "Methods for Chemical Analysis of Water and Wastes," Method 160.1.

(4) Temperature—"Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 212, pp. 125–128.

"(5) Calcium—EDTA titrimetric method 'Standard Methods for the Examination of Water and Wastewater, 14th Edition. Method 306C, pp. 189–191; or 'Annual Book of ASTM Standards,' Method D–1126–67B; 'Methods for Chemical Analysis of Water and Wastes,' Method 215.2."

[141.42(c)(5) amended by 47 FR 10998, March 12, 1982]

(6) Alkalinity—Methyl Orange end point pH 4.5. "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 403, pp. 278–281; or "Annual Book of ASTM Standards," Method D1067–70B; or "Methods for Chemical Analysis of Water and Wastes," Method 310.1.

[141.42(c)(6) corrected by 47 FR 10998, March 12, 1982]

(7) pH—"Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 424, pp. 460–465; or "Methods for Chemical Analysis of Water and Wastes," Method 150.1; or "Annual Book of ASTM Standards," Method D–1293–78A or B

[141.42(c)(7) corrected by 47 FR 10998, March 12, 1982]

(8) Chloride—Potentiometric Method, "Standard Methods for the Examination of Water and Wastewater," 14th Edition, p. 306.

(9) Sulfate—Turbidimetric Method, "Methods for Chemical Analysis of Water and Wastes," pp. 277–278, EPA, Office of Technology Transfer, Washington, D.C. 20460, 1974, or "Standard Methods for the Examination

of Water and Wastewater," 14th Edition, pp. 496-498

[141.42(c)(9) corrected by 47 FR 10998, March 12, 1982]

(d) Community water supply systems shall identify whether the following construction materials are present in their distribution system and report to the State:

- **Lead from piping, solder, caulking, interior lining of distribution mains, alloys and home plumbing.**
- **Copper from piping and alloys, service lines, and home plumbing.**
- **Galvanized piping, service lines, and home plumbing.**
- **Ferrous piping materials such as cast iron and steel.**
- **Asbestos cement pipe.**

In addition, States may require identification and reporting of other materials of construction present in distribution systems that may contribute contaminants to the drinking water, such as:

- **Vinyl lined asbestos cement pipe.**
- **Coal tar lined pipes and tanks.**

[Sec. 141.42(d)]

ENVIRONMENTAL PROTECTION AGENCY
NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS IMPLEMENTATION

(40 CFR 142; 41 FR 2916, January 20, 1976; Amended as shown in Code of Federal Regulations, Volume 40, Revised as of July 1, 1982; 48 FR 8413, February 28, 1983)

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

PART 142—NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS IMPLEMENTATION

Implementation of Standards

Subpart A—General Provisions

Sec.
142.1 Applicability.
142.2 Definitions.
142.3 Scope.
142.4 State and Local Authority.

Subpart B—Primary Enforcement Responsibility

142.10 Requirements for a Determination of Primary Enforcement Responsibility.
142.11 Request for Determination of Primary Enforcement Responsibility.
142.12 Determination of Primary Enforcement Responsibility.
142.13 Public Hearings.
142.14 Records Kept by States.
142.15 Reports by States.
142.16 State Public Notification Requirements.

Subpart C—Review of State-Issued Variances and Exemptions

142.20 State-Issued Variances and Exemptions.
142.21 State Consideration of a Variance or Exemption Request.
142.22 Review of State Variances, Exemptions and Schedules.
142.23 Notice to State.
142.24 Administrator's Rescission.

Subpart D—Federal Enforcement

142.30 Failure by State to Assure Enforcement.
142.31 Federal Action.
142.32 Petition for Public Hearing.
142.33 Public Hearing.
142.34 Entry and Inspection of Public Water Systems.

Subpart E—Variances Issued by the Administrator

142.40 Requirements for a Variance.
142.41 Variance Request.
142.42 Consideration of a Variance Request.
142.43 Disposition of a Variance Request.
142.44 Public Hearings on Variances and Schedules.
142.45 Action After Hearing.
142.46 Alternative Treatment Techniques.

Subpart F—Exemptions Issued by the Administrator

142.50 Requirements for an Exemption.
142.51 Exemption Request.
142.52 Consideration of an Exemption Request.
142.53 Disposition of an Exemption Request.
142.54 Public Hearings on Exemption Schedules.
142.55 Final Schedule.

AUTHORITY: Secs. 1413, 1414, 1415, 1416, 1445 and 1450 of Pub. L. 93-523, 88 Stat. 1660 (42 U.S.C. 300g-2, 300g-3, 300g-4, 300g-5, 300j-4 and 300j-9).

Subpart A—General Provisions

§ 142.1 Applicability.

This part sets forth, pursuant to Sections 1413 through 1416, 1445 and 1450 of the Public Health Service Act, as amended by the Safe Drinking Water Act, Pub. L. 93-523, regulations for the implementation and enforcement of the national primary drinking water regulations contained in Part 141 of this chapter.

§ 142.2 Definitions.

As used in this part, and except as otherwise specifically provided:

(a) "Act" means the Public Health Service Act.

(b) "Administrator" means the Administrator of the United States Environmental Protection Agency or his authorized representative.

(c) "Agency" means the United States Environmental Protection Agency.

(d) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(e) "Federal agency" means any department, agency, or instrumentality of the United States.

(f) "Maximum contaminant level" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system; except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except for those resulting from corrosion of piping and plumbing caused by water quality are excluded from this definition.

(g) "Municipality" means a city, town or other public body created by or pursuant to State law, or an Indian tribal organization authorized by law.

(h) "National primary drinking water regulation" means any primary drinking water regulation contained in Part 141 of this chapter.

(i) "Person" means an individual, corporation, company, association, partnership, State, municipality or Federal agency.

(j) "Primary enforcement responsibility" means the primary responsibility for administration and enforcement of primary drinking water regulations and related requirements applicable to public water systems within a State.

(k) "Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

(l) "Sanitary survey" means an on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

(m) "State" means one of the States of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, or the Trust Territory of the Pacific Islands.

(n) "State primary drinking water regulation" means a drinking water regulation of a State which is comparable to a national primary drinking water regulation.

(o) "Supplier of water" means any person who owns or operates a public water system.

(p) "Treatment technique requirement" means a requirement of the national primary drinking water regulations which specifies for a contaminant a specific treatment technique(s) known to the Administrator which leads to a reduction in the level of such contaminant sufficient to comply with the requirements of Part 141 of this chapter.

§ 142.3 Scope.

(a) Except where otherwise provided, this part applies to each public water system in each State; except that this part shall not apply to a public water system which meets all of the following conditions:

(1) which consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(2) which obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(3) which does not sell water to any person; and

(4) which is not a carrier which conveys passengers in interstate commerce.

(b) In order to qualify for primary enforcement responsibility, a State's program for enforcement of primary drinking water regulations must apply to all other public water systems in the State, except for:

(1) public water systems on carriers which convey passengers in interstate commerce;

(2) public water systems on Indian land with respect to which the State does not have the necessary jurisdiction or its jurisdiction is in question; or

(3) public water systems owned or maintained by a Federal agency where the Administrator has waived compliance with national primary drinking water regulations pursuant to Section 1447(b) of the Act.

§ 142.4 State and Local Authority.

Nothing in this part shall diminish any authority of a State or political subdivision to adopt or enforce any law or regulation respecting drinking water regulations or public water systems, but no such law or regulation shall relieve any person of any requirements otherwise applicable under this part.

Subpart B—Primary Enforcement Responsibility

§ 142.10 Requirements for a Determination of Primary Enforcement Responsibility.

A State has primary enforcement responsibility for public water systems in the State during any period for which the Administrator determines, based upon a submission made pursuant to § 142.11, that such State, pursuant to appropriate State legal authority:

(a) Has adopted State primary drinking water regulations which (1) in case of the period beginning on the date the national interim primary drinking water regulations are promulgated in Part 141 of this chapter and ending on the date such regulations take effect are no less stringent than such regulations and (2) in the case of the period after such effective date are no less stringent than the interim and revised national primary drinking water regulations in effect under such part;

(b) Has adopted and is implementing adequate procedures for the enforcement of such State regulations, such procedures to include:

(1) Maintenance of an inventory of public water systems.

(2) A systematic program for conducting sanitary surveys of public water systems in the State, with priority given to sanitary surveys of public water systems not in compliance with State primary drinking water regulations.

(3) The establishment and maintenance of a State program for the certification of laboratories conducting analytical measurements of drinking water contaminants pursuant to the requirements of the State primary drinking water regulations including the designation by the State of a laboratory officer, or officers, certified by the Administrator, as the official(s) responsible for the State's certification program. The requirements of this paragraph may be waived by the Administrator for any State where all analytical measurements required by the State's primary drinking water regulations are conducted at laboratories operated by the State and certified by the Agency. Until such time as the Agency establishes a National quality assurance program for laboratory certification the State shall maintain an interim program for the purpose of approving those laboratories from which the required analytical measurements will be acceptable.

(4) Assurance of the availability to the State of laboratory facilities certified by the Administrator and capable of performing analytical measurements of all contaminants specified in the State primary drinking water regulations.

Until such time as the Agency establishes a National quality assurance program for laboratory certification the Administrator will approve such State laboratories on an interim basis.

(5) The establishment and maintenance of an activity to assure that the design and construction of new or substantially modified public water system facilities will be capable of compliance with the State primary drinking water regulations.

(6) Statutory or regulatory enforcement authority adequate to compel compliance with the State primary drinking water regulations in appropriate cases, such authority to include:

(i) Authority to apply State primary drinking water regulations to all public water systems in the State covered by the national primary drinking water regulations, except for interstate carrier conveyances and systems on Indian land with respect to which the State does not have the necessary jurisdiction or its jurisdiction is in question.

(ii) Authority to sue in courts of competent jurisdiction to enjoin any threatened or continuing violation of the State primary drinking water regulations.

(iii) Right of entry and inspection of public water systems, including the right to take water samples, whether or not the State has evidence that the system is in violation of an applicable legal requirement.

(iv) Authority to require suppliers of water to keep appropriate records and make appropriate reports to the State.

(v) Authority to require public water systems to give public notice of violations of State primary drinking water regulations to the extent set forth in § 142.16, and authority to order additional notification when circumstances make more immediate or broader notice appropriate to protect the public health.

(vi) Authority to assess civil or criminal penalties for violation of the State's primary drinking water regulations and public notification requirements, including the authority to assess daily penalties or multiple penalties when a violation continues.

(c) Has established and will maintain record keeping and reporting of its activities under paragraphs (a), (b) and (d) in compliance with §§ 142.14 and 142.15;

(d) If it permits variances or exemptions, or both, from the requirements of the State primary drinking water regulations, it shall do so under conditions and in a manner which is no less stringent than the conditions under which, and the manner in which, variances and exemptions may be granted under Sections 1415 and 1416 of the Act (regulations governing the issuance of variances and exemptions by the Administrator in States that do not have primary enforcement responsibility are set forth in Subparts E and F. States with primary enforcement responsibility may adopt procedures different from those set forth in Subparts E and F, provided that the State procedures meet the requirements of this paragraph); and

(e) Has adopted and can implement an adequate plan for the provision of safe drinking water under emergency circumstances.

§ 142.11 Request for Determination of Primary Enforcement Responsibility.

A State may apply to the Administrator for a determination that the State has primary enforcement responsibility for public water systems in the State pursuant to Section 1413 of the Act. The application shall be as concise as possible and describe the State's compliance with each of the five requirements set forth in § 142.10, and include the following information:

(a) The text of the State's primary drinking water regulations, with references to those State regulations that vary from comparable regulations set forth in Part 141 of this chapter, and a demonstration that any different State regulation is at least as stringent as the comparable regulation contained in Part 141.

(b) A description, accompanied by appropriate documentation, of the State's procedures for the enforcement of the State primary drinking water regulations. The submission shall include:

(1) A brief description of the State's program to maintain a current inventory of public water systems.

(2) A brief description of the State's program for conducting sanitary surveys,

including an explanation of the priorities given to various classes of public water systems.

(3) A brief description of the State's laboratory approval or certification program, including the name(s) of the responsible State laboratory officer(s) certified by the Administrator.

(4) Identification of laboratory facilities, available to the State, certified or approved by the Administrator and capable of performing analytical measuremeants of all contaminants specified in the State's primary drinking water regulations.

(5) A brief description of the State's program activity to assure that the design and construction of new or substantially modified public water system facilities will be capable of compliance with the requirements of the State primary drinking water regulations.

(6) Copies of State statutory and regulatory provisions authorizing the adoption and enforcement of State primary drinking water regulations, and a brief description of State procedures for administrative or judicial action with respect to public water systems not in compliance with such regulations.

(c) A statement that the State will make such reports and will keep such records as may be required pursuant to §§ 142.14 and 142.15.

(d) If the State permits variances or exemptions from its primary drinking water regulations, the text of the State's statutory and regulatory provisions concerning variances and exemptions.

(e) A brief description of the State's plan for the provision of safe drinking water under emergency conditions.

§ 142.12 Determination of Primary Enforcement Responsibility.

(a) (1) The administrator shall act on an application submitted pursuant to § 142.11 within 90 days after receiving such application, and shall promptly inform the State in writing of his action. If he denies the application, his written notification to the State shall include a statement of reasons for the denial.

(2) A determination by the Administrator that a State has met the requirements for primary enforcement responsibility shall take effect in accordance with § 142.13.

(3) When the Administrator's determination becomes effective pursuant to § 142.13, it shall continue in effect unless terminated pursuant to paragraph (b) of this section.

(b) (1) The administrator shall annually review, with respect to each State determined to have primary enforcement responsibility, the compliance of the State with the requirements set forth in § 142.10.

(2) When the Administrator's annual review, or other information available to him, indicate that a State no longer meets the requirements set forth in § 142.10, he shall notify the State in writing of that fact and shall summarize in his notice the information available to him which indicates that the State no longer meets such requirements.

(3) The State notified pursuant to subparagraph (2) of this paragraph may, within 30 days of receiving the Administrator's notice, submit to the Administrator evidence demonstrating that the State continues to meet the requirements for primary enforcement responsibility.

(4) After reviewing the submission of the State, if any, made pursuant to subparagraph (3) of this paragraph the Administrator shall either determine that the State no longer meets the requirements of § 142.10 or that the State continues to meet those requirements, and shall notify the State of his determination. Any determination that the State no longer meets the requirements of § 142.10 shall not become effective except as provided in § 142.13.

(c) If a State which has primary enforcement responsibility determines to relinquish that authority, it may do so by notifying the Administrator in writing of the State's decision at least 90 days before the effective date of the decision.

§ 142.13 Public Hearing.

(a) Before any determination pursuant to § 142.12(a) that a State meets the requirements of § 142.10 for primary enforcement responsibility becomes effective, or any determination pursuant to § 142.12(b) that a State no longer meets the requirements of § 142.10 becomes effective, the Administrator shall provide an opportunity for public hearing on his determination.

(b) The Administrator shall publish notice of any determination specified in paragraph (a) of this section in the FEDERAL REGISTER and in a newspaper or newspapers of general circulation in the State involved within 15 days after making such determination, with a statement of his reasons for the determination. Such notice shall inform interested persons that they may request a public hearing on the Administrator's determination. Such notice shall also indicate one or more locations in the State where information submitted by the State pursuant to § 142.11 is available for inspection by the general public. A public hearing may be requested by any interested person other than a Federal agency. Frivolous or insubstantial requests for hearing may be denied by the Administrator.

(c) Requests for hearing submitted pursuant to paragraph (b) of this section shall be submitted to the Administrator within 30 days after publication of notice of opportunity for hearing in the FEDERAL REGISTER. Such requests shall include the following information:

(1) The name, address and telephone number of the individual, organization or other entity requesting a hearing.

(2) A brief statement of the requesting person's interest in the Administrator's determination and of information that the requesting person intends to submit at such hearing.

(3) The signature of the individual making the request; or, if the request is made on behalf of an organization or other entity, the signature of a responsible official of the organization or other entity.

(d) The Administrator shall give notice in the FEDERAL REGISTER and in a newspaper or newspapers of general circulation in the State involved of any hearing to be held pursuant to a request submitted by an interested persof or on his own motion. Notice of the hearing shall also be sent to the person requesting a hearing, if any, and to the State involved. Notice of the hearing shall include a statement of the purpose of the hearing, information regarding the time and location or locations for the hearing and the address and telephone number of an office at which interested persons may obtain further information concerning the hearing. At least one hearing location specified in the public notice shall be within the involved State. Notice of hearing shall be given not less than 15 days prior to the time scheduled for the hearing.

(e) Hearings convened pursuant to paragraph (d) of this section shall be conducted before a hearing officer to be designated by the Administrator. The hearing shall be conducted by the hearing officer in an informal, orderly and expeditious manner. The hearing officer shall have authority to call witnesses, receive oral and written testimony and take such other action as may be necessary to assure the fair and efficient conduct of the hearing. Following the conclusion of the hearing, the hearing officer shall forward the record of the hearing to the Administrator.

(f) After reviewing the record of the hearing, the Administrator shall issue an order affirming the determination referred to in paragraph (a) of this section or rescinding such determination. If the determination is affirmed, it shall become effective as of the date of the Administrator's order.

(g) If no timely request for hearing is received and the Administrator does not determine to hold a hearing on his own motion, the Administrator's determination shall become effective 30 days after notice is issued pursuant to paragraph (b) of this section.

(h) If a determination of the Administrator that a State no longer meets the requirements for primary enforcement responsibility becomes effective, the State may subsequently apply for a determination that it meets such requirements by submitting to the Administrator information demonstrating that it has remedied the deficiencies found by the Administrator without adversely sacrificing other aspects of its program required for primary enforcement responsibility.

§ 142.14 Records kept by States.

(a) Each State which has primary enforcement responsibility shall maintain records of tests, measurements and analyses performed on each public water system to determine compliance with applicable provisions of State primary drinking water regulations.

(1) Records of microbiological analyses shall be retained for not less than 1

year. Actual laboratory reports may be kept or data may be transferred to tabular summaries, provided that the information retained includes:

(i) The analytical method used;

(ii) The number of samples analyzed each month;

(iii) The analytical results, set forth in a form which makes possible comparison with the limits specified in § 141.14 of this chapter.

(2) Records of microbiological analyses of check or special samples shall be retained for not less than 1 year in the form of actual laboratory reports or in an appropriate summary form.

(3) Records of turbidity measurements shall be retained for not less than 1 year and shall include at least the following information:

(i) Date and place of sampling.

(ii) Date and results of analyses.

(4) Records of analyses for other than microbiological contaminants or turbidity shall be retained for not less than 40 years and shall include at least the following information:

(i) Date and place of sampling.

(ii) Date and results of analyses.

Records retained by a State pursuant to this paragraph for at least 10 years, may be transferred to the Agency to satisfy the remainder of the required 40 year retention period.

(b) Records required to be kept pursuant to paragraph (a) must be in a form admissible as evidence in State enforcement proceedings.

(c) Each State which has primary enforcement responsibility shall maintain current inventory information for each public water system in the State and shall retain inventory records of public water systems for not less than 40 years. Records retained by a State pursuant to this paragraph for at least 10 years may be transferred to the Agency to satisfy the remainder of the 40 year retention period.

(d) Each State which has primary enforcement responsibility shall retain, for not less than 10 years, files which shall include for each such public water system in the State:

(1) Reports of sanitary surveys;

(2) Records of any State approvals;

(3) Records of any enforcement actions.

(e) Each State which has primary enforcement responsibility shall retain records pertaining to each variance and exemption granted by it for a period of not less than 5 years following the expiration of such variance or exemption.

(f) The records required to be kept by this section shall be maintained and made available for public inspection by the State, or, the State at its option may require suppliers of water to make available for public inspection those records maintained in accordance with § 141.33.

§ 142.15 Reports by States.

Each State which has primary enforcement responsibility shall submit to the Administrator the following information:

(a) Additions or corrections to the State's inventory of public water systems, as such additions or corrections are made if feasible, and in any event by January 1 of each year.

(b) An annual report to be submitted by January 1 of each year, covering the preceding Federal fiscal year ending September 30 of each year, and consisting of:

(1) Summary of violations by public water systems in the State of primary drinking water regulations, except public water systems serving fewer than 25,000 population which will have until June 1, 1978, to report the FY 1977 violations only, and of enforcement actions taken by the State;

(2) A summary of the status of each variance and exemption granted by the State which was in effect during any part of the calendar year.

(c) Prompt notification of the granting of a variance or exemption. The notice shall include a statement of reasons for the granting of the variance or exemption, including support for the need for the variance or exemption and for the finding that the granting of the variance or exemption will not result in an unreasonable risk to health. A single notification statement may be used to report two or more similar variances or exemptions.

(d) The annual report submitted pursuant to paragraph (b) of this section shall be made available by a State to the public for inspection at one or more locations within the State.

§ 142.16 State Public Notification Requirements.

Each State program qualifying for primary enforcement responsibility shall include, at a minimum, the following requirements for public notification by public water systems for violation of State primary drinking water regulations.

(a) Public notification by a supplier of water whenever the supplier's public water system fails to comply with a maximum contaminant level or is granted a variance or exemption from a maximum contaminant level or fails to comply with a schedule for contaminant levels prescribed pursuant to a variance or exemption.

(b) In the case of a community water system (as defined in § 141.2), such notification shall include a notice in the first set of water bills of the system issued after the failure or grant. In the case of a failure to comply with a maximum contaminant level, such written notice shall be repeated not less than once every three months so long as such failure continues; if the system issues water bills less frequently than quarterly, or does not issue water bills, the notice shall be made or supplemented by another form of direct mail. In the case of a failure to comply with a maximum contaminant level which is not corrected promptly after discovery, the supplier of water must give other general public notice of the failure, in addition to notice by direct mail, in a manner required by the State. The additional notice required by the State may consist of notice by newspaper advertisement, by press release or other appropriate means.

(c) If the public water system is a noncommunity water system (as defined in § 141.2), the notice shall be given by conspicuous posting, in a location where it can be seen by consumers, rather than in the manner specified in paragraph (b) of this section.

(d) Notices given pursuant to this section shall be written in a manner reasonably designed to inform fully the users of the system. The notice shall be conspicuous and shall not use unduly technical language, unduly small print or other methods which would frustrate the purpose of the notice. The notice shall disclose all material facts regarding the subject including the nature of the problem and, where appropriate, a clear statement that a primary drinking water regulation has been violated and any preventive measures that should be taken by the public. Where appropriate, or where designated by the State, bilingual notice shall be given. Notices may include a balanced explanation of the significance or seriousness to the public health of the subject of the notice, a fair explanation of steps taken by the system to correct any problem and the results of any additional sampling.

(e) Notices required by this section may be given by the State on behalf of the supplier of water.

Subpart C—Review of State-Issued Variances and Exemptions

§ 142.20 State-Issued Variances and Exemptions.

States with primary enforcement responsibility may issue variances and exemptions from the requirements of primary drinking water regulations under conditions and in a manner which are not less stringent than the conditions under which, and the manner in which, variances and exemptions may be granted under Sections 1415 and 1416 of the Act. In States that do not have primary enforcement responsibility, variances and exemptions from the requirements of applicable national primary drinking water regulations may be granted by the Administrator pursuant to Subparts E and F.

§ 142.21 State Consideration of a Variance or Exemption Request.

A State with primary enforcement responsibility shall act on any variance or exemption request submitted to it, within 90 days of receipt of the request.

§ 142.22 Review of State Variances, Exemptions and Schedules.

(a) Not later than 18 months after the effective date of the interim national primary drinking water regulations the Administrator shall complete a comprehensive review of the variances and exemptions granted (and schedules prescribed pursuant thereto) by the States with primary enforcement responsibility during the one-year period beginning on such effective date. The Administrator shall conduct such subsequent reviews of exemptions and schedules as he deems necessary to carry out the purposes of this title, but at least one review shall be completed within each 3-year period

following the completion of the first review under this paragraph.

(b) Notice of a proposed review shall be published in the FEDERAL REGISTER. Such notice shall (1) provide information respecting the location of data and other information respecting the variances and exemptions to be reviewed (including data and other information concerning new scientific matters bearing on such variances and exemptions), and (2) advise of the opportunity to submit comments on the variances and exemptions reviewed and on the need for continuing them. Upon completion of any such review, the Administrator shall publish in the FEDERAL REGISTER the results of his review, together with findings responsive to any comments submitted in connection with such review.

§ 142.23 Notice to State.

(a) If the Administrator finds that a State has, in a substantial number of instances, abused its discretion in granting variances or exemptions under Section 1415(a) or Section 1416(a) of the Act or failed to prescribe schedules in accordance with Section 1415(a) or Section 1416(b) of the Act, he shall notify the State of his findings. Such notice shall:

(1) Identify each public water system for which the finding was made;

(2) Specify the reasons for the finding; and

(3) As appropriate, propose revocation of specific variances or exemptions, or propose revised schedules for specific public water systems.

(b) The Administrator shall also notify the State of a public hearing to be held on the provisions of the notice required by paragraph (a) of this section. Such notice shall specify the time and location for the hearing. If, upon notification of a finding by the Administrator, the State takes adequate corrective action, the Administrator shall rescind his notice to the State of a public hearing, provided that the Administrator is notified of the corrective action prior to the hearing.

(c) The Administrator shall publish notice of the public hearing in the FEDERAL REGISTER and in a newspaper or newspapers of general circulation in the involved State including a summary of the findings made pursuant to paragraph (a) of this section, a statement of the time and location for the hearing, and the address and telephone number of an office at which interested persons may obtain further information concerning the hearing.

(d) Hearings convened pursuant to paragraph (b) and (c) of this section shall be conducted before a hearing officer to be designated by the Administrator. The hearing shall be conducted by the hearing officer in an informal, orderly and expeditious manner. The hearing officer shall have authority to call witnesses, receive oral and written testimony and take such other action as may be necessary to assure the fair and efficient conduct of the hearing. Following the conclusion of the hearing, the hearing officer shall forward the record of the hearing to the Administrator.

(e) Within 180 days after the date notice is given pursuant to paragraph (b) of this section, the Administrator shall:

(1) Rescind the finding for which the notice was given and promptly notify the State of such rescission, or

(2) Promulgate with any modifications as appropriate such revocation and revised schedules proposed in such notice and promptly notify the State of such action.

(f) A revocation or revised schedule shall take effect 90 days after the State is notified under paragraph (e)(2) of this section.

§ 142.24 Administrator's Rescission.

If, upon notification of a finding by the Administrator under § 142.23, the State takes adequate corrective action before the effective date of the revocation or revised schedule, the Administrator shall rescind the application of his finding to that variance, exemption or schedule.

Subpart D—Federal Enforcement

§ 142.30 Failure by State to Assure Enforcement.

(a) The Administrator shall notify a State and the appropriate supplier of water whenever he finds during a period in which the State has primary enforcement responsibility for public water systems that a public water system within such State is not in compliance with any primary drinking water regulation contained in Part 141 of this chapter or with any schedule or other requirements imposed pursuant to a variance or exemption granted under Section 1415 or 1416 of the Act; provided, that the State will be deemed to have been notified of a violation referred to in a report submitted by the State.

(b) The Administrator shall provide advice and technical assistance to such State and public water system as may be appropriate to bring the system into compliance by the earliest feasible time.

(c) If the Administrator finds that the public water system fails to comply within 30 days after the date of the notice given to the State pursuant to paragraph (a), and fails to initiate appropriate corrective actions to bring the system into compliance by the earliest feasible time, the Administrator shall give public notice of his findings of noncompliance. Such notice shall be by publication in the FEDERAL REGISTER, and in a newspaper of general circulation or by other appropriate communications media covering the area served by such public water system. The Administrator shall also mail a copy of the notification to the supplier of water.

(d) The Administrator shall request the State to report to him within 15 days from the date of such public notice. Such report shall specify information including but not limited to:

(1) Reasons for any failure by the State to bring the system into compliance,

(2) A timetable with increments of progress by which compliance will be achieved,

(3) Steps that are being taken or will be taken to bring the system into compliance and the reasons for such steps, and

(4) Legal steps that will be taken by the State to assure that the timetable is followed (the State may refer to information on file with the Administrator).

(e) The Administrator, after considering the report submitted by the State within such time period as specified in paragraph (d), will (1) determine that the State has taken appropriate action or (2) determine that the State has abused its discretion in carrying out primary enforcement responsibility by both:

(i) Failing to implement by the sixtieth day after the date of notice given under paragraph (a), adequate procedures to bring the system into compliance by the earliest feasible time, and

(ii) Failing to assure by such day the provision through alternative means of safe drinking water by the earliest feasible time.

§ 142.31 Federal Action.

(a) The Administrator may commence a civil action against a supplier of water whose public water system is not in compliance with a regulation or provision of Part 141 of this chapter or with any schedule or other requirements imposed pursuant to a variance or exemption granted pursuant to Section 1415 or 1416 of the Act:

(1) During a period in which the State in which the system is located does not have primary enforcement responsibility for public water systems.

(2) During a period in which the State in which the system is located has primary enforcement responsibility, if such failure to comply extends beyond the sixtieth day after the date of the notice given pursuant to § 142.30(a), and if

(i) The State fails to submit the report requested by the Administrator as provided by § 142.30(d); or

(ii) The Administrator determines, after considering the report submitted by the State as provided by § 142.30(d), that the State has abused its discretion in carrying out primary enforcement responsibility pursuant to § 142.30(e).

(3) If requested by the chief executive officer of the State in which the system is located or by the agency of such State which has jurisdiction over compliance by public water systems in the State with primary drinking water regulations.

§ 142.32 Petition for Public Hearing.

(a) If the Administrator makes a finding of noncompliance pursuant to § 142.30 with respect to a public water system in a State which has primary enforcement responsibility, the Administrator may, for the purpose of assisting that State in carrying out such responsibility and upon the petition of such State or public water system or persons served

Copyright © 1976 by The Bureau of National Affairs, Inc.

by such system, hold, after appropriate notice, public hearings for the purpose of gathering information as described in § 142.33.

(b) A petition for a public hearing pursuant to paragraph (a) of this section shall be filed with the Administrator and shall include the following information:

(1) The name, address and telephone number of the individual or other entity requesting a hearing.

(2) If the petition is filed by a person other than the State or public water system, a statement that the person is served by the system.

(3) A brief statement of information that the requesting person intends to submit at the requested hearing.

(4) The signature of the individual submitting the petition; or, if the petition is filed on behalf of a State, public water system or other entity, the signature of a responsible official of the State or other entity.

§ 142.33 Public Hearing.

(a) If the Administrator grants the petition for public hearing, he shall give appropriate public notice of such hearing. Such notice shall be by publication in the FEDERAL REGISTER and in a newspaper of general circulation or by other appropriate communications media covering the area served by such public water system.

(b) A hearing officer designated by the Administrator shall gather during the public hearing information from technical or other experts, Federal, State, or other public officials, representatives of the public water system, persons served by the system, and other interested persons on:

(1) The ways in which the system can within the earliest feasible time be brought into compliance, and

(2) The means for the maximum feasible protection of the public health during any period in which such system is not in compliance.

(c) On the basis of the hearing and other available information the Administrator shall issue recommendations which shall be sent to the State and public water system and shall be made available to the public and communications media.

§ 142.34 Entry and Inspection of Public Water Systems.

(a) Any supplier of water or other person subject to a national primary drinking water regulation shall, at any time, allow the Administrator, or a designated representative of the Administrator, upon presenting appropriate credentials and a written notice of inspection, to enter any establishment, facility or other property of such supplier or other person to determine whether such supplier or other person has acted or is acting in compliance with the requirements of the Act or Subchapter D of this chapter. Such inspection may include inspection, at reasonable times, of records, files, papers, processes, controls and facilities, or testing of any feature of a public water system, including its raw water source.

(b) Prior to entry into any establishment, facility or other property within a State which has primary enforcement responsibility, the Administrator shall notify, in writing, the State agency charged with responsibility for safe drinking water of his intention to make such entry and shall include in his notification a statement of reasons for such entry. The Administrator shall, upon a showing by the State agency that such an entry will be detrimental to the administration of the State's program of primary enforcement responsibility, take such showing into consideration in determining whether to make such entry. The Administrator shall in any event offer the State agency the opportunity of having a representative accompany the Administrator or his representative on such entry.

(c) No State agency which receives notice under paragraph (b) may use the information contained in the notice to inform the person whose property is proposed to be entered of the proposed entry; if a State so uses such information, notice to the agency under paragraph (b) is not required for subsequent inspections of public water systems until such time as the Administrator determines that the agency has provided him satisfactory assurances that it will no longer so use information contained in a notice received under paragraph (b).

Subpart E—Variances Issued by the Administrator

§ 142.40 Requirements for a Variance.

(a) The Administrator may grant one or more variances to any public water system within a State that does not have primary enforcement responsibility from any requirement respecting a maximum contaminant level of an applicable national primary drinking water regulation upon a finding that:

(1) Because of characteristics of the raw water sources which are reasonably available to the system, the system cannot meet the requirements respecting the maximum contaminant levels of such drinking water regulations despite application of the best technology, treatment techniques, or other means, which the Administrator finds are generally available (taking costs into consideration); and

(2) The granting of a variance will not result in an unreasonable risk to the health of persons served by the system.

(b) The Administrator may grant one or more variances to any public water system within a State that does not have primary enforcement responsibility from any requirement of a specified treatment technique of an applicable national primary drinking water regulation upon a finding that the public water system applying for the variance has demonstrated that such treatment technique is not necessary to protect the health of persons because of the nature of the raw water source of such system.

§ 142.41 Variance Request.

A supplier of water may request the granting of a variance pursuant to this subpart for a public water system within a State that does not have primary enforcement responsibility by submitting a request for a variance in writing to the Administrator. Suppliers of water may submit a joint request for variances when they seek similar variances under similar circumstances. Any written request for a variance or variances shall include the following information:

(a) The nature and duration of variance requested.

(b) Relevant analytical results of water quality sampling of the system, including results of relevant tests conducted pursuant to the requirements of the national primary drinking water regulations.

(c) For any request made under § 142.40(a):

(1) Explanation in full and evidence of the best available treatment technology and techniques.

(2) Economic and legal factors relevant to ability to comply.

(3) Analytical results of raw water quality relevant to the variance request.

(4) A proposed compliance schedule, including the date each step toward compliance will be achieved. Such schedule shall include as a minimum the following dates:

(i) Date by which arrangement for alternative raw water source or improvement of existing raw water source will be completed.

(ii) Date of initiation of the connection of the alternative raw water source or improvement of existing raw water source.

(iii) Date by which final compliance is to be achieved.

(5) A plan for the provision of safe drinking water in the case of an excessive rise in the contaminant level for which the variance is requested.

(6) A plan for interim control measures during the effective period of variance.

(d) For any request made under § 142.40(b), a statement that the system will perform monitoring and other reasonable requirements prescribed by the Administrator as a condition to the variance.

(e) Other information, if any, believed to be pertinent by the applicant.

(f) Such other information as the Administrator may require.

§ 142.42 Consideration of Variance Request.

(a) The Administrator shall act on any variance request submitted pursuant to § 142.41 within 90 days of receipt of the request.

(b) In his consideration of whether the public water system is unable to comply with a contaminant level required by the national primary drinking

water regulations because of the nature of the raw water source, the Administrator shall consider such factors as the following:

(1) The availability and effectiveness of treatment methods for the contaminant for which the variance is requested.

(2) Cost and other economic considerations such as implementing treatment, improving the quality of the source water or using an alternate source.

(c) In his consideration of whether a public water system should be granted a variance to a required treatment technique because such treatment is unnecessary to protect the public health, the Administrator shall consider such factors as the following:

(1) Quality of the water source including water quality data and pertinent sources of pollution.

(2) Source protection measures employed by the public water system.

§ 142.43 Disposition of a Variance Request.

(a) If the Administrator decides to deny the application for a variance, he shall notify the applicant of his intention to issue a denial. Such notice shall include a statement of reasons for the proposed denial, and shall offer the applicant an opportunity to present, within 30 days of receipt of the notice, additional information or argument to the Administrator. The Administrator shall make a final determination on the request within 30 days after receiving any such additional information or argument. If no additional information or argument is submitted by the applicant the application shall be denied.

(b) If the Administrator proposes to grant a variance request submitted pursuant to § 142.41, he shall notify the applicant of his decision in writing. Such notice shall identify the variance, the facility covered, and shall specify the period of time for which the variance will be effective.

(1) For the type of variance specified in § 142.40(a) such notice shall provide that the variance will be terminated when the system comes into compliance with the applicable regulation, and may be terminated upon a finding by the Administrator that the system has failed to comply with any requirements of a final schedule issued pursuant to § 141.44.

(2) For the type of variance specified in § 142.40(b) such notice shall provide that the variance may be terminated at any time upon a finding that the nature of the raw water source is such that the specified treatment technique for which the variance was granted is necessary to protect the health of persons or upon a finding that the public water system has failed to comply with monitoring and other requirements prescribed by the Administrator as a condition to the granting of the variance.

(c) For a variance specified in § 142.40 (a) (1) the Administrator shall propose a schedule for:

(1) Compliance (including increments of progress) by the public water system with each contaminant level requirement covered by the variance; and,

(2) Implementation by the public water system of such control measures as the Administrator may require for each contaminant covered by the variance.

(d) The proposed schedule for compliance shall specify dates by which steps towards compliance are to be taken, including at the minimum, where applicable:

(1) Date by which arrangement for an alternative raw water source or improvement of existing raw water source will be completed.

(2) Date of initiation of the connection for the alternative raw water source or improvement of the existing raw water source.

(3) Date by which final compliance is to be achieved.

(e) The proposed schedule may, if the public water system has no access to an alternative raw water source, and can effect or anticipate no adequate improvement of the existing raw water source, specify an indefinite time period for compliance until a new and effective treatment technology is developed at which time a new compliance schedule shall be prescribed by the Administrator.

(f) The proposed schedule for implementation of interim control measures during the period of variance shall specify interim treatment techniques, methods and equipment, and dates by which steps toward meeting the interim control measures are to be met.

(g) The schedule shall be prescribed by the Administrator within one year after the granting of the variance, subsequent to provision of opportunity for hearing pursuant to § 142.44.

§ 142.44 Public Hearings on Variances and Schedules.

(a) Before a variance or a schedule proposed by the Administrator pursuant to § 142.43 may take effect, the Administrator shall provide notice and opportunity for public hearing on the variance or schedule. A notice given pursuant to the preceding sentence may cover the granting of more than one variance and a hearing held pursuant to such notice shall include each of the variances covered by the notice.

(b) Public notice of an opportunity for hearing on a variance or schedule shall be circulated in a manner designed to inform interested and potentially interested persons of the proposed variance or schedule, and shall include at least the following:

(1) Posting of a notice in the principal post office of each municipality or area served by the public water system, and publishing of a notice in a newspaper or newspapers of general circulation in the area served by the public water system; and

(2) Mailing of a notice to the agency of the State in which the system is located which is responsible for the State's water supply program, and to other appropriate State or local agencies at the Administrator's discretion.

(3) Such notice shall include a summary of the proposed variance or schedule and shall inform interested persons that they may request a public hearing on the proposed variance or schedule.

(c) Requests for hearing may be submitted by any interested person other than a Federal agency. Frivolous or insubstantial requests for hearing may be denied by the Administrator. Requests must be submitted to the Administrator within 30 days after issuance of the public notices provided for in paragraph (b). Such requests shall include the following information:

(1) The name, address and telephone number of the individual, organization or other entity requesting a hearing;

(2) A brief statement of the interest of the person making the request in the proposed variance or schedule and of information that the requesting person intends to submit at such hearing;

(3) The signature of the individual making the request, or, if the request is made on behalf of an organization or other entity, the signature of a responsible official of the organization or other entity.

(d) The Administrator shall give notice in the manner set forth in paragraph (b) of this section of any hearing to be held pursuant to a request submitted by an interested person or on his own motion. Notice of the hearing shall also be sent to the persons requesting the hearing, if any. Notice of the hearing shall include a statement of the purpose of the hearing, information regarding the time and location for the hearing, and the address and telephone number of an office at which interested persons may obtain further information concerning the hearing. At least one hearing location specified in the public notice shall be within the involved State. Notice of hearing shall be given not less than 15 days prior to the time scheduled for the hearing.

(e) A hearing convened pursuant to paragraph (d) of this section shall be conducted before a hearing officer to be designated by the Administrator. The hearing shall be conducted by the hearing officer in an informal, orderly and expeditious manner. The hearing officer shall have authority to call witnesses, receive oral and written testimony and take such other action as may be necessary to assure the fair and efficient conduct of the hearing. Following the conclusion of the hearing, the hearing officer shall forward the record of the hearing to the Administrator.

(f) The variance or schedule shall become effective 30 days after notice of opportunity for hearing is given pursuant to paragraph (b) if no timely request for hearing is submitted and the Administrator does not determine to hold a public hearing on his own motion.

§ 142.45 Action After Hearing.

Within 30 days after the termination of the public hearing held pursuant to

Copyright © 1976 by The Bureau of National Affairs, Inc.

§142.44, the Administrator shall, taking into consideration information obtained during such hearing and other relevant information, confirm, revise or rescind the proposed variance or schedule.

§ 142.46 Alternative Treatment Techniques.

The Administrator may grant a variance from any treatment technique requirement of a national primary drinking water regulation to a supplier of water, whether or not the public water system for which the variance is requested is located in a State which has primary enforcement responsibility, upon a showing from any person that an alternative treatment technique not included in such requirement is at least as efficient in lowering the level of the contaminant with respect to which such requirements was prescribed. A variance under this paragraph shall be conditioned on the use of the alternative treatment technique which is the basis of the variance.

Subpart F—Exemptions Issued by the Administrator

§ 142.50 Requirements for an Exemption.

The Administrator may exempt any public water system within a State that does not have primary enforcement responsibility from any requirement respecting a maximum contaminant level or any treatment technique requirement, or from both, of an applicable national primary drinking water regulation upon a finding that:

(a) Due to compelling factors (which may include economic factors), the public water system is unable to comply with such contaminant level or treatment technique requirement;

(b) The public water system was in operation on the effective date of such contaminant level or treatment technique requirement; and

(c) The granting of the exemption will not result in an unreasonable risk to health.

§ 142.51 Exemption Request.

A supplier of water may request the granting of an exemption pursuant to this subpart for a public water system within a State that does not have primary enforcement responsibility by submitting a request for exemption in writing to the Administrator. Suppliers of water may submit a joint request for exemptions when they seek similar exemptions under similar circumstances. Any written request for an exemption or exemptions shall include the following information:

(a) The nature and duration of exemption requested.

(b) Relevant analytical results of water quality sampling of the system, including results of relevant tests conducted pursuant to the requirements of the national primary drinking water regulations.

(c) Explanation of the compelling factors such as time or economic factors which prevent such system from achieving compliance.

(d) Other information, if any, believed by the applicant to be pertinent to the application.

(e) A proposed compliance schedule, including the date when each step toward compliance will be achieved.

(f) Such other information as the Administrator may require.

§ 142.52 Consideration of an Exemption Request.

(a) The Administrator shall act on any exemption request submitted pursuant to § 142.51 within 90 days of receipt of the request.

(b) In his consideration of whether the public water system is unable to comply due to compelling factors, the Administrator shall consider such factors as the following:

(1) Construction, installation, or modification of treatment equipment or systems.

(2) The time needed to put into operation a new treatment facility to replace an existing system which is not in compliance.

(3) Economic feasibility of compliance.

§ 142.53 Disposition of an Exemption Request.

(a) If the Administrator decides to deny the application for an exemption, he shall notify the applicant of his intention to issue a denial. Such notice shall include a statement of reasons for the proposed denial, and shall offer the applicant an opportunity to present, within 30 days of receipt of the notice, additional information or argument to the Administrator. The Administrator shall make a final determination on the request within 30 days after receiving any such additional information or argument. If no additional information or argument is submitted by the applicant, the application shall be denied.

(b) If the Administrator grants an exemption request submitted pursuant to § 142.51, he shall notify the applicant of his decision in writing. Such notice shall identify the facility covered, and shall specify the termination date of the exemption. Such notice shall provide that the exemption will be terminated when the system comes into compliance with the applicable regulation, and may be terminated upon a finding by the Administrator that the system has failed to comply with any requirements of a final schedule issued pursuant to § 142.55.

(c) The Administrator shall propose a schedule for:

(1) Compliance (including increments of progress) by the public water system with each contaminant level requirement and treatment technique requirement covered by the exemption; and

(2) Implementation by the public water system of such control measures as the Administrator may require for each contaminant covered by the exemption.

(d) The schedule shall be prescribed by the Administrator within one year after the granting of the exemption, subsequent to provision of opportunity for hearing pursuant to § 142.54.

§ 142.54 Public Hearings on Exemption Schedules.

(a) Before a schedule proposed by the Administrator pursuant to § 142.53 may take effect, the Administrator shall provide notice and opportunity for public hearing on the schedule. A notice given pursuant to the preceding sentence may cover the proposal of more than one such schedule and a hearing held pursuant to such notice shall include each of the schedules covered by the notice.

(b) Public notice of an opportunity for hearing on an exemption schedule shall be circulated in a manner designed to inform interested and potentially interested persons of the proposed schedule, and shall include at least the following:.

(1) Posting of a notice in the principal post office of each municipality or area served by the public water system, and publishing of a notice in a newspaper or newspapers of general circulation in the area served by the public water system.

(2) Mailing of a notice to the agency of the State in which the system is located which is responsible for the State's water supply program and to other appropriate State or local agencies at the Administrator's discretion.

(3) Such notices shall include a summary of the proposed schedule and shall inform interested persons that they may request a public hearing on the proposed schedule.

(c) Requests for hearing may be submitted by any interested person other than a Federal agency. Frivolous or insubstantial requests for hearing may be denied by the Administrator. Requests must be submitted to the Administrator within 30 days after issuance of the public notices provided for in paragraph (b). Such requests shall include the following information:

(1) The name, address and telephone number of the individual, organization or other entity requesting a hearing;

(2) A brief statement of the interest of the person making the request in the proposed schedule and of information that the requesting person intends to submit at such hearing; and

(3) The signature of the individual making the request, or, if the request is made on behalf of an organization or other entity, the signature of a responsible official of the organization or other entity.

(d) The Administrator shall give notice in the manner set forth in paragraph (b) of this section of any hearing to be held pursuant to a request submitted by an interested person or on his own motion. Notice of the hearing shall also be sent to the person requesting the hearing, if any. Notice of the hearing shall include a statement of the purpose of the hearing, information regarding the time and location for the hearing, and the address and telephone number of an office at which interested persons may obtain further information concerning the hearing. At least one hearing location specified in the public notice shall be within

the involved State. Notice of hearing shall be given not less than 5 days prior to the time scheduled for the hearing.

(e) A hearing convened pursuant to paragraph (d) of this section shall be conducted before a hearing officer to be designated by the Administrator. The hearing shall be conducted by the hearing officer in an informal, orderly and expeditious manner. The hearing officer shall have authority to call witnesses, receive oral and written testimony and take such action as may be necessary to assure the fair and efficient conduct of the hearing. Following the conclusion of the hearing, the hearing officer shall forward the record of the hearing to the Administrator.

§ 142.55 Final Schedule.

(a) Within 30 days after the termination of the public hearing pursuant to § 142.54, the Administrator shall, taking into consideration information obtained during such hearing, revise the proposed schedule as necessary and prescribe the final schedule for compliance and interim measures for the public water system granted an exemption under § 142.52.

(b) Such schedule shall require compliance by the public water system with each contaminant level and treatment technique requirement prescribed by:

(1) Interim national primary drinking water regulations pursuant to Part 141 of this chapter, by no later than January 1, 1981; and

(2) Revised national primary drinking water regulations pursuant to Part 141 of this chapter, by no later than seven years after the effective date of such regulations.

(c) If the public water system has entered into an enforceable agreement to become a part of a regional public water system, as determined by the Administrator, such schedule shall require compliance by the public water system with each contaminant level and treatment technique requirement prescribed by:

(1) Interim national primary drinking water regulations pursuant to Part 141 of this chapter, by no later than January 1, 1983; and

(2) Revised national primary drinking water regulations pursuant to Part 141 of this chapter, by no later than nine years after the effective date of such regulations.

Subpart G—Identification of Best Technology, Treatment Techniques or Other Means Generally Available

§ 142.60 Variances from the maximum contaminant level for total trihalomethanes.

[142.60 added by 48 FR 8413, February 28, 1983]

(a) The Administrator, pursuant to Section 1415(a)(1)(A) of the Act, hereby identifies the following as the best technology, treatment techiques or other means generally available for achieving compliance with the maximum contaminant level for total trihalomethanes (Section 141.12(c)):

(1) Use of chloramines as an alternate or supplemental disinfectant or oxidant.

(2) Use of chlorine dioxide as an alternate or supplemental disinfectant or oxidant.

(3) Improved existing clarification for THM precursor reduction.

(4) Moving the point of chlorination to reduce TTHM formation and, where necessary, substituting for the use of chlorine as a pre-oxidant chloramines, chlorine dioxide or potassium permanganate.

(5) Use of powdered activated carbon for THM precursor or TTHM reduction seasonally or intermittently at dosages not to exceed 10 mg/L on an annual average basis.

(b) The Administrator in a state that does not have primary enforcement responsibility or a state with primary enforcement responsibility (primacy state) that issues variances shall require a community water system to install and/or use any treatment method identified in § 142.60(a) as a condition for granting a variance unless the Administrator or primacy state determines that such treatment method identified in § 142.60(a) is not available and effective for TTHM control for the system. A treatment method shall not be considered to be "available and effective" for an individual system if the treatment method would not be technically appropriate and technically feasible for that system or would only result in a marginal reduction in TTHM for the system. If, upon application by a system for a variance, the Administrator or primacy state that issues variances determines that none of the treatment methods identified in § 142.60(a) is available and effective for the system, that system shall be entitled to a variance under the provisions of Section 1415(a)(1)(A) of the Act. The Administrator's or primacy state's determination as to the availability and effectiveness of such treatment methods shall be based upon studies by the system and other relevant information. If a system submits information intending to demonstrate that a treatment method is not available and effective for TTHM control for that system, the Administrator or primacy state shall make a finding whether this information supports a decision that such treatment method is not available and effective for that system before requiring installation and/or use of such treatment method.

(c) Pursuant to § 142.43(c)–(g) or corresponding state regulations, the Administrator or primacy state that issues variances shall issue a schedule of compliance that may require the system being granted the variance to examine the following treatment methods (1) to determine the probability that any of these methods will significantly reduce the level of TTHM for that system, and (2) if such probability exists, to determine whether any of these methods are technically feasible and economically reasonable, and that the TTHM reductions obtained will be commensurate with the costs incurred with the installation and use of such treatment methods for that system:

Introduction of off-line water storage for THM precursor reduction.

Aeration for TTHM reduction, where geographically and environmentally appropriate.

Introduction of clarification where not currently practiced.

Consideration of alternative sources of raw water.

Use of ozone as an alternate or supplemental disinfectant or oxidant.

(d) If the Administrator or primacy state that issues variances determines that a treatment method identified in § 142.60(c) is technically feasible, economically reasonable and will achieve TTHM reductions commensurate with the costs incurred with the installation and/or use of such treatment method for the system, the Administrator or primacy state shall require the system to install and/or use that treatment method in connection with a compliance schedule issued under the provisions of Section 1415(a)(1)(A) of the Act. The Administrator's or primacy state's determination shall be based upon studies by the system and other relevant information. In no event shall the Administrator require a system to install and/or use a treatment method not described in § 142.60 (a) or (c) to obtain or maintain a variance from the TTHM Rule or in connection with any variance compliance schedule.

QUALITY CRITERIA FOR WATER

July 1976

U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. 20460

OIL AND GREASE

CRITERIA

For domestic water supply: Virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products.

For aquatic life:

(1) Levels of individual petrochemicals in the water column should not exceed 0.01 of the lowest continuous flow 96-hour LC_{50} to several important freshwater or marine species, each having a demonstrated high susceptibility to oils and petrochemicals;

(2) Levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota should not be allowed;

(3) Surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin, as well as petroleum derived oils.

INTRODUCTION

It has been estimated that between 5 and 10 million metric tons of oil enter the marine environment annually (Blumer, 1970). A major difficulty encountered in the setting of criteria for oils and grease is that these are not definitive chemical categories, but include thousands of organic compounds with varying physical, chemical, and toxicological properties. They may be volatile or nonvolatile, soluble or insoluble, persistent or easily degraded.

RATIONALE

Field and laboratory evidence has demonstrated both acute lethal toxicity and long term sublethal toxicity of oils to aquatic organisms. Events such as the Tampico Maru wreck of 1957 in Baja, Calif., (Diaz-Piferrer, 1962), and the No. 2 fuel oil spill in West Falmouth, Mass., in 1969 (Hampson and Sanders, 1969), both of which caused immediate death to a wide variety of organisms, are illustrative of the lethal toxicity that may be attributed to oil pollution. Similarly, a gasoline spill in South Dakota in November 1969 (Bugbee and Walter, 1973), was reported to have caused immediate death to the majority of freshwater invertebrates and to approximately 2,500 fish, 30 percent of which were native species of trout. Because of the wide range of compounds included in the category of oil, it is impossible to establish meaningful 96-hour LC_{50} values for oil and grease without specifying the product

involved. However, as the data in Table 9 show, the most susceptible category of organisms, the marine larvae, appear to be intolerant of petroleum pollutants, particularly the water soluble compounds, at concentrations as low as 0.1 mg/l.

The long term sublethal effects of oil pollution include interferences with cellular and physiological processes such as feeding and reproduction and do not lead to immediate death of the organism. Disruption of such behavior apparently can result from petroleum product concentrations as low as 10 to 100 ug/l (see Table 10).

Table 10 summarizes some of the sublethal toxicities for various petroleum pollutants and various aquatic species. In addition to sublethal effects reported at the 10 to 100 ug/l level, it has been shown that petroleum products can harm aquatic life at concentrations as low as 1 ug/l (Jacobson and Boylan, 1973).

Bioaccumulation of petroleum products presents two especially important public health problems: (1) the tainting of edible, aquatic species, and (2) the possibility of edible marine organisms incorporating in their tissues the high boiling, carcinogenic polycyclic aromatics. Nelson-Smith (1971) reported that 0.01 mg/l of crude oil caused tainting in oysters. Moore, et al. (1973) reported that concentrations as low as 1 to 10 ug/l could lead to tainting within very short periods of time. It has been shown that chemicals responsible for cancer in animals and man (such as 3,4-benzopyrene) occur in crude oil (Blumer, 1970). It has also been shown that marine organisms are capable of incorporating potentially carcinogenic compounds into their body fat where the compounds remain unchanged (Blumer, 1970).

Oil pollutants may also become incorporated into sediments. There is evidence that once this occurs in the sediments below the aerobic surface layer, petroleum oil can remain unchanged and toxic for long periods, since its rate of bacterial degradation is slow. For example, Blumer (1970) reported that No. 2 fuel oil incorporated into the sediments after the West Falmouth spill persisted for over a year, and even began spreading in the form of oil-laden sediments to more distant areas that had remained unpolluted immediately after the spill. The persistence of unweathered oil within the sediment could have a long term effect on the structure of the benthic community or cause the demise of specific sensitive important species. Moore, et al. (1973) reported concentrations of 5 mg/l for the carcinogen, 3,4-benzopyrene in marine sediments.

Mironov (1967) reported that 0.01 mg/l oil produced deformed and inactive flatfish larvae. Mironov (1970) also reported inhibition or delay of cellular division in algae by oil concentrations of 10^{-4} to 10^{-1} mg/l. Jacobsen and Boylan (1973) reported a reduction in the chemotactic perception of food by the snail, *Nassarius obsoletus*, at kerosene concentrations of 0.001 to 0.004 mg/l. Bellan, et al. (1972) reported decreased survival and fecundity in worms at concentrations of 0.01 to 10 mg/l of detergent.

Because of the great variability in the toxic properties of oil, it is difficult to establish a numerical criterion which would be applicable to all types of oil. Thus, for a given discharge situation, an upper allowable

limit of an individual petrochemical should be determined by applying a factor of 0.01 to the lowest continuous flow 96-hour LC_{50} for several important and sensitive resident species.

There is a paucity of toxicological data on the ingestion of the components of refinery wastewaters by humans or by test animals. It is apparent that any tolerable health concentrations for petroleum-derived substances far exceed the limits of taste and odor. Since petroleum derivatives become organoleptically objectionable at concentrations far below the human chronic toxicity, it appears that hazards to humans will not arise from drinking oil-polluted waters (Johns Hopkins University, 1956; Mckee and Wolf, 1963). Oils of animal or vegetable origin generally are nontoxic to humans and aquatic life.

In view of the problem of petroleum oil incorporation in sediments, its persistence and chronic toxicity potential, and the present lack of sufficient toxicity data to support specific criteria, concentrations of oils in sediments should not approach levels that cause deleterious effects to important species or the bottom community as a whole.

Petroleum and nonpetroleum oils share some similar physical and chemical properties. Because they share common properties, they may cause similar harmful effects in the aquatic environment by forming a sheen, a film, or discoloration on the surface of the water. Like petroleum oils, nonpetroleum oils may occur at four levels of the aquatic environment: (a) floating on the surface, (b) emulsified in the water column, (c) solubilized, and (d) settled on the bottom as a sludge. Analogous to the grease balls from vegetable oil and animal fats are the tar balls of petroleum origin which have been found in the marine environment or washed ashore on beaches.

Oils of any kind can cause: (a) drowning of waterfowl because of loss of buoyancy, exposure because of loss of insulating capacity of feathers, and starvation and vulnerability to predators due to lack of mobility; (b) lethal effects on fish by coating epithelial surfaces of gills, thus preventing respiration; (c) potential fishkills due to increased biochemical oxygen demand; (d) asphyxiation of benthic life forms when floating masses become engaged with surface debris and settle on the bottom; and (e) adverse aesthetic effects of fouled shorelines and beaches. These and other effects have been documented in the U.S. Department of Health, Education and Welfare report on "Oil Spills Affecting the Minnesota and Mississippi Rivers" and the 1975 "Proceedings of the Joint Conference on Prevention and Control of Oil Spills."

Oils of animal or vegetable origin generally are chemically nontoxic to humans or aquatic life; however, floating sheens of such oils result in deleterious environmental effects as described above. Thus, it is recommended that surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin. This same recommendation applies to floating oils of petroleum origin since they too may produce the above effects.

Table 9.—Summary of lethal toxicities of various petroleum products to aquatic organisms (a thorough discussion of duration and test conditions is found in Moore, Dwyer, and Katz, 1973)

Type organism	Soluble H-carbons	Dispersants	#2 Fuel oil/ Kerosene	Fresh crude	Gasoline	Diesel fuel	Refinery effluents	Waste oil	Lubricants	Residuals	Weathered crude
Marine Flora	10 ppm[20]- 650 ppm[20]	1.2 ppm[29]- 313 mg/l [ppm][2]	<100 ul/l [ppm][21]	Toxic to many salt marsh plants.[31]				10 ppm[14]			Costing more significant than lethal toxicity.[29]
Finfish	5 ppm[20]- 50 ppm[29]	1 ppm[29]> 10,000 mg/l [ppm][29]	550 ug/ml [ppm][30]	88 mg/l [ppm][25] 18 ml/l [$\times 10^3$ o/oo]	*91 ppm*[29]	204–420 ppm[29]		1,700 ppm[14]		2,000–10,000 mg/l[ppm][29]	
Larvae and Eggs	0.1 ppm[20]- 1 ppm[29]	1 ppm[29]- 42 ppm[29]	0.1 ul/l[ppm][21] 4 ug/ml [ppm][21]	0.1 ul/l[ppm][21] 100 ppm[27, 29]				1–>25 ppm[14]		No effect reported.[29]	
Pelagic Crustacea	1 ppm[20]- 10 ppm[20]	5 ppm[29]- 100 ppm[29]	5 ppm[20]- *50 ppm*[29]	0.1 ml/l [$\times 10^3$ *ppm*][29] 40 ppt [$\times 10^3$ ppm][29]				15–>50 ppm[14]			
Benthic Crustacea	1 ppm[20]- 10 ppm[20]	2 ppm[29]- 100 ppm[29]	5 ppm[20]- 50 ppm[20]	0.56 mg/l [ppm][15]						>10,000 ppm[29]	

Gastropods....	10 ppm[20*]-100 ppm[20*]	5 ppm[20]-2,000 ppm[20]	50 ppm[20*]-500 ppm[20*]	Toxicity reported for several species, but no concentration given.[20]						No effect reported.[20]	
Bivalves.....	5 ppm[20*]-500 ppm[20]	0.5 ppm[20]-100 ppm[20]	30–40 ml/l [$\times 10^3$ ppm][21]	1 ml/l [$\times 10^3$ ppm][21] 10^6 ppm[20]						Incorporation.[20]	
Other Benthic Invertebrates	1 ppm[20*]-10 ppm[20*]	5 ppm[20]-100,000 ppm[20]	5 ppm[20*]-50 ppm[20*]	100 ppm-6,100 ppm[20]						1,962–2,417 mg/l[ppm][21]	
Freshwater Finfish.....	5.6 ppm[12]-4,924 ppm[24]	10 ppm[21]	1,000–150,000 mg/l[ppm][20]	0.3 mg/l [ppm][12] 500 mg/l [ppm][20]	40 mg/l [ppm][20] 180 mg/l [ppm][21]	160–4,000 mg/l[ppm][21]	160–4,000 mg/l[ppm][21]	~39 ppm[13]	3,000–180,000 mg/l[ppm][21]		
Freshwater Flora.....		200 ppm[21]									
Mammals & Birds.....	Most lethal (or sublethal) effects are caused by physical coating, entanglement, ingestion of fine oil droplets, or incorporation of hydrocarbons through food chains.										

Note: (1) Numbers in brackets represent reported values (volume to volume or weight to volume basis) converted to ppm.

(2) Superscript numbers refer to references.

(3) Asterisks indicate values estimated by Moore, Dwyer, and Katz, 1973. (However, estimates are supported by examples given therein).

(4) In some cases, the above values have been taken from summary type presentations (for example: Moore, Dwyer, and Katz, 1973); the corresponding reference numbers therefore do not necessarily refer to the original publication.

(5) The manner in which the above values are reported is only an attempt to exemplify the ranges in threshold lethal toxicities, based on some of the existing published data, and should therefore not be regarded as absolute limits of toxicity for a given category of toxicant or test organism. It must be understood that there exist numerous additional published data that fall within the ranges suggested above, and possibly data that may suggest further widening these ranges. It is not the author's intention to herein summarize all of the toxicity values reported thus far *for petroleum and petroleum products.*

I51

Table 10.—Summary of some sublethal effects of petroleum products on marine life

Type organism	Species	Reference	Type petroleum product	Concentration	Sublethal response
Marine flora:	Phytoplankton (*Chlorella vulgaris*).....	Knauss, et al. 1972[2]	Crude Napthalene	1 ppm 3 ppm	Suppress growth; reduction of bicarbonate uptake
	Phytoplankton (*diatoms* and *dinoflagellates*).....	Mironov, 1970[*1, 2]	"Oil"	10^{-1} 10^{-4} ppm	Inhibition or delay in cellular division
	Phytoplankton (*Asterionella japonica*).....	Aubert, et al. 1969[*1]	Kerosene	3 ppm; 38 ppm	Depression of growth rate
	Phytoplankton (*Phaeodactylum tricornutum*).....	Lacaze, 1967[*1]	Kuwait crude	"1 ppm"	Depression of growth rate
	Phytoplankton (*Monochrysis lutheri*).....	Strand, et al. 1971[*1]	Kuwait crude; dispersant emulsions	20–100 ppm	Inhibition of growth; reduction of bicarbonate uptake at 50 ppm
	Phytoplankton (*Phaeodactylum tricornutum, Skeletonema costatum, Chlorella sp., Chlamydomonas sp.*).....	Nuzzi, 1973[*1]	Extracts of outboard motor oils, No. 6 fuel oil, No. 2 fuel oil		
	Phytoplankton.....	Gordon and Prouse, 1973[*1]	Venezuelan crude, *No. 2 and 6* fuel oils	10–200 mg/l(ppm)	Stimulation of photosynthesis at 10–30 mg/l; decrease in photosynthesis at 100–200 ug/l No. 2 fuel oil

T52

	Kelp (*Macrocystis angustifolia*).....	Wilber, 1968*[2]	Toluene	10 ppm	75% reduction in photosynthesis within 96 hours
	Lichen (*Lichen pygmaea*).....	Brown, 1972*[1]	Kuwait crude, BP_{1002}	0.1–100 ppm	1 ppm emulsifier decrease; total C^* fixation
Larvae and eggs:	Pink salmon fry (*Oncorhynchus gorbuscha*).....	Rice, 1973	Prudhoe Bay crude	1.6 ppm	Avoidance effects; could have effect on migration behavior
	Black Sea turbot (*Rhombus maeoticus*)...	Mironov, 1967	"Oil"	0.01 ppm	Irregularity and delay in hatching; resulting larvae deformed and inactive
	Plaice larvae (*Pleuronectes platessa*).....	Wilson, 1970*	BP 1002	0–10 ppm	Disruption of feeding behavior
	Cod fish larvae (*Gadus morhua*).....	Kuhnhold, 1970*	Iranian crude	Aqueous extracts from 10^3 ppm, 10^4 ppm	Adverse effect on behavior, leading to death
	Lobster larvae (*Homarus americanus*).....	Wells, 1972*	Venezuelan crude	6 ppm	Delay molt to 4th stage
	Sea Urchin larvae (*Strongylocentrotus purpuratus*).....	Allen, 1971*	Extracts of Bunker C	0.1–1 ppm	Interference with fertilized egg development

See footnotes at end of table.

Table 10.—Summary of some sublethal effects of petroleum products on marine life—*Continued*

Type organism	Species	Reference	Type petroleum product	Concentration	Sublethal response
	Barnacle larvae (*Balanus balanoides*)...	Mironov, 1970	"Oil"	10–100 ul/l (ppm)	Abnormal development
	Crab larvae (*Pachygraphus marmoratus*)	Mironov, 1970	"Oil"	10–100 ul/l (ppm)	Initial increase in respiration
Fish:	Chinook salmon (*Oncorhynchus tshawytscha*).....	Rocksen & Bailey, 1973[*1]	Benzene	5,10 ppm	Initial increase in respiration
	Atlantic silversides *Menidia menidia*.....	Gardner, et al. 1973	Crude (whole fractions) (water soluble) (water insoluble)	140 ppm (v/v) 12 ppm estimated 588 ppm (v/v)	Histological damage to chemoreceptors
Crustaceans:	Lobster (*Homarus americanus*).....	Blumer, et al. 1973	Crude, kerosene	10 ppm	Effects on chemo-reception, feeding times, stress behavior, aggression
	Pollicipes polymerus.....	Straughan, 1971	Crude–Santa Barbara	Field study after blowout	Apparent decrease in adult breeding; no recruitment in oiled areas
	Lobster (*H. americanus*).....	Atema & Stein, 1972	La Rosa crude	Extracts	Delay in feeding
	Pachygraphus crassipes.....	Kittredge, 1971[*1]	Crude	Dilutions of diethyl ether extracts (1:100)	Inhibition of feeding
	Uca pugnax.....	Krebs, 1373[*1]	No. 2 fuel oil	Field observations after W. Falmouth spill	Adverse effects on sexual behavior

Molluscs:	Mussel (*Mytilus edulis*).....	Gilfillan, 1973*2	Crude	1 ppm	Reduction in carbon budget (increase in respiration; decrease in feeding)
	Snail (*Nassarius obsoletus*).....	Blumer, et al. 1973	Kerosene	Saturated extract diluted 10^{10}	40% reduction in chemotactic perception of food
	Snail (*Nassarius obsoletus*).....	Jacobson & Boylan, 1973	Kerosene		
	Clam (*Mya arenaria*).....	Barry & Yevich, 1974	No. 2 fuel oil	Collected from field	Gonadal tumors
	Oyster (*Crassostrea virginica*).....	Mackin & Hopkins, 1961	Bleedwater		Reduced growth and glycogen content
	Snail (*Littorina littorea*).....	Perkins, 1970*1	BP 1002	30 ppm	Significant inhibition to growth
	Oyster (*Crassostrea virginica*).....	Menzel, 1948; in Nelson-Smith, 1973	"Oil"	0.01 ppm	Marked tainting
	Mussel (*Mytilus edulis*).....	Blumer, et al. 1971*1	No. 2 fuel oil	Collected from field after spill	Inhibition in development of gonads
Other benthic invertebrates:	Polychaeta (*Capitella capitata*).....	Bellan, et al. 1972[1]	Detergent	0.01–10 ppm	Decrease in survival, fecundity

Note: *1 taken from National Academy of Sciences, 1975.
*2 taken from Moore, Dwyer and Katz, 1973.

REFERENCES CITED IN TABLES 9 AND 10

1. Allen, H. 1971. Effects of petroleum fractions on the early development of a sea urchin. Marine Pollution Bulletin, 2: 138.
2. Atema, J., and L. Stein. 1972. Sublethal effects of crude oil on the behavior of the American lobster. Technical Report, Woods Hole Oceanographic Inst. No. 72-72.
3. Aubert, M.R. et al. 1969. Etude de la toxicite de produits chemiques vis-a-vis de la chaine bibliogique marine. Rev. Int. Oceanogr. Med. 13/14:45.
4. Baker, J. M. 1971. Several papers *in* E. B. Cowell, ed. The ecological effects of oil pollution on littoral communities. Institute of Petroleum, London.
5. Barry, M., and P. Yevich, 1974. Incidence of cancer in the softshell clam, *Mya arenaria*. Final report of State of Maine (Dept. Sea and Shore Fisheries) to U. S. Air Force. Contract No. F. 33600-72-C-0540.
6. Bellan, G., et al. 1972. The sublethal effects of a detergent on the reproduction, development, and settlement in the polychaetous annelid *Capitella capitata*. Marine Biology, 14: 183.
7. Blumer, M., et al. 1971. A small oil spill. Environment, 13:2.
8. Blumer, M., J. M. Hunt, J. Atema, and L. Stein, 1973. Interaction between marine organisms and oil pollution. EPA-RS-73-042. U. S. Environmental Protection Agency.
9. Brockson, R.W., and H.T. Bailey, 1973. Respiratory response of juvenile Chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil. *In* Proceedings, Joint Conference on Prevention and Control of Oil Spills. American Petroleum Institute, Washington, D.C.
10. Brown, D.H. 1972. The effects of Kuwait crude oil and a solvent emulsifier on the metabolism of the marine lichen, *Lichina pygmaea*. Marine Biology, 12:309.
11. Cairns and Scheier. 1962. The effects of temperature and water hardness upon the toxicity of naphthenic acids to the common bluegill sunfish, *Lepomis machrochirus* Rafinesque, and the pond snail, *Physa heterostropha* say., NOTUL. NAT. Philadelphia. 353: pp 1-12.
12. Chipman, W. A., and P. S. Galtsoff. 1949. Effects of oil mixed with carbonized sand on aquatic animals. Spec. Scient. Rep. U. S. Fish and Wildlife Service. 1.
13. Dorris, T. C., W. Gould, and C. R. Jenkins. 1959. Toxicity bioassay of oil refinery effluents in Oklahoma. Pages 276-285 *in* Trans. 2nd Sem. Biol. Prob. Water Poll., R. A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Tech. Rep. WGO-3.
14. Environmental Protection Agency. 1974. Waste oil study. Report to Congress.
15. Gardner, G.R. 1975. Chemically induced lesions in estuarine or marine teleosts. *In* W. Ribelin and G. Migaki, eds. Pathology of fishes. University of Wisconsin Press, Madison.
16. Gilfillan, E.C. 1973. Effects of seawater extracts of crude oil on carbon budgets in two species of mussels. *In* Proceedings, Joint Conference on Prevention and Control of Oil Spills. American Petroleum Institute, Washington, D.C.
17. Gordon, D.C.; and N. J. Prouse. (1973). The effects of three different oils on marine phytoplankton photosynthesis. Marine Biol. 22: 329-333
18. Jacobson, S.M., and Boylan, 1973. Effects of seawater soluble fraction of kerosene on chemotaxis in a marine snail, *Nassarius obsoletus*. Nature. 241: 213.
19. Karinen, J. F., and S. D. Rice. 1974. Effects of Prudhoe Bay crude oil on molting tanner crabs, *Chionoecetes bairdi*. Marine Fisheries Review. 36: 31.
20. Kauss, et al. 1972. Field and laboratory studies of the effects of crude oil spills on phytoplankton. *In* Proceedings, 18th Annual Technical Conference, Environmental Progress in Science and Education.
21. Kittredge, J.S., 1973. Effects of water-soluble component of oil pollution on chemoreception by crabs. Fisheries Bulletin.
22. Krebs, C.T. 1973. Qualitative observations of the marsh fiddler (*Uca Pugnax*) populations in Wild Harbor Marsh following the September 1969 oil spill. National Academy of Sciences, Washington, D.C. Unpublished manuscript.
23. Kuhnhold, W.W. 1970. The influence of crude oils on fish fry. *In* Proceedings, Food and Agriculture Organization Conference, Rome.
24. Lacaze, J. C. 1967. Etude de la croissance d'une algue planctonique en presence d'un detergent utlize pour la destruction des nappes de petrole en mer. C.R. Acad. Sci., Paris. 265 (Ser. D): 489.

25. Mackin, J. M., and S. H. Hopkins. 1961. Studies on oyster mortality in relation to natural environments and to oil fields in Louisiana. Publs. Inst. Mar. Sci. Univ. Tex. 7:1–131.
26. Meinck, F. et. al. 1956. Industrie-Abwasser. 2nd Edit. (Gustov Fisher Verlag, Stuttgart). p. 536, 48 D. M.
27. Mironov, O. G. 1967. Effects of low concentrations of petroleum and its products on the development of roe of the Black Sea flatfish. Vop. Ikhtiol. 7(3): 557.
28. Mironov, O. G. 1970. The effect of oil pollution on flora and fauna of the Black Sea. *In* Proceedings, FAO Conference on Marine Pollution and its Effects on Living Resources and Fish. Rome, December 1970. Food and Agriculture Organization of the United Nations, Rome.
29. Moore, S. F., R. L. Dwyer, and S. N. Katz. 1973. A preliminary assessment of the environmental vulnerability of Machias Bay, Maine to oil supertankers. Report No. MITSG 73–6.
30. Morrow, J. E. 1974. Effects of crude oil and some of its components on young coho and sockeye salmon. Publications EPA–660/3–73–018. U.S. Environmental Protection Agency.
31. Nelson-Smith, A. 1973. Oil pollution and marine ecology. Plenum Press. New York.
32. Nuzzi, R. 1973. Effects of water soluble extracts of oil on phytoplankton. *In* Proceedings, Joint Conference on Prevention and Control of Oil Spills. American Petroleum Institute, Washington, D.C.
33. Perkins, E.J. 1970. Some effects of "detergents" in the marine environment. Chem. Ind. 1: 14.
34. Pickering, Q. H., and C. Henderson. 1966. Acute toxicity of some important petrochemicals to fish. Water Poll. Contr. Fed. J. 38 (9): 1419–1429.
35. Rice, S. D. 1973. Toxicity and avoidance tests with Prudhoe Bay oil and pink salmon fry. Proceedings of Joint Conference on Prevention of Oil Spills, Washington, D. C., pp. 667–670.
36. Steel, D. L., and B. J. Copeland, 1967. Metabolic responses of some estuarine organisms to an industrial effluent control. Mar. Sci. Univ. Texas; 12: 143–159.
37. Strand, J. W., et al. 1971. Development of toxicity test procedure for marine phytoplankton. Pages 279–286 *In* Proceedings of a Joint Conference on Prevention and Control of Oil Spills. American Petroleum Institute, Washington, D. C.
38. Straughan, D. 1971. Biological and oceanographic survey of the Santa Barbara channel oil spill. Vol. 1. Biology and bacteriology. Allan Hancock Foundation, University of Southern California.
39. Todd, J.H. 1972. An introduction to environmental ethology. Woods Hole Oceanographic Institution. Ref. 72–42. Woods Hole, Mass. Unpublished manuscript.
40. Vaughan, B.E. 1973. Effects of oil and chemically dispersed oil on selected marine biota — a laboratory study. Battelle Pacific Northwest Laboratories, Richland, Wash.
41. Wells, P.G. 1972. Influence of Venezuelan crude oil on lobster larvae. Marine Pollution Bull. 3: 105.
42. Wilber, C. G. ed. 1968. Biological aspects of water pollution. C.C. Thomas Publishing Co., Springfield, Ill.
43. Wilson, K. W. 1970. The toxicity of oil-spill dispersants to the embryos and larvae of some marine fish. *In* Proceedings, Food and Agriculture Organization Conference, Rome, Italy.
44. Wohlschlog, D.E., and J.N. Cameron. 1967. Assessment of low level stress on the respiratory metabolism of the pinfish (*Lagodon rhomboides*). Inst. Mar. Sci. Univ. Texas, 12:160–171

REFERENCES CITED

Bellan, et al. 1972. The sublethal effects of a detergent on the reproduction, development, and settlement in the polychaetous annelid *Capitella capitata*. Marine Biology, 14: 183.
Blumer, M. 1970. Oil contamination and the living resources of the sea. Food and Agriculture Organization Tech. Conf. Rome. FIR: MP/70/R–1,11P.
Bugbee, S. L., and C. M. Walter. 1973. The response of macroinvertebrates to gasoline pollution in a mountain stream. Page 725 *in* Prevention and control of oil spills, proceedings of symposium March 13–17. Washington, D. C.

Diaz-Piferrer. 1962. The effects of an oil spill on the shore of Guanica, Puerto Rico (abstract). Ass. Isl. Mar. Labs, 4th Mtg. Curacao, 12–13.
Hampson, G. R., and H. L. Sanders. 1969. Local oil spill. Oceanus, 15:8.
Jacobson, S. M., and D. B. Boylan. 1973. Effect of seawater soluble fraction of kerosene on chemotaxis in a marine snail, *Nassarius obsoletus*. Nature, 241: 213.
Johns Hopkins University. 1956. Final report to the water quality subcommittee of the American Petroleum Institute, Project PG 49.41.
McKee and Wolf. 1963. Water quality criteria. State Water Resources Control Board, Sacramento, Calif. Pub. No. 3–A.
Mironov, O.G. 1967. Effects of low concentrations of petroleum and its products on the development of roe of the Black Sea flatfish. Vop Ikhtiol. 7: 557.
Mironov, O. G. 1970. The effect of oil pollution on flora and fauna of the Black Sea. *In* Proceedings: FAO conference on marine pollution and its effects on living resources and fish. Rome, December 1970, E–92. Food and Agriculture Organization of the United Nations.
Moore, S. F., et al. 1973. A preliminary assessment of the environmental vulnerability of Machias Bay, Maine to oil supertankers. Report No. MITSG 73-6.
Nelson-Smith, A. 1971. Effects of oil on marine plants and animals, Pages 273–330 *in* P. Hepple, ed. Water pollution by oil. London.
Nelson-Smith, A. 1973. Oil pollution and marine ecology. Plenum Press, New York.

PHENOL

CRITERION

1 ug/l for domestic water supply (welfare), and to protect against fish flesh tainting.

INTRODUCTION

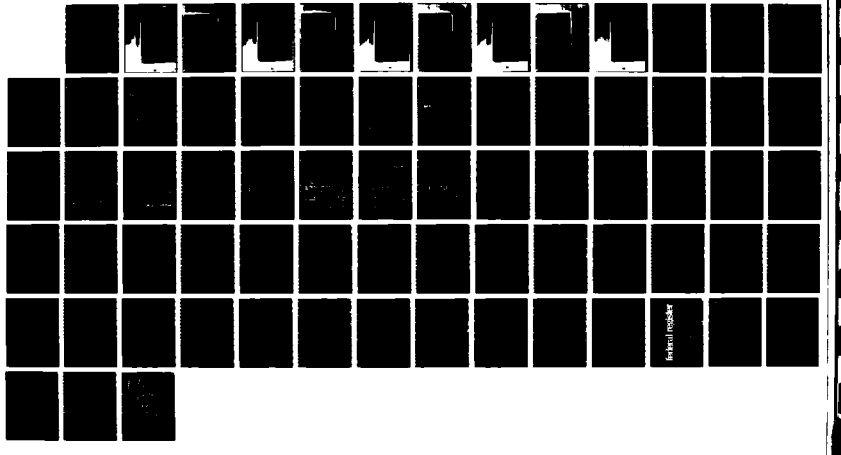
Phenolic compounds include a wide variety of organic chemicals. The phenols may be classified into monohydric, dihydric, and polyhydric phenols depending upon the number of hydroxyl groups attached to the aromatic ring. Phenol itself, which has but one hydroxyl group, is the most typical of the group and is often used as a model compound. The properties of phenol, with certain modifications depending on the nature of the substituents on the benzene ring, are shared by other phenolic compounds. Phenolic compounds arise from the distillation of coal and wood; from oil refineries; chemical plants; livestock dips; human and other organic wastes; hydrolysis, chemical oxidation, and microbial degradation of pesticides; and from naturally occurring sources and substances. Some compounds are refractory to biological degradation and can be transported long distances in water.

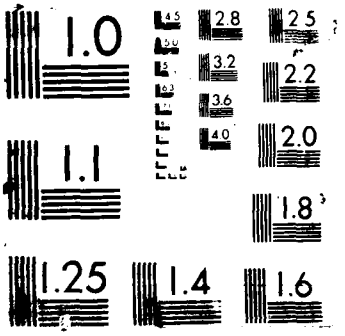
RATIONALE

Phenolic compounds can affect freshwater fishes adversely by direct toxicity to fish and fish-food organisms; by lowering the amount of available oxygen because of the high oxygen demand of the compounds; and by tainting of fish flesh (EIFAC, 1973). Shelford (1917) observed that a concentration of 1 cc per liter (purity of compound and concentration are unknown) was rapidly fatal to fish, but solutions of one half to three quarters of this amount, i.e., 0.5 to 0.75 cc, would require up to 1 hour to kill fish. Subsequent studies have confirmed the toxicity of phenol to both adult and immature organisms (EIFAC, 1973). Decreased egg development in the oyster, *Crassostrea virginica*, has been found to occur at levels of 2 mg/l phenol (Davis and Hidu, 1969).

Various environmental conditions will increase the toxicity of phenol. Lower dissolved oxygen concentrations, increased salinity, and increased temperature all enhance the toxicity of phenol (EIFAC, 1973). It has been shown that phenol and o-cresol have 24-hour LC_{50}s of 5 and 2 mg/l respectively for trout embryos (Albersmeyer and von Erichsen, 1959). Rainbow trout were killed in 7.3 mg/l phenol in 2 hours and in 6.5 mg/l phenol in 12 hours; at these concentrations there was rapid

AD-A195 808 INSTALLATION RESTORATION PROGRAM PHASE 2 6/6
CONFIRMATION/QUANTIFICATION STAGE 1 VOLUME 2(U) WESTON
(ROY F) INC WEST CHESTER PA OCT 86 F33615-80-D-4006
UNCLASSIFIED F/G 24/3 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5

damage to gills and severe pathology of other tissues (Mitrovic, et al. 1968). Pathologic changes in gills and in fish tissues were found at concentrations in the range of 20 to 70 ug/l phenol (Reichenbach-Klinke, 1965).

McKee and Wolf (1963), following a review of world literature, concluded that phenol in a concentration of 1 ug/l would not interfere with domestic water supplies; 200 ug/l would not interfere with fish and aquatic life; 50 mg/l would not interfere with irrigation; and 1,000 mg/l would not interfere with stock watering.

A major aesthetic problem associated with phenolic compounds is their organoleptic properties in water and fish flesh. Threshold odor levels range from 55 ug/l for p-cresol (Rosen, et al. 1962) to 2 ug/l for 2-chlorophenol (Burttschell, et al. 1959). The chlorinated phenols present problems in drinking water supplies because phenol is not removed efficiently by conventional water treatment and can be chlorinated during the final water treatment process to form persistent odor-producing compounds. Thus, odor problems are created in the distribution system. Boetius (1954), Fetterolf (1962), Schulze (1961), and Shumway (1966) estimated threshold fish flesh tainting concentrations for o-chlorophenol, p-chlorophenol, and 2, 4-dichlorophenol to range from 0.1 ug/l to 15 ug/l. The o-chlorophenol produced tainting at the lower concentration.

A criterion of 1 ug/l phenol, which is about half of the chlorophenol odor effect level for a water supply and near the threshold fish flesh tainting concentration, should protect the freshwater environment for such uses.

REFERENCES CITED

Albersmeyer, W., and L. von Erichsen. 1959. Untersuchungen zur wirung von Teerbestandteilen in abwassern. Mitteilungen, Z. Fisch. 3: 29.

Boetius, J. 1954. Foul taste of fish and oysters caused by chlorophenol. Medd. Dan. Fisk. Havunders. 1:1.

Burttschell, et al. 1959. Chlorine derivatives of phenol causing taste and odor. Jour. Amer. Water Works Assn. 51:205.

Davis, H.C., and H. Hidu. 1969. Effects of pesticides on embryonic development of clams and oysters and on survival and growth of the larvae. Fish. Bull. 67: 393.

European Inland Fisheries Advisory Commission. 1973. Water quality criteria for European freshwater fish. Report on mono-hydric phenols and inland fisheries. Water Res. 7:929.

Fetterolf, C.M. 1962. Investigation of fish off flavor, Muskegon lake. Bureau of Water Management, Michigan Department of Natural Resources, Lansing.

McKee, J.E., and H.W. Wolf. 1963. Water quality criteria. State Water Quality Control Board, Sacramento, Calif. Pub. 3-A.

Mitrovic, V.A., et al. 1968. Some pathologic effects of sub-acute and acute poisoning of rainbow trout by phenol in hard water. Water Res. 2: 249.

Reichenbach-Klinke, H.H. 1965. Der phenolgeholt des wasser in seiner auswerkung auf den fischorgaismus. Arch. Fischwiss. 16:1.

Rosen, A.A. et al. 1962. Odor thresholds of mixed organic chemicals, Jour. Water Poll. Cont. Fed. 34:7.

Schulze, E. 1961. The influence of phenol-containing effluents on the taste of fish. Int. Rev. ges. Hydrobiol. 46:84.

Shelford, V.E. 1917. An experimental study of the effects of gas wastes upon fishes, with especial reference to stream pollution. Bull. of the Illinois State Lab. of Nat. Hist. XI: 381.

Shumway, D.I. 1966. Effects of effluents on flavor of salmon flesh. Agricultural Experiment Station, Oregon State University, Corvallis.

PHOSPHORUS

CRITERION

0.10 ug/l yellow (elemental) phosphorus for marine or estuarine waters.

INTRODUCTION

Phosphorus in the elemental form is particularly toxic and is subject to bioaccumulation in much the same way as mercury. Phosphorus as phosphate is one of the major nutrients required for plant nutrition and is essential for life. In excess of a critical concentration, phosphates stimulate plant growth. During the past 30 years, the belief has developed that increased standing crops of aquatic plants frequently are caused by increased supplies of phosphorus. Such phenomena are associated with a condition of accelerated eutrophication or aging of waters. Generally, it is recognized that phosphorus is not the sole cause of eutrophication but there is evidence that frequently it is the key element required by freshwater plants, and generally, is present in the least amount relative to need. Therefore, an increase in phosphorus allows use of other already present nutrients for plant growth. Further, of all of the elements required for plant growth in the water environment, phosphorus is the most easily controlled by man.

Large deposits of phosphate rock are found near the western shore of central Florida, as well as in a number of other states. Deposits in Florida are found in the form of pebbles which vary in size from fine sand to about the size of a human foot. These pebbles are embedded in a matrix of clay and sand. The phosphate rock beds lie within a few feet of the surface and mining is accomplished by use of hydraulic water jets and a washing operation that separates the phosphate from waste materials. The process is similar to that of strip-mining. Florida, Idaho, Montana, North Carolina, South Carolina, Tennessee, Utah, Virginia, and Wyoming share phosphate mining activities.

Phosphates enter waterways from several different sources. The human body excretes about 1 pound per year of phosphorus expressed as "P." The use of phosphate detergents and other domestic phosphates increases the per capita contribution to about 3½ pounds per year of phosphorus as P. Some industries, such as potato processing, have wastewaters high in phosphates. Varying amounts of phosphorus drain to watercourses from the land. This drainage may be surface runoff of rainfall, effluent from tile lines, or return flow from irrigation. Cattle feedlots, concentrations of domestic duck or wild duck populations, and tree leaves, as well as atmospheric fallout are all contributing sources.

Evidence indicates that: (1) high phosphorus concentrations are associated with accelerated eutrophication of waters, when other growth-promoting factors are present; (2) aquatic plant problems develop in reservoirs and other standing waters at phosphorus values lower than those critical in flowing streams; (3) reservoirs and lakes collect phosphates from influent streams and store a portion of them within consolidated sediments, thus serving as a phosphate sink; and, (4) phosphorus concentrations critical to noxious plant growth vary, and nuisance growths may result from a particular concentration of phosphate in one geographical area but not in another. The amount or percentage of inflowing nutrients that may be retained by a lake or reservoir is variable and will depend upon: (1) the nutrient loading to the lake or reservoir; (2) the volume of the euphotic zone; (3) the extent of biological activities; (4) the detention time within the lake basin or the time available for biological activities; and, (5) the level of discharge from the lake or of the penstock from the reservoir.

Once nutrients are combined within the aquatic ecosystem, their removal is tedious and expensive. Phosphates are used by algae and higher aquatic plants and an excess may be stored within the plant cell. With decomposition of the plant cell, some phosphorus may be released immediately through bacterial action for recycling within the biotic community, while the remainder may be deposited with sediments. Much of the material that becomes combined with the consolidated sediments within the lake bottom is bound permanently and will not be recycled into the system.

RATIONALE

Elemental Phosphorus

Isom (1960) reported an LC_{50} of 0.105 mg/l at 48 hours and 0.025 mg/l at 160 hours for bluegill sunfish, *Lepomis macrochirus*, exposed to yellow phosphorus in distilled water at 26° C and pH 7. The 125- and 195-hour LC_{50}s of yellow phosphorus to Atlantic cod, *Gadus morhua*, and Atlantic salmon, *Salmo salar*, smolts in continuous exposure experiments were 1.89 and 0.79 ug/l, respectively (Fletcher and Hoyle, 1972). No evidence of an incipient lethal level was observed since the lowest concentration of elemental phosphorus (P_4) tested was 0.79 ug/l. Salmon that were exposed to elemental phosphorus concentrations of 40 ug/l or less developed a distinct external red color and showed signs of extensive hemolysis. The predominant features of P_4 poisoning in salmon were external redness, hemolysis, and reduced hematocrits.

Following the opening of an elemental phosphorus production plant in Long Harbour, Placentia Bay, Newfoundland, divers observed dead fish upon the bottom throughout the harbour (Peer, 1972). Mortalities were confined to a water depth of less than 18 meters. There was visual evidence of selective mortality among benthos. Live mussels were found within 300 meters of the effluent pipe, while all scallops within this area were dead.

Fish will concentrate elemental phosphorus from water containing as little as 1 ug/l (Idler, 1969). In one set of experiments, a cod swimming in water containing 1 ug/l elemental phosphorus for 18 hours concentrated phosphorus to 50 ug/kg in muscle, 150 ug/kg in fatty tissue, and 25,000 ug/kg in the liver (Idler, 1969; Jangaard, 1970). The experimental findings showed that phosphorus is quite stable in the fish tissues.

The criterion of 0.10 ug/l elemental phosphorus for marine or estuarine waters is 1/10 of demonstrated lethal levels to important marine organisms and of levels that have been found to result in significant bioaccumulation.

Phosphate Phosphorus

Although a total phosphorus criterion to control nuisance aquatic growths is not presented, it is believed that the following rationale to support such a criterion, which currently is evolving, should be considered.

Total phosphate phosphorus concentrations in excess of 100 ug/l P may interfere with coagulation in water treatment plants. When such concentrations exceed 25 ug/l at the time of the spring turnover on a volume-weighted basis in lakes or reservoirs, they may occasionally stimulate excessive or nuisance growths of algae and other aquatic plants. Algal growths impart undesirable tastes and odors to water, interfere with water treatment, become aesthetically unpleasant, and alter the chemistry of the water supply. They contribute to the phenomenon of cultural eutrophication.

To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphates as phosphorus (P) should not exceed 50 ug/l in any stream at the point where it enters any lake or reservoir, or 25 ug/l within the lake or reservoir. A desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments is 100 ug/l total P (Mackenthun, 1973). Most relatively uncontaminated lake districts are known to have surface waters that contain from 10 to 30 ug/l total phosphorus as P (Hutchinson, 1957).

The majority of the Nation's eutrophication problems are associated with lakes or reservoirs, and currently more data support the establishment of a limiting phosphorus level in those waters than in streams or rivers that do not directly impact such water. Natural conditions also dictate the consideration of either a more or less stringent phosphorus level. Eutrophication problems may occur in waters where the phosphorus concentration is less than that indicated above and, obviously, there would be a need in such waters to have nutrient limits that are more stringent. Likewise, there are those waters within the Nation where phosphorus is not now a limiting nutrient and where the need for phosphorus limits is substantially diminished. Such conditions are described in the last paragraph of this rationale.

Two basic needs must be met in establishing a phosphorus criterion for flowing waters: one is to control the development of plant nuisances within the flowing water and, in turn, to control and prevent animal

pests that may become associated with such plants; the other is to protect the downstream receiving waterway, regardless of its proximity in linear distance. It is evident that a portion of that phosphorus that enters a stream or other flowing waterway eventually will reach a receiving lake or estuary either as a component of the fluid mass, as bed load sediments that are carried downstream, or, as floating organic materials that may drift just above the stream's bed or float on its surface. Superimposed on the loading from the inflowing waterway, additional phosphorus may enter the lake or estuary as fallout from the air shed or as a direct introduction from shoreline areas.

Another method to control the inflow of nutrients, particularly phosphates, into a lake is that of prescribing an annual loading to the receiving water. Vollenweider (1973) suggests total phosphorus (P) loadings in grams per square meter of surface area per year that will be a critical level for eutrophic conditions within the receiving waterway for a particular water volume where the mean depth of the lake in meters is divided by the hydraulic detention time in years. Vollenweider's data (Table 13) suggest a range of loading values that should result in oligotrophic lake water quality.

Table 13.

Mean depth/hydraulic detention time	Oligotrophic or permissible loading	Eutrophic or critical loading
(meters/year)	(grams/meter^2/year)	(grams/meter^2/year)
0.5	0.07	0.14
1.0	0.10	0.20
2.5	0.16	0.32
5.0	0.22	0.45
7.5	0.27	0.55
10.0	0.32	0.63
25.0	0.50	1.00
50.0	0.71	1.41
75.0	0.87	1.73
100.0	1.00	2.00

There may be waterways wherein higher concentrations or loadings of total phosphorus do not produce eutrophy, as well as those waterways wherein lower concentrations or loadings of total phosphorus may be associated with populations of nuisance organisms. Waters now containing less than the specified amounts of phosphorus should not be degraded by the introduction of additional phosphates.

It should be recognized that a number of specific exceptions can occur to reduce the threat of phosphorus as a contributor to lake eutrophy. Often, naturally occurring phenomena limit the development of plant nuisances; often there are technological or cost-effective limitations to the control of introduced pollutants. Exceptions to the threat of phosphorus in eutrophication occur in waters (1) highly laden with natural silts or colors which reduce the penetration of sunlight needed for plant photosynthesis; (2) whose morphometric features of

steep banks, great depth, and substantial flows contribute to a history of no plant problems; (3) that are managed primarily for waterfowl or other wildlife; (4) where an identified nutrient other than phosphorus is limiting to plant growth and the level and nature of such limiting nutrient would not be expected to increase to an extent that would influence eutrophication; and (5) where phosphorus control cannot be sufficiently effective under present technology to make phosphorus the limiting nutrient. No national criterion is presented for phosphate phosphorus for the control of eutrophication.

REFERENCES CITED

Fletcher, G.L., and R.J. Hoyle. 1972. Acute toxicity of yellow phosphorus to Atlantic cod (*Gadus morhua*) and Atlantic salmon (*Salmo salar*) smolts. Jour. Fish. Res. Bd. of Canada, 29: 1295.

Hutchinson, G.E. 1957. A treatise on limnology. John Wiley and Sons, New York.

Idler, D.R. 1969. Coexistence of a fishery and a major industry in Placentia Bay. Chemistry in Canada, 21(11):16.

Isom, B.G. 1960. Toxicity of elementary phosphorus. Jour. Water Poll. Control Fed. 32: 1312.

Jangaard, P.M. 1970. The role played by the Fisheries Research Board of Canada in the "red" herring phosphorus pollution crisis in Placentia Bay, Newfoundland. Circular No. 1, Fisheries Research Board, Atlantic Regional Office, Halifax, Nova Scotia.

Mackenthun, K.M. 1973. Toward a cleaner aquatic environment. U.S. Environmental Protection Agency, Washington, D.C.

Peer, D.L. 1972. Observations on mortalities of benthic organisms after contamination of the bottom of Long Harbour, Placentia Bay, Newfoundland with elemental phosphorus. Pages 181–186 *in* Effects of elemental phosphorus on marine life. Fisheries Research Board of Canada, Circular 2.

Vollenweider, R.A. 1973. Input output models. Schweiz Z. Hydrol.

PHTHALATE ESTERS

CRITERION

3 ug/l for freshwater aquatic life.

INTRODUCTION

Phthalate esters are organic compounds extensively used as plasticizers, particularly in polyvinyl chloride plastics. The function of a plasticizer is to change the characteristics of the plastic resins by making them more flexible or improving their workability. Some plastic formulations may contain up to 60 parts per hundred of a phthalate ester. Several phthalate esters are synthesized and vary in the side chain length and structure attached to the parent benzene ring. Certain esters, the di-2-ethylhexyl and di-n-butyl phthalates, are used as an orchard acaricide and insect repellent, respectively.

Occurrence of the phthalate residues has been demonstrated in fresh (Mayer, et al. 1971), marine (Morris, 1970), industrial, and heavily populated waters (Stalling, 1972). No well-documented information exists on the fate of the phthalate compounds in aquatic environments (Mayer, et al. 1972).

RATIONALE

Acute toxicity of the phthalate esters tested has been shown to be quite low (Sanders, et al. 1973). Mayer and Sanders (1973) determined the 96-hour LC_{50} of di-n-butyl phthalate to be 1.3 mg/l for the fathead minnow, *Pimephales promelas*; 0.73 mg/l for the bluegill, *Lepomis macrochirus*; 2.91 mg/l for channel catfish, *Ictalurus punctatus*; 6.47 mg/l for rainbow trout, *Salmo gairdneri*; 2.10 mg/l for the scud, *Gammarus pseudolimnaeus*; and >10 mg/l for the crayfish, *Orconectes nais*. *Daphnia magna*, when exposed to the di-2-ethylhexyl phthalate at levels of from 3 ug/l to 30 ug/l for 21 days, exhibited a decrease in the number of young produced of 60 to 83 percent, respectively.

Ability of aquatic organisms to accumulate various phthalate residues depends upon the ester, concentration, and time of exposure. Concentration factors up to 6,600 have been reported for di-n-butyl phthalate in midge larva, *Chironomus plumosus*, after 7 days' exposure to 0.18 ug/l. Amphipods, *Gammarus pseudolimnaeus*, were found to concentrate the di-2-ethylhexyl phthalate 13,400 times in water containing 0.1 ug/l after 14 days exposure (Sanders, et al. 1973). *Daphnia magna* were exposed to 0.1 ug/l of radioactively labeled phthalate for 7 days and then transferred to fresh flowing water to

determine the time required for elimination of phthalate residues (Mayer and Sanders, 1973). After 3 days, 50 percent of the total radioactivity remained; 25 percent of the activity was still present after 7 days in fresh water.

Phthalate esters can be detrimental to aquatic organisms at low water concentrations. Ability to concentrate high levels from water and reproductive impairment in certain species are suggestive of potential environmental damage. While the fate of these compounds remains obscure, their presence in water affects successful growth and reproduction essential for maintenance of animal populations. A freshwater criterion of 3 ug/l is recommended even though some reproductive impairment was seen in daphnids, since all other species tested were so much more resistant. Until additional effect data become available this criterion should be a goal for marine waters.

REFERENCES CITED

Mayer, F.L., Jr. et al. 1971. Phthalate esters: an environmental contaminant. Presented at Midwest Regional A.C.S. meeting, Oct. 28–29, 1971, St. Louis, Mo.

Mayer, F.L., Jr. et al. 1972. Phthalate esters as environmental contaminants. Nature, 238: 411.

Mayer, F.L., Jr., and H.O. Sanders. 1973. Toxicology of phthalate acid esters in aquatic organisms. Environ. Health Perspec. 3: 153.

Morris, R.J. 1970. Phthalate acid in the deep sea jellyfish, *Atolla*. Nature, 227: 1264.

Sanders, H.O. et al. 1973. Toxicity, residue dynamics and reproductive effects of phthalate esters in aquatic invertebrates. Environ. Res. 6: 84.

Stalling, D.C. 1972. Analysis of organochlorine residues in fish: Current research at the Fish-Pesticide Research Laboratory. Page 413 *in* A.S. Tahori, ed. Pesticide chemistry, Vol. 4, Methods in residue analysis. Gordon and Breach Publ., New York.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 141

[OW-FRL-2514-3]

National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rulemaking.

SUMMARY: This proposed rule under the Safe Drinking Water Act (42 U.S.C. 300f *et seq.*) establishes Recommended Maximum Contaminant Levels (RMCLs) for the following volatile synthetic organic chemicals (VOCs) in drinking water: trichloroethylene, tetrachloroethylene, carbon tetrachloride, 1,1,1-trichloroethane, vinyl-chloride, 1,2-dichloroethane, benzene, 1,1-dichloroethylene, and p-dichlorobenene. RMCLs (goals) for non-carcinogens are proposed based upon chronic toxicity data, and RMCLs (goals) for carcinogens are proposed at the zero level. VOCs that are not included in this proposal may be considered for subsequent rulemaking as appropriate.

RMCLs are *non-enforceable health goals* which are to be set at levels which would result in no known or anticipated adverse health effects with an adequate margin of safety. This proposal is the initial stage in rulemaking for the establishment of primary drinking water regulations for the VOCs. Following this proposal, Maximum Contaminant Levels (MCLs) and monitoring/reporting requirements will be proposed when the RMCLs are promulgated. MCLs are *enforceable standards* and are to be set as close to the RMCLs as is feasible and are based upon health, treatment technologies, cost and other factors.

Public comments are solicited on the approach to setting RMCLs as proposed in this notice as well as on the alternatives presented. Specifically, comments are requested on the following: Should the RMCLs for carcinogens be zero or a level of exposure considered to constitute a negligible incremental lifetime risk, say one in one million, based upon a conservative risk estimate calculation procedure; or should the RMCLs for carcinogens be established at the limits of analytical detection?

DATES: Written comments should be submitted by September 10, 1984. A public hearing will be held in Washington, D.C. on August 6 and 7, 1984, if needed beginning at 9:00 a.m..

ADDRESSES: Send written comments to Comment Clerk, Criteria and Standards Division, Office of Drinking Water (WH-550), Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460. A copy of the comments and supporting documents will be available for review during normal business hours at the EPA, Room 55EB, 401 M Street, S.W., Washington, D.C. 20460. The public hearing will be held in Room 3906, EPA, 401 M. St. S.W., Washington, D.C. It is requested that anyone planning to attend the public hearing (especially those who plan to make statements) register in advance by calling or writing Ms. Arnetta Davis at 202/382-7575, EPA, WH-550, 401 M St., S.W., Washington, D.C. 20460. Persons planning to make statements at the hearings are encouraged to submit written copies of their remarks at the time of the hearing.

References cited on section VII will be available for inspection at the Drinking Water Supply Branches of EPA's Regional Offices.

I. JFK Federal Bldg., Boston, MA 02203, Phone: (617) 223-6486, Jerome Healy
II. 26 Federal Plaza, Room 824, New York, NY 10278, Phone: (212) 264-1800, Walter Andrews
III. 6th & Walnut Sts., Philadelphia, PA 19106, Phone: (215) 597-9873, Bernie Sarnowski
IV. 345 Courtland Street, Atlanta, GA 30365, Phone: (404) 881-3781, Robert Jourdan
V. 230 S. Dearborn St., Chicago, IL 60604, Phone: (312) 886-6176, Joseph Harrison
VI. 1201 Elm St., Dallas, TX 75270, Phone: (214) 767-2620, James Graham
VII. 324 East 11th St., Kansas City, MO 64106, Phone: (816) 374-6514, Gerald R. Fores
VIII. 1860 Lincoln St., Denver, CO 80295, Phone: (303) 837-2731, Dean Chevasse
IX. 215 Fremont St., San Francisco, CA 94105, Phone: (415) 974-8076, Leslie Ragle
X. 1200 Sixth Ave., Seattle, WA 98101, Phone: (206) 442-1225, Jerry Opatz

Copies of the nine draft health criteria documents will be available for a fee from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll free number is 800/336-4700; local: 703/487-4650.

FOR FURTHER INFORMATION CONTACT: Contact Joseph A. Cotruvo, Ph.D., Director, Criteria and Standards Division, Office of Drinking Water (WH-550), Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, telephone (202) 382-7575.

SUPPLEMENTARY INFORMATION:

I. Statutory Requirements
II. Regulatory Framework
III. Background and Summary of Comments
IV. VOCs in Drinking Water
- Occurrence of VOCs in Drinking Water
- Human Health Considerations
  —Development of RMCLs for Non-carcinogens
  —Development of RMCLs for Carcinogens
  —Toxicology of VOCs

V. RMCL Development Rationale
- VOCs: Regulatory Approach
- Regulations for Which VOCs
- RMCLs: Regulatory Approach

VI. Other Considerations for Public Comment
VII. References
VIII. Request for Comments

I. Statutory Requirements

The Safe Drinking Water Act (42 USC 300f, *et seq.*) ("SDWA" or "the Act") requires the EPA to establish primary drinking water regulations which: (1) Apply to public water systems; (2) specify contaminants which in the judgment of the Administrator, may have any adverse effect on the health of persons; (3) specify for each contaminant either (a) maximum contaminant levels (MCLs) or (b) treatment techniques. See section 1401(1), 42 U.S.C. 300f. A treatment technique requirement would only be set if "it is not economically or technologically feasible" to ascertain the level of a contaminant in drinking water.

The SDWA includes provisions for interim and revised regulations. See section 1412, 42 U.S.C. 300g-1. Interim regulations were to be established within 180 days of enactment of the SDWA. Revised regulations are to be developed in two steps: the Agency is to establish recommended maximum contaminant levels (RMCLs) and then establish maximum contaminant levels (MCLs) as close to the RMCLs as feasible. MCLs are to be proposed at the time of promulgation of the RMCLs. *RMCLs are non-enforceable health goals.* RMCLs are to be set at a level which, in the Administrator's judgment, "no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety". Section 1412(b)(1)(B). The House Report on the 1974 legislation provides congressional guidance on developing RMCLs:

> "* * * the recommended maximum [contaminant] level must be set to prevent the occurrence of any known or anticipated adverse effect. It must include an adequate margin of safety, unless there is no safe threshold for a contaminant. In such a case, the recommended maximum contaminant level should be set at zero level.

House Report No. 93-1185, July 28, 1974, at 20.

MCLs are the enforceable standards. MCLs must be set as close to RMCLs as is feasible. Feasible means "with the use of the best technology, treatment techniques and other means, which the Administrator finds are generally available (taking costs into consideration)." Section 1412(b)(3).

RMCLs of themselves have no impact on public water systems or the public. By promulgating RMCLs, no system is forced to reduce contaminants to this level or to take other action regarding contaminants. RMCLs serve as goals for the Agency in the course of setting MCLs and are therefore initial steps in the MCL rulemaking that will follow. In some cases, the MCLs will be set very close to the RMCLs; in other cases control processes or economic considerations may dictate an MCL that is not as close. Public water systems must comply with the MCL; non-compliance with an RMCL cannot be the basis of an enforcement action under section 1414 of the Safe Drinking Water Act.

In addition, the SDWA specifies that primary drinking water regulations contain criteria and procedures to assure a supply of water that complies with the MCLs (i.e., *monitoring and reporting requirements*). Section 1401(1)(D), Section 1445(a) authorizes EPA to require by regulation any public water supplier to keep records, make reports, conduct monitoring and provide such other information as may be required to audit. In determining compliance with the SDWA, in evaluating health risks of unregulated contaminants, or in advising the public of such health risks.

The SDWA also requires that the revised primary drinking water regulations be reviewed every three years and amended whenever changes in technology, treatment techniques or other factors permit greater health protection.

In addition to the regulatory mandates, the SDWA provides authorities for ensuring the safety of the nation's drinking water in a non-regulatory context. Section 1442(a)(2)(B) authorizes EPA to provide technical assistance to States and publicly owned water systems in response to and alleviation of any emergency situation which the Administrator determines to be a substantial danger to public health. In the absence of appropriate State or local action, section 1431 authorizes EPA to take such actions as the administrator deems necessary to protect public health from a contaminant that may present an imminent and substantial endangerment to the health of persons.

II. Regulatory Framework

The issuance of Revised Primary Drinking Water Regulations is the third step in the evolution of the primary drinking water regulations mandated by the SDWA.

In the *first step*, the National Interim Primary Drinking Water Regulations (NIPDWR) were promulgated on December 24, 1975, with an effective date of June 24, 1977. Amendments were issued in 1976, and 1979 and 1980. See 40 CFR 141. Maximum contaminant levels (MCLs) and monitoring and reporting requirements were set for numerous microbiological, inorganic, organic, and radionuclide contaminants (40 CFR, Part 141, Subpart B). At the direction of the Congress, EPA based the NIPDWR in large part on the 1962 U.S. Public Health Service (PHS) Standards for drinking water which in turn were derived from previous standards dating as far back as 1915 for the microbiological standards and the 1940's for the MCLs for some of the inorganic chemicals.

As the *second step*, section 1412(a) of the SDWA directed EPA to arrange for the National Academy of Sciences (NAS) or an equivalent organization to conduct a study to assess the health effects of contaminants in drinking water and to provide proposals for RMCLs at levels at which there were "no known or anticipated effects on the health of persons * * *," and a list of contaminants whose levels in drinking water cannot be determined but which may have an adverse effect on the health of persons. The NAS submitted its initial report, "Drinking Water and Health," to EPA in 1977 which was published in the Federal Register for public comment; four additional reports have been received. While Congress envisioned that the NAS would provide proposals for RMCLs in the report, the NAS stated essentially that it would do toxicological assessments of contaminants in drinking water but that developing proposals for RMCLs was not an NAS responsibility but an EPA regulatory function. In the words of the Academy, "determining safe levels to protect the health of persons' drinking water containing contaminants requires consideration of other factors in addition to the harmful properties of the contaminants" (John S. Coleman, Executive Officer, NAS, Feb. 28, 1975). The NAS reports have provided EPA with toxicological assessments of contaminants in drinking water and based upon this information and data from other scientific sources. EPA is developing the RMCLs.

As the *third step*, section 1412(b)(1)(B) provided that EPA must propose and promulgate National Revised Primary Drinking Water Regulations (NPDWR) that would include RMCLs, MCLs and monitoring and reporting requirements for those contaminants that may have an adverse effect on human health.

Regulatory Development Approach

Development of the NPDWR will be accomplished in four phases:

- Phase I Volatile Synthetic Organic Chemicals,
- Phase II Synthetic Organic Chemicals, Inorganic Chemicals and Microbiological Contaminants,
- Phase III Radionuclides,
- Phase IV Disinfectant By-Products including Trihalomethanes.

In general the approach for all four phases will be similar.

- Initially an ANPRM will be published followed by a comment period and a public meeting. Public technical workshops will also be held. The workshops provide an opportunity for EPA to present the issues that must be addressed in development of the regulations and to receive information on scientific and technical matters as well as receive comments on regulatory approaches.
- RMCLs will then be proposed followed by a public comment period and a public hearing(s).
- RMCLs will then be promulgated and proposals published for MCLs or treatment techniques, monitoring and reporting, and other requirements followed by a public comment period and a public hearing(s). Technologies will be identified that were used as the basis of determining the MCLs; in addition, generally available treatment technologies (GAT) will be identified for use in compliance with the MCLs and the issuance of variances.
- The MCLs or treatment techniques, monitoring and reporting, and other requirements including GAT will then be promulgated.

An ANPRM for Phase I (VOCs) was issued on March 4, 1982 (47 FR 9350, et seq.), and a public meeting was held in Washington, D.C., on April 28, 1982. In addition, four public technical workshops were conducted across the country (June–August 1982) on volatile synthetic organic chemicals (VOCs) in drinking water.

III. Background and Summary of Comments

The ANPRM identified the VOCs listed below as among those most commonly detected in drinking water based upon data available at that time.

trichloroethylene
tetrachloroethylene
carbon tetrachloride
1,1,1-trichloroethane
1,2-dichloroethane
vinyl chloride
dichloromethane
benzene
chlorobenzene
dichlorobenzene
trichlorobenzene
1,1-dichloroethylene
cis-1,2-dichloroethylene
trans-1,2-dichloroethylene

The purpose of the ANPRM was to solicit comments on the many scientific, technical, legal and economic questions associated with determining the proper approach under the Safe Drinking Water Act (SDWA) to limit human exposure to VOCs.

The ANPRM was published to initiate discussions that would assist the Agency in determining the proper approach under the SDWA for minimizing human exposure to VOCs. The public was invited to comment on the following broad issues:

- What is the significance of contamination of drinking water by VOCs?
- Should national standards be set for VOCs?
- If standards are appropriate, how should levels be established?

In addition to the above broad questions, comments were requested on specific technical and scientific questions. Also, available reference materials on occurrence, health effects, analytical methods, and treatment costs of VOCs in drinking water were provided for technical and scientific review.

Summary of Public Comments

A total of 130 public written comments were received with the comment period ending on September 30, 1982.

The National Drinking Water Advisory Council (NDWAC) met in Washington, D.C., on September 23–24, 1982, to discuss the VOC ANPRM and its related issues. The NDWAC provided its recommendations to the Administrator in a letter dated January 5, 1983.

Public comments pertinent to this proposal are summarized in this section and in Appendix A. Comments pertinent to proposal of the MCLs and monitoring/reporting requirements will be summarized in that proposal. The public workshops conclusions and recommendations and the NDWAC recommendations are briefly summarized below. As representative of comments received by drinking water industry associations and public interest groups, comments submitted by the American Water Works Association and Natural Resources Defense Council (NRDC), respectively, are also summarized.

Summary of Comments From Public Workshops

Overall, it was concluded that contamination by VOCs is a national problem warranting action. There was sentiment in favor of establishing MCLs and some sort of monitoring program, provided the health effects data are valid and indicate the need to reduce human exposure.

The health effects work groups believed that there are sufficient data to cause concern. Three groups suggested that MCLs be set. However, every group qualified its recommendation by saying, variously, that the data are limited, more studies are needed, and that the difference between genotoxic and non-genotoxic carcinogens should be addressed by EPA.

Aeration and granular activated carbon were identified as generally available technologies, effective in reducing VOC levels to 10 μg/l (micrograms per liter or parts per billion (ppb)) or lower. Cost projections presented by EPA were considered to be reasonable but they should be updated.

The proposed analytical methods were found to be suitably accurate and the best available at this time.

Concerning monitoring, the consensus seemed to be that EPA should provide minimum requirements within which States could develop their own monitoring plans, if data show that VOC contamination can be adequately predicted. EPA would provide criteria and guidance to assist States in predicting which systems were vulnerable to contamination by VOCs and thus be monitored.

American Water Works Association (AWWA)

The AWWA recommended that contaminants be controlled at their source through EPA's existing statutory authorities. They believed MCLs are not appropriate at this time, since "safe" levels of VOCs cannot be determined from existing health-effects data. However, when the health effects data have been evaluated by a recognized independent scientific organization (i.e., National Academy of Sciences (NAS)), the AWWA felt that MCLs should be established if a significant health risk exists.

In the interim, AWWA recommended that national monitoring for specific compound identification should be implemented for all water supplies, preferably using the purge and trap procedure (EPA Method 502.1 or equivalent), but requirements for systems serving less than 10,000 people would be at the discretion of the State. The initial monitoring frequency should be similar to the trihalomethane (THM) rule. In addition, guidance in the form of contamination levels, and action categories for five of the VOCs (i.e., vinyl chloride, trichloroethylene, tetrachloroethylene, carbon tetrachloride, 1,2-dichloroethane) should be established for all water supplies.

Natural Resources Defense Council (NRDC)

The NRDC recommended comprehensive national standards for volatile organic chemicals (VOCs) saying that the occurrence and health effects data show a significant national problem that warrants action under the SDWA. NRDC stated the EPA should establish RMCLs and MCLs for the 14 VOCs addressed in the ANPRM as well as an RMCL and MCL for total VOCs supported by mandatory national monitoring requirements. Other comments by NRDC included:

- Recommended Maximum Contaminant Levels (RMCLs) should be set at zero for carcinogens. RMCLs for non-carcinogens may be set at a no-observed-effect-level with an adequate margin of safety because RMCLs are health goals and are not intended to reflect feasibility of attainment.
- The multi-stage model as modified by the Carcinogen Assessment Group (CAG) should not be used in establishing RMCLs for carcinogens. Mathematical models at best provide crude estimates of the risks resulting from exposure to a carcinogen.
- Calculations of exposure levels corresponding to lifetime cancer risks of 10^{-4} should provide the upper limit for MCLs. That is, contaminant levels should be set at concentrations corresponding to lifetime cancer risks of no greater than 10^{-4}. MCLs for non-carcinogens should be set at correspondingly conservative levels.

NDWAC Recommendations

The National Drinking Water Advisory Council (NDWAC) provided the following recommendations and analyses.

1. The occurrence data derived primarily from the random surveys conducted by EPA and selected data produced by the States in conjunction with the health risk data, warrant establishing controls for 5 of the VOCs

found in drinking water. These are: trichloroethylene, tetrachloroethylene, carbon tetrachloride, 1,2-dichloroethane and 1,1,1-trichloroethane.

2. Regulations under the Safe Drinking Water Act should be established for those 5 chemicals at this time. Additional data would be needed before a decision could be made on other volatile organics found in drinking water. Health advisory type guidance should be provided for these compounds in lieu of establishing MCLs.

3. Sufficient animal toxicology does exist at this time for establishing RMCLs for those 5 chemicals noted in 1. above. Quantitative risk calculations using a linearized multi-stage model should be used for establishing RMCLs for the carcinogens. A 1 in 100,000 target risk is recommended as the RMCL. For 1,1,1-trichloroethane, which the current data indicate is not carcinogenic, the RMCL should be calculated from the No Observed Effect Level (NOEL) for neurotoxicity with appropriate safety factors.

4. The analytical methodology for detecting and quantitating VOCs is well established (i.e., EPA Method 502.1 using the Purge and Trap technique and similar procedures). No information was provided to the Council on the availability of laboratory services; however, it is assumed that services would be available to meet ultimate demand. The Council believes that monitoring is technically and economically feasible.

5. Sufficient data exists at this time to determine that granular activated carbon and aeration are "generally available technologies" for central treatment application. Appropriately designed point of use devices, when shown to be effective for VOC control, can also be considered for some small water systems if they are cost/effective and properly managed.

IV. Volatile Synthetic Organic Chemicals in Drinking Water

Hundreds of chemicals have been detected at one time or another in drinking water in the U.S., but the vast majority have been detected infrequently and at very low concentrations. Selection of candidate chemicals for revised national primary drinking water regulations is made from an analysis of data on the occurrence frequency, concentrations detected, size of the exposed populations and the toxicology of the chemicals. This section briefly summarizes the available occurrence data, provides an overview of population exposure estimates, and discusses the health effects data for the VOCs. Additional information can be found in the references listed in section VII.

Occurrence of VOCs in Drinking Water

One or more VOCs have been detected in numerous public water systems across the country. Typically, contamination is at low levels (i.e., less than 1 part per billion, µg/l) but some systems have found higher levels. The VOCs are man-made chemicals, their presence may indicate that a pollution incident has occurred, and some of them are among the most frequently detected contaminants around hazardous waste sites. Several of these chemicals are suspected carcinogens, with differing degrees of evidence, while certain of these are mutagens and/or teratogens in some test systems.

In 1982, EPA conducted a national sampling (Ground Water Supply Survey (GWSS)) of almost 1000 drinking water systems using ground water; 500 were selected at random and 500 were selected by the States as having high potential for VOC contamination (non-random). Table 1 presents results of the random portion of the GWSS. Approximately 21 percent of the systems in the random set had one or more of the VOCs at detectable levels (mostly in the sub µg/l range). The data showed a distinct difference in the frequency of occurrence of VOCs between larger and smaller systems; approximately 28 percent of samples in systems serving over 10,000 detected one or more VOCs in the drinking water whereas 17 percent of samples in systems serving less than 10,000 detected VOCs. Six tenths percent of all public water systems serving less than 10,000 were sampled in the survey whereas 15 percent of systems greater than 10,000 were sampled.

Six national surveys have been conducted by EPA since 1975. These include:

- National Organics Reconnaissance Survey (NORS)
- National Organics Monitoring Survey (NOMS)
- National Screening Program for Organics in Drinking Water (NSP)
- Community Water Supply Survey (CWSS)
- Rural Water Survey (RWS)
- Ground Water Supply Survey (GWSS)

Based upon the above six surveys, projections of national occurrence and human exposure potential for the VOCs are summarized in Table 2 for levels associated with various risk rates. These surveys were conducted for various purposes over an eight year period which saw a rapidly developing state-of-the-art in water analytical methods. Different analytical procedures were used and, consequently, some surveys were able to detect and measure particular VOCs at lower concentrations than other surveys were able to do. The most significant portion of the data base on VOCs, however, is derived from the Ground Water Supply Survey and the Community Water Supply Survey.

In combining the survey data, the national projections of the frequency of occurrence of VOCs at various concentrations can be provided only for those concentrations at or above the level at which all of the surveys were capable of detecting and measuring them. This level, referred to as the lowest common quantifiable concentration, is generally the highest detection limit or minimum quantifiable concentration from among the surveys that are combined. Table 2 shows the estimated frequency of occurrence of the VOCs at or above the lowest common quantifiable concentration. Individual surveys using detection limits or minimum quantifiable concentrations less than the lowest common quantifiable concentration may report a higher frequency of occurrence of some VOCs. For example, according to Table 2, 3.6% of the nation's ground water supplies are projected to have trichloroethylene at or above the lowest common quantifiable concentration of 0.5 µg/l, whereas the GWSS (random sample), using a minimum quantifiable nominal concentration of 0.2 µg/l, reported trichloroethylene to be present in 6.4% of the supplies sampled (Table 1). (Note: The GWSS random sample was found to have 4.1% at or above 0.5 µg/L)

TABLE 1.—Summary of GWSS Occurrence Data

(Random sample: n=466)

Parameter	Quantification limit µg/l	Positives		Median of + µg/l	Max µg/l
		No.	Percent		
Tetrachloroethylene	0.2	34	7.3	0.5	23
Trichloroethylene	.2	30	6.4	1	78
1,1,1-Trichloroethane	.2	27	5.8	8	18
1,1-Dichloroethane	.2	18	3.9	.5	3.2
1,2-Dichloroethylenes (cis and or trans)	.2	16	3.4	1.1	2
Carbon tetrachloride	.2	15	3.2	4	16

TABLE 1.—Summary of GWSS Occurrence Data—Continued

[Random sample: n=466]

Parameter	Quantification limit µg/l	Positives		Median of + µg/l	Max µg/l
		No.	Percent		
1,1-Dichloroethylene	.2	9	1.9	.3	6.3
m-Xylene	.2	8	1.7	.3	1.5
o- + p-Xylene	.2	8	1.7	.3	.9
Toluene	.5	6	1.3	.5	2.9
1,2-Dichloropropane	.2	6	1.3	.5	21
p-Dichlorobenzene	.5	5	1.1	.7	1.3
Bromobenzene	.5	4	.9	1.5	5.9
Ethylbenzene	.5	3	.6	.8	1.1
Benzene	.5	3	.6	3	15
1, 2-Dichloroethane	.5	3	.6	.6	1
Vinyl chloride	1	1	.2	1.1	1.1
1, 2-Dibromo-3-chloropropane	5	1	.2	5.5	5.5
1, 1, 2-Trichloroethane	.2	0			
1, 1, 1, 2-Tetrachloroethane	.2	0			
1, 1, 2, 2-Tetrachloroethane	.5	0			
Chlorobenzene	.5	0			
n-Propylbenzene	.5	0			
o-Chlorotoluene	.5	0			
p-Chlorotoluene	.5	0			
m-Dichlorobenzene	.5	0			
o-Dichlorobenzene	.5	0			
Styrene	.5	0			
Isopropylbenzene	.5	0			

TABLE 2.—APPROXIMATE PERCENT OF GROUND WATER SYSTEMS AND SIZE OF POPULATION PROJECTED TO EXCEED THE NOMINAL INDICATED RISK LEVEL

Substance	Risk level	Drinking water		Nearest drinking water concentration for which data are available µg/l	Percent of systems	Population exposed (thousands)
		Concentration	Risk level (µg/l)			
Trichloroethylene	10^{-4}	2.8	[1] 1.8	0.5	3.4	6,620
	10^{-5}	28	18	20	.4	510
	10^{-6}	280	180	100	.1	49
Tetrachloroethylene	10^{-4}	1		.5	3.6	4,270
	10^{-5}	10		10	.5	449
	10^{-6}	100		85	0	0
Carbontetrachloride	10^{-4}	.4	[1] 0.27	.5	1.8	1,109
	10^{-5}	4	2.7[1]	5	.3	169
	10^{-6}	40	27	40	0	0
Benzene	10^{-4}	.67		.5	1.5	1,000
	10^{-5}	6.7		5	.4	210
	10^{-6}	67		70	0	0
1,1-Dichloroethylene	10^{-4}	.33	[1] 0.24	.2	2.8	1,810
	10^{-5}	2.3	2.4	5	.1	70
	10^{-6}	23	24	20	0	0
1,2-Dichloroethane	10^{-4}	.99	[1] 0.5	.5	.3	1,230
	10^{-5}	9.9	5	5	0	0
	10^{-6}	99	50	20	0	0
Vinyl chloride	10^{-4}	1	[1] 0.015			
	10^{-5}	10	0.15			
	10^{-6}	100	1.5	1	.06	160
1,1,1-Trichloroethane [2]	10^{-4}	21.7		10	.3	270
	10^{-5}	217		100	.01	180
	10^{-6}	2,170				
p-Dichlorobenzene		[3] 75				

[1] Recent draft calculations by EPA's Carcinogen Assessment Group.
[2] Preliminary data; non carcinogenic Adjustable Acceptable Daily Intake (AADI) is 1,000 µg/l; proposed RMCL is 200 µg/l. Not considered in this proposal as a carcinogen. Developing data may change this classification. See text.
[3] Random sample found 6 occurrences at below this level.

Estimating the occurrence of VOCs as a class in public water supplies is difficult because not all of the six surveys looked for all the listed VOCs and because the detection limits or minimum quantifiable concentrations for specific VOCs varied from one survey to another. However, some insight to the overall occurrence of VOCs can be gained from analyses of the data from the GWSS and CWSS. As shown in Table 3, in the GWSS, 99 of 466 (21.2%) randomly selected ground water supplies had at least one of the 29 VOCs identified in that survey. In the CWSS, 50 of the 330 (15.2%) ground water supplies had at least one of 10 VOCs identified in that survey; 14 of 106 (13.2%) surface water supplies were found to have one or more of the VOCs present.

Occurrence of VOCs at levels above 5 µg/l appears to be more likely in ground water rather than surface water; however the detection frequencies may be similar. Virtually all persistent occurrences of VOCs above 50 µg/l are expected to be in ground water. However, the frequency of specific VOCs occurring above that higher level is expected to be much less than 1%.

Table 3 also provides data on multiple occurrences of VOCs; 44 of 466 (9.4%) randomly selected sites in the GWSS had measurable levels of two or more VOCs, while 19 of 330 (5.8%) of the ground water supplies in the CWSS had two or more present.

TABLE 3.—Summary of Single and Multiple Occurrence of VOCs as a Class

No. of contaminants	GWSS [1]	CWSS [2]	
	Random [3]	Ground water [4]	Surface water [5]
0	357(78.8%)	280(84.9%)	92(86.8%)
>1	99(21.2%)	50(15.2%)	14(13.2%)
>2	44 (9.4%)	19 (5.8%)	5 (4.7%)
>3	26 (5.6%)	6 (1.8%)	1 (0.9%)
>4	14 (3.0%)	4 (1.2%)	0
>5	8 (1.7%)	2 (0.6%)	0
>6	4 (0.9%)	0	0
>7	2 (0.4%)	0	0
>8	0	0	0

[1] Based on analyses for 29 VOCs.
[2] 466 supplies studied.
[3] Based on analyses for 10 VOCs.
[4] 330 supplies studied.
[5] 106 supplies studied.

Table 4 shows the frequency of occurrence of supplies with total concentrations of the 29 VOCs examined in the GWSS (random sample) above the indicated levels.

In addition to the EPA national survey data, numerous incidents of contamination have been reported by States across the country, and contamination in some public water wells has been in the range of 100 μg/l to 1,000 μg/l and higher. Usually when concentrations in that range have been detected, corrective measures have been rapidly taken; this could explain the relatively small number detected in the random surveys.

Several States, including California, Michigan, New York, and Connecticut, have monitored comprehensively for VOCs while others have generally responded to incidents of contamination. Table 5 summarizes State data that were available to EPA. The estimates of population exposed to VOCs in Table 2 are based only on the data from the EPA surveys; the State data and miscellaneous information were not included because those data were only from a few States and therefore not geographically representative. Furthermore, since much of the State data were obtained in response to incidents of recognized contamination problems, these data may not be representative of typical conditions existing nationally. However, while these data were not used for computing the national projections, they (including the GWSS non-random data) do provide a valuable and necessary perspective for evaluating those projections.

TABLE 4.—CUMULATIVE OCCURRENCE OF SUPPLIES IN THE GWSS RANDOM SAMPLE WITH TOTAL CONCENTRATION OF 29 VOC'S ABOVE THE INDICATED LEVELS

Total number of supplies sampled	>Minimum quantifiable concentrations	>5 μg/l	>10 μg/l	>50 μg/l	>100 μg/l
466	99 (21.2 percent)	20 (4.3 percent)	12 (2.6 percent)	2 (0.4 percent)	0.

TABLE 5.—SUMMARY OF STATE OCCURRENCE DATA [1]

Parameter	Number of States	Number of samples	Number of positives	Max (ppb)
Tetrachloroethylene	17	3,636	629	1,000
Trichloroethylene	18	4,228	694	510,000
1,1,1,-Trichloroethane	16	3,3330	715	2,250
1,2-Dichloroethylenes (cis and/or trans)	13	1,349	197	880
Carbon tetrachloride	15	2,646	368	1,300
Benzene	2	946	4	17
1,2-Dichloroethane	15	2,539	177	2,100
Vinyl chloride	9	1,760	138	360

[1] The State data are not a comprehensive data base. The data represent a collection of available data from various State agencies, are normally in response to contamination incidents, and are not considered to be statistically representative of national occurrence. In addition, not all the data are from public water systems since private and industrial wells are included in some cases.

Occurrence and Exposure Assessment

As part of the basis for determining how to reduce human exposure to VOCs and determine the appropriate regulatory actions, the occurrence data on VOCs are used in two principal areas. As input to the health risk assessment of the VOCs, an estimate is conducted of the number of individuals in the United States exposed to various levels of the VOCs in drinking water from public water supplies. Information on Dietary intake and respiratory intake from ambient air is provided and is used to estimate the relative contributions of the three sources, particularly of drinking water, to the total dose received by individuals. While it is recognized that some individuals may be exposed to the VOCs from other sources, such as occupational settings or the use of particular consumer products, these analyses are limited to drinking water, food and air because these are the major exposure routes common to all individuals.

In addition to serving as an input to the health assessment, the exposure assessment supports EPA efforts to estimate the economic impact of the regulatory alternatives being considered. To aid in that effort, projections are provided to estimate the number of public water supplies of various water source and system size categories likely to have VOCs present, and the distribution of the VOCs levels in those water supplies.

There are approximately 60,000 public water supplies in the United States. These systems fall into two major categories according to water source (i.e., surface water and ground water) and for purposes of estimating the potential regulatory impact are divided into eleven size categories according to the number of individuals served.

Probability distributions for computing the expected number of systems with concentrations in specified intervals were examined and tested by statistical significance procedures. Ideally, separate probability distributions should be developed for each water soure and system size category: however, the available data were too limited for this. Therefore, it was necessary to consolidate some of the size categories to have sufficient data for developing the probability distribution. Specifically, for ground water it was necessary to collapse the data into two size categories: less than 10,000 people served and 10,000 or more people served. For surface water, there were insufficient data for statistical analysis even when all size categories were combined. The delta distribution was found to be reasonable for the available data and was used for determining the probability of contamination at various levels within the two ground water size categories. For completing the national estimates for ground water, it was assumed that the probability distribution function established for a given consolidated size

category was directly applicable to each of the systems in a particular source/size category. Concentrations of VOCs within a given interval were calculated as the product of the probability associated with the interval and the total number of systems in that source/size category.

As noted previously, Table 2 summarizes the estimated population exposures at various levels of contamination. Details of the data base used in these projections for each of the VOC's can be found in the occurrence documents referenced in section VII.

Human Health Considerations

The underlying principles used to assess the potential health risks of exposure to chemicals are discussed in this section. Brief summaries of the toxicology of each selected VOC are also provided. A more detailed evaluation of the health effects of the chemicals is given in the individual health criteria documents referenced in section VII.

Development of RMCLs for Non-carcinogens

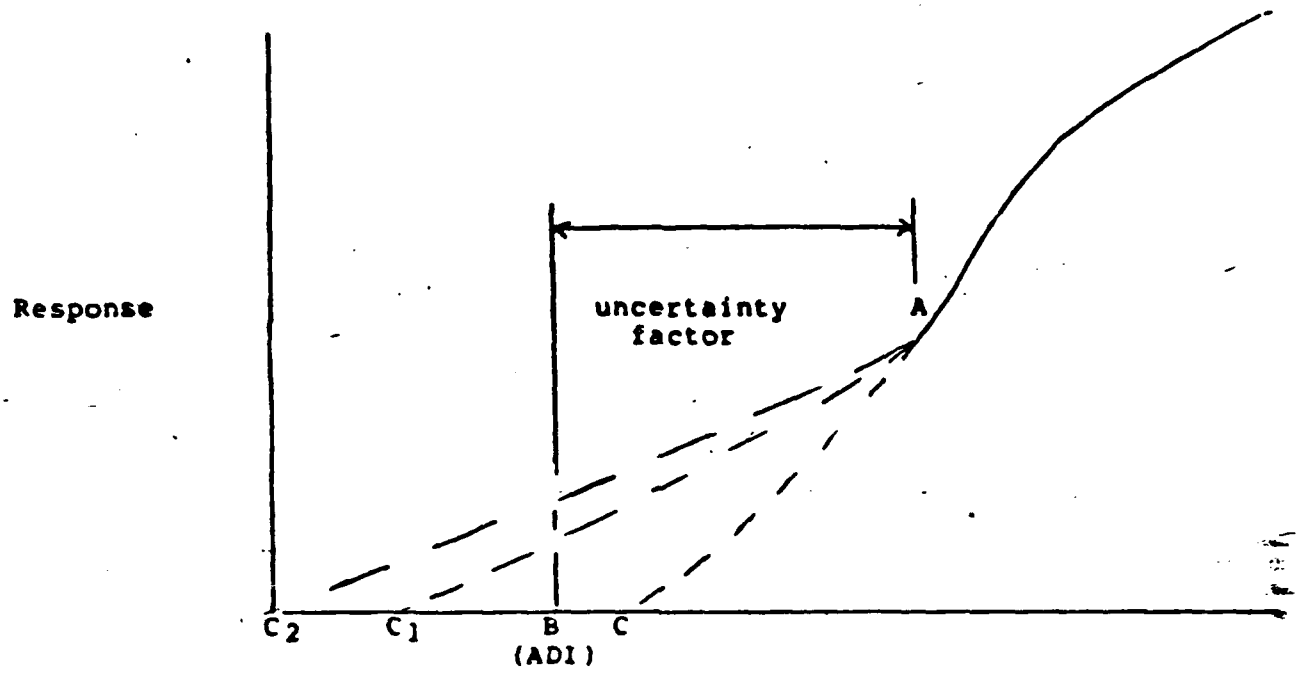
When appropriate data are available from human epidemiology or animal studies, determination of the "no known or anticipated adverse effect levels" for RMCL purposes for toxic agents not considered to have carcinogenic potential is a relatively well-accepted procedure. "No effect" levels for chronic or lifetime periods of exposure including a margin of safety are referred to commonly as ADIs or Acceptable Daily Intakes. These ADI's are considered to be exposure levels which would be without significant risk to humans when received daily over a lifetime. For non-carcinogenic end-points of toxicity, it is assumed that an organism can tolerate and detoxify some amount of a toxic agent without ill effect up to a certain does or threshold. As the threshold is exceeded, the extent of the response will be a function of the dose applied and the length of time exposed.

The intent of a toxicological analysis performed as part of the regulatory development process is to identify the highest no-observed-adverse-effect-level (NOAEL) based upon assessment of human or animal data (usually from animal experiments). To determine the ADI or "no effect" level, the NOAEL is divided by appropriate "uncertainty" or "safety" factors. This process makes accommodations for the extrapolation of animal data to the human, for the existence of weak or insufficient data and for individual differences in human sensitivity toxic agents, among other factors. General guidelines were provided by the NAS Safe Drinking Water Committee (*Drinking Water and Health*, Vol. I) which state that an uncertainty factor of 10 is used if there exist valid experimental results via ingestion in humans; an uncertainty factor of 100 is used if there exist valid experimental results on long-term feeding studies on experimental animals; and an uncertainty factor of 1000 is used if there exist inadequate animal data. Additional factors and variations also may be used if the circumstances dictate it.

Figure 1 illustrates a process by which an ADI for humans is computed. Figure 1 shows the lower end of a typical sigmoid-shaped dose-response curve as might be generated experimentally for a non-carcinogenic end-point of toxicity believed to have a threshold. The solid line represents the curve as experimentally-determined. Point A represents the highest NOAEL determined during the experiment. Point C represents the theoretical threshold dose at or above which an adverse effect might occur in the most sensitive case.

Figure 1

Non-Carcinogenic Effect



A: NOAEL (experimentally derived)

B: ADI or "no effect" level

C: Presumed threshold for adverse effect

C_1: Another possible presumed threshold for adverse effect

C_2: Non-threshold end point of toxicity

To derive the human "no effect" level or ADI based upon the experimentally-derived data displayed in Figure 1, the appropriate margin of safety (i.e., uncertainty factor) is applied to establish an acceptable level of exposure, depicted as Point B. The objective of applying the uncertainty factor is to make Point B fall below Point C. Thus, Point B would represent the ADI or "no effect" level with a margin of safety. It is possible that the actual dose response curve would result in Point C_1 not detected in the experiment, in which case the calculated ADI (i.e., Point B) might not be below the actual threshold for an adverse effect.

There is suggestive scientific evidence available to postulate that thresholds do exist for non-carcinogenic end-points of toxicity. In the absence of irrefutable evidence, however, it remains theoretically possible that one or more non-carcinogenic end-points may not have a demonstrable threshold. The dose-response curve for this case is depicted as the dashed line from Point A to the origin or C_2. C_2 represents the threshold dose and the "no effect" level in this case would thus be zero.

Table 6 summarizes the suggested Adjusted Acceptable Daily Intakes (AADIs) for the VOCs based upon chronic toxicity data without consideration of the potential carcinogenic risk. These values were not used for developing proposed RMCLs

for chemicals considered to be potential carcinogens, but are provided to add some perspective on the chemical's total toxicity including potential non-carcinogenic end-points.

In addition, these values may have some practical application as guidance on the levels at which no adverse health effects would be expected to occur based upon non-carcinogenic data. This would be especially useful for substances considered to be "weak" carcinogens. Comment is requested on these values.

The AADI's were calculated by:

- Determining the highest No-Observed-Adverse Effect Level (NOAEL), or the lowest observed adverse effect level (LOAEL) in mg/kg body weight/day,
- Dividing by appropriate safety or uncertainty factor(s) (U.F.),
- Multiplying by the weight of an adult (70 kg), and
- Dividing by the amount of water consumed by an adult per day (2 liters/day). (This allocates the ADI totally to drinking water which would have to be modified to consider other routes of exposure when the RMCL or MCL is computed.) The formula for this calculation is as follows:

$$\frac{\text{(NOAEL in mg/kg/day) (70 kg)}}{\text{U.F.(s)} \times \text{2 liters/day}} = \text{AADI mg/l}$$

TABLE 6.—SUGGESTED ADJUSTED ACCEPTABLE DAILY INTAKE: VOC'S

(Does not consider carcinogenicity and excludes contributions from air and food)

Compound	AADI
Tetrachloroethylene	0.085 mg/l.
Trichloroethylene	0.28 mg/l.
Carbon tetrachloride	0.025 mg/l.
1,1,1-Trichloroethane	1.0 mg/l.
1,2-Dichloroethane	0.28 mg/l.
Vinyl chloride	0.05 mg/l.
Benzene	0.025 mg/l.
1,1-Dichloroethylene	0.35 mg/l.
p-Dichlorobenzene	3.75 mg/l.

The calculated AADIs above assume that the total exposure was from drinking water. Since normally exposure also comes from air and food, in addition to drinking water, and since drinking water is frequently a minor contributor to the total exposure, the RMCL or MCL should be modified to take into account the relative source contributions. The World Health Organization, in "Guidelines for Drinking Water Quality" (1983), assigned as little as 1 percent of the ADI to drinking water where the chemical was known to bioaccumulate to a high degree, while greater proportions were assigned where the chemical was known to bioaccumulate to a lesser degree. In "Drinking Water and Health" (1977), the National Academy of Sciences provided projections of 1 percent and 20 percent as illustrations of drinking water contributions. In the National Interim Primary Drinking Water Regulations for six organic chemicals, drinking water was assumed to contribute 20 percent of the total daily intake.

Because of the wide range of environmental exposure distributions that would occur across urban and rural populations as well as because of age and occupationally-related differences, assumption of a 20 percent contribution from drinking water would be reasonably conservative and protective. Thus, in this case, if an AADI value for a non-carcinogen were to be the basis for an RMCL, it would be reduced by 80 percent to account for up to 20 percent contribution from drinking water to the total daily burden.

Development of RMCLs for Carcinogens. Evaluations of the toxicology of substances which may possess carcinogenic potential is a two-phase process. In the first phase, the toxicological data base for non-carcinogenic end-points of toxicity was evaluated in the same manner as described above for "non-carcinogens" (Table 6). In the second phase, assessment was made of the evidence of the carcinogenic potential (e.g., long-term bioassays in rodents and human epidemiology) as well as information which provides indirect evidence (e.g., mutagenicity and other short-term test results). This process is complex since the production of cancer probably is a multi-stage event, determined by a multiplicity of mechanisms, the nature of which remain, for the most part, hypothesized rather than identified.

To date, scientists have been unable to demonstrate experimentally a threshold of effect for "carcinogens," acording to the 1977 report of the NAS Safe Drinking Water Committee. This leads to the assumption that since no threshold dose can be demonstrated for carcinogens, any exposure might represent some finite level of risk. Depending upon the potency of the specific carcinogen and the level, such a risk could be vanishingly small at very low doses.

Human epidemiology data are extremely limited in their ability to identify carcinogenic risks. Thus, animal experiments are conducted from which potential human risk is extrapolated. In the first volume of *Drinking Water and Health* (1977), the NAS Safe Drinking Water Committee provided principles to serve as guidance to EPA when assessing the irreversible effects of long term exposure to non-threshold substances at low doses:

Principle 1: Effects in animals, properly qualified, are applicable to man.

Principle 2: Methods do not now exist to establish a threshold for long term effects of toxic agents.

Principle 3: The exposure of experimental animals to toxic agents in high doses is a necessary and valid method of discovering possible carcinogenic hazards in man.

Principle 4: Material should be assessed in terms of human risk, rather than "safe" or "unsafe".

Tumors appear spontaneously in experimental animals, at different rates and different sites depending upon the species and strain. It is unlikely that any increased tumor incidence could be detected following exposure of experimental animals to most carcinogens at dose levels occurring in the ambient environment. Very large numbers of animals would be required to distinguish between treated and control groups. It is possible, as was shown in the 24,000 animal "mega-mouse" study on 2-acetylaminofluorene at the National Center for Toxicology Research (NCTR), that a definitive answer would not necessarily be forthcoming at the low dose levels. Mathematical extrapolation still would be required to project human risk. Relying on this type of study for individual assessments is impractical because of its great expense and lingering scientific uncertainty.

In order to produce quantitative estimates, the assumption has been made that estimated excess cancer risk in humans at low dose levels can be extrapolated using various techniques from results observed in animals at high dose levels. Conventionally, designed carcinogenicity bioassay studies are conducted using both sexes of two species of test animals (usually rat and mouse) with each group of 50 animals exposed at the maximum tolerated dose or one-half the maximum tolerated dose. In addition to the possible existence of thresholds, other sources of uncertainty in high to low dose extrapolation include: (1) heterogeneity of sensitivity in the exposed populations, (2) the pharmacokinetic behavior of the toxic agent in animals vs. the human and (3) mechanisms of action (i.e., whether the agent initiates the process or acts at a later stage). Classification of carcinogens into genotoxic vs. non-genotoxic carcinogens based on possible mechanisms has also been considered

but a scientific consensus has not been achieved. Fundamental changes in normal cells are the most probable basis for the conversion of normal cells to cancer cells; however, the nature of these changes and how they are brought about is still a scientific uncertainty. Many scientists believe that the most likely mechanism involves direct alteration of DNA by carcinogens. Many carcinogens are capable of altering DNA; chemically-induced alteration of DNA in germinal cells can also cause heritable changes, or mutations; thus, when a chemical shows a positive response in short-term mutagenicity tests, there is concern that it could also be a carcinogen. Scientists also generally believe that cancer results from a multi-stage process. However, these processes are not well understood and available evidence is insufficient to differentiate between carcinogens on the basis of mechanism (IARC, 1983). Therefore in this proposal EPA did not make a differentiation based upon potential mechanisms.

Thus, quantitative risk extrapolation procedures can provide only a rough projection of carcinogenic hazard because of the many unknown factors which enter into these estimates. Models using different assumptions may produce estimates ranging over several orders of magnitude. Since there is currently no way to demonstrate the accuracy of any model at low doses, this process is a subject of debate in the scientific community. However, in spite of these difficulties, quantitative risk estimation does provide the decision-maker one means of setting priorities among pollutants and some gauge of the potential seriousness of environmental hazards (see NCI Subcommittee report referenced in section VII).

EPA's Carcinogen Assessment Group employs a multi-stage model among various others to extrapolate potential excess cancer risk expected at doses of the chemical found in the environment from results in high dose animal studies (U.S. EPA, 1980). Equivalent human doses are established either on a body weight basis (mg/kg) such that the ratio of human to animal body weights is raised to the ⅓ power:

$$\left[\frac{\text{human body weight}}{\text{animal body weight}}\right]^{1/3}$$

or on a body surface area comparison.

The multi-stage model is used for several reasons: (1) it is more systematic than the one-hit model, (2) it invokes fewer arbitrary assumptions, (3) the assumption of low dose linearity is not essential in the use of the model and (4) it incorporates data from all of the dosage groups which are consistent with the multi-stage model. At the same time, it is conceptually consistent with the linear, non-threshold concept. With this model, CAG estimated the upper bound excess cancer risk rate at a specific exposure level for a 70 kg adult who consumes 2 liters of drinking water per day, every day over a 70 year lifespan.

These calculated risk rates have associated uncertainties. This uncertainty has many sources, including such uncertainties as the shape of the dose-response relationship at low doses, differences in responses between humans and laboratory animals, and the effects of artificial dosing regimens. A relatively minor source of uncertainty is statistical fluctuation that results from the finite sample size necessarily used in any experiemental study. This is the only uncertainty that can be readily quantified; it is expressed in EPA's methodology by giving the upper-95% confidence limit of the observed response. Other confidence limits could also be calculated. (In more technically precise terms, the confidence limit is calculated on the coefficient of the linear term in the multi-stage model, assuming that all the statistical uncertainty is loaded on that term.)

Excess cancer risk rates also can be projected using variations within a specific model or other models, such as the one-hit model, the Weibull model, and logit and probit models. There exists no solid basis in the current understanding of the biological mechanisms involved in cancer to say that one model provides a better estimate of the true risk. The estimates of risk at low doses for these models can differ by several orders of magnitude. However, the linear non-threshold model usually has the best, even if limited, scientific biological basis of any of the currently available models for giving an upper limit estimate. The multi-stage model is presumed to usually give a conservative risk estimate (i.e., less likely to underestimate the actual risk) and thus would usually be consistent with a protective regulatory philosophy. A similar model was used by the NAS Safe Drinking Water Committee in the calculations provided to EPA in "Drinking Water and Health". The NDWAC recommended that the multi-stage model be used in the estimation of cancer risk associated with the VOCs. Various calculations using multi-stage models are presented in Table 7.

Shown along with the risk estimates in Table 7 is a qualification of the degree of evidence of carcinogenicity exhibited by the chemicals. The International Agency for Research on Cancer (IARC) provides guidance for categorizing chemicals having sufficient or limited evidence of carcinogenicity. In the IARC *Monographs Supplement #1* the definition for sufficient evidence for carcinogenicity indicates that there need be an increased incidence of malignant tumors: (a) In mulitple species or strains, or (b) in multiple experiments, or (c) to an unusual degree with regard to incidence, site or type of tumor, or age at onset. Sufficient evidence of *human* carcinogenicity indicates a causal association between exposure and human cancer. *Limited evidence* of carcinogenicity means that the data suggest a carcinogenic effect but are limited because: (a) The studies involve a single species, strain, or experiment; of (b) the experiments have an inadequate period of follow-up, poor survival, too few animals, or inadequate reporting; or (c) the neoplasms produced often occur spontaneously or are difficult to classify as malignant by histological criteria alone. Limited evidence of *human* carcinogenicity indicate a possible carcinogenic effect in humans, although the data are not sufficient to demonstrate a causal association. In general, although a single study may be indicative of a cause-effect relationship, confidence in inferring a causal association is increased when several independent studies are concordant in showing the association, when the association is strong, when therer is a dose-response relationship, or when a reduction in exposure is followed by a reduction in the incidence of cancer.

The National Academy of Sciences in their report, *Drinking Water and Health*, Vol. I, (1977) classified chemical carcinogens into four categories: human carcinogens, suspected human carcinogens, animal carcinogens and suspected animal carcinogens.

Figure 2 presents a typical dose-response curve for animal experiments dealing with carcinogens. Usually only two data points are available either from an NTP bioassay or other chronic study. Points A_1 amd A_2 represent the tumor incidence observed in the animal experiment at the high and low dose levels, respectively. Point B represents the mathematically extrapolated tumor incidence estimated to occur at an exposure level below those experimentally applied. This exposure level would correspond to a level likely to exist in the ambient environment (usually far below the experimental

dose). Identification of this point (B) and others along the extrapolated lower end of the curve then allows for the projection of an associated excess human carner risk.

TABLE 7.—CANCER RISK ESTIMATES FOR VOCs; PROJECTED UPPER LIMIT LIFETIME CANCER RISKS

Compound	Projected upper limit excess lifetime cancer risk	Concentration in drinking water (µg/l)			Quality of evidence **
		CAG	CAG *	NAS	
Trichloroethylene	10^{-5}	28	18	46	Limited (animal).
	10^{-6}	2.8	1.8	4.6	
Tetrachloroethylene	10^{-5}	10		35	Limited (animal).
	10^{-6}	1		3.5	
Carbon tetrachloride	10^{-5}	4	2.7	46	Sufficient (animal).
	10^{-6}	0.4	0.27	4.5	
1,2-Dichloroethane	10^{-5}	9.5	5.0	7.0	Sufficient (animal).
	10^{-6}	0.95	0.5	0.7	
Vinyl chloride ††	10^{-5}	20	0.15	10	Sufficient (human).
	10^{-6}	2	0.015	1	
1,1-Dichloroethylene	10^{-5}	2.3	2.4		Limited *** (animal).
	10^{-6}	0.23	0.24		
Benzene ††	10^{-5}	6.7			Sufficient (human).
	10^{-6}	0.67			
1,1,1-Trichloroethane (1)	10^{-5}	217		169	Limited **** (animal).
	10^{-6}	21.7		16.8	
p-Dichlorobenzene					Inadequate.

† 95% confidence limit.

†† Vinyl chloride and benzene classified as human and suspected human carcinogens, respectively, by NSA. Both have been classified as human carcinogens by IARC (1982).

CAG—EPA Carcinogen Assessment Group; NAS—National Academy of Sciences Safe Drinking Water Committee; IARC—International Agency for Research on Cancer.

* Recent draft updated calculations by CAG.

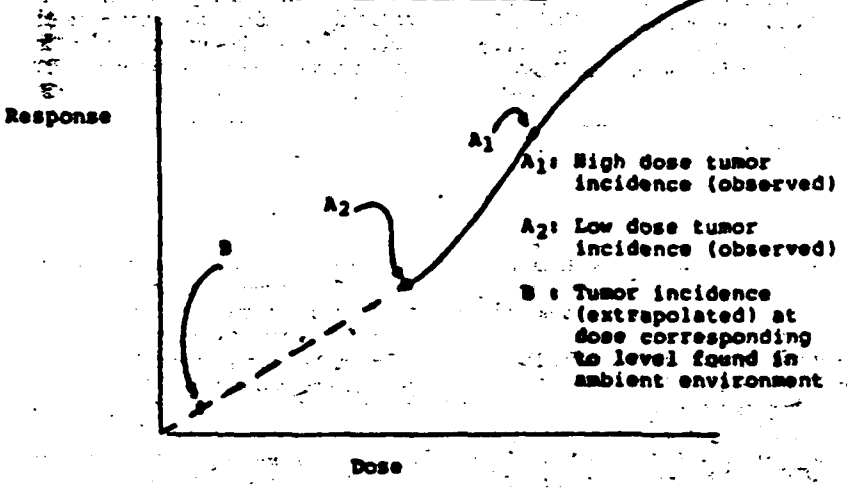
** Based upon IARC unless otherwise noted. Indicates strength of evidence as an animal carcinogen.

*** Assessment made by EPA Carcinogen Assessment Group (CAG), and IARC.

**** Limited evidence as determined by the NAS Safe Drinking Water Committee (1980) and CAG (1983) from preliminary data.

(1) Not considered in this proposal as a carcinogen. Risk estimates are provided for perspective. Developing data may change this classification. See text.

Figure 2
Carcinogenic Effects



Toxicology of VOCs

The following are short discussions of the toxicity of VOCs for which RMCLs are proposed. Detailed assessments are found in the draft health criteria documents that have been prepared for each VOC and are provided for public comment; see section VII, References.

Trichloroethylene. Trichloroethylene has been shown to exhibit non-carcinogenic bioeffects at high (non-environmental) doses in humans and several other animal species, including dogs, rabbits, guinea pigs, rats and mice. The major effects demonstrated are liver and kidney damage, central nervous system effects and depression in myocardial contractility.

In the calculation of a suggested adjusted ADI for trichloroethylene, liver toxicity was used as the most sensitive end-point with respect to adverse health effects, not including the potential carcinogenic risk that may result from exposure to the chemical. A study in which rats were exposed to trichloroethylene through inhalation with resulting elevation of liver weights was used to calculate a suggested Adjusted ADI of 0.257 mg/l. This value was calculated based upon a minimal-effect-level of 300 mg/m³ (55 ppm), since rats exposed to this dose level (5 days a week for 14 weeks) showed elevation of liver weights. An uncertainty factor of 1000 was applied due to the fact that an animal study, where the no-observed-adverse-effect-level was not identified, was used and because the study was only of 14 weeks duration. One hundred percent exposure from drinking water and a 70 kg adult consuming 2 liters of water per day were assumed in the calculations.

The NAS has not calculated a chronic non-carcinogenic Suggested No-Adverse-Response Level (equivalent to an Adjusted ADI) for trichloroethylene, because every long-term study, with the exception of the National Cancer Institute (NCI) carcinogenesis investigation, involves trichloroethylene administration by inhalation. The NCI bioassay did not determine a "no-effect level" and thus it was not considered appropriate for use in the deviation of a chronic, noncarcinogenic value.

Bacterial mutagenicity studies have shown trichloroethylene to be mutagenic in several systems, including metabolically activated *Salmonella typhimurium* and *E. coli* K12 strain; however, a later study reported trichloroethylene to be non-mutagenic in the Ames test system.

Commercial grade trichloroethylene was tested by the National Cancer Institute (NCI) (1976) and was reported to induce hepatocellular carcinomas in male and female mice by oral gavage. A repeat bioassay by the National Toxicology Program (1983) using purified trichloroethylene in corn oil found it to cause hepatocellular carcinomas in both sexes of mice, at a dose of 1,000 mg/kg per day, five days per week for 2 years, administered by gavage. Trichloroethylene was not carcinogenic in female rats under the test conditions and the results in male rats were determined to be insufficient to make an

adequate evaluation of the carcinogenicity. The doses administered to the rat were 1,000 and 500 mg/kg/day.

The International Agency for Research on Cancer (IARC) has concluded that trichloroethylene has limited evidence of carcinogenicity, based upon experimental animal studies and inadequate evidence from available human data. This means that the data suggest a carcinogenic effect in one species, but lack of confirmation in others. The World Health Organization (1981) has recommended a tentative guideline value of 30 μg/l for trichloroethylene in drinking water.

EPA's Carcinogen Assessment Group has used the linearized non-threshold multi-stage model to calculate projected excess cancer risk estimates extrapolated from high dose animal studies. For trichloroethylene, these estimates were based upon the NCI bioassay data. Calculated risks correspondingly to various doses are listed in Table 7.

Tetrachloroethylene. The principal non-carcinogenic effects of tetrachloroethylene in humans and other animals from both acute and longer-term exposures at relatively high (non-environmental) doses include central nervous system depression and fatty infiltration of the liver and kidney with concomitant changes in serum enzyme activity levels indicative of tissue damage.

A suggested adjusted ADI for tetrachloroethylene, considering adverse health effects other than the potential carcinogenic risk, was calculated based upon a series of studies in which rats were exposed by inhalation to tetrachloroethylene with effects observed on the central nervous system, immune system and certain blood components. The value of 0.065 mg/l was derived from these studies, based upon a no-observed-adverse-effect level of 10 mg/m³ (1.5 ppm) and an uncertainty factor of 100. This uncertainty factor was considered appropriate for use with a no-observed-adverse effect level from an animal study with no comparable human data. Daily exposure of a 70 kg adult drinking 2 liters of water per day was assumed in the calculations.

Tetrachloroethylene in corn oil was tested for carcinogenic potential in mice and rats by gavage in the NCI Bioassay Program (1977). In these bioassays, it was shown that tetrachloroethylene increased the incidence of hepatocellular carcinomas in both sexes of mice, but not in rats. A dose rate of 531 mg/kg per day, 5 days/week in male mice and 386 mg/kg in female mice resulted in a tumor incidence rate of 65 percent and 40 percent, respectively. Because of an excessive dose related mortality in the gavage experiment and low dose level in the inhalation study, no conclusion can be made about the carcinogenicity of tetrachloroethylene in rats. Data from the recent gavage study has been withdrawn for the time being pending the results of an indepth audit by the NTP due to unresolved problems with the study as conducted.

The majority of mutagenicity studies on tetrachloroethylene were negative. Two positive studies have been reported; however, the purity of the tetrachloroethylene was questioned in these cases.

The IARC has concluded that tetrachloroethylene has limited evidence of carcinogenicity in animals and inadequate evidence from available human data. This means that the data suggest a carcinogenic effect in one species, but lack confirmation in others. The World Health Organization has recommended a tentative guideline value of 10 μg/l for tetrachloroethylene in drinking water.

EPA's Carcinogen Assessment Group has used the linearized multi-state model to calculate projected excess cancer risk estimates extrapolated from high-does animal studies. For tetrachloroethylene, these estimates were based upon the 1977 NCI bioassay in mice. Calculated risks corresponding to various doses are listed in Table 7.

1,1,1-Trichloroethane. The principal toxic effects of 1,1,1-trichloroethane from which (non-environmental) dose exposure in animals and humans are depression of the central nervous system, increase in liver weight and cardiovascular changes.

Liver toxicity was used as the most sensitive end-point with respect to adverse health effects, not including the potential carcinogenic risk, in the calculation of an adjusted ADI for 1,1,1-trichloroethane. An inhalation study which examined exposure of mice to 1,1,1-trichloroethane was used to calculate a suggested Adjusted ADI of 1.0 mg/l. This study demonstrated changes in the livers of the mice at various dose levels.

Two animal bioassays by the National Cancer Institute (NCI) have been completed in rats and mice (1977; 1983). In the earlier bioassay, rats and mice were treated with 1,1,1-trichloroethane in corn oil by gavage. Because only 3 percent of the animals survived to the end of the experiment, due in part to chronic murine pneumonia which was determined to be the most probable cause of the high incidence of natural deaths among the animals, it was concluded that carcinogenicity could not be determined from this study. A repeat carcinogenesis bioassay of 1,1,1-trichloroethane was conducted in which doses of 3,000 or 1,500 mg/kg were administered by gavage to both sexes of mice, and rates were given does of 750 or 375 mg/kg. In the preliminary report of this study, 1,1,1-trichloroethane was carcinogenic in both male and female mice showing an increased incidence of hepatocellular carcinomas but not in rats; however, these initial results have been questioned.

1,1,1-Trichloroethane has been tested for mutagenicity in several test systems. Both negative and positive results were reported in mutagenicity tests in various *Salmonella typhimurium* strains, and 1,1,1-trichloroethane was not shown to be mutagenic in studies using yeast as an indicator organism.

EPA's Carcinogen Assessment group has used the linearized non-threshold multi-stage model to calculate preliminary excess cancer risk estimates extrapolated from the preliminary reported incidence of hepatocellular carcinomas in female mice in the study cited above. Calculated risks corresponding to various doses are listed in Table 7.

Similar calculations were made by the NAS (*Drinking Water and Health*, Vol. V) except that the average of the results in both male and female mice were used as the basis.

The latest bioassay data, on 1,1,1-trichloroethane is currently undergoing audit by the NTP and a final report has not been issued. Therefore this proposal will use the noncancer inhalation data as the basis for the proposed RMCL. This notice will be amended if the final NTP report determines that 1,1,1-trichloroethane was carcinogenic under the conditions of the tests.

Carbon Tetrachloride. Carbon tetrachloride (CCl_4) has been shown to exhibit non-carcinogenic effects in humans and animals following acute and chronic exposures. The principal effects seen at high doses are liver changes such as fatty liver with centrilobular necrosis developing if exposure is continued.

A chronic AADI for CCl_4 of 0.025 mg/l was calculated from a recent report of a study (Bruckner, et al., 1983) which has not yet been published or peer reviewed at this juncture.

Rats weighing 200–300 g were randomly divided into groups of 15 to 25 animals each. The animals were given by gavage 0, 1, 10, 33 mg CCl_4/kg bw (in corn oil). The animals were dosed on a daily basis, 5 times weekly, for a total period of 12 weeks. Blood samples were obtained from alternate animals at the

following intervals: 2, 4, 6, 8, 10 and 12 weeks post-treatment. The serum was analyzed for BUN, GPT, SDH and OCT. At 1 mg/kg, there were no significant biochemical/histopathological changes. SDH, the most sensitive index of hepatotoxicity, was elevated ($p < 0.05$) in rats receiving 10 mg/kg for 12 weeks. Also, these rats exhibited mild centrilobular vacuolization. At 33 mg/kg, levels of GPT, SDH, and OCT were increased ($p < 0.01$) and marked hepatic lesions were apparent. There was no evidence that CCl_4 was nephrotoxic.

Comments on the experimental protocols and interpretations of the data are requested.

Carbon tetrachloride has been shown to be carcinogenic in rats, mice and hamsters through oral administration. In the NCI (1976) bioassay for trichloroethylene, carbon tetrachloride was used as the positive control. Carbon tetrachloride was administered in corn oil by gavage to rats at two dose levels: 47 and 94 mg/kg for males and 80 and 159 mg/kg for females. In mice, the chemical was administered at 1,250 and 2,550 mg/kg. Carbon tetrachloride was determined to increase carcinomas of the liver in both rats and mice in this bioassay.

Carbon tetrachloride has not been shown to be mutagenic in any of the reported Salomonella (Ames) assays. However, mutagenic activity associated with carbon tetrachloride has been observed in a test system using the yeast *Saccharomyces cerevisiae*.

The IARC has concluded that sufficient evidence of carcinogenicity in animals exists for carbon tetrachloride. The NCI has also identified carbon tetrachloride as an animal carcinogen and has used it as a positive control in several bioassays. The World Health Organization (1981) has recommended a tentative guideline value of 3 µg/l for carbon tetrachloride in drinking water.

EPA's Carcinogen Assessment Group has used the linearized non-threshold multi-stage model to calculate projected excess cancer risk estimates extrapolated from high dose animal studies. For carbon tetrachloride, the latest draft estimates were based upon the geometric mean of the four cancer studies. Calculated risks corresponding to various doses are listed in Table 7.

1,2-Dichloroethane. The toxic effects of 1,2-dichloroethane in humans and other animals from both acute and longer-term exposures at relatively high levels include central nervous system depression, liver and kidney damage, gastrointestinal distress, adrenal and pulmonary effects and circulatory disturbances.

A series of inhalation studies in which a variety of animal species were exposed for up to 8 months to 1,2-dichloroethane were used to calculate a suggested Adjusted ADI for 1,2-dichloroethane. The most sensitive end-points, not including the potential carcinogenic risk, identified in these studies were pulmonary congestion, diffused myocarditis, and fatty degeneration of the liver, kidney, adrenal and heart. A value of 0.280 mg/l was calculated, based upon a no-observed-adverse-effect-level of 405 mg/m³ (100 ppm). A variety of animal species exposed to this dose level for 6 to 7 hours/day, 5 days/week yielded no adverse effects as measured by general appearance, behavior, mortality rates, growth rates, organ function and blood chemistry. An undertainty factor of 1000 was used to account for an animal study with no equivalent human data, and for the use of a study of less than lifetime exposure. One hundred percent exposure from drinking water and a 70 kg adult consuming 2 liters of water per day were assumed in the calculations.

1,2-Dichloroethane has been shown to significantly increase tumor incidences at several sites in both rats and mice when administered by gavage, but not following inhalation exposure. In the NCI bioassay, doses of 47 or 95 mg/kg in corn oil administered by gavage to rats and 97 or 195 mg/kg given to male mice and 149 or 299 mg/kg given to female mice were shown to increase the incidence of several types of tumors. 1,2-Dichloroethane has also been shown to be mutagenic in a number of biological systems, including *Drosophila melanogaster, Salmonella typhimurium* and *E. coli*.

The IARC has concluded that sufficient evidence of carcinogenicity in animals exists for 1,2-dichloroethane. The World Health Organization (1981) has recommended a tentative guideline value of 10 ug/l for 1,2-dichloroethane in drinking water.

EPA's Carcinogen Assessment Group has used the linearized non-threshold multi-stage model to calculate projected excess cancer risk estimates extrapolated from high-dose animal studies. For 1,2-dichloroethane, these estimates were based upon the NCI bioassay data. Calculated risks corresponding to various doses are listed in Table 7.

Vinyl chloride. Acute and chroic toxicity studies with vinyl chloride have shown the major non-carcinogenic effects resulting from high dose exposures to be congestion and edema of the lungs and hyperemia of the kidney and liver. Other non-carcinogenic effects have been noted, including disturbances of the central nervous system, pulmonary insufficiency, cardiovascular manifestations, gastrointestinal symptoms and acroosteolysis.

A suggested Adjusted ADI for vinyl chloride of 0.08 mg/l considering adverse health effects not including carcinogenic risk, was calculated based upon an oral toxicity study in rats in which a variety of carcinogenic and non-carcinogenic effects were observed at all dose levels. A minimal-effect-level of 1.7 mg/kg was used in the calculations, as histopathological changes in the liver including clear-cell foci, extensive necrosis, cysts and liver-cell polymorphism were observed at this dose level. An uncertainty factor of 1000 was applied to account for an animal study where the no-observed-adverse-effect level was not identified. One hundred percent exposure from drinking water and a 70 kg adult consuming 2 liters of water per day were assumed in the calculations.

Vinyl chloride has been shown to have carcinogenic effects in animals and humans. Animal studies have demonstrated the production of liver angiosarcomas, mammary carcinomas, pulmonary angiosarcomas and other tumor types in rats following oral exposure and carcinogenic effects in mice, rats and hamsters by inhalation exposure have been reported. In humans, studies have linked vinyl chloride with angiosarcoma of the liver and other forms of neoplasm. The IARC has concluded that sufficient evidence of carcinogenicity exists for vinyl chloride from animal studies and human studies, and that vinyl chloride should be considered a human carcinogen with target organs of the liver, brain, lungs and haemo-lymphopoietic system.

Vinyl chloride was shown to be mutagenic in the test system using metabolically activated *Salmonella typhimurium, E. coli* K12 strain, in germ cells of *Drosophila* and Chinese hamster V79 cells.

EPA's carcinogen assessment Group has used the linearized non-threshold multi-stage model to calculate projected excess cancer estimates extrapolated from high dose animal studies. For vinyl chloride, these estimates were based upon an inhalation study in rats in which vinyl chloride concentrations ranging from 50 to 10,000 ppm resulted in a total tumor incidence rate of 17 percent to 82 percent, respectively. The NAS has also used the multi-stage model to calculate excess cancer risk values. They based their estimates upon the same study as did CAG (Maltoni, *et al.*, 1975), except ingestion data instead of inhalation data were used. The NAS

risk estimation used ingestion exposure and thus may be more appropriate for estimating risks from drinking water exposure. Calculated risks corresponding to various doses are listed in Table 7. In addition, data from a recent draft CAG calculation using an ingestion study in rats (EPA, 1984) are also included for comment.

Benzene. The toxic effects of benzene in humans and other animals include central nervous system effects, hematological effects as well as immunological effects. The toxicity of benzene to the hematopoietic system of humans experiencing chronic exposure to benzene is well documented. Repeated exposure effects include myelocytic anemia, thrombocytopenia and leukemia. In laboratory animals, leukopenia is the most commonly observed effect of chronic benezene exposure.

A suggested Adjusted ADI for benzene, considering adverse health effects not including carcinogenic risk, was calculated based upon data from a gavage study in rats in which leucopenia was observed at specific dose levels. A value of 0.025 mg/l was calculated using a no-observed-adverse-effect level of 1 mg/kg and an uncertainty factor of 1000. This uncertainty factor was used to account for an animal study with no equivalent human data, and for the use of a study of less than lifetime exposure. One hundred percent exposure from drinking water and a 70 kg adult consuming 2 liters of water per day were assumed in the calculations.

Benzene has been shown to be carcinogenic in Sprague-Dawley rats, causing tumors at dose levels of 50 mg/kg and 250 mg/kg. An increase in zymbal gland carcinomas, luekemias and mammary carcinomas in rats has also been observed. Toxic effects on bone marrow cells of rats and other laboratory animals from benzene exposure include changes in chromosome number and chromosome breakage. These types of effects have also been obeserved in humans.

EPA's Carcinogen Assessment group has used the linearized non-threshold multi-stage model to calculate projected excess cancer estimates extrapolated from high-dose animal and human studies. For benzene, these estimates were based upon an epidemiologic study of workers exposed to benzene vapors on their jobs. Calculated risks corresponding to various doses are listed in Table 7.

1,1-Dichloroethylene. 1,1-Dichloroethylene has been shown to cause liver and kidney injury in animals from high dose exposures. Liver damage in rats, mice and gunea pigs has been documented, along with renal toxicity, CNS depression and sensitization of the heart.

An Adjusted ADI of 350 μg/l for 1,1-dichloroethylene considering adverse health effects not including the potential carcinogenic risk was calculated based upon toxic liver effects using a NOAEL of 10 mg/kg and 100 percent exposure from drinking water.

The NAS (1983) has calculated a chronic, suggested-no-adverse-response level (equivalent to an adjusted ADI) of 0.1 mg/l based upon non-carcinogenic effects only for 1,1-dichloroethylene, from data in the National Toxicology Program bioassay (1982) in rats and mice. A no-observed-adverse-effect level of 2 mg/kg was used and an uncertainty factor of 100, and complete absorption from the GI tract. Twenty percent exposure from drinking water and a 70 kg adult consuming 2 liters of water per day were assumed in the calculations, along with conversions from a 5 d/week dosing regime to a 7 d/week exposure.

1,1-Dichloroethylene was found to be mutagenic with microsomal activation in *Salmonella typhimurium* and *E. coli* test systems. However, mutagenicity was not observed with V79 Chinese hamster cells or in dominant lethal studies in mice and rats.

1,1-Dichloroethylene was shown to produce kidney adenocarcinomas in mice and rats in one study (Maltoni, 1977). However, most of the other studies have failed to demonstrate significant carcinogenic activity of the chemical. A study by the National Toxicology Program (1982) examined 1,1-dichloroethylene exposures of 1 mg/kg or 5 mg/kg 5 times per week in rats and 2 mg/kg or 10 mg/kg 5 times per week in mice. In this bioassay, there was no evidence that 1,1-dichloroethylene was carcinogenic for either the rats or the mice. However, there was some question as to whether the maximum tolerated dose had been used in this study. The NAS (1983) has concluded that information on 1,1-dichloroethylene is not sufficient to reach a definite conclusion on the carcinogenicity of the compound.

EPA's Carcinogen Assessment Group found 1,1-dichloroethylene to have limited evidence of carcinogenicity in animals. They have used the linearized, non-threshold, multi-stage model to calculate projected excess cancer estimates extrapolated from high-dose animal studies. For 1,1-dichloroethylene, these estimates were based on results of inhalation studies in mice and rats. Calculated risks corresponding to various doses are listed in Table 7. EPA's SAB has recently questioned validity of this study result. This tentative classification of 1,1-DCE as a carcinogen will be reexamined during the comment period. Comment is solicited in this regard.

p-Dichlorobenzene. Non-carcinogenic adverse effects observed in animal studies include liver and kidney damage, porphyria, pulmonary edema and congestion and splenic weight changes. In humans, exposure to fairly high concentrations of the dichlorobenzenes has been reported to result in anorexia, nausea, yellow atrophy of the liver and blood dyscrasias.

A suggested Adjusted ADI of 3.75 mg/l for p-dichlorobenzene considering adverse health effects other than carcinogenic potential was calculated. This value was based upon the rat subchronic gavage study which served as the dose range-finding study for the NTP bioassay. The ADI was based upon a NOAEL of 150 mg/kg/day. Uncertainty factors of 100 and 10 were used to account interspecies extrapolation and use of data from an exposure duration significantly less than lifetime.

p-Dichlorobenzene has been shown to induce abnormal mitotic division in higher plants. The compound was not seen to be mutagenic when tested in the *Salmonella typhimurium* or *E. coli* WP2 systems, and no evidence of mutagenicity in animals has been reported to date.

In June 1980, a carcinogenesis bioassay of p-dichlorobenzene in mice and rats was undertaken by the National Toxicology Program. Doses of 200 mg/kg or 600 mg/kg were administered by gavage to both sexes of mice and to female rats. Male rats were given 150 or 300 mg/kg. The results of this study have not yet been released.

V. RMCL Development Rationale

The ANPRM requested public comment on the appropriate approach to deal with VOCs in drinking water, specifically requesting consideration of the following:

- What approach should be followed under the SDWA to reduce human exposure to VOCs?
- For which VOCs should regulations be set?
- What approach should be followed in setting RMCLs for suspected carcinogens?

Each of these issues is discussed below in regard to the rationale used by the Agency in development of this proposal and the Agency's consideration of the public comments, the

requirements of the SDWA, and the available scientific information.

VOCs: Regulatory Approach

Alternative approaches. The major alternatives considered for limiting human exposure to VOCs in drinking water as discussed in 47 FR 9350 are provided below.

(1) *No federal regulations. Provision of health advisories for State action as appropriate.* Health advisories and advice on treatment and analytical methods are currently being provided to States and public water systems for use in dealing with incidents of VOC contamination.

Each State would design its own control strategies to address incidents of contamination on a case-by-case basis or state-wide. Health advisories were developed to deal primarily with isolated incidents of short-term contamination in lieu of standards and not as a substitute for MCLs. Experience has shown that, as would be expected, States have interpreted and applied the health advisories in different ways. Some States have applied the health advisories as if they were standards or considered adopting them as State standards.

(2) *Set federal monitoring regulations and provide health advisories for State action as appropriate.* This option would set monitoring requirements for VOCs under section 1445 and provide health advisories for State action as needed. This alternative would result in all public water systems determining if they have VOCs in their drinking water and could be proposed and promulgated in a shorter period of time than alternative 3. Different States would probably adopt different control options and action levels.

(3) *Set Primary Drinking Water Regulations for certain of the VOCs.* This option would set RMCLs, MCLs, monitoring and reporting requirements for a number of VOCs and would result in consistent, nation-wide controls on VOCs.

Proposed regulatory approach. The SDWA authorizes EPA to establish RMCLs for "each contaminant which, in [the Administrator's] judgment * * * may have any adverse effect on the health of persons" section 1412(b)(1)(B). A primary drinking water regulation is to be established for each contaminant for which an RMCL is established. Section 1412(b)(2). In implementing this broad statutory mandate, EPA is considering the following factors to select contaminants appropriate for regulations. These include:

- Whether the frequency of occurrence and the concentrations detected in drinking water and the extent of the population exposed warrant establishment of national primary drinking water regulations.
- Whether the available toxicology data are sufficient to warrant a determination that adverse effects may be known or anticipated at levels found in drinking water.

Notwithstanding these factors, EPA feels that primary drinking water regulations may be appropriate in some instances for substances which to date have not been found at high concentrations or frequencies in drinking water, but where in the Administrator's judgement it would be appropriate to anticipate possible future potential for drinking water contamination from spills or improper disposal.

Other factors that must be considered as part of the decision on the type of regulation (MCL or treatment requirement) include:

- Whether monitoring is technically and economically feasible.
- Whether treatment technologies are available to reduce the contaminants to appropriate levels.

In addition, some guidance was provided in the legislative history to the SDWA Senate Report on possible candidates for Revised Regulations. Contaminants listed in the following sources were expected to be considered for regulation.

- World Health Organization: "Maximum Permissible Concentrations of Harmful Substances in the Water of Water Courses used for Hygienic and Domestic Purposes (1970)."
- World Health Organization: "European Standards for Drinking Water," 2nd edition, Revised, Geneva (1970).
- National Institute of Occupational Safety and Health annual list of toxic substances.
- Toxic Substances listed under section 307 of the Federal Water Pollution Control Act.

Information provided by the NAS in the Drinking Water and Health series is an additional source.

While numerous contaminants are listed in these sources, this proposal in Phase I of EPA's National Primary Drinking Water Regulations addresses a limited number of contaminants in the VOC category found in drinking water. Because of EPA's desire to avoid delay in developing regulations for certain VOCs that have been detected in ground waters and the need to prioritize the expenditure of limited resources, only nine VOCs are addressed in this initial proposal. Other VOCs for which sufficient occurrence and health effects information become available will be addressed in Phase II and later iterations of the National Primary Drinking Water Regulations along with other contaminants. Specific VOCs considered in this proposal are those that have appeared to be the highest priority for regulation based upon occurrence, health risk considerations and available data.

Several VOCs have been found across the country in numerous drinking water supplies. In the GWSS, 21 percent of systems had at least one VOC detected. EPA has concluded that sufficient health effects data are available to cause concern about potential human exposure to certain VOCs via drinking water. Various of the VOCs are suspected or proven mammalian carcinogens, some are known human carcinogens, some are active in certain mutagenic test systems and exposure to certain of the VOCs at high doses has shown other non-carcinogenic toxic effects. EPA recognizes that interpretation of health risk data raises numerous scientific issues. However, drawing upon the conclusions/recommendations of the NAS, IARC and the NDWAC, EPA believes that the data adequately demonstrate concern such that RMCLs and primary drinking water regulations are warranted. Thus, EPA has determined that human exposure to certain VOCs via drinking water may have an "adverse effect upon the health of persons" thereby warranting regulatory action.

Selection of VOCs for Regulation

This section provides a discussion of the factors used to select the specific contaminants for which RMCLs are proposed at this time. VOCs that were not included in this proposal will be reconsidered in Phase II of the Revised Regulations as additional data become available.

Factors considered. A number of factors were considered in determining which VOCs should be regulated; however, there is no established formula or set criteria for these determinations. The SDWA states that regulations should be set for contaminants that the Administrator determines "may have any adverse effect upon the health of persons" but little additional guidance was provided. Obviously, it is impossible to consider for regulation every chemical that may appear in drinking water and that theoretically may adversely affect health in some remote circumstances. What is needed is some prioritization of contaminants in drinking water so that a reasonable

number of contaminants of sufficient concern can be addressed in regulations.

To best employ its resources, EPA must select contaminants for regulation based upon considerations that will advance the goals of the Act to assure the safety of drinking water. EPA believes that the most relevant criteria are the: (1) Analytical ability to detect a contaminant in drinking water, (2) the frequency and level of occurrence and population exposed, and (3) potential health aspects of the contaminants. In addition EPA considers regulation when there are sufficient incidents or contamination potential such that national guidance in the form of a Primary Drinking Water Regulation is desirable to assist States and public water systems which must determine appropriate responses.

Analytical methods. Analytical methods must be available such that the presence of the chemicals in water can be validly determined. This factor is an important part in determining whether the substance can be regulated and whether an MCL or a treatment technique regulation should be promulgated.

National or limited significance. Consideration of occurrence data encompasses both the frequency of occurrence, the level of occurrence and ther extent of the population exposed. The occurrence data allow EPA to determine whether contamination of drinking water represents isolated or localized incidents of contamination more appropriately dealt with by States, or whether contamination has occurred or has the potential for occurring in numerous locations across the country involving a sufficient number of water supplies and population exposed to warrant action under the Safe Drinking Water Act. In the ANPRM for Phase II of the NPDWR, 48 FR 45502, *et seq.*, EPA described a categorization system for differentiation between widespread and limited contamination potential.

Health effects. Consideration of the potential health effects of a chemical encompasses the: (1) Suitability of the available data for assessing the toxicology of the chemical, and (2) the possibility of human health concern from exposure from drinking water. When it is possible scientifically, section 1412(e)(3) of the SDWA also requires consideration of the impact of the following:

(A) The existence of groups or individuals in the population which are more susceptible to adverse effects than the normal healthy adult.

(B) The exposure to contaminants in other media than drinking water (including exposures in food, in the ambient air and in occupational settings) and the resulting body burden of contaminants.

(C) Synergistic effects resulting from exposure to or interaction by two or more contaminants.

(D) The contaminant exposure and body burden levels which alter physiological function or structure in a manner reasonably suspected of increasing the risk of illness.

These factors were addressed in assessing the potential health effects of each of the VOCs and are discussed in each of the health effects criteria documents as referenced in section VII. However, applicable data are seldom available for any of these factors except B (to a limited extent) which is addressed in both the occurrence and health effects documents.

Other considerations. Additional factors considered in determining which VOCs should be regulated and how are discussed below.

• One approach that might be considered would be to set RMCLs by category, i.e., the same RMCL for each VOC or subcategories of VOCs. In effect this is being proposed for the category determined to be non-threshold toxicants. However, a categorical RMCL for non-carcinogenic VOCs is not scientifically supportable due to differing relative toxicities of individual substances (different thresholds) and different toxic endpoints.

• *Strength of evidence.* Pertaining to either the extent of contamination or to the potential health risks of exposure, the amount of available data of sufficient quality on a certain chemical was considered. For example:

—A chemical proven to be a human carcinogen, even though occurring relatively infrequently in drinking water supplies might be appropriate for regulation, e.g., vinyl chloride and benzene.

—A chemical occurring at a higher frequency in drinking water supplies but for which the strength of evidence on potential health risks was weaker could be appropriate for regulation, e.g., trichloroethylene, tetrachloroethylene, carbon tetrachloride, 1,1-dichloroethylene, 1,1,1-trichloroethane, 1,2-dichloroethane.

• *National guidance to address incidents of contamination.* Regulations provide a benchmark for potential action by State and local officials in evaluating incidents of contamination. In certain cases, this factor may be a major consideration in determining if regulations are appropriate. For example, regulations would be appropriate for a chemical that occurs but at levels normally below those associated with potential health risks, e.g., p-dichlorobenzene and 1,1,1-trichloroethane. The MCL would provide guidance that no action was necessary for these systems with less than that level; without regulations, these types of situations have met widely varying responses by States and public water systems. Regulations can provide a basis for rational and uniform responses to incidents of contamination.

• *Potential impact.* The potential impact of setting regulations can be considered in a general manner; however, this factor is primarily considered during establishment of MCLs. This evaluation considers potential burdens including such factors as the affordability of treatment systems, the technical feasibility of meeting MCLs, and other possible impacts such as monitoring and reporting.

The results of setting regulations for VOCs will vary widely from no impact to installation of treatment systems for reduction of VOCs. Recognizing that the great majority of public water systems do not have VOCs in the drinking water, the only burden on these systems would be monitoring and reporting. These burdens could be minimized through flexible monitoring requirements (see 48 FR 45502) that would provide states with authority to determine appropriate requirements beyond the national minimum. In addition, the VOCs are somewhat unique in the sense that several of them can be analyzed for in a single analytical procedure.

• *Other factors.* Surrogate parameters or aggregate parameters may be needed to take into account other potential effects not considered in setting RMCLs and MCLs for individual chemicals, such as possible additive or synergistic risks of simultaneous exposure to more than one VOC.

Proposed VOCs. The ANPRM listed fourteen VOCs being considered for regulations. Detailed occurrence and health effects information were provided for six of the fourteen VOCs.

Since the ANPRM was published, EPA completed the Ground Water Supply Survey (GWSS) in which twenty-nine VOCs were looked for in each sample using the "purge and trap" analytical procedure employing gas chromatography (Method 502.1 and Method 503.1, U.S. EPA, Environmental Monitoring and Support Laboratory). As shown in Table 1, not all of the ANPRM list of 14 VOCs were detected in the GWSS.

Based upon the above considerations, public comments and recommendations of the NDWAC and other information, EPA has concluded that these chemicals

"may have an adverse effect upon the health of persons" and that RMCLs and primary drinking water regulations under Section 1412 should be proposed at this time. They are:

trichloroethylene
tetracholoroethylene
1,1,1-trichloroethane
carbon tetrachloride
1,2-dichloroethane
benzene
vinyl chloride
p-dichlorobenzene
1,1-dichloroethylene

As presented previously, the NDWAC recommended developing regulations for the first five of the above nine VOCs. Their rationale was based upon an evaluation of the available occurrence and health effects data for each of the VOCs. The NDWAC evaluated the information in September 1982. Since that time additional data have become available and the Agency has concluded that four additional VOCs warrant regulation.

The background occurrence and health effects data used as the basis for determining which VOCs warranted regulations is summarized below.

Trichloroethylene. Occurrence: GWSS (Random): 0.6%; max: 78 μg/l; median: 1.0 μg/l. GWSS (Non-random): 12.7%; max: 130 μg/l; median: 1.4 μg/l. State Data: 624 positives/4228 sampled, max: 510,000 μg/l.

Health Effects: Non-carcinogenic effects (at high doses): liver and kidney damage, central nervous system effects, depression in myocardial contractility. Carcinogenic effects: mutagenic in some test systems; carcinogenic in NCI test: mice. Limited evidence.

Tetrachloroethylene. Occurrence: GWSS (Random): 7.3%; max: 23 μg/l; median: 0.5 μg/l. GWSS (Non-random): 9.4%; max: 89 μg/l; median: 0.7 μg/l. State Data: 428 positive/3038 sampled, max: 1,000 μg/l.

Health Effects: Non-carcinogenic effects (at high doses): central nervous system depression, fatty infiltration of liver and kidney, tissue damage. Carcinogenic effects: carcinogenic in NCI test: mice; limited evidence.

1,1,1-Trichloroethane. Occurrence: GWSS (Random): 3.6%; max: 18 μg/l; median: 0.8 μg/l. GWSS (Non-random): 10.8%; max: 21 μg/l; median: 1.0 μg/l. State Data: 715 positive/3330 sampled, max: 2,250 μg/l.

Health Effects: Non-carcinogenic effects (at high doses): central nervous system depression, increase in liver weight, cardiovascular changes. Carcinogenic effects: carcinogenic in preliminary report from NTP test: mice; limited evidence. This report is currently being evaluated.

Carbon tetrachloride. Occurrence (may be a contaminant in chlorine) GWSS (Random): 3.2% max: 18 μg/l; median: 0.4 μg/l. GWSS (Non-random): 3.1%; max: 15 μg/l; median: 0.5 μg/l. State Data: 368 positive/2646 sampled, max: 1,200 μg/l.

Health Effects: Non-carcinogenic effects: liver effects such as fatty liver with centrilobular necrosis. Carcinogenic effects: mutagenic in some test systems; carcinogenic in NCI test: mice, rats, hamsters; sufficient evidence.

1,2-Dichloroethane. Occurrence: GWSS (Random): 0.8%, max: 1.0 μg/l; median: 0.5 μg/l. GWSS (Non-random): 1.5%; max: 10 μg/l; median: 2.5 μg/l. State Data: 177 positive/1793 sampled, max: 2,100 μg/l.

Health Effects: Non-carcinogenic (at high doses): central nervous system depression, liver and kidney change, gastro-intestinal distress, adrenal and pulmonary effects, circulatory disturbances. Carcinogenic effects: mutagenic in most test systems; carcinogenic in NCI test: mice, rats; sufficient evidence.

Vinyl chloride. Occurrence: GWSS (Random): 0.2%; max: 1.1 μg/l; median: 1.1 μg/l. GWSS (Non-random): 1.3% max: 8 μg/l; median: 2.7 μg/l. State Data: 128 positive/1793 sampled, max: 389 μg/l.

Health Effects: Non-carcinogenic (at high doses): congestion and edema of the lungs, hyperemia of the kidneys and liver. Carcinogenic effects: mutagenic; carcinogenic in animal studies: mice, rats, hamsters; sufficient evidence for human carcinogenicity.

Benzene. Occurrence: GWSS (Random): 0.8% max: 15 μg/l; median: 3 μg/l. GWSS (non-random): 1.7%; max: 12 μg/l; median: 1.8 μg/l. State Data: 4 positive/615 sampled, max: 17 μg/l.

Health Effects: non-carcinogenic: central nervous system effects, hematological and immunological effects. Carcinogenic effects: sufficient evidence for human carcinogenicity.

1,1-Dichloroethylene. Occurrence: GWSS (Random): 1.9%, max: 6.8 μg/l; median: 03. μg/l. GWSS (non-random): 3.1%, max: 3.0 μg/l; median: 0.4 μg/l. State Data: NA.

Health Effects: non-carcinogenic effects (at high doses): liver and kidney damage, renal toxicity, CNS depression and sensitization of the heart. Carcinogenic effects: mutagenic, carcinogenic in one animal study: mice and rats; limited evidence.

p-Dichlorobenzene. Occurrence: GWSS (Random): 1.1%, max: 1.3 μg/l. median: 0.7 μg/l. GWSS (Non-random): 0.8%, max: 0.9 μg/l, median: 0.7 μg/l. State Data: N/A.

Health Effects: non-carcionogenic (at high doses): kidney and liver damage, pulmonary edema and congestion, splenic weight changes. Carcinogenic effects: NTP test underway.

Other VOCs. Several additional VOCs listed in the ANPRM (47 FR 9350) have been found in some drinking water samples but the available data has been judged to be insufficient to propose RMCLs at this time.

• Cis-1,2-dichloroethylene and trans-1,2-dichloroethylene

These two VOCs have not been tested for carcinogenicity by the NTP and adequate studies on non-carcinogenic toxicity have not been conducted.

• Chlorobenzene

While some occurrence has been reported by a number of States, the GWSS did not detect any chlorobenzene in the random sample; however, it was found twice in the non-random sample. The toxicology evaluation has not been completed.

• Trichlorobenzene(s)

States have detected trichlorobenzene in a number of water samples; however the number of drinking water versus non-drinking water incidences could not be determined from the data. In addition, analytical difficulties in analyzing samples in the GWSS precluded obtaining representative occurrence data.

• Dichloromethane

Because of problems of laboratory contamination and quality assurance, the available occurrence data for dichloromethane was not considered reliable. In addition, the NTP initial report on carcinogenicity has been withdrawn and the NTP is currently conducting an in-depth audit of the data.

These VOCs and several others will be considered in the Phase II portion of the Primary Drinking Water Regulations when sufficient occurrence and toxicology data become available. Among the other compounds being evaluated are such VOCs as ethylene dibromide, 1,1-dichloroethane, xylenes, toluene, bromobenzene, dibromochloropropane, 1,2-dichloropropane, and ethylbenzene (see ANPRM, October 5, 1983, 48 FR 45502). Other chemicals in the random GWSS for which no occurrence information was obtained but which will receive some consideration in Phase II or other iterations include: 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,1,2-tetrachloroethane, n-propylbenzene, o-chlorotoluene, p-chlorotoluene, m-dichlorobenzene, o-dichlorobenzene, styrene, isopropylbenzene.

Total VOCs

In addition to regulations for individual VOCs, the inclusion of RMCLs and MCLs for total VOCs (TVOC) is being considered. TVOC is not formally proposed in this regulation. Public comments are being solicited on whether it would be proper to include TVOC in drinking water regulations or in supporting guidance.

TVOC would represent summation of the levels of the individual VOCs for which RMCLs and MCLs have been set. The objective of a TVOC standard is to provide some additional protection from simultaneous exposure to multiple VOCs. As indicated in Table 4, drinking water often contains several VOCs. Generally, toxicology has not yet been able to provide a scientifically based conclusion on possible effects of simultaneous exposure to more than one chemical. Chemicals are normally tested separately and the possible synergistic, antagonistic, or additive health effects are not known. However, the NAS suggestion in this area was that in the absence of any other procedures, exposure to multiple carcinogens could be assessed by adding the risk rates. Comment is requested on the technical validity of this approach.

The potential problem that EPA feels must be addressed is a situation where a public water system finds several VOCs in its drinking water at levels slightly below the MCLs. For example, assume that MCLs are set for trichloroethylene, tetrachloroethylene, and carbon tetrachloride; a public water system with the following levels would technically be in compliance with the MCLs:

Compound	Measured level	Hypothetical MCL
Trichloroethylene	9 μg/l	10 μg/l
Tetrachloroethylene	14 μg/l	15 μg/l
Carbon tetrachloride	4 μg/l	5 μg/l

While technically in compliance with the standards, this condition probably represents an increased risk over any single chemical but the question that cannot be scientifically answered is whether this would be significant. EPA feels that multiple exposures could be more significant than indicated from just consideration of individual substances and requests public comments considering the myriad of possibilities in assessing multiple exposures, the costs and feasibility to reduce all the VOCs by application of one treatment technology, and the unknown aggregate health risk and the SDWA intent to err on the side of safety. If an RMCL and MCL for total VOCs (TVOCs) were appropriate, should EPA adopt the NAS suggestion that risks be considered additive be an appropriate approach?

RMCLs: Regulatory Approach

EPA is to set RMCLs at levels which, "no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety". Section 1412(b)(1)(B). Recommended MCLs are health goals and not enforceable standards. The proposed RMCLs for non-carcinogens can be determined using the scientific procedures set forth previously by calculating an AADI. However, determination of the "no effect" levels for carcinogens is a much more complex decision on what constitutes the safe level for non-threshold toxicants. Guidance on levels for the RMCLs was provided in House Report 93-1185 which stated that "It [The RMCL] must include an adequate margin of safety, unless there is no safe threshold for a contaminant. In such a case, the recommended maximum contaminant level should be set at zero level." EPA has considered the following approaches for setting RMCLs for carcinogens:

1. Set the RMCLs at zero.

2. Set the RMCLs at the analytical detection limit.

3. Set the RMCLs at a non-zero level based upon a calculated negligible contribution to lifetime risk.

Although one of these is proposed at this time, EPA requests comments on all three approaches. EPA's analysis of these approaches and the issues they raised are provided below.

Alternative 1: Set RMCLs at zero. One approach would be to establish RMCLs at zero for substances considered to be non-threshold toxicants. The existence of a threshold for the action of genotoxic carcinogens cannot be demonstrated by current science; thus, it could be conservatively assumed that no threshold exists, absent evidence to the contrary. Since distinctions between mechanisms of action of most carcinogens also cannot be conclusively made at this time, virtually all substances determined to be "carcinogens" would be assumed to be "non-threshold". Variation of this approach would be to limit the selection of RMCLs at zero only for those substances known to function by genotoxic processes, or perhaps only those determined to be human carcinogens, or only those for which "sufficient" rather than "limited" evidence of mammalian carcinogenicity exists.

Setting RMCLs for carcinogens at zero would follow the guidance provided in House Report 93-1185 and would express a general philosophy that *as a goal* carcinogens should not be present in drinking water. The Agency believes that the RMCLs (as a goal) should express the ideal concept that drinking water should be free from avoidable contamination and risk and that quality degradation should not be permitted.

If RMCLs are set at zero, some explanation may be needed to differentiate an RMCL from an MCL that would not be zero, since MCLs consider factors such as potential health risk, costs of treatment and feasibility of meeting the MCL. If these factors changed substantially, MCLs would need to be reexamined.

Alternative 2: Set RMCLs at the analytical detection limit. Due to limitations in analytical techniques, it will always be impossible to say with certainty that the substance is not present. In theory, RMCLS at zero will always be unachievable (or at least not demonstrable). While zero could be the theoretical goal for carcinogens in drinking water, in practice, a goal of achieving the analytical detection limits for specific carcinogens would have to be followed.

One possible approach would be for EPA to specify RMCLs for carcinogens based upon defined state-of-the-art analytical detection limits. The verifiable detection limits (i.e., the RMCLs) would probably fall in the vicinity of 1 μg/l depending upon the specific VOC. EPA believes this approach is justifiable in that zero is analytically undefinable and the detection limit may be the functional equivalent of zero. Of course, analytical detection limits are also moving targets as the state-of-the-art of analytical chemistry progresses, but at least they do provide a measurable target.

Alternative 3: Set RMCLs at a non-zero level based upon a calculated negligible contribution to lifetime risk. Alternative 3 would establish a non-zero level as the RMCL. A level could be selected that would present a negligible risk. In practical terms, such a low nominal risk would effectively preclude any discernable adverse effect on the health of the population and, because of the conservative nature of the risk calculation process, may not result in any actual adverse effects on an individual. EPA would have to conclude that this very low risk would result in "no known or anticipated adverse effect on the health of persons and which allows an adequate a margin of safety". This approach would provide some

quantitative guidance to public water systems of the ultimate goal which they might wish to use in the operation of water treatment facilities and in the design of future planned facilities. However, it should be recognized that just as with analytical detection limits (Option 2) a calculated risk target would also be moving target, because: (1) calculation methods change, and (2) the subjective determination of what is a negligible risk might change.

One possible variation of Option 3 would be to set RMCLs as a range of finite risk levels. This alternative would recognize the lack of accuracy and precision of risk calculations and the inherent difficulties in selecting one finite level as the *only* appropriate health goal in view of the numerous scientific uncertainties of risk estimates. However, this approach has a number of disadvantages including: lack of national uniformity and lack of specific guidance from EPA.

If a non-zero level is determined as appropriate for the RMCLs, two questions must be considered.

(1) What level should be used as representing the "no effect" level?

(2) How can an "adequate margin of safety" be incorporated into the finite risk level?

The NAS principles (*Drinking Water and Health*, Vol. 1) state that human exposure to carcinogens should be addressed in terms of risk rather than safe or non-safe. Because zero is not definable in an analytical sense, rather than speaking in terms of zero concentrations for carcinogens RMCLs for carcinogens could be set at levels at which the risks are so small that they are considered virtually nonexistent.

Determination of RMCLs for carcinogens at a finite level would be based on available science and the only quantitative tools available are cancer risk models. These are based upon animal studies and none of the models is experimentally verifiable as there is no scientifically valid method for determining the actual risks at low environmental exposure levels. Scientific issues surround their use in such areas as the data used, extrapolation techniques, and various factors in the analysis. Risk models are recognized as imperfect but they are the best tool available for estimating toxic potency or risk at low exposure levels. The commonly used risk models are generally conservative in their estimation of human risk of exposure to a contaminant. Selection of a target risk based upon a conservative risk model, such as the linearized multi-stage model, is arguably in accord with the SDWA, which requires the RMCL to be set at a no effect level "with an adequate margin of safety." The Agency believes that there is no exact or precise way to determine this level. The decision is judgmental—not strictly based upon science but upon a social judgment on what constitutes a negligible risk.

Federal regulations for environmental contaminants have generally fallen in the 10^{-4} to 10^{-6} lifetime risk range, as calculated from a linear multi-stage model. Most of those decisions incorporated consideration of costs and feasibility.

The negligible risk concept considered here is based strictly on individual risk rates and exposure. It does not include other economic or technical considerations that are part of setting the enforcement standards (i.e., the MCLs). The level for the MCLs (not RMCLs) would thus be considered to be the upper limits of risk that are considered to be acceptable based upon our current evaluation of the feasibility and costs of controls.

Under this approach to setting drinking water RMCLs, EPA has considered two risk levels as possibly representing an upper limit for a risk: one in 100,000 (10^{-5}) probability per 70 years of exposure and one in 1,000,000 (10^{-6}) probability. An incremental lifetime risk level of 10^{-6} would probably be more representative than 10^{-5} as the "no effect" level for these chemicals in drinking water with a margin of safety as envisioned by Congress. The NDWAC stated that 10^{-5} would be an appropriate target. However, a level of 10^{-6} is the level of concern that commonly has been discussed as the lower limit of concern over the potential health risks of exposure, especially for the generally involuntary risk from exposure to a drinking water contaminant.

In addition, if RMCLs were to be set at a non-zero level, use of the linearized multi-stage model would often appear to be more appropriate than others to meet the Congressional intent. The conservative nature of the model could actually mean that the real risk of exposure was probably lower (e.g., 10^{-7} or 10^{-8}) if any risk actually exists (assuming a non-threshold mechanism were operative) because the model was structured to be conservative and because of the nature of many of the assumptions in the model.

As an example of what 10^{-6} would mean in terms of the U.S. population, a total of 20 cases of cancer would result if 10 percent of the population were exposed at a dose level equivalent to a 10^{-6} risk for 70 years. Stated another way, that would be one-third of a cancer case per year as an upper limit in the U.S. population compared to the appropriately 500,000 annual cancer deaths that occur. The actual number of cases attributable to that particular substance would probably be less and perhaps none at all would occur unless some additive or synergistic interaction with other substances resulted in enhanced toxicity.

Proposed RMCLs: Conclusions. This proposal selects RMCLs for potential carcinogens at zero; the alternatives were carefully considered in view of the intent of the SDWA and public comments. It should be recognized that regardless of which of the three alternatives is ultimately selected for the RMCL, it is unlikely that the MCL for a particular substance would be affected, since normally all of the approaches would yield targets that are likely to be below levels that are "technically and economically feasible" using available technologies. MCLs will be set as close to the RMCLs as feasible. Preliminary analyses indicate that the MCLs may fall roughly in the range of 5 to 50 μg/l for most of the VOCs being considered in this proposal.

Proposed RMCLs for the following substances considered carcinogenic are "zero": tetrachloroethylene, trichloroethylene, carbon tetrachloride, 1,2-dichoroethane, vinyl chloride, benzene, 1,1-dichloroethylene.

The proposed RMCL for 1,1,1-trichloroethane is 0.2 mg/l, derived from the calculated AADI of 1.0 mg/l assuming 20 percent contribution from drinking water to total exposure. If the preliminary NTP report on the carcinogenicity of this compound is affirmed, the RMCL would be zero. EPA would provide formal notice if and when this occurs.

The proposed RMCL for p-dichlorobenzene (1,4-dichlorobenzene) is 0.75 mg/l, derived from the calculated AADI of 3.75 mg/l assuming 20 percent contribution from drinking water to total exposure.

Three of these substances (trichloroethylene, tetrachloroethylene and 1,1-dichloroethylene) have only "limited" animal evidence of carcinogenicity, as this term is used in the IARC criteria. Factors which contribute to this classification include lack of replication in multiple experiments or multiple species, as well as defects in particular studies. In addition, indicators of certain types of tumors, such as in the mouse liver, are considered by some scientists to have less weight than others in predicting carcinogenicity in humans. Data of this type, obtained by corn oil gavage, introduces another variable that

complicates interpretation. While evidence for these three substances is of a weaker nature than for others that EPA is proposing to regulate as carcinogens, it is nevertheless evidence that must be weighed by the Administrator.

The strictly scientific evaluation of such evidence (known as "risk assessment") can only describe its strength and weaknesses. EPA's risk assessment is summarized above and described in detail in the documents referenced in Section VII. Health Assessment documents for these three substances were reviewed by EPA's Science Advisory Board in April and May of 1984. Those reviews will be considered in this rulemaking action under the SDWA and become part of the record.

Decisions about what actions to take on the basis of the evidence (known as "risk management"), including decisions about how strong the scientific evidence should be to justify regulating a substance, require policy judgments which must be made by the Administrator, after public comment, in the light of the Agency's statutory mandates.

EPA strongly believes that its risk assessments should be consistent among Agency programs. On the other hand, risk management decisions can and should vary in the light of differing circumstances or statutory mandates. It is therefore possible that some of these substances might be regulated differently in other Agency programs. For example, EPA plans to decide whether to list several of these substances as hazardous air pollutants under section 112 of the Clean Air Act. The same scientific evidence will be considered along with other factors relevant to that decision. This may or may not lead to a conclusion to list and to regulate them as carcinogens.

Public comments are requested on setting RMCLs for carcinogens at zero, the analytical detection limit, and at some finite value based upon risk estimation. Comment is also requested on appropriate analytical detection limits, and on the method for calculating the finite risk value and for determining the risk target. Comments are also requested on the RMCLs for non-carcinogenic substances and the assumption of an exposure factor of 20 percent from drinking water, absent quantitative multi-media exposure data.

Comment is also directed to technical determinations, AADI calculations, the draft revised CAG risk calculations, and the inclusion of substances with "limited evidence" in the carcinogen category. If, on the basis of the record, it is determined that one or more of these substances should not be treated as carcinogens, then the AADI calculations modified by an allocation of 20 percent to drinking water would be the basis for the promulgated RMCL.

VI. Other Considerations for Public Comment

The next regulatory steps will be promulgation of the RMCLs and proposal of MCLs and monitoring and reporting requirements. Supporting documentation for the MCL proposal will include: (1) Exposure and risk assessments, (2) an assessment of generally available technology, (3) an assessment of available analytical methods and costs of monitoring, and (4) an economic and financial impact analysis. Available information to support several of the assessments is referenced in the next section. The public is requested to review those references and provide comments and other supporting information and data. The public is also requested to comment on the issues and information discussed below on available treatment techniques and costs and current estimates of the potential impact of VOC regulations.

Treatment of Control of VOCs

Economics, treatment technologies and feasibility are not factors involved in the determination of RMCLs; however brief discussions are provided here. These factors are key elements in the determination of the MCL which will be proposed when the RMCLs are promulgated.

Methods for removal of these volatile organic chemicals include aeration and granular activated carbon (GAC). The available data do not show powdered activated carbon treatment or conventional drinking water treatment (i.e., coagulation, sedimentation, and filtration) to be sufficiently effective for long term application. Macroreticular resins may eventually prove to have value for removing VOCs; questions still exist concerning their use. Data describing actual exhaustive capacity of the resins are not available to define the regeneration frequencies to be expected with the resins. Thus, costs have not yet been estimated for application of resin technology. At this time, substantial operational experience and/or experimental data are available only for aeration and GAC.

Costs of treatment. Preliminary designs and cost estimates have been developed for a hypothetical ground water contamination situation involving trichloroethylene (TCE). Table 8 provides relevant estimated cost information for treatment of TCE at the 90 percent and 99 percent removal levels, respectively, for aeration and GAC technologies.

TABLE 8.—PRELIMINARY COSTS FOR CONTROLLING TCE IN DRINKING WATER

(1980 dollars)

Type of treatment	Estimated costs—System size—Population served		
	100 to 999 (0.05 mgd)	1,000 to 2,999 (0.49 mgd)	10,000 to 25,000 (4.9 mgd)
Packed tower aeration:			
For 90 percent removal, e.g., source 500 µg/l MCL 50 µg/l:			
Capital cost	$18,000	$68,000	$269,000
Cost per thousand gallons (cents)	128	34	.8
For 99 percent removal, e.g., source 500 µg/l MCL 5 µg/l:			
Capital cost	$68,000	$128,000	$310,000
Cost per thousand gallons (cents)	191	43	11
Granular activated carbon:			
For 90 percent removal, e.g., source 500 µg/l MCL 50 µg/l:			
Capital cost	$28,400	$84,000	$488,500
Cost per thousand gallons (cents)	148	39	19
For 99 percent removal, e.g., source 500 µg/l MCL 5 µg/l:			
Capital cost	$58,400	$84,000	$488,500
Cost per thousand gallons (cents)	148	39	22

Basis for designs:
Notes:
For packed tower aeration—fiberglass reinforced plastic shell with plastic packing material and separate housing; Kawasaugh & Trussell design procedure; contingency factors of 25 percent for engineering, 25 percent for overhead and profit, 25 percent for shipping and installation; electricity costs 6 cents per kWh; interest rate of 12 percent; amortization period of 20 years.
For granular activated carbon—empty-bed-contact-time of 10 minutes; pressure contractors based upon quoted prices of various manufacturers; initial charge carbon costs 95 cents per lb.; contingency factors of 25 percent of engineering, 25 percent for overhead and profit, 25 percent of shipping and installation; electricity costs 6 cents per kWh; interest rate of 12 percent; amortization period of 20 years.

Potential Impact of Regulations

The nominal limits of detection attained by the laboratories performing analyses in the GWSS were usually in the 0.2 to 0.5 µg/l range depending upon the specific chemical, although it appears that precision and accuracy requirements for regulatory compliance determination might require that regulations (MCLs) be set at least one

order of magnitude higher. The feasible application of aeration and granular carbon might also lead to MCLs in a similar range, i.e., on the order of 5–50 µg/l. At this level, very preliminary projections are that about 1,000 systems would probably need to reduce VOC levels either through treatment technologies or other options such as blending or shutting down wells; most of these would be communities utilizing ground water.

Therefore, based upon current exposure estimates, risks of most VOCs would not appear likely to represent a high impact, nor would regulations result in a significant number of cancer cases avoided based upon total cancer rates and projected risks using the linear multi-stage model. Although VOC contamination is widespread across the country, it is usually at low levels, and the overall population at risk is quite low. Moreover, most VOCs do not appear to be highly potent carcinogens. However, in those communities where exposed levels are relatively high, resulting in correspondingly higher risks per individual, control is obviously essential. On the other hand, where that is not the case, the non-quantifiable benefits would probably be of most importance in determining the proper approach. These would include such items as providing federal standards to be used as a benchmark in responding to incidences of contamination, and use in ground water protection and clean-up programs.

Economic impact analysis. The proposal of an RMCL is different than proposal of an MCL in that an RMCL is, by law, to be based only on health and safety considerations, while an MCL is to take costs into consideration. Therefore, this RMCL proposal notice does not include an analysis of the economic impacts of various possible RMCLs. However, we intend to fully analyze the probable impacts of the various MCL alternatives, and will report on them at the time an MCL is proposed.

Because the economic impact analysis is an import part of the rulemaking decision process, and because some reviewers of this notice may be concerned that insufficient attention is being paid to economic considerations, below is a brief indication of how EPA will conduct the economic analysis of alternative MCLs, and what is considered from the results of the analysis.

Executive Order 12291 and the Regulatory Flexibility Act specify how and when to analyze the probable impacts of a Federal action. In essence, information on the impacts to industry, consumers and the nation is assembled. Where possible, this information is put in the form of an analysis of the net benefits of the various alternatives. This "regulatory impact" information then becomes a part of the official record in support of whatever action EPA finally takes, and is used by decision-makers when an alternative MCL is selected for proposal, and when final MCL is promulgated.

The types of impacts which will be examined for each of the various regulatory and non-regulatory alternatives are of three basic types. The impacts of the alternatives on the water supply industry wil be examined. This will be done by reviewing three elements, the capital cost of technology, the operating and maintenance cost and the feasibility of financing new treatments. The first two elements are derived by the engineering analysis of treatment technologies, and the cost of treatments. The third element, the ability to finance new treatments is derived from an analysis of the water supply industry. A financial model of the industry has been developed by EPA, and this model indicates how likely it is for water systems to be able to finance new treatments, based on the historical financial performance of water systems.

The second type of impact is the impact on the consumer. Information on the cost of water to consumers is assembled, based on the cost data prepared during the engineering analysis of treatment technologies. These costs are compared with the historical cost of water.

The third type of impact is the impact on the nation as a whole. The purpose of this analysis is to allow balancing of the cost of a federal action, in this case MCLs, with the benefit to be derived from the action. In some cases, it is not possible to describe the value of the benefits in the same terms as the costs, i.e., dollars. The benefits which will accrue to the nation are derived from an analysis of the contamination occurrence, the reduction in human exposure likely to result from an alternative, and the health effect averted by the reduction.

The cost of the various alternative MCLs is more than merely the cost to industry. It also includes the cost to government of implementing the regulation. These national costs are summarized and presented with the national benefits, and this too becomes a part of the record supporting the proposed and final MCL.

Because these various analyses are based on estimates, an additional analysis is conducted which indicates the sensitivity of analytical results to the assumptions maded during the analysis. This sensitivity analysis completes the general regulatory and non-regulatory analysis required under E.O. 12291. A summary of these analyses will be presented in the preamble of the MCL proposal notice, and full documentation of the underlying analyses will be entered into the formal record of the rulemaking procedure.

VII. References

The following supporting documentation for this proposal is available on request from the address listed at the beginning of this notice.

Bellar, T.A., Lichtenberg, J.J. "The Determination of Halogenated Chemical Indicators of Industrial Contamination in Water by the Purge and Trap Method: Method 502.2," U.S. EPA, EMSL #600/4–81–059.

Bellar, T.A., Lichtenberg, J.J. "The Analysis of Aromatic Chemicals in Water by the Purge and Trap Method: Method 503.1," U.S. EPA, EMSL, EPA 600/4–81–057.

Love, O. Thomas, Jr. and Richard G. Eilers. "Treatment for the Control Trichloroethylene and Related Industrial Solvents in Drinking Water," U.S. EPA, Office of Research and Development, February 1981.

Environmental Science and Engineering, "Treatment for Control of VOCs in Drinking Water," August 1983.

EPA, Criteria and Standards Division. Draft Criteria Document for Trichloroethylene, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Tetrachloroethylene, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Carbon Tetrachloride, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for 1,1,1-Trichloroethane, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for 1,2-Dichloroethane, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Vinyl Chloride, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Benzene, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Dichloroethylene, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Draft Criteria Document for Dichlorobenzene, EPA, Office of Drinking Water, February 1984.

EPA, Criteria and Standards Division. Occurrence of Volatile Organic Chemicals

in Drinking Water, Benzene, November 1983.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Dichlorobenzene, December 1983.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Dichloroethylenes, November 1983.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Trichloroethylene, June 1982.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Tetrachloroethylenes, June 1982.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Vinyl Chloride, June 1982.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, 1,1,1-Trichloroethane, June 1982.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, 1,2-Dichloroethane, November 1983.
EPA, Criteria and Standards Division, Occurrence of Volatile Organic Chemicals in Drinking Water, Carbon Tetrachloride, November 1983.
EPA, EMSL, "Total Organic Halide, Method 450.1-Interim," EPA 600/4-81-056.
EPA, Office of Health and Environmental Assessment, Draft Health Assessment Document for Vinylidene Chloride, Office of Research and Development, October 1983.
EPA, Office of Health and Environmental Assessment, Draft Health Assessment Document for Carbon Tetrachloride, Office of Research and Development, August 1983.
EPA, Office of Health and Environmental Assessment, Draft Health Assessment Document for 1,1,1-Trichloroethane, Office of Research and Development, November 1983.
EPA, Office of Health and Environmental Assessment, Draft Health Assessment for Tetrachloroethylene, Office of Research and Development, December 1983.
EPA, Office of Health and Environmental Assessment, The Carcinogen Assessment Group's Evaluation of the Carcinogenicity of Benzene (DRAFT), Office of Research and Development, March 1983.
EPA, Office of Health and Environmental Assessment, Draft Health Assessment Document for Trichloroethylene, Office of Research and Development, December 1983.
EPA, "Review of a Carcinogenicity Study on Vinyl Chloride," Memo from Robert E. McGaughy, Office of Research and Development to Joseph A. Cotruvo, Office of Drinking Water. Jan. 6, 1984.
National Academy of Sciences, "Drinking Water and Health," Volume 1 (1977), II (1980), IV (1981), V (1983).
IARC. 1979. IARC Monographs on the evaluation of the carcinogenic risk of chemicals to humans: some halogenated hydrocarbons. Vol. 20: 14–15.
IARC, Approaches to Classifying Chemical Carcinogens According to Mechanism of Action, Technical Report No. 83/001. April 1983.
NCI, "Policy of Risk Assessment of the Health Effects of Hazardous Exposures to Populations," Subcommittee on Environmental Carcinogens, National Cancer Advisory Board. 1983.
Bruckner, James. Progress Report, Coop. Agr. 807449-02, pp. 18–22. Univ. of Texas Medical Center at Houston, July 11, 1983. Oral Toxicity of Carbon Tetrachloride in Rats. Manuscript in preparation.

VIII. Request for Comments

EPA requests public analyses, comments and information on all aspects of this proposal. The questions for which comment is being specifically solicited are listed below. Comment will be of great assistance to EPA in formulating a protective and practical approach to reducing human exposure to VOCs in drinking water.

• How strong should the scientific evidence be to justify regulating a substance, particularly for carcinogenicity?

—When positive evidence exists but is sparse or inconclusive, how should it affect decision-making? Should there be a well-defined and uniform minimum level of evidence of carcinogenicity in animals or humans? If so, what evidence would comprise this minimal level?

—When substantial doubt exists as to whether a substance causes a serious health or environmental risk, how should EPA balance its mandate to err on the side of protection against the competing risk of imposing costly regulations on substances which may later be shown to be benign?

• How should evidence of mouse liver tumors be weighed? If evidence is limited to mouse liver tumors, is that sufficient evidence to warrant regulating that substance as a carcinogen? Conversely, what would be the scientific basis for giving mouse liver tumors less weight in the evaluation of the potential for human carcinogenicity?

• What level should be set for RMCLs that would represent a level such that "no known or anticipated adverse effect would result with an adequate margin of safety"?

—For non-carcinogens, is the approach used for computing the AADIs scientifically acceptable? Is providing for an assumed contribution of 20 percent from drinking water appropriate when more precise data is not available.

—Should RMCLs for carcinogens be set at zero? If RMCLs are set at zero, what guidance, if any, should be provided on the actually attainable target levels in drinking water?

—Should RMCLs for carcinogens be set at the analytical detection limit? What would this be for each VOC considered in this proposal?

—Should setting RMCLs for carcinogens be established at a non-zero level based upon a negligible risk determination? What non-zero level and upon what basis? Which model and which assumptions? Does an incremental lifetime risk level of 10^{-6} represent a virtually non existent or negligible risk? Should higher or lower risk rates be considered? Would another level be more representative yet meet the needs for practical implementation of the SDWA? Would use of the linearized multi-stage model in the non-zero RMCL calculations meet the Congressional intent to incorporate a margin of safety into the RMCLs?

—Should a range of finite risk levels for each RMCL be selected such as 10^{-5} to 10^{-6} instead of zero or a single value?

• How should the degree of evidence of potential carcinogenicity be factored into the RMCL determinations? If there is sufficient experimental evidence of human carcinogenicity, should the RMCL be either zero or the one in one million risk equivalent, or some other calculated value? Should the RMCL be set at a higher concentration and higher nominal risk (to indirectly reflect less concern) as the strength of evidence of carcinogenicity is reduced? For example, if there is only sufficient evidence of animal carcinogenicity, should the RMCL be in the 10^{-5} up to the 10^{-6} range, whereas if there is only limited evidence of animal carcinogenicity, should the RMCL be in the 10^{-4} to 10^{-5} risk range? If less than "limited evidence" is available, should the RMCL be determined based upon an ADI calculation?

As another example, could RMCLs for substances such as TCE and PCE with limited, insufficient, or less convincing evidence of carcinogenicity be produced on the basis of chronic toxicity, but with an additional margin of safety or based upon the minimum measured cancer producing dose level such as was suggested by Weil (Toxicology and Applied Pharmacology *21* 454–463 (1972))? This would differentiate those from substances such as benzene or vinyl chlorides which have the most complete evidence and therefore warrant the most conservative regulatory treatment.

• Should an RMCL and an MCL be set for total VOCs to address multiple exposure to VOCs? On what basis?

A public hearing will be held in Washington, D.C., for the interested public to comment and provide information and data on the regulatory approach.

EPA recognizes that many significant questions surround the issue of the control of volatile synthetic organic chemicals in drinking water. The Agency has attempted in this proposal to portray current scientific uncertainties in a measured and objective manner. In this way, any data gaps or errors in logic which may exist can be identified and corrected. For that reason, careful review of and thoughtful comment on the information in this proposal is encouraged.

Under the Regulatory Flexibility Act, 5 U.S.C. 601 et seq., I certify that this action will not have a significant impact on a substantial number of small entities. This proposed action will have no economic impact in and of itself because these are non-enforceable health goals.

Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore subject to the requirements of a Regulatory Impact Analysis. This proposed action does not constitute a "major" regulatory because it will not have a major financial or adverse impact on the community and it is a non-enforceable action. This regulation was submitted to the Office of Management and Budget for review as required by Executive Order 12291.

List of Subjects in 40 CFR Part 141

Chemicals, Water supply.

42 U.S.C. 300/SDWA 1412.

Dated: June 1, 1984.

William D. Ruckelshaus,

Administrator.

For the reasons set out in the preamble, Part 141 of Chapter I of Title 40 of the Code of Federal Regulations is proposed to be amended as follows:

PART 141—NATIONAL PRIMARY DRINKING WATER REGULATIONS

1. The title of Part 141 is revised to read as set forth above.

2. In § 141.2, paragraph (u) is added to read as follows:

§ 141.2 [Amended]

* * * * *

(u) "Recommended maximum contaminant levels" means the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur and which includes an adequate margin of safety.

3. A new Subpart F, consisting of §§ 141.50 and 141.51, is added as follows:

Subpart F—Recommended Maximum Contaminant Levels

§ 141.50 Recommended maximum contaminant levels for organic chemicals.

The following are Recommended Maximum Contaminant Levels for organic chemicals. They are non-enforceable goals for public water systems.

(a) Recommended Maximum Contaminant Levels are zero for the following substances: trichloroethylene, tetrachloroethylene, carbon tetrachloride, 1,2-dichloroethane, vinyl chloride, 1,1-dichloroethylene, and benzene.

(b) Recommended Maximum Contaminant Levels for the following substances are as indicated:

	Milligrams per liter
1,1,1-trichloroethane	0.2
p-dichlorobenzene (1,4-dichlorobenzene)	0.75

§ 141.51 [Reserved]

Appendix A.—Summary of Public Comments Pertinent to the Proposed Recommended Maximum Contaminant Levels (RMCLs) for Volatile Synthetic Organic Chemicals (VOCs) in Drinking Water

The following is a summary and discussion of the principal public comments to EPA's proposed rule for the establishment of RMCLs for certain VOCs in drinking water. EPA specifically solicited comments on the following three issues in its March 4, 1982, Advance Notice of Proposed Rulemaking:

1. What is the significance of contamination of drinking water by VOCs?

2. What approach should EPA take to deal with VOCs in drinking water?

3. What level should be set for RMCLs such that, "no known or anticipated adverse effect" will result? How should the health basis be determined for any MCLs?

EPA received 136 written comments during the 220-day public comment period and five oral statements were presented at the public meeting held in Washington, D.C., on April 28, 1982. The comments included 28 public interest groups, 14 water utilities, 16 chemical manufacturing companies, 11 state governments and state organizations, 12 local governments, 40 private citizens and 16 from other groups including some members of Congress.

The following discussion summarizes comments received on the ANPRM for VOCs.

1. What is the significance of contamination of drinking water by VOCs?

A total of 66 commenters addressed this issue. A majority of comments (41) felt that VOC contamination in drinking water is a significant national problem because of the frequency of occurrence and potential health risk warranting action to limit exposure to VOCs. Their reasoning is based on the following: Local problems of severe VOC contamination, the number of VOCs in drinking water is continually increasing and VOCs have been demonstrated to cause serious carcinogenic and non-carcinogenic toxic effects. Some of the toxic effects are as follows: Some VOCs are known animal carcinogens and vinyl chloride is both an animal and human carcinogen, causes hepatomas in animals and in some cases in humans, is toxic to the kidneys, has serious effects on the reproductive system, and depresses the central nervous system.

One commenter stated that the results of a monitoring study conducted by New Jersey showed 17 percent of the 1,200 wells tested contained VOCs at concentrations above 10 ppb. They felt that, "the toxic properties of these chemicals, including the potential increased risks of cancer and birth defects, warrant federal action".

Twenty-five commenters felt that neither the occurrence data, the health effects data, nor the combined data, demonstrate on a national basis the significance of VOC contamination in drinking water; therefore action to limit human exposure to VOCs is not warranted. Reasons cited were: VOC contamination in drinking water is a localized problem, not a widespread national problem; more information is needed on occurrence and health effects, especially in order to assess the significance of VOC contamination; state data represented emergency spill situations which are not considered to be statistically representative of national occurrence; when present, VOCs usually occur at low part per billion concentrations, whereby significant health risks would not be expected; and the results of the Ground Water Supply Survey (GWSS) should be considered questionable because the detection limits that were used (i.e., 0.2 µg/l) are extremely sensitive and can rarely be reached. One comment stated that "positive occurrence data does not present a case for regulation".

In general, these commenters felt that the major shortcomings of the available health effects data is that it is not scientifically established at this time and subject to debate among the scientific community. One commenter specifically stated that "until the extent of the threat of human health of VOCs, if any, can be established, federal regulations governing VOCs are not justifiable on mere occurrence data alone".

2. What approach should EPA take to deal with VOCs in drinking water?

A total of 118 comments were received that addressed this issue. Comments favored one of the three approaches provided in the ANPRM which are:

- Non-federal regulatory approach
- Establish montioring requirements and provide Health Advisories (formerly termed SNARLs) for State response as appropriate
- Establish national regulations for monitoring and MCLs

The non-federal regulatory approach was favored by 22 commenters. Several commenters stated that recent surveys by EPA and their own sampling did not indicate a major VOC contamination problem within certain States, thus, MCLs and monitoring requirements are not warranted.

A number of commenters felt that the health effects data were insufficient to show a health risk that would warrant regulation. One commenter stated that "EPA has not presented any evidence that there is any risk to the population requiring Federal regulation. Furthermore, where the contamination is the result of improper disposal of solvents, guidance is needed by those implementing the RCRA/Superfund cleanup as to an adequate effort". One commenter summed up this sentiment as "there is a need for a rational[e] and consistent approach to the problem of low levels of carcinogens in drinking water, but the science is not sufficiently developed to guide regulatory and utility actions with any degree of certainty".

Some commenters are opposed to national regulations for VOCs because, "shrinking federal and state resources are creating problems for the already existing drinking water programs". They felt that "EPA should focus on source protection and rapid reaction to ground water contamination than attempt to cover all possibilities by regulation".

The majority of these commenters favored the continued use of Health Advisories to handle contaminant situations. However, two comments were received that specifically requested that "once a health advisory is released, it should be published in the Federal Register, detailing EPA's derivation of the health advisory". "Based on the scientific input and occurrence information received, EPA must issue an updated health advisory and can then decide if there is a need to establish MCLs." One commenter stated that "Health Advisories should be the first step in determining whether or not it is necessary to establish an MCL for a particular contaminant". In addition, one commenter favored the use of Health Advisories as opposed to national monitoring requirements, in that the latter would only gather more occurrence data.

In general, these commenters favored EPA continuing to provide research data and technical advise (i.e., Health Advisories) when dealing with contaminant situations. In addition, "routine, repetitive monitoring requirements must not be put into regulations because monitoring programs must be flexible and can best be developed by States and water utilities".

Option 2, whereby EPA should establish monitoring requirements and provide Health Advisories for State response as appropriate was favored by 13 commenters. The basis for the comments which recommended this approach was two-fold: (1) Localized VOC contaminant situations, especially in ground water necessitates monitoring requirements, and (2) the health effects data is unclear and insufficient to establish MCLs since "safe" levels of VOCs cannot be determined at this time. Health Advisories should be used in dealing with contaminant situations.

Generally, these commenters felt that gound water contamination is a problem in some places, which must be addressed; however, VOC contamination is not widespread enough to require highly formalized and restrictive requirements. Furthermore, the available data are insufficient to determine the scope of the problem and only monitoring should be done to determine where problems exist. Therefore, instead of setting MCLs, guidance should be provided. These commenters generally supported giving States considerable authority for implementation of the monitoring requirements and for determining appropriate action when contamination is found.

A few of the comments received, which favored the monitoring requirements option, proposed an action-oriented approach in the form of contamination levels and action categories. They felt that guidance for five of the VOCs should be established as follows:

Compound	Concentration levels categories (ug/l)		
	I	II	III
Vinyl chloride	>100	10–100	<10
Trichloroethylene	>500	50–500	<50
Tetrachloroethylene	>500	50–500	<50
Carbon tetrachloride	>500	50–500	<50
1, 2-Dichloroethane	>250	25–250	<25

Note:
Category I—high concentration and consequently greater risks. Immediate action warranted to reduce contaminant level.
Category II—intermediate concentration with lower risk. Prompt action warranted to step up surveillance and consider control strategies. Action should reflect whether the concentration is at higher or lower part of the range.
Category III—very low concentration. Little risk associated with these concentrations. Only routine monitoring is needed.

The third option which would require establishing national regulations for monitoring and MCLs, was favored by 82 commenters. Numerous commenters stated that MCLs and monitoring requirements should be set for the VOCs. A number of these commenters qualified their statements by saying MCLs should be set if it is shown that the occurrence of VOCs is widespread and the health effects data show that VOCs are a health risk. However, most commenters felt that sufficient data were available showing VOCs to be a widespread problem, that data did show a potential health hazard, and that MCLs were needed.

The following related statements were made:

- Problems with organic chemicals have been shown in several States and without enforceable standards; the problems will continue to spread; the justification for cleaning contaminated aquifers will be challenged on a case-by-case basis.
- Consistent, nation-wide standards are needed for VOCs (numerous commenters explicitly stated that "uniform, mandatory and enforceable standards" are needed) to provide adequate public health protection in each State. Latitude for stricter rules by the States was suggested by one commenter.
- While Health Advisories were noted to have been very useful in addressing incidences of VOC contamination, several public water systems commented that the States have adopted widely varying approaches to dealing with VOCs in drinking water. Some States have adopted the Health Advisories as enforceable standards and consequently public water systems have been forced to make permanent and costly decisions on the basis of health guidance.
- Alternative involving determination of the acceptable levels of contaminants by individual States, based on EPA advisory options, will not be effective. Their reasoning is that EPA advisory

opinions on health effects will be misinterpreted and misused as demonstrated by many States that have used the Health Advisories as rigid criteria by which suitability of a water supply is measured. The fact that Health Advisories are developed without consideration for possible carcinogenic properties of a compound and with disregard for economic and technological feasibility of achieving them is forgotten. We are better off with MCLs established in the process involving public participation and *intended* to be the rigid standards by which quality of drinking water is measured.

• If left to the States, drinking water guidelines will differ from each other. This will lead to confusion and poor public image for State agencies which recommend guidelines less stringent than others. In addition, leaving the regulatory activity to States will require more human resources in the area of toxicological evaluation and standard setting. Many States do not have these resources. Thirdly, enforcement will be very difficult, if not impossible, if neighboring States have different drinking water standards. Contamination has no boundaries."

One commenter summarized their argument for MCLs in the following manner: "*Contamination of water* supplies in the U.S. with VOCs is indicative of a national trend. Setting legally enforceable national standards will be important in reversing that trend. It will establish a ceiling on how much contamination of drinking water is acceptable and will trigger remedial action in situations where the ceiling is almost reached or exceeded."

A number of comments were received that addressed monitoring requirements and treatment costs; however, these comments will be addressed when the proposed rule for the establishment for MCLs is published."

3. How should the potential health risks of exposure to VOCs be assessed? What level should be set for RMCLs such that "no known or anticipated adverse effects" will result?

In assessing the potential health risks of exposure to VOCs, numerous questions arise such as:

(1) Whether or not a compound can be classified as "genotoxic" or "non-genotoxic"?

(2) Should different risk models or approaches be used for carcinogens that are not genotoxic?

(3) Would the risk of exposure to two or more VOCs be considered additive, antagonistic, synergistic?

(4) Which subgroup of the general population should be addressed?

(5) How should exposure to VOCs from other routes (i.e., air or food) be addressed?

Consideration of the potential health effects of a chemical encompasses the evaluation of available data and the potential for human health effects from exposure via drinking water. A number of comments addressed the aforementioned issues.

First, the issue as to what criteria could be used to classify a compound as "genotoxic" or "non-genotoxic" was addressed by seven comments. Four of the commenters suggested that the criteria to classify a compound as "genotoxic" include:

1. a reliable, positive demonstration of genotoxicity in appropriate prokaryotic and eukaryotic systems *in vitro;*
2. positive results in studies on binding to *DNA;* and
3. evidence of biochemical or biologic consequences of DNA damage.

One commenter submitted data and information on recent developments in the understanding of the various mechanisms by which a carcinogenic response can be produced in laboratory animals. These comments can be summarized as follows:

Based on the extent of a chemical's interaction with DNA, it appears that chemicals that have a greater propensity to *directly interact* with *DNA are appropriately* classified as genotoxic. Those that do not have this propensity to interact directly with *DNA, but lead* to tumors via recurrent tissue injury or other secondary events are classified as non-genotoxic or epigenetic carcinogens. The carcinogenic risk to man posed by such epigenetic carcinogens appears to be substantially less than that posed by purely genetic carcinogens. Whereas, there has been relatively less disagreement over appropriate measures for the control of those materials categorized as human carcinogens, there has been considerable disagreement among scientists regarding appropriate measures for the control of the numbers materials categorized as animal carcinogens on the basis of tests in rats, mice or hamsters.

The above commenters stated that different risk models should be used to account for the differentiation of carcinogens recognizing different mechanisms. All of these comments reject the CAG risk model because it is too conservative and that both the upper and lower bound risks must be taken into account. In other words, EPA's cancer risk estimation process overstates the potential risk posed by these chemicals in a manner which may mislead the public. Furthermore, they believe that EPA has accepted animal data at face value without any critical review. They recommended that the health criteria documents be subject to independent peer review before further government and industry resources are spent on discussing approaches to regulate chemicals which may be non-hazardous or pose an insignificant risk.

Three comments were received that recommended EPA should continue to use the CAG model for both genotoxic and nongenotoxic carcinogens. Even though knowledge of the carcinogenic mechanism should be a major factor in selecting the most appropriate risk model, this information is generally not available for environmental carcinogens. One commenter stated that a distinction between carcinogenic mechanisms is arbitrary because there is a lack of experimental data establishing a threshold for non-mutagenic carcinogens or showing that the dose-response curve is different in the lower range from that for substances that cause gene mutations. In addition, thresholds observed in experiments with an inbred animal populations cannot be estrapolated with any degree of certainty to a diverse human population; therefore, no distinction between carcinogenic mechanisms should be made at this time.

One commenter added that the multi-stage model as modified by the Carcinogen Assessment Group (CAG) should be used in establishing MCLs for carcinogens *regardless of mechanisms* of action. Mathematical models at best provide crude estimates of the risks resulting from exposure to a carcinogen.

The third issue as to how the risk of exposure to two or more VOC's should be considered was addressed by five comments. Four commenters felt that two or more chemicals found to be toxic to the same organ system should be considered to be additive in their cumulative effect on the body. Added margins of safety should then be included in the health basis of each MCL. The magnitude of the safety factor should reflect, where possible, current understanding of synergistic interaction between chemicals and should be considered at least additive in proportion to the absolute and relative levels of exposure. In addition, no evidence has been put forth that suggests that these interactions could never be a problem. One recommended approach was to set an RMCL and MCL for "total VOCs".

One commenter believed that the risk of exposure to two or more VOCs is *not* additive. The reasoning was based on two studies in which two chlorinated solvents were administered simultaneously for 3 to 6 months, in which no synergism was indicated and, in fact, the effects were less than

additive. Thus, the commenter felt that an increase in the margin of safety is not required.

The issue of which subgroup of the general population should be protected received six comments. Three commenters felt that the 10 kg child should be used because adequate protection should be provided to all segments of the general population. Two commenters felt that the 70 kg adult should be the basis for potential MCLs because life-time exposure should be used in the calculation. A 10 kg child is not exposed over a 70-year lifetime. One commenter recommended that if MCLs are warranted, the level should be set to protect all signficant populations groups (i.e., children, pregnant women, aged adults, etc.). Also, short term exposure risk calculations should be based on a 10 kg child, long term exposures based on a 70 kg adult, and the worst case would be controlling.

Lastly, the issue as to how exposure to VOCs from other routes should be addressed in the development of RMCLs received eight comments. Five commenters felt that relative source contribution should *not* be a major factor in determining the acceptable risk. One commenter suggested that EPA state the likely other sources of VOC exposure and average levels. Another commenter put it this way, "The contribution of drinking water to the total exposure to a contaminant should be considered in light of the risk to public health and not in terms of its relative significance to other sources of exposure".

Three comments recommended that the total allowable body burden from all media (air, food and water) should be taken into account, based on health effects data.

Twenty-six comments were received on what level should be set for RMCLs such that "no known or anticipated adverse effects" will result. Twenty-two commenters recommended that the RMCLs for carcinogens be set at zero. Their reasoning was based on the premise that an RMCL is a health goal, which is not intended to reflect cost and feasibility of treatment, and that scientific evidence to date cannot be used to establish a no adverse health effect threshold for carcinogens.

Four commenters recommended that the RMCLs for carcinogens be set at a finite risk level and not zero. Their reasoning was that every water supply contains at least some of the chemicals listed in the ANPRM. A finite risk level is the only realistic basis. Furthermore, it is impossible to establish with any degree of certainty that the concentration of a contaminant in water is zero, due to limited analytical capability. One commenter stated that, "The question of the level of the RMCL for carcinogens is the most fundamental in the ANPRM. RMCLs are confusing and an RMCL set at zero is not useful because it could not be measured." Instead a regulatory target level (RTL), set as a negligible risk level should be established. The level should be 10^{-6}, based upon the National Academy of Sciences projections, not CAG's."

Another commenter felt that "RMCLs for compounds shown to increase tumors in test animals through non-genetic mechanisms, should be set at a finite number based on the toxicity of the contaminant (i.e., incorporating the threshold concept)".

[FR Doc. 84-15554 Filed 6-11-84; 8:45 am]
BILLING CODE 6560-50-M

DEPARTMENT OF NATURAL RESOURCES

WATER RESOURCES COMMISSION

GENERAL RULES

(By authority conferred on the water resources commission by sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being §§323.2 and 323.5 of the Michigan Compiled Laws)

PART 4. WATER QUALITY STANDARDS

R. 323.1041. Purpose

Rule 1041. It is the purpose of the water quality standards as prescribed by these rules to establish water quality requirements applicable to the Great Lakes, their connecting waterways and all other surface waters of the state, which shall protect the public health and welfare, enhance and maintain the quality of water, serve the purposes of United States Public Law 92-500 and the commission act; and which shall protect the quality of waters for recreational purposes, public and industrial water supplies, agriculture uses, navigation and propagation of fish, other aquatic life and wildlife.

History: 1979 AC, p. 1630, eff. Dec. 13, 1973.

R 323.1043 Definitions; A to N.

Rule 43. As used in this part:

(a) "Agricultural water use" means a use of water for agricultural purposes, including livestock watering, irrigation, and crop spraying.

(b) "Anadromous salmonids" means those trout and salmon which ascend streams to spawn.

(c) "Best practicable waste treatment technology for control of total phosphorus" means chemical-physical or chemical-physical-biological treatment processes, including treatment with aluminum salts, iron salts, or lime in conjunction with appropriate coagulant chemicals, settling or filtration or both, with operation and management of the treatment facilities and the process to achieve optimum phosphorus removal rates, or equivalent treatment.

(d) "Carcinogen" means a substance which causes an increased incidence of benign or malignant neoplasms or a substantial decrease in the latency period between exposure and onset of neoplasms through oral or dermal exposure or through inhalation exposure when the cancer occurs at non-respiratory sites, in at least 1 mammalian species, or man through epidemiological or clinical studies, unless the commission, on the basis of credible scientific evidence, determines that there is significant uncertainty regarding the credibility, validity, or significance of such study or studies, in which case it shall refer the question of carcinogenicity to experts on carcinogenesis and shall consider the recommendations of those experts in making its final determination.

Jan. 18, 1985

R 323.1044 Definitions; P to W.

Rule 44. As used in this part:

(a) "Palatability" means the state of being agreeable or acceptable to the senses of sight, taste, or smell.

(b) "Plant nutrients" means those chemicals, including nitrogen and phosphorus, necessary for the growth and reproduction of aquatic rooted, attached, and floating plants, fungi, or bacteria.

(c) "Point source" means a discernible, confined, and discrete conveyance from which wastewater is or may be discharged to the waters of the state, including any of the following:

(i) A pipe.
(ii) A ditch.
(iii) A channel.
(iv) A tunnel.
(v) A conduit.
(vi) A well.
(vii) A discrete fissure.
(viii) A container.
(ix) A concentrated animal feeding operation.
(x) A vessel or other floating craft.

(d) "Public water supply" means a surface raw water source which, after conventional treatment, will provide safe, clear, potable, and aesthetically pleasing water for uses which shall include human consumption, food processing, and cooking and as a liquid ingredient in foods and beverages.

(e) "Raw water" means the waters of the state before any treatment.

(f) "Receiving waters" means the waters of the state into which an effluent is or may be discharged.

(g) "Sanitary sewage" means treated or untreated wastewaters which contain human metabolic and domestic wastes.

(h) "Standard" means a definite numerical value or narrative statement promulgated by the commission to enhance or maintain water quality to provide for, and fully protect, a designated use of the waters of the state.

(i) "Suspended solids" means the amount of materials suspended in water, commonly expressed as a concentration in terms of milligrams per liter.

(j) "Total body contact recreation" means an activity where the human body may come into direct contact with water to the point of complete submergence, including activities such as swimming, water skiing, and skin diving.

(k) Toxic substance" means a substance, except heat, when present in sufficient concentrations or quantities which are or may become harmful to plant life, animal life, or designated uses.

(l) "Warmwater fish" means those fish species whose populations thrive in relatively warm water, including the following:

(i) Bass.
(ii) Pike.
(iii) Walleye.

R 323.1055. Taste and odor producing substances.

Rule 1055. The waters of the state shall contain no unnatural substances in concentrations which are or may become injurious to their use for public, industrial or agricultural water supply, or in concentrations which lower the palatability of fish as measured by test procedures acceptable to the commission.

History: 1979 AC, p. 1632, eff. Dec. 13, 1973.

R 323.1057. Toxic substances.

Rule 57. (1) Toxic substances shall not be present in the waters of the state at levels which are or may become injurious to the public health, safety, or welfare; plant and animal life; or the designated uses of those waters. Allowable levels of toxic substances shall be determined by the commission using appropriate scientific data.

(2) All of the following provisions apply for purposes of developing allowable levels of toxic substances in the surface waters of the state applicable to point source discharge permits issued pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws:

(a) Water quality-based effluent limits developed pursuant to this subrule shall be used only when they are more restrictive than technology-based limitations required pursuant to R 323.2137 and R 323.2140.

(b) The toxic substances to which this subrule shall apply are those on the 1984 Michigan critical materials register established pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et. seq. of the Michigan Compiled Laws; the priority pollutants and hazardous chemicals in 40 C.F.R. §122.21, appendix D (1983); and any other toxic substances as the commission may determine are of concern at a specific site.

(c) Allowable levels of toxic substances in the surface water after a discharge is mixed with the receiving stream volume specified in R 323.1082 shall be determined by applying an adequate margin of safety to the MATC, NOAEL, or other appropriate effect end points, based on knowledge of the behavior of the toxic substance, characteristics of the receiving water, and the organisms to be protected.

(d) In addition to restrictions pursuant to subdivision (c) of this subrule, a discharge of carcinogens, not determined to cause cancer by a threshold mechanism, shall not create a level of risk to the public health greater than 1 in 100,000 in the surface water after mixing with the allowable receiving stream volume specified in R 323.1082. The commission may require a greater degree of protection pursuant to R 323.1098 where achievable through utilization of control measures already in place or where otherwise determined necessary.

(e) Guidelines shall be adopted pursuant to Act No. 306 of the Public Acts of 1969, as amended, being §24.201 et seq. of the Michigan Compiled Laws, setting forth procedures to be used by staff in the development of recommendations to the commission on allowable levels of toxic substances and the minimum data necessary to derive such recommendations. The commission may require the applicant to provide the minimum data when otherwise not available for derivation of allowable levels of toxic substances.

Rule 1064. A minimum of 6 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained and, except for inland lakes as prescribed in rule 1065, a minimum of 6 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland streams designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by rule 1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained as a daily average and no single value shall be less than 4 milligrams per liter in waters naturally capable of supporting warmwater fish.

History: 1979 AC, p. 1633, eff. Dec. 13, 1973.

R 323.1065. Dissolved oxygen; inland lakes.

Rule 1065. (1) The following standards for dissolved oxygen shall apply to inland lakes capable of supporting coldwater fish.

(a) In warmwater inland lakes with little water exchange which are capable of sustaining a cold stratum of well-oxygenated water throughout the summer above a hypolimnion with very little oxygen, a minimum of 6 milligrams per liter of dissolved oxygen shall be maintained throughout the epilimnion and the upper one-third of the thermocline during the entire summer stagnation period. At all other times, the dissolved oxygen concentration shall be maintained at natural levels.

(b) In inland lakes capable of sustaining high oxygen values throughout the hypolimnion during periods of stagnation, dissolved oxygen concentrations greater than 6 milligrams per liter shall be maintained throughout the entire lake.

(c) In inland lakes which serve a principal anadromous fish migration routes, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained throughout the epilimnion and the upper one-third of the thermocline in stratified lakes throughout periods of fish migration. In unstratified lakes, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained throughout the entire lake during periods of fish migration.

(d) In shallow, unstratified coldwater inland lakes, dissolved oxygen concentrations greater than 6 milligrams per liter shall be maintained throughout the entire lake.

(2) The following standards for dissolved oxygen shall apply to inland lakes capable of supporting warmwater fish.

(a) In warmwater lakes with little water exchange, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained throughout the epilimnion and the upper one-third of the thermocline during the entire summer stagnation period. At all other times, dissolved oxygen concentrations shall be maintained at natural levels.

(b) In warmwater lakes with a high rate of water exchange, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained throughout the epilimnion and the upper one-third of the thermocline during the summer stagnation period. At all other times, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained except in areas where natural oxygen depressions occur.

History: 1979 AC, p. 1634, eff. Dec. 13, 1973.

(e) Lake Huron south of a line due east from Tawas Point, except Saginaw Bay.

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	55	60	75	80	80	80	65	55	45

(f) Lake Huron, Saginaw bay:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	78	65	55	45

(g) St. Clair river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	50

(h) Lake St. Clair:

J	F	M	A	M	J.	J	A	S	O	N	D
40	40	45	55	70	75	80	83	80	70	55	45

(i) Detroit river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	60	70	75	80	83	80	70	55	45

(j) Lake Erie:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	80	70	60	50

History: 1979 AC, p. 1635, eff. Dec. 13, 1973.

R 323.1072. Temperature: inland lakes, general standards.

Rule 1072. Inland Lakes shall not receive a heat load which would:

(a) Increase the temperature of the thermocline or hypolimnion or decrease the volume thereof.

(b) Increase the temperature of the receiving waters at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

(c) Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	50	60	70	75	80	85	80	70	60	50

History: 1979 AC, p. 1636, eff. Dec. 13, 1979.

R 323.1073. Temperature; inland lakes, anadromous salmonid migrations.

Rule 1073. Warmwater inland lakes which serve as principal migratory routes for anadromous salmonids shall not receive a heat load during periods of migration at such locations and in a manner which may adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

History: 1979 AC, p. 1636, eff. Dec. 13, 1973.

periods of migration at such locations and in a manner which may adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 5 degrees Fahreheit above the existing natural water temperature.

History: 1979 AC, p. 1636, eff. Dec. 13, 1973.

R 323.1080. Special conditions

Rule 1080. To be consistent with the agreement between the United States of America and Canada on Great Lakes water quality effective April 15, 1972, the following conditions shall apply to the Michigan waters of the Great Lakes and their connecting waterways:

(a) Values of pH shall not be outside the range of 6.7 to 8.5.

(b) In Lake Erie, the level of total dissolved solids shall not be greater than 200 milligrams per liter.

(c) Filtrable iron shall not be greater than 0.3 milligrams per liter.

History: 1979 AC, p. 1637, eff. Dec. 13, 1973.

R 323.1082. Mixing zones.

Rule 82. (1) A mixing zone to achieve a mixture of a point source discharge with the receiving waters shall be considered a region in which the response of organisms to water quality characteristics is time-dependent. Exposure in mixing zones shall not cause an irreversible response which results in deleterious effects to populations of aquatic life or wildlife. As a minimum restriction, the final acute value for aquatic life shall not be exceeded in the mixing zone at any point inhabitable by these organisms, unless it can be demonstrated to the commission that a higher level is acceptable. The mixing zone shall not prevent the passage of fish or fish food organisms in a manner which would result in adverse impacts on their immediate or future populations. Watercourses or portions thereof which, without 1 or more point source discharge, would have no flow except during periods of surface runoff may be considered as a mixing zone for a point source discharge. The area of mixing zones should be minimized. To this end, devices for rapid mixing, dilution, and dispersion are encouraged where practicable.

(2) For toxic substances, not more than 25% of the receiving water design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges, unless it can be demonstrated to the commission that the use of a larger volume is acceptable. The commission shall not base a decision to grant more than 25% of the receiving water design flow for purposes of developing effluent limitations for discharges of toxic substances solely on the use of rapid mixing, dilution, or dispersion devices. However, where such a device is or may be employed, the commission may authorize the use of a design flow greater than 25% if the effluent limitations which correspond to such a design flow are shown, based upon a site specific demonstration, to be consistent with Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and other applicable law.

(3) For substances not included in subrule (2) of this rule, the design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges, if the provisions in

R 323.1092. Dredging.

Rule 1092. The water quality standards prescribed by these rules shall not apply to dredging or construction activities within water areas where such activities occur or during the periods of time when the after effects of dredging or construction activities degrade water quality within such water areas, if the dredging operations or construction have been authorized by the United States army corps of engineers or the department. The water quality standards shall apply, however, in non-confined water areas utilized for the disposal of spoil from dredging operations, except within spoil disposal sites specifically defined by the United States army corps of engineers or the department.

History: 1979 AC, p. 1638, eff. Dec. 13, 1973.

R 323.1096. Determinations of compliance.

Rule 1096. Analysis of the waters of the state to determine compliance with the water quality standards prescribed by these rules shall be made according to procedures outlined in the current edition of "Standard Methods for the Examination of Water and Wastewater" as published jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation, or other methods prescribed or approved by the commission and the United States environmental protection agency.

History: 1979 AC, p. 1638, eff. Dec. 13, 1973.

R 323.1097. Chemical applications.

Rule 1097. The application of chemicals for water resource management projects in accordance with and subject to state statutory provisions is not subject to the standards prescribed by these rules, but all projects shall be reviewed and approved by the commission prior to chemical applications.

History: 1979 AC, p. 1638, eff. Dec 13, 1973.

R 323.1098. Nondegradation and water quality improvement.

Rule 1098. (1) Waters of the state in which the existing water quality is better than the water quality standards prescribed by these rules on the date when the standards become effective, shall not be lowered in quality by action of the commission unless and until it has been affirmatively demonstrated to the commission that a change in quality will not become injurious to the public health, safety or welfare; or become injurious to domestic, commercial, industrial, agricultural, recreational or other uses which are being made of the waters; or become injurious to livestock, wild animals, birds, aquatic life or plants, or the growth or propagation thereof be prevented or injuriously affected; or whereby the value of fish or game may be destroyed or impaired, and that a lowering in quality will not be unreasonable and against the public interest in view of the existing conditions in any waters of the state.

(2) Waters of the state which do not meet the water quality standards prescribed by these rules shall be improved to meet those standards.

	Name	Water Impounded	County	Location
(a)	Ada Lake	Thornapple River	Kent	From head of Ada Dam, T. 7 N., R. 10 W Sec. 34 upstream to headwaters of Casca Lake (48th Street)
(b)	Belleville Lake	Huron River	Wayne	T. 3 S., R. 8 E., Sec. 19 downstream T. 3 S., R. 8 E., Sec. 24.
(c)	C. S. Mott Lake	Flint River	Genesee	T. 8 N., R. 7 E., Sec. 11, 12, 15, 16, 21.
(d)	Caley Pond	Farmer Creek	Lapeer	T. 6 N., R. 9 E., Sec. 12 and 13.
(e)	Cascade Lake	Thornapple River	Kent	Included in Ada Lake Area
(f)	Fallasberg Dam	Flat River	Kent	T. 7 N., R. 9 W., Sec. 24, 25, 26.
(g)	Ford Lake	Huron River	Washtenaw	T. 3 S., R. 7 E., Sec. 14, 15, 16, 2 22, 23, 24.
(h)	Geddes Pond	Huron River	Washtenaw	T. 2 S., R. 6 E., Sec. 26, 35, 36.
(i)	Grand River	Grand River (not impounded)	Ottawa	Eastmanville T. 7 N., R. 14 W. Sec. 10, downstream to 160th Avenue
(j)	Grand River	Grand River (not impounded)	Kent	Plainfield Road bridge downstream to lower limits of Comstock Riverside Park, T. 8 N., R. 11 W., Sec. 31
(k)	Holloway Reservoir	Flint River	Genesee	T. 8 N., R. 8 E., Sec. 1, 2, 11, 12, T. 8 N., R. 9 E., Sec. 7, 8, 17, 18
(l)	Ionia Recreation Area	Sessions Creek	Ionia	T. 6 N., R. 7 W., Sec. 3, N.W. ¼, Sec. 3.

(z)	Shamrock Lake	Tobacco River	Clare	T. 17 N., R 4 W., Sec. 26.
(aa)	Shiawassee Impoundment	Shiawassee River	Shiawassee	T. 6 N., R. 3 E., Sec. 11, 14.
(bb)	Sleepy Hollow Reservoir	Maple River	Clinton	T. 6 N., R. 1 W., Sec. 3, 10, Jason Rd. downstream to dam.
(cc)	Springbrook Lake	Springbrook Creek	Shiawassee	T. 6 N., R. 2 E., Sec. 10.
(dd)	Smallwood Lake	Tittabawassee River	Gladwin	T. 18 N., R 1. W., Sec. 1, T. 18 N., R. 1 E., Sec. 4, 9, 13, 16, T. 19 N., R. 1 W., Sec. 36.
(ee)	Thompson Lake	Bogue Creek	Livingston	T. 3 N., R. 5 E., Sec. 30, 31. T. 3 N., R. 4 E., Sec. 25, 36.
(ff)	Thornapple Lake	Thornapple River	Barry	T. 3 N., R. 7 W., Sec. 19, 20, 30. T. 3 N., R. 8 W., Sec. 24, 25.
(gg)	Thread Lake	Thread Creek	Genesee	T. 7 N., R. 7 E., Sec. 19, 20.
(hh)	Webber Dam Impoundment	Grand River	Ionia	Goodwin Road downstream to dam, T. 7 N., R. 5 W., Sec. 33.
(ii)	Wiggins Lake	Cedar River	Gladwin	T. 18 N., R 2 W., Sec. 4, T. 19 N., R. 2 W., Sec. 27, 34
(jj)	Wildwood Lake	Thread Creek	Oakland	T. 5 N., R. 8 E., Sec. 28.
(kk)	Wixom Lake	Tittabawassee River	Gladwin	T. 17 N., R. 1 W., Sec. 36. T. 17 N., R. 1 E., Sec. 1, 2, 11, 12, 13, 14, 23, 26, 27, 33, 34, 35. T. 18 N., R. 1 E., Sec. 25, 36
			Midland	T. 16 N., R. 1 E., Sec. 2, 3, 4. T. 16 N., R. 1 W., Sec. 1.

(l)	St. Joseph River	Calhoun	Existing east village limits of Burlington to section line between Sections 33 and 34, Takonsha Township.
(m)	St. Joseph River	Hillsdale	Existing east village limits of Tekonsha to section line between Sections 8 and 9, Litchfield Township.
(n)	St. Joseph River	Hillsdale	Existing east city limits of Litchfield to Genesee Mill dam.
(o)	Hickory Creek	Berrien	Mouth at St. Joseph River to section line between Sections 15 and 22, Lincoln Township.
(p)	Dowagiac River	Cass	City of Niles dam to section line between Sections 9 and 16, Pokagon Township.
(q)	East Branch Dowagiac Creek	Cass	Mill pond dam to LeGrange Lake.
(r)	Christiann Creek	Cass	Michigan-Indiana border to Christiann Lake.
(s)	Portage River	St. Joseph	Existing north city limits of Three Rivers to Portage Lake.
(t)	Coldwater River	Branch	Existing east city limits of Union City to Craig Lake.

History: 1979 AC, p. 1639, eff. Dec. 13, 1973.

R. 323.1116 Availability of documents.

Rule 116. Documents referenced in R 323.1057 and R 323.1096 may be obtained at current costs as listed as follows:

(a) "EPA Priority Pollutants and Hazardous Substances," 40 C.F.R. §122.21, appendix D (1983); copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan, 48909, at no cost, or from the Office of Water Enforcement, U.S. Environmental Protection Agency, Washington, D.C. 20460, at no cost.

(b) "1984 Michigan Critical Materials Register;" copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(c) "Standard Methods for the Examination of Water and Wastewater," 15th edition, 1980; copies may be obtained from the American Public Health Association, 1015 Eighteenth Street, N.W., Washington, D.C. 20036, at a cost of $50.00, or from the Surface Water Quality Division,

State of Michigan

Department of Natural Resources

Environmental Protection Bureau

Guidelines for Rule 57(2)

Rule 323.1057 of the Part 4 Water Quality Standards filed with the Secretary of State, January 2, 1985, establishes standards for toxic substances. These guidelines set forth procedures, pursuant to Rule 57(2), that Environmental Protection Bureau staff will use in the development of recommendations to the Water Resources Commission on allowable levels of toxic substances in the waters of the state applicable to point source discharge permits. The most recent of such toxic substance levels developed pursuant to these guidelines shall be compiled on an annual basis and be available for distribution by February 1 of each year.

(1) As used in these guidelines:

(a) "Acute toxicity" means the ability of a chemical to cause a debilitating or injurious change in an organism which results from a single or short-term exposure to the chemical.

(b) "Bioconcentration" is the increase in concentration of the chemical of concern and its metabolities in or on the target organisms (or specified tissues thereof) relative to the concentration of the chemical of concern in the ambient water.

(c) "Carcinogen" means a chemical which causes an increased incidence of benign or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms through oral or dermal exposure, or through inhalation exposure when the cancer occurs at non-respiratory sites in at least one mammalian species, or man through epidemiological and/or clinical studies.

(d) "Chronic toxicity" means the ability of a chemical to cause an injurious or debilitating effect in an organism which results from repeated exposure to a chemical for a time period representing a substantial portion of the natural life expectancy of that organism.

(i) "Life Cycle Safe Concentration" is the highest concentration of a chemical to which an organism is exposed continuously for a life time, and which results in no observable adverse effects to this organism and its progency.

(j) "log Kow" means the log (base 10) of the n-octanol/water partition coefficient.

(k) "MATC" is the maximum acceptable toxicant concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration which did not cause the occurrence of a specified adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specified adverse effect and above which all tested concentrations caused such an occurrence.

(l) "NOAEL" means the highest level of toxicant which results in no observable adverse effects to exposed test organisms.

(m) "n-octanol/water partition coefficient" (Kow) means the ratio of the octanol to water equilibrium concentrations of a compound.

(n) "Risk" means the probability that a chemical, when released to the environment, will cause an adverse effect in exposed humans, other living organisms, or abiotic environmental compartments.

(2) The allowable level in the surface water after a discharge is mixed with the receiving stream volume specified in R 323.1082 shall not exceed any of the following:

(a) The Aquatic Chronic Value as derived in (3).

(b) The Terrestrial Life Cycle Safe Concentration as derived in (4).

(c) The Human Life Cycle Safe Concentration as derived in (5).

(d) The concentration providing an acceptable degree of protection to public health for cancer, as derived in (6), when sufficient data are available in the scientific literature to establish that a chemical is a carcinogen.

(e) The concentration providing an acceptable degree of protection to public health for hereditary mutagenic or genotoxic teratogenic effects, as derived in (7), when sufficient data are available in the scientific literature to establish that a chemical is a hereditary mutagen or genotoxic teratogen.

are not site resident, the requirement may be waived and appropriate substitution will be made.

(i) If the chronic toxicity of the chemical has not been adequately shown to be related to a water quality characteristic, an ACV is calculated using the following procedures. If the toxicity of the chemical is related to a water quality characteristic, go to (a)(ii).

(A) For each species for which at least one chronic MATC is available, the Species Mean Chronic Value (SMCV) is calculated as the geometric mean of the results of all flow-through tests in which the concentrations of test material were measured. For a species for which no such result is available, the geometric mean of all available MATC's is calculated, i.e., results of flow-through tests in which the concentrations were not measured and the results of static and renewal tests based on initial total concentrations of test material.

(B) The SMCV's are ordered from high to low.

(ii) If data for a chemical are available to show that chronic toxicity to two or more species is similarly related to a water quality characteristic, an Aquatic Final Chronic Equation must be calculated using the following procedures:

(A) For each species for which comparable chronic toxicity values are available at three or more different values of the water quality characteristic, perform a least squares regression of the chronic toxicity values on the values of the water quality characteristic. Because the best documented relationship is that between hardness and toxicity of metals in fresh water and a log-log relationship best fits the available data, natural logarithms of both toxicity and water quality are used here. For relationships based on other water quality characteristics, such as pH or temperature, no transformation or a different transformation may fit the data better, and appropriate changes will be necessary throughout this section.

(B) Each chronic slope is evaluated as to whether or not it is meaningful, taking into account the range and number of the tested values of the water quality characteristic. For example, a slope based on four data points may be of limited value if it is based

(G) The Aquatic Chronic Intercept is obtained by using the procedure described in (a)(i)(A-G), except "Intercept" is inserted for "Value".

(H) The Aquatic Chronic Equation is written as

$e^{(V \ \ln(\text{water quality characteristic}) + \ln Z)}$,

where V = mean chronic slope and Z = Aquatic Chronic Intercept.

(b) If chronic MATC data for a chemical is not available for at least six freshwater species meeting the requirements in (a) an ACV is calculated as follows:

(i) The Final Acute Value (FAV) is divided by an acute/chronic ratio (or geometric mean if more than one is available) for at least one North American freshwater species. The FAV is derived in the following manner (listed in order of preference);

(A) The FAV is derived in the same manner as the ACV described in (a) by substituting FAV for ACV, SMAV (Species Mean Acute Value) for SMCV, and acute for chronic, and LC50 or EC50 for MATC.

(d) On the basis of all available pertinent laboratory and field information, the FAV and ACV are evaluated as to whether they are consistent with sound scientific evidence and are protective of ecologically, commercially, or recreationally important resident species. If not, staff will evaluate appropriate modifications of the procedures, including site specific techniques for deriving acute and chronic values for chemicals.

Reference

U.S. Environmental Protection Agency. 1983. Draft Guidelines for Deriving National Water Quality Criteria for the Protection of Aquatic Life and Its Uses (July 5, 1983). U.S. Environmental Protection Agency Development Document, Environmental Research Laboratory, Duluth, Minnesota.

W_a = weight of test animal (kg)

V_w = volume of water consumed daily by the test animal (l)

(c) If a chronic or subacute NOAEL from mammalian or avian species exposed to toxicant by gavage is available,

$$TLSC = \frac{\text{NOAEL (mg/kg)} \times \frac{W_a}{V_w} \times Fw}{U}$$

Where: Fw = fraction of days dosed per week

(d) If an oral rat LD50 is available,

$$TLSC = \frac{\text{LD50 (mg/kg)} \times \frac{W_a}{V_w} \times M}{10}$$

Where: M = acute to chronic application factor (M = 0.0001)

(e) TLSCs are best derived from data involving oral exposure. However, if available oral data are insufficient, it may be useful to use data from other exposure routes. Use of such data will depend on the specific pharmacokinetic and toxicological properties of each chemical.

(5) The concentration to protect public health from threshold effect toxicants is the Human Life Cycle Safe Concentration (HLSC). The HLSC shall be derived in the following manner. The minimum toxicity data requirement for derivation of an HLSC shall consist of an acute oral LD50 for rats.

(a) The HLSC shall be derived from appropriate toxicological data using the following formula:

$$HLSC = \frac{MgT\ (mg/day)}{WC + (F \times BCF)}$$

Where: MgT = maximum milligrams of toxicant per day causing no adverse effects to humans when ingested daily for lifetime.

WC = volume of water consumed daily in liters (2 liters (1) for surface water protected for drinking water supply; 0.01 liters (1) for surface water protected for total and partial body contact)

F = daily consumption of fish by humans (F = 0.0065 kg)

BCF = bioconcentration factor as determined in (8).

(i) The MgT shall be derived by one of the following methods depending on the type and quality of the toxicity data base.

$$MgT = \frac{\text{NOAEL (mg/l)} \times \frac{V_w}{W_a} \times W_h}{B}$$

Where: V_w = volume of water consumed daily by test animal (l)

W_a = weight of test animal (kg)

W_h = weight of human (W_h = 70 kg)

B = uncertainty factor (B = 100-1,000 depending on quality of study)

(E) If a chronic or subacute NOAEL from mammalian test species exposed to toxicant contaminated food is available,

$$MgT = \frac{\text{NOAEL (ppm)} \times C \times W_h}{B}$$

Where: C = daily food consumption expressed as a fraction of the animal's body weight

(F) If a chronic or subacute NOAEL from mammalian test species exposed to toxicant by gavage is available,

$$MgT = \frac{\text{NOAEL (mg/kg)} \times F_w \times W_h}{B}$$

Where: F_w = fraction of days dosed per week

(6) The concentration providing an acceptable degree of protection to public health for cancer shall be derived in (a), except for carcinogens that are assumed to cause cancer by a non-threshold mechanism. For these chemicals a greater degree of protection than that derived in (a) may be developed pursuant to R 323.1098 where achievable through utilization of control measures already in place.

(a) A water concentration of the carcinogen shall be derived from human epidemiological data or from appropriate animal research data using the following formula.

$$C = \frac{D \times W_h}{WC + (F \times BCF)}$$

Where: C = concentration of the carcinogen (mg/l)

D = dose derived in (i) (ii) or (iii) (mg/kg/day)

W_h = weight of an average human (W_h = 70 kg)

WC = daily water consumption 0.01 l for surface water protected for total or partial body contact; 2.0 l for surface waters protected for drinking water supply)

F = daily fish consumption (F = 0.0065 kg)

BCF = bioconcentration factor as determined in (8)

(i) The dose (D) may be derived from appropriate human epidemiological data on a case-by-case basis with staff seeking the advice of an expert committee established in (b) as needed.

than one type of tumor is available, then the response for the tumor type predicting the highest estimate of q_1^* is generally used for the risk assessment. If two or more studies of equal quality are available, but vary in any of the following: species, strain, sex or tumor type, then the data set giving the highest estimate of q_1^* is generally used for the risk assessment. If two or more studies exist which are identical regarding species, strain, sex, tumor type, and are of equal quality, then the geometric mean of the q_1^* values from these data sets is used.

(B) The dose corresponding to an estimated one additional cancer in 100,000 exposed test organisms is determined by dividing 10^{-5} by the value for q_1^*.

(C) A species sensitivity factor is used to account for differences between test species and man. It is assumed that mg/surface area/day is an equivalent dose between species. The value may be calculated by dividing the average weight of a human (70 kg) by the weight of the test species and taking the cube root of this value; the slope q_1^* is multiplied by this factor. However, if adequate pharmacokinetic and metabolism studies are available, this data may be factored into the adjustment for species

(B) The safety factor shall be determined by staff based on an evaluation of appropriate toxicological and pharmacological considerations including, mechanism of carcinogenesis, number and type of tumors induced, the spontaneous incidence of tumors, the number of animal species tested and affected, metabolic considerations, epidemiologic observation on exposed humans, extent of the data supporting a nongenetic mechanism, and other pertinent information.

(C) A species sensitivity factor may be used to account for differences between test species and man.

(b) A committee of scientists expert in the field of carcinogenesis shall be established by the director, as needed.

(i) A committee may be convened when the director determines that staff will benefit from advice and recommendations on a highly technical scientific issue which staff requires additional technical expertise to resolve. Such issues include, but are not limited to: specific mechanisms of carcinogenicity (i.e. epigenetic/genetic or promotor/initiator), species sensitivity, and determination of carcinogenicity for chemicals with data not fitting the criteria to determine carcinogenicity established in

(iv) The department shall provide staff to the committee.

(v) The committee shall provide a written report stating their recommendations and supporting documentation and rationale.

(c) On the basis of available information, the concentration providing an acceptable degree of protection to public health for cancer is evaluated as to whether it is consistent with sound scientific judgement. If not, staff will evaluate appropriate modifications of these procedures.

References

Crump, Kenny S. and Warren W. Watson. 1979. GLOBAL 79. A FORTRAN program to extrapolate dichotomous animal carcinogenicity data to low doses. National Institute of Environmental Health Science Contract NOI-ES 2123.

U.S. Environmental Protection Agency. 1980. Water Quality Criteria Availability. Appendix C - Guidelines and Methodology Used in the Preparation of Health Effect Assessment Chapters of the Consent Decree Water Criteria Documents. 45 Federal Register 79347-79357.

(8) The final bioconcentration factor (BCF_f) standardized to reflect the value for fresh fish tissue having a lipid content of 9.6% shall be determined as follows in order of preference:

(a) Measured, steady-state bioconcentration factors from standardized laboratory tests shall be recorded as BCF_m. If more than a single value is available the BCF_m shall be equal to the geometric mean of the reported values:

(b) If bioconcentration factors are available from other laboratory tests, the BCF_m will be the highest of the following values:

(i) The projected steady-state BCF as calculated from the test data.

(ii) The highest individual BCF reported during the study.

(iii) The apparent steady-state BCF if steady-state was reached but the test duration was not of sufficient length.

(iv) The BCF obtained by dividing the highest tissue concentration of the chemical by the nominal water concentration.

(e) If a measured Kow is not available for the chemical of interest the Kow may be calculated according to standard references and used in the regression equation in (d).

(f) If a Kow cannot be calculated, BCF_c may be estimated on a case-by-case basis using other regression equations or correlations as appropriate.

(g) The final bioconcentration factor (BCF_f) will be obtained by normalization to 9.6% lipids as follows:

(i) For measured bioconcentration factors:

$$BCF_f = BCF_m \left(\frac{9.6}{L}\right)$$

where BCF_m = measured bioconcentration factor

L = percent lipid content of fish used in the test

(ii) For calculated bioconcentration factors:

$$BCF_f = BCF_c \left(\frac{9.6}{4.8}\right)$$

where BCF_c = calculated bioconcentration factor from log Kow or other regression equations.

4.8 = average percent lipid for test fish used to develop the regression equation in (d)

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

WATER RESOURCES COMMISSION

GUIDELINE - MONITORING REQUIREMENTS IN WATER DISCHARGE PERMITS

Implementation of the permit programs for surface and groundwater discharges, applicable under Public Law 92-500 and Act 245, as amended, of the Public Laws of 1929, has often included the requirement for self-monitoring within individual permits. While this measure has aided in efforts towards the water quality goals the specified monitoring has sometimes been of a general nature and in excess of that required to assure environmental protection. The following policy was approved by the Water Resources Commission:

Staff is hereby directed to:

A. Continue to evaluate surface water and groundwater permits on a case-by-case basis to tailor monitoring programs to specific discharges.

B. Reduce monitoring where possible while establishing frequency and parameters which will assure environmental protection.

C. Inform permit holders when they receive their draft permit that such evaluation has been done and that any additional suggestions are welcome.

This guideline will be binding upon the Groundwater Quality Division and Surface Water Quality Division of the Department of Natural Resources in permit issuance. This guideline will become effective on March 1, 1985.

DEPARTMENT OF NATURAL RESOURCES

WATER RESOURCES COMMISSION

GENERAL RULES

TABLE OF CONTENTS AND AUTHORITIES

By authority conferred on the water resources commission as follows:

Part 1: General Provisions . . . . . .R 323.1001-R 323.1009

Section 33 of Act No. 306 of the Public Acts of 1969, as amended, being section 24.233 of the Michigan Compiled Laws.
Filed with Secretary of State, June 6, 1972 (Effective June 21, 1972)

Part 2: Organization, Operation and Procedures. . . . . .R 323.1011-R 323.1027
Sections 33 and 63 of Act No. 306 of the Public Acts of 1969, as amended, being sections 24.233 and 24.263 of the Michigan Compiled Laws.
Filed with Secretary of State, June 6, 1972 (Effective June 21, 1972)

Part 3: Hearings. . . . . R 323.1031-R 323.1038
Section 33 of Act No. 306 of the Public Acts of 1969, as amended, being sections 24.233 of the Michigan Compiled Laws. Filed with Secretary of State, June 6, 1972 (Effective June 21, 1972)

Part 4: Water Quality Standards. . . . . .R 323.1041-R 323.1116
Sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being sections 323.2 and 323.5 of the Michigan Compiled Laws.
Filed with Secretary of State, November 27, 1973 (Effective December 12, 1973) and amended on January 2, 1985 (Effective January 18, 1985).

Part 5: Spillage of Oil and Other Pollutants. . . . . R 323.1151-R 323.1169
Sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being sections 323.2 and 323.5 of the Michigan Compiled Laws.
Filed with Secretary of State, March 6, 1973 (Effective March 21, 1973)

Part 6: Cleaning Agents and Water Conditioners. . . . . R 323.1171-R 323.1181
Section 3 of Act No. 226 of the Public Acts of 1971, being section 323.233 of the Michigan Compiled Laws.
Filed with Secretary of State, October 4, 1972 (Effective October 19, 1972) and amended October 3, 1973.

Part 7: . . . . . .(Reserved for Specific Pollutant Rules)

Part 8: . . . . . .(Reserved for Specific Pollutant Rules)

Part 9: Wastewater Reporting and Surveillance Fees. . R 323.1231-R 323.1242
Sections 2, 6b and 13 of Act No. 245 of the Public Acts of 1929, as amended, being sections 323.2, 323.6b and 323.13 of the Michigan Compiled Laws. Filed with Secretary of State, November 1, 1971; (Effective November 16, 1971). Amendments filed with Secretary of State, October 3, 1973 (effective October 18, 1973).

Part 10: Treatment Plant Operators. . . . . R 323.1251-R 323.1259
Section 2 of Act No. 245 of the Public Acts of 1929, as amended, being Section 323.2 of the Michigan Compiled Laws. Filed with Secretary of State, January 26, 1970 (Effective February 10, 1970). Amendments filed with Secretary of State, September 5, 1973 (effective September 20, 1973).

Part 11: Construction Grants for Wastewater Treatment Works
R 323.1271-R 323.1288
Section 12 of Act No. 329 of the Public Acts of 1966, as amended, being section 323.122 of the Michigan Compiled Laws. Filed with Secretary of State, October 10, 1974 (Effective October 25, 1974).

Part 21. Wastewater Discharge Permits. . . . . .R 323.2101 to 323.2160
Sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being pages 32-50 of Supplement #72 of the Michigan Administrative Code. Filed with Secretary of State, October 1, 1973.

Part 22: Ground Water Quality . . . . . R 323.2201-R 323.2211
Sections 2 and 5 of Act 245, Public Acts of 1929, as amended, being Sections 323.2 and 323.5 of the Michigan Compiled Laws. Filed with Secretary of State on August 14, 1980.

federal register

Wednesday
November 13, 1985

Part IV

Environmental Protection Agency

40 CFR Part 141

National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms; Proposed Rule

[1] Category I—Strong evidence of carcinogenicity; zero RMCL.
[2] Category II—Equivocal evidence of carcinogenicity; RMCL based on cancer risk or the AADI with additional factor.
[3] Category III—Inadequate or no evidence of carcinogenicity, RMCL based on AADI.
[4] Classified by IARC in Group 3. However, re-examination has resulted in the classification in EPA's Group B2 and thus these chemicals have been placed in the "probable" carcinogen category.

TABLE 4A.—CLASSIFICATION OF SOCs AND IOCs BASED ON PROPOSED EPA GUIDELINES

Chemical	EPA classification	Basis
A. SOCs		
DBCP	B2	Carcinogenic in rats/mice. Carcinomas of forestomach in rats and mice of both sexes, positive in short tests.
2,3,7,8-TCDD	B2	Carcinogenic in rats/mice. Cancer in liver, thyroid, tongue, etc. Inadequate evidence in humans.
Epichlorohydrin	B2	Carcinogenic in rats. Cancer in forestomach (oral), subcutaneous injection sites, and nasal turbinates (inhalation). Mutagen. No human evidence.
Hexachlorobenzene	B2	Carcinogenic in rats/hamsters/mice. Liver cancer. No human evidence.
Alachlor	B2	Carcinogenic in rats/mice. Both sexes and dose responsive.
Toxaphene	B2	Do.
Acrylamide	B2	Carcinogenic in two species, tumors at multiple sites.
EDB	B2	Carcinogenic in rats/mice by gavage, inhalation. Dermal in mice only.
Chlordane	B2	Carcinogenic in both sexes of mice. Liver hepatocellular carcinoma.
Heptachlor	B2	Carcinogenic in mice. Liver hepatocellular carcinoma.
Heptachlor Epoxide	B2	Carcinogenic in mice and rats. Hepatocellular carcinoma.
PCB	B2	Certain PCB's carcinogenic in mice and rats (oral). Produces benign and malignant neoplasms.
Lindane	C	Marginal tumors of the liver of both sexes in mice. Carcinogenic metabolite.
1,2 dichloropropane	C	Limited evidence of carcinogenicity in mice. Evidence in rats equivocal (based on NTP draft report).
Styrene	C	Carcinogenic in rats. Alveolar/bronchiolar adenomas and carcinomas in both sexes of rats (oral). However, these studies are not conclusive.
Monochlorobenzene	C	Increased occurrence of neoplastic nodules of the liver in high dose male rats. (Based on NTP draft report).
Pentachlorophenol	D	Negative in studies in rats and mice, mouse data not really solid. Negative for mutagenicity. No human evidence.
Cis and Trans-1,2-dichloroethylene.	D	Not tested.
o-Dichlorobenzene	D	Negative results in both rats and mice NTP (draft report) gavage studies. Some caution should be used since high dose may have been below MTD.
m-Dichlorobenzene	D	Not tested.
2,4-D	D	Inadequate animal data to classify for carcinogenicity.
2,4,5-TP	D	Do.
Ethylbenzene	D	Not tested.
Methoxychlor	D	Inadequate animal evidence. Inconclusive results.
Toluene	D	Negative in one CIIT bioassay (inhalation) up to 300 ppm. MTD was not reached. Negative in microbial bioassay.
Xylene	D	Insufficient information to determine whether or not xylene itself is carcinogenic.
Atrazine	D	Inadequate data to classify.
Simazine	D	Do.
Endrin	E	Negative results in studies, including NCI, 1979, bioassay.
Carbofuran	E	Negative in 2 species and negative in short-term tests.
Aldicarb	E	Negative results in several studies including the NCI bioassay.
B. IOCs		
Asbestos	A	By inhalation, carcinogenic in humans and animals. By ingestion of intermediate (>10 μm length) range chrysotile asbestos, limited evidence in animals-benign polyps in male rats. However, the available epidemiologic/experimental data are inadequate to conclude that the chemical is carcinogenic via ingestion.
Arsenic	A	Carcinogenic in humans by inhalation and ingestion. However, this chemical has potential essential nutrient value.
Chromium	A (based on data for Cr^{+6}).	Carcinogenic in humans by inhalation and rodents by intratracheal instillation. However, regulating as "D" since there is inadequate evidence to conclude that the chemical is caronogenic via ingestion.
Cadmium	B1	Limited evidence in humans exposed to cadmium fumes, cancer in rats exposed to cadmium chloride aerosol, injection site tumors in animals given cadmium salts. However, regulating as "D" since there is inadequate evidence to conclude that the chemical is carcinogenic via ingestion.
Nickel	B1 (based on subsulfide and carbonyl).	Limited evidence in humans by inhalation, sufficient evidence in animals by inhalation and injection. However, regulating as "D" since there is inadequate evidence to conclude that the chemical is a carcinogenic via ingestion.
Lead	B2	Sufficient evidence in animals. Kidney tumors by oral route in rats. However, insufficient basis to regulate as human carcinogen via ingestion
Barium	D	Inadequate data to classify.
Nitrate/Nitrite	D	Do.
Sodium	D	Do.
Cyanide	D	Do.
Copper	D	Do.
Selenium	D	Do.
Silver	D	Do.
Molybdenum	D	Do.
Sulfates	D	Do.
Mercury	D	Do.

TABLE 5.—RMCL OPTIONS FOR CATEGORY II CONTAMINANTS

Chemical	AADI with added factor of 10 (μg/l) considering 20 percent drinking water contribution	10^{-5} cancer risk (CAG μg/l)	10^{-6} cancer risk (CAG)(μg/l)
1,2-Dichloropropane	NA	6	0.6
Lindane	0.2	0.28	0.028

TABLE 5.—RMCL OPTIONS FOR CATEGORY II CONTAMINANTS—Continued

Chemical	AADI with added factor of 10 (μg/l) considering 20 percent drinking water contribution	10^{-5} cancer risk (CAG μg/l)	10^{-6} cancer risk (CAG)(μg/l)
Monochlorobenzene	60	24(NAS)	2.4(NAS)
Styrene	140	NA	NA

TABLE 5.—RMCL OPTIONS FOR CATEGORY II CONTAMINANTS—Continued

Chemical	AADI with added factor of 10 (μg/l) considering 20 percent drinking water contribution	10^{-5} cancer risk (CAG μg/l)	10^{-6} cancer risk (CAG)(μg/l)
Asbestos (medium and long fibers)	NA	71,000,000 f/1	7,100,000 f/1

NA = Not available.

I 126

9. Zinc

Zinc was also included in the list of IOCs under consideration for Revised Regulations in the ANPRM. The Agency has not identified any adverse health effects that are caused by zinc. The NAS Safe Drinking Water Committee (*Drinking Water and Health*, 1977. Vol. I) concluded that, "zinc is an essential nutrient for humans. There is evidence of borderline deficiencies of the element in children in the United States as well as in other parts of the world . . . . The possibility of detrimental health effects arising from zinc consumed in food and drinking water is extremely remote."

Thus, EPA has concluded that potential adverse health effects will not arise from zinc in drinking water and this compound is not being considered for regulation at the present time.

VIII. Synthetic Organic Chemicals: RMCL's

The ANPRM (48 FR 45502) listed a total of 43 synthetic organic chemicals (SOCs) that were being considered for inclusion in the NPDWR. Inclusion of specific SOCs on the list was based upon the occurrence or potential occurrence of the SOC in drinking water and the potential health effects of exposure to that SOC. Inclusion in the list did not necessarily mean that regulations would be developed for the SOC but that those were the SOCs currently being considered; other SOCs not listed could also be considered and included in the NPDWR. Selection of SOCs for the NPDWR is based upon an analysis of occurrence and potential occurrence, the significance of potential human exposure, associated health effects of exposure and other pertinent factors.

EPA is today proposing to regulate 26 of the 43 SOCs in the ANPRM; five of the SOCs were determined to be inappropriate for regulation due to such factors as lack of potential occurrence in drinking water, lack of actual occurrence data, or insufficient health effects data. Short- and longer-term toxicology assessments have been developed for those five SOCs for which regulations are not appropriate; these assessments may be converted to formal Health Advisories. In addition, 12 SOCs of the 43 SOCs will be reconsidered in later phases of the Revised Regulation development as additional data become available (see Table 1).

RMCLs are proposed for 26 SOCs for which the Administrator has determined that: (1) Analytical methods are available, (2) exposure to any of these SOCs "may have any adverse effect upon the health of persons" and, (3) they occur or are likely to occur in drinking water.

Below are: (1) A summary of the availability of analytical methods, and (2) summaries per SOC of analytical methods, occurrence/exposure and toxicology.

In the MCL proposal, EPA will propose the analytical methods that have been determined to be economically and technologically feasible. In the toxicology discussion for each SOC, the acute and chronic toxic effects of exposure along with any carcinogenicity data are summarized. When data are available, adjusted acceptable daily intakes (AADIs) based on non-carcinogenic effects are determined for long term exposure to the SOCs. In addition, short-term exposure is also considered and short-term assessments are determined for 1-day and 10-day exposures. These assessments are provided for both SOCs for which RMCLs are proposed and for those SOCs for which regulations do not appear to be appropriate. A summary of health-related guidelines prepared by other groups and organizations is provided for each SOC. Values that have been calculated by the World Health Organization (WHO), the National Academy of Sciencies (NAS), EPA's Office of Water Regulations and Standards (OWRS, Water Quality Criteria) and EPA's Office of Pesticide Programs (OPP) have been included. In several instances, these values differ from the proposed AADIs. This is due to several factors, including the use of different uncertainty factors, and reinterpretation of data and varying assumptions. In addition, new data may have become available over the years which has resulted in the derivation of an AADI which differs from older calculated values. Taste and odor threshold values also have been included for certain contaminants.

A summary of the RMCLs and AADIs is presented in Table 12. Risk estimates have been projected using calculation models for SOCs for which data are available and are summarized in Table 13. Short-term assessments and provisional AADIs for SOCs for which RMCLs are not proposed are summarized in Table 14 and short-term assessments for SOCs for which RMCLs are proposed are summarized in Table 15.

A. Availability of Analytical Methods

EPA approved analytical methods are available for most of the SOCs being considered in this RMCL proposal. These methods may involve gas chromatography (GC), gas chromatography/mass spectrometry (CG/MS), and and high pressure liquid chromatography (HPLC).

Purge and trap methods are available for those SOCs that are volatile. Those compounds which are methylene chloride extractable may be analyzed by 600 series methods (i.e., EPA methods for analysis of priority pollutants). Other compounds may be analyzed by newer methods developed recently but not yet approved by the Agency.

Since a number of the 600 series methods have been recently applied to drinking water samples in addition to waste effluent samples, multi-laboratory method validation data are available for many of the compounds in this proposal. Multi-laboratory data from performance evaluation studies are also available for some compounds, using reagent water. For the newer methods, only single laboratory, single operator performance data are available.

TABLE 12.—PROPOSED RMCL'S AND AADI'S FOR SOC'S PROPOSED FOR REGULATION

SOC	Safety factor	AADI [1] (mg/l)	Proposed RMCL (mg/l)
Acrylamide	100	[2] 0.007	0
Alachlor	NA	NA	0
Aldicarb, aldicarb sulfonde and aldicarb sulfone	100	[2] 0.042	0.009
Carboturan	100	0.18	0.036
Chlordane	100	0.03	0
cis-1,2-Dichloroethylene	1,000	0.35	0.07
DBCP	NA	NA	0
1,2-Dichloropropane	NA	NA	0.006
o-Dichlorobenzene	1,000	3.12	0.62
2,4-D	100	[2] 0.35	0.07
EDB	NA	NA	0
Epichlorohydrin	100	0.076	0
Ethylbenzene	1,000	[2] 3.4	0.68
Heptachlor	1,000	[2] 0.0025	0
Heptachlor epoxide	1,000	[2] 0.001	0
Lindane	1,000	[2] 0.01	0.0002
Methoxychlor	100	1.7	0.34
Monochlorobenzene	1,000	[2] 3.0	0.06
PCBs	NA	NA	0
Pentachlorophenol	100	1.1	0.22
Styrene	1,000	[2] 7.0	0.14
Toluene	100	10.1	2.0
2,4,5-TP	NA	0.26	0.052
Toxaphene	NA	NA	0
trans-1,2-Dichloroethylene	1,000	0.35	0.07
Xylene	1,000	[2] 2.2	0.44

[1] Does not consider carcinogenicity potential.
[2] These AADIs are termed "provisional" as they were determined from studies of less than lifetime duration (approximately 2 years for an animal study).
Note.—NA = Not available.

the test data. Another commenter stated that "a safety factor of 100 should be used to account for differing sensitivities within the heterogeneous population (e.g., young vs. old); variability in body weights and the amount of water ingested daily; and uncertanties in extrapolation". Another commenter felt, "NAS" safety factors are appropriate only when epidemiolgical date are lacking. If historical data are available to allow a lower safety factor (e.g., NO_3) or where a benefit can be prescribed (e.g., fluoride) then a lower safety factor should be applied".

(6) What approach should be used to set RMCLs for carcinogens?

Eight commenters addressed how RMCLs should be set for carcinogens. Four commenters felt that setting RMCLs at zero for non-threshold carcinogens was appropriate, however RMCLs must be clearly defined as a health goal. A common sentiment among some of these commenters was that zero provides little foundation for the establishment of MCLs. Furthermore, these commenters felt that RMCLs serve no purpose and are impractical because they are confusing to the public and the press, if not the regulated community. Despite the shortcomings of RMCLs, a few commenters made recommendations on how to improve the understanding of RMCLs. One commenter recommended that EPA, States and the American Water Works Association develop educational material to explain the differences between RMCLs and MCLs. Another commenter suggested that RMCLs and MCLs should be proposed and promulgated simultaneously.

Another suggestion as to how RMCLs should be set for carcinogens was expressed by one commenter to, "evaluate each compound and based on strength of the scientific data and comparative carcinogenicity of each compound, establish an RMCL at a level determined to have a mininal or insignificant health risk. These risk levels should be consistent with past determinations of "acceptable" risks to society, possibly 10^{-6}".

Two commenters were opposed to using risk models because there are such a variety of models which argue against the selection of only one for risk assessments. One commenter suggested EPA should consider a combination of mathematical models and the safety factor approach. Another commenter said, "due to the inadequacies in today's science, EPA should state that they are unable to determine safe levels for carcinogens".

One commenter recommended that animal bioassay results would have to be considered "sufficient" evidence of carcinogenicity before they can be considered for use in human cancer risk. They suggested using IARC's classification scheme which states that "limited" evidence in animals is "inadequate" to evaluate the carcinogenicity in humans.

(7) Is waiving certain MCLs when susceptible populations are not affected an appropriate approach?

Five comments addressed the issue whether to waiver certain MCLs when susceptible populations are not affected. The commenters were split on this issue, three felt this was an appropriate approach, particularly concerning nitrate.

Two commenters did not favor this approach. One commenter stated that, "waivers based on population would be very subjective and lead to the setting of undersirable precedents. Gathering the data to make determinations for a 'susceptible population' would be too timely and costly and populations are too mobile. Furthermore, failing to account for synergistic effects from other exposures would make any waiver meaningless in terms of protecting public health".

(8) Should separate or different MCLs be considered for certain contaminants for non-community water systems?

Two commenters addressed this issue. One commenter favored the existing procedures for non-community water systems to comply with the MCLs for coliforms, turbidity and nitrates. The other commenter recommended "changing the definitions for community and non-community to more properly reflect the difference between transient and non-transient populations because the current approach of resident vs. non-resident does not properly protect the health of persons using drinking water from systems such as schools and factories which are non-community systems that may have excessive concentrations of other contaminants, such as lead. Community systems should apply to non-transient populations such as schools, day-care facilities, and factories not just residential. Non-community systems should apply to true transient populations such as hotels, campgrounds, gas stations, restaurants etc".

(9) Which analytical methods are most reliable?

Only a few comments were received which addressed the availability of analytical methods for contaminants under consideration. The following discussion will be summarized per chemical.

Inorganic Chemicals

Asbestos

One commenter noted that the only available analytical method for asbestos in water, transmission electron microscopy, is very expensive ($300–$800 per sample). This method is neither precise nor accurate enough to use for enforcement purposes.

Chromium

One commenter noted that there are two methods to separate dissolved Cr (III) from Cr (IV). The first was developed by Martin and Riley at U.S. EPA, Environmental Monitoring and Support Laboratory (EMSL). The colorimetric method (*Standard Methods*, 15th ed. #312.B) is also valuable for distinguishing the hexavalent form. They also mentioned that Krull, Panaro and Gersmar (*J. Chrom. Science*. In press, 1983) have developed a method for speciation of Cr (VI) and Cr (III) in water using HPLC-Direct Coupled Plasma Emission Spectroscopy.

Another commenter recommended that the Atomic Absorption method be used to screen for total chromium, but that Cr (VI) should be the basis for the MCL.

Pesticides

One commenter noted the analytical method for glyphosate in water requires a high degree of technical skill and is very expensive. Costs are about $200 per sample. National cost for each public water system to monitor two times per year would approach $100 million.

Another commenter noted that while electron capture detection has excellent characteristics for insecticides and herbicides regulated by the SDWA, it has generally poor detection ability for the currently used phosphorous and nitrogen containing pesticides. Specific detectors are required such as, thermionic detection to detect even high levels of atrazine, simazine and tabufos.

PART 141—[AMENDED]

For the reasons set out in the preamble, it is proposed that the following be added to proposed Subpart F, Part 141, Subchapter D, Chapter I of Title 40, *Code of Federal Regulations* as proposed on May 14, 1985 (50 FR 20175).

1. The authority section of Part 141 continues to read as follows:

Authority: 42 U.S.C. 300g–1, 300g–3, 300j–4, and 300j–9.

2. It is proposed that Subpart F, 40 CFR 141.50 is amended by adding (a) (6) through (15) and (b) table entries (4) through (18) to read as follows:

§ 141.50 Recommended maximum contaminant levels for organic contaminants.

(a) * * *

* * * * * *

(6) Acrylamide,
(7) Alachlor,
(8) Chlordane,
(9) DBCP,
(10) EDB,
(11) Epichlorohydrin,
(12) Heptachlor,
(13) Heptachlor epoxide,
(14) PCBs,
(15) Toxaphene.

(b) * * *

Contaminant	RMCL in mg/l
* * * * *	*
(4) Aldicarb, aldicarb sulfoxide and aldicarb sulfone	0.009
(5) Carbofuran	0.036
(6) 2,4-D	0.07
(7) o-Dichlorobenzene	0.62
(8) cis-1,2-Dichloroethylene	0.07
(9) trans-1,2-Dichloroethylene	0.07
(10) Ethylbenzene	0.68
(11) Lindane	0.0002
(12) Methoxychlor	0.34
(13) Monochlorobenzene	0.06
(14) Pentachlorophenol	0.22
(15) Styrene	0.14
(16) Toluene	2.0
(17) 2,4,5-TP	0.052
(18) Xylene	0.44

3. It is proposed that proposed Subpart F, § 141.51 be amended by adding (b) table entries (2) through (12) to read as follows:

§ 141.51 Recommended maximum contaminant levels for inorganic contaminants

(a) [Reserved]

(b) * * *

Contaminant	RMCL in mg/l
* * * * *	*
(2) Arsenic	0.05
(3) Asbestos (medium and long fibers)	[1]7.1
(4) Barium	1.5
(5) Cadmium	0.005
(6) Chromium (total)	0.12
(7) Copper	1.3
(8) Lead	0.020
(9) Mercury	0.003
(10) Nitrate (as N)	10.0
(11) Nitrite (as N)	1.0
(12) Selenium	0.045

[1] Million fibers per liter.

4. It is proposed to add a new § 141.52 to 40 CFR Part 141 to read as follows:

§ 141.52 Recommended maximum contaminant levels for microbial contaminants.

(a) Recommended maximum contaminant levels are zero for the following microorganisms: total coliforms, *Giardia*, and viruses.

(b) Recommended maximum contaminant levels for the following microorganisms parameters are as indicated: Turbidity 0.1 Nephelometric Turbidity Unit.

[FR Doc. 85-28417 Filed 11-12-85; 8:45 am]
BILLING CODE 6560-50-M

I 124

END

DATE

FILMED

9-88

DTIC