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Original

CLOSURE PLAN

HYDRAZINE BLENDING AND STORAGE FACILITY

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ROCKY MOUNTAIN ARSENAL

Prepared for

US ARMY

PROGRAM MANAGER

RMA CONTAMINATION CLEANUP

by

EBASCO SERVICES INCORPORATED

DECEMBER, 1985

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AS A RESULT OF DISCUSSIONS WITH THE COLORADO DEPARTMENT OF HEALTH IN AUGUST, 1985, THIS CLOSURE PLAN FOR THE HYDRAZINE BLENDING AND STORAGE FACILITY (HBSF) HAS BEEN DEVELOPED. THE PLAN IS DIVIDED INTO SIX SECTIONS:
1. INTRODUCTION AND OVERVIEW OF THE HBSF CLOSURE REQUIREMENTS
2. HBSF DESCRIPTION AND HISTORY
3. WASTE CHARACTERIZATION
4. CLOSURE PLAN, DISCUSSION OF THE PROCEDURES TO BE EMPLOYED
5. SCHEDULE FOR CLOSURE
6. DESCRIPTION OF HOW THE FACILITY WILL BE CERTIFIED AS CLEAN UPON COMPLETION OF CLOSURE ACTIVITIES.

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SYNOPSIS OF GENERAL RCRA CLOSURE REQUIREMENTS	LOCATION IN CLOSURE PLAN/COMMENTS
265.110 Applicability	
Sections 265.111-265.115 apply to the owners and operators of all hazardous waste management facilities.	
265.111 Closure performance standard	
265.111(a) Must minimize need for further maintenance 265.111(b) Must control, minimize, or eliminate, to the extent necessary to prevent threats to human health and the environment, post-closure escape of hazardous waste or related substance	Section 4.3 All equipment and structures will be decontaminated. Waste will be treated and disposed.
265.112 Closure plan; amendment of plan	
265.112(a) Plan must identify steps necessary to completely or partially close the facility at any point during its intended operating life and to completely close the facility at the end of its intended operating life. The plan must include at least:	Section 4.3 Identification of steps necessary to completely close the facilit
(1) A description of how and when the facility will be partially closed, if applicable, and finally closed. The description must identify the maximum extent of the operation which will be unclosed during the life of the facility, and how the requirement of Sections 265.111, 265.113-115, and the closure requirements for containers (265.178) will be met.	No partial closures are anticipated.
265.112(b) The owner or operator may amend his closure plan at any time during the active life of the facility.	
265.112(c) The owner or operator must notify the Regional Administrator at least 180 days prior to the date he expects to begin closure.	In the revised Part-B application submitted on November 26, 1984, RMA informed CDH about the decision to close down HBSF.

SYNOPSIS OF GENERAL RCRA CLOSURE REQUIREMENTS	LOCATION IN CLOSURE PLAN/COMMENTS
265.113 Closure; time allowed for closure	
265.113(a) Hazardous wastes must be treated, removed, or disposed of on-site within 90 days after receiving the final volume of hazardous waste unless, in the judgment of the Regional Administrator, the activities required to comply with this paragraph will of necessity take longer than 90 days to complete, and the owner or operator has taken and will continue to take all steps to prevent threats to human health and the environment.	Section 5. The schedule for all the treatment and disposal of hazardous wast is furnished. Approval will be obtained to extend the 90 day time limit.
265.113(b) The owner or operator must complete closure activities within 180 days after receiving the final volume of hazardous wastes unless, in the judgment of the Regional Administrator, the activities required to comply with this paragraph will of necessity take longer than 180 days to complete, and the owner or operator has taken and will continue to take all steps to prevent threats to human health and the environment.	Section 5. The schedule for all the closure activity is furnished. Approval will be obtained to extend the 180 time limit.
265.114 Disposal or decontamination of equipment	
When closure is completed, all facility equipment and structures must have been properly disposed of or decontaminated by removing all hazardous waste and residues.	Section 5. The schedule for decontamination and disposal of all equipment is furnished.
265.115 Certification of Closure	
Certification must be submitted by both the owner or operator and an independent professional engineer when closure is completed as specified in the approved closure plan.	Section 6.
265.118 Post closure plan	Ground water monitoring will be addressed separately . PM-RMA has installed a boundary control system that prevents the possibility of contaminant migration off post.
266.12 Cost-estimates for facility closure	Not-applicable to federal facilities as per 266.10(c)
266.13 Cost-estimates for closure and post-closure	Not-applicable to federal facilities as per 266.10(c)
266.14 Financial assurance for closure and post closure	Not-applicable to federal facilities as per 266.10(c)
266.15 Use of a mechanism for financial assurance for both closure and post closure care.	Not-applicable to federal facilities as per 266.10(c)

SYNOPSIS OF GENERAL RCRA CLOSURE REQUIREMENTS	LOCATION IN CLOSURE PLAN/COMMENTS
(2) An estimate of the maximum inventory of wastes in storage and in treatment at any time during the life of the facility.	Section 3.1
(3) A description of the steps needed to decontaminate facility equipment during closure.	Section 4.3 Feasibility Study to define methods of decontamination and final disposition of waste.
(4) An estimate of the expected year of closure and a schedule for final closure. The schedule must include the total time required to close the facility and the time required for intervening closure activities.	Section 5.0 Schedule for closure plan.
265.176 Special requirements for ignitable or reactive waste	
Containers holding ignitable or reactive waste must be located at least 15 meters (50 feet) from the facility's property line (See Part 265.17, below).	Section 2.1 and 2.2.
265.17 General requirements for ignitable, reactive or incompatible Wastes	
265.17(a) The owner or operator must take precautions to prevent accidental reaction of the wastes. This waste must be separated and protected from sources of reaction or heating. While the waste is being handled, the owner or operator must confine smoking and open flame to specially designated locations. "No Smoking" signs must be conspicuously placed wherever there is a hazard from the reactive wastes.	Section 4.5 Discusses the Health and Safety Plan
265.17(b)The owner or operator must take precautions to prevent reactions which:	
(1) Generate extreme heat or pressure, fire or explosions, or violent reactions; (2) Produce uncontrolled toxic mists, dusts, or gases in sufficient quantity to threaten human health or the environment; (3) Produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions; (4) Damage the structural integrity of the device or facility; (5) Through other like means, threaten human health or the environment.	Sections 3.2, 3.3, 4.2, 4.4 and 4.5. Waste handling procedure will be reviewed by a Certified Industrial Hyginist.

REGULATORY MATRIX (Continued)

SYNOPSIS OF GENERAL RCRA CLOSURE REQUIREMENTS		LOCATION IN CLOSURE PLAN/COMMENTS
265.17(c)	The owner or operator must document compliance with applicable requirements of paragraphs (a) and (b). This documentation may be based on references to published scientific or engineering literature, data from trial tests, waste analyses, or the results of the treatment of similar waste by similar treatment processes under similar operating conditons.	Applicable requirements will be documented by waste analysis.
265.178	Closure (containers)	
	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues must be decontaminated or removed.	Section 4.3.

1.0 INTRODUCTION

The Rocky Mountain Arsenal (RMA), a U.S. Army installation, has been managing a number of Resource Conservation and Recovery Act (RCRA) regulated hazardous waste facilities including the Hydrazine Blending and Storage Facility (HBSF). The RMA's Environmental Protection Agency (EPA) identification number as a generator and owner/operator of hazardous waste storage/treatment/disposal facilities is C05 210 020 769.

On July 21, 1982, EPA Region VIII requested the RMA to submit the RCRA Part B permit application for the hazardous waste facilities. On May 23, 1983, the RMA submitted a draft RCRA Part B permit application, encompassing seven facilities, to EPA Region VIII. On May 10, 1984, EPA Region VIII issued a Notice of Deficiency of the application to the RMA.

On September 30, 1984, the State of Colorado received interim authorization from the EPA to administer equivalent state hazardous waste regulations in lieu of federal requirements. Under the state hazardous waste regulations the RCRA Part B permit application, for which no decision had been reached by the EPA, was to be resubmitted to the Colorado Department of Health (CDH), the state agency administering the hazardous waste regulations.

The RMA submitted a revised Part B application to the CDH on November 28, 1984. In the revised application, the RMA informed the CDH about the decision to close down the HBSF. In that submittal, the RMA also indicated to the CDH that the United States Air Force (USAF), the owner of the HBSF, had initiated a formal closure planning activity that would outline the closure scenario, and a formal closure plan would be submitted by the USAF at a later date. Because no information regarding closure of the facility was available to the RMA as of the refiling date, they did not include any information regarding the closure plan of HBSF in the revised permit application.

On June 24, 1985, the CDH informed the RMA by letter of the agency's tentative decision to deny a Colorado Hazardous Waste Permit for the HBSF. The CDH also indicated in that letter that the RMA will be required to submit a closure plan for the hydrazine facility within 15 days after the agency's intent to deny the permit application becomes effective (Part 265.112(c)).

On August 13, 1985, the Program Manager for the RMA Contamination Cleanup (PM-RMA) met with the CDH to discuss the closure plan requirements for the HBSF. As a result of that discussion the PM-RMA has developed this plan. The HBSF closure plan incorporates all requirements stated in the Colorado Hazardous Waste Regulation Part 265 Subpart G and Section 100. The plan is divided into six sections, summarized as follows:

- Section 1.0 - Introduction, provides an overview of the HBSF closure requirements;
- Section 2.0 - Hydrazine Blending and Storage Facility Description, provides an overview of the process involved and operating history of the facility;
- Section 3.0 - Waste Characteristics, provides a waste inventory and a characterization of the wastes present in the facility;
- Section 4.0 - Closure Plan, discusses the procedures to be employed for the closure of the facility;

- Section 5.0 - Schedule, outlines the timeframe within which the closure will be accomplished; and

- Section 6.0 - Certification of Closure, describes how the facility will be certified as clean upon completion of closure activities.

2.0 HYDRAZINE BLENDING AND STORAGE FACILITY

The RMA is located in Adams County, Colorado about 10 miles northeast of the central business district of Denver (Figure 2-1). The RMA encompasses 17,238 acres, including portions occupied by inactive and active waste storage and treatment facilities. The HBSF is located east of the South Plants area in the northeast corner of Section 1 (Figure 2-2).

2.1 PROCESS DESCRIPTION AND PHYSICAL FACILITY

The HBSF was constructed in 1959 for the U.S. Air Force (USAF) as a depot to receive, store, and blend hydrazine fuels and to issue these fuels to various customers. The facility is owned by the USAF, but has been operated by the RMA, a U.S. Army operation under an Interservice Support Agreement (ISSA) since 1960 (Hazard Abatement Plan, undated).

The primary objective of the HBSF was the production of the rocket fuel Aerozine 50. Aerozine 50 was produced at the facility by blending anhydrous hydrazine (AH) with unsymmetrical dimethylhydrazine (UDMH). These constituents were manufactured elsewhere and shipped to the RMA for the purpose of rocket fuel production.

Hydrazine operations consisted of downloading/uploading of railroad cars and tanker trucks, storage of rocket fuel and rocket fuel constituents, and blending of rocket fuels. Chemicals stored at the facility for fuel production included AH, UDMH and Aerozine 50. This facility was also used to store other fuels such as monomethyl hydrazine (MMH), monopropellant hydrazine (MPH) and hydrazine 70 (a hydrazine/water mixture). Chemicals to be transported were removed from bulk storage and placed in drums, rail cars or trucks (Hazard Abatement Plan, undated).

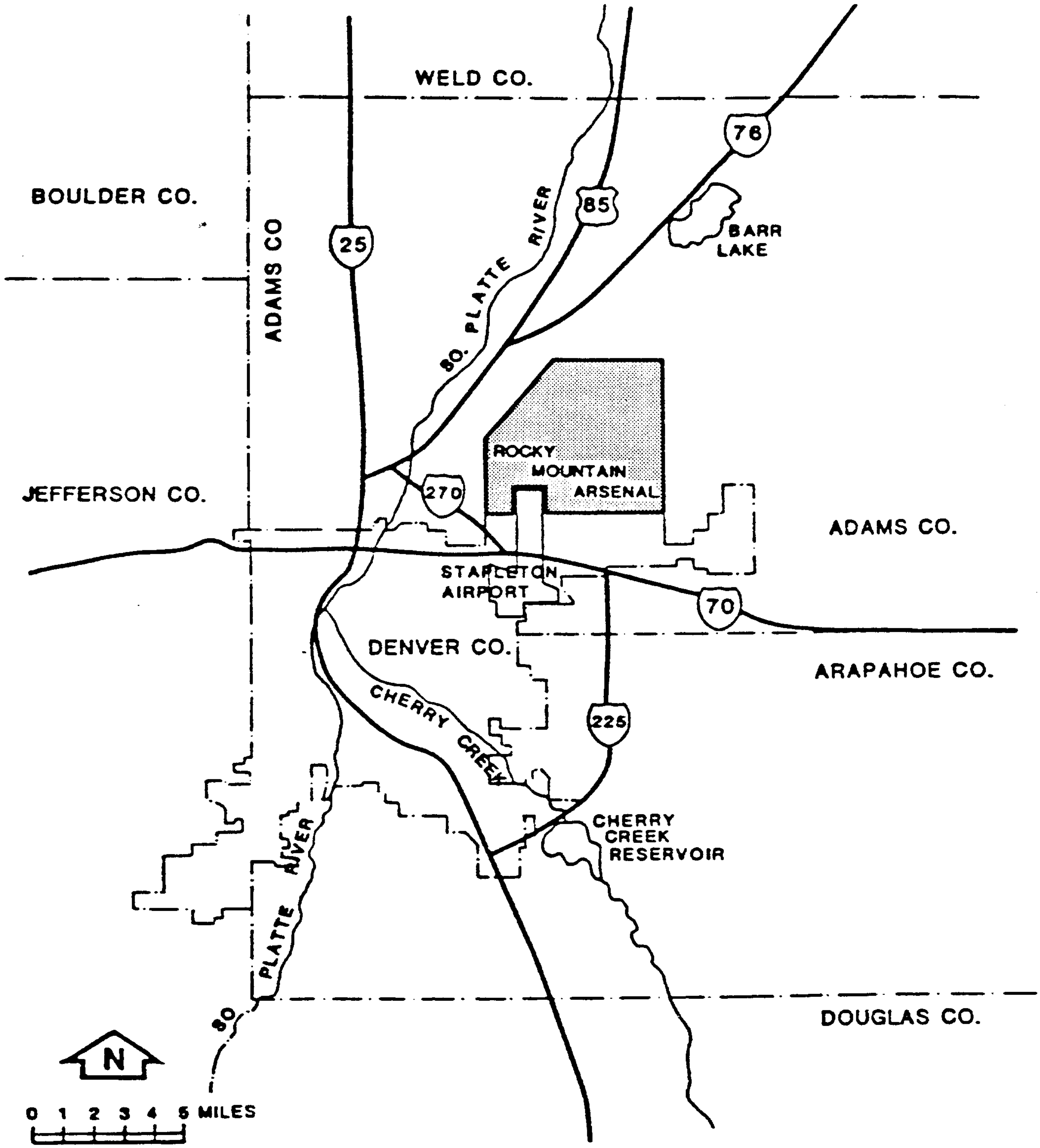
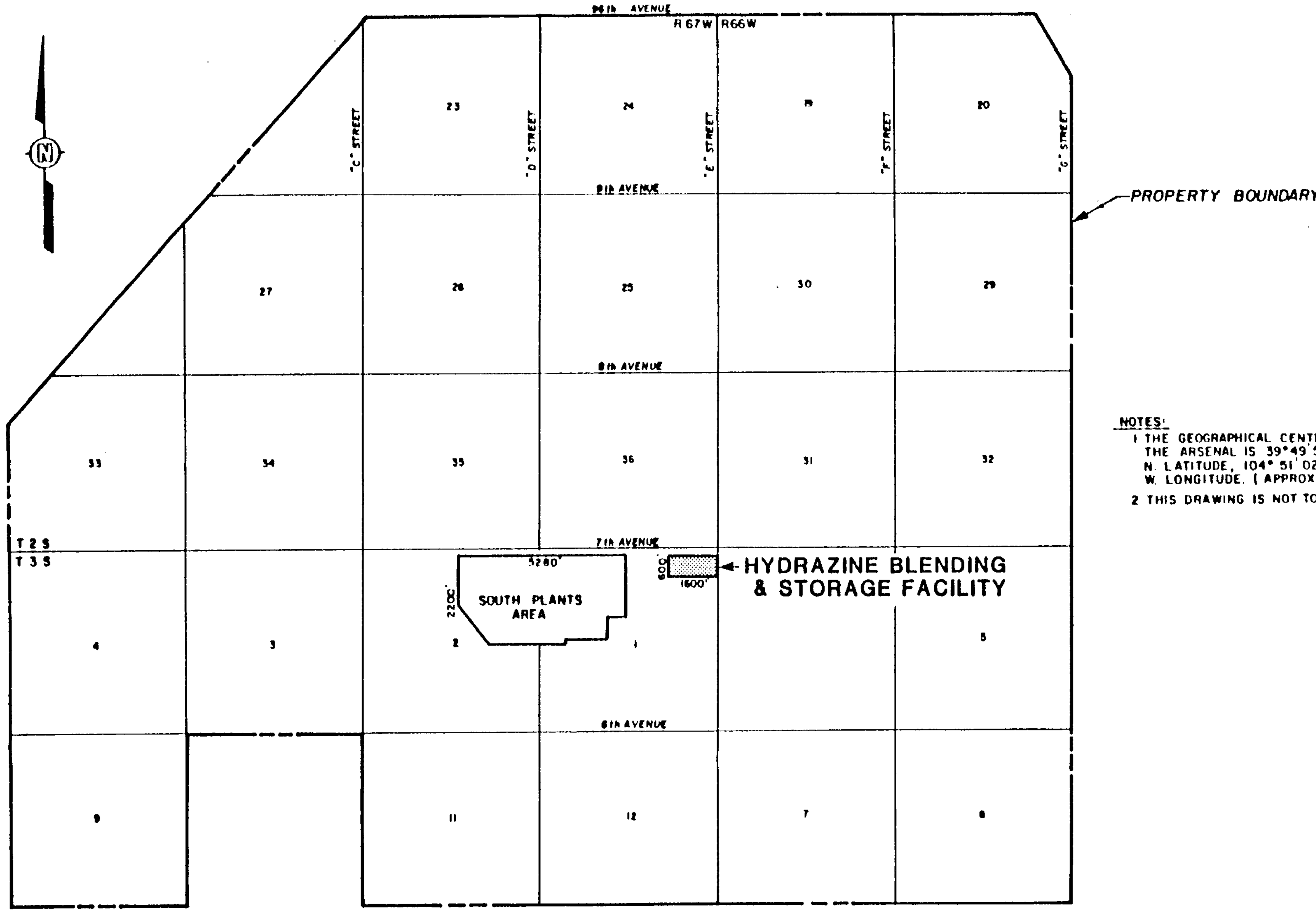


FIGURE 2-1
ROCKY MOUNTAIN ARSENAL LOCATION MAP



NOTES:
1 THE GEOGRAPHICAL CENTER OF THE ARSENAL IS 39°49'56" N. LATITUDE, 104°51'02" W. LONGITUDE. (APPROXIMATE)
2 THIS DRAWING IS NOT TO SCALE.

FIGURE 2-2
LOCATION OF HYDRAZINE BLENDING & STORAGE FACILITY AT RMA

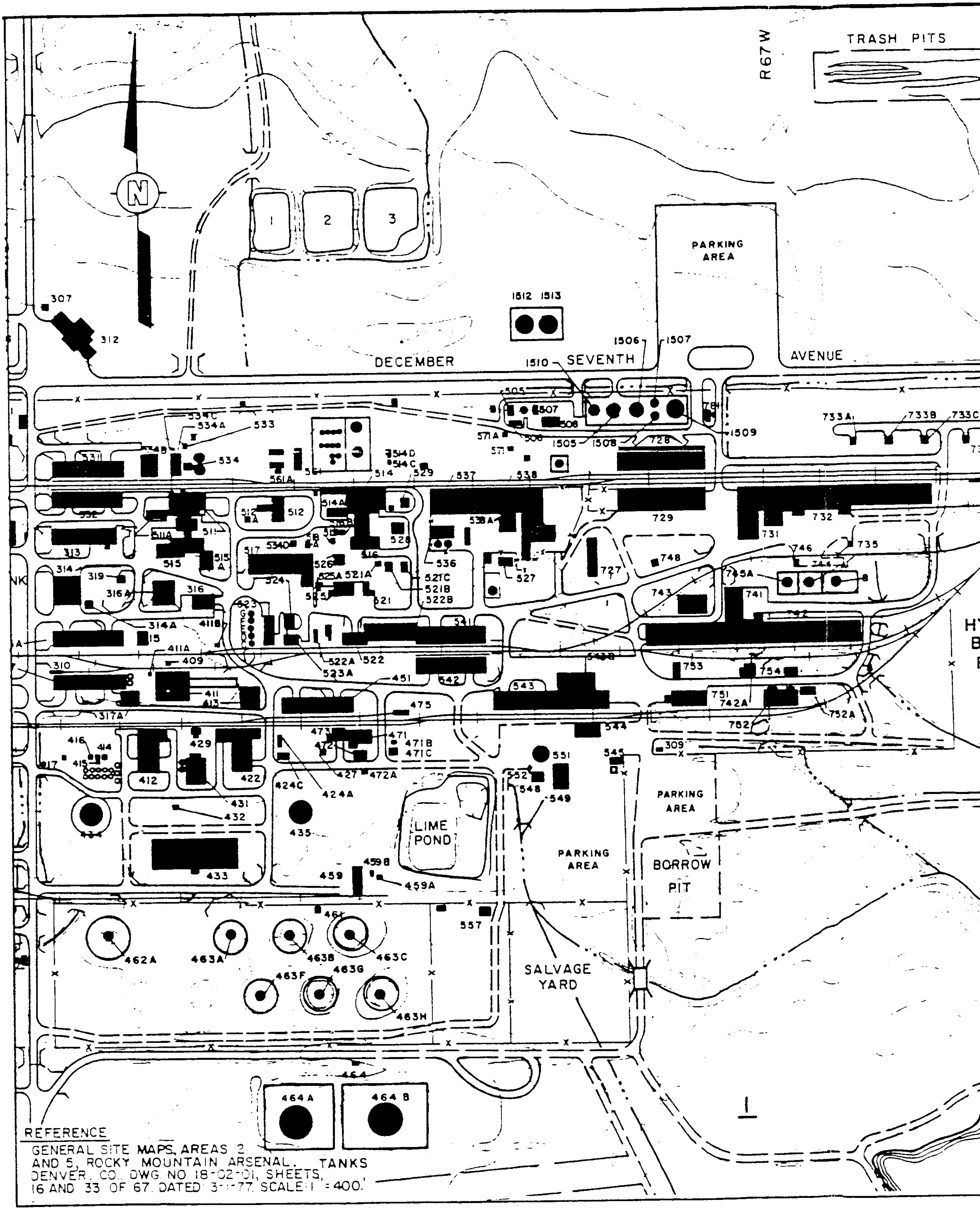
The existing hydrazine blending facility area is a limited access site which occupies approximately 960,000 square feet (see Figure 2-3), (1,600 ft x 600 ft). It is completely enclosed by two concentric security fences.

The facility consists of four carbon steel tanks (one of 50,000, one of 200,000, and two of 19,000-gallon capacity) that are compatible with UDMH and water only; four stainless steel tanks (each of 24,900-gallon capacity) compatible with all of the fuels; a 44,000-gallon capacity inground concrete tank for the collection of wastewaters and area runoff; a blender; a drum filling station; truck and railcar loading/offloading station; concrete pads and dikes; a drum storage pad; a storage shed; a tool shed; an office shed and associated piping. The two carbon steel storage tanks (one of 50,000 and one of 200,000-gallon capacities), located directly east of the facility have been used since 1982, only for wastewater storage. Each group of tanks has its own catch basin which drains to main inground concrete tank (44,000 gal). Figure 2-4 presents a schematic layout of the HBSF. A process flow schematic for the HBSF is shown in Figure 2-5.

Railroad tracks pass through the facility area. The HBSF also is served by water, electric power, and steam lines, and a nitrogen gas storage and feed system. The fuel handling facilities contain waterflood type fire protection fixtures and a circulating ethylene glycol-based heating system. Table 2-1 lists the major equipment and structures of the hydrazine blending and storage facility.

2.2 OPERATING HISTORY

This section provides a brief background on the operating history of the hydrazine blending facility: the types of materials processed, the wastes generated, the disposal methods used, and a description of major spills and other events that led to the shutdown of the facility.


TRASH PITS
R67W
N
PARKING AREA
DECEMBER SEVENTH AVENUE
LIME POND
PARKING AREA
PARKING AREA
BORROW PIT
SALVAGE YARD
TANKS
REFERENCE
GENERAL SITE MAPS, AREAS 2 AND 5, ROCKY MOUNTAIN ARSENAL, DENVER, CO., DWG NO 18-02-01, SHEETS, 16 AND 33 OF 67. DATED 3-1-77. SCALE 1" = 400.'

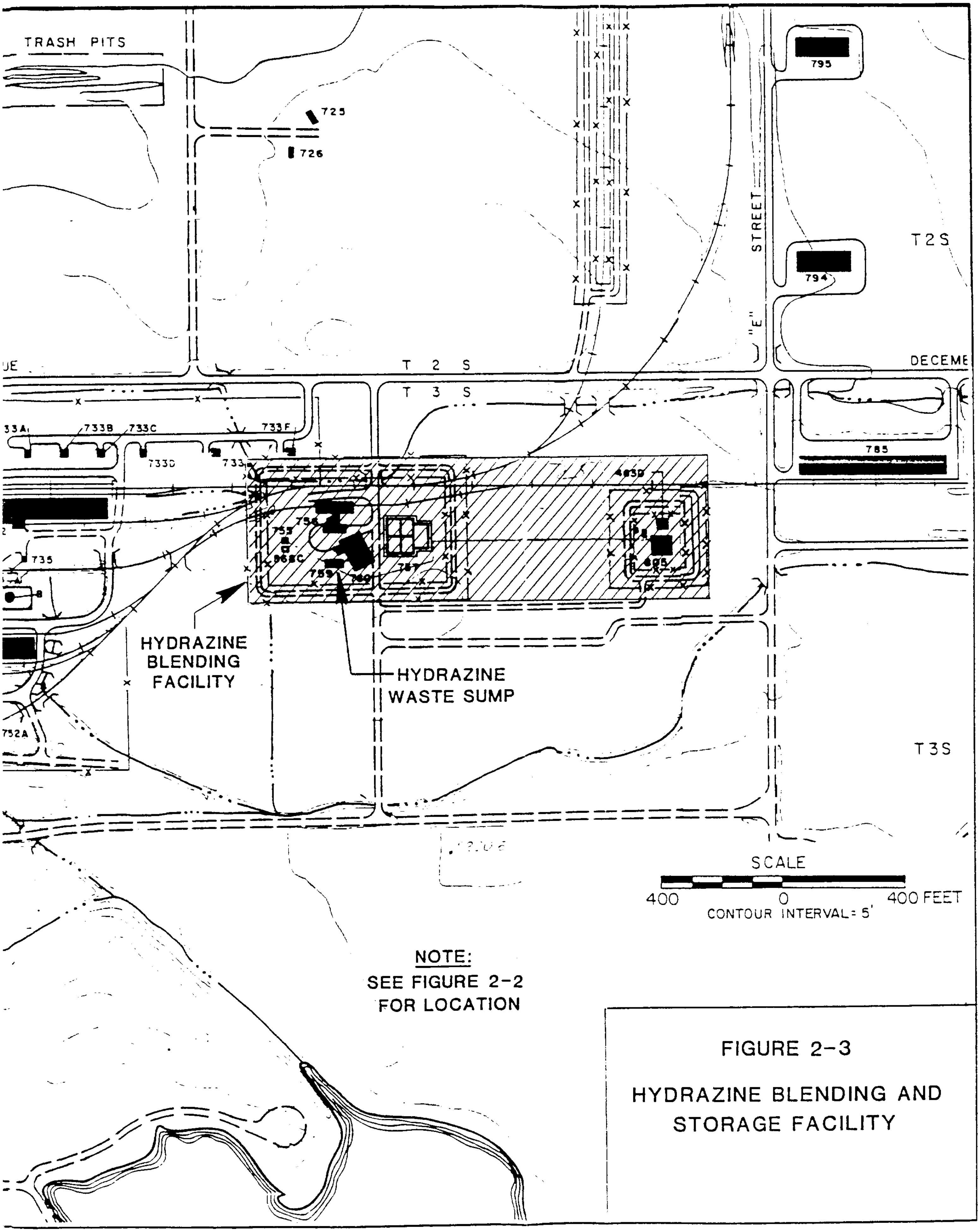
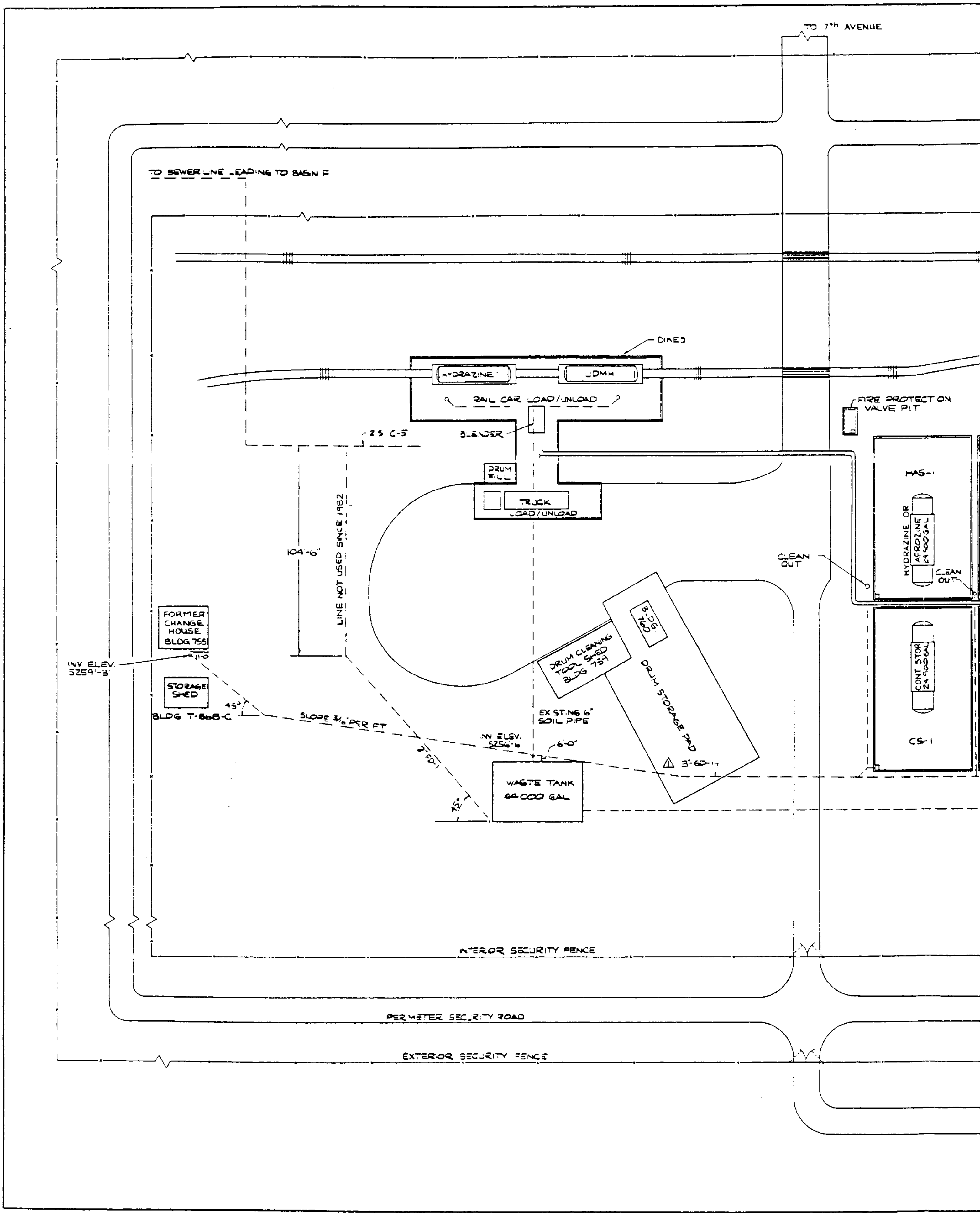


FIGURE 2-3

HYDRAZINE BLENDING AND STORAGE FACILITY



TO 7TH AVENUE
TO SEWER LINE LEADING TO BASIN F
DIKES
HYDRAZINE
UDMH
RAIL CAR LOAD/UNLOAD
BLENDER
25 C-5
DRUM FILL
TRUCK LOAD/UNLOAD
FIRE PROTECTION VALVE PIT
HAS-1
HYDRAZINE OR AEROZINE 24,900 GAL
CLEAN OUT
CLEAN OUT
CONT STOR 24,900 GAL
CS-1
104'-6"
LINE NOT USED SINCE 1982
FORMER CHANGE HOUSE BLDG 755
INV ELEV. 5259'-3
STORAGE SHED
BLDG T-868-C
45°
SLOPE 3/16" PER FT
2'-0"
75°
INV ELEV. 5256'-6
6'-0"
EXISTING 6" SOIL PIPE
DRUM CLEANING TOOL SHED BLDG 759
BLDG 760
DRUM STORAGE PAD
3'-6"
WASTE TANK 44,000 GAL
INTERIOR SECURITY FENCE
PERIMETER SECURITY ROAD
EXTERIOR SECURITY FENCE

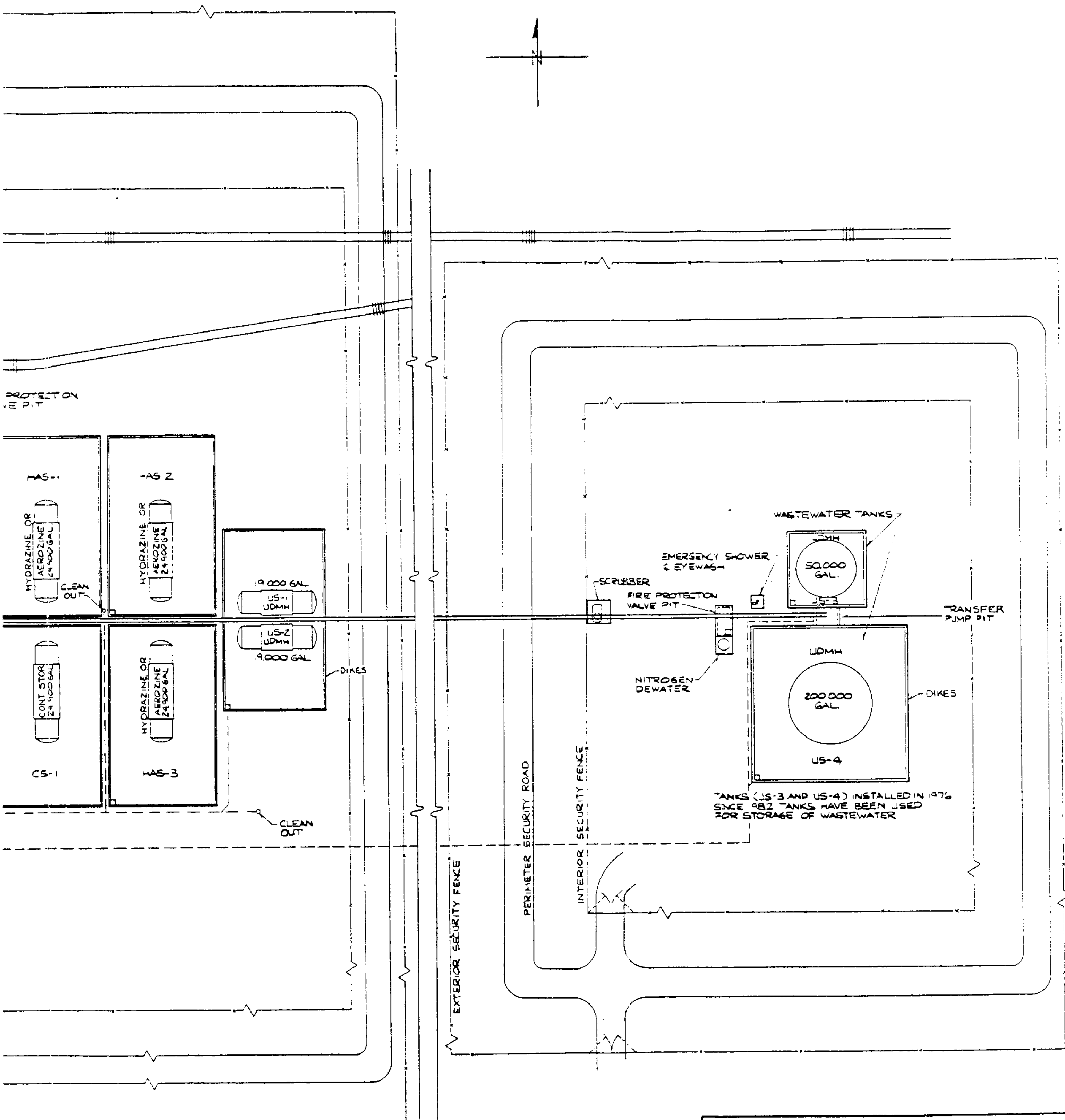
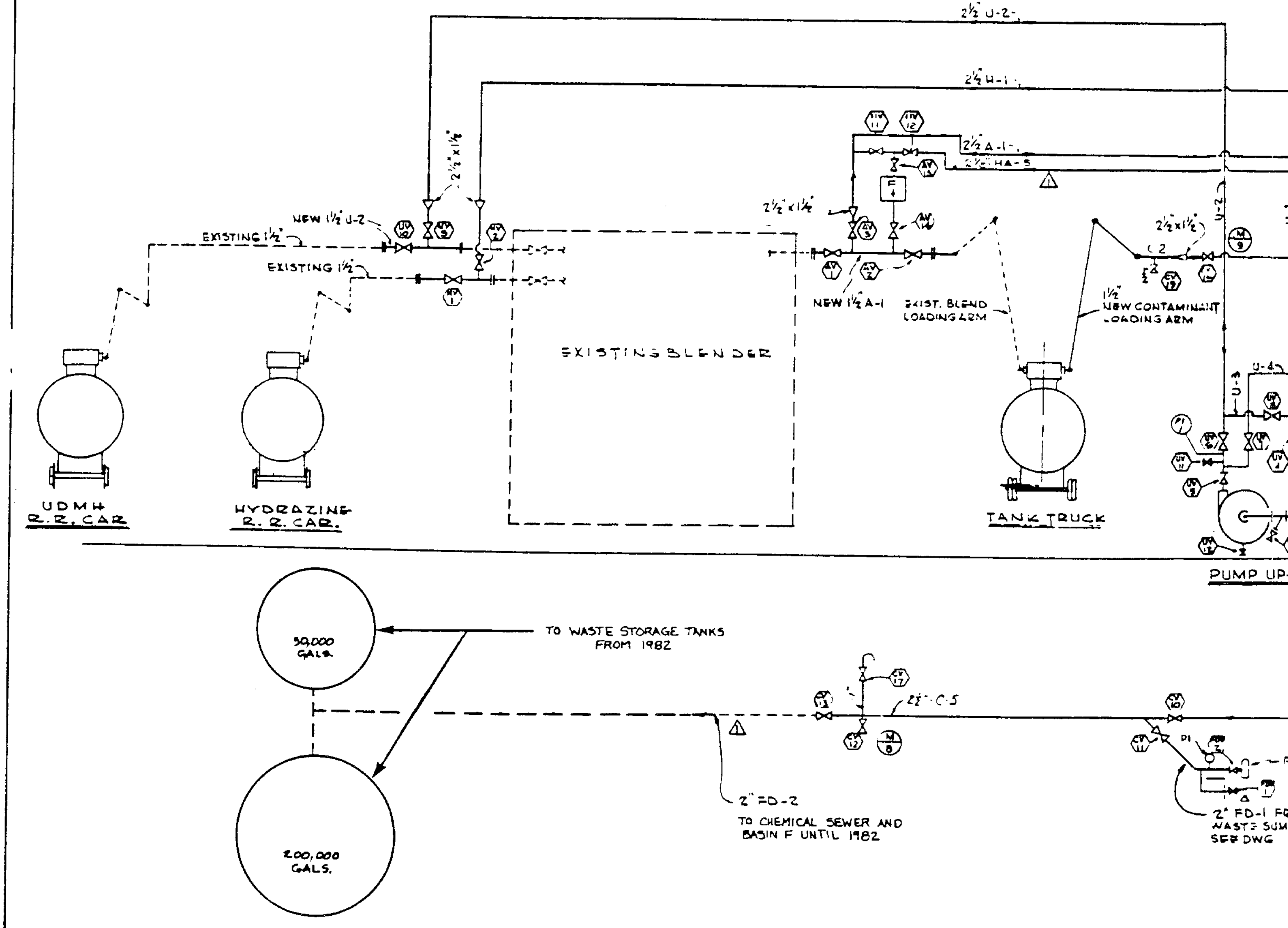


FIGURE 2-4
SCHEMATIC LAYOUT
HYDRAZINE BLENDING
AND STORAGE FACILITY
ROCKY MOUNTAIN ARSENAL



2½" U-2
2½" H-1
2½" A-1
2½" HA-5
2½" x 1¼"
NEW 1½" U-2
EXISTING 1½"
EXISTING 1½"
EXISTING BLENDER
NEW 1½" A-1
EXIST. BLEND LOADING ARM
1½" NEW CONTAMINANT LOADING ARM
2½" x 1½"
UDMH R.R. CAR
HYDRAZINE R.R. CAR
TANK TRUCK
50,000 GALS.
TO WASTE STORAGE TANKS FROM 1982
200,000 GALS.
2½" C-5
2" FD-2
TO CHEMICAL SEWER AND BASIN F UNTIL 1982

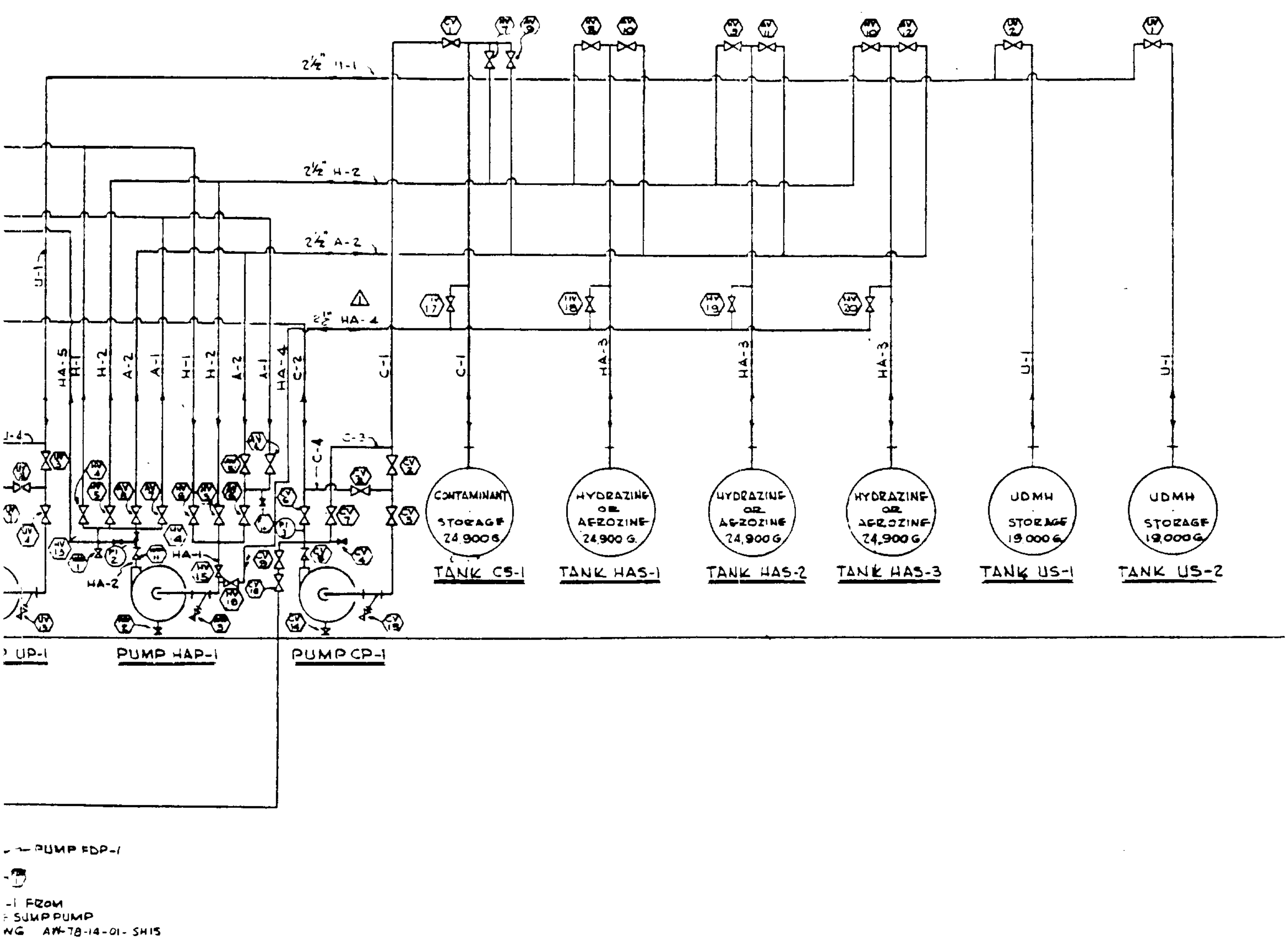


FIGURE 2-5

PROCESS FLOW DIAGRAM
HYDRAZINE BLENDING AND
STORAGE FACILITY

TABLE 2-1

MAJOR EQUIPMENT AND STRUCTURES OF THE HYDRAZINE BLENDING FACILITY

	Item	Description
1.	Railroad Tank Car Facility	
	Enclosed Area	120'-0" x 30'-0"
	Function	Unloading of anhydrous hydrazine and UDMH from railroad tanker cars
	Construction Material	Reinforced concrete. Metal sheets.
2.	Blender	
	Function	Blend Hydrazine and UDMH to produce Aerozine 50
	Construction Material	Reinforced concrete. Metal sheets
3.	Drum Loading Station (Bldg 761)	
	Area	22' - 0" x 10'0"
	Function	Loading of Aerozine 50
	Construction Material	Reinforced concrete
4.	Truck Loading Station	
	Area	60'-0" x 18'-0"
	Function	Loading of Aerozine 50 into tanker trucks
5.	Office Shed/Change House (Bldg 755)	
	Size	20'-0" x 24'-0" x 9'-0"
	Construction Material	8" masonry (concrete block)
6.	Inground Concrete Tank	
	Area	40'-0" x 26'-0"
	Volume	44,000 gallons
	Function	Receive wastewater and stormwater runoff
	Construction Material	Concrete
7.	Building 759	
	Size	40'-0" x 20'-0" x 10'-0"
	Function	Drum cleaning
	Construction Material	Metal siding/metal roofing

TABLE 2-1 (Continued)

MAJOR EQUIPMENT AND STRUCTURES OF THE HYDRAZINE BLENDING FACILITY

	Item	Description
8.	Shelter (Bldg. 760)	
	Location	In drum storage area
	Size	20' x 0" x 10'-10"
9.	Drum Storage Pad	
	Size	70'-0" x 45'-0" x 6"
	Function	Storage of drums
10.	Aerozine Storage Tanks	
	Number of Tanks	3 (HAS 1, HAS 2, HAS 3)
	Geometric Shape	Cylindrical, Horizontal
	Volume	24,900 gallons
	Construction Material	Stainless steel
	Located	Inside concrete dikes
	Size of Dike	53'-6" x 47'-0" x 5'-0"
11.	Anhydrous Hydrazine Storage Tank	
	Number of Tanks	1 (CS 1)
	Geometric Shape	Cylindrical, Horizontal
	Volume	24,900 gallons
	Construction Material	Stainless steel
	Located	Inside concrete dike
	Size of Dike	53'-6" x 47'-0" x 5'-0"
12.	UDMH Storage Tanks	
	Number of Tanks	2 (US-1, US-2)
	Geometric Shape	Cylindrical, Horizontal
	Volume	19,000 gallons
	Construction Material	Carbon steel
	Located	Inside concrete dike
	Size of Dike	43'-0" x 77'-0" x 5'-0"
13.	Wastewater Tanks	
	Number of Tanks	2 (US-3, US-4)
	Geometric Shape	Cylindrical, Vertical
	Volume	50,000 gallons and 200,000 gallons
	Construction Material	Carbon Steel
14.	Pumps	
	Number	6 (HWP-1, HWP-2, UP-1, HAP-1, CP-1, FDP-1)
	Liquids	Hot water, waste water, UDMH, hydrazine, aerozine, contaminants

TABLE 2-1 (Continued)

MAJOR EQUIPMENT AND STRUCTURES OF THE HYDRAZINE BLENDING FACILITY

	Item	Description
15.	Pipes* (Above Ground)	
	Diameter	2.5"
	Number	18 (U-1, U-2, U-3, U-4, HA-1, HA-2, HA-3, HA-4, HA-5, A-1, A-2, H-1, H-2, C-1, C-2, C-3, C-4, C-5)
	Diameter	3.0"
	Number	2 (HWR-1, HWS-2)
	Diameter	4.5"
	Number	1 (V-1)
16.	Scrubbers	
	Number	2
	Location	One at blender area, one at wastewater tank area
17.	Fire Protection Valve Pit	
	Number	2
	Location	One near hydrazine/aerozine tank area and one near wastewater tank area

*There is a variety of underground piping at the HBSF. IT will be removed as part of the closure activities.

2.2.1 Types of Material Processed

The hydrazine blending facility has been used primarily for the production of Aerozine 50 missile fuel which is approximately 50 percent AH and 50 percent UDMH. Blending operations were not continuous, but occurred in response to requests by the USAF. The facility also has been used to store other fuels such as monopropellant hydrazine (MPH) and hydrazine 70 (hydrazine/water mixture). The USAF utilized the RMA facility as a depot to receive, store, blend and issue hydrazine fuels to various customers.

2.2.2 Generation and Disposal of Wastes

It was estimated that a maximum of approximately 300,000 gallons of wastewater had been generated annually from the HBSF (USATHAMA, 1979). Most of the wastewater from this facility was generated during blending operations. During the blending process, the off-gases were scrubbed with water. This water was then collected by gravity in the 44,000-gallon inground concrete tank (40 ft x 26 ft x 7.5 ft) located south of the hydrazine blender (Figure 2-4). The storage area catch basins, waste drains in the blender facility, and the steam expansion line from Building 755 also drained into the inground concrete tank. Waste materials were carried to the sump by underground pipes.

During more active years of facility production, many of the drums were returned to the facility for filling. Dirty drums and also drums where the fuel to be filled was different from what was already present, were cleaned before filling. These residues were poured into the inground concrete tank. These drums were then washed in the open area south and east of Building 755 (Figure 2-4).

The contents of the inground concrete tank were neutralized by batch treatment with solid calcium hypochlorite to oxidize the hydrazine to ammonia and water. It was necessary to maintain a pH between 7 and 10 for effective neutralization to occur. Mixing of the waste and hypochlorite was accomplished by recirculating the inground concrete tank contents through a transfer pump, located in the southwest corner of the inground concrete tank. The neutralization process resulted in the accumulation of large amounts of sediment or solid sludge in the inground concrete tank. This sludge was collected and transported to pits in Section 30 and 36 for disposal from 1975 through 1978 (Kuzunear and Trautmann, 1980). Until 1982 the treated wastewater from the inground concrete tank was pumped into Basin F (located in Section 26) via the industrial sewer. In 1982, the industrial waste discharge into Basin F was eliminated by excavating the portion of industrial (chemical) sewer feeding the basin. After that time, the neutralized wastewater from the inground concrete tank was pumped to two storage tanks (Tanks US-3 and US-4) originally used for UDMH storage. An exception was about 10,000 gallons of wastewater which was shipped to Lowry Landfill.

2.2.3 Spill History

In November 1975, the fire protection system at the hydrazine facility malfunctioned due to a power outage. Several hundred thousand gallons of water filled the pit around the largest UDMH storage tank causing it to float. No fuels or wastewaters were spilled. To remedy this situation, the water from the pit area was pumped onto the fields to the east and south of the east yard (Trautmann, undated).

In May 1976, approximately 4 inches of UDMH leaked from the largest tank within the surrounding dike area. The UDMH was pumped to the sump and was neutralized for disposal into Basin F (Trautmann, undated).

2.2.4 OSHA Survey

During January, February, and March 1982, the U.S. Occupational Safety and Health Agency's (OSHA) District Office conducted sampling of the

HBSF work area during both operational and nonoperational periods. The sampling and analysis were limited to hydrazine, UDMH, and NDMA. Analysis of the OSHA sample indicated the presence of airborne NDMA at various locations within the HBSF. Table 2-2 presents the location and concentration of contaminants found by OSHA at the HBSF (Hazard Abatement Plan, undated). OSHA advised RMA to upgrade worker health and safety protection level before continuing operation of the HBSF.

2.2.5 AEHA Survey

In December 1982, United States Army Environmental Hygiene Agency (AEHA) conducted a sampling program at the HBSF to quantify worker exposures to NDMA, UDMH, and hydrazine (AEHA, 1982). AEHA collected samples at specific work locations based on known or potential hydrazine, UDMH and/or NDMA release or contamination. Figure 2-6 presents sampling locations used by AEHA. Results of this sampling program are presented in Tables 2-3 and 2-4.

The significant findings of this sampling program are:

a. The samples from the general area contained insignificant levels of both hydrazine and UDMH as indicated in Table 2-3. (The detectable limits were 0.05 ug/m^3 for hydrazine and 0.1 ug/m^3 for UDMH.

b. The wipe samples from the drum filling nozzles and connectors, mixing and blending area showed relatively low levels of hydrazine and UDMH as indicated in Table 2-4.

c. The atmosphere samples taken from all work area showed low but detectable level of contamination with NDMA as indicated in Table 2-3.

TABLE 2-2

RESULT OF ANALYSIS OF SAMPLES TAKEN BY OSHA AT VARIOUS LOCATIONS AT HBSF

Date	Sample ID	Type	Operation	Location of Sampler	Sampling Period (Min)	Contaminant	Exposure	Time Weighted Average (TWA)
01/28/82	RMA 1 and 3	Area	Transfer from storage tank to truck tanker	In Office	50	Dimethyl Amine	N.D.	--
	RMA 2 and 4	Area		Sump (North side)	50	Dimethyl Amine	N.D.	--
	RMA 11	Area		Office	200	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 17	Area		Office	51	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 12	Area		Sump (north side)	200	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 18	Area		Sump (north side)	43	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 13	Area		Support beam near office	200	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 19	Area		Support beam near office	41	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 23	Area		Office	252	NDMA	10.0 ug/m^3	5.25 ug/m^3
	RMA 24	Area		Sump (north side)	242	NDMA	4.1 ug/m^3	2.1 ug/m^3
	RMA 25	Area		Support beam near office	240	NDMA	1.5 ug/m^3	.25 ug/m^3
02/25/82	RMA 40	Area	Background levels	N.W. Corner Tank Farm	276	NDMA	0.58 ug/m^3	0.33 ug/m^3
	RMA 41	Area		Office	274	NDMA	2.7 ug/m^3	1.54 ug/m^3
	RMA 42	Area		Sump (N.E. corner)	274	NDMA	2.7 ug/m^3	1.54 ug/m^3
	RMA 43	Area		Sump (S.W. coner)	274	NDMA	1.8 ug/m^3	1.03 ug/m^3
	RMA 44	Area		North Out Building	270	NDMA	0.37 ug/m^3	--
	RMA 45	Area		Truck Loading Bay	269	NDMA	2.6 ug/m^3	1.46 ug/m^3
	RMA 46	Area		Rail Car Loading Bay	268	NDMA	1.5 ug/m^3	0.84 ug/m^3
	RMA 47	Area		Control Station	267	NDMA	2.6 ug/m^3	1.45 ug/m^3
	RMA 48	Area		Drum Storage	266	NDMA	0.43 ug/m^3	0.74 ug/m^3
	RMA 49	Area		Tank Farm Between NAS and CS 1	265	NDMA	2.3 ug/m^3	1.3 ug/m^3
	RMA 50	Area		S.E. Corner Tank Farm	263	NDMA	1.0 ug/m^3	0.55 ug/m^3
	RMA 51	Area		Outer Gate (North)	262	NDMA	0.30 ug/m^3	--
03/10/82	RMA 55	Area	Background Levels at other parts of the Arsenal	North side building 111	252	NDMA	N.D.	--
	RMA 56	Area		N.E. side basin "F"	198	NDMA	N.D.	--
	RMA 58	Area		South side building 831	193	NDMA	N.D.	--
	RMA 60	Area		E. side building 1710 (Clinic)	191	NDMA	N.D.	--
	RMA 62	Area		S. of building 538	172	NDMA	N.D.	--
	RMA 64	Area		Building 314 in lunch room	171	NDMA	N.D.	--
	RMA 57	Area		N.E. side basin "F"	193	Hydrazine	N.D.	--
						UDMH	N.D.	--

1000a

TABLE 2-2 (Continued)

RESULT OF ANALYSIS OF SAMPLES TAKEN BY OSHA AT VARIOUS LOCATIONS AT HBSF

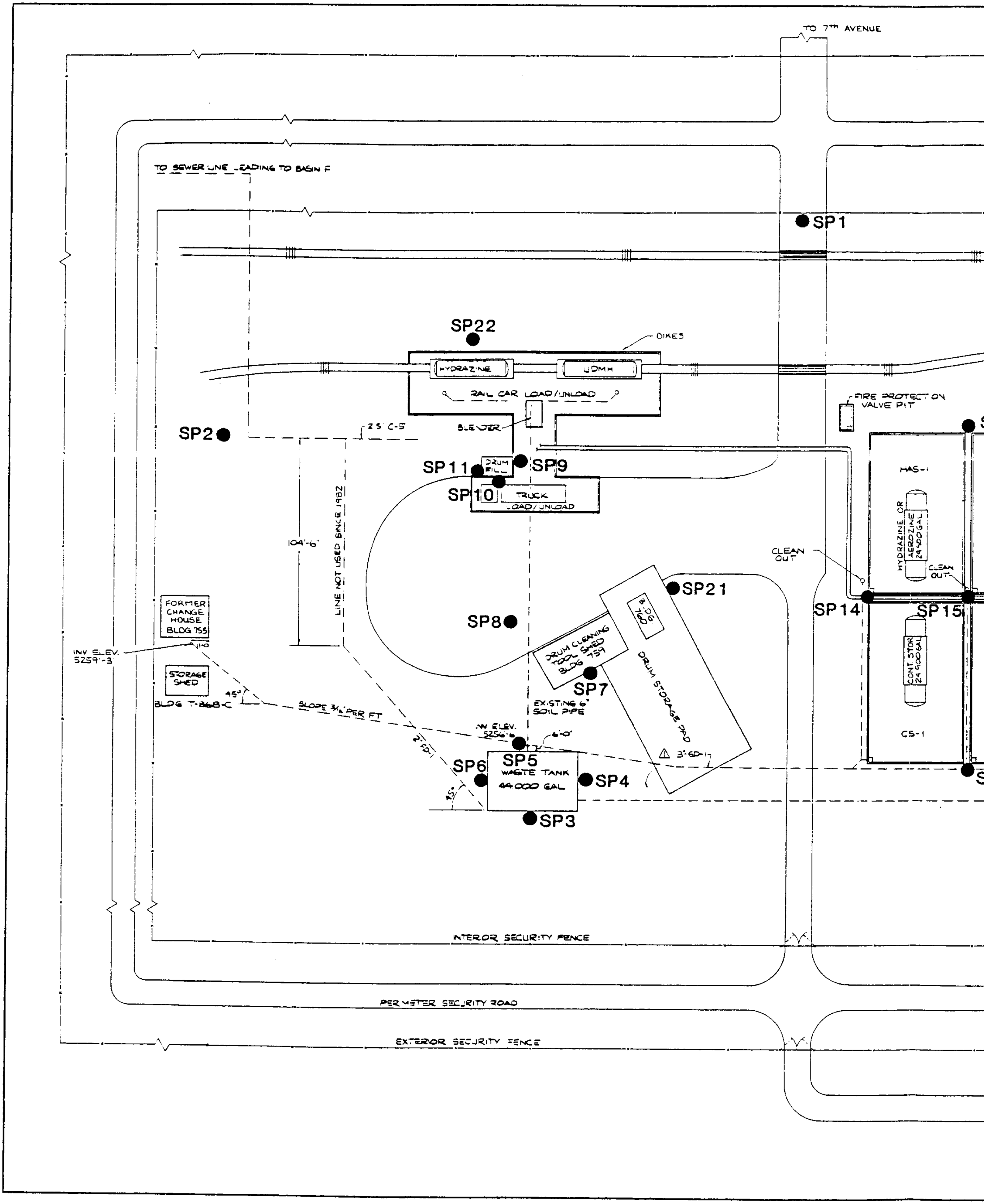
Date	Sample ID	Type	Operation	Location of Sampler	Sampling Period (Min)	Contaminant	Exposure	Time Weighted Average (TWA)
	RMA 59	Area		South side building 831	193	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 61	Area		E. side building 1710 (Clinic)	190	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 63	Area		South of building 538	172	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 65			Building 314 in lunch room	170	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 69	Area	Draining Sump	On retaining wall of storage tank east of hydrazine facility	60	NDMA	N.D.	--
	RMA 68	Area		On retaining wall of storage tank east of hydrazine facility	60	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 93	Area	Transfer UDMH from rail car to storage tank.	Near scrubber vent	183	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 94	Area		Near scrubber vent	120	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 95	Area		Near scrubber vent	186	NDMA	1.3 ug/m^3	1.81 ug/m^3
	RMA 96	Area		Near scrubber vent	118	NDMA	5.3 ug/m^3	--
	RMA 98	Area		In office	235	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 99	Area		In office	66	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 100	Area		In office	303	NDMA	1.1 ug/m^3	.69 ug/m^3
	RMA 102	Area		At control panel	230	Hydrazine	16.0 ug/m^3	9.9 ug/m^3
						UDMH	56.0 ug/m^3	43.01 ug/m^3
	RMA 103	Area		At control panel	67	Hydrazine	N.D.	--
						UDMH	116.0 ug/m^3	--
	RMA 104	Area		At control panel	298	NDMA	30.0 ug/m^3	18.63 ug/m^3
3/82	RMA 78	Area	Draining Sump	In office near drain	240	NDMA	3.5 ug/m^3	1.25 ug/m^3
	RMA 79	Area		North out building on refrigerator	240	NDMA	E.42 ug/m^3	--
	RMA 81	Bulk		Sump water		NDMA	180.0 ug/m^3	--
	RMA 82	Bulk		Sump water		Hydrazine		
						UDMH		

TABLE 2-2 (Continued)

RESULT OF ANALYSIS OF SAMPLES TAKEN BY OSHA AT VARIOUS LOCATIONS AT HBSF

Date	Sample ID	Type	Operation	Location of Sampler	Sampling Period (Min)	Contaminant	Exposure	Time Weighted Average (TWA)
3/82	RMA 92	Area	Transfer of rail car of UDMA	Scrubber near vent pipe (Bubbler)	300	NDMA	1.8 ug/m^3	1.13 ug/m^3
	RMA 97	Area		Office (bubbler)	298	NDMA	.27 ug/m^3	.17 ug/m^3
	RMA 101	Area		Control panel (bubbler)	249	NDMA	16.9 ug/m^3	10.35 ug/m^3
	RMA 105	Area		Tank farm, east side	293	NDMA	.14 ug/m^3	.045
ug/m^3				of US 1				
	RMA 106	Area		On top tank CS 1	228	Hydrazine	N.D.	--
						UDMH	N.D.	--
03/17/82	RMA 107	Area	Transfer UDMH from rail car to storage tank	On top tank CS 1	66	Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 108	Area		On top tank CS 1	294	NDMA	N.D.	--
	RMA 112	Wipe		Abe Padilla's apron	N/A	NDMA	N.D.	--
						Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 113	Wipe		Rudy Martinez's apron	N/A	NDMA	N.D.	--
						Hydrazine	5.7 ug/m^3	--
						UDMH	N.D.	--
	RMA 114	Wipe		Dip sticks used to gauge tanks	N/A	NDMA	N.D.	--
						Hydrazine	N.D.	--
						UDMH	N.D.	--
	RMA 115	Wipe		Desk in office	N/A	NDMA	N.D.	--
						Hydrazine	N.D.	--
						UDMH	N.D.	--

1000a


TO 7TH AVENUE
TO SEWER LINE LEADING TO BASIN F
SP1
SP22
DIKES
HYDRAZINE
UDMH
RAIL CAR LOAD/UNLOAD
FIRE PROTECTION VALVE PIT
SP2
BLENDER
25' C-5
SP11
DRUM FILL
SP9
SP10
TRUCK LOAD/UNLOAD
HAS-1
HYDRAZINE OR AEROZINE 24,900 GAL
104'-6"
LINE NOT USED SINCE 1982
CLEAN OUT
SP21
BLDG 760
SP14
SP15
SP8
FORMER CHANGE HOUSE BLDG 755
INV ELEV. 5259'-3
DRUM CLEANING TOOL SHED BLDG 759
DRUM STORAGE PAD
CONT STOR 24,900 GAL
STORAGE SHED
BLDG T-868-C
45°
SLOPE 3/16" PER FT
SP7
EXISTING 6" SOIL PIPE
INV ELEV. 5256'-6
6'-0"
CS-1
SP6
SP5
WASTE TANK 44,000 GAL
SP4
SP3
INTERIOR SECURITY FENCE
PERIMETER SECURITY ROAD
EXTERIOR SECURITY FENCE

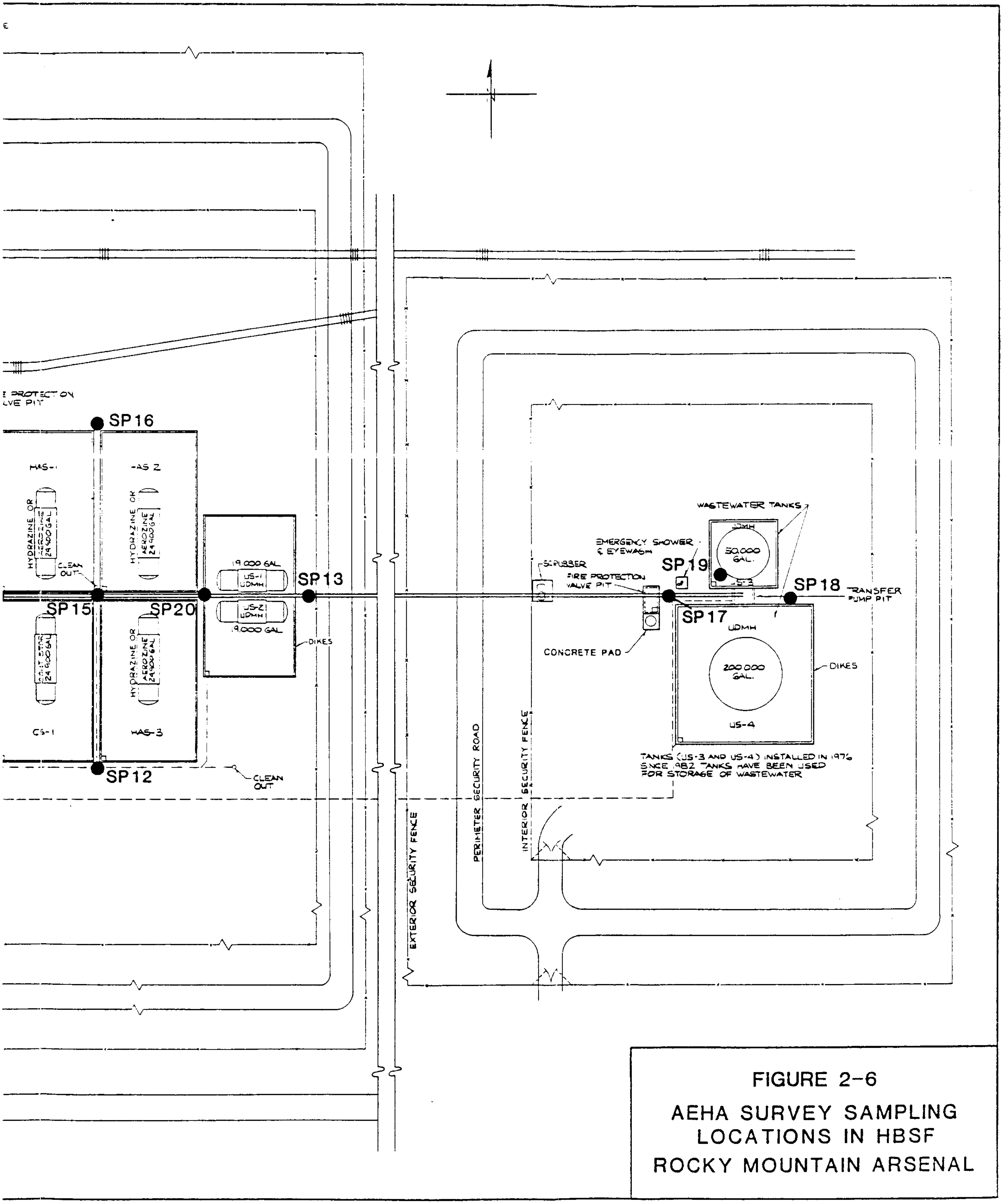


FIGURE 2-6

AEHA SURVEY SAMPLING LOCATIONS IN HBSF ROCKY MOUNTAIN ARSENAL

TABLE 2-3

RESULTS OF ANALYSES OF ATMOSPHERIC SAMPLES
COLLECTED BY U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY, DECEMBER 1982

Sampling Point	Simultaneous Samples: Hyd/UDMH Sample No.	Simultaneous Samples: NDMA Sample No.	Sample Results (in micrograms/cubic meter-ug/m^3): Hydrazine	UDMH	NDMA
SP-1	SG-47, FB-03, FB-38	AO 3489, AO 3407	< 0.05	< 0.10	ND - Traces
SP-2	FB-07, FB-09	AO 3410, AO 3486	< 0.05	< 0.10	ND
SP-3	SG-10, SG-37, FB-23, FB-52, FB-36	AO 3066, AO 3475, AO 3401, AO 3480	< 0.05	< 0.10	Trace - 1.70
SP-4	SG-06, SG-36, FB-08 FB-10, FB-42	AO 3061, AO 3476, AO 3478, AO 3488	< 0.05	< 0.10	0.18 - 1.50
SP-5	SG-09, SG-38, FB-24, FB-16, FB-13	AO 3063, AO 3491, AO 3399, AO 3482	< 0.05	< 0.10	Trace - 2.60
SP-6	SG-08, SG-33, FB-31, FB-22, FB-41	AO 3059, AO 3073, AO 3409, AO 3481	< 0.05	< 0.10	ND - 1.50
SP-7	SG-03, SG-12	AO 3071, AO 3069	< 0.05	< 0.10	1.30 - 1.70
SP-8	SG-07, SG-18	AO 3058, AO 3070	< 0.05	< 0.10	4.20 - 10.0
SP-9	SG-11, SG-34, SG-32 FB-21, FB-12	AO 3064, AO 3068, AO 3490, AO 3411, AO 3427	< 0.05	< 0.10	3.40 - 18.0
SP-10	SG-13, SG-16, SG-31 FB-01, FB-40	AO 3072, AO 3060, AO 3479, AO 3406	< 0.05	< 0.10	0.27 - 12.0
SP-11	SG-14, SG-15, SG-39 FB-02, FB-43	AO 3074, AO 3065, AO 3477, AO 3402	< 0.05	< 0.10	0.55 - 20.0

Trace - Value between 0.05 and 0.15 ug/m^3.
ND - None Detected, value < .05 ug/m^3.

TABLE ⌞-3 ⌟ontinued)

Sampling Point	Simultaneous Samples: Hyd/UDMH Sample No.	Simultaneous Samples: NDMA Sample No.	Sample Results (in micrograms/cubic meter-ug/m^3): Hydrazine	UDMH	NDMA
SP-12	FB-04, FB-15	AO 3487, AO 3398	< 0.05	< 0.10	0.50 - 1.90
SP-13	FB-63, FB-18	AO 3393, AO 3396	< 0.05	< 0.10	1.00 - 4.70
SP-14	FB-47, FB-27	AO 3397, AO 3394	< 0.05	< 0.10	0.63 - 1.20
SP-15	FB-58, FB-37	AO 3404, AO 3484	< 0.05	< 0.10	0.92 - 1.00
SP-16	FB-45, FB-36	AO 3392, AO 3483	< 0.05	< 0.10	0.62 - 1.10
SP-17	FB-33, FB-59	AO 3413, AO 3417	< 0.05	< 0.10	Trace 0.16
SP-18	FB-39, FB-17	AO 3412, AO 3416	< 0.05	< 0.10	0.24 - 0.62
SP-19	FB-06, FB-28	AO 3415, AO 3418	< 0.05	< 0.10	0.17 - 0.50
SP-20	FB-49, FB-29	AO 3395, AO 3400	< 0.05	< 0.10	0.92 - 1.20
SP-21	SG-04, SG-19, SG-46, FB-44, FB-46	AO 3057, AO 3062, AO 3473, AO 3405	< 0.05	< 0.10	1.00 - 1.40
SP-22	SG-20, SG-17, SG-36, FB-20, FB-65	AO 3067, AO 3056, AO 3472, AO 3408	< 0.05	< 0.10	ND - 0.94
SP-FH	SG-05, SG-51, FB-05	AO 3075, AO 3474	< 0.05	< 0.10	ND
SP-NQ	SG-55, FB-26, Fb-32	AO 3485, AO 3403	< 0.05	< 0.10	ND

Trace - Value between 0.05 and 0.15 ug/m^3.
ND - None Detected, value < .05 ug/m^3.

Detection Limits
Hydrazine 0.05 ug/m3
UDMH 0.10 ug/m3
NDMA 0.05 ug/m3

TABLE 2-4

RESULTS OF WIPE SAMPLES FOR HYDRAZINE AND UNSYMMETRICAL DIMETHYLHYDRAZINE

Sample Number	Location	Results (in micrograms-total) Hydrazine	UDMH 1/
W-100	Electrical control panel (west fence)	<5	0.2
W-101	Ground wipe, Drum Steamout (SP-8)	<5	<0.2
W-102	Electrical outlet north of Tank HAS-1	<5	0.3
W-103	Desktop and telephone inside Building 759	<5	<0.2
W-104	Empty barrel storage south of SP-21	<5	<0.2
W-105	Gauges and piping around sump pump at Waste Sump	<5	<0.2
W-106	Control Panel (SP-9)	<5	6
W-107	Water Sample from Waste Sump	<5	<0.2
W-108	Drum loading station (wipe of drum filling nozzles/connectors)	3,475	19.0
W-109	Tank HAS-2, drain value (Tank pit valve)	<5	<0.2
W-110	Tank HAS-1, control valve (on top)	sample bottle broken	
W-111	Tank Truck Station, Truck loading filler nozzle and boom	sample bottle broken	

1/ UDMH - 1,1-Dimethylhydrazine

Detection Limits: Hydrazine 5.0 ug
UDMH 0.2 ug

Source: AEHA, 1982.

Based on the finds AEHA concluded:

a. There were no sources of detectable quantities of hydrazine or UDMH contamination identified by air sampling.

b. Wipe sampling identified the drum loading station filler nozzles and connectors, the control panel of the mixing and blending area, and the electrical outlet north of Tank HAS-1 as sites of potential hydrazine/UDMH contact exposure.

c. Detectable quantities of NDMA were present, as air contaminants, throughout the HBSF.

d. The potential exists for worker exposure to "detectable amounts" of NDMA at the Personnel Change Facility Trailer located approximately 50 feet from the north fence entrance (SP-1).

2.2.6 Current Status

The RMA stopped routine HBSF operations after the OSHA and AEHA Surveys. The USAF and RMA jointly developed a hazard abatement plan for the facility, and fuel removal actions have continued since the HBSF shutdown. Currently, the facility is regularly inspected to check the automatic sprinker system, the ethylene glycol heating system, the nitrogen storage tank and the nitrogen blanket for the storage and fuel transfer system, and the inground concrete tank level. The USAF commissioned Dames and Moore to prepare a study to recommend a detailed closure procedure for the severable equipment at the HBSF, and this study is presently being finalized.

3.0 WASTE CHARACTERISTICS

3.1 WASTE INVENTORY

Although the HBSF is presently inoperative, it still contains various fuels and wastewater. These are itemized in Table 3-1.

3.2 GENERAL CHARACTERISTICS OF CHEMICALS

Chemicals present at the site include hydrazine, UDMH, Aerozine 50, and MMH. These are liquids and under normal conditions are ignitable, corrosive, suspected carcinogens, and toxic. In addition, UDMH when exposed to air reacts to form small quantities of the suspected carcinogen N-Nitrosodimethylamine (NDMA). Important physical properties of the major raw materials and reactants of Aerozine production are shown in Table 3-2.

3.3 WASTEWATER CHARACTERISTICS

The waters in the inground concrete tank were analyzed on several occasions for hydrazine, UDMH and NDMA concentrations by the Analytical Systems Branch Laboratory of the Environmental Division at RMA. The analyses of samples collected to support Part B Permit Application indicate the following results (RCRA Part B, 1983):

pH (standard units)	7.1
Hydrazine (ug/1)	0.69.-0.73
UDMH (ug/1)	1.81-2.40
NDMA (ug/1)	<0.3

TABLE 3-1

INVENTORY OF FUELS AND WASTEWATER REMAINING AT
THE HYDRAZINE BLENDING FACILITY

FUEL INVENTORY AS OF 31 DECEMBER 1985

Tank	Fuel	Maximum Capacity Gallons	Current Inventory Pounds	Current Inventory Approximate Gallons	Remarks
CS-1	Blend	24,900	14,752	1,770	Contaminated
HS-1	Blend	24,900	3,000	360	Off Spec
HS-2	Hydrazine	24,900	3,300	390	Heel
HS-3	Blend	24,900	43,757	5,245	Off Spec
US-1	UDMH	19,000	2,200	265	Heel
US-2	UDMH	19,000	2,200	265	Heel
	TOTAL		69,209	8,295	

WASTEWATER INVENTORY

Tank	Tank Gallons	Current Inventory Gallons
US-3	50,000	50,000
US-4	200,000	160,000
Inground Concrete	44,000	44,000

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TABLE 3-2

PHYSICAL PROPERTIES OF HYDRAZINE FUELS

Property	Unit	Hydrazine	MMH	UDMH	NDMA
Molecular Weight		32.04	46.08	60.08	74.08
Boiling Point (at 1 atm)	°C	113.5	87.5	63.	151-153
Freezing Point	°C	2.0	-52.37	-57.2	--
Liquid Density at 25°C	g/cc	1.0040	0.8743	0.784	1.0048
Critical Temperature	°C	380.	312.	250.	--
Vapor Pressure of Liquid at 298°C	mm Hg	14.19	49.47	167.1	--
Heat of Vaporization at 25°C	kcal/mole	10.7	9.648	8.37	--
Heat of Formation (Liquid at 25°C)	kcal/mole	+11.999	+13.109	+12.734	--
Heat of Combustion (Liquid at 25°C)	kcal/mole	148.6	311.7	473.	--
Heat Capacity	cal/mole-°C	23.62 σ 25°C	32.17 σ 25°C	39.2 σ 25°C	--
Flash Point (Tag Open Cup)	°C	52.0	17.2	-15.	--
Autoignition Temperature	°C	270.0	194.3	250.	--
Flammability Range (Volume Δ) in Air		4.7-100	2.5-98	2-95	--

Source: Windholz, 1976
Kane and Williamson, 1979

The wastewater in the inground concrete tank has also been analyzed for EP toxicity parameters (Table 3-3). Concentrations of parameters of interest did not exceed the RCRA criteria (RCRA Part B, 1983). GC/MS analyses indicated the presence of dimethylcyanamide, N,N-dimethylformamide, tetrachloroethane, and 1-ethyl-1H-1,2,4,-Trizole. However, the concentrations of these organic compounds were very small (less than 20 ug/l) and, therefore, they were not quantified (RCRA Part B, 1983).

The results of 1983 and 1985 analyses of the wastewater stored in the 50,000- and 200,000- gallon storage tanks are presented in Table 3-4. The 1983 analyses were performed by the RMA laboratory. The 1985 analytical results have been supplied by Dames and Moore (Dames and Moore, 1985).

The reason for the variations between the 1983 and 1985 data is not clear. Possible explanations include additional pumping of wastewater to the tanks; different analytical methods; different sampling techniques; chemical reactions and degradation; and interferences during either set of laboratory analyses.

3.4 OTHER CONTAMINANTS

Dames and Moore performed sampling activities at the HBSF on June 11-13, 1985. The objective of the field sampling program was to sample surfaces and bulk materials of unknown contamination. Those surfaces and bulk materials that were known to be contaminated (i.e., inside surfaces of fuel storage tank) were not sampled. Samples of various insulation materials present on the site were obtained for asbestos analysis. The results of chemical analyses of wipe, bulk, asbestos, and PCB samples are discussed in this section. All of the chemical analyses except for PCB samples were performed by UBTL, Inc., of Salt Lake City, Utah, a Dames and Moore subcontractor. PCB sampling and laboratory analysis were performed by Colorado Coal Company, Golden, Colorado, on behalf of RMA.

TABLE 3-3

RESULTS OF ANALYSES OF EXTRACTS FROM EP TESTS
INGROUND CONCRETE TANK WASTEWATER 1/

Parameters	Units	RCRA Concentration Limits 2/	Inground Concrete Tank Wastewater
pH	s.u.	-- 3/	--
TRACE METALS:			
Arsenic	mg/l	5.0	0.007
Barium	mg/l	100	--
Cadmium	mg/l	1.0	0.0022
Chromium	mg/l	5.0	<0.001
Lead	mg/l	5.0	0.001
Mercury	mg/l	0.2	<0.005
Selenium	mg/l	1.0	<0.0004
Silver	mg/l	5.0	0.002
ORGANICS:			
Endrin	ug/l	20	<0.01
Lindane	ug/l	400	<0.01
Methoxychlor	ug/l	10,000	<0.2
Toxaphene	ug/l	500	<0.01
2, 4-D	ug/l	10,000	0.5
2, 4, 5-TP (Silvex)	ug/l	1,000	<0.1

1/ The samples were analyzed by Environmental Laboratory Analytical Laboratory Group, Waterways Experiment Station, Vicksburg, Mississippi.

2/ CDH Part 261.24.

3/ "--" = Not determined.

Source: RCRA Part B, 1983.

TABLE 3-4

ANALYTICAL RESULTS - WASTEWATER
HYDRAZINE BLENDING AND STORAGE FACILITY

Parameter*	50,000-Gallon Tank mg/l	Date	200,000-Gallon Tank mg/l	Date
Hydrazine	444.4	6-83	2.96	6-83
	225.36	8-83	0.71	8-83
	140.	6-85	*	6-85
MMH	505.3	6-83	28.4	6-83
	1,300.	6-85	8.	6-85
UDMH	4-5.6	6-83	3.04	6-83
	213.58	8-83	2.03	8-83
	470.	6-85	*	6-85
NDMA	<1.	6-83	<1.	6-83
	0.805	8-83	0.134	8-83
	0.021	6-85	0.007	6-85

* Below detection limit. Detection limits for 6/85 analyses are:

Hydrazine	0.2 mg/L
MMH	1.0 mg/L
UDMH	1.0 mg/L
NDMA	0.0002 mg/L

Sources: RCRA Part B, 1983 and Dames and Moore, 1985

Table 3-5 is a summary of the analytical results that were above the method detection limit (Dames and Moore, 1985).

3.4.1 Wipe Samples

The purpose of a wipe sample was to provide an indication of contaminant presence on material surfaces, not a quantitative measure of its concentration. Each wipe sample consisted of wiping a 100 cm^2 area (10 by 10 cm) with a dry Whatman No. 41 filter paper. Two adjacent 100 cm^2 area were sampled at each sample location. Due to different extraction and analytical procedures, one wipe sample, or filter paper, was analyzed for NDMA and the other for hydrazine, MMH, and UDMH.

Wipe sample locations included: product tank exterior surfaces (cladding); pipe supports; handrails; office building; glycol building; storage shed; blending skid; railroad rails; liquid nitrogen tank; concrete containment dikes; inground wastewater tank; chain link fence supports; drum storage pad; and east scrubber.

With the exception of two samples (Samples 42B and 43B) all of the wipe samples analyzed were below the detection limit for hydrazine, NDMA, MMH, and UDMH (5.0, 0.6, 25, and 25 ug/sample, respectively). Samples 42B and 43B had reported MMH concentration of 26 and 25 ug/sample, respectively, near the limit of detection for MMH.

3.4.2 Bulk Samples

The collection of bulk samples was very limited due to the requirements of working in a spark-free environment and avoiding destruction of facilities.

Bulk samples could only be taken when materials were easily obtainable, since no chipping, sawing, or use of power tools was allowed. The two

TABLE 3-5

ANALYTICAL RESULTS OF WIPE, BULK AND ABESTOS SAMPLES
(ABOVE METHOD DETECTION LIMITS)
HBSF - RMA

Sample Number	Sample Type	Parameter	Method	Unit	Detection Limit	Concentration
42B	Wipe	MMH	S149 1/	ug/sample ($ug/100\ cm^2$)	25	26
43B	Wipe	MMH	S149	ug/sample ($ug/100\ cm^2$)	25	25
2B	Bulk	Hydrazine	S149	ug/g	20	350
2B	Bulk	UDMH	S149	ug/g	50	2.3
2B	Bulk	MMH	S149	ug/g	50	18
ASB-1	Insulation	Asbestos	---	percent	0.5	5 - 10

1/ NIOSH Method S149, USAFSAM Report TR-82-29 and USAF "The Firebrick Method" by Tom Thomas.

Source: Dames and Moore, 1985

1000a

bulk samples that were taken included: 1) loose concrete near the drum weigh scale, and 2) wood from the railroad ties opposite and north of the drum blend pumping skid.

The concentrations of hydrazine, UDMH, and MMH detected in Bulk Sample 2, pieces of wooden railroad tie, were 350, 2.3, and 18 ug/g (equivalent to ppm), respectively. NDMA was below the detection limit for this sample.

Contaminant levels in Bulk Sample 1, a piece of loose concrete near the drum scale, were all below the detection limit (hydrazine 20 ug/g, NDMA 0.1 ug/g, UDMH 50 ug/g, MMH 50 ug/g).

3.4.3 Asbestos Samples

Several samples were obtained of insulation materials suspected of containing asbestos. Two types of insulation material were sampled above the northwest Aerozine tank HS-3, on an inlet pipe located near the catwalk. One sample was of a hard, matrix type of insulation, and the other was of a fiberglass-like piece of insulation. The other sample location was piping insulation south of the blend pump building. Each sample was placed in a plastic screw-top container. Additional samples were not obtained due to the limited amount of accessible, visible insulation.

The only insulation sample that had reported levels of asbestos was ASB-1. This sample was taken from an inlet pipe near the catwalk above Tank HS-3 and contained both fibrous and solid gray material. The fiber material did not contain any detected asbestos; however, the gray material was determined to contain 5 to 10 percent Chrysolite, a common form of asbestos. Split samples of ASB-1 both resulted in 5 to 10 percent asbestos.

3.4.4 Transformers

There are four transformers at the HBSF. The oil in these transformers has been analyzed by the Colorado Coil Company of Golden, Colorado, for the RMA. Detailed analytical information is not presently available. However, the PM-RMA is reviewing current documentation. Transformer No. 755 West, Serial No. 5977576, tested in May 1984, is reported to have contained 50 ppm of Aroclor 1260, a trade name for PCB isomers containing 60 percent chlorine. The only available data for the other transformers indicates that they were "O.K." RMA staff interpreted this to mean that the oil in these transformers contained less than 50 ppm of PCBs. If current documentation is found not to be sufficient to support the characterization of these transformers, then they will be resampled and retested.

4.0 CLOSURE PLAN

4.1 OBJECTIVES AND SCOPE OF PLAN

The closure plan is designed to meet the following performance standards:

- Protect human health and the environment;

- Prevent the escape of hazardous waste, hazardous waste constituents or waste decomposition products to the ground, surface waters, or the atmosphere by eliminating sources of contamination; and

- Render the site suitable for modified unrestricted use (i.e., the site is suitable for general use excluding use of any contaminated groundwater that may be underneath the site).

The series of activities that are necessary to accomplish the closure objectives at the HBSF are outlined in the following sections of the plan. The criteria under which the closure will be executed are discussed in Section 4.2.4. The following factors were taken into account in the development of this plan:

- The closure activities will take place within the designated boundary of the HBSF (fence).

- Areas outside the boundary of the hydrazine facility are being addressed by the arsenalwide remedial action strategy.

- Groundwater contamination is being addressed by the overall remedial action strategy for the South Plants Area.

- Because the RMA is a federal facility, no closure cost estimates or financial assurance mechanisms are included as per Part 266 of the state hazardous waste regulations. In addition, because all wastes and contaminated materials will be removed, no post closure activities will be required.

4.2 DETERMINATION OF CONTAMINATION

4.2.1 Sampling Program

The purpose of the sampling program is to determine the extent of site contamination. Although past sampling efforts have provided valuable information regarding the extent and volume of contamination within the HBSF, additional sampling and analyses will be needed to more accurately define closure requirements and to verify the completion of waste removal activity.

4.2.2 Sampling and Analytical Techniques

4.2.2.1 Sampling Techniques

A number of methods have been developed for sampling hazardous wastes as well as equipment, structures, soil, and water contaminated with toxic materials. The following list provides a brief description of each method, the equipment needed, the materials for which it is an appropriate sampling technique, any conditions which preclude its use, and a reference for its documentation:

- Glass tubes - used to collect liquid samples from open containers. The tubes are 122 cm in length with a 6 to 16 mm diameter; the longer tubes are for more viscous fluids (Ebasco Services, 1985b).

- Kemmerer bottle - used to collect discrete at-depth samples from surface water or from vessels where collection depth exceeds pump lift capacity. A Kemmerer bottle is a messenger-activated water sampling device. That is, once the bottle is lowered to the desired depth, a messenger is dropped down the sample line tripping the release and closing the bottle. Since commercially available Kemmerer bottles are made of brass or plastic, their application may be limited due to incompatability with analytical techniques (Ebasco Services, 1985b).

- Coliwasa sampler - used to sample containerized liquid wastes (Ebasco Services, 1985b).

- Weighted Bottle Sampler - used to sample liquids in storage tanks, wells, sumps, or containers that cannot be adequately sampled with a Coliwasa sampler. Some liquids may react chemically with the sinker weight and line; these materials may also be incompatible with some analytical techniques (Ebasco Services, 1985b).

- Scoop Sampler - used to collect composite dust samples from buildings (Ebasco Services, 1985b).

- Constant flow samplers, personal samplers, air sampler, and bubble samplers - used to sample air in contaminated buildings or areas. Pumps are calibrated to a specific air flow and a collecting media applied (AEHA, 1982).

- Vacuum Pump Sampler - used to collect liquid residual from sumps (EPA, 1985).

The following lists those procedures that would be most appropriate for sampling each of the categories of materials to be handled:

- Stored Wastes - The method of choice for sampling will depend on the type of container in which the fuel or wastewater is stored as well as the presence of other chemical compounds. Sampling techniques include glass tubes, Kemmerer bottles, Coliwasa samplers, and weighted bottle samplers.

- Contaminated Equipment (tanks, pipes, pumps, etc.) - The method of choice for sampling the surface of contaminated or suspected contaminated equipment is to collect a sample of the washwater used to decontaminate the equipment. Washwater will in general be sampled using glass tubes or weighted bottles.

- Air Quality Monitoring - Air sampling will be accomplished using a DuPont constant flow sampler, Model P4000 or an MSA Air Sampler, Model G. Pumps will be calibrated at a flow 1.0 liters per minute. To test for the presence of hydrazine or UDMH, collection media should consist of 250 mg of 40/60 mesh activated silica gel coated with concentrated sulfuric acid (20 percent by weight). To test for the presence of NDMA the same sampling pumps can be used, but the collecting media should be a commercial Thermo Sorb/N$^{\sigma}$ air sampler (AEHA, 1982).

- Contaminated Soils - Soil sampling at the hydrazine facility will be performed under Task 11. If additional soil samples must be taken, the procedures developed under Task 11 will be followed. These procedures are similar to those developed under Task 2 for the Environmental Program at RMA and involve the use of drill rigs, precut sampling tubes of different lengths and specific decontamination procedures (Ebasco Services, 1985a).

- Contaminated Groundwater - Most groundwater sampling at the hydrazine facility will be performed under for Task 11. If additional groundwater samples must be taken, for example, under an extremely contaminated soils area, the methods developed under Task 11 will be followed (Ebasco Services, 1985a).

4.2.2.2 Analytical Techniques

Indicator Techniques

Sample analysis can be very costly and in many cases all that is necessary, at least initially, is an indication of the presence or absence of a particular compound in a sample. A number of colorometric tests exist for such qualitative determinations:

- o Hydrazine - The colorometric tests for hydrazine detection is called the PDAB technique and is based on the observation that paradimethyly-aminobenzaldehyde (PDAB) and N_2H_4 in a dilute solution turn yellow. Absorption is measured at 460 mm with a Coleman 55 spectrophotometer (Stauffer and Eyl, 1978).

- o UDMH - The colorometric test for UDMH involves the use of trisodium pentacyanoamina ferrate (TPF) as a test reagent. Absorption is measured at 500 mm (Stauffer and Eyl, 1978).

Quantitative Methods

Analysis of all samples will follow EPA- and PM-RMA-approved analytical methods when these procedures are available for the chemicals of concern at the hydrazine facility.

- o Hydrazine, MMH and UDMH - At this time, methods for hydrazine, MMH, and UDMH analysis have been developed under the Task 11 contract and are waiting for approval by EPA and PM-RMA. These methods involve the use of high pressure liquid chromatography (HPLC).

- o NDMA - The current approved technique for NDMA analysis is EPA method 607. This method involves using methylene chloride to extract NDMA from aqueous solution followed by HCL treatment and then gas chromatography (GC) (EPA-600/4-82-057, July 1982).

Extraction Procedures

- o Hydrazine, MMH and UMDH -- Ethanol (95 percent) can be used to extract hydrazine, MMH, and UMDH from soils (Hick et al., 1963) and wipe samples (Handbook of Chemistry and Physics 1978). The extraction procedure for air samples consists of: elution of the sample from the sorbant with distilled water; formation of derivatives by the addition of 2-furaldehyde and extraction of the derivation by ethyl acetate (AEHA, 1982).

- o NDMA -- Methylene chloride is likely the solvent of choice for NDMA extraction from soil and wipe samples as well as aqueous solutions. Extraction procedures are not needed for air samples; after thermo-desorption from the Thermo Sorb/N$^{\sigma}$ air sampling media, the sample can be fed directly to GC (NIOSH, 1979).

Sample Preservation

Since hydrazine, MMH, UDMH, and NDMA may be sensitive to photolysis, all samples will be protected from light and heat. Samples will be packed in coolers with blue ice; if necessary a preservative may be added. Sample containers will be chosen according to the specification developed by Ebasco for RMA (Ebasco Services, 1985c).

Sample Management

A sample management and documentation program is a vital portion of any field data collection effort. The basis of sample management is stringent documentation of the possession and handling of samples from collection to data sample reporting. The management process includes sample identification, chain of custody records, transfer of sample custody (i.e., from the field to the laboratory), and sample shipment. The sample management program for the hydrazine facility will follow the procedures developed by Ebasco for RMA (Ebasco Services, 1985c).

4.2.3 Methodology for Determining Extent and Location of Contamination

4.2.3.1 Sampling Program - Equipment and Structures

Equipment and structures present at the HBSF are classified into two groups: those items known to be contaminated, such as the interiors of tanks, blending equipment, the wastewater collection tanks, and associated pipe valves and pumps; and those items of uncertain status, such as the exteriors of the above structures and equipment, concrete slabs, and buildings, roofs, and miscellaneous materials, equipment, and soils surrounding the facility. Although some or all of the equipment may be clean after washing, the PM-RMA will presume that all these materials are contaminated and they will be disposed of in a hazardous waste landfill. Therefore, no sampling of these items will be necessary.

As part of the closure activities for the HBSF, Dames and Moore on behalf of USAF has performed the initial sampling to determine the extent and location of contaminated equipment and structures. The sampling program for equipment and structures was limited to those items of uncertain status. The results of this sampling program are briefly discussed in Section 3.0 of this closure plan. The details of the program can be found in the Dames and Moore Draft Report (Dames and Moore, 1985).

At this point no additional sampling is planned for equipment and structures at the HBSF.

4.2.3.2 Sampling Program - Soils and Groundwater

Soil Boring Program

Under a separate task order (Task 11) Ebasco is investigating the HBSF area to determine the extent of soil and groundwater contamination which has resulted from the operation of the facility. Figure 4-1 depicts the locations and depth of the proposed boreholes for the soil sampling program. The technical plan for Task 11 contains the detailed rational for selecting the numbers, locations, and depths of boreholes for the soil sampling program (Ebasco, 1985a).

Groundwater Program

Under Task 11, groundwater at the site will be monitored. Twelve (12) monitoring wells (ten existing and two new) will be sampled to determine the presence of contaminants from the HBSF. The Task 11 technical plan contains the rationale for selecting the monitoring wells for sampling.

4.2.4 Action Levels

One of the key items in the decommissioning of HBSF will be the definition of concentration levels for materials to be classified as contaminated or decontaminated. Currently there are no published regulations or standards for acceptable concentration levels for those chemicals found at the HBSF. Decontamination levels have been and continue to be established on a case by case basis by the concerned regulatory agencies.

All efforts will be made to decontaminate materials and areas to the action levels. However, the contaminated material and area cleanup tasks will be limited by the analytical methods available for detection and by the existing technology for cleanup.

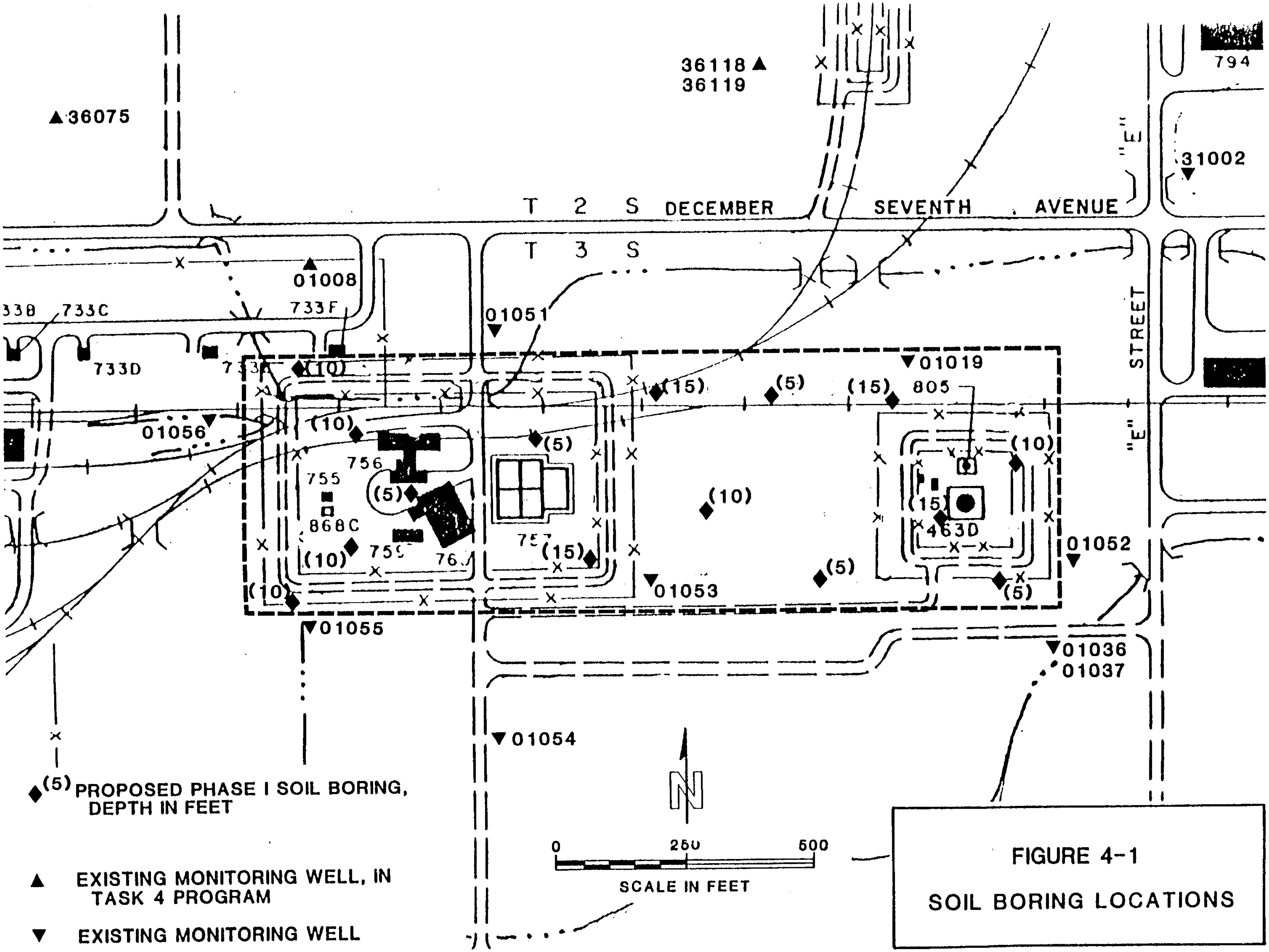


FIGURE 4-1

SOIL BORING LOCATIONS

The following action levels for the closure of the HBSF are proposed:

- o Soils and Wastewater

  Under a separate task, PM-RMA is developing contamination criteria levels for various contaminants present throughout the arsenal including the contaminants of concern at the HBSF. The results of this study will define the concentration levels for hydrazine, MMH, UDMH, and NDMA in soils and wastewater below which they can be classified as uncontaminated or clean. To determine these action levels for various contaminants, PM-RMA is performing risk analyses for each of the contaminants. Upon completion of this study, PM-RMA will identify the action levels for the HBSF and will amend this closure plan.

- o Buildings, Equipment, and Structures

  Because the PM-RMA will presume that all buildings, equipment, and structures (except transformers) are contaminated, even after washing, no action levels are needed. All of these materials will be disposed in a hazardous waste landfill. Equipment used during closure will be decontaminated by a triple rinse with a hypochlorite solution. This rinse solution will be analyzed and handled in a manner identical to that described for other wastewaters.

- o Air Quality

  Air quality will be monitored throughout the closure activities, primarily to ensure adequate worker protection. The document published by The American Conference of Governmental Industrial Hygienists, Inc, 1984, (ACGIH) has furnished threshold limits of the chemicals. Based on these recommendations, the following action levels for air samples have been established taking into consideration the toxic nature of the chemicals and the exposure limits fixed by OSHA and ACGIH.

Contaminants	Threshold Limit
Hydrazine (AH)	0.1 mg/m^3
N Nitrosodimethylamine (NDMA)	None established
1,1 Dimethyl hydrazine (UDMH)	1 mg/m^3
Monomethyl hydrazine (MMH)	0.35 mg/m^3

4.3 CLOSURE PROCEDURES

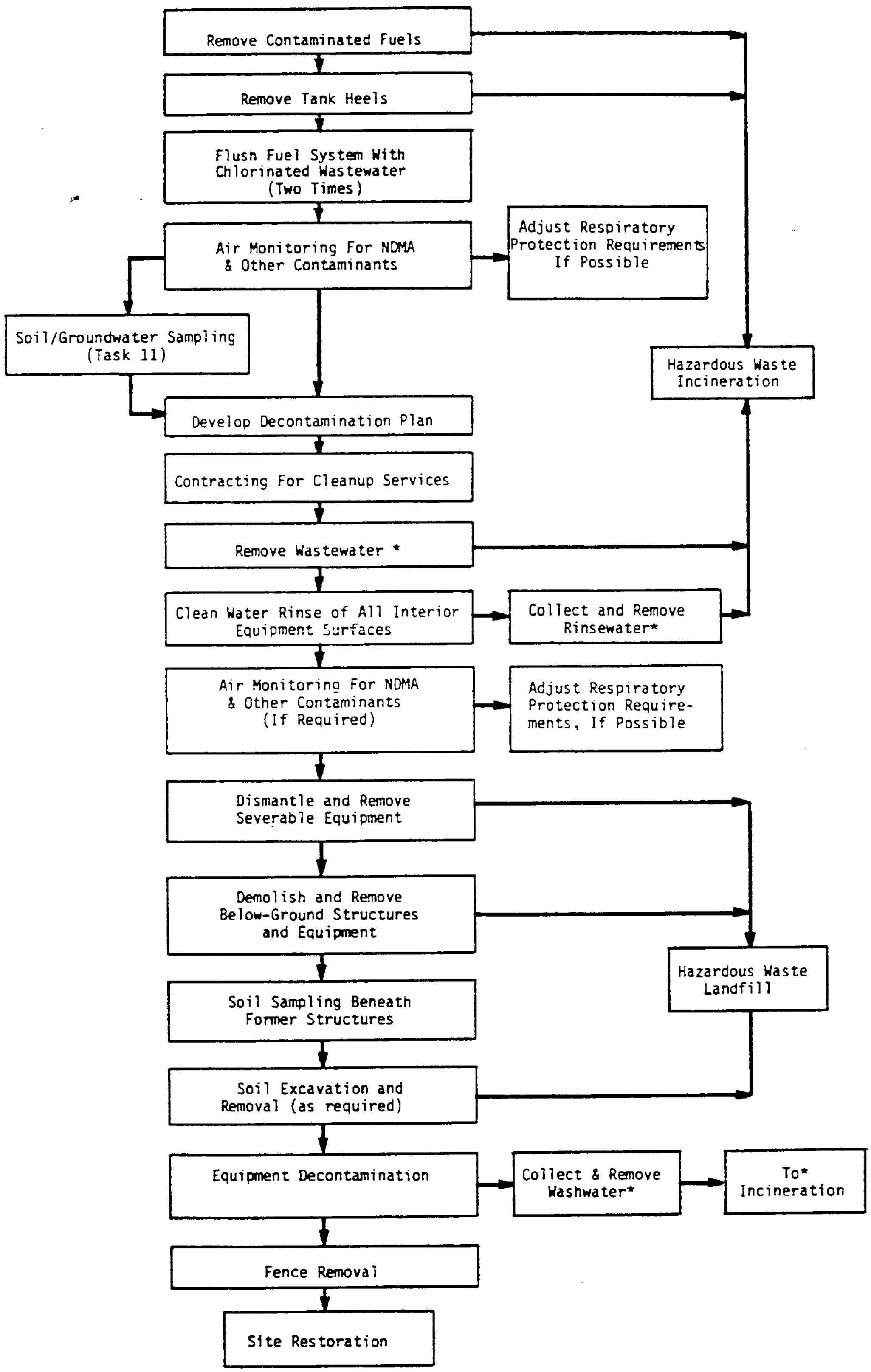
The actual closure of the HBSF is presently complicated by the presence of detectable levels of NDMA at the site. As described earlier, there is no acceptable limit for exposure to NDMA. As a result, workers must be in an air-supplied respirator when working in environments where NDMA is present. Workers in such protective clothing cannot efficiently and quickly perform what would otherwise be routine functions. Therefore, one of the first tasks to be undertaken during closure will be to remove all known sources of NDMA. UDMH is the only identified precursor of NDMA at the HBSF, so if the UDMH can be eliminated, no further NDMA generation can occur. If the HBSF site can be made NDMA-free, then further closure activities can be carried out in less restrictive protective gear.

The closure scenario is depicted in Figure 4-2. This sequence was designed to minimize the amount of decommissioning time that personnel must wear air-supplied respiratory equipment and protective clothing.

Final fuel removal will be accomplished in two steps. First, the remainder of the contaminated fuel that can be pumped out of the storage tanks will be loaded onto hydrazine tankers and shipped to

Figure 4-2

OVERVIEW OF HBSF DECOMMISSIONING



*Ultimate disposal method may be changed depending upon feasibility study results.

Rollins Environmental Service, Inc. of Baton Rouge, Louisiana for incineration. This fuel removal will be started in January 1986. No additional activities will be undertaken to remove the residual fuel materials until the coldest winter months have passed. These wastes will be incinerated at Rollins' facility. In order to remove the last traces of fuel from the tanks, they will be flushed with water and then with a mixture of the existing wastewaters and calcium hypochlorite. This oxidizing flush solution will be run through all pumps, piping, valves, and tanks that may have contained fuel. Clean water amended with calcium hypochlorite will be flushed through piping systems believed to have contained only surface drainage or treated wastewater. Flush water use will be minimized at this stage, because the intended disposal mechanism is incineration by Rollins. If, however, a less costly but environmentally sound disposal technique for this wastewater is found (e.g., ultraviolet/ozone treatment with subsequent discharge to an NPDES-permitted biological treatment facility), then, with concurrence from the CDH, an alternate disposal mechanism will be employed.

Once all fuels have been removed from the HBSF, an air monitoring program will be implemented. If ambient levels of NDMA and other hydrazine-related compounds are sufficiently low, then arrangements will be made with OSHA to decrease the respiratory protection requirements. The switch from the current requirement of a self-contained breathing apparatus (SCBH) to an air purifying respirator will greatly increase the efficiency of decommissioning personnel.

Concurrently with the fuel removal activities, a soil and groundwater sampling program will be conducted. The purpose of this program is to determine the locations and volumes of soils contaminated by hydrazine materials, if any. Groundwater quality will also be investigated.

Completion of the fuel removal and sampling tasks will enable the PM-RMA to develop a detailed decontamination plan from which a scope of work and contract procurement package will be prepared. The development of the detailed plan will also result in the selection of a final treatment/disposal method for wastewaters contaminated with low levels of hydrazine-related compounds.

Once a cleanup contractor has been selected, all remaining wastewater at the HBSF will be removed. As noted earlier, incineration is presently the method of choice for ultimate disposal of this material; however, the PM-RMA is investigating alternate approaches and will amend this plan as required if and when an alternate treatment/disposal option can be proven effective.

After all existing wastewaters have been removed from the HBSF, all interior equipment surfaces and any exterior surfaces thought to have come into contact with fuels or fuel products will be final rinsed with a dilute calcium hypochlorite solution. All rinse waters will be collected and disposed of in accordance with the procedure described above.

If the earlier air monitoring effort demonstrated that NDMA or other hydrazine-related compounds were not reduced to acceptable levels, then another round of sampling will be carried out at this stage, again to determine if SCBA protection can be eliminated. Dismantling and demolition of the HBSF will then begin. All equipment and structures removed from the facility will, as noted earlier, be presumed to be contaminated and will be hauled off site to a hazardous waste disposal facility. Although piping and tank insulation is believed to be predominantly fiberglass and urethane foam, sampling has revealed that at least a small portion contains asbestos. As a result, until and unless sampling and analysis proves otherwise, all insulation will be handled as though it contained friable asbestos. In any event, all insulation materials will be disposed of with the remainder of the equipment and debris at a hazardous waste landfill.

The only equipment that will be salvaged from the HBSF are the four transformers on the site. There is no reason to believe that these transformers have ever been exposed to any fuel, fuel products, or wastewaters, but they will be rinsed on the exterior surfaces with a dilute hypochlorite solution prior to their removal. These transformers are located at Building 755. Transformers at Substation 755A have been found to contain PCBs in excess of 50 ppm, whereas the other transformers were tested and found to have PCBs below 50 ppm. The transformers at Substation 755A will be cleaned, moved to the Conforming Storage Building 332, and evaluated for reuse by the Defense Reutilization and Marketing Organization (DRMO). The remaining transformers will be used elsewhere at the RMA.

Sampling has revealed the presence of waste products on one of the railroad ties in the rail spur at the HBSF. There is no practical means of decontaminating this spur, so it will be removed and the debris will be hauled to a hazardous waste disposal facility; however, the rail line will be replaced upon completion of closure activities to maintain an active rail link to the North Plants.

After all structures and foundations are removed, a soil-sampling program will be conducted beneath these former structures to detect any contaminated soils. The contractor will then remove any contaminated soils for disposal in a hazardous waste landfill. This will complete removal of all contaminated or potentially contaminated items from the HBSF. The contractor will then decontaminate his cleanup equipment with a hypochlorite solution. This wastewater will be handled in accordance with the procedures described earlier.

Final activities at the HBSF will include fence removal, regrading to restore approximate original site contours, replanting the area with native grasses and certification of closure.

4.4 REGULATORY REQUIREMENTS

4.4.1 Preclosure

The EPA (Region VIII) and the Colorado Department of Health (CDH) are the two regulatory agencies that will be involved during the preclosure period at the hydrazine facility. The CDH, under the Colorado

Hazardous Waste Management Act has primacy over the EPA. Therefore, the EPA need only review any preclosure activities for compliance with the 1984 RCRA amendments, and it is unlikely that any of these amendments apply to the hydrazine facility. CDH requirements for closure plan and closure activities are identical to those of RCRA and the waste numbering system is also the same. The major preclosure activity is likely to be the preparation of a written closure plan that meets the closure performance standards of Part 265.111 and the closure requirements of Part 265.112 of the state hazardous waste regulations. The most significant component of the closure performance standards is the exact definition of the concentrations to be used in determining clean and contaminated materials. The PM-RMA is developing proposed contamination criteria. The criteria are discussed in Section 4.2.4. Before initiating the decontamination phase these contamination criteria must be approved by the CDH.

Any sampling program undertaken during preclosure also will meet the OSHA standards for worker protection as well as DOT requirements for hazardous waste sample shipment.

4.4.2 Closure

There are a number of agencies who will become involved or whose requirements will have to be met during closure activities. The following federal statutes, associated regulations, and the corresponding Colorado requirements will apply to the HBSF closure plan activities:

- Resource Conservation and Recovery Act as amended by the 1984 Hazardous and Solid Waste Amendments (RCRA)
- Clean Water Act (CWA)
- Clean Air Act (CAA)
- Toxic Substance Control Act (TSCA)

The Resource Conservation and Recovery Act (RCRA) regulates all aspects of Hazardous Waste Management from cradle to grave. The HBSF is classified as a treatment, storage and disposal (TSD) facility because wastewater is stored in the facility. The two major agencies who implement the closure of a RCRA facility are the United States Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH). The CDH acts on behalf of the EPA in Colorado in implementing RCRA regulations. The specific Colorado regulations impacting the RCRA closure plan are as follows:

- Part 265.111, Closure performance standard
- Part 265.112, Closure plan; amendment of plan
- Part 265.113, Closure time allowed for closure
- Part 265.114, Disposal or decontamination of equipment
- Part 265.115, Certification of closure
- Part 265.118, Postclosure plan
- Part 265.228, Closure and postclosure care of hazardous waste storage tanks
- Part 262 Subpart-B, Manifesting for hazardous waste transportation
- Part 262 Subpart-C, Pretransfer requirements (packup, labeling, etc.) of hazardous waste
- Part 262 Subpart D, Record keeping for hazardous waste equipment

The other regulatory agencies who will be involved in the closure activity are listed below:

a. Occupational Safety and Health Administration (OSHA).

The impact of OSHA regulation will be felt during the closure activity for the personnel protection and ambient air concentrations of pollutants at the site. Specific OSHA requirements include:

29 CFR 1910.1000	Hydrazine 8 hour PEL is 1.0 ppm or 1.3 mg/m^3 of air UDMH 8 hours PEL is 0.4 ppm or 1.0 mg/m^3 of air.
29 CFR 1910.1016	NDMA 8 hour PEL is no detectable level.

Prior approval will be obtained from OSHA for the safety measures and the protective clothing to be used at the time of closure activity.

b. Clean Air Act (CAA).

Asbestos is a designated hazardous air pollutant and must be transported as per the Colorado State Air Law. Regulation 8, Section II identifies asbestos as a hazardous air pollutant.

Demolition activities of structures, installations, buildings, or portions thereof which contain any boiler, pipe, or load supportive structural member that is insulated or fire proofed with friable asbestos material must comply with the requirements of this regulation. As noted earlier, insulation at the HBSF is believed <u>not</u> to be predominantly asbestos, but it will be handled as asbestos until demonstrated otherwise.

As required by the regulations, the Colorado Air Pollution Control Commission (CAPCC) will be informed and all CAPCC requirements met before start-up of demolition work. At the time of demolition, the friable asbestos will be removed and thoroughly wetted before commencement of wrecking or dismantling. The removed wet asbestos then will be double-contained in plastic bags and steel drums. The containers will be labeled and transported to an approved hazardous waste landfill.

c. Toxic Substance Control Act - (TSCA).

Four electrical transformers are located at the HBSF. The disposition of these transformers has been discussed earlier. Transformers with PCB concentrations in excess of 50 ppm will be handled of in accordance with 40 CFR 761, PCB Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.

d. Department of Transportation (DOT).

The DOT requirements that apply during closure involve labeling, packaging and shipping of hazardous waste and possible fuel products (USAF will dispose of most fuel products).

49 CFR 172, Labeling, packaging, marking, placarding and documenting.

49 CFR 173, Hazardous waste preparation for shipping.

40 CFR 178, Containers.

All the shipping activities will be carried out as per the above DOT regulations during the closure activities.

4.4.3 Postclosure

Since all waste will be removed from the hydrazine facility, post closure care will not be required.

4.5 HEALTH AND SAFETY PROGRAM

To ensure the safety of all personnel directly engaged in closure activities of the HBSF, a Health and Safety Program (HASP) has been established. The program is developed based on the standard operating procedures (SOP) and guidelines developed by the U.S. Army and U.S. Air Force for the HBSF. The SOP were developed based upon recommendations by the U.S. Occupational Safety and Health Administration (OSHA).

The main aspects of the HASP, i.e., management and personnel protection, are briefly discussed here. The contractor(s) performing the closure activities will follow the framework established here to develop the site-specific Health and Safety Plan.

4.5.1 Management of the HASP

The prime contractor working on the HBSF closure activities will have the responsibility to develop a comprehensive, site specific Health and Safety Plan and to implement the plan for all phases of the project. The plan must be administered by a Certified Industrial Hygienist (CIH) employed by the contractor. The primary responsibilities of the CIH will be to:

- Establish site control work zones;
- Assure that appropriate protective equipment is available and properly utilized by all on-site personnel;
- Assure that personnel are aware of the provisions of the HASP and are instructed in the work practices necessary to ensure safety and in the planned procedures for dealing with emergencies;

- Assure that personnel are aware of the potential hazards associated with site operations;
- Monitor the safety performance of all personnel to ensure that the required work practices are employed;
- Correct any work practice or condition that may result in injury or exposure to hazardous substances;
- Arrange for medical examinations for specified project personnel;
- Arrange for on-site emergency medical care and first aid to be available;
- Notify RMA emergency officers (i.e., police and fire department) of the project team's operations and make emergency telephone numbers available to all team members;
- Provide adequate training specific to the expected hazards including, but not limited to, instructions and demonstrations on the use of required safety equipment, hand signals, monitoring equipment, the buddy system, response to accident and emergencies, removal of protective clothing and equipment, and decontamination of such equipment and of self;
- Provide baseline physicals for all employees engaged in closure activities to identify health and contaminant status of each employee prior to working at HBSF and to identify any restrictions affecting the use of protective clothing and equipment;
- Prepare any accident/incident reports;
- Keep daily logs of all significant safety related incidents that occur.

4.5.2 Personnel Protection

The general guidelines on personnel protection as presented here will be followed unless the on-site monitoring indicates otherwise. For the purpose of clarifying the use of various levels of protective clothing, operations which will be performed during the closure period can be classified into following types:

Type 1: Routine entry for inspection, data gathering and other administrative activities that require no contact with liquids containing NDMA.

Type 2: Entry to conduct sampling or abatement where the possibility of exposure to NDMA, UDMH, or hydrazine has been practically eliminated.

Type 3: Entry to conduct sampling or abatement procedures where possibility of exposure to NDMA, UDMH, or hydrazine exists only under unforeseen circumstances.

Type 4: Entry to conduct sampling and decontamination operations, where exposure to NDMA, UDMH, or hydrazine is probable or certain.

The protective clothing to be employed consists of three levels, i.e., Level 1, Level 2 and Level 3. The definitions and contents of the various protective clothing levels are outlined in Table 4-1. Table 4-2 outlines the levels of protective clothing to be employed during the sampling and decontamination period, correlated to the types of operation expected to occur. These tables are provided as guidelines only. The contractor's CIH will ultimately be responsible for proper worker protection during closure.

TABLE 4-1

PROTECTIVE CLOTHING LEVELS

1) Level 1

Inner Clothing:

a) Undershirt
b) Drawers
c) Socks

Liner: Coveralls, disposable, tyvek material
Outer Clothing: Suit - Coverall
Gloves: Butyl
Footwear: Boots, butyl, safety toe
Headgear: Hood, butyl rubber, (MSA) Mine Safety Appliances (for SCBA)
Respirator: SCBA, MSA or Scott

2) Level 2

Inner Clothing:

a) Drawers
b) Undershirt
c) Socks

Outer Clothing: Apron
Gloves: Butyl
Footwear: Boots, butyl, safety toe
Headgear: Hood, butyl rubber, MSA (for SCBA)
Respirator: SCBA, MSA or Scott

3) Level 3

Inner Clothing:

a) Drawers
b) Undershirt
c) Socks

Outer Clothing: Coveralls, disposable, tyvek material
Gloves: Surgical, disposable
Footwear: Boots, butyl, safety toed
Headgear: None
Respirator: SCBA, MSA or Scott

TABLE 4-2

TYPES OF OPERATIONS WITH CORRESPONDING PROTECTIVE CLOTHING LEVEL

	Types of Operation	Protective Clothing Level
Type 1:	Routine safety inspection. Collecting wipe samples of external surface of equipment, tanks, piping and structures, drilling operations for soil sampling, and dismantling and removing uncontaminated structures and equipment, draining of sump via remote pump controls, etc.	Level 3 unless results of air sampling and analysis show the need for Level 2 gear.
Type 2:	Cleaning of tanks, blending equipment and piping using closed loop rinsing, cleaning of contaminated equipment in an open system.	Level 2
Type 3:	Transfer of fuels, if necessary, transfer of contaminated wastewater by pumping.	Level 2 clothing. In the event that the risk of exposure is higher, Level 1
Type 4:	Sampling the contents of tank, equipment; removing tank heels; disassembly of equipment containing UDMH vapors or wastewater.	Level 1

5.0 SCHEDULE

The schedule for closure of the HBSF is presented in Figure 5-1. The initial activities for the HBSF closure have commenced with the development of this plan. PM-RMA has initiated the soil sampling program to determine the areal and vertical extent of soil contamination due to suspected leaks and spills from the HBSF. The results of the soil sampling investigation will be available in March, 1986. Waste fuels (except tank heels) have also been removed.

As indicated earlier, the decommissioning sequence of events are planned to minimize the amount of time that high levels of protection are required. This will enhance the productivity of the workers and at the same time maximize the safety of the decommissioning crew. Therefore, the PM-RMA in conjunction with the USAF plans to remove the remaining stored fuel at the facility and to decontaminate the fuel system prior to commencement of any other decontamination or demolition activities at the HBSF. The PM-RMA plans to complete fuel removal and decontamination of the fuel system by July 1986.

The PM-RMA will employ an outside contractor for decommissioning of the HBSF. It is anticipated that the contractor will initiate the decommissioning work in January 1987. It is estimated that approximately six months would be necessary to clean contaminated equipment and structures, remove wastewater from the site, and to dismantle and remove equipment for disposal.

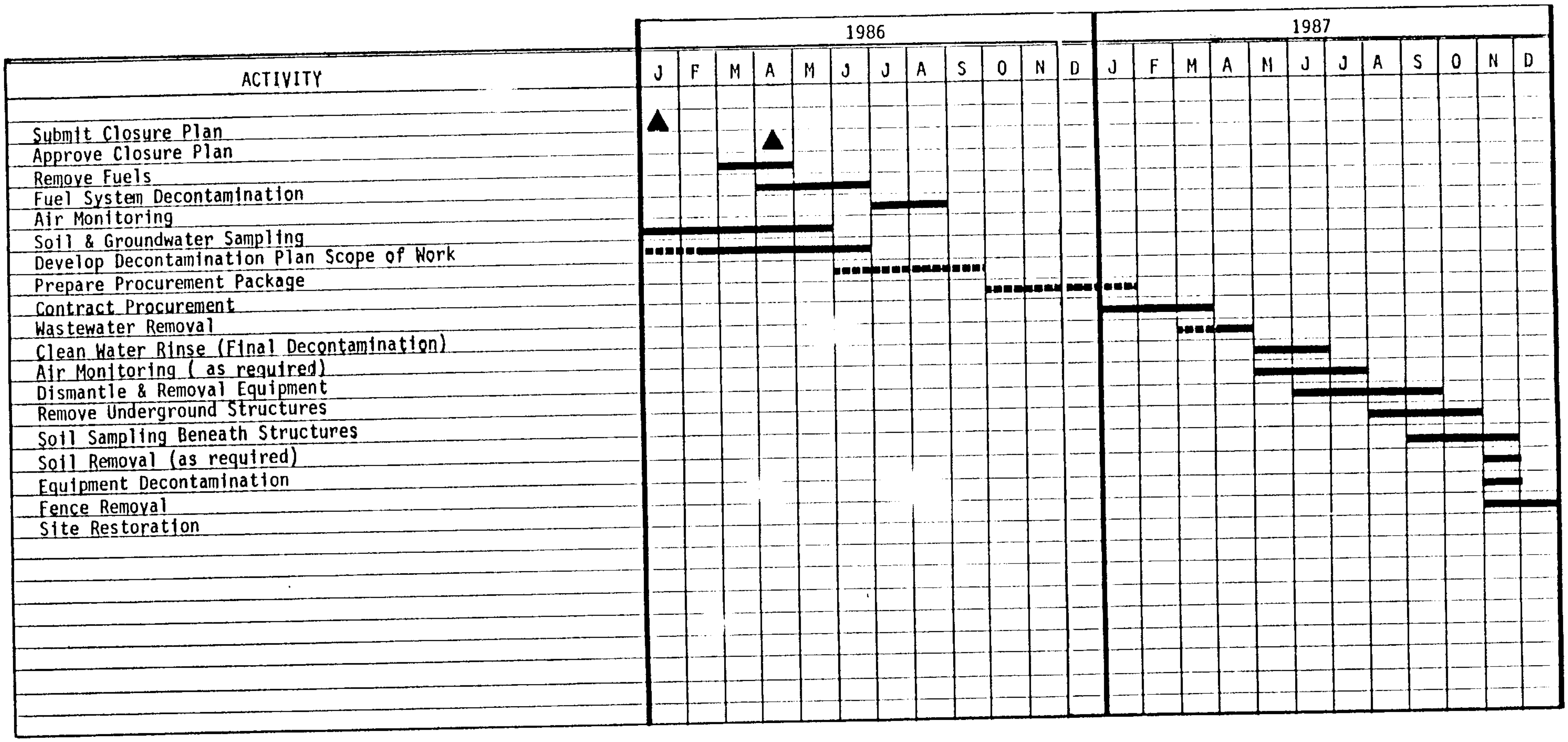
The removal of contaminated soil, if any, and structures within the boundary of the HBSF will be initiated last. The exact time required for removal and disposal of contaminated soils and underground pipes cannot be estimated at this time. However, PM-RMA plans to complete the HBSF closure by the end of 1987.

For the above-mentioned reasons, the closure activities of HBSF will require more than 180 days to complete after approval of the closure plan by the CDH.

FIGURE 5-1

SCHEDULE FOR CLOSURE

HYDRAZINE BLENDING AND STORAGE FACILITY



Key: ▪▪▪▪▪▪ = Contracting Phase; ▬▬▬ = Performance Phase

6.0 CERTIFICATION OF CLOSURE

Following cleaning, decontamination, removal, and disposal of contaminated and uncontaminated equipment, and structures the PM-RMA, in conjunction with an independent registered professional engineer working for the cleanup contractor, will certify that all hazardous wastes and constituents have been removed from the HBSF in accordance with the provisions of this plan.

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