AD-756 641

SURVEY OF INDUSTRIAL WASTE INJECTION WELLS. VOLUME I.

Don L. Warner

Missouri University

Prepared for:

Geological Survey
Advanced Research Projects Agency

June 1972

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

DISCLAIMER NOTICE

THIS DOCUMENT IS THE BEST QUALITY AVAILABLE.

COPY FURNISHED CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SURVEY OF INDUSTRIAL WASTE INJECTION WELLS

VOLUME I

by
Don L. Worner, Ph.D.
Professor of Geological Engineering
University of Missouri

June 1972

Sponsored by the
U. S. Geological Survey
Contract No. 14-08-0001-12280
Under ARPA Order No. 1684

Final Technical Report on
"Survey of Industrial Waste Injection Wells"

U. S. Geological Survey Contract

14-01-0001-12280 ($26,678.00)

Jan. 1, 1971 -- June 30, 1972

Submitted by

Dr. Don L. Warner, Principal Investigator

Department of Geological Engineering

University of Missouri

Rolla, Missouri 65401

To

Dr. C. B. Raleigh

Program Manager

U. S. Geological Survey

345 Middlefield Road

Menlo Park, California

June 1972

INTRODUCTORY STATEMENT

This report consists of 246 forms, each eight or more pages long, describing individual wastewater injection wells that have been inventoried. The following table lists the 22 states in which wells are known to exist and the number of wells inventoried in each of the 22 states. The forms are grouped by state and arranged approximately chronologically within each state.

Alabama	5	Nevada	1
California	4	New Mexico	1
Colorado	2	New York	4
Florida	5	North Carolina	1
Illinois	5	Ohio	8
Indiana	12	Oklahoma	9
Iowa	1	Pennsylvania	8
Kansas	27	Texas	71
Kentucky	3	Tennessee	4
Louisiana	40	West Virginia	7
Michigan	27	Wyoming	1
			246

There are presently more than 246 wells in existence, because this study has been carried out over a period of 18 months, and during that time additional wells were constructed in Texas, Louisiana, Michigan, Indiana, Illinois, and perhaps other states, after the time at which wells in those states were described. All wells that have been constructed for injection of industrial wastewaters into saline water aquifers were included. In addition to operative wells, some of the wells in the survey have never been operated others have been operated, but are now inactive or abandoned. Oilfield brine injection wells are not included, nor are wells exclusively for injection of sewage effluent.

Most of the information contained in the forms has been obtained from the files of state agencies. In some cases, the individual companies have been asked to supply information and have done so. In a few instances, information is from other sources. Each form lists the source or sources from which information was obtained. The wide variation in the quantity and quality of the information in the forms reflects the amount and quality of information readily available. No doubt all or almost all of the items in each form could be filled in, if sufficient time and effort were invested. Although some of the pages contain no information, the complete form has been reproduced for each well, so that additional data can be added if desired.

WELL FILE NUMBER

A1-1
UMR

I. Operating Company & General Well Location

Stauffer Chemical Company
Bucks, Alabama
about 16 miles north of Mobile

II. Well location (legal description)

Location: 2056.3 ft. north of the south line, 868.2 ft. east of the west line, SE 1/4, Sec. 7, T.1D., R.1E. Mobile County, Alabama

III. History; system planning, construction & operation.

An initial feasibility study was completed in June, 1968. The well was drilled, completed and tested by February 1969. Surface facilities were completed during April-August, 1969. Injection began in August, 1969. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on a small anticlinal feature within the Mobil graben on the Gulf Coastal plain of southwest Alabama.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___ ; no ___).

(Ground elevation _____) (Total well depth 4,300')

Datum for depth measurement D. F. 41.4 ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
Alluvium			at 40'	---
Miocene			400- 430'	---
Oligocene-Chickasaway Limestone?			1060-1090'	---
Byram Formation? - Bucatunna				
Clay Member?			1150-1180'	1070'
Jackson Group			1270-1300'	---
Moodys Branch Formation			1390-1420'	---
Claiborne Group?			1510-1540'	---

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wilcox Group	Eocene	2500'		Sands of extensive areal distribution which are each 70 to 80 feet thick.
Midway Group	Paleocene	3880'		

D. Engineering description of injection units

1. Porosity: 34%
2. Permeability: 400 millidarcies
3. Original Reservoir Pressure: 1418 psi - depth not specified
4. Reservoir Temperature: 136°F
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: Fracture gradient found to be 0.82 psi/ft.

(continuation IV - B)

Tallahatta Formation	2080-2110'	1810'?
Wilcox Group?	2500-2530'	---
Hatchetigbee Formation?	3220-3250'	---
Salt Mountain Limestone	3820-3850'	3800'
Midway Group	3880-3910'	3880'

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Recent and Miocene sands	0-1,200'	1,200'	unconsolidated sand	potable, used for industrial & municipal supply, yields up to 1,000 gpm

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil production in the area is from the following fields:

Citronelle field - Rodessa Formation - 10,500 - 11,500'

South Carlton field - Tuscaloosa Formation - 5,800'

Tensaw Lakes field - Paluxy Formation - 8,400'

Salt is produced from the McIntosh salt dome at a depth of about 400'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15 "	32.7#/ft.,H-40,ST&C	10 3/4"	1,238	(1)
Intermed.	9 7/8"	23#/ft.,J-55,ST&C	7 "	4,216	(2)
Injection		9.5#/ft.,H-40	4 1/2"	3,401	

(1) 250sks 50-50 Litepoz w/4% gel, 3% CaCl, followed by 225sks 50-50 Litepoz w/4% gel & 3% CaCl, followed by 200sks Class H common w/3% CaCl

Cement (2) 175sks 50-50 Litepoz w/10% gel followed by 300sks Class H

Describe bottom hole completion method: perforation of 7" casing

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Centralizers for 10 3/4" 1235', 1147', 945', 800', 754', 612', 465'

Centralizers for 7" 4212', 4172', 4131', 4048', 3583

packer Baker model A-1 Lok-set @ 3393'

VI. Description of surface equipment

A. Holding tanks & flow lines Holding tanks before and after filters

B. Filters yes - pressure type

C. Pumps yes - transfer and injection

D. Other

VII. Cores, samples, & logs

A. Coring - Sidewall cores

[illegible]	[illegible]	[illegible]	[illegible]	Recovery
"	[illegible]		[illegible]	
"	[illegible]		[illegible]	
"	[illegible]		[illegible]	
"	[illegible]		[illegible]	
"	[illegible]			

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

___ Gamma ray-neutron

X Temperature

___ Cement bond

___ Other Compensated density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Industrial and agricultural chemical manufacture

B. Physical & chemical Description alkaline wastewater containing small amounts of chlorides and phosporous

C. Volume maximum of 216,000 gpd (140gpm)

IX. Preinjection waste treatment Filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection		Wilcox sands	420gpm at 500psi well head pressure
		Midway sands	would also accept wastewater, but not as readily as Wilcox zone

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
	30 gpm	
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
	150psi	
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Will require periodic acid treatment to maintain injection capacity.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Alabama Geological Survey

WELL FILE NUMBER

STATE

A1-2
UMR

I. Operating Company & General Well Location

U. S. Steel Corp.
Fairfield Works
Fairfield, Alabama

II. Well location (legal description)

Location: 438.5' E & 279.5S NE Corner, NW 1/4, SW 1/4, Sec. 10, T18S, R4W, Jefferson Couty, Alabama

III. History, system planning, construction & operation.

Drilling began in January, 1970, and the well was completed in March. The well was financed as a research project by U. S. Steel, with the Alabama Geological Survey in charge of all operations. The well is not yet in operation as of June 1972, and it is not certain whether the wastewater will be $FeCl_2$ or $FeSO_4$ when the well is put into operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Valley and Ridge geographic province on the flank of the Birmingham anticline. Limestones, shales, sandstones, chert, dolomite, and some iron ore seams occur, ranging in age from Cambrian to Pennsylvanian at the well site.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no 1).

(Ground elevation _____) (Total well depth 6000)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Pottsville	Pennsylvanian	surf.	3[illegible]	ss., siltstone, shale & coal
Bangor	Mississippian	3[illegible]	200	limestone, ss & shale
Hartselle	Mississippian	3[illegible]	181	sandstone
Gasper	Mississippian	3[illegible]	3[illegible]	black shale
Tuscumbia	Mississippian	3[illegible]	108	limestone
Ft. Payne	Mississippian	3[illegible]	2[illegible]	limestone and cherts
Red Mountain	Silurian	4[illegible]	4[illegible]	sandstone and limestone
Chickamauga	Ordovician	4[illegible]	2[illegible]	dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Description (as about injection)
Copper Ridge (Knox)	Ordovician	4[illegible] (drilled)	2[illegible]	dolomite-periodically stimulated

Injection zones are at 4,415 to 4,635 ft. and 5,540 to 5,770 ft.

D. Engineering description of injection units

1. Porosity: fracture porosity
2. Permeability: fracture permeability
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: saline
6. Reservoir Fracture Pressure: _____

V. Drill design and equipment, continued

2. Packers, centralizers, and bent sub/bumper, size _____
Centralizers at 2200, 2800, 3004, 3117, 3217, and 3377
Bumper sub at 3377

VI. Description of surface equipment

A. Rotary table & flow line _____

B. Pitcher _____

C. Tanks _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

Type	Size	In	Depth	Recovery	Pct.
*	9.625		2110		100%
*	9.625		2.3		100%
*					
*					
*					

B. Drilling logs

Driller's log

X Drilling time

X Sample log

Other _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Injection Laterlog

X SP

X Caliper

X Other Sidewall neutron, formation density, flowmeter, radioactive tracer survey

X Gamma ray-neutron

Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical description Spent steel pickling liquor. Primarily $FeCl_2$ or $FeSO_4$, depending on the process that is used.

C. Volume 100 cm

IX. Preinjection waste treatment Decanting, skimming, two stage filtering

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	19 hrs.	Injection	well accepted
		Zone	150gpm @ 1250psi
		2810-2975	ISIP 375 FSIP 386 (2171
		3153-3551	ISIP 882 FSIP 882 (3117
		3570-3724	test failed
		3570-3724	ISIP 1492 FSIP 1421 (3711
		4382-4416	ISIP 615 FSIP 615 (4413

B. Treatments or Stimulation

Zones Treated	Treatment Intervals	Description of Treatment and Results
5525-6003	acidized and	
	swabbed	

C. Injection rates and pressures- (well not yet operated, see testing information above)

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

I. Well operation & operating history

D. Description of operating program: Not determined, but injection will be continuous during operation of the pre-treatment system, because very little retention of treated wastewater is provided for.

E. Operating problems: Not yet operating, an anticipated possible problem is reaction of the acid wastewater with the minerals of the injection zone to form precipitates of $Fe(OH)_3$, $Fe(OH)_2$, and $CaSO_4$.

II. Regulatory aspects.

A. Construction requirements: as constructed

B. Monitoring requirements: Monitoring of reinjection and of fresh water zones. Monitoring of injection rate and pressure and calculation annular pressure.

C. Restrictions on operating procedure

VII. Facilities

A. Total and unit costs of construction _____

B. Operating costs _____

VIII. Summary of Information and Problems Encountered _____
Airborne Industrial Survey

WELL FILE NUMBER STATE A1-3 UMR

I. Operating Company & General Well Location

Petrolab Chemical Company

Tuscaloosa, Alabama

II. Well location (legal description)

Northwest 1/4 Sec. 3, T.21N., R.9W., Tuscaloosa County, about 1 mile northwest of the center of Tuscaloosa on U.S. Hwy. 11, Alabama.

III. History, system planning, construction & operation.

Initial feasibility and geological studies were made by the Geological Survey of Alabama and a consulting firm. The results of site study were presented in a report in September 1969. Drilling of the well began in May, 1970, and the well was completed in August 1970. The project was financed by the Federal Water Quality Administration and Petrolab Chemicals, Inc. The project was operated by the Alabama Industrial Water Board. The well is not in operation (1974).

IV. Geology & Geohydrology

A. Regional geologic setting: The site is within the Black Warrior sedimentary basin. Sedimentary rocks at the site range in age from Devonian to Pennsylvanian.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 8097)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Pottsville	Pennsylvanian	80		ss., sh., siltstone
Parkwood	Mississippian	4390		sh. and siltstone
Floyd Shale	Mississippian	4845		sh. and limestone
Ft. Payne Chert		5610		limestone and chert
Chattanooga Shale	Devonian	5835		shale and cherty limestone
Pre- "	Devonian	6870		shale and cherty limestone
undifferentiated	Silurian	6070		limestone
undifferentiated	Ordovician	[illegible]		
Knox Group	Cambrian	[illegible]		dolomitic limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
-	Cambrian	[illegible]	50ft.	sandstone
-	"	[illegible]	200ft.	dolomitic limestone
				porous zone

D. Engineering description of injection units

1. Porosity: 1.5 to 1.0% in sandstone interval
2. Permeability:
3. Original Reservoir Pressure: 1,200 psi from DST at 6,980 - 7,465 ft.
4. Reservoir Temperature:
5. Chemical Character of Formation Water: From 6986-7465' Ca-8,600 mg/l, Mg-1,600, Na-25,000, K-1,040, Chloride (Cl)-56,000
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	0-	80ft.	limestone and dolomite	fresh
Pottsville	80-3000ft.		sandstones	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Coal beds occur in the Pottsville Formation.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40 [illegible] #/ft.	16 in	45'	150sks Port.A. & Poz
Intermed.	13 3/4in.	H-40 [illegible] #/ft.	10 3/4in	1220'	500sks lt. cement
	9 5/8in.	K-55 [illegible] #/ft.	7 in	5020'	bottom to 4150ft.
Injection		H-40 6.4#/ft.	2 7/8in	5023'	

Other

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Baker tubing anchor at bottom of tubing string.

Centralizers for each casing string.

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	*8075	to 8097	Recovery 100%
"			
"			
"			
"			
"			

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other: _____

*medium-gray dense limestone with thin layers of shale and dolomite.

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity laterlog — X [illegible]

___SP — ___Temperature

___Caliper — X Gamma ray

___Other Sonic, density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Production of mixed resins, Phenol-formaldehyde resins, Formaldehyde, Perhaps other, and DMF waste.

B. Physical & chemical Description Extremely oxidizing sodium sulfite and sulfate, liquid, caustic, mix traces of organic chemicals.

C. Volume 50,000 to 100,000 gpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem		6986-7465	recovered 6,000 ft. of saline water

See opposite page for injectivity test data.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements: _____

C. Restrictions on operating procedures: _____

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Published References _____

Alabama Geological Survey

I. Operator Company & General Well Location

Disposition, Inc.
Atchison, Kansas

II. Well Location (Legal Description)

Location: Sec. 41, T9S, R19, Wyandotte County, Kansas.

III. History, system planning, construction & operation.

Initial feasibility studies were made in 1969. The first well was drilled, completed, and tested during the period October 31, 1970, to December 21, 1970. The second well was completed in June, 1971. The wells are not yet in operation (June 1973).

IV. Geology & Hydrology

A. Regional Geologic Setting. The wells are located within the central Gulf Coastal Plain. The most prominent geologic structural feature in the area are the Ouachita mountains and the Ouachita rift zone. Brine penetrates in the wells place is one from Mississippi to Texas and its uniformity throughout the southwest.

IV. Geology & Geohydrology, continued 3.

B. Geologic description of rock units penetrated by well:

Rock Unit (Geologic Column Included--yes ___; no X).

(Ground elevation _____) (Total well depth 7,500ft.)

Datum for depth measurement _____

Time	Age	Depth (top)	Thickness	Lithologic Description
[illegible]	Oligocene	~1050		
[illegible] Group	Eocene	~1230		clay, sand, shale, limestone and marl
[illegible] Group	Eocene	~1440		
[illegible] Fm.	Eocene	~2160		claystone, shale, and limestone
Wilcox Group	Eocene	~2340		shale, limestone, sandstone, and marl
Wilcox Group	Eocene	~2360?		marl, limestone, sandstone, and shale
[illegible] Group	Cretaceous	~4710		shale
[illegible] Fm.	Cretaceous	~6150		sand, sandstone, and shale
[illegible] Group	Cretaceous	~7850		sand, gravel, and [illegible]

C. Geologic description of injection units & possible units not in use

Rock Unit

Time	Age	Depth (top)	Thickness	Character and Areal Distribution
Wilcox Group	Eocene	2340		sands and sandstones

injection from 1,800 to 3,950

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: _____

IV. Geology & Hydrologic Conditions

1.

A. Determination, fresh water aquifers in vicinity

Zone	Depth	Thickness	Character	Chemical Quality
These zones range in Recent and Tertiary age deposits to a depth of about 600 feet.				

B. Mineral Resources (oil and gas, coal, brines, etc.)

None in the injection unit.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface				1,100	to surface
Intermed.					
Injection					
Other					

Describe bottom hole completion method: screen and gravel pack

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Radioactivity - Induction ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other Dipmeter, borehole televiewer, formation density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description Liquid radioactive waste and stock consists and laboratory waste including strontium, cesium-radium, and tritium

C. Volume Estimated to be here from 1970-78

IX. Proinjection waste treatment

I. Well operation & operation history

A. Description of operating programs: fuel operation

B. Operating problems:

II. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedures

WELL FILE NUMBER _____ STATE A1-5 UMR

I. Operating Company & General Well Location

Ciba-Geigy, Inc.

McIntosh, Alabama

II. Well location (legal description)

Location: Sec. 41, T4N, R1W, Washington County, Alabama

III. History, system planning, construction & operation.

Initial feasibility studies were made in 1969. The first well was drilled, completed, and tested during the period October 31, 1970, to December 23, 1970. The second well was completed by June, 1971. The wells are not yet in operation (June 1972).

IV. Geology & Geohydrology

A. Regional geologic setting: See A1-4

[illegible] [illegible]

A. [illegible], [illegible] [illegible] [illegible] [illegible]

Date	Depth	Thickness	Physical Quality
[illegible]			

F. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

V. [illegible] [illegible] [illegible]

A. [illegible], [illegible], [illegible] [illegible]

	Date	Testing or Testing		Depth	Type & Length
[illegible]					
[illegible]					
[illegible]					
[illegible]					

[illegible] [illegible] [illegible] [illegible] [illegible]

V. Well design and construction

A. Packers, hangers, well head equipment, etc: _____

VI. Description of surface equipment

A. Tubing valve & flow lines _____

B. Fillers _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling logs

_____ Drillers log

_____ Sample log

_____ Mudlog data

_____ Log: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity - Induction ____Gamma ray-neutron

____SP ____Temperature

_X_Caliper ____Cement bond

____Other formation density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description See file

C. Volume See file

IX. Preinjection waste treatment

X. Well operation & operating history

A. Description of operating programs: [illegible]

B. Operating problems:

XI. Regulatory aspects.

A. Construction requirements:

B. Monitoring requirements:

C. Restrictions on operating procedure:

WELL FILE HISTORY

STATE

Ca-1
OWW

I. Operating Company & General Well Location

Aerojet General Corporation
Sacramento, California

II. Well location (legal description)

Location: Aerojet General's plant, Sacramento, California.
Sec. 12, T9N, R7E, Sacramento County

III. History, system planning, construction & operation.

The well was drilled and completed in January, 1963 and began operating soon after completion. The well is presently not in use and has been filled with a corrosion inhibitor while it is on standby status.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the southern portion of California's Sacramento Valley. The regional dip at the well site is to the west. The stratigraphic section consists of sands, siltstones, shales of Cretaceous, Tertiary, and Quaternary age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___ ; no X).

(Ground elevation _____) (Total well depth 1564 ft.)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
The strata encountered in the well consist of a highly variable series of sands, silts, and clays, of Tertiary age. Injection is into sands, that occur between 970 and 1564 feet. Confinement is provided by a sandy siltstone that occurs from 500 to 930 feet.				

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	Tertiary	970ft.	594ft.	sands with interbedded siltstone and mudstone

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: 400psi at 915ft.
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: about 300ppm total chlorides and 500ppm total dissolved solids according to an analysis provided by Aerojet General.
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Fresh water occurs in shallow sands				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			18 "	72ft.	to surface
Intermed.	17"	black steel	13 3/4"	670ft.	*to surface
(*356sks Permanente Class A + 356sks of perlite + 4% bentonite)					
Injection			8 5/8"	1400ft.	
Injection tubing			2 "	1200ft.	

Other

Describe bottom hole completion method: Slotted 8 5/8in. casing with a gravel pack, with 2in. injection tubing inside the casing.

V. Well design and construction, continued

D. Packers, Centralizers, well head equipment, etc: Casing centralizers on 12 3/4 in. casing at 250, 300, 725, and 935 feet. Wall scratchers on bottom joint of 12 3/4 in. casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Detention pond

B. Filters yes

C. Pumps Centrifugal pump with a maximum allowable well head injection pressure of [illegible] psig.

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from nitroplasticizer plant.

B. Physical & chemical Description 48,000ppm TDS, 14,500ppm Na, 6,000ppm K, 2,100ppm NO_3, 12,100ppm Cl, 1,000ppm F, 12,000ppm SO_4, 47ppm B, pH 6.7 to 12.2

C. Volume _____

IX. Preinjection waste treatment Settling in a detention pond, filtration, pH adjustment, and addition of corrosion inhibitor.

I. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Pressure testing of cement was performed to confirm a satisfactory cementing of the 13 3/4in. casing.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None reported		

C. Injection rates and pressures

1. Rate

Date(s)	Average 30gpm	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average 50psi	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Increase in injection pressure during later half of 1963 approached the limit specified by the State. This was attributed to corrosion products from the holding tank, the injection tubing, and the 8 3/4 in casing. The entire system was cleaned of corrosion products and put back into operation with corrosion inhibitor added to prevent additional corrosion.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure Maximum bottom hole injection pressure of 500psi.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication: California Water Quality Control Board and the Aerojet General Corporation

I. [redacted]

[redacted]

II. [redacted]

[redacted]

III. [redacted]

[redacted]

IV. [redacted]

A. [redacted]

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 95ft.) (Total well depth 1110ft.) (plugged back to 1070ft.)

Datum for depth measurement K.B. 105 ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
- - -	Cenozoic	0'	396'	interbedded sand and gravel with some silt and clay
- - -	Cenozoic	396'	154'	sand, silt, and clay
	Cenozoic	550'	182'	clay and clayey silt
	Cenozoic	732'	278'	olive gray clay
Wheatland Fm.	Eocene?	1010'	100'	gray fine-grained silty sand
		1110'		volcanic basement rocks

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1010'	100'	gray fine-grained silty sand, highly variable in lithology, not regionally distributed
	(only 60ft. was left open in the well)			

D. Engineering description of injection units

1. Porosity: about 35% intergranular
2. Permeability: from less than 100 to 5,000 millidarcies Av. (See below)
3. Original Reservoir Pressure: Not known
4. Reservoir Temperature: Not known
5. Chemical Character of Formation Water: TDS-27,664mg/l, including 14,600mg/l Chloride, 8,400mg/l sodium, 3,000mg/l Sulfate, and 1,600mg/l Calcium, pH 7.6. Analysis of sample from several thousand gallons pumped from one of the test wells.
6. Reservoir Fracture Pressure: _____

(continuation- D - 2) about 800 md. on one core and 26 Sidewall samples

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs in sands and gravels to a depth of 396 ft. Brackish water is present from 396 to 550 ft. below which the formation water is saline.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/4"	48#/ft.	H-40R-3	13 3/8"	205'	190sks-surface
Intermed.	12 1/4"	32#/ft.	H-40R-3	8 5/8"	980'	450 sacks
Injection						
Other liner		~~96.25 ft. long~~ stainless steel		6 5/8"	1066'	

Describe bottom hole completion method: Liner - perforated, top at 979', bottom at 1070', 60 mesh perforations, 2" slots, 6" centers, gravel packed

V. Well design and construction, continued

D. Packers, Centralizers, well head equipment, etc: 8 5/8" Packer set in the lower joint of the liner at 944' Type - Baker Model AD tension packer set with 10,000 lb. tension.

VI. Description of surface equipment

A. Holding tanks & flow lines An elaborate pre-injection treatment system is used to remove oil/gas from the waste-water and to prepare the wastewater for injection.

B. Filters pre-details not known

C. Pumps pre-details not known

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
1018	1057	Not known

B. Drilling Logs

X Drillers log

X Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	X Cement bond
___ Other ___	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Photo processing waste

B. Physical & chemical Description Developers, fix solutions, hardeners, bleaches, and wash waters from both color and black and white processes.

C. Volume [illegible] gpd

IX. Preinjection waste treatment Treated to retard bacterial growth with Dowicide G at 10ppm continual feed, pH maintained at 7.

Silver is removed from the waste by ion exchanger with iron.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water Shut off	1 Hour	98%.	confirmed good cement bond
Pumping	19 Hours	Injection zone	could produce 45gpm maximum
Injectivity		Injection zone	100gpm at 750psi well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Output	Description of Treatment and Results
Injection zone	Pumping and injection for 19 hours	

C. Injection rates and pressures - See injectivity test data. No operating information obtained.

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements A ground water monitor well was constructed to a total depth of 364ft., located 330ft. N and 460ft. West of SE corner, Sec. 5, T15S, R4E

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Published References _____

Written communication - Fairchild Space and Defense Systems and California Division of Water Quality Control

WELL FILE REPORT

STATE

Ca-1

I. Operating Company & General Well Location

Fairchild Space and Defense Systems, Beale Air Force Base, near Marysville, California

II. Well location (legal description)

Location: 70' South, 275' West of NE corner, Sec. 8, T14N, R4E, Yuba County, California

III. History, system planning, construction & operation.

See Ca-2

IV. Geology & Geohydrology

A. Regional geologic setting: See Ca-2

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ____ ; no X).

(Ground elevation 6[illegible]ft.) (Total well depth 1,10[illegible]ft. (plugged back to [illegible]ft.)

Datum for depth measurement K.B. [illegible]ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
	Cenozoic	0	475	Intermedded sand and gravel with some silt & cl[illegible]
	Cenozoic	475	115	sand, silt, & clay
	Cenozoic	590	290	clay and clayey silt
	Cenozoic	880	230	olive gray clay
Wheatland	Eocene?	1110	150	gray fine-grained silty sand
		1260		volcanic basement rock

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1110	150ft. (36' open in well)	gray fine-grained silty sand, highly variable in lithology, not regionally distributed

D. Engineering description of injection units

1. Porosity: about 5% from 31 tests
2. Permeability: from 1 to 813 millidarcies - see below
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: TDS-27,664ppm Sec Ca-2
6. Reservoir Fracture Pressure: _____

(continuation D - 2) Average about 225 md. from 31 tests.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs in sands and gravels to a depth of 476ft. Brackish water is present from 476 to 590 ft., below which the formation water is saline.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"	48#/ft.	H-40P-3	13 3/8"	207'	160sks-surface
Intermed.	12 1/4"	32#/ft.	H-40R-3	8 5/8"	1096'	530sks-surface
Injection	liner	100.31 ft. long stainless steel		6 5/8"	1191'	

Other

Describe bottom hole completion method: Gravel packed the perforated liner - 90 cu. ft. of gravel. Top at 1096', Bottom at 1196', 60 mesh perforations, 2" slots, 6" centers.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 8 5/8 in. Packer set at bottom 10 ft. with 15,000 lb. tension.

VI. Description of surface equipment

A. Holding tanks & flow lines See Ca-2

B. Filters See Ca-2

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	1133 ft.	to	1143 ft.	Recovery
"	1143 ft.		1158 ft.	
"				
"				
"				
"				

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction

X SP

____ Caliper

____ Other _____

____ Gamma ray-neutron

____ Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Ca-2

B. Physical & chemical Description Same as Ca-2

C. Volume 400,000 gpd

IX. Preinjection waste treatment Same as Ca-2

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water shut off	1 Hour	1055ft.	confirmed good cement job
Pumping	18 Hours	Injection Zone	produced 1m barrels of water
Injectivity		Injection Zone	165gpm at 1500# well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Tested	Description of Treatment and Results

C. Injection rates and pressures - Pre operation data. See injectivity test results

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ Bottom hole _____)

Date(s)	Average	Maximum

4. [illegible] operation & operating history

5. Description of controlling program: [illegible]

6. Operating problems: [illegible]

45. Regulatory aspects

A. Compliance [illegible]

B. Monitoring requirements [illegible]

C. Description of operating procedures [illegible]

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Fairchild Space and Defense Systems and California Division of Water Quality Control

WELL FILE NUMBER

Ca-4
UMR

I. Operating Company & General Well Location

Fairchild Space and Defense System, Beale Air Force Base, near Marysville, California

II. Well location (legal description)

Location: 730' North, 260' West of SE corner, Sec. 5, T14N, R5E, Yuba County, California.

III. History, system planning, construction & operation.

See Ca-2

IV. Geology & Geohydrology

A. Regional geologic setting: See Ca-2

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 85 ft.) (Total well depth 1289 ft.)

Datum for depth measurement K.B. 95ft. (Plugged back to 1213ft.)

Name	Age	Depth (top)	Thickness	Lithologic Description
	Cenozoic	0	465ft.	interbedded sand and gravel
	Cenozoic	465ft.	135ft.	sand, silt, & clay some silt ~~and clay~~
	Cenozoic	600ft.	307ft.	clay and clayey silt
	Cenozoic	907ft.	198ft.	olive gray clay
Wheatland Fm.?	Eocene?	1105ft.	178ft.	gray fine-grained silty sand
		1283ft.		volcanic basement rocks

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1105ft.	178ft. (108' open in well)	gray fine-grained silty sand, highly variable in lithology, not regionally distributed

D. Engineering description of injection units

1. Porosity: Av. about 32% for 9 samples
2. Permeability: Range from 1 to 3,700 millidareies-See below
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: TDS-27,664ppm See Ca-2
6. Reservoir Fracture Pressure: _____

(continuation D - 2) Av. for 9 tests 560 md.

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs in sands and gravels to a depth of 465 ft. Brackish water is present from 465 to 600 ft., below which the formation water is saline.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"		13 3/8"	212'	160sks-surface
Intermed.	12 1/4"		8 5/8"	1095'	360sks
Injection liner		~~108.47 ft. long~~ stainless steel	6 5/8"	1203'	

Other

Describe bottom hole completion method: Liner-(bottom to top) 20' perforated, 10' semiperforated, 10' blank, 60' perforated, 5' blank, 1' perforated, 5' blank. Gravel pack - 58 cu. ft. of gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Baker Model AD tension Packer at 1089.6 ft. with 18,000 lb. tension

VI. Description of surface equipment

A. Holding tanks & flow lines See Ca-2

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs - no core, but 12 sidewall samples

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

X Drillers Log

X Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

_X_SP ___Temperature

___Caliper _X_Cement bond

_X_Other Induction log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Cs-2

B. Physical & chemical Description Same as Cs-2

C. Volume 400,000 gpd

IX. Preinjection waste treatment Treated to retard bacterial growth with bowicide G at 10ppm continual feed.

pH is maintained at 7.

Silver is removed from the waste by ion exchange with iron.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water shut off		1046ft. and 400ft.	confirmed good cement job
Pumping	8 Hours	Injection zone	Could produce more than 90gpm
Injectivity			Could inject 160gpm at 120 psi well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection	Pumping and surging for 8 hours	

C. Injection rates and pressures - See injectivity test,

1. Rate no operating data obtained.

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements See Ca-2

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Fairchild Space and Defense Systems

WELL FILE NUMBER

STATE

Co-1
UMR

I. **Operating Company & General Well Location**

U. S. Corps of Engineers and Chemical Corps
Rocky Mountain Arsenal, Colorado

II. **Well location (legal description)**

Location: NW 1/4, NE 1/4, Sec. 26, T2S, R67W, Adams County, Colorado.

III. **History, system planning, construction & operation.**

The well was drilled and completed in November, 1961 and began disposing of chemical waste from the Rocky Mountain Arsenal into PreCambrian crystalline rock. Prior to the operation of the disposal well, waste was disposed of into seepage ponds on the arsenal grounds. These ponds were responsible for supplying waste which was destroying crops by communication through a shallow aquifer system.

Soon after injection began, the area around the well began experiencing numerous earth tremors which was highly abnormal for this area, since the last quake in the area occurred in 1885.

A statistical correlation between the number of shocks and the injection rate was carried out which postulated that injection could be causing the earth tremors. The operation of the well was suspended in February, 1966 until the correlation could be properly investigated. The well has not operated since it was suspended.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The well is situated on the east flank of the Denver Basin, nine miles east of the synclinal axis. The stratigraphic section consists of sandstones, limestones, and shales of Cambrian to Cretaceous age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ____).

(Ground elevation 5170 ft. MSL) (Total well depth 12,045 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
Fox Hills	Cretaceous	0ft.	1250ft.	sandstone
Pierre	Cretaceous	1,250ft.	4198ft.	shale
Hygiene	Cretaceous	5,448ft.	2262ft.	sandstone
Niobrara	Cretaceous	7,710ft.	290ft.	chalky shale
Benton	Cretaceous	8,000ft.	345ft.	shale with limestone
Muddy	Cretaceous	8,345ft.	100ft.	sandstone
Dakota	Cretaceous	8,445ft.	300ft.	sandstone

CONTINUED ON NEXT PAGE

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	PreCambrian	11,950ft.		highly fractured hornblende granite gneiss containing pegmatite intrusions

D. Engineering description of injection units

1. Porosity: 2%
2. Permeability: [illegible].9 X 10^{-2} md
3. Original Reservoir Pressure: 4653psi
4. Reservoir Temperature: 240°F
5. Chemical Character of Formation Water: Brine at 114°C and a density of 1.01gm/cm^3
6. Reservoir Fracture Pressure: .41psi/ft.

IV. Geology & Geohydrology, continued (CONTINUED) 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Lakota	Cretaceous	8,700ft.	56ft.	sandstone
Morrison	Jurassic	8,786ft.	190ft.	shale
Lykins	Triassic	8,972ft.	610ft.	sandstone
Fountain	Pennsylvanian	9,772ft.	2100ft.	conglomerate, siltstone & shale
Regolith	Ordovician - Cambrian	11,880ft.	170ft.	
	PreCambrian	11,950ft.		schist & gneiss

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Positive Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Fox Hills	0	1250	sandstone and gravel	

F. Mineral Resources (oil and gas, coal, uranium, etc.)

Oil is produced from the Dakota and Minnelusa formations in the Hanna Basin.

V. Well Design and Completion

A. Casing, Tubing, and Screen

	Hole Size	Setting of Casing (Ft. & Feet)	Size	Setting of Tubing (Ft. & Feet)	Screen Set	Type & Amount of Screen
Surface	17	5[illegible]		20	5[illegible]	Screen + 18 [illegible]
Intermed.	17 1/2[illegible]			11 1/2[illegible]	7,[illegible]	[illegible]
	11	1[illegible]		8 1/2[illegible]	11,[illegible]	[illegible]
Interior				5 1/2[illegible]	5,[illegible]	Screen + 18
						Bentonite

Other

Describe bottom hole completion, mining: open hole completion

V. Well design and construction, continued

B. Packers, foundations, well head equipment, etc: Baker Model 3 packer at 1112ft.

2 foundations on 8 7/8in casing at 812ft. and 1082ft.

VI. Description of uniform columns

A. Casing tubes & flow lines: 4 tons flow line, 10 gray iron 12in casing, 12,000 gal. concrete penstock, 1000, and a 30,000 gal. clarifier.

B. Pumps: 2 x 10 stage Co. Lab Pumps

C. Pumps: 2 x single stage vertical lift pumps, 4 Worthington piston air-lift pumps to prevent backlash water hammer

D. Power: Electric motor + gas (ign) for 2 to drive batteries

VII. Comp. Health, & Lab

A. Outlet

Price	Size	Capacity
a		
b		
c		
d		
e		

B. Drilling Log

$ Drillers log

Dowell Inc

$ Drilling time

Depth

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

___ Caliper

___ Other

___ Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste

B. Physical & chemical Description Analysis of injection waste is not available, but it described as slightly basic (pH=8.0) and contains ammonia, nitrates, chlorides, chlorates, chlorinated hydrocarbons, and organic phosphorous compounds.

C. Volume 165 million gal. for life of well.

IX. Preinjection waste treatment Settling, filtration, and addition of bacteria killing agent.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	13 tests	Fountain Fm.	7,400ft. of water was recovered. Results were poor.
Pump test		PreCambrian Rocks	Reservoir accepted >400gpm at 2000psi.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 250gpm Maximum 700gpm

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 550psi Maximum 1100psi

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Problem is stated in well history.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements The well was seismically monitored from several locations.

C. Restrictions on operating procedure None reported.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

U. S. Army Corps of Engineers, Report of Investigation, "Injection Well Earthquakes Relationship - Rocky Mountain Arsenal, Colo.", Oct. 1966.

David M. Evans, "Man Made Earthquakes in Denver", Geotimes, Vol. 10, No. 9, May 1966.

Donaldson, 1964.

Louis J. Scott, "Pressure Injection Disposal Well, Rocky Mountain Arsenal, Denver, Colo.", The Mountain Geologist, Vol., No. 1, Jan. 1963.

Healy & Others, "The Denver Earthquakes", Science, Vol. 161, Sept. 1968.

Healy & Others, "Geophysical & Geological Investigations Relating to Earthquakes in the Denver Area, Colo.", Dept. of Interior, open file report, March 1966.

WELL FILE NUMBER

STATE

Co-2
UMR

I. Operating Company & General Well Location

Shell Oil Company

1700 Broadway

Denver, Colorado 80202

II. Well location (legal description)

250 ft. east and 110 ft. south of west 1/4 corner of sec. 28, T.1 S., R.97 W., Rio Blanco County, Colorado

III. History, system planning, construction & operation.

Injection began January 1, 1971

The well was converted from a stratigraphic test well to a waste disposal well. It is intended for use for 30 months to dispose of approximately 150 acre-feet of waste water from an experimental pilot project.

The well was originally designed for injection at 1200 ft. but due to low permeability at that depth, it was extended to 1,500 ft. It is presently operating successfully.

The driller was - Signal Drilling Co.

IV. Geology : Geohydrology

A. Regional Geologic setting: The well is located on the east flank of the Piceance Creek Basin. The basin contains approximately 4,000 ft. of Tertiary sediments. A CRSI bulletin lists a fault 2 1/4 miles from the site. Major drainage in the area is Piceance Creek

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included --yes ____; no X).

(Ground elevation 6,082 ft.) (Total well depth 1500 ft.)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Green River Formation	Tertiary	120'	4000'	
Evacuation Creek Member				
Mahogany Member				
Parachute Creek Member				
Garden Gulch Member				
Douglas Creek Member				
Wasatch Fm. Member				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Parachute Creek Member of Green River Fm.	Tertiary	1475'	80'	Leached zone

D. Engineering description of injection units

1. Porosity: + 30% - by acoustic velocity
2. Permeability: _____
3. Original Reservoir Pressure: about 540 psi in the interval 1270 - 1551 ft.
4. Reservoir Temperature: 77° F
5. Chemical Character of Formation Water: A sodium bicarbonate with a total dissolved solids content of about 44,000 ppm.
6. Reservoir Fracture Pressure: 1566 psi

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
The only information states that ground water is found in the Green River Formation. Information related to ground-water can be found in "Geohydrology of the Piceance Creek Structural Basin between the White and Colorado Rivers, Colorado" by Coffin, et. al.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Extensive petroleum deposits are found in the basin in the form of oil shale. Sodium minerals such as dawsonite [$NaAl(OH_2)CO_3$] and nahcolite [$NaHCO_3$] are found in the lower portion of the Parachute Creek Member.

7. Well design and construction (See attached diagram)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement used
Surface	12 1/4"		9 5/8"	192'	475 sacks -Class G
Intermed.	8 3/4"	K-55 36lb/ft.	7"	1100'	230 sacks - Dowell
Injection	5"	[illegible]	3 1/2"	1100'	
Producer	6 1/4"	[illegible]	3 1/2"		
			3 1/2"	bottom 170'	

Other

Describe bottom hole completion method: Open hole completion to 1242 ft. Slotted 3 1/2 inch casing at the bottom 50 ft. of hole.

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc: _____

Tension packer at 1,090 ft. Baker lock set packer at 1,127 ft.

A pressure gauge is used in the well head.

VI. Description of surface equipment (See attached diagram)

A. Holding tanks & flow lines 100 barrel surge tank and 7,500 barrel lined sump pit.

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling logs

___ Drillers log ___ Drilling time

___ Sample log ___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	X Gamma ray-neutron
X SP	___ Temperature
___ Caliper	___ Cement bond

X Other Dual Induction - Laterolog, sonic log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Waste from an experimental oil shale pilot project.

B. Physical & chemical Description Brine solution with up to 151,000 ppm of dissolved solids containing sodium carbonate and bicarbonate as the principal salts.

C. Volume ~150 gpm

IX. Preinjection waste treatment Settling of suspended solids and possible filtration and dilution if necessary.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem #1		1111'-1242'	Pressure-470psi at 1111'
Drill stem #2		1270'-1500'	Pressure-562psi at 1253'
Injectivity tests (at least 5)		Leached zone at 1440'-1481'	Injection about 140 gal./min. at a well-head pressure of 300psi

B. Treatments or Stimulation

Zones Treated	Treatment (other)	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Jan. 6, 1971		62 gpm			
Feb. 1971		62 gpm		63 gpm	

2. Pressure (well head _____ bottom hole _____)

Date(s)		Average		Maximum	
Jan. 6, 1971		300 psi			
Feb. 1971		310 psi			

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Conservation requirements _____

B. Reflecting requirements _____

C. Possibilities of revenue reduction _____

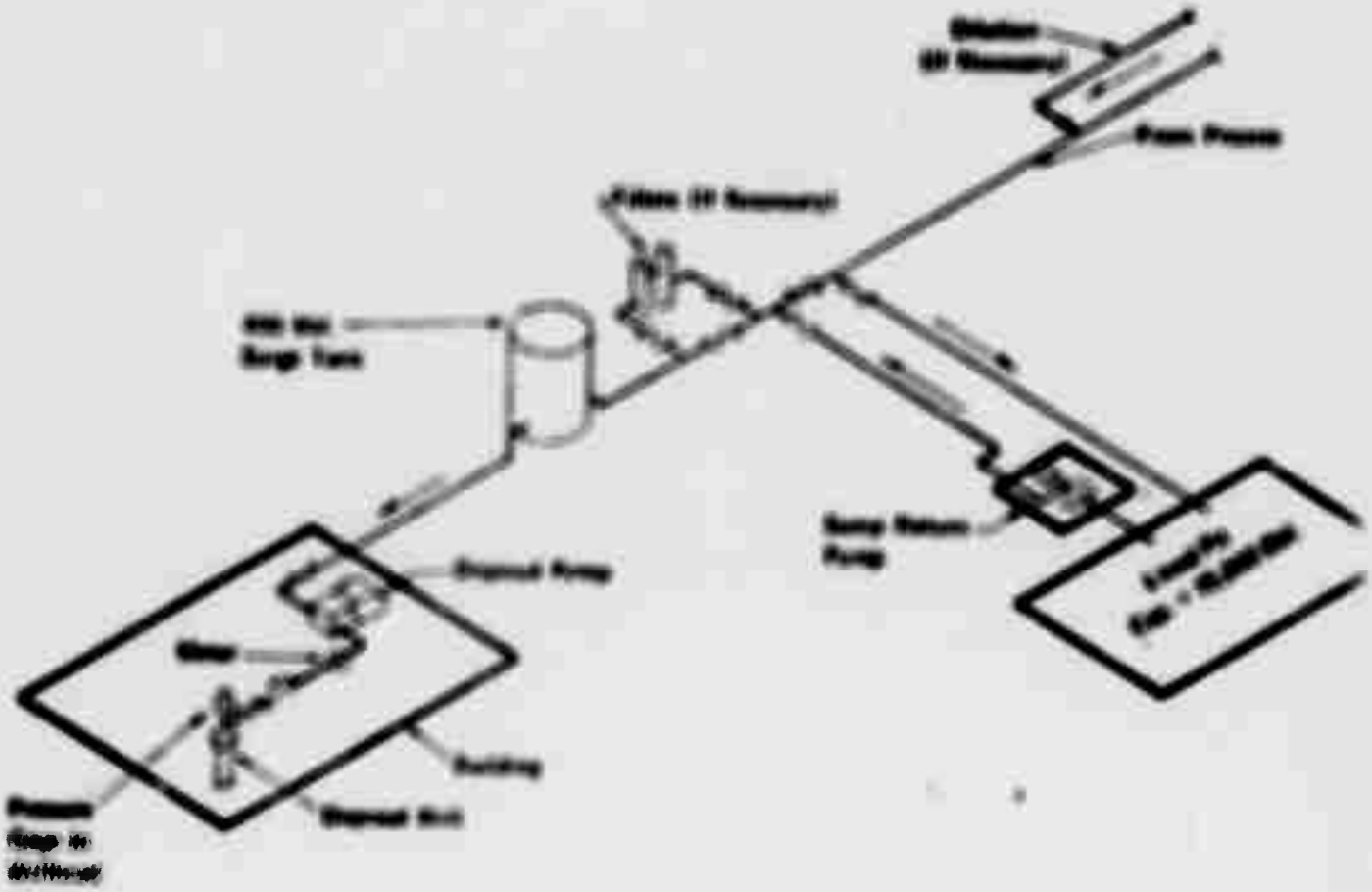
XII. Remarks

2. Total & unit costs of construction

3. Operating costs

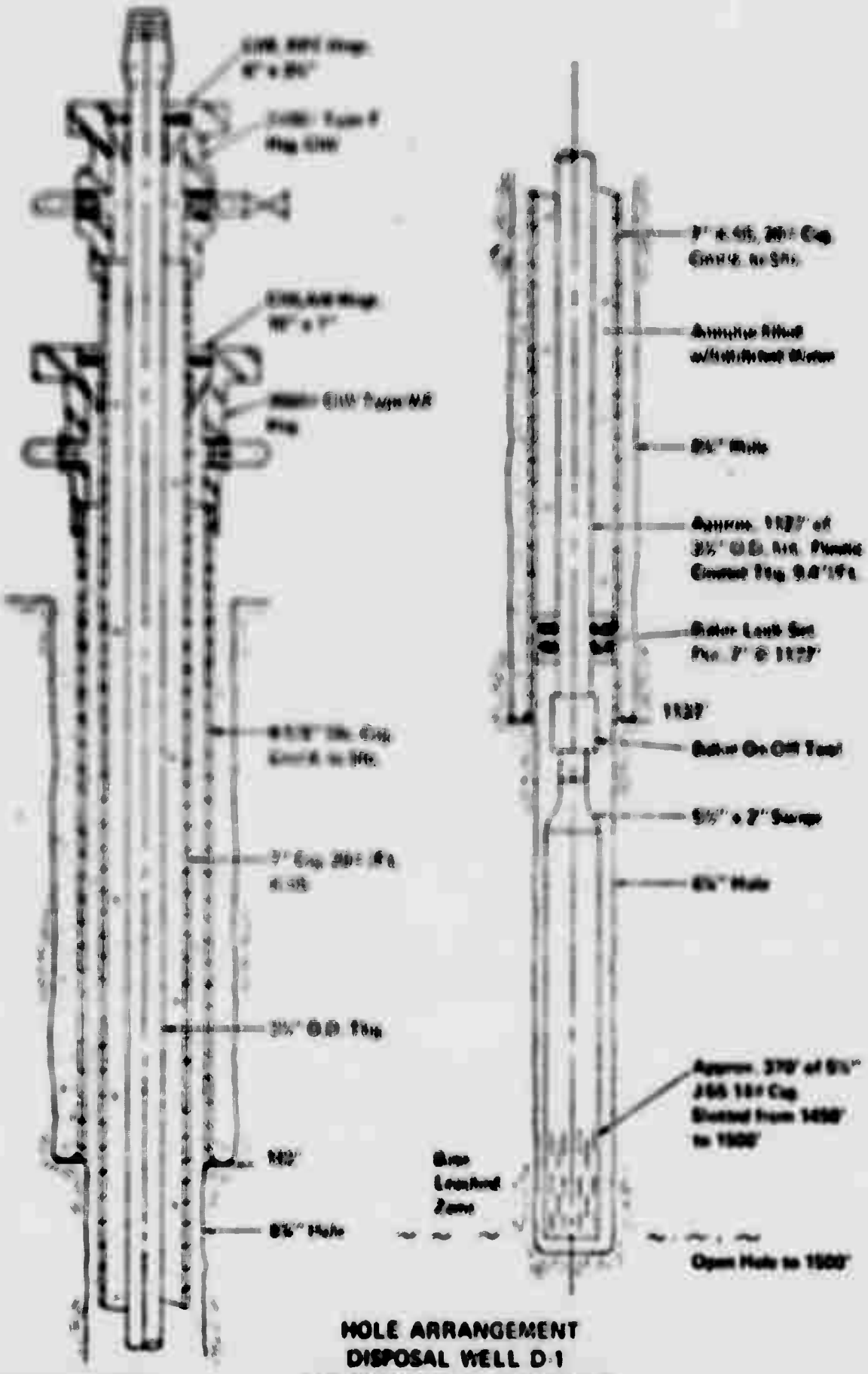
XIII. Source(s) of Information and Published References

Written communication - Colorado Water Pollution Control Commission



DISPOSAL SYSTEM
RIO BLANCO CO., COLORADO

Revised Fig. 1
of Exhibit "C"



HOLE ARRANGEMENT
DISPOSAL WELL D-1
RIO BLANCO CO., COLORADO

Supplement to Figs. 2 of Exhibit "C"

WATER POLLUTION CONTROL COMMISSION

OF THE STATE OF COLORADO

APPLICATION OF SHELL OIL COMPANY TO OPERATE A SUBSURFACE DISPOSAL SYSTEM UPON AND UNDER A TRACT OF LAND IN THE NW¼ SW¼ OF SECTION 28 AND THE NE¼ SE¼ OF SECTION 29, TOWNSHIP 1 SOUTH, RANGE 97 WEST, RIO BLANCO COUNTY, COLORADO, AND TO CONVERT A STRATIGRAPHIC TEST WELL TO A DISPOSAL WELL.)	PERMIT FOR SUBSURFACE DISPOSAL

1. The Colorado Water Pollution Control Commission has found that disposal as proposed in the application by Shell Oil Company could take place within the intended meaning of Section 3, subsection (b), paragraph (4) of the Rules and Regulations for Subsurface Disposal Systems.

2. The Commission hereby grants Shell Oil Company a permit for the operation of a subsurface disposal system as provided for in Section 3, subsection (d) of the Rules and Regulations of Subsurface Disposal Systems, subject to the following conditions and stipulations:

   a) Permit is granted for a period of thirty (30) months, effective December 1, 1970.
   b) Total volume is not to exceed 150 acre feet.
   c) Pump pressure is not to exceed 350 pounds per square inch.
   d) Injection interval is to be from 1133 feet to 1500 feet.
   e) Daily records are to be submitted monthly in duplicate to the Division of Administration showing rate of injection, volume of fluid, pump pressure, casing pressure (on inert fluid), chemical character of waste and/or any other reasonable information required. Report forms to be furnished by the Division of Administration.

   f) Samples of waste are to be analyzed weekly, unless waived by Division of Administration, or whenever a significant change in chemical quality is anticipated by the operator. Analysis is to be performed by the applicant's laboratory or an approved independent laboratory and the results of analysis certified.

   g) Employees of Department of Health and Department of Natural Resources are to be allowed access to the disposal site without prior notification for purposes of observation of disposal operation and sample collection of waste being injected.

   h) All evaporation pits, settling basins, and holding ponds are to be lined with an impermeable membrane.

1) Permit is not to be assigned nor operations contracted to another party without prior approval of the Commission.

3. Monitoring to be conducted by Shell Oil Company is to be as follows:

a) The disposal well shall be shut down and a pressure fall off test performed periodically. (Ten day intervals initially and until further notice.) Shut down period is to be as long as necessary to obtain conclusive results. Data and/or charts are to be submitted to Division of Administration within five days of completion of test.

b) Chemical quality records (by laboratory analysis) from Shell's domestic water well are to be submitted monthly to monitor quality of water in the alluvium. If analysis are performed more frequently, this data will also be submitted.

c) Three river sampling stations on Piceance Creek will be activated and maintained by Shell Oil Company. Locations to be as follows:

1) Approximately one mile upstream from disposal site to measure quality and flow.

2) Approximately one-half mile downstream from disposal site to measure quality.

3) Near the confluence of Piceance Creek with the White River to measure quality and flow.

Laboratory analysis on quality measurements from river sampling stations to be submitted monthly.

d) Additional monitoring procedures and installations as may be required upon subsequent review by the Commission.

4. All other requirements as adopted by the Commission in the Rules and Regulations for Subsurface Disposal shall be observed by Shell Oil Company.

BY ORDER OF THE COLORADO WATER POLLUTION CONTROL COMMISSION

Frank J. Rozich

Frank J. Rozich, P.E., Technical Secretary

WELL FILE NUMBER [illegible] P-1

I. Operating Company & General Well Location
Consolidated Company, Division of Monsanto Company
Pensacola, Florida

II. Well location (legal description)
Location 30° 22' N., 87° 13' W - Well No. 1
Escambia County

III. History, system planning, construction & operation.
Plant operation began in 1953. By 1962 waste volumes had tripled. Problems with the bio-oxidation system caused examination of other methods. Because of favorable geologic circumstances, subsurface injection was selected. A rotary - cable tool rig was selected for drilling, and the well was drilled to T.D. of 1,808 ft. (surf. elev. + 36 ft.). Injection began in July 1963. Injection rate averaged 600 gpm, but increased to 1,200 gpm in 1965. A second well was then constructed in 1964.

IV. Geology & Geohydrology
A. Regional geologic setting: The well is located on the Coastal Plain of Florida. The sedimentary beds dip gently toward the southwest (See attached cross section, Fig. 1).

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic failure included -yes X ; no___).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurements_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
lower limestone of the Floridan Aquifer - Oscalla Group	Tertiary		359'	Nearly pure limestone 97% $CaCO_3$ with wide areal distribution.

D. Engineering description of injection units

1. Porosity: unknown, but increased continuously by the acidic waste
2. Permeability: Original transmissivity about 6,500gpd/ft. Storage coefficient 2 x 10^{-4}
3. Original Reservoir Pressure: 76 feet above sea level 17 psi
4. Reservoir Temperature:
5. Chemical Character of Formation Water: See table I
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Hydrology, Continued

B. Hydrology, fresh water aquifers in vicinity

Name	Depth	Thick.	Character	Chemical Quality
	0'-465'	[illegible]	Sand and gravel	Fresh water
Floridan Aquifer	-970'	50'	Sand	Generally potable saline water (Cl 1000 ppm)
	-970'	225'	Limestone	Slightly saline water (Cl 1000 ppm)

V. Mineral resources (oil and gas, coal, brines, etc.)

V. Well design and construction (See Figure 2)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection	Casing liner is stainless steel.				
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

D. Packers, Centralizers, well head equipment, etc: A telfon packer was installed, but failed to seal initially. It was later installed. Since there was no packer at first, inhibited diesel oil was kept in the casing-tubing annulus. Later, the packer was repaired and installed with corrosion inhibited water in the annulus. A pump is used to circulate inhibited water around the annulus.

VI. Description of surface equipment

A. Holding tanks & flow lines Holding pond

B. Filters None

C. Pumps Horizontal two-stage centrifugal constructed of 304 stainless steel and driven by a 350 hp. electric motor. Pump capacity 1,200 gpm at 400 psi.

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

G. Other logs run - no logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of major products from raw materials, including intermediates such as adipic acid and hexamethylenediamine, and secondary chemicals required for the process.

B. Physical & chemical Description

Organic monomeric acids, nitric acid, ammonia, adiponitrile, hexamethylenediamine, sodium hydroxide, sodium carbonate phenols, and ketones. See table for other waste properties.

C. Volume About 300 gpm in 1963 increased to 2000 gpm in 1971

IX. Preinjection waste treatment Because precipitates result when alkaline and acid waste streams are mixed, the combined waste is aged and the precipitates allowed to settle in waste ponds. A pH of less than 5.0 is maintained in the final waste to maintain and increase the permeability of the injection horizon.

[illegible]

[illegible]	[illegible]
Chemical Oxygen Demand, ppm	[illegible]-12,000
Turbidity, ppm	[illegible]
Settleable solids (24 hr.), ppm	5-52
Particle size of settleable solids, microns	0.5-40
pH	2.2-[illegible].0
Reactions with formation brine at pH of 8.0	Heavy magnesium precipitate
Reactions with formation brine at pH of 6.0	No precipitate
Bacteria count (final pond), colonies/cu. cm.	50
Bacterial count (composited waste), colonies/cu. cm.	0-8
Reaction alkaline waste with acid waste	Heavy precipitate
Sand filtration reduced turbidity, ppm	0.6-1.5

E. Well specifications & operating history

A. Data

Date	Operation	Depth interval	Description of test results
[illegible]	[illegible]	1,010-1,020	165 feet cemented at 650 psi
[illegible]	Injection	1,020-1,160	1000 gpm injected at 350 psi

B. Treatments or stimulation

Date(s)	Treatment Design	Description of Treatment and Results
The [illegible] injection unit is periodically acid treated to remove which [illegible] of less than 5.0		

C. Injection rates and pressures

1. Rate

Date(s) _____ initial ~~Average~~ 288 gpm Maximum 1,100 gpm

" _____ Average 600 gpm up to 1965.

" _____ " the present average

" _____ " (1971) is about

" _____ " 1000 gpm "

2. Pressure (well head X bottom hole _____)

Date(s) _____ initial ~~Average~~ 149 psi Maximum 165 psi

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

A. Description of operating program: _____

B. Operating problems: Failure of liner hanger & cover failure, which slab-from the hole. A new smaller diameter heavier liner was installed with a packer.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Monitor wells were constructed. A shallow well was constructed 100 feet from the injection well to monitor the upper limestone. A monitor well was constructed 1,500 feet south of the injection well to monitor the lower limestone. The deep monitor wells were drilled one 2 miles

continued below

C. Restrictions on operating procedure _____

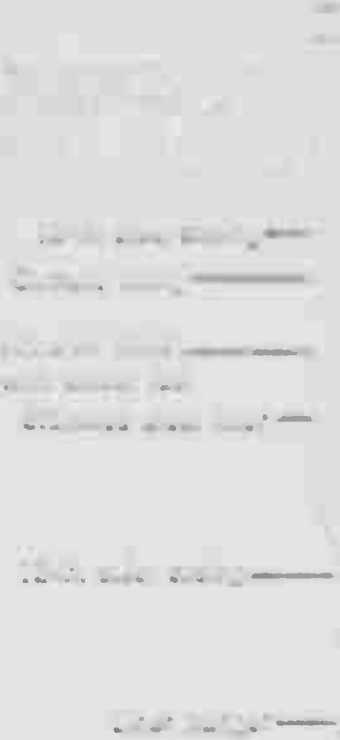
north and one 1 1/2 miles south of injection well. Pressures in the monitor wells are continuously recorded and monthly water samples are collected.

XII. Licensing

A. Total low level waste of construction [illegible]

B. Operating waste [illegible]

XIII. Source(s) of Information and Published References



[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

B. Geologic Description of rock units penetrated by well
Rock Unit (Formation Bottom included--yes ____ ; no X).
Volcanic Formation (Bottom 30') (Total well depth 1,750)
Datum for depth measurements _____

Name	Age	Depth (top)	Thickness	Lithologic Description
See F-1				

C. Geologic Description of injection units & possible units not in use

Rock Units

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Lower Florissant Volcanics	Tertiary	1,400'	350'	

D. Engineering description of injection units

1. Porosity: See F-1
2. Permeability: See F-1
3. Original Reservoir Pressure: See F-1
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: See F-1
6. Reservoir Fracture Pressure: _____ unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
See F-1				

F. Mineral Resources (oil and gas, coal, brines, etc.)

None present in the area

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			12"	1,400'	
Intermed.					
Injection					
Other					

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____ Drillers Log ____ Drilling time

____ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

See F-1

B. Physical & chemical Description See F-1

C. Volume See F-1

IX. Preinjection waste treatment See F-1

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

U. S. Geological Survey

WELL FILE NUMBER

STATE

F-3
UMR

I. Operating Company & General Well Location

Sugar Cane Growers Cooperative of Florida

Belle Glade, Florida

Quaker Oats Co.-Belle Galde Chemical Plant is well operator

Well is on Quaker Oats Company property.

II. Well location (legal description)

Location: Sec. 28, T43S, R37E - Well No. 1

Palm Beach Co.

III. History, system planning, construction & operation.

A report concerning the feasibility of subsurface waste disposal at the Sugar Cane Growers Cooperative furfural plant was prepared by a consulting engineering firm and submitted to the Quaker Oats Company in June, 1965. Specifications for the well were contained in a report dated July, 1965. Drilling of the test well began August 12, 1965, and stopped December 10, 1965, at a depth of 1,705 feet. Shortly thereafter, the well was deepened to 1,939 feet. In 1971, the well was deepened again to 2,242 feet. Injection zone was originally 1,496 to 1,938. It is now 1,940 to 2,240 feet. Operated from Dec. 1966 through July 1971, when the well was shut down for the season. From October 1971 to mid January 1972 injection was into well number 2. Injection resumed in January 1972, but in a deeper interval.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Florida Peninsula portion of the Gulf Coastal Plain. Limestones, marts, and some clays of Cretaceous to Miocene age occur in the subsurface. Disposal is into permeable limestones of Eocene to Oligocene age that dip gently southward.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ____).

(Ground elevation 11.3') (Total well depth 2,242')

Datum for depth measurement ____

Name	Age	Depth (top)	Thickness	Lithologic Description
See geologic column attached to F-4				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Lake City Formation	M.Eocene	1,496-1,940	original	widely distributed throughout all of Florida and parts of Alabama, Georgia, and South Carolina
Lower permeable zone of the Floridan aquifer		1,940-2,240	now	

D. Engineering description of injection units

1. Porosity: very porous
2. Permeability: very permeable
3. Original Reservoir Pressure: 18 psi above ground
4. Reservoir Temperature: 85°
5. Chemical Character of Formation Water: Chloride content in excess of 7000 ppm at 1,940 feet.
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Biscayne	0-200'	200'	fresh	

Fresh water occurs only in the shallow Biscayne aquifer to a depth of about 200 feet. The upper zone of the Floridan aquifer at 1,045 to 1,105 feet contains water with a chloride of 1,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

Groundwater is the only known resource.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			20"	228	300sks Type I
Intermed.			16"	684	400sks Type I
			12"	1,492(2)	850sks Type (1)
Injection - liner		ss 316 sch. 40	8"	1,938	cemented in 1,500 to 1,938' interval

(1) 300sks Type I followed by 500sks Type II and 20sks G-8

Other (2) bottom 16 feet stainless steel 316 MLC

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Liner hanger and teflon seal at 1,482 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines Surge tank for holding of wastewater after screening.

B. Filters 500 micron screen for removal of large suspended particles in sugar house wastewater.

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring-no coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

X Drillers Log ___ Drilling time

X Sample log at 5' intervals ___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

____ SP

X Caliper

____ Other

X Gamma ray-neutron

X Temperature - on deepened well

____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Manufacture of furfural from sugar cane bagasse and sugar cane processing.

B. Physical & chemical Description Stripping column effluent, which is essentially a dilute acetic acid solution, containing minor amounts of other dissolved organic chemicals and 200 ppm of insoluble fibres, pH 2.3, BOD 10,000 mg/l, and temperature 210°F. A wastewater stream from the sugar plant also injected.

C. Volume About 1 million gpd with approximately 200,000 gpd from the sugar plant and 800,000 gpd from the furfural plant.

IX. Preinjection waste treatment Filtration of sugar house wastewater

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	25 hours	1,500-1,705'	810gpm @ 11psi; 550gpm @ 7psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum
Overall		400-800gpm		
"	Jan. 15, 1972	"	700gpm	"
"		"		"
"		"		"
"		"		"

2. Pressure (well head _____ bottom hole _____)

Date(s)		Average		Maximum
Overall		40-50psi		
"	Jan. 15, 1972	"	28psi	"
"		"		"
"		"		"
"		"		"

Well operates from approximately October or November to May or June.

X. Well operation & operating history

D. Description of operating programs: The well operates from approximately October or November to May or June with rest.

E. Operating problems: An increase of BOD and TOC was noted in the two monitor wells, in the sediment zone of the Floridan aquifer during the fall of 1969. As a result, it was decided to deepen the well and seal it off to a depth of 1,510 feet to prevent upward migration of the injected wastewater. The well was shut down from July 1971 to January 1972 for this work.

XI. Regulatory aspects.

A. Construction requirements as constructed

B. Monitoring requirements 1. Continuous monitoring of wastewater flow. 2. Continuous recording of wastewater temperature & injection pressure. 3. Daily and weekly analysis of wastewater. BOD, COD, pH, and suspended solids is required on weekly basis (composite samples from the wastewater stream. 4. Construction of shallow and deep monitor wells. Conductivity is measured on daily grab samples and COD and pH on weekly grab samples from the monitor wells.

C. Recommendations on operating procedure see below

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

U. S. Geological Survey

Garcia-Bengochea and Vernon, 1970

Vernon, 1970

WELL FILE NUMBER _____ STATE F-4 UMR

I. Operating Company & General Well Location

Sugar Can Growers Cooperative (well owners)
Belle Glade, Florida
Quaker Oats.-Belle Glade Chemical plant is well operator.
Well is on Quaker Oats Co. property.

II. Well location (legal description)

Location: Sec. 28, T46S, R37E, Palm Beach County
about 75 feet from well number 1.

III. History, system planning, construction & operation.

Deep monitor well drilled in 1966 operated as a monitor well from 1966 to 1971 used for injection October 1971 to January 1972, now in use as a monitor well and standby injection well.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Florida Peninsula portion of the Gulf Coastal Plain. Limestones, marts, and some clays of Cretaceous to Miocene age occur in the subsurface. Disposal is into permeable limestones of Eocene to Oligocene age that dip gently southward.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ___).

(Ground elevation ± 15ft.) (Total well depth 2,067ft.)

Datum for depth measurement Ground level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
See attached geologic column				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Lower permeable zone of the Floridan aquifer	Eocene and Oligocene	1,610	300'	widely distributed throughout all of Florida and parts of Alabama, Georgia, and South Carolina

D. Engineering description of injection units

1. Porosity: very porous
2. Permeability: very permeable
3. Original Reservoir Pressure: 16 psig above hydrostatic or about 720 psi total at 1600 feet.
4. Reservoir Temperature: 85°
5. Chemical Character of Formation Water: Chloride content in excess of about 1,000 mg/l up to 7,000 mg/l
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs only in the shallow Biscayne aquifer to a depth of about 200 feet. The upper zone of the Floridan aquifer at 1,045 to 1,105 feet contains water with a chloride content of 1,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No resources other than fresh water in the immediate area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		black steel	20"	240	
Intermed.		black steel	16"	848	
0-1474 black steel, 1474-1490 SS316ELC			12"	1490	
Injection		through tubing			
Other					

Describe bottom hole completion method: Open hole

1490 - 1840 12" hole, 1840 - 2067 9" hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

___X___ Drillers Log ____ Drilling time

___X___ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity ____ Gamma ray-neutron

____ SP ____ Temperature

X Caliper ____ Cement bond

____ Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of furfural from sugar cane bagasse and sugar cane processing.

B. Physical & chemical Description Stripping column effluent, which is essentially a dilute acetic acid solution, containing minor amounts of other dissolved organic chemicals and 200 ppm of insoluble fibres, pH 2.3, BOD 10,000 mg/l, and temperature 210°F. A wastewater stream from the sugar plant is also injected.

C. Volume _____

IX. Preinjection waste treatment Filtration of sugar house wastewater

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
*Jan. 12, 1972	~700gpm	
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
*Jan. 12, 1972	55psi	
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

last date of operation as an injection well

X. Well operation & operating history

D. Description of operating programs: Used only as a standby well at the present time.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements See P-3

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

U. S. Geological Survey

Garcia-Bengochea and Vernon, 1970

Vernon, 1970

SUGAR CANE GROWERS CO-OP. No.2 DISPOSAL WELL

WELL FILE NUMBER

STATE

P-5
UWR

I. Operating Company & General Well Location

E. I. DuPont de Nemours and Co.

Starke, Florida

II. Well location (legal description)

Location: Sec. 17, T.3S., R.24E., Clay County

III. History, system planning, construction & operation.

Drilling permit issued in March 1963. Well drilled in April - August, 1963, and plugged January 19, 1965. Without being used for injection.

Well plugged Jan. 19, 1965, from 1,940 to 2,140 feet with cement and top 20 feet of casing plugged with cement.

IV. Geology & Geohydrology

A. Regional geologic setting:

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
----	early Ordovician ?	3,400-3,500		quartz sandstone - micaceous shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
No satisfactory injection units encountered				

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____

1,877' - <700 mg/l NaCl Equivalent

2,036' - 16,500 mg/l NaCl Equivalent

6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		78#	24 "	300	
Intermed.		78# J-55	16 "	1,900	
		47# J-55	11 3/4"	2,040	
Injection	10 5/8"				
Other					

Describe bottom hole completion method:

V. Test design and construction, continued

a. Features, functionality, and test requirements, etc.: _____

_____

_____

_____

_____

_____

VI. Calibration of test equipment

a. Calibrated items & file index: _____

_____

_____

_____

_____

b. Fixtures _____

_____

_____

c. Tanks _____

_____

_____

d. Other _____

_____

_____

_____

_____

VII. Data, results, & logs

a. Results

Test	Id	Accept

b. Testing logs

___ Test data log ___ Testing time

___ Error log ___ Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

__X__Caliper ____Cement bond

____Other Sonic

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Phosphate mine and mill

B. Physical & chemical Description

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	23'	2028'	Formation pressure ~800 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

WELL FILE NUMBER 1965-EA-106 STATE I1-1 UMR

I. **Operating Company & General Well Location**

Velsicol Chemical Corporation
Marshall, Illinois

II. **Well location (legal description)**

Location: Well No. 1
615' S and 750' W of the NE corner, SW 1/4, Sec. 12, T11N, R12W, Clark County.

III. **History; system planning, construction & operation.**

In January, 1965, Velsicol Chemical Corporation wrote to the Sanitary Water Board, documenting their intention to construct a well for injection of a sodium hypochlorite brine. Design documents for the injection system were submitted with the letter. A permit was issued March 5, 1965, by the Sanitary Water Board to construct the well subject to the following restrictions:

(a) As-built plan documents will submitted by Velsicol Chemical Corp. to this Board upon completion of the construction of the facilities including surface works of pumps, piping and waste receiving sump etc., deep well head structure and curbing, deep well log, casing record and all development activity records in preparing well to receive wastes;

(b) Also, that particular precautions will be taken to place the saran lined casing in the well without critical damage to the saran lining;

(over)

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** At the well site, Paleozoic rocks dip gently southward into the Illinois basin. The well is located in a broad syncline, about 13 miles east of the LaSalle anticlinal belt.

(c) Also, that the well hole will be plugged in the event it cannot be completed or used now or/ it is abandoned in the future and said plugging precedures will be in accordance with the specific approval of the State Sanitary Water Board and the Department of Mines and Minerals;

(d) Also, monthly operation records be submitted to this Board indicating the volumes of material injected, type and approximate composition of waste materials injected, operational injection pressures and other data essential to operation of the deep well disposal facilities.

Drilling began March 29, 1965, and was completed April 11, 1965, at a total depth of 2,636 feet. About 30 to 35 feet of drilling tools were lost in the hole, blocking it off about 100 feet from the bottom. The tools could not be retrieved, and injection tests were made with the tools in the hole. Injection tests were successful, and fresh water was injected for a few weeks to create a barrier between the formation water and the wastewater.

Injection of about 50gpm of wastewater began in November, 1965. Injection was by gravity flow and no pump was required.

A feasibility report for a second well was submitted by Velsicol July 9, 1971. Additional information was submitted July 30, 1971.

The Illinois EPA agreed to drilling of the test well August 18, 1971 subject to the following conditions:

(1) Final engineering plans be submitted after completion of the well to review and approve prior to waste injection.

(2) Computations of underground storage area and rate of waste travel be provided.

(3) If modification of test well drilling procedure are necessary, the Epa be notified prior to making such changes is projected to Devonian at 2,500'.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ___).

(Ground elevation 627') (Total well depth 2636')

Datum for depth measurement Kelly Bushing 632'

Name	Age	Depth (top)	Thickness	Lithologic Description
See geologic column				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
----	Devonian	2372	200-300' 264' penetrated in well	Cherty dolomitic limestone-widely distributed through Illinois and surrounding sta
*Salem	Mississippian	1534	237'	dense oolitic limestone

*planned for disposal, but not used

D. Engineering description of injection units

1. Porosity: ___

2. Permeability: ___

3. Original Reservoir Pressure: 1008psi at 2382' to 2636'

4. Reservoir Temperature: ___

5. Chemical Character of Formation Water: 14,000ppm dissolved solids

6. Reservoir Fracture Pressure: ___

F. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

As far as could be determined, all water wells in the vicinity (10 mi. radius) were located in glacial drift although some penetrated a few feet into bedrock. Most are 100 feet or less in depth. The Pennsylvanian rocks are fairly impermeable and the ground water is highly mineralized below a depth of a few hundred feet. Dissolved solids in the ground water: 4500ppm at 150 feet, 7,000ppm at 321 feet, 10,000ppm at 505 feet.

F. Mineral Resources (oil and gas, coal, brines, etc.)

Numerous oil wells are located in the vicinity of the well. Oil and gas producing zones are within 4 miles of the well. The depth ranges from 400 feet in the Westfield East Pool to 2700 feet in the Martinsburg pool. A gas-producing zone is situated about 1.5 miles east of the well at a depth of 2030 feet. Some stratigraphic pay zones are Pennsylvanian sandstone, Trenton limestone, Carper sandstone, and Devonian limestone. Many of the dry wells are later used as brine injection wells.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	28 API	8 5/8"OD	417'	to surface
Intermed.	7 3/8"	Saran lined Steel	14 1/2"OD	2390'	to surface

Injection through 4 1/2" casing

Other 4 1/2" OD aluminum casing from 1530 to 1756

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines See figure

B. Filters None

C. Pumps None

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other: final construction report

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity-induction ___ Gamma ray-neutron

___ SP ___ Temperature

___ Caliper ___ Cement bond

X Other Scale log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description The waste is a spent hypochlorite process liquor with the following approximate chemical analysis: sodium chloride 140,000ppm, sodium hydroxide 25,000ppm, sodium hypochlorite 20,000ppm. Temperature 135°F, pH 10.5-11.5, Specific gravity 1.15

C. Volume about 50,000 gallons/day

IX. Preinjection waste treatment Settling of dissolved solids and pH adjustment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem	48'	Salem 1501-1810	Formation pressure 574psi
	38'	Devonian 2382-2636	" " 1008psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
2390-2600	acidized	

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
" week of 1/06/67	" 62 gpm	"
" " " 6/07/68	" 30 gpm	"
" " " 8/29/69	" 33 gpm	"
"	"	"

2. Pressure (well head X bottom hole)

Date(s)	Average	Maximum
" week of 1/06/67	" 28"mercury	"
" " " 6/07/68	" 24" "	"
" " " 8/29/69	" 0	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: injection is generally continuous

E. Operating problems: Equipment was lost in the bottom 34 feet of the hole during construction and was never recovered. The well periodically plugs with carbonate precipitate, and is acidized to restore permeability.

XI. Regulatory aspects.

A. Construction requirements See permit documents

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction _____

_____

_____

_____

_____

B. Operating costs _____

_____

_____

_____

_____

III. Source(s) of Information and Published References _____

_____

_____

_____

_____

_____

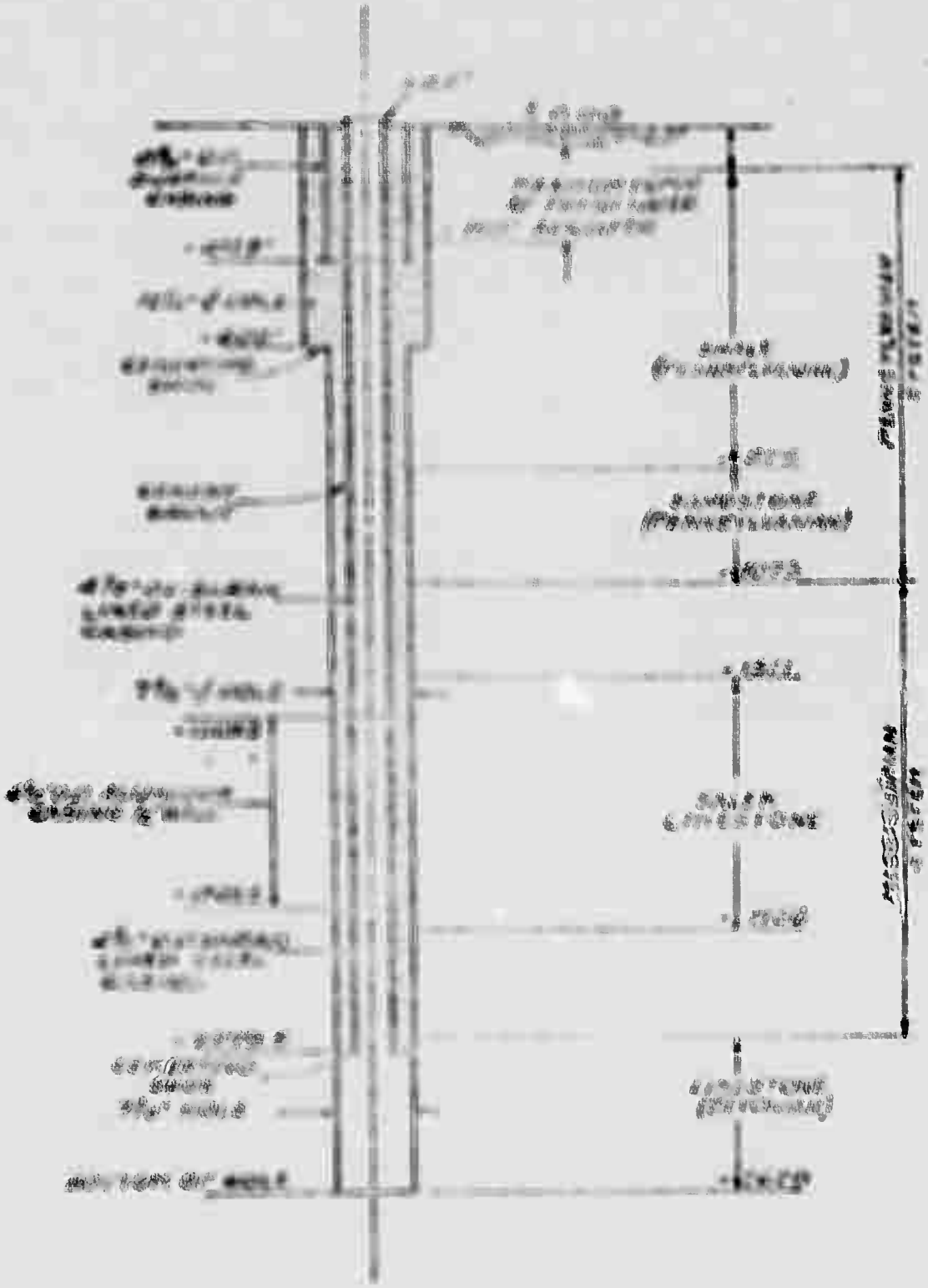
_____

_____

_____

_____

_____



MARSHALL, ILLINOIS
WESTON CHEMICAL CORP
WASTE DISPOSAL WELL

LOG OF WELL

CONSOER TOWNSEND & ASSOC.
CONSULTING ENGINEERS
CHICAGO, ILLINOIS 11-10-65

WELL FILE NUMBER No. 1966-EA-32 STATE

II-2 UMR

I. **Operating Company & General Well Location**

Cabot Corporation

P. O. Box 188

Tuscola, Illinois

Plant is about 3 miles west of Tuscola, Illinois.

II. **Well location (legal description)**

Location: 1745" North and 800" of the SE corner, SE 1/4, SW 1/4, SE 1/4, T16N, R8E, 3rd principal meridian, Douglas County.

III. **History, system planning, construction & operation.**

Application for a drilling permit was filed with Division of Oil and Gas November 3, 1965. Permit No. 231 was issued March 10, 1966. Application for a permit to construct a waste treatment work was filed with the Sanitary Water Board December 1, 1965. A Permit No. 1966-EA-32 was issued January 20, 1966, to construct and operate the injection system. The permit specified that a final construction report would be submitted, and that any changes from the original plan would be reported. A letter dated April 11, 1966, from Cabot Corp. to the Illinois Sanitary Water Board reported that the well had been drilled to the St. Peter Sandstone, which was found to be unsuitable for disposal and stating Cabot Corporation's plan to deepen the hole and examine the Trempealeau Dolomite at 5,100 ft., the Galesville Sandstone at 5,600 ft. and the Mt. Simon Sandstone at 6,400 ft.

A letter dated April 26, 1966, from the Cabot Corp. to the Sanitary Water Board reported the results of drilling the hole to 5,318 ft. and completing it for disposal into the (Over)

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The well is located in the Illinois synclinal basin on the west flank of the LaSalle anticlinal belt. The regional dip is about 40 feet per mile toward the south. The Tuscola anticline crests a few miles east of the well.

Trempealeau and Franconia Formations from 4,898' to 5318 ft.

The well was apparently put into operation during late 1966. A letter dated August 16, 1967 from the Sanitary Water Board to Cabot Corporation requested a monthly report of system operation inclunding the quantity of wastewater injected, any indication of change in the injection pressure, and character or injected wastewater.

In May 1960, Cabot Corporation requested permission to inject 200 - 400 gpm of sodium chloride solution separated from the waste efflunet from production of organically treated bentonite into the annulus between the injection tubing and the casing of the existing injection well.

Formal application for a Permit to inject the chloride wastewater was applied for by Cabot Corporation April 30, 1969. In the application, permission was also requested to inject the filtrate from the wastes produced by the Staley Starch Company. At the request of the Sanitary Water Board, Cabot Corporation supplied further information.

A letter dated September 17, 1970, from Cabot Corporation to the Illinois Environmental Protection Agency requested that Cabot be allowed to inject an etching waste produced by the R. R. Donnelley Company.

Illinois EPA Permit 1971-EB-29 was issued January 11, 1971, granting permission to Cabot Corporation to inject 150 gpm into the existing well, including the four wastewaters mentioned. Conditions of the permit are the standard eight conditions of all permits and the additional conditions that the Agency be notified of any changes in operation or in materials injected and any modifications in surface disposal facilities, or well maintenance program.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 689.56) (Total well depth 5,318)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
	Mississippian	1,330		
	Devonian	2,466		
	Silurian	2,602		
Maquoqketa Sh.	Ordovician	3,148		
Trenton Ls.	Ordovician	3,360		
St. Peter ss.	Ordovician	4,006		
Eminence	Cambrian	4,809	150-200	
Potosi	Cambrian	---	250-300	

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Emmence	Dolomite-Cambrian	4892	---	sandy dolomite
Potosi	Dolomite-Cambrian	----	---	limestone and dolomite

The total injection interval is 426 feet from 4,892 feet to 5,318 feet in the two formations, which are widely distributed throughout the north central states.

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: very high
3. Original Reservoir Pressure: 2,035 psi @ 4,861 feet
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: Estimated to be greater than 20,000ppm dissolved solids, based on swab samples.
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Most water wells in this area are in the glacial drift and are relatively shallow, usually less than 300 feet.

The city of Tuscola municipal well No. 5 penetrates the Devonian and terminates in the Silurian at a depth of 552 feet. The entire column is essentially dolomite, with some limestone and chert in the Devonian. The aquifer was not identified by the driller, but was probably fissured Silurian Dolomite.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The Tuscola Anticlinal is an oil producing structure, with production starting in 1962. The pay zone is the Kimmswick (Trenton). Oil shows are present in Pennsylvanian, Devonian, and Silurian Groups.

Coal is mined near Newman, west of the area. The coal beds are in the Pennsylvanian.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	24# seamless steel	8 5/8"	816	to surface
Intermed.	7 7/8"	14# J-55	5 1/2"	4600	1050sks Pozmix to
		Fiberglass	4 1/2"	4898	surface
Injection		Fiberglass	2 "	4867	680 gal. resin

Other Fibercast casing is attached to bottom of 5 1/2" steel casing.

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: The annulus is filled with diesel oil, no packer is used.

VI. Description of surface equipment

A. Holding tanks & flow lines See attached line diagram for original design. The present design is included in a report submitted by Cabot Corp. April 1969. All piping is pvc or fiberglass.

B. Filters

C. Pumps Teflon body Vanton pump with Harell rubber internal parts.

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time-geolograph

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction ____ Gamma ray-neutron

____ SP ____ Temperature

____ Caliper ____ Cement bond

____ Other Fm. density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Manufacture of Cab-O-Sil, a finely divided silicon dioxide used for various industrial purposes.

B. Physical & chemical Description Hydrochloric acid (33%) with a specifice gravity of 1.16, and a trace of suspended silicon dioxide. The HCl was originally sold, but loss of the market forced implementation of a disposal program.

C. Volume 35,000 gal. per day as of Dec. 1965

IX. Preinjection waste treatment Portions of the various waste-waters are settled and filtered.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injectivity	8.5 hours at 280gpm		pressure increased 11 psi in 8.5 hours and returned to normal 6 minutes after shut-in.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures *

1. Rate

Date(s)	Average	Maximum
	107,000 gal/month	75 gpm
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

*Operating reports contain only monthly tonages of acid and starch filtrate. No volume or pressure data are included.

X. Well operation & operating history

D. Description of operating programs: Not known

E. Operating problems: None reported.

XI. Regulatory aspects.

A. Construction requirements System required to be constructed as specified in application for permit, or specific request made for any changes.

B. Monitoring requirements Measurement of injected volumes, injection pressure, and chemistry of injected wastewater.

C. Restrictions on operating procedure EPA must be notified of any changes in facilities, procedures, or waste chemistry.

XII. Economics

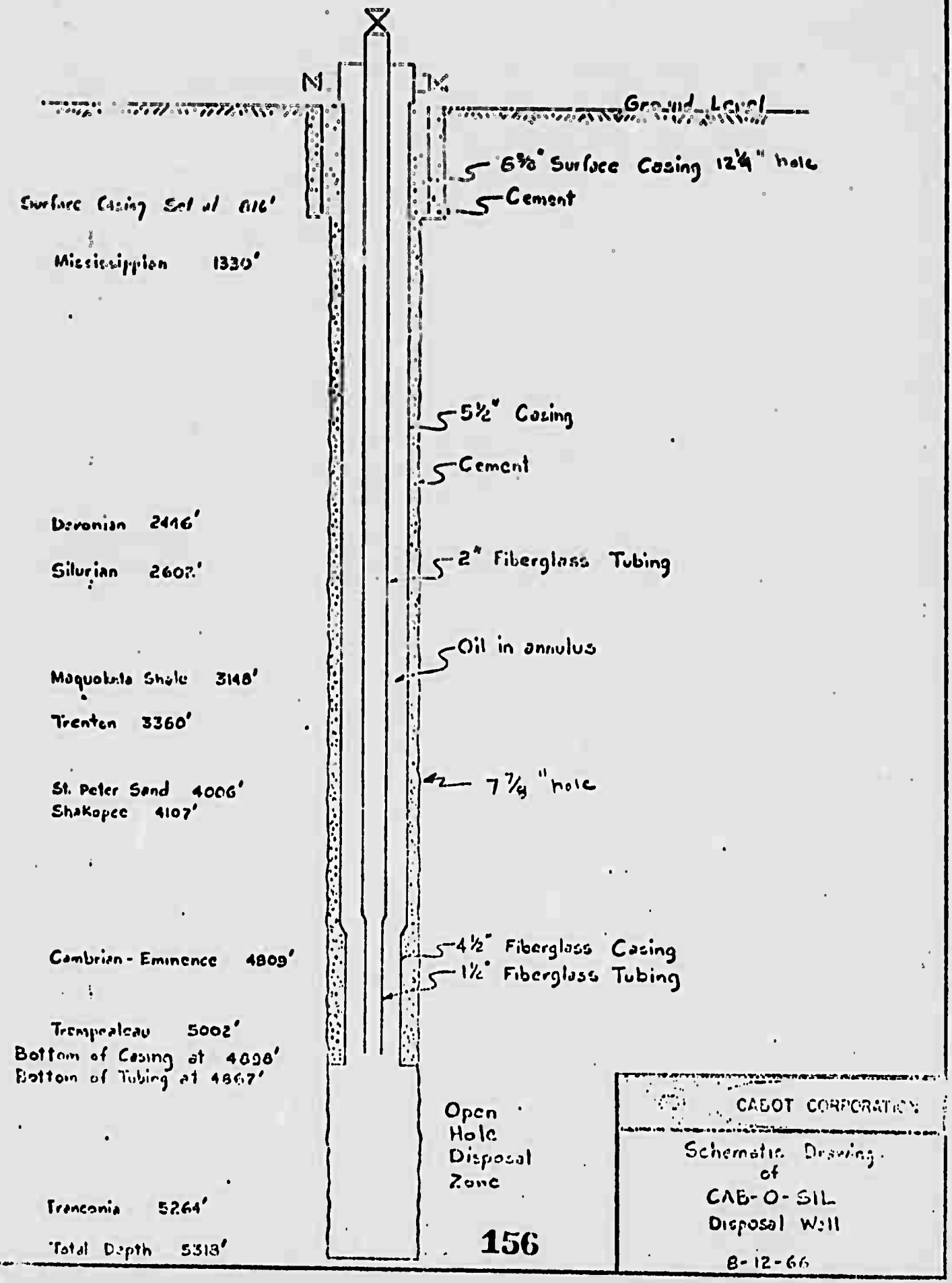
A. Total and unit costs of construction

B. Operating costs

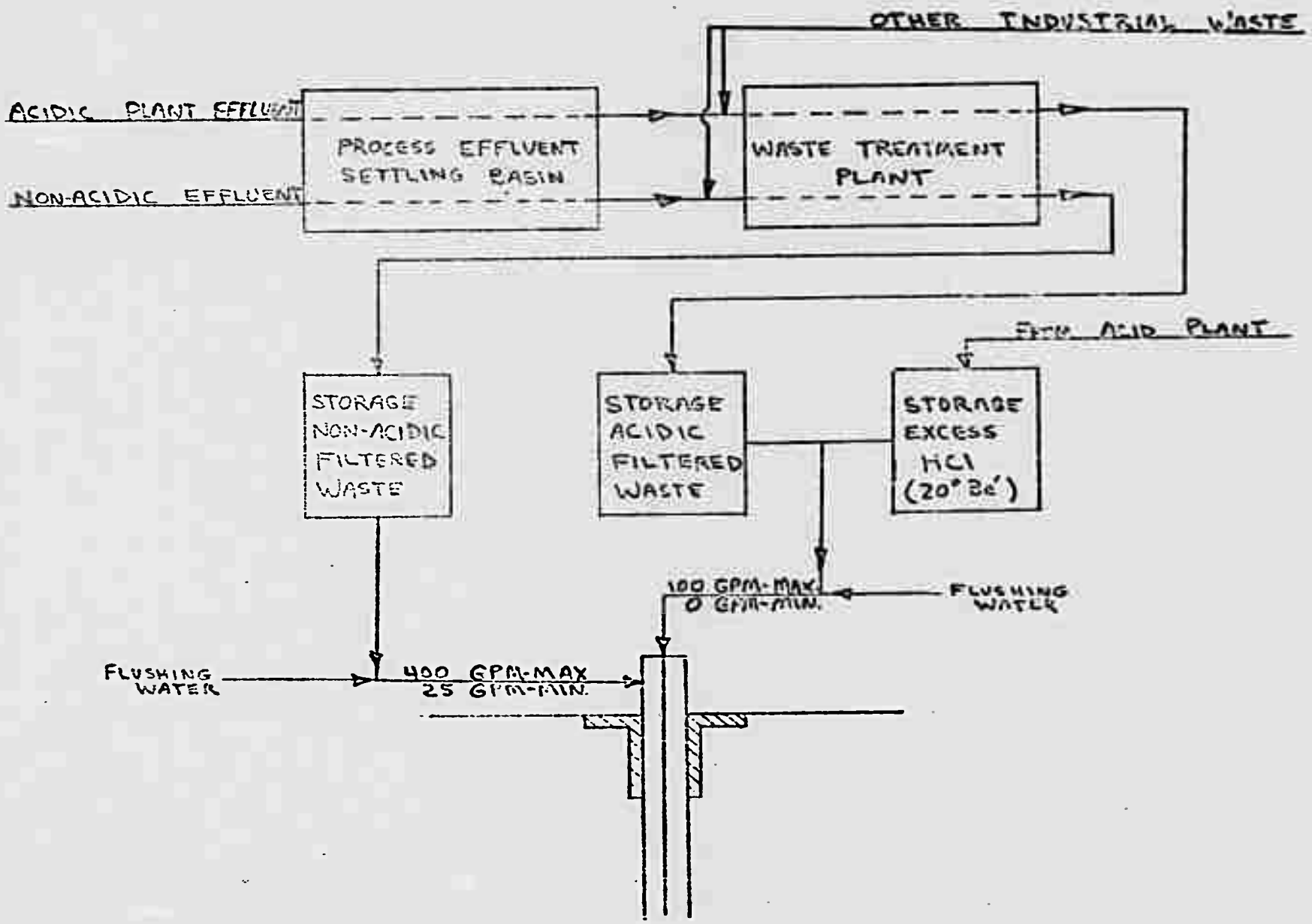
XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

Illinois Geological Survey


N
Ground Level
6⅝" Surface Casing 12¼" hole
Cement
Surface Casing Set at 616'
Mississippian 1330'
5½" Casing
Cement
Devonian 2416'
Silurian 2607'
2" Fiberglass Tubing
Oil in annulus
Maquoketa Shale 3148'
Trenton 3360'
7⅞" hole
St. Peter Sand 4006'
Shakopee 4107'
4½" Fiberglass Casing
Cambrian - Eminence 4809'
1¼" Fiberglass Tubing
Trempealeau 5002'
Bottom of Casing at 4898'
Bottom of Tubing at 4867'
Open Hole Disposal Zone
Trenconia 5264'
Total Depth 5318'
CABOT CORPORATION
Schematic Drawing of CAB-O-SIL Disposal Well
8-12-66

CABOT CORPORATION DISPOSAL WELL
TUSCOLA, ILL.



WELL FILE NUMBER Permit No. 1966-EA-321 STATE I1-3 UMR

I. **Operating Company & General Well Location**

Jones and Laughlin Steel Company
Hennepin, Illinois

II. **Well location (legal description)**

Locations: 390" north and 190.8' west of the SE corner of the SW 1/4, SW 1/4, Section 3, T32N, R2W, Putnam County.

III. **History, system planning, construction & operation.**

A feasibility report was submitted by Jones and Laughlin Steel Company to the Illinois Sanitary Water Board in early 1966. The report was reviewed by the Board, and the Illinois Geological Survey, and a permit (No. 1966-EA-321) to construct and use the well was issued June 9.

Drilling permit No. 683 was issued June 1, 1966, by the Illinois Department of Mines and Minerals.

Drilling of the well began July 1, 1966 and was completed August 12, at a total depth of 4,868 ft.

In compliance with the specifications of the permit, the well completion data was submitted by Jones and Laughlin to the Sanitary Water Board in August, 1967.

The well was placed in operation in December, 1967, and is still in operation.

IV. Geology & Geohydrology

A. **Regional geologic setting:** The well is located in the northern portion of the Illinois synclinal basin west of the LaSalle anticlinal belt. The beds in the area dip dently toward to southeast.

IV. Geology & Geohydrology, continued

2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no___).

(Ground elevation_____) (Total well depth 4,846)

Datum for depth measurement Ground Surface

Name	Age	Depth (top)	Thickness	Lithologic Description
(See attached geologic column)				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	3,109	1,734	Course to fine-grained sandstone with interbedded shale. Occurs throughout Illinois and in adjacent states.

D. Engineering description of injection units

1. Porosity: Range 2.9-19% Average 12.1-14%
2. Permeability: Range 1.0 to 1,160 millidarcies Where taken with of core sample to be 300 millidarcies
3. Original reservoir pressure: Unknown
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: Total dissolved solids about 60,000 ppm, chlorides about 35,000 ppm. Swab testing of the Galesville sandstone yielded water with a total dissolved solids content of about 16,000 ppm.
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Hydrology, continued

E. Hydrology, fresh water aquifers in vicinity

Zone	Depth	Thickness	Character	Chemical Quality
Recent drift	0-175'	175'	gravel, sand & clay	fresh
Pennsylvanian	1874'	118'	limestone	dissolved solids 585mg/l at DePue, Illinois used for water supply at Peru and Oglesby
Devonian-Trenton	2535'	170'	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Coal, which occurs in Pennsylvanian age rocks, is the only known mineral resource in the area. Pennsylvanian age rocks occur between 175 and 300 feet in the well and are separated from the injection interval by about 2,700 feet of strata.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"	0-40, 65#, Grade H-40	13 3/8"	302'	to surface
Intermed.	12 1/4"	0-75, 36#, Grade H-40	9 5/8"	2703'	to surface
	8 3/4"	0-88, 23#, Grade H-40	7 "	3108'	to surface
Injection		fiberglass tubing	3 1/2"	3700'	

Other 7 3/8" hole 3107-4813', 6 1/4" hole 4813-4846

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Casing strings were run with centralizers, guide shoes, or float shoes, and float collars.

VI. Description of surface equipment

A. Holding tanks & flow lines 150,000 gal. holding tanks are used before and after filtration (see attached diagram).

B. Filters A diatomaceous earth filter is used to remove particles larger than 5 microns.

C. Pumps A centrifugal pump is used for wastewater injection. A positive displacement pump is used to maintain a positive pressure in the annulus between the tubing and the 7" casing.

D. Other

VII. Cores, samples, & logs

A. Coring

From	feet	to	feet	Recovery	Unknown
"	[illegible]		[illegible]		"
"	[illegible]		[illegible]		"
"	[illegible]		[illegible]		"
"	[illegible]		[illegible]		"
"	[illegible]		[illegible]		"
"	[illegible]		[illegible]		"
	[illegible]		[illegible]		"
	[illegible]		[illegible]		"

B. Drilling Logs

Drillers log — Drilling time

X Sample log by the Co. & the Illinois Geological Survey — Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond
___ Other Bulk density, microlog, sonic log	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel mill

B. Physical & chemical Description 70,000gpd of wastewater from steel pickling, containing 0.5% HCl, 24% $FeCl_2$, and 35,000gpd of wastewater containing 1% chromic acid.

C. Volume The volume is variable but estimated to average about 100,000gal./day.

IX. Preinjection waste treatment Settling and filtration

Wastewater chemistry during period 6/30/69 - 2/30/69

CONSTITUENT	MINIMUM CONTENT	MAXIMUM CONTENT
Iron	4.6 mg/l	113 mg/l
Aluminum	---	0.2 mg/l
Chromate	0.01 mg/l	11.0 mg/l
HCl	1,500 mg/l	4,000 mg/l
$FeCl_2$	68,000 mg/l	184,000 mg/l

Temperature about 106°F

Specific gravity about 1.2

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results	
Injectivity	Unknown	Mt. Simon	PSIG	GPM
			410	300
			240	200
			100	100

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None reported.		

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average	~100 gpm	Maximum	~200 gpm
"	April 1969	"	190 gpm	"	
"	May 1970	"	179 gpm	"	
"	July 1971	"	135 gpm	"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average	~150 psi	Maximum	~265 psi
"	April 1969	"	265 psi	"	
"	May 1970	"	177 psi	"	
"	July 1971	"	265 psi	"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: Injection began in December, 1967, and is intermittent.

E. Operating problems: Pump for annulus pressure was originally a centrifugal pump, but was replaced with a positive displacement pump to stabilize flow rate and pressure.

XI. Regulatory aspects.

A. Construction requirements Required to be constructed as specified in the application for the permit.

B. Monitoring requirements Monthly report of injection rate and pressure, annulus pressure, waste character, and other significant operational information.

C. Restrictions on operating procedure None

XII. Economics

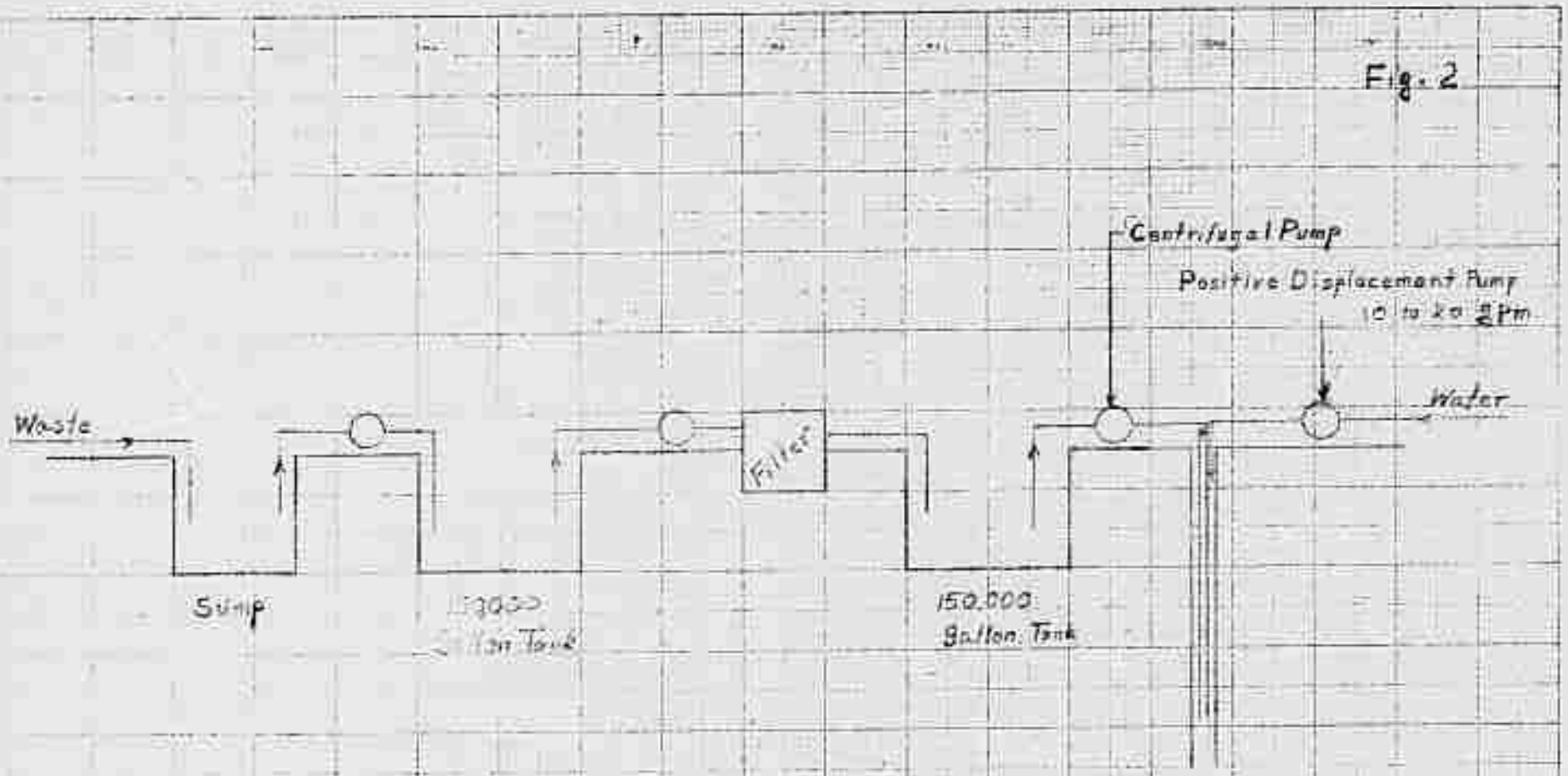
A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

Illinois Geological Survey



Schematic Representation of Surface Equipment

Jones & Laughlin Wase Disposal Well, Hennepin, Ill.

JONES & LAUGHLIN STEEL CORPORATION

Waste Disposal Well No. 1
Final Formation Tops

System, Group or Formation	Top	Bottom	Thickness
Pleistocene	0	175	175
Pennsylvanian System	175	385	210
Silurian System	385	930	545
Ordovician System	930	2127	1197
Maquoketa Group	930	1108	178
Brainard Formation	930	1002	72
Ft. Atkinson Formation	1002	1040	38
Scales Formation	1040	1108	68
Galena Group	1108	1474	366
St. Peter Formation	1474	1592	118
Prairie DuChien Group	1592	2127	535
Shakopee Formation	1592	1865	273
New Richmond Formation	1865	1905	40
Oneota Formation	1905	2114	209
Gunter Formation	2114	2127	13
Cambrian System	2127	4843	2716
Knox Group	2127	2380	253
Eminence Formation	2127	2235	108
Potosi Formation	2235	2380	145
Potsdam Group	2380	4843	2463
Franconia Formation	2380	2535	155
Ironton Formation	2535	2643	108
Galesville Formation	2643	2705	62
Eau Claire Formation	2705	3109	404
Mt. Simon Formation	3109	4843	1734
Pre-Cambrian Granite	4843	4846+	--

EXHIBIT I

WELL FILE NUMBER Not permitted / STATE — I1-4 / UMR

I. **Operating Company & General Well Location**

American Potash and Chemical Company

West Chicago

II. **Well location (legal description)**

Location: SW 1/4, Sec. 9, T39N, R9E, Dupage County.

III. **History, system planning, construction & operation.**

In August, 1966, a report discussing the feasibility of deep well disposal at the American Potash and Chemical Company Plant, at West Chicago, was submitted to the Sanitary Water Board. The Company submitted a formal application to the Sanitary Water Board for a permit to drill and operate a disposal well October 11, 1966. A November 7 letter from the Board to the Company stated that, a permit would not be issued to operate a disposal well until a test well was drilled and evaluated.

Drilling began on the well December 1, and water samples were obtained from the interval from 2,250 to 2,280 feet. The water samples contained a maximum of about 3,000 ppm dissolved solids. The Company completed drilling of the well to a total depth of 4,043 feet in PreCambrian granite. Based on all evidence, the Company was not allowed to use the well for wastewater injection. Since the well could not be used for wastewater injection, it was plugged from the bottom back to a depth of 2,130 feet in 1969, and the casing above 2,130 feet perforated to allow use of the well for water supply.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The well is located in northern Illinois, just west of Chicago on the Kankakee arch. Consolidated sediments in the area range in age from Cambrian to Silurian. These beds dip gently southeastward and are overlain by Pleistocene glacial deposits.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 723) (Total well depth 4,043)

Datum for depth measurement Ground

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	Pleistocene	0		gravel, sand, and clay
	Silurian	93		limestone and dolomite
Maquoketa	Ordovician	277		shale
Galena		366		
		547		
Ancell		660		
	Cambrian	1050		
Mt. Simon		1820-4,020		sandstone and shales

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity: _____

2. Permeability: _____

3. Original Reservoir Pressure: _____

4. Reservoir Temperature: _____

5. Chemical Character of Formation Water: About 100,000 parts per million dissolved solids in the basal Mt. Simon.

6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs in all units, except lower Mt. Simon.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs Considerable coring was done.

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log ____ Drilling time

X Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run A complete log suite was run.

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

_____

_____

B. Physical & chemical Description _____

_____

_____

_____

_____

_____

_____

_____

C. Volume _____

_____

_____

_____

IX. Preinjection waste treatment _____

_____

_____

_____

_____

_____

_____

_____

_____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Numerous drill stem tests were run in the Mt. Simon Formation. Injectivity tests were run in the basal Mt. Simon.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures Never operated

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ Bottom hole _____)

Date(s)	Average	Maximum

h. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

i. Regulatory aspects.

A. Construction requirements Well was constructed as specified.

B. Monitoring requirements No operating permit was issued.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

WELL FILE NUMBER Permit No. 1970-EA-517 STATE I1-5 UMR

I. **Operating Company & General Well Location**

U. S. Industrial Chemicals Company
Division of National Distillers and Chemical Corporation
P. O. Box 218
Tuscola, Illinois

II. **Well location (legal description)**

Location: 430 ft. south and 1135 ft. east of the NW corner of section 31, T16N, R8E, Douglas County.

III. **History, system planning, construction & operation.**

A five page report was submitted by U. S. Industrial Chemicals to the Illinois Health Department December 2, 1969, proposing subsurface injection for about 120 million gallons of wastewater being held in ponds at their plants. In January, U. S. Industrial Chemicals submitted a further report for study. After review of the two reports by these agencies, the Sanitary Water Board agreed in a letter dated February 9, 1970, to permit the Company to drill a test well.

Drilling of the test well began on April 7, 1970, and the total depth of 5,524 feet was reached on May 9. The well was completed and tested, and a well-history report submitted to the Sanitary Water Board May 27, 1970, with a letter requesting a permit to use the well for wastewater injection. Permit 1970-EA-517 was issued to U. S. Industrial Chemicals granting permission, August 4, 1970, to operate the injection well and to inject into the zone between 5,00 and 5,507 ft. in accordance with all plans and specifications submitted and subject to various additional conditions. The well is presently in operation.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Well is on the west flank of the Tuscola anticline on the LaSalle arch. Beds at the well dip southwest.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 693) (Total well depth 5,524)

Datum for depth measurement Rotary bushing elev. 708'

Name	Age	Depth (top)	Thick-ness	Lithologic Description
See attachment				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Eminence-Potosi	Cambrian	5,015 to 5,524		very wide spread dolomite with porous and permeable zones
permeable zones	5,020-5,030			
	5,144-5,176			
	5,186-5,194			

D. Engineering description of injection units

1. Porosity: 25 percent (estimated)
2. Permeability: ____
3. Original Reservoir Pressure: Static fresh water level was 175 below KB therefore, at 5,500ft. the pressure was 2,309 psi.
4. Reservoir Temperature: ____
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: Unknown-Not Fractured

Name	Age	Depth (top)
glacial drift	Quaternary	surface
undifferentiated	Pennsylvanian	---
Cypress Sandstone	Mississippian	1,246
Paint Creek	Mississippian	1,302
Bethel-Benoist	Mississippian	1,318
Aux Vases Sandstone	Mississippian	1,384
St. Geneieve	Mississippian	1,425
Rosiclaire	Mississippian	1,458
Fredonia Limestone		1,472
St. Louis Limestone		1,550
Salem Limestone		1,706
Warsaw Limestone		1,786
Osage Shale		1,820
Corper Sandstone		2,200
New Albany Shale	Devonian	2,314
	Silurian	2,470
Maquoketa Shale	Ordovician	3,105
Galena Limestone	Ordovician	3,313
Decora Shale	Ordovician	3,464
Glenwood Shale	Ordovician	3,826
St. Peter Sandstone	Ordovician	3,886
Shakopee Dolomite	Ordovician	4,064
New Richmond Shale	Ordovician	4,124
Oneta	Ordovician	4,400
Eminence	Cambrian	4,984
Potosi	Cambrian	5,075

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Glacial drift			fresh water extends to	a drill stem test at
Silurian			less than 2,400 ft.	2,412-2,510 yielded
				water with dissolved
				solids content of
				14,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The Tuscola anticlinel is an oil producing structure, with production starting in 1962. The pay zone is the Kimmswick (Trenton). Oil shows are present in Pennsylvanian, Devonian, and Silurian rocks.

Coal is mined near Newman, west of the area. The coal beds are in the Pennsylvanian System.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"		13 3/8"	219	200sks 3% $CaCl_2$ +
Intermed.	12 1/4"	H-40	9 5/8"	2,810	700sks Howco Lite +
	8 3/4"	J-55	7 "	5,015	850 " 100 Class A
Injection	6 1/2"	EUE J-55	2.875 OD	4,990	
		w/plastic lining			

Other annulus filled w/fresh water and 2bbls Coretron w/crude oil at bottom

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Centralizers every 90 ft. on 9 5/8" & 7" casing

Halliburton R-4 tubing packer

Continuous pressure recorder on tubing and annulus and flow meter on tubing.

VI. Description of surface equipment

A. Holding tanks & flow lines Waste is transferred from lagoon No. 3 through 4 in. diameter plastic pipe.

B. Filters None - a strainer is used on the well head.

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____ Drillers Log

X Sample log

____ Drilling time

____ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

____ Resistivity	____ Gamma ray-neutron
X SP	____ Temperature
____ Caliper	X Cement bond

____ Other Induction - Laterlog 219' to TD

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of various petrochemical and agricultural chemicals.

B. Physical & chemical Description Wastewater containing $CaSO_4$, phosphoric acid (3%), sulfuric acid 1 1/2%), fluoride (0.7%), carbon, and other salts (company description). The waste has a pH of about 1.0 and a specific gravity of 1.034 at 60°F.

C. Volume 80 acres of ponds contain this waste, which will not be produced after 1971. (about 130,000,000 gal.)

IX. Preinjection waste treatment holding in ponds

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results	
1st Injectivity	---	5,015-5,524	Gage Press	GPM Injected
			120 psi	98
			200 psi	136
			525 psi	200
			675 psi	243
2nd after acidizing			300 psi	150
			500 psi	220
Drill stem		2,412-2,510	water salinity>10,000ppm	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
5,015-5,524	5,000 gal. 28% HCl	- before first injectivity test
"	5,000 gal. 28% HCl	- before second injectivity test
5,176 & 5,186-5,194 perforated	3shots/ft.	

C. Injection rates and pressures

1. Rate

Date(s)	Sept. 1, 1970	Average	485,000gal	Maximum	
"	March 22, 1971	"	370,000gal	"	
"	May 1, 1971	"	432,000gal	"	
"	August 31, 1971	"	446,000gal	"	
"		"		"	

2. Pressure (well head X ~~Casing~~ bottom hole ~~Tubing~~)

Date(s)	Sept. 1, 1970	Average	30-100psi	Maximum	6psi
"	March 22, 1971	"	52psi	"	22psi
"	May 1, 1971	"	52psi	"	16psi
"	August 31, 1971	"	52psi	"	10psi
"		"		"	

Cumulative amount injected to August 31, 1971, 92,963,000gal.

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Packer unseated Oct. 1970, well was shut down during part of October and all of November, December, and January and February 1971. Operation was resumed in March with a new packer. A third packer was installed in May 1971.

XI. Regulatory aspects. - (See system history)

A. Construction requirements Well was to be constructed as designed and approved.

B. Monitoring requirements Monthly report of operating pressures and injected volumes, annulus pressure, waste character, and any other significant operational information.

C. Restrictions on operating procedure Waste water injected limited to that approved. Injection pressures not to exceed 0.65 psi/foot of depth at the bottom of the hole.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environemntal Protection Agency

Illinois Geological Survey

WELL FILE NUMBER

STATE

IN-1
UMR

I. Operating Company & General Well Location

American Cyanimid Company
P. O. Box 262
Michigan City, Indiana 46360
Phone 219-874-6211

II. Well location (legal description)

Location: Sec. 22, T38N, R4W, LaPorte County, Indiana.

III. History, system planning, construction & operation.

Well 1 began operating in disposing waste water in Aug., 1951 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting. The well is located on the northern flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes____; no X).

(Ground elevation 611 ft.) (Total well depth 650 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Devonian & Silurian		270ft.	397ft.	dolomite and limestone

D. Engineering description of injection units

1. Porosity: vuggy and intergranular
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 50mg/l H_2S, 4,000mg/l NaCl
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	175ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat, marl, and sand are mined in LaPorte County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			16in.	255ft.	
Intermed.			12in.	170-257ft.	
Injection		Carlon tubing	6in.	270ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 3 settling tanks in series

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Floor washing waste and filter washing waste.

B. Physical & chemical Description 14,000ppm TDS, 6,500mg/l Na_2SO_4, 5000mg/l ammonium sulfate, 120mg/l acidity, Specific gravity 1.0, pH 4.6, Temperature 60°F.

C. Volume 500 - 600 gpm

IX. Preinjection waste treatment Sedimentation

X. Well operation & operational history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	500gpm at 21psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 400gpm Maximum 600gpm

" " " "

" " " "

" " " "

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" " " "

" " " "

" " " "

" " " "

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Well #1 - The originial casing failed in 1954. It was replaced with Carlon plastic pipe.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements Monthly operational reports are filed with the state board.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $23,000.00

B. Operating costs $500.00 per year for boths well.

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-2
UMR

I. Operating Company & General Well Location

American Cyanimid Company

P. O. Box 262

Michigan City, Indiana 46360

Phone 219-874-6211

II. Well location (legal description)

Location: Sec. 22, T38N, R4W, LaPorte County, Indiana - 850ft. east of the first well.

III. History, system planning, construction & operation.

The well began operating in 1952 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northern flank of the Kankakee Arch and the regional dip in this area is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ____; no X).

(Ground elevation 612 ft.) (Total well depth 295 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
---	Devonian	255ft.	40ft.	dolomite and limestone

D. Engineering description of injection units

1. Porosity: vugular and intergranular
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: 50mg/l H_2S, 4,000 mg/l NaCl
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as In-1

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	255ft.	
Intermed.					
Injection		Carlon tubing	6 in.	270ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 3 settling tanks in series

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as In-1

B. Physical & chemical Description Same as In-1

C. Volume 500 - 600 gpm

IX. Preinjection waste treatment Sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	936gpm at 19.0psig

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 400 gpm Maximum 600 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 35 psig Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: No problems were reported

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

a. Total and unit costs of construction 15,000.00

b. Operating costs [illegible] per year for both units

XIII. Comments of Administrator and Technical Reviewers.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-3
UMR

I. Operating Company & General Well Location

Indiana Farm Bureau Coop. Assn. Inc.

Mt. Vernon, Indiana

II. Well location (legal description)

Location: Sec. 6, T7S, R13W, Posey County, Indiana

III. History, system planning, construction & operation.

This well was originally completed as an oil test in April, 1950. It was converted to a disposal well and began operating in October, 1955. Originally it extended into the Hardinsburg at 2457 ft. and was later plugged back to 2328 ft.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the east flank of the Illinois Basin. The regional dip is to the southwest. The stratigraphic section consists of sandstone, shale, limestone and dolomite of Cambrian to Pennsylvanian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation_____) (Total well depth 2427 ft.)

Datum for depth measurement 416' Derrick floor

Name	Age	Depth (top)	Thickness	Lithologic Description
	Pennsylvania			
Kincaid	Mississippian			limestone
Menard	Mississippian			limestone
Vienna	Mississippian			sandy limestone
Tar Springs	Mississippian			sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Tar Springs	Mississippian	2266'	100ft.	sandstone

D. Engineering description of injection units

1. Porosity: 20% (estimated)
2. Permeability: 200 millidarcies (estimated)
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	200ft.	sand & clay	< 3000ppm TDS

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are recovered near the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	11 in.		10 3/4in.		100 sacks
Intermed.	8 3/4in.		5 1/2in.		150 sacks
Injection			2 1/2in.		
Other					

Describe bottom hole completion method: perforated - 40 holes at 2302 ft. to 2808

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

No packer

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	To	Recovery

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

_____

_____

B. Physical & chemical Description Water, sodium, hydroxide, sodium sulfide, sodium metasilicate, Specific gravity 1.12

_____

_____

_____

_____

_____

C. Volume 4,500 gal. every 3 to 4 weeks

_____

_____

_____

IX. Preinjection waste treatment settling

_____

_____

_____

_____

_____

_____

_____

_____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Perforated Zone	Acidization	15% muratic acid + Dowell L-1 & # 9 additives
" "	Hyd. fracturing	3000 gal. - water at 7500 psi

C. Injection rates and pressures

1. Rate

Date(s)	Average 6300gal. per month	Maximum

2. Pressure (well head X bottom hole)

Date(s)	Average 200psi	Maximum 350psi

X. Well operation & operating history

D. Description of operating programs: Waste is injected approximately once each month

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $19,000.00

B. Operating costs $100.00

XIII. Source(s) of Information and Pertinent References.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-4
UMR

I. Operating Company & General Well Location

F M C Corporation

P. O. Box 34

Newport, Indiana

Phone Ch-5-2251

II. Well location (legal description)

Location: Ne 1/4, NW 1/4, Sec. 9, T16N, R6W Vermillion County, Indiana. -Newport Army Ammunition Plant.

III. History, system planning, construction & operation.

The well was completed on May 22, 1960 and began operation during the same year. In 1966, a cathode type protection system was installed. The well is presently inactive, but has not been plugged.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Illinois Basin. The regional dip is to the southwest. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Pennsylvanian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 6160 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Cincinnatian	Ordovician	1880ft.	319ft.	shale
Trenton	Ordovician	2199ft.	161ft.	limestone
Black River	Ordovician	2360ft.	450ft.	limestone
Knox	Cambrian	2819ft.	1600ft.	dolomite
Eau Claire	Cambrian	4420ft.	840ft.	limestone & shale
Mt. Simon	Cambrian	5260ft.	900ft.	limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	5260ft.	900ft.	fractured sandstone

Injection interval 5450 to 6160 ft.

D. Engineering description of injection units

1. Porosity: 6%
2. Permeability: 6 to 8 md
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: 204,400 ppm TS, 125,000 ppm Cl, 508 ppm SO_4, 116 ppm $(CO_3)_2$, 22,400 ppm Ca, 2,840 ppm Mg, pH - 4.5
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

The area around the disposal well is an area of large coal deposits. Over 150 million tons of coal has been produced from the deposits.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	13 3/4in.		10 3/4in.	498ft.	
Intermed.	9 in.	23lb/ft.	7 in.	5450ft.	
Injection					
Other					

Describe bottom hole completion method: open hole completion 710 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 13,000 gal. waste rundown tank and a surge tank

B. Filters Leaf filters and cartridge filters

C. Pumps 23 stage centrifugal pump

D. Other _____

VII. Cores, samples, & Logs

A. Coring Intermittantly

From	4500 ft.	to 6160 ft.	Recovery 354 ft. - 97.5%
"			
"			
"			
"			
"			

B. Drilling Logs

____ Drillers Log

X Sample log

____ Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

X Other Velocity, Lateralog

___ Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste

B. Physical & chemical Description 22,000 mg/l Ca, 9,000 mg/l Fe, 3,000 mg/l Mg, 125,000 ppm Cl, 10 ppm solids (after filtration), Specific gravity 1.09, pH 4.0

C. Volume

IX. Preinjection waste treatment pH control, sedimentation, and filtration

X. Well operation & maintenance history

A. Tests

Test	Depth	Date Tested	Interpretation of test results
None			

B. Treatments or stimulation

Date Treated	Treatment Fluid	Interpretation of Treatment and Results
open hole	Buffer Solution	250,000 gal. fresh water and 250,000 gal. oil contaminated waste water

C. Injection rates and pressures

1. Rate

Interval _____ Pressure _____ to _____ Pressure _____

2. Pressure (well head _____ 0 _____ bottom hole _____)

Interval _____ Pressure _____ to _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: 1) Bore hole collapsed in 1962 and was drilled out at a cost of $30,000. 2) Waste and formation water formed a precipitate. This was alleviated by buffer injection.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

8.

A. Total and unit costs of construction $200,000.00

B. Operating costs

XIII. Source(s) of Information and Facilities Inference.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

IN-5

I. Operating Company & General Well Location

Bethlehem Steel Corporation

Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 26, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

The well began operating in November 1967. The well was originally used to dispose of sulfuric acid and now it disposes of hydrochloric acid. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting. The well is on the northeast flank of the Cambrian Arch and the regional dip in the area is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___; no X).

(Ground elevation 624 ft.) (Total well depth 4304 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
	Silurian	256ft.	700ft.	shale
Trenton	Ordovician	956ft.	200ft.	limestone
Black River	Ordovician	1156ft.	100ft.	limestone
Knox	Cambrian	1256ft.	300ft.	dolomite
Eau Claire	Cambrian	1625ft.	900ft.	limestone
Mt. Simon	Cambrian	2525ft.	1700ft.	sandstone
	PreCambrian	4225		

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2525ft.	1700ft.	sandstone

D. Engineering description of injection units

1. Porosity: 9% intergranular
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: 40,000 mg/l NaCl, 7,000 mg/l Ca
6. Reservoir Fracture Pressure _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		190	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are mined in Porter County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	24in.		20in.		
Intermed.	15in.	H-40 32lb.	10 3/4in.		
	8 3/4in.	H-40 17lb.	7in.		
Injection	8 3/4in.	J-55 Tubing	3 1/2in.O.D.		
		Fiberglass coated			

Other

Describe bottom hole completion method: perforated completion below 290 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 2 Baker Model D packers

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters precoat filter 2 microns

C. Pumps

D. Other

VII. Cores, sampler, & logs

A. Coring

From	to	Recovery

B. Drilling logs

X Drillers log

X Sample log

Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity — X Gamma ray-neutron

___ SP — X Temperature

X Caliper — ___ Cement bond

X Other Formation density, acoic

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel mill

B. Physical & chemical Description 71,600 ppm TDS, 6-10% H_2SO_4, 14-18% $FeSO_4$, 41,000 ppm Cl, 22,000 ppm Na_2O, temperature 40-120°F.

C. Volume

IX. Preinjection waste treatment Filtration, addition of biocide and corrosion and oxygen inhibitors

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	perforated zone	2400 bwd at 500 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Perforated zone	Acidization	16% HCl

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average 125 gpm	Maximum
"		"	"
"		"	"
"		"	"
"		"	"
"		"	"

2. Pressure (well head X bottom hole)

Date(s)		Average 700 psi	Maximum
"		"	"
"		"	"
"		"	"
"		"	"
"		"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements: _____

C. Restrictions on operating procedure: _____

XII. Economics

A. Total and unit costs of construction $500,000.00

B. Operating costs $12,000.00 per year

XIII. Source(s) of Information and Pertinent References.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

~~STATE~~ IN-6
~~STATE~~ UNR

I. Operating Company & General Well Location

Bethlehem Steel Corporation
Burns Harbor Plant
Box 248
Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 30, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

This well was completed on April 4, 1968 and began operation soon after completion. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 613 ft.) (Total well depth 3945 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
	Silurian	250ft.	695ft.	shale & limestone
Trenton	Ordovician	945ft.	215ft.	limestone
Black River	Ordovician	1160ft.	185ft.	limestone
Knox	Cambrian	1355ft.	300ft.	dolomite
Eau Claire	Cambrian	1662ft.	900ft.	limestone
Mt. Simon	Cambrian	2510ft.	3945ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2530"	141[illegible]ft.	sandstone

D. Engineering description of injection units

1. Porosity: 10 - 20%
2. Permeability: 20 - 100 md
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: 92°F
5. Chemical Character of Formation Water: 98,000 TS, 58,000 ppm Cl, 1210 ppm SO_4, 78.1 ppm HCO_3, 8140 ppm Ca, 1320 ppm Mg, 27,000 ppm Na
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		190	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are mined from Porter County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 in.	H-40	55 lb.	13 3/8in.	226ft.	300 sacks
Intermed.	12 1/4in.	J-55	48 lb.	9 5/8in.	1437ft.	500sacks
	8 3/4in.	J-55	23lb.	7 in.	2530ft.	525sacks
Injection	6 1/4in.					

Other

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 500,000 gal. storage tanks, 1 - 50,000 gal. storage tank.

B. Filters: 2 - diatomaceous earth filters

C. Pumps: _____

D. Other: 2 - 2000 gallon chlorine tanks in DAFW

VII. Cores, samples, & logs

A. Cores

Depth	Int	Recovery

B. Drilling logs

X Geologic log

X Sample log

Drilling time

X Other: Geophysical log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	X Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond
X Other Formation density, velocity	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from a coke plant

B. Physical & chemical Description Aqueous ammonium salts containing phenols and cyanides.

C. Volume 450 gpm - maximum

IX. Preinjection waste treatment Oil skimming, sludge removal filtration, temperature reduction, and addition of Biocide.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average 125 gpm	Maximum

2. Pressure (well head 1 bottom hole)

Date(s)		Average 700 psi	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: There were several tubing leaks. The tubing was replaced.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Pertinent References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

IX-7

I. Operating Company & General Well Location

Bethlehem Steel Corp.

Burns Harbor Plant

Box 248

Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 29, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

The well was completed on March 22, 1968 and began operating soon after completion. This well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation 633 ft.) (Total well depth 4301 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Silurian	Silurian	238	520ft.	shale & limestone
Cincinnatian	Silurian	758	200ft.	limestone
Trenton	Ordovician	945	225ft.	limestone
Black River	Ordovician	1170	170ft.	limestone
Knox	Cambrian	1340	315ft.	dolomite
Eau Claire	Cambrian	1655	885ft.	limestone
Mt. Simon	Cambrian	2530	1744ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Eau Claire	Cambrian	1655ft.	885ft.	limestone
Mt. Simon	Cambrian	2530ft.	1744ft.	sandstone

D. Engineering description of injection units

1. Porosity: 10 - 30% Intergranular
2. Permeability: 20 - 100 md
3. Original Reservoir Pressure:
4. Reservoir Temperature: 92°F
5. Chemical Character of Formation Water: Same as In-6
6. Reservoir Fracture Pressure:

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		190ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as 1.-4

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"	H-40 48lb.	13 3/8in.	230ft.	300 sacks
Intermed.	12 1/4"	J-55 32lb.	9 5/8in.	1435ft.	
	8 3/4"	23lb/ft.	7in.	2521ft.	
Injection	6 1/4"	Open hole below		2521 ft.	

Other

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 400,000 gal. storage tanks, 1 - 60,000 gal. storage tank

B. Filters 2 diatomaceous earth filters

C. Pumps _____

D. Other 2 Heat exchangers 14"? to 20"?

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling logs

X Drillers log

X Sample log

___ Drilling time

X Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity X Gamma ray-neutron

___SP ___Temperature

X Caliper ___Cement bond

X Other Velocity, formation density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from a coke plant

B. Physical & chemical Description Aqueous ammonium salts containing phenols and cyanides.

C. Volume 450 gpm - maximum

IX. Preinjection waste treatment Oil skimming, sludge removal filtration, temperature reduction, and addition of Biocide.

X. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average 32 gpm	Maximum

2. Pressure (well head X bottom hole)

Date(s)	Average 15 psi	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Daily injection volumes and data on waste chemistry to be filed monthly.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER IN-8

STATE

I. Operating Company & General Well Location

Midwest Steel Division

National Steel Corporation

Portage, Indiana 46368

Supt. of Services (1971) Mr. C. Hortman

II. Well location (legal description) Phone 219-762-3131

Location: Sec. 25, T37N, R7W, Porter County, Indiana

III. History, system planning, construction & operation.

Initial operation began in Feb. 1965. The reason for the well was to alleviate a water sludge problem. The well is still in operation.

All logs are on file with the Indiana Geological Survey.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, limestone, dolomite, and shale of Cambrian to Devonian age.

IV. Geology & Geophysics, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Include future penetrated yes ___; no X).
(Ground elevation 5105 ft) (Total well depth 4305 ft.)
Datum for depth measurement _____

Name	Age	Depth (ft)	Thickness	Lithologic Description
	Eocene	2400 ft.		sand
Reveno	Cretaceous	3375 ft.		limestone
Black River	Ordovician	3950 ft.		limestone
Knox	Cambrian	4100 ft.		dolomite
Eau Claire	Cambrian	4250 ft.		limestone and shale
Mt. Simon	Cambrian	4300 ft.		conglomerate
	Precambrian	4305 ft.		

C. Geologic Description of injection units & nearby units not in use

Rock Units

Name	Age	Depth (ft)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	4300	4300	conglomerate

D. Engineering description of injection units

1. Porosity: see intergranular
2. Permeability: 80 - 10 md
3. Vertical Permeability Barriers: _____
4. Horizontal Transmissivity: _____
5. Chemical Composition of formation water: 40,000 mg/l NaCl, and 1,000 mg/l Ca

6. Geologic Structure Barriers: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	190ft.	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat and marl are recovered from the county in which the well is located.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.		16 in.	180ft.	Portland
Intermed.	13 3/8in.		10 2/4in.	400ft.	"
	9 5/8in.		7 in.	2750ft.	"
Injection		Fibercast	2 in.	800ft.	Resin
		"	3 in.	800 to 2750ft.	

Stainless steel tail pipe at end of fibercast tubing string

Other 15ft. of monel casing at end of 7 in. string

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Packer set near the bottom of the 7in casing string.

VI. Description of surface equipment

A. Holding tanks & flow lines 100,000 gal. storage tank, 3,000 gal. surge tank, and an 80 in. continuous pickle line

B. Filters precoat filters - .5 microns

C. Pumps 2 booster pumps and 2 (75 gpm) injection pumps

D. Other rust inhibitor

VII. Cores, samples, & logs

A. Coring

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling logs

___ Drillers log

X Sample log

___ Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity X Gamma ray-neutron

X SP X Temperature

___Caliper ___Cement bond

X Other Sonic log, conductivity log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste pickle from a metals products operation

B. Physical & chemical Description 6 to 10% H_2SO_4, 14 to 18% Ferrous sulfate, Specific Gravity 1.14, Temperature 130°F to 150°F, also contains some K_2CrO_4

C. Volume

IX. Preinjection waste treatment Filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zone tested	Description of test results
DST	2 hours	open hole	225 gpm at 225 psig
Injection	---	open hole	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
open hole	Acidization	NO
open hole	Buffer Injection	Injection fresh water with chlorine and biocide 8-9 volume - 12,000,000 gal.

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 275 gpm Maximum _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 0 psig Maximum 30 psi

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: The injection tubing ruptured and was replaced.

The buffer injection was required because the effluent reacts with the connate water to precipitate gypsum ($CaSO_4$)

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

a. Total and unit costs of construction $450,000.00

b. Operating costs $5,000.00 per month

XIII. Source(s) of Information and Pertinent References

Indiana Stream Pollution Control Board

Indiana Geological Survey

I. Operating Company & General Well Location

U. S. Steel Corp.

208 S. LaSalle Street

Chicago, Illinois 60604

Well in Gary, Indiana

II. Well location (legal description)

Location: Sec. 22, T37N, R8W, Lake County, Indiana

III. History, system planning, construction & operation.

The well began operating in 1965 and is still in operation.

Drilling was completed Jan. 7, 1965.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwest flank of the Kankakee Arch. The regional dip is to the southwest. Drainage is into Lake Michigan. The stratigraphic section consists of various sediments of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation[illegible]) (Total well depth 4303 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
Trenton	Ordovician	845ft.	200ft.	limestone
Black River	Ordovician	1047ft.	160ft.	limestone
Eau	Cambrian	1190ft.	170ft.	dolomite
Eau Claire	Cambrian	1547ft.	200ft.	limestone & shale
Mt. Simon	Cambrian	2422ft.	1800ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	[illegible]	[illegible]	sandstone

Injection Interval - 2542 ft. to 4301 ft.

D. Engineering description of injection units

1. Porosity: 18.1 intergranular
2. Permeability: 327 md
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: 40,000 mg/l NaCl, 7,000 mg/l Ca
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	160ft.	sand & gravel	

V. Mineral Resources (oil and gas, coal, brines, etc.)

Peat is recovered from pits in the general area of the disposal well.

VI. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40	16 in.	182ft.	375 sacks
Intermed.	13 3/4in.	H-40	10 3/4in.	823ft.	550 sacks
	9 5/8in.	J-55	7 in.	2452ft.	650 sacks +
Injection		Fiberglass	4 1/2in.		40 sacks of resin

Other

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Flowmeter and totalizer

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

X Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity
X SP
X Caliper
X Other Velocity
X Gamma ray-neutron
X Temperature
X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Spent pickle liquor

B. Physical & chemical Description

Sulfuric acid 8-37%
Ferrous sulfate 18-25%
Chromic acid 2-6%
Hydrochloric acid 1%
$FeCl_2$ 15-20%
Specific gravity 1.06-1.13

C. Volume 6,500,000 gal. per month

IX. Preinjection waste treatment filtration & skimming

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
open hole	Acidization	2,000 gal. - Dowell mud acid
open hole	Buffer injection	600,000 gal. of chlorinated water

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 210 gpm Maximum 240 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 200 psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information on Facilities Inventory _____

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-10
UMR

I. Operating Company & General Well Location

General Electric Company
Lexan Lane
Mt. Vernon, Indiana 47620

II. Well location (legal description)

Location: Sec. 18, T7S, R13W, Posey County, Indiana

III. History; system planning, construction & operation.

The disposal well was originally an oil test well. The well began disposing of waste in February, 1967 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located within the Illinois Basin. Locally the well is situated in the center of a graben with normal faults near the well. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian through Pennsylvanian age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 391 ft.) (Total well depth 3054 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Kinkaid	Mississippian	1790ft.		sand, sandstone, shale
Menard	Mississippian	2086ft.		
Vienna	Mississippian	2248ft.		sandy limestone
Glen Dean	Mississippian	2380ft.		limestone & shale
Barlow	Mississippian	2606ft.		shale
Cypress	Mississippian	2635ft.		shale
Bethel	Mississippian	2760ft.		sandstone & shale

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Bethel	Mississippian	2760ft.	46ft.	sandstone

D. Engineering description of injection units

1. Porosity: 18% intergranular
2. Permeability: 100 md
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 110,000 mg/l 6250 mg/l SO_4, 260 mg/l total alkalinity, 1100 mg/l total hardness, 6,400 mg/l Ca, 33.5 mg/l Fe, pH 7.6
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	200ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Over 30 million barrels of oil have been produced from the overlying Waltersburg sand. Coal is also produced from the area in large amounts.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8in.		
Intermed.	6 3/4in.		4 1/2in.		660 sacks 18% Salt-Pozmix
Injection			2 3/8in.		

Other Annulus filled with diesel oil

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Flowmeter, automatic sampler, continuous rate pressure recorder.

Packer on 2 3/8in. tubing

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters 2 cartridge filters - 20 micron cartridge

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	___ Cement bond

___ Other ___

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Waste from a phenolic distillation facility and acid regeneration system.

B. Physical & chemical Description 3% phenol, Specific gravity 1.003, pH 10 to 13.

C. Volume 48,000 gpd

IX. Preinjection waste treatment Sedimentation, filtration pH control at 8, and injection of a scale corrosion inhibitor.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	3.5 hours	open hole	
Injection		" "	40 gpm at 1050 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Open hole	Acidization	4000 gal. 25% HCl

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 30 gpm Maximum 40 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 465 psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Back pressure build up occurred due to iron oxide residue. This was corrected by adding an iron chelating agent.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Monthly reports with the state on operation.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction $50,000.00

B. Operating costs $4,000.00 per year

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-11
UMR

I. Operating Company & General Well Location

Inland Steel Company
30 W. Monroe Street
Chicago, Ill. 60603

II. Well location (legal description)

Location: Sec. 14, T37N, R9W, Lake County, Indiana.

III. History, system planning, construction & operation.

The well was completed and began operation in March, 1968. This well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwest flank of the Kankakee Arch and the regional dip in this area is to the southwest. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included --yes ____; no X).

(Ground elevation 608 ft.) (Total well depth 4348 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
Cincinnatian	Ordovician	680ft.	100ft.	shale
Trenton	Ordovician	780ft.	220ft.	limestone
Black River	Ordovician	1000ft.	130ft.	limestone
St. Peter	Ordovician	1130ft.	340ft.	sandstone
Eau Claire	Cambrian	1470ft.	890ft.	limestone
Mt. Simon	Cambrian	2360ft.	1980ft.	sandstone
---	PreCambrian	4340ft.		granite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2360ft.	1980ft.	sandstone

injection zone 2550 to 2800 ft.

D. Engineering description of injection units

1. Porosity: 12%
2. Permeability: 316 md
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: 123,000 ppm TDS, 75,900 ppm Cl, 1,300 ppm SO_4, 31,500 ppm Na, 12,400 ppm Ca, pH 5.5, Specific gravity 1.090
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	160ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Small amounts of peat and marl are recovered commercially in the area of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40	16 in.		
Intermed.	13 5/8in.	J-55	10 3/4in.	2440ft.	
Injection			2 7/8in.	2550ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

2 - 100,000 gal. storage tanks

1 - 20,000 gal. collection tank

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters 2 percent filters

C. Pumps 2 - 150 gpm booster pumps

2 - 150 gpm injection pumps

D. Other

VII. Cores, samples, & logs

A. Coring

From	to	%recovery
"		
"		
"		
"		
"		

B. Drilling logs

___Drillers log

X Sample log

___Drilling time

X Other lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity ___ Gamma ray-neutron

X SP ___ Temperature

X Caliper ___ Cement bond

X Other Sonic, microlog

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from metals products operation - waste pickle liquor

B. Physical & chemical Description 9.5% H_2SO_4, 13% $FeSO_4$, 0.5% HCl, 17.4% $FeCl_2$, Specific gravity 1.1 to 1.2

C. Volume 130 gal

IX. Pretreatment waste treatment Filtration to 0.5 microns

5. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	12,000 bpd at Gravity

B. Treatments or stimulations

Zones Treated	Treatment Method	Description of Treatment and Results
Open hole	Acidizing	7,500 gal. of MCA
Open hole	Sulfur filtering	---

C. Injection water and chemicals

1. Make

Date(s) [illegible] Formation [illegible] Maximum

2. Previously drill used [illegible] Bottom hole [illegible])

Date(s) [illegible] Formation [illegible] Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-12
UMR

I. Operating Company & General Well Location

Indiana General Corporation
405 Elm Street
Valparaiso, Indiana

II. Well location (legal description)

Location: Sec. 16, T35N, R5W, Porter County, Indiana

III. History, system planning, construction & operation.

The well was put in operation in 1970.

The well is temporary and will operate only until facilities are installed to evaporate the waste fluid and sell the Dry-Crystal Ammonium Chloride.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is toward the northeast.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 774 ft.) (Total well depth 4548 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Silurian		440		
Cincinnatian	Ordovician	923		shale
Trenton	Ordovician	1131		limestone
Black River	Ordovician	1397		limestone
Knox	Cambrian	1498		dolomite and shale
Eau Claire	Cambrian	1898		shale
Mt. Simon	Cambrian	2815		sandstone
	Precambrian	4[illegible]		crystalline basement

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2815 ft.	[illegible] ft.	sandstone

D. Engineering Description of Injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: High saline content
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	190ft.	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat is mined commercially on a small scale.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.		16 in.	313ft.	
Intermed.	11 3/4in.		10 3/4in.	605ft.	
	9 5/8in.		7 in.	2514ft.	
Injection		Fiberglass	2 7/8in.	2508ft.	

Other Fresh water in annulus

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 10,000 gal. holding tank

B. Filters 2 rotary leaf pressure filters

C. Pumps 10 hp - 50 gpm

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling Logs

X Drillers log _____ Drilling time

X Sample log X Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

_X_Caliper

____Other

_X_Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Ammonium chloride waste from the manufacture of iron oxide from pickle liquor

B. Physical & chemical Description

C. Volume 30 gpm

IX. Preinjection waste treatment filtration & sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or stimulations

Zones Treated	Treatment [illegible]	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average 10 min	Maximum
"		"	"
"		"	"
"		"	"
"		"	"

2. Pressure (well head _____ % _____ bottom hole _____)

Date(s)		Average 10 min	Maximum
"		"	"
"		"	"
"		"	"
"		"	"

X. Well operation & operating history

D. Description of operating program: _____

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements monitor aspects of operation to state

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction _____

_____

_____

_____

_____

B. Operating costs _____

_____

_____

XIII. Source(s) of information and pertinent references _____

Indiana Stream Pollution Control Board

Indiana Geological Survey

_____

_____

_____

_____

_____

_____

_____

WELL FILE NUMBER

STATE

Iowa

I. Operating Company & General Well Location

Cedar Falls Company

Cedar Rapids, Iowa

II. Well location (legal description)

III. History, system planning, construction & operation.

Operation of the well began in 1955. The well was recently put in use in 1967 as a result of disuse of the injection horizon and has apparently not been used since that time. Abandoned in the Devonian.

IV. Geology & Geohydrology

A. Regional geologic setting:

E. Hydrogeology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not known				

F. Mineral Resources (oil and gas, coal, uranium, etc.)

None reported in the area

V. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Size	Setting of Tubing Intervals & Depth	Size		Depth Set	Type & Amount of Cement
Surface			16	*	110ft.	
Intermed. Csg.			12	*	4000ft.	
Injection Csg.			8	*	9000ft.	
Injection tubing			3 1/2"	*	9000ft.	

Plans: Lution 10ft. of 8in. water to stainless steel

Describe bottom hole completion method: 8 inch open hole 9,000 to 9,500 ft.

V. [illegible] GRADE AND CONSTRUCTION, [illegible]

A. Velocity, [illegible], [illegible] [illegible], [illegible] _____
[illegible] [illegible] [illegible]

VI. Description of certain [illegible]

A. Detailed [illegible] & Flow [illegible] _____

B. Pavement _____

C. Pumps _____

D. Other _____

VII. Costs, [illegible], & Laws

A. Capital

Item	[illegible]	Payment
a.		
b.		
c.		
d.		
e.		

B. Operating Data

____Drivers Log ____Driving Time

____Accide Log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description Acetic acid solution (1.5%)

C. Volume

IX. Preinjection waste treatment filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones Tested	Description of test results
Pumping	4 hrs.	No. Sand	yield 250gpm of brackish water

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Iowa Geological Survey

Quaker Oats Company

WELL FILE NUMBER Ya-1

STATE UNK

I. **Operating Company & General Well Location**

Vulcan Materials Company
(formerly Frontier Chemical Company)
Wichita, Kansas

II. **Well location (legal description)**

Location: 600ft. from the south line and 1065ft. from the west line of the NW 1/4 of Sec. 8, T29S, R1W, Sedgwick County, Kansas

III. **History, system planning, construction & operation.**

Injection began in 1952, the well is reported by the Kansas Health Department to be in use.

IV. Geology & Geohydrology

A. **Regional geologic setting:** Wichita, Kansas, is located in an uplift area between the Anadarko basin on the south and the Salina basin on the north. The north-south trending Nemaha uplift lies just east of Wichita.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth 400 ft.)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Wellington	Permian		240-322'	salt section of the Wellington fm.

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wellington	Permian	240'		salt section

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water: Saturated brine
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Highly saline natural brines are obtained locally for chemical production.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8	240'	138 sacks cemented to surface
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery	
"			
"			
"			
"			
"			

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___SP

___Caliper

___Other_____

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Products of chlorine, sodium hydroxide, and related products from brines of the Wellington Fm.

B. Physical & chemical Description Saturated brines, lime sludge, and waste sodium hydroxide

C. Volume

IX. Preinjection waste treatment None

V. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	100 - 200gpm	Maximum	350gpm
	"		"	
"	"		"	
"	"		"	
"	"		"	

2. Pressure (well head _____ X _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum	
"	"		"	
"	"		"	
"	"		"	
"	"		"	

X. Well operation & operating history

B. Description of operating programs: _____

E. Operating problems: Pressure control valve closed causing pipes to rupture in 1961. A shut-off control was installed on the pumps to prevent repetition.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

III. Economics

A. Total and unit costs of construction

B. Operating costs

IV. Summary of Information and Judgment Reference

Agency Data Department of Health

Connecticut, 1974

WELL FILE NUMBER

STATE

Ka-2
UMR

I. **Operating Company & General Well Location**

Vulcan Materials Company
(formerly Frontier Chemical Company)
Wichita, Kansas

II. **Well location (legal description)**

Location: Wichita, Kansas, 810 feet from the north line and 1200 feet from the west line of SW 1/4 of Section 27, 28, R1W, Sedgwick County.

III. **History, system planning, construction & operation.**

Injection began in May 1961. The original well was completed in 1956 and was lost in 1961 when the well casing collapsed due to corrosion. This well was then plugged with cement. The second well is still in operation.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Wichita, Kansas, is located in an uplift area between the Anadarko basin on the south and the Salina basin on the north. The north-south trending Nemaha uplift lies just east of Wichita.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation _____) (Total well depth 4,125)

Datum for depth measurement K. B. - 1331'

Name	Age	Depth (top)	Thickness	Lithologic Description
See page 2A				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	3997	128 (Total drilled)	limestone and dolomite

D. Engineering description of injection units

1. Porosity: _____

2. Permeability: _____

3. Original Reservoir Pressure: Static fluid level 375 feet

4. Reservoir Temperature: _____

5. Chemical Character of Formation Water: Formation fluid is highly mineralized - 150,000 mg/l

6. Reservoir Fracture Pressure: _____

DEPTH FROM	DEPTH TO	NAME OF FORMATION	DESCRIPTION
0	100		Sand and clay
100	410		Shale with gypsum
410	1758		Thin layers of limestone and shale
1758	1794	Severy	Shale and shaley sand
1794	2229	Topeka	Limestone mixed with thin lenses of shale
2229	2238	Heebner Shale	Shale, black, carbonaceous
2238	2240	Leavenworth	Limestone, grayish, dense
2240	2264	Snyderville	Shale, gray, green, brown
2264	2288	Toronto	Limestone, brown, with streaks of shale
2288	2495	Douglas	Shale, gray-green, light shaley sand
2495	2654	Lansing	Limestone, tan-brown, with fine grained sand
2654	2997	Kansas City	Shale, gray-green with fine grained sand
2997	3086	Pleasanton	Shale, drak gray, with streaks of limestone
3086	3273	Marmaton	Limestone, cream to brown, slightly chalky
3274	3426	Cherokee	Layers of shale and limestone
3426	3792	Kinderhook	Shale, grayish
3792	3837	Chattanooga	Shale, gray to brownish gray
3837	3927	Simpson	Shale, gray to green with streaks of sand
3927	4125	Arbuckle	Dolomite, tan to dark brown; 88% $CaCO_3$, 12% SiO_2

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas are produced in the area, and shows of oil were encountered in samples from the interval at 3925 to 3930 feet below the surface. (Kansas City Formation).

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	3.42#/ft.	10 3/4"	395ft.	800sks Pozmix
Intermed.	9"	26#/ft. plastic coated	7 "	3965ft.	1500gal. Celo-
	9"	26#/ft. uncoated	7 "	3965ft.	to 4125ft.
Injection	9"	TK-300 heavy duty	4 1/2"	4125ft.	

Perforation - 3990 to 4115 ft. - 4 jet shots per foot

Other

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: A Centralizer is located immediately above the perforated zone.

VI. Description of surface equipment

A. Holding tanks & flow lines 407,000 gallon holding pond and surface drainage of rainfall in 300' x 6' drainage ditch. The liquid eventually flows through a 6 inch reinforced polyethylene pipe.

B. Filters

C. Pumps 10'W x 50'L x 14'D pump with 51,360 gal. capacity

D. Other Two automatic throttling valves govern the flow of waste from a pump to the well

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

The waste is derived from the production of chlorine, sodium chloride, and related products

B. Physical & chemical Description Unsaturated Ca and Mg brine solutions, impure bromine, chlorinated organics, and hydrochloric acid. The pH ranges from 1 to 9 during short periods. Average temperature - 120° F

C. Volume 200 - 400 gpm

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment method	Description of Treatment and Results
Perforated	Acidized	June 1, 1961 - 2,345 gal.
Zones		HCl
3990-4115		June 3, 1961 - 3,760 gal.
		HCl

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 110 gpm Maximum 440 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 27 mm of Hg Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Tubing rupture has occured on four occasions. This is due to a phenomenon called "water hammer" which causes gradual tubing fatigue. Corrosion also supplements the rupture.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction $30,000 for drilling and completion. Approximately $40,000 for tubing.

B. Operating costs Maintenance - $25,000 per year.

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Donaldson, 1964

WELL FILE NUMBER

Health Dept.
Permit 4108
STATE

Ka-3
UMR

I. Operating Company & General Well Location

National Cooperative Refinery Assoc.
Conway, Kansas

II. Well location (legal description)

Location: NW 1/4, SE 1/4, Sec. 29, T19, R4E, McPherson County, Kansas

III. History; system planning, construction & operation.

Installed in 1952 the well is still in operation and there are no plans for abandonment.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southern edge of the Salina basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 4,225)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Lower Arbuckle	Ordovician	3998'	237' (total drilled)	tan to gray dolomite

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: Unknown
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8"	250	to surface
Intermed.			5 1/2"	3,938	cemented to 480' below ground surface
Injection					
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc. _____

VI. Description of surface equipment

A. Holding tanks & flow lines 8 ft. high 10 ft. diameter redwood settling tank

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. — Gases, vapors, & dust, continued

E. Other logic map

___Pentaborane ___Nickel carbonyl

___DF ___Tetraethyl lead

___Phosgene ___Cement kiln

___Other _____

VIII. Work Characteristics

A. Industrial Process Risk which might be Borne

Situation of such gases that is can change

B. Physical & chemical Description Never occurred

C. Volume 2 x 1000 lbs

IX. Performance with Equipment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
	0 to 840 gpm	840 gpm
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"
"	"		"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Five shallow (100') observation wells have been constructed in the area of the well.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health and National Cooperative Dairy Association

WELL FILE NUMBER

Ka-4

I. Operating Company & General Well Location

Shell Oil Company

II. Well location (legal description)

Location: NE 1/4, Sec. 30, T19, R4W, McPherson County, Kansas.

III. History, system planning, construction & operation.

Installed in 1961 for return of brine solutions resulting from dissolving of salt beds to develop liquid petroleum storage caverns. The well was used primarily during the development phase and is rarely used now.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southern edge of the Salina basin.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column Included yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement _____

Name	Age	Depth (log)	Thickness	Lithologic Description

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (log)	Thickness	Character and Areal Distribution
Artesia Lo	Ordovician	8000'		

D. Engineering Description of Injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	%recovery
"		
"		
"		
"		
"		

B. Drilling logs

____Drillers log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Saturated solution from solutioning of salt zone to develop storage room

B. Physical & chemical Description Brine solution

C. Volume 3,500 - 17,000 bbl during the development phase

IX. Reinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

WELL FILE NUMBER

STATE

Ka-5
UMR

I. Operating Company & General Well Location

Northern ~~National~~ Natural Gas Company, Mullinville, Kansas.

Well approximately 3½ miles east of Mullinville, Kansas.

II. Well location (legal description)

Location: SE 1/4, Sec. 20, T28, R19W, Kiowa County, Kansas

III. History, system planning, construction & operation.

Installed in 1954 for injection of a brine solution from regeneration of zeolite water softener. The well is still in use. It was unsuccessfully attempted to use the Cheyenne Sandstone for injection in the interval 550 to 750 feet before drilling the well to the Arbuckle Formation at 5500 feet.

IV. Geology & Geohydrology

A. Regional geologic setting: Kiowa County is located on the extreme eastern edge of the Hugoton embayment of the Anadarko basin and on the western flank of the Pratt anticline. The Pratt anticline serves to separate the Sedgwick basin on the east from the Hugoton embayment on the west.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___ ; no X).

(Ground elevation 2[illegible]) (Total well depth [illegible])

Datum for depth measurement [illegible]

Name	Age	Depth (top)	Thickness	Lithologic Description
Heebner	Penn	4130(-1621) [illegible]	[illegible]	Shale
Lansing	Penn	4305(-1796)	75'	Limestone & shale
Marmaton	Penn	4730(-2421)	200'	Limestone & shale
Mississippian	Mississippian	4912(-2603)	430'	Limestone
Viola	Ordovician	5342(-3033)	[illegible]	Limestone
Simpson	Ordovician	5474(-3165)	21'	Shale, Limestone & sandstone
Arbuckle	Ordo-Camb	5494(-3185)		Dolomite

C. Geologic Description of injection units & feasible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls	Ordo-Camb	5500(-3[illegible])	N/A	[illegible]
Lansing/Kansas City	Missourian	4305(-1[illegible])	4[illegible]'	[illegible]
Mississippian	Mississippian	4912(-2[illegible])	[illegible]	
Viola	Ordovician	5342(-3033)	[illegible]	

D. Engineering description of injection units

1. Porosity: (Unknown)
2. Permeability: (Unknown)
3. Original Reservoir Pressure: (Unknown)
4. Reservoir Temperature: 110° F
5. Chemical Character of Formation Water:

   Unknown

6. Reservoir Fracture Pressure:

   Unknown

IV. Geology & Geophysics, continued 3.

B. Geochemistry, Fluid water [illegible] in minerals

Name	Years	Interest	Technical	Physical Quality

F. Mineral Resources (all old min. coal, uranium, etc.)

[illegible]

V. Well Logging and Interpretation

A. Testing, Taking, and Finding

	Depth Range	Factual or Training Values & Units	Logs Run	Type & Amount of Format
Surface	[illegible]	[illegible]	[illegible]	[illegible]
Underground	[illegible]	[illegible]	[illegible]	[illegible]
Television	[illegible]	[illegible]	[illegible]	
Other				

Describe broken hole injection attempt: [illegible]

[illegible]

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Everseal hook wall packer

VI. Description of surface equipment

A. Holding tanks & flow lines _____

None

B. Filters _____

None

C. Pumps _____

None

D. Other Earthen pond. Size: 82,000 sq. ft. Avg. depth: 3.067 ft.

These figures are original engineering data surveyed in 1953.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

__X__ Resistivity

____ SP

____ Caliper

____ Other ____

__X__ Gamma ray-[redacted]

____ Temperature

____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Regeneration of mobile water softener

B. Physical & chemical Description Brine solution

Also blow down water from cooling tower.

C. Volume 170 - 190 bbl

IX. Preinjection waste treatment

None

I. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
		None	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
	None	

C. Injection rates and pressures (monthly)

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average Gravity	Maximum

X. Well operation & operating history

D. Description of operating procedures: [illegible]

E. Operating problems: [illegible]

XI. Regulatory aspects

A. Construction requirements: [illegible]

B. Monitoring requirements: [illegible]

C. Restrictions on operating procedures: [illegible]

I. Economics

A. Total and unit costs of construction _____

_____

_____

_____

_____

B. Operating costs _____

_____

_____

_____

II. Source(s) of Information and Pertinent References. _____

Written communication - Kansas State Department of Health and Northern Natural Gas Company

_____

_____

_____

_____

_____

_____

_____

WELL FILE NUMBER

Ka-6

I. Operating Company & General Well Location

Southern Natural Gas Pipeline Co.

Bushton Compressor

II. Well location (legal description)

Location: NE 1/4, Sec. 5, T16S, R9W, Rice County

III. History, system planning, construction & operation.

Injection began - February 19, 1954

Drilled in 1952 into Cherokee Sandstone (550'-750'), but apparently not successful as a disposal system, so the well was deepened to the Arbuckle in 1954.

IV. Geology & Geohydrology

A. Regional geologic setting: Rice County is on the Central Texas uplift southwest of the Salina basin.

IV. Geology & Hydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___; no___).

(Ground elevation_____) (Total well depth 5413 ft.)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Arbuckle	Ordovician	3,305	108 (total drilled)	limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas are produced in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Depth	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Melting tanks & flow lines Small concrete holding pit siphon from pit to well bore to reclude air

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling logs

___ Drillers log ___ Drilling time

___ Sample log ___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characterization

A. Industrial Process from which waste is derived

_____

B. Physical & chemical Description: Brine solution from backwashing of a textile water softening unit

_____

C. Volume _____

_____

IX. Preinjection waste treatment: Removal of chromium and pH adjustment

_____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 170 bpd Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head ____X____ bottom hole _____)

Date(s) _____ Average Gravity Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

_____

_____

_____

_____

_____

E. Operating problems: _____

_____

_____

_____

_____

_____

_____

_____

_____

XI. Regulatory aspects.

A. Construction requirements _____

_____

_____

_____

_____

B. Monitoring requirements _____

_____

_____

_____

_____

C. Restrictions on operating procedure _____

_____

_____

_____

_____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

[illegible]

[illegible]

I. OPERATING REPORT & GENERAL WELL LOCATION

[illegible]

II. WELL LOCATION (EACH) DESCRIBED BELOW OF WELL #[illegible]

[illegible]

III. SURVEY, OPEN HOLE, CASING, CEMENTING & COMPLETION.

[illegible]

IV. QUALITY & CONSERVATION

A. [illegible] [illegible]

3. Estimate recoverable oil and gas that may remain by well that this injection taken place: Oil ____; Gas ____.
(Probable distribution ____ ____ (Total well output ____ ____)
Source for data and assumptions ____

Lease	Age	Total Prod.	Recov. Prod.	Interpretive Description

C. Geologic description of injection units & possible units not in use

Rock Units

Name	Age	Depth (feet)	Thickness (feet)	Porosity and Permeability

D. Engineering characteristics of injection units

1. Porosity: ____
2. Permeability: ____
3. Original Reservoir Pressure: ____
4. Recoverable Hydrocarbons: ____
5. Chemical Character of Formation Water: ____
6. Recoverable Reserve Volume: ____

IV. Geology & Geohydrology, continued

B. Geohydrology: fresh water aquifers in vicinity

Date	Depth	Drill Stem Test	Chemistry	Chemical Quality
Fill in data where you can find information to use in order of (top 10) to 100', where is water.				

7. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas from 8000' in Atlantic Deposits.

V. Well design and construction.

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade		Place	Depth Set	Type & Amount of Cement
Surface	17½"	48#	H40	13-3/8"	800'	800 sx
Intermed.	12¼"	47,53#	N80	9-5/8"	1000'	1000 sx
	8-3/4"	"	"	7"	4000'	1000 sx
Injection						
Other						

Describe bottom hole completion method: If inside with casing, for at size: show case hole diameter.

VII. -- Power, amplifier, & keys, continued

C. Other keys used

___Intensity

___XY

___Caliper

___Phase

___Focus ray-receiver

___Temperature

___Focus beam

VIII. Note Characteristics

A. Indicating Trends from which state is derived (positive trend, noted - cancel from calculation page)

B. Provide a critical description (condition noted and indicated relative from temperature of noted indicator and [illegible])

C. Volume

IX. Peculiarities noted treatment

XII. Economics

A. Total and unit costs of construction

Approximately $50,000.

B. Operating costs $800 per year.

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Shell Oil Corporation

Oklahoma City, Oklahoma

WELL FILE NUMBER

STATE

Ks-8

I. Operating Company & General Well Location

Colorado Interstate Gas Company

Elkhart Compressor Station, Kansas

II. Well location (legal description)

Location: NW 1/4, Sec. 15, T33N, R43W, Morton County

III. History, system planning, construction & operation.

Injection commenced: late 1967

The well was installed in 1957, and is still in use.

IV. Geology & Geohydrology

A. Regional geologic setting: Morton County is in the extreme northwest corner of the Anadarko basin. Consolidated rocks in the area range from Ordovician to Cretaceous in age. Cretaceous rocks are overlain by the Tertiary age Ogallala Formation.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ____; no X).

(Ground elevation _____) (Total well depth 1,272)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Glorietta		1065		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Glorietta		1065		widespread blanket sandstone

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Ogallala			Tertiary age sands, gravels, and clays	Fresh

F. Mineral Resources (oil and gas, coal, brines, etc.)

Extensive oil and gas exploration occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection	6 3/4in.	7.5lb. J-55	4 1/2in.	1270	275 sacks
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - laterlog

X Gamma ray-neutron

SP

Temperature

Caliper

Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Regeneration of resin in a de-alkalizer unit

B. Physical & chemical Description Brine solution and rinse water

C. Volume

IX. Preinjection waste treatment

Plant wastes:

Boiler water is recirculated; sanitary wastes are piped to stabilization pond; wastes containing petroleum products are placed in burn pit.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	120 to 200bbl	Maximum
"	"		"
"	"		"
"	"		"

2. Pressure (well head _____ ; bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

I. Will operation & operating history

B. Description of operating program: _____

C. Operating problems: Reported operating satisfactorily in July, 1981

VI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communication - Kansas State Department of Health and Colorado Interstate Gas Co.

WELL FILE NUMBER

I. Operating Company & General Well Location

Amoco Production Company

Ulysses Gasoline Plant

II. Well location (legal description)

Location: NE 1/4, Sec. 5, T32S, R38W, Grant County

McGannon Disposal Well No. 2 - 660' S of NL 1070' W of NL

No.c: Also have SWD No. 1 at plant but handles only brine, no industrial waste.

III. History, system planning, construction & operation.

Until 1958, the wastewater was discharged to evaporation ponds. The well was completed May 5, 1958, and injection was began in 1958. Encountered some problems with lost circulation and fishing during drilling. Also experienced considerable formation plugging during first 18 months' operation, requiring well repairs. Installed filters on injection stream and reduced formation plugging problems. Well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Grant County is located in the northwest portion of the Anadarko Basin. Consolidated rocks range in age from Ordovician to Cretaceous, and are overlain by unconsolidated Tertiary age deposits.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation 3149') (Total well depth 3950ft.)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Ogallala	Tertiary	Surface	460ft.	
	Cretaceous			
Cimarron Salt Sect.	Wolfcamp.	1690	60ft.	
Hugoton Gas Pay	"	2388	212ft.	
Council Grove Lime	"	2730	160ft.	
Topeka Lime	Virgil	3400	370ft.	

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
*Lansing		3992	450'	Thin stringers separated by
Topeka		3400	370'	limestone shale

Note: The Lansing zone is used as both salt water source and disposal zone in McGannon No. 1 SWD well listed on page 1, but was not penetrated in subject well

D. Engineering description of injection units

1. Porosity: 12-16%
2. Permeability: _____
3. Original Reservoir Pressure: est. 840 psi
4. Reservoir Temperature: 88F.
5. Chemical Character of Formation Water: Not accurately determined--only Topeka water sample obtained believed to be contaminated by filtrate during drilling operations, however, chlorides are at least 25,200ppm and total solids are 44,600 ppm by analysis of available water samples.
6. Reservoir Fracture Pressure: 1700psi (breakdown on acidizing)

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Ogallala	400	45'	Coarse Sand - Prolific	Excellent - used for domestic and irrigation purposes throughout area.

F. Mineral Resources (oil and gas, coal, brines, etc.)

Gas production from Hugoton gas listed on page 1.

i.e.	Herington-Krider	top 2390'
	Winfield	2430'
	Towanda	2513'
	Ft. Riley	2570'

Brine production from Lansing zone in adjacent McGannon SWD Well No. 1 (not penetrated in subject well).

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing ~~or Tubing~~ Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	23.7# Armco ST	8-5/8"	623'	500 sx circ. to sfc.
Intermed.	7-7/8"	9.5# J55 STLS	4-1/2"	3939'	1600 sx - DV tool @ 2116' - 1000 sx
Injection	Down 4-1/2" casing -(no tubing in well)				
Other					

Describe bottom hole completion method: Perf. 3514-24', 3536-41', 3803-13', with 6 SPF. Acid w/750 gal 15% HCL (see Section X for subsequent repairs and re-perforations).

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Centralizers at [illegible] (on spline or packer)

Wellhead - 4½' to 2½" casing [illegible]

VI. Description of surface equipment

A. Holding tanks & flow lines 10' x 12' dia. 200 barrel - 2" inf. line from holding tank to well.

B. Filters Use two 3' x 4' dia. Permutit filters packed with graded (#1-6) anthrafiltr filter bed ranged with preformed floc composed of alum and soda ash to improve filter efficiency.

C. Pumps 1 - Frank Wheatley [illegible] - with 10 HP motor.

D. Other None

VII. Cores, samples, & Logs

A. Coring None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

____ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity ___ Gamma ray-neutron

X SP ___ Temperature

___ Caliper ___ Cement bond

X Other Lane Wells Perforating Formation Collar Chart

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

3 colling towers serving heat exchanges in hydrocarbon extraction plant.

B. Physical & chemical Description Coolong water containing hexavalent chromium

C. Volume 0-1500 bpd

IX. Preinjection waste treatment filter through two Permutit filters listed above.

X. Well operation & operating history

A. Tests

	Type	Duration	Zones tested	Description of test results
v. 1960	Injectivity*	1 hr. 47 min	All Topeka perfs listed below.	Inj 300 gpm @ 43 psig

*Note: This is last known injectivity test--well began taking 1000 BPD on vacuum within 2 weeks after above test. Well currently takes normal injection rates on vacuum.

B. Treatments or Stimulation (all prior to November, 1960)

Zones Treated	Treatment Method	Description of Treatment and Results
Original completion interval (see Page 2)	Acidized	1000 gal 15% HCL, no relief to plugging
Reperfed 3748-56' (4 SPF)	Acidized	1000 gal 15% retarded HCL-relieved plugging 6 mo
All perfs.	Acidized	1500 gal 15% retarded HCL-no relief to plugging
Reperfed 3516-19', 3538-40', 3564-68', 3750-52', 3[illegible]	Fracture (4 stage)	100,000 gal H_2O, 100,000# sand-relieved plugging
Reperfed 3644-52', 3617-22' and 3582-88'	Acidized	4000 gal 15% HCL

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
5-5-58 (on completion)		2.05 BPM (2950 [illegible]
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head 20" vacuum bottom hole -)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: primarily involved periodic formation plugging during first 2 years' operation as described above. Situation improved by filtering water.

E. Operating problems: Currently - none

XI. Regulatory aspects.

A. Construction requirements Must protect fresh water zone

B. Monitoring requirements None

C. Restrictions on operating procedure Limited to gravity injection on Kansas State permit No. 6216 covering discharge of industrial waste into well.

XII. Economics

A. Total and unit costs of construction $39,000 initial well investment--approximately $12,000 subsequent repair costs.

B. Operating costs Negligible (plant generators supply electricity for motor on disposal pump when needed)

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health
Amoco Production COmpany

WELL FILE NUMBER

KANSAS STATE

Ks-10 UIC

I. Operating Company & General Well Location

Derby Refining Co. (owner)

Colorado Oil Company (operator)

(Each of these companies is a division of Colorado Oil and Gas Corporation)

II. Well location (legal description)

Location:

675 feet from south line; 865 feet from east line, Section 4, Township 27 South, Range 1 East; Sedgwick County, Kansas

III. History; system planning, construction & operation.

Installed in 1957

Well is a directional hole. TVD 3880 feet. Bottom Hole Location, 539.5 feet North & 1,255.5 feet West of Surface Location.

Original completion involved injection down casing. Tubing to below water level was added in late 1960 to prevent corrosion at the air-water interface.

Initial use was for disposal of spent caustic from refinery operation, but since early 1959 only oil field brine has been injected, as refinery converted to a water treatment system that permitted sewer disposal.

IV. Geology & Geohydrology

A. Regional geologic setting: Located in Sedgwick Basin, on west flank of an anticline.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 1310) (Total well depth 3899 TVD)

Datum for depth measurement 1316 KB

Name	Age	Depth (top)	Thickness	Lithologic Description
Lansing	Penn.	2515 TVD		ls - sh
Mississippian	Miss.	2981		ls
Viola	Ord.	3317		Dol.
Simpson	Ord.	3352		ss - sh
Arbuckle	Ord.	3415		Dol.

This well was directionally drilled. Depths reported are true vertical depths.

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle ls	Ordovician	3415	484 ft.	Blanket porous Dolomite

D. Engineering description of injection units

1. Porosity: Unknown
2. Permeability: Unknown
3. Original Reservoir Pressure: Not measured - Estimate 1300#
4. Reservoir Temperature: Not measured
5. Chemical Character of Formation Water: Salt water
6. Reservoir Fracture Pressure: Not fractured

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Located on west side of an oil field which products from Lansing, Viola and Simpson

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	11-3/4"	[illegible]	[illegible]	[illegible]	[illegible] sx pozmix (cement to surf.)
Intermed.					
Injection st.		[illegible]	[illegible]	[illegible]	[illegible] sx pozmix + [illegible] sx cement
Other					

Describe bottom hole completion method: [illegible] hole [illegible] - [illegible]. Drilled 9-inch hole to [illegible]. Cemented 7-inch casing to [illegible]. Cleaned out with 6-1/4 inch bit to [illegible]. Treated with [illegible] gal. [illegible] acid. Backwashed. Treated with 6,000 gal [illegible] acid. Initial report after acidizing [illegible] - [illegible] BWPD.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc.

Wellhead - 10-3/4 x 7" Type 10 Bowls w/ 2 inch outlet.

Tubing Head - 2 x 2 Bowls, as above.

1300 ft. 2-inch EUE 8-rd Tubing, recent lined.

VI. Description of surface equipment

A. Holding tanks & flow lines 1 - 300 bbl. 10 x 10 upright tank w/2-inch bottom & dump & 3-inch stack.

[illegible] ft. 3-inch EUE steel line

[illegible] ft. 3-inch Tubing

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & logs

A. Coring

From	Core	To	Recovery
"			
"			
"			
"			
"			

B. Drilling logs

X Drillers log

X Sample log

Drilling time

Other:

VII. -- Cover, ranches, & bags, continued

C. Other bags run

___Pesticides

___PP

___Fertilizer

___Other Lubricating

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Extraction, refining, decomposition, reclamation. Oil has been used exclusively for oil field before it is a waste now.

B. Physical & chemical Property (ies) Oily liquid

Drilling fluid was used mainly from military operations

Mixed with oil field brine only. Flows a little Powdered

Barite dust oil field brine only. No analysis available.

C. Volume Oil field use

IX. Protection other considerations

Practically, impossible to use the oil field water brine to separate waste from drilling mud a normal use could with produced oil field brine and separated data will give effective mixture ratio. At present, oil field brine is injected with no filtrate.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	One hour	Viola	30' oil, 2245' water
"	" "	Simpson	60' Oil, 65' OCM
"	" "	"	60' Mud
"	" "	"	140' Muddy Sulphur Water
"	" "	Arbuckle	265' Muddy Sulphur Water

B. Treatments or Stimulation

	Zones Treated	Treatment Method	Description of Treatment and Results
tial	4204-3750	Pumped down 7-in. csg.	1000 gal 15% MCA, followed by 8000 gal. 15% HCL
57	4204-3750	" " " "	3000 gal 15% HCL
ol	4204-3750	Cleaned out scale & caustic well by swabbing	400 ft - 3860 ft. & backflowed
63	4204-3750	Pumped down 7-in. csg.	2000 gal. 15% HCL

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum	
" 12/57	" 3 BPM	"	Before acid job abo
" 12/57	" 6 BPM	"	After acid job abo
" 12/61	" 6 BPM	"	After cleanout
"	"	"	

2. Pressure (well head ____ X ____ bottom hole ____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

Periodic plugging of well with reduction in injection rate. Corrected by periodic acid jobs and clean out. Problems less since refinery waste no longer injected.

XI. Regulatory aspects.

A. Construction requirements Protect fresh water aquifers with casing

B. Monitoring requirements None

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

Approximate cost of drilling and completing	$45,822
Approximate cost of well equipment	11,919
	$57,741

B. Operating costs None

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

Colorado Oil Company

WELL FILE NUMBER

STATE

Ka-11
UMR

I. Operating Company & General Well Location

Cities Service Oil Company

II. Well location (legal description)

Location: SW 1/4, Sec. 22, T23, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

1st Well installed in 1958, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies between the Anadarko basin on the southwest and the Salina basin on the northeast.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls		±4000'		

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for storage of LP gas.

B. Physical & chemical Description Brine solution

C. Volume 0-30,000 bbl

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head ___X___ bottom hole _____)

Date(s)	Average Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Pertinent References.

Written communication - Kansas State Department of Health. Cities Service Oil Company was also contacted, but did not provide further information.

WELL FILE NUMBER

PRIOR

Ka-12

I. Operating Company & General Well Location

Cities Service Oil Company

II. Well location (legal description)

Location: SW 1/4, SEC. 22, T23, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Test well - Installed in 1957, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: See Ka-11

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes___; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Lm		[illegible]		

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Critical Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, uranium, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling logs

____Drillers log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0 - 30,000 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
		"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communications - Kansas State Department of Health

Cities Service Oil Company was also contacted, but did not provide further information.

WELL FILE NUMBER STATE Ka-13 UMR

I. Operating Company & General Well Location

Cities Service Oil Company

3 Wells

II. Well location (legal description)

Location: SW 1/4, Sec. 22, T23, R6W, Reno County, Kansas.

III. History, system planning, construction & operation.

3rd well - Installed in 1968, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: See Ka-11

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls		4000'		

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

_____

_____

_____

_____

_____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

_____

_____

_____

_____

B. Filters _____

_____

_____

C. Pumps _____

_____

_____

D. Other _____

_____

_____

_____

_____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

_____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0 - 30,000 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____X____ bottom hole _____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Cities Service Oil Company was also contacted, but did not provide further information.

WELL FILE NUMBER Ka-14

I. Operating Company & General Well Location

Tuloma Gas Products Company

II. Well location (legal description)

Location: NW 1/4, Sec. 14, T24, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Installed in 1958, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County is located between the Anadarko basin on the south and the Salina basin on the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes___; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls.	Ordovician	1100'		Limestone, occurs regionally

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0-3,000 bbl

IX. Preinjection waste treatment _____

X. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ X _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Pertinent References.

Written communication - Kansas State Department of Health

Tulsa Gas Products Company was also contacted, but did not respond.

WELL FILE NUMBER Kansas Kn-15 / DNR

I. Operating Company & General Well Location

Shelly Oil Company - Kansas Pipe Line Division
1 mile east - 2 miles south of Burton, Kansas at
Shelly's Pipe Line pumping station.

II. Well location (legal description)

Location: SW 1/4, Sec. 36, T23, R3W, Harvey County, Kansas

III. History, system planning, construction & operation.

Installed in 1958 - Drilled for purpose of disposing of brines which collid in bottom of tank from crude oil storage. This operation ceased in 1964 by order of the Kansas State Board of Health.

IV. Geology & Geohydrology

A. Regional geologic setting: Harvey County is located between the Arkansas basin on the south and the Salina basin on the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column Included yes____; no X).

(Ground elevation_____) (Total well depth 937')

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character And Areal Distribution
Wellington Formation		[illegible]	[illegible]	

lost circulation zone from [illegible]937 feet used for disposal

D. Engineering Description of Injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

K. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

V. Mineral Resources (oil and gas, coal, brines, etc.)

VI. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	8 5/8"O.D. Grade B	8 5/8"OD	275.61'	
Intermed.	7 7/8"	Casing Seamless	5 1/2"OD	913.91'	17 sax Maccogel 5 sax Lime
Injection		2 3/8" Tubing-Seamless	2 3/8"OD	915'	

Other

Describe bottom hole completion method: Packer at 913'. Tubing through packer. Casing cemented top to bottom.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 250 bbl. brine holding tank.
High Pressure pump - 10 BPH at 350 PSI
Powered by 5 H. P. elec. motor.

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil pipe line pump station - regeneration of zeolite softener.

B. Physical & chemical Description Brine solution

C. Volume 160 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No gravity flow. Brine pumped into Wellington Lost Circulation Zone.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements: Conservation Division of Kansas State Corporation Commission, established requirements.

B. Monitoring requirements: _____

C. Restrictions on operating procedure: State Department of Health ordered operations to cease in 1961 because of possible pollution of fresh water.

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Pertinent References. _____

Written communication - Kansas State Department of Health

Skelly Oil Company

WELL FILE NUMBER

STATE

Ks-16

DWR

I. Operating Company & General Well Location

Security Underground Storage, Inc.

II. Well location (legal description)

Location: SW 1/4, SW 1/4, Sec. 28, T19, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1958 - purely used

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes___; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wellington Formation	Permian	[illegible]		

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling Logs

____Drillers log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0-50,000 bpd (2 wells)

IX. Preinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Security Underground Storage, Inc. was also contacted, but did not respond.

WELL FILE NUMBER Ka-17

I. Operating Company & General Well Location

Security Underground Storage, Inc.

2nd of 2 wells

II. Well location (legal description)

Location: SW 1/4, Sec. 28, T19, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1969 - rarely used

IV. Geology & Seismology

A. Regional geologic setting: See Ka-16

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3,974'		Limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

_____

_____

_____

_____

_____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

_____

_____

_____

_____

B. Filters _____

_____

_____

C. Pumps _____

_____

_____

D. Other _____

_____

_____

_____

_____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

_____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage.

B. Physical & chemical Description Brine solution

C. Volume 0 - 50,000 bbl (2 wells)

IX. Preinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum

X. Well operation & operation history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements: _____

C. Restrictions on operating procedure: _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Pertinent References.

Kansas State Department of Health

Security Underground Storage was also contacted but did not respond.

WELL FILE NUMBER

Ks-18
CWK

I. Operating Company & General Well Location

Mid-America Pipe Line Company

II. Well location (legal description)

Location: SW 1/4, Sec. 28, T19, R2W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1962 - rarely used

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Lm	Ordovician	3000'		Limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt cavern for storage of LP gas

B. Physical & chemical Description Brine solution

C. Volume 0 - 21,000 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communication - Kansas State Department of Health

Mid-America Pipeline Company was contacted, but did not respond.

WELL FILE NUMBER

~~STATE~~ Ka-19 ~~UNW~~

I. Operating Company & General Well Location

Atlantic Richfield Company (formerly Sinclair Oil and Gas Company)

II. Well location (legal description)

Location: W 1/2, NW 1/4, NW 1/4, Sec. 14, T24, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Installed in 1960 to dispose of brine produced while washing out five storage wells for propane and brine that is displaced when propane is pumped into storage. Well is still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies between the Anadarko basin on the southwest and the Salina basin on the northeast, on the west side of the Sedgewick basin. Consolidated rocks range in age from Ordovician to Permian or Pennsylvanian. Unconsolidated Cenozoic deposits occur at the surface, at the well location.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ____ ; no X).

(Ground elevation _____) (Total well depth 4130)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
No description of shallow formations available				
tops given below are from a nearby well.				
Topeka	Pennsylvanian	2354		limestone
Heeppner	Pennsylvanian	2752		sandstone
Lansing	Pennsylvanian	2838		limestone
	Mississippian	3603		limestone
Kinderhookian	Mississippian	3703		shale
Misener	Mississippian	3964		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	4130		dolomite & limestone, regionally distributed

D. Engineering Description of injection units

1. Porosity Unknown
2. Permeability Unknown
3. Original Reservoir Pressure Unknown
4. Reservoir Temperature Unknown
5. Chemical Character of Formation Water: No test
6. Reservoir Fracture Pressure: Unknown

435

(Continuation of rock unit descriptions)

Maquoketa	Ordovician	3994	shale
Viola	Ordovician	4020	limestone
Simpson	Ordovician	4046	sandstone
Arbuckle	Ordovician	4140	dolomite and limestone

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	25'-53'		Gravel	
	78'-91'		Gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

4[illegible]'-[illegible]' - Salt and shale

V. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Size & Weight		Size	Depth Set	Type & Amount of Cement
Surface	15"	32.75	H-40	10 3/4"	162'	150 Sacks
Intermed.	9"	20.0	H- 4	7 "	4130'	1300 Sacks
Tubing				4 1/2"	4110'	Set on H-1 Packer
Injection						
Other						

Describe bottom hole completion method: 4130'-4330' Acid Treatment 5000 Gallons 0-30% Hc. Press.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

4 1/2" tubing set on R-3 Packer

Centralizers used on 9" casing

Proper wellhead equipment installed

VI. Description of surface equipment

A. Holding tanks & flow lines _____

4" flow line from propane storage wells. No tanks for brine storage.

B. Filters None

C. Pumps None

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP _X_Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt dome for LP gas storage

B. Physical & chemical Description Brine solution

No data

C. Volume 9 - 5,000 bbl

IX. Preinjection waste treatment None

2. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment (kind)	Description of Treatment and Results
Arbuckle lime	1000 Gallons Acid pumped into formation 4130'-4136'	

C. Injection rates and pressures

1. Rate

Date(s) July 2, 1969 Average 1000 b/d Maximum 2500 b/d.

2. Pressure (well head 0 bottom hole _____)

Date(s) July 2, 1969 Average 0 psig Maximum _____

X. Well operation & operating history

D. Description of operating programs: Have disposed of brine from propane storage wells each year starting July, 1960. Approximately 450,000 - 500,000 barrels injected each year.

E. Operating problems: None

XI. Regulatory aspects

A. Construction requirements: Cemented surface pipe and casing from bottom to top to protection for fresh water zone.

B. Monitoring requirements: Test holes for checking fresh water zone drilled near disposal well. Run chloride test on samples from test wells quarterly. No problems to date.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health and Atlantic Richfield Company

WELL FILE NUMBER

Kansas
Ellsw

Ks-20
UGS

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 1

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History, system planning, construction & operation.

These wells are rarely used in the normal storage operation. The first well was installed in 1960, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 1120) (Total well depth 1330)

Datum for depth measurement "Weiss" Radioactivity log

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Is	Ordovician	1320'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	17½"	[illegible]	[illegible]	200'	Unknown
Intermed.					
Injection	[illegible]	[illegible]	[illegible]	[illegible]	Pozmix [illegible] Sacks
Other					

Describe bottom hole completion method: Drilled out - open hole.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

6 centralizers, Model 6-1 Halliburton
well-head equipment (flanges, and valves)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) [illegible] Asphalt lined catch pit with (1) approximately 12 bbl. steel holding tank. Flow gauge covered. Inside lines pit with flow control valve.

B. Filters None

C. Pumps None

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

_1_Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

LP gas storage operation

B. Physical & chemical Description Saturated sodium brine resulting from solutioning of salt zone to develope storage "jugs".

C. Volume 0 - 96,000 bbl/day (in four wells)

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

X. Well operation & operating history

D. Description of operating programs: The pressure "Vacuum" checked three times daily by Operating Personnel

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements:

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written information - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER [illegible] Ks-71

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 2

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History; system planning, construction & operation.

Well 2 of a four well disposal operation. Installed in 1960, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Ordovician to Cretaceous.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 3400)

Datum for depth measurement "Lane Wells" Gamma Ray Neutron Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	Unknown (in hole)	8-5/8"	201'	Unknown
Intermed.					
Injection	7-7/8"	14# H 40	5-1/2"	3366'	Pozmix 2100 Sacks
Other					

Describe bottom hole completion method: Drilled out - open hole.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 6 centralizers, Model B-3 - Halliburton well head equipment (flanged and valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 bbl. Asphalt lined catch pit with (1) approximately 15,000 steel holding tank. Fiber glass covered Located inside lined pit with flow control valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____ Drillers Log

____ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other_____

X__Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

X. Well operation & operating history

D. Description of operating programs: [illegible]

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Pertinent References

Written communications - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER

~~Kansas~~ ~~S.A.E.~~ ~~Ks-22~~ ~~UNK~~

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 3

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History, system planning, construction & operation.

Well completed in 1967, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Saline Basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 3670')

Datum for depth measurement "Chet Brown Co" Gamma-Ray Neutron Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	32.40	H-40	9-5/8"	324'	300 Sacks Pozmix
Intermed.	8-3/8"	20#	H-40	7-1/8"	3284'	1150 Sacks Pozmix
Injection		14#	H-40	4-1/2"	3280'	
Other						

Describe bottom hole completion method: Drilled out - open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

11 - Centralizers - Model S-3 Halliburton

Well Head Equipment (Flanged and Valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 Bbl. Asphalt Lined Catch Pit with (1) Approx. 15 bbl. steel holding tank. Fiber Glass covered. Located inside lined pit with flow. Control valve.

B. Filters None

C. Pumps None

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other_____

_X_Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

X. Well operation & operating history

D. Description of operating programs: The Pressure "Vacuum" checked three times daily by Operating Personnel.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health and Northern Natural Gas COmpany

WELL FILE NUMBER

KANSAS STATE

Ka-23 UMR

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 4

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas.

III. History; system planning, construction & operation.

Well 4 completed in 1969, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no x).

(Ground elevation_____) (Total well depth 3745')

Datum for depth measurement "Chet Brown Co" Gamma-Ray Neutron Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	32.75#	H-40	10-3/4"	315	Pozmix 275 sacks
Intermed.	9"	26#	H-40	7-5/8"	3315	Pozmix 1100 sacks
Injection		14#	H-40	5-1/2"	3283	
Other						

Describe bottom hole completion method: Drilled out - open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

11 - Centralizers - Model S-3 Halliburton

Well head equipment (Flanced and Valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 Bbl asphalt lined catch pit with (1) Approximately 15 bbl. steel holding tank. Fiber Glass covered Located inside lined pit with Flow Control Valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

_x_Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)_____ Average_____ Gravity Maximum_____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole_____)

Date(s)_____ Average_____ Gravity Maximum_____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: The pressure "vacuum" checked three times daily by Operating Personnel.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER STATE Ka-24 UNR

I. Operating Company & General Well Location

Morton Salt Company

II. Well location (legal description)

Location: N 1/2, SE 1/4, Sec. 22, T23, R6W, Reno County, Kansas.

III. History; system planning, construction & operation.

Installed in 1967, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies on the west edge of the Sedgewick basin, and between the Anadarko basin on the south and the Salina basin on the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no_X_).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle ls	Ordovician	4200'	500'	dolomite and limestone, regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Salt is mined hydraulically by Morton Salt Company.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Hydraulic salt mining

B. Physical & chemical Description Sodium brine solution

C. Volume 1,000 - 2,500 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ X _____ bottom hole _____)

Date(s) _____ Average Gravity _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Morton Salt Company was contacted, but company policy prevented release of information.

WELL FILE NUMBER

Ka-25

I. Operating Company & General Well Location

Farmland Industries, Inc.

Dodge City, Kansas

II. Well location (legal description)

Location: Center of north half, SW 1/4, NE 1/4, Sec. 22, T26S, R24E, Ford County, Kansas

III. History, system planning, construction & operation.

Farmland through their associate company, Terra Resources, and with the Technical assistance of J. W. Rockhold (consultant), and Garvey Drilling Company designed, planned, and constructed the #1 Fee well for Ammonia Plant effluent subsurface disposal. Evaluation of the pore for commercial oil was also conducted. A show of oil in the conglomerate sand at 4996 to 5001 feet was tested at the rate of 8 BOD and cemented off with 100 sacks. The well was completed April 5, 1968. Its use is standby to accept emergency spills or all plant effluent to maintain production. Plant effluent is 750,000 gallons per day. The well capacity exceeds 500,000 gpd at less than zero well head pressure.

IV. Geology & Geohydrology

A. Regional geologic setting: Ford County is on the north edge of the Anadarko basin.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___; no X).

(Ground elevation [illegible] ft.) (Total well depth 6507 ft.)

Datum for depth measurement K. B. 2161

Name	Age	Depth (top)	Thickness	Lithologic Description
Topeka	Pennsylvanian	3732	424	limestone and shale
Lansing	Pennsylvanian	4329	392	limestone and shale
Marmaton	Pennsylvanian	4720	153	limestone and shale
- - -	Pennsylvanian	4987	75	porous ss. with oil shows
Warsaw	Mississippian	5232	54	chert, dolomite, & limestone
Osage	Mississippian	5302	238	chert, dolomite, & limestone
Kinderhook	Mississippian	5540	139	limestone, chert, and shale
Viola	Ordovician	5679	87	dolomite, chert, and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician		5820'-6507	dolomite, regionally distributed

D. Engineering description of injection units

1. Porosity: 15% vugular and fractured
2. Permeability: very high
3. Original Reservoir Pressure: about 2000 psi
4. Reservoir Temperature: 130°F
5. Chemical Character of Formation Water: No analysis was made, however other analyses show the water to be saline and to contain H_2S
6. Reservoir Fracture Pressure: _____

(continuation of IV - B)

Simpson	Ordovician	5679	87	dolomite, chert, and shale
Arbuckle	Ordovician	5820	687	dolomite, with porous zones

IV. Geology & Geophysics, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
- - -	Surface to 1500ft.		sandstones	fresh water

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in economic quantities below 2,600 feet, where structure is favorable.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4in.	24# J-55	8 5/8in.	1654	550 sacks
Intermed.					
Injection	7 7/8	15# J-55	5 1/2in.	5835	125 sacks
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

D. Packers, Centralizers, well head equipment, etc: Centralizers on 5 5/8 casing at 1664 and 1638ft., and on 5 1/2 at 5520, 5737, 5633, and 5637

VI. Description of surface equipment

A. Holding tanks & flow lines yes, in plant

B. Filters yes, in plant

C. Pumps well should accept about one million gallons per day without an injection pump

D. Other:

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____ Drillers Log

X Sample log

X Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity ___ Gamma ray-neutron

___ SP ___ Temperature

X Caliper ___ Cement bond

___ Other Casing collar

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Ammonia plant

B. Physical & chemical Description water plus 1000ppm ammonium bicarbonate

Usually diluted with fresh water to 55ppm NH_4HCO_3 prior to discharge to retention ponds and irrigation use.

C. Volume 432,000 gallons per day maximum, 160,000 gpd average.

IX. Preinjection waste treatment Waste water is discharge to retention ponds; normally it will be used for crop irrigation; except when stripper tower is inoperative, then the waste will go down the well.

4. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
1. Open hole - Drill Stem Test	1.25 hrs.	[illegible] to [illegible]'	Recovered gas to surface 30 standard & [illegible]' of muddy gassy oil.
2. Open hole Drill Stem Test		[illegible]' to [illegible]'	Rec. [illegible]' slightly oil. Out water with [illegible]' water "[illegible]"
3. Open hole - DST	1.5 hrs.	[illegible]' to [illegible]'	Rec. [illegible]' water & [illegible]
4. Casing Test	Natural	[illegible]' to [illegible]'	[illegible]
	250 gal.acid	[illegible]' to [illegible]'	[illegible]
	500 gal.mud acid	[illegible]' to [illegible]'	[illegible]
5. Upper Arbuckle		[illegible]' to [illegible]'	Water, 300 barrels.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	1300bbl max. 0 to VACUUM	"
"	<4200bbl	"
"	"	"
"	"	"

2. Pressure (well head X bottom hole)

Date(s)	Average	Gravity	Maximum
"	"		"
"	"		"
"	"		"
"	"		"

(continuation of X - A)

6. Upper & Lower Arbuckle

15,540 gallons per hour or
373,000 gallons per day on vacuum.
"3" line restricted available field."
5835' to 6507'
18,060 gallons per hour or
433,440 gallons per day on "Vacuum"
10,320 Barrels per day without acid stimulation and short term test.

7. No capacity vs pressure tests taken

8. Will operation a operating binary

B. Description of operating processes: long heavyweight will give children input to deal for equipt, or if author climbed gain house fill.

C. Operating problems: Problems by similar concrete shape, a pile being detection goods, I will and flagged will fight down.

D. Regulatory agency:

A. Information furnished [illegible] in the annular

B. Reporting requirements: [illegible] why will an motivated

C. Restrictions on operating procedures

XII. Economics

A. Total and unit costs of construction $75,000.00

B. Operating costs None available

XIII. Source(s) of Information and Published References

Kansas State Health Department

Terra Resources, Inc. associate company of Farmland Industries, Inc.

WELL FILE NUMBER Ks-26

STATE

I. Operating Company & General Well Location

Mid-West Underground Storage, Inc.

II. Well location (legal description)

Location: NW 1/4, Section 29, T19, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1970, used primarily during the development of storage caverns, rarely used otherwise.

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Arbuckle	Ordovician	4200'		
Granite Wash				

C. Geologic Description of injection units & possible units not in use

Rock Units

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	4200'		dolomite and limestone regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling logs

____Drillers log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for gas storage.

B. Physical & chemical Description Brine solution

C. Volume 0 - [illegible],000 bbl

IX. Preinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	" 48,000 barrel per day
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: Used primarily during the development os storage caverns, rarely used otherwise.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Mid-West Underground Storage was contacted, but did not reply.

WELL FILE NUMBER Ka-27

STATE UMR

I. Operating Company & General Well Location

American Salt Company

II. Well location (legal description)

Location: SE 1/4, Sec. 15, T15, R6W, Rice County, Kansas.

III. History, system planning, construction & operation.

Installed in 1968, presently in use. The well is used for disposal of brine from hydraulic salt mining and processing operations.

IV. Geology & Geohydrology

A. Regional geologic setting: Rice County is on the Central Kansas uplift southwest of the Salina basin.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3501'	- - -	porous dolomite and limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Salt is hydraulically mined by American Salt Company

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: _____

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. — Cases, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characterization

A. Industrial Process from which waste is derived

Optimizing salt mining

B. Physical & chemical Description Sodium nitrate solution

C. Volume 5,000 + 10,000 bbl

IX. Permitting work haveheard _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____X____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References.

Written communications - Kansas State Department of Health

American Salt Company was contacted but did not reply.

WELL FILE NUMBER

STATE Ky-1

I. Operating Company & General Well Location

Sohio Petroleum Company

Latonia, Kentucky

II. Well location (legal description)

Location: Kenton County, Kentucky

Carter coordinate 12-EN-60

III. History, system planning, construction & operation.

The well operated from 1948 to 1954 and briefly during 1962. It was been plugged and abandoned. The well was apparently successful, but was not used much after 1954 because a market was developed for the chemicals in the wastewater.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the axis of the Cincinnati arch. Bedrock at the site is shale of Ordovician age.

7. Geology & Grohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).
(Ground elevation _____) (Total well depth 1011)
Datum for depth measurement Derick floor 472.7ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
den	Ordovician	50	79	shale
renton	Ordovician	129	134	limestone
	Ordovician	263	441	shale and limestone
t. Peter		704	82	sandstone
nox	Cambro-Ord.	786	not completely drilled	dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
t. Peter	Ordovician	704	82	sandstone-regionally distributed
nox	Cambro-Ord.	786	225 (total drilled)	dolomite-regionally distributed

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

A small amount of natural gas was encountered in drilling the well, but not in commercial quantities. No other resources occur locally.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface			13in.	78ft.	
Intermed.					
Injection			7in.	506ft.	130 sacks
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Refinery

B. Physical & chemical Description Caustic wastewater

C. Volume _____

IX. Preinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Kentucky Geological Survey

WELL FILE NUMBER | Kentucky Permit STATE #24576 | Ky-2 UMR

I. **Operating Company & General Well Location**

E. I. duPont de Nemours & Co., Inc,
Louisville, Kentucky

II. **Well location (legal description)**

Location: Jefferson Co. Carter Coord. Sec. 10 Letter U No 44
921.9 FSL & 2763.4' FWL

III. **History, system planning, construction & operation.**

Permit application -
Permit granted - 11/10/70
Well spudded - 2/6/71
Well completed - 3/30/71
Well testing - 3/31/71 to 6/27/71
Injection started - have not begun injection as of 6/27/72

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Well is located on the flood-plain of the Ohio River. Bedrock is the New Albany Shale (lower Mississippian).

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no___).

(Ground elevation 452') (Total well depth 6911)

Datum for depth measurement Kelly Bushing 462

Name	Age	Depth (top)	Thickness	Lithologic Description
See attached sheet				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Knox	Ord-Cam.	1710'	2590'	dolomite-white-green
Mt. Simon	Cambrian	5086'	594'	sandstone-white-green

Injection is planned for the Knox - between 3100' and 4500'

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: Knox 74°-90°; Mt. Simon 1[illegible]°
5. Chemical Character of Formation Water: From analysis of water obtained from DST 3,350 to 3,550ft., total dissolved solids 21,000mg/l, pH 7.0, Na 6,000mg/l, Ca 1,[illegible]mg/l, Cl 10,000mg/l, SO_4 3,100mg/l
6. Reservoir Fracture Pressure: Mt. Simon was fractured but breakdown pressure was not reported. Maximum pressure at about 5,500 feet was reported as 6,000psi.

IV. Geology & Geophysics, continued

E. Geophysics, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Planned resources tests (core, cust. treat., etc.)

None in specific vicinity.

V. Well design and construction

A. Casing, tubing, and cement

	Hole Size	Setting of Casing Size & Grade	Joint	Depth Set	Type & Amount of Cement
Surface	Not applicable - a drilling rig has not requested full completion				
Intermed.	Depth, Gas withdrawal (that for proposed well design.				
Injection					
Other					

Specific Natural Gas Completion Method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	2822	to	2835	Recovery	13ft.
"	4409		4459		full
"	5335		5335		1/2in.
"	5335		5338		2ft.
"	5718		5748		full
"	5993		6008		15ft.

B. Drilling Logs

X Drillers Log

X Sample log

___ Drilling time

___ Other: _____

A total of 16 cores were taken in interval from 1153 to 6008. Only cores #10 to #16 are listed above.

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
X SP	X Temperature
X Caliper	___ Cement bond
___ Other Synergetic, density, GR-tracer, IDV, SNP, Sonic	

VIII. Waste Characteristics Borehole comp., dual induct., laterlog, microlaterlog

A. Industrial Process from which waste is derived

B. Physical & chemical Description Aqueous hydrochloric acid solution having a maximum concentration of 20 wt. % S.G. 1.103, temp. 140°F. The waste will not have more than 100ppm "organics."

C. Volume Injection has not yet begun (6/27/72)

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
2 DST's were run in the intervals 4300-4500, 4130-4130, 3850-4050, 3150-3550, 2970-3170, 2690-2890, 1600-1800, 2978-3178, 5808-6000			
Injection profiles Mt. Simon Fm. and Knox Fm.			
Injection tests Mt. Simon unsatisfactory			
Injection		Knox-Conasauga	
	2hr. 15min.	3150-4497	150gpm @ 1350psi
	2hr. 25min.	2650-4497	150gpm @ 175psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	Fractured and acidized	not successful
Knox	Not tried	

C. Injection rates and pressures - not yet in operation, see test results for Knox

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating program: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Kentucky Geological Survey

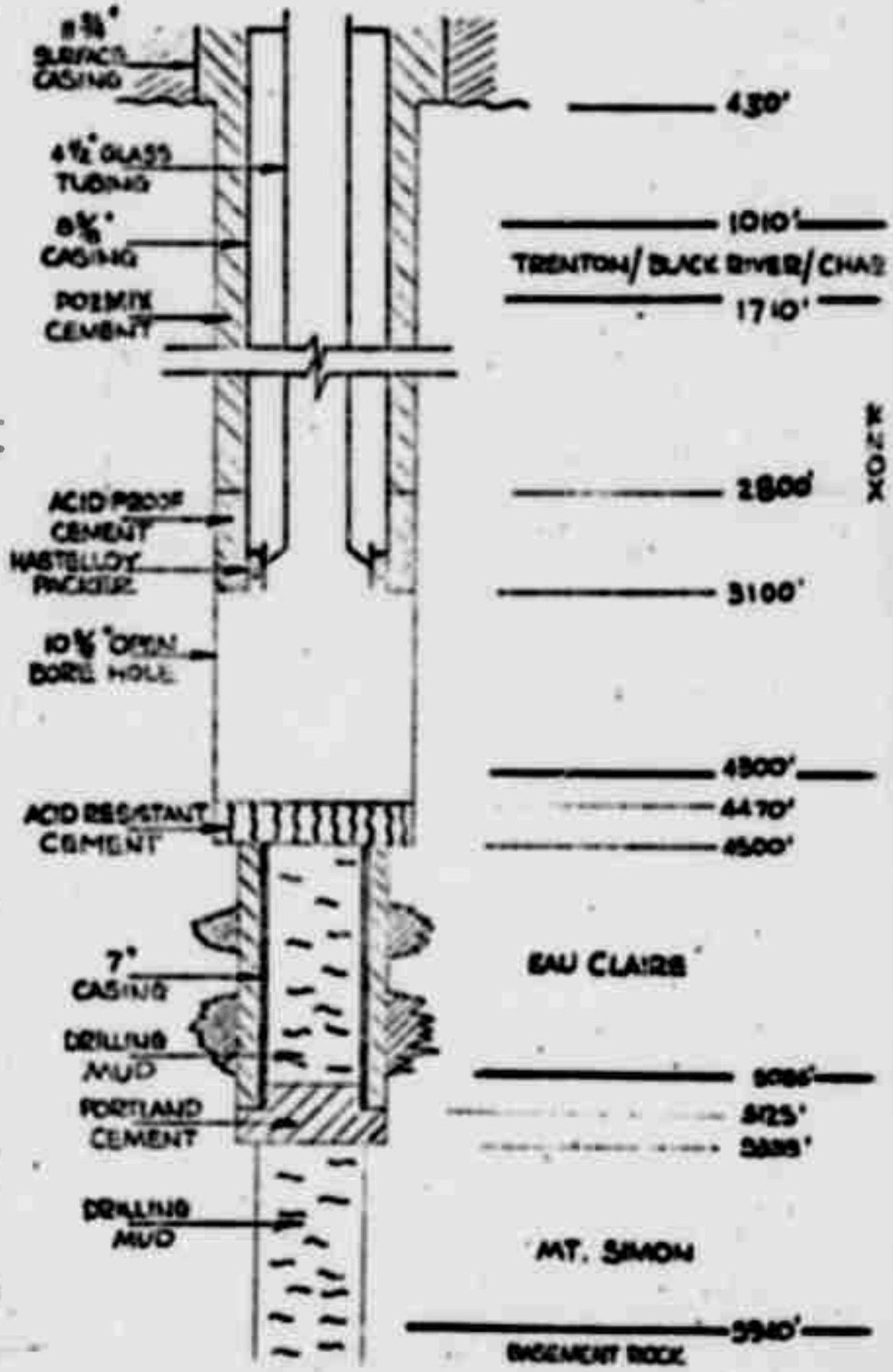
K-1

III. Subsurface Geology

Depth	Top Corrected To Sea Level	Thickness	Formation	Lithology
0' - 125'	+ 464'	125'	Alluvium	Sands and gravels
125' - 215'	+ 339'	90'	Devonian	Shale and limestone
215' - 370'	+ 249'	155'	Silurian	Dolomite and limeste
370' - 1010'	+ 94'	640'	Ordovician	Shale, limestone, dolomite, siltstone
1010' - 1150'	- 546'	140'	Trenton	Limestone
1150' - 1570'	- 686'	420'	Black River	Limestone
1570' - 1700'	- 1106'	130'	Chazyan	Dolomite
1700' - 1710'	- 1236'	10'	St. Peter	Sandstone
1710' - 4300'	- 1246'	2590'	Knox	Dolomite (Fractured and cavernous in part)
4300' - 5086'	- 3836'	786'	Eau Claire	Dolomite and shale
5086' - 5940'	- 4622'	854'	Mt. Simon	Sandstone and shale
5940' - 6008'	- 5476'	68'	Pre-Cambrian	Serpentine

W.D.W. No. 1 KNOX COMPLETION

FIGURE 2



WELL FILE NUMBER [illegible] Kentucky Permit: [illegible] #[illegible] Ky-3 [illegible]

I. Operating Company & General Well Location

E. I. duPont deNemours & Co., Inc.

Louisville, Kentucky

II. Well location (legal description)

Location: Jefferson Co., Sec. 11, U 44 - 5307' FWL

2275' FNL

III. History, system planning, construction & operation.

Permit application - 8/20/71

Permit granted - 10/26/71

Well completion report not yet submitted.

IV. Geology & Geohydrology

A. Regional geologic setting: Well is located on the flood-plain of the Ohio River. Bedrock is the New Albany shale (lower Mississippian).

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement:_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Not yet available - See Ky-2				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Knox	Ord.-Camb.	- - -	- - -	dolomite
Mt. Simon	Camb.	- - -	- - -	sandstone

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water: Water sample from 3,120-3,167 analysis very similar to that reported for Ky-2.
6. Reservoir Fracture Pressure:_____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth feet	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, sampler, & Log:

A. Coring

From _____ to _____ Recovery _____

B. Drilling Logs

___X___ Drillers Log

___X___ Sample log

___ Drilling time

___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____ Resistivity	X Gamma ray-neutron
____ SP	____ Temperature
X Caliper	____ Cement bond

____ Other Synergetic, SNP, density, borehole compensated, sonic 3DV, dual induction laterlog

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description aqueous hydrochloric acid solution having a maximum concentration of 20wt. % S. G. 1.106, temp. 140°F. Waste will not have more than 100ppm "organics".

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Have not received			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

I. Well operation & operating history

D. Description of operating program: _____

E. Operating problems: _____

II. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements. _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Kentucky Geological Survey

WELL FILE [illegible]

USP M. D. Well #1

I. Operating Company & General Well Location

Universal Oil Products Company

Brian, Cadd Parish, Louisiana

(P. O. Box [illegible], Shreveport, Louisiana)

II. Well Location (legal description)

NE/4 [illegible] - First half of Section 29

Caddo Parish, Louisiana

(# Waste Disposal Well)

III. History, system planning, construction & operation.

1. December 15, 1969 - Contacted Louisiana Dept. of Conservation about drilling a waste disposal well.

2. April 28, [illegible] - Obtained a work permit from the La. Dept. of Conservation to drill a disposal well on [illegible]

3. June 1, 1970 to July 5, 1970 - Drilled to [illegible] round off surface water and cased well.

4. July 5, 1970 to August 7, 1970 - Completed surface equipment installation and attempted to inject at [illegible] without success.

5. August 12, 1970 - Permission granted by Louisiana Dept. of Conservation to perforate at [illegible] to inject in stream, injection at this level.

6. September 27, 1970 - [illegible] and heavy injection of water.

7. June [illegible] - Replace casing in well.

8. August [illegible] - Increase pressure in well.

9. November [illegible] - Pull [illegible] in to be well to remove tubing in the hole to a depth of [illegible]

10. December, [illegible] - Cases will be [illegible] with no further injection.

IV. Geology & Hydrology

A. Geological conditions relating to Universal Plant of Caddo Lake.

The well is located [illegible] Universal Plant of Caddo Lake. [illegible] of life and the [illegible] of life and the [illegible] in this location. The shallow geologic section [illegible] of sands and clays of Quaternary to Pleistocene age.

B. Geologic description of rock units penetrated by well

Rock Data (Duplicate Copies included -yes ___; no X).

(Ground elevation 395) (Total well depth 3262)

Datum for depth measurement Derrick Floor

Name	Age	Depth (ft)	Thickness (feet)	Lithologic Description
Alluvium	Tertiary	Surface	95'	Sand and Gravel
Arapahoe	U. Cretaceous	95	130'	Gray Shale and Shale
Denver	Lower	225	30	Coal and lime and shale
Dakota and Purgatoire	Upper	255	200	Lime and shale
Morrison	Upper	455	175	Lime
Sundance	Upper	630	45	Gray Shale
Jacksonburg	Upper	675	175	Shale and Sandy Shale
Tubbs	Upper	850	200	Shale and Sandy Shale and sand

C. Geologic description of injection units & possible units not in use

Rock Data

Name	Age	Depth (feet)	Thickness (feet)	Character and Areal Distribution
Morrison Sand	U. Cretaceous	[illegible]	50'	Sandstone & Sh. Lens. In.

D. Engineering description of injection units

1. Porosity, %

2. Permeability

3. Critical Pressure (psi) psi

4. Compressibility

5. Chemical Capacity of Injection Waters 10,000 ppm cl

6. Reservoir Fracture Pressure psi

IV. Geology & Hydrology, continued 3.

E. Hydrology, fresh water aquifers in vicinity

Zone	Depth	Thickness	Character	Chemical Quality
Glen	87-1/2'	11'	Sandstone	50 ppm Cl

F. Mineral Resources (oil and gas, coal, sulfur, etc.)

No mineral resources are reported in the vicinity of the well.

V. Well Design and Completion

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Size	Weight	Grade	Depth Set	Type & Amount of Cement
Surface	13-3/4"	9-5/8"	36.0	J-55	200'	5.4. (circ.)
Intermed.	8-3/4"	7"	23#	J-55	2800'	5.4.
Injection	5"	4½	10.5	J-55	3700'	Class A, 17% NaCl
	(Set on Packer Test)					

Other Zone

Injection Packer with Arrangement Material: Internal 5-1/2" casing

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc: Halliburton Packer [illegible]

VI. Description of surface equipment

A. Mixing tanks & flow lines Interpret mixing tank concrete mix with line to flow lines.

B. Filters Sand filters in injection pump system.

C. Pumps Centrifugal pumps, triplex reciprocating injection pump [illegible]

D. Other Oil skimmers, clarifier equipment, water storage in enclosed collection site.

VII. Cores, samples, & logs

A. Cores

From, mbgs	To, mbgs	Recovery

B. Drilling logs

_X_ Drilling log

_X_ Geologic log

_X_ Drilling time

_X_ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity	No Gamma ray-neutron
Yes SP	No Temperature
No Caliper	No Cement bond
No Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of synthetic detergent for the petroleum refinery industry.

B. Physical & chemical characteristics Waste water having the following approximate analysis:

Na	1036 ppm	pH 8.3
Ca	0 ppm	
SO_4	1[illegible] ppm	
Cr	5.59 ppm	
Cl	1[illegible] ppm	
PO_4	8[illegible] ppm	

C. Volume [illegible] gallons per day, presently unused on stand-by.

IX. Preinjection water treatment pH control, oil skimming, septic tank treatment of sewage.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	Not reported	3000'	Formation too tight for waste water injection

B. Treatments or Stimulations

Zones Treated	Treatment Intent	Description of Treatment and Results
3000' to 3015	Injection	Provided access to a zone which would accept waste water.

C. Injection rates and pressures

1. Rate

Date(s) Each, 1973 to Dec. 1973 | Average 10,000 | Maximum 100,000

2. Pressure (will vary and be the injection pressure) 500 PSI)

Date(s) Each, 1973 to Dec. 1973 | Average 500 PSI | Maximum 700 PSI

Before Injection	After Injection

X. Well operation & operating history

D. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

E. Operating problems: Two tubing leaks and one casing leak are listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water zone. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions on operating procedures: None.

XII. Economics

A. Total & unit costs of construction Accurate records are unavailable. Estimated total cost in 1962 to 1972 would be approximately $50,000. Unit costs are unavailable.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons.

XIII. Source(s) of Information and Published References None

Louisiana Geological Survey

I. Operating Company & General Well Location

Universal Oil Products Company

Brian, Caddo Parish, Louisiana

(P. O. Box 1360, Shreveport, Louisiana)

II. Well Location (legal description)

R 15 W T 19 N South half of Section 20

Caddo Parish, Louisiana

#2 Harte (Tested Well)

III. History, station planning, construction & operation.

1. April 1, 1957 - Contacted Louisiana Dept. of Conservation about drilling W. D. Well #2 to [illegible] and perforate between [illegible] and [illegible].

2. April 8, 1957 - Obtained work permit from the Louisiana Dept. of Conservation to drill W. D. Well #2 to [illegible].

3. July 8, 1957 to July 11, 1957 - Settled to [illegible] cased of surface water not cased well. Perforated from [illegible] to [illegible].

4. June 20, 1961 to June 27, 1961 - Installed tubing in well.

5. January 10, 1962 - Tubing broken.

6. March 16, 1970 - Tubing repaired.

IV. Geology & Reservoirs

A. Regional geologic setting: Northeast flank of Sabine uplift

The well is located on the northeast flank of the Sabine Uplift and the regional dip is to the southeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ____; no x).

(Ground elevation 272) (Total well depth 2065)

Datum for depth measurement Derrick Floor

Name	Age	Depth (top)	Thickness	Lithologic Description
Milnes	Tertiary	Surface	830'	Sand and Shale.
Annadelphia	U. Cretaceous	830'	115	Limey Shale and Shale
Mecetoch	Same	945'	365	Sand and Lime and Shale
Saratoga & Marlbrook	Same	1310	210	Lime and Shale
Annona	Same	1520	170	Lime
Ozan	Same	1690	95	Limey Shale
Brownstown	Same	1785	175	Shale and Sandy Shale
Tokio	Same	1960	105	Shale and sandy shale and Sand

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mecetoch	U. Cretaceous	945	65	Continuous & Ark, Tex, La.

D. Engineering description of Injection units

1. Porosity: 30%
2. Permeability: 1000 md
3. Original Reservoir Pressure 410 PSI
4. Reservoir Temperature [illegible]
5. Chemical Character of Formation Water: 10,000 PPM Cl
6. Reservoir Fracture Pressure: 800 PSI

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
None				

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

No mineral resources are reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	13-3/4"	N. A.	N. A.	9-5/8"	200'	Class A - 200 SKS
Intermed.	7-7/8"	N. A.	N. A.	7 1/2"	2069	Class A - 310 SKS
Injection	5"	6.5	J-55	2-1/2"	970	Quick-Set-75 SKS

Other None

Describe bottom hole completion method: Casing perforations

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc: Cement Basket on 2-1/2" at 860'

VI. Description of surface equipment

A. Holding tanks & flow lines Surface storage pond with 3 inch PVC flow lines

B. Filters None

C. Pumps 100 GPM Triplex injection pump

D. Other None

VII. Cores, samples, & Logs

A. Coring

From None to Recovery

"

"

"

"

"

B. Drilling Logs

No Drillers log No Drilling time

No Sample log No Other

VII. -- Cover, Engine, & Lect. Handbook

C. Other tips you

_____ Viscosity

_____ EP

_____ Oxidant

_____ Other

_____ Acute Pyr-neutron

_____ Temperature

_____ Invert tank

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of metallic catalysts for the petroleum refining industry.

B. Physical & chemical Description Data when having the following

Ph _____ pH _____

Cr _____

Fe _____ Fe(OH)3 _____

Ni _____ Ni(OH)2 _____

Cl _____

Cu _____

C. Volume _____

IX. Pretreatment waste Uniformed _____ of surface, metals and treatment of

metal.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	Not recorded		Tubing was found to be intact
Tubing	Not recorded		Tubing was found to be intact

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
August 1957 to present	0 GPM	100 GPM
"	"	"
"	"	"
"	"	"

2. Pressure (well headout in 100 PSI bottom hole)

Date(s)	Average	Maximum
August 1957 to present	500 PSI during injection	700 PSI during injection
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating program: Very little difficulty has been experienced in operating this well. As a result continuous injection was possible without the need for any special operating techniques.

E. Operating problems: Tubing parted at top of well and string was in the hole. Tubing was replaced as listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water sands. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of the injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions or operating procedures: None

XII. Economics

A. Total & unit costs of construction Total cost of this disposal facility was approximately $40,000.00. Unit costs are not available.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons.

XIII. Source(s) of Information and Published References None

Louisiana Geological Survey

WELL FILE NO. [illegible]
OCS S. D. Well #1 — Lease — Lot [illegible]

I. Operating Company & Original Well Location

Universal Oil Products Company

Brian, Inc. Parish, Louisiana

(P. O. Box [illegible], Shreveport, Louisiana)

II. Well location (legal description)

A. [illegible] T [illegible] N North half of Section [illegible]

Lake Charles, Louisiana

Elevation [illegible]

III. History, spudding, completion & operation.

1. August [illegible] [illegible] Dept. of Conservation about drilling

S. R. [illegible]

2. August 21, [illegible] [illegible] from the Louisiana Dept. of Conservation [illegible] S. S. Well is [illegible]

3. September [illegible] [illegible] Cased off surface water and cased well.

4. October [illegible] [illegible] Completed well by cementing in 8 5/8" as casing and [illegible] for [illegible] casing.

5. February [illegible] [illegible] from [illegible]

6. March [illegible] [illegible] [illegible] in well.

IV. Geology & Stratigraphy

A. Regional [illegible] Northeast flank of Sabine uplift. The well is located on the northeast flank of the Sabine uplift and the [illegible] is to the southeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no x).

(Ground elevation 270) (Total well depth 1100)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Allow	Tertiary	Surface	345	Sand and shale
Bradleyville	U-Cretaceous	345'	125	Liver Shale and Shale
Westoch	Dev	470	130	Sand and lime and Shale

C. Geologic Description of injection units & possible units not in use

Rock Units

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Westoch	Cretaceous	345	60'	Continuous - Ark, Tex, La.

D. Engineering Characteristics of Injection units

1. Porosity: 30%
2. Permeability: [illegible]
3. Original Reservoir Pressure: [illegible] PSI
4. Reservoir Temperature: [illegible]
5. Chemical Characteristics of Formation Water: 10,000 PPM Cl
6. Reservoir Fracture Pressure: 800 PSI

E. Geohydrology: (with water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Milnor	13	10'	Sandstone	90 PPM Cl

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

No mineral resources are reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Length			Depth Set	Type & Amount of Cement
Surface	20"	65#	N.A.	0	300'	Class A - 300 SKS
Intermed.	15"	40.5#	N.A.	IC 3/4"	1022'	Class A - 700 SKS
Injection	10"	32#	N.A.	8-5/8"	962	Class A - 675 SKS
Other	6-5/8" Tubing swung at 950'					

Describe bottom hole completion method: Casing perforations

V. Well design and construction, continued 4.

5. Packers, centralizers, well head equipment, etc: _____

Halliburton Packer Shoe at 943: _____

VI. Description of surface equipment

A. Holding tanks & flow lines Underground open top concrete pits and steel storage tank with 6 inch IPS flow lines.

B. Filters None

C. Pumps #3 and #4 Waste disposal wells have common pumps.

1 - 175 GPM injection pump.

D. Other None

VII. Cores, samples, & Logs

A. Coring

From None to _____ Recovery _____

B. Drilling Logs

No Drillers Log

No Sample log

No Drilling time

No Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — No Gamma ray-neutron

Yes SP — No Temperature

No Caliper — No Cement bond

No Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of synthetic catalysts for the petroleum refining industry.

B. Physical & chemical characteristics Waste water having the following approximate analysis

Na	2250 ppm	pH	8.5
Ca	0 ppm		
SiO_4	34.2 ppm	chromatropheol	200ppm
Cr	0.54 ppm	other organics	370ppm
Cl	3270 ppm		
SO_4	801 ppm		

C. Volume 400 GPM average during injection. This well is spared with the #4 waste disposal well and only one well being used at a time.

IX. Preinjection waste treatment pH control, septic tank treatment of sewage.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	not recorded		Tubing was found to have a hole was replaced

B. Treatments or Stimulation

Zones Treated	Treatment Tested	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	January, 1962	Average	400 GPM	Maximum	700 GPM
"	to present	"	(from	"	
"		"	practice)	"	
"		"		"	
"		"		"	

2. Pressure (well head Shut in 150 PSI bottom hole 780 PSIG)

Date(s)	January, 1962	Average	600 PSI	Maximum	800 PSI
"	to present	"	during	"	during
"		"	injection	"	injection
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

E. Operating problems: A casing leak and a tubing leak as listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water sands. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions on operating procedure: None

XII. Economics

A. Total & unit costs of construction Total cost of construction of the well and piping was approximately $[illegible],000.00. Other related pumping and holding equipment cost approximately $100,000.00.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons

XIII. Source(s) of Information and Published References None
Louisiana Geological Survey

WELL FILE NUMBER

UOP W. D. Well #4 STATE 1-4 UMR

I. Operating Company & General Well Location

Universal Oil Products Company

Brian, Caddo Parish, Louisiana

(P. O. Box 1566, Shreveport, Louisiana)

II. Well location (legal description)

R15W T 19 N North half of Section 29

Caddo Parish, Louisiana

Waste Disposal Well

III. History, system planning, construction & operation.

1. Mar 3, 1967 - Contacted Louisiana Department of Conservation about drilling W. D. Well #4 to 1095'.
2. Mar 26 1967 - Obtained a work permit from the Louisiana Dept of Conservation to drill #4 W. D. well to 1100'
3. July 10 1967 - to July 22 1967 - Drilled to 1090' Cased off surface water and cased well.
4. March 10, 1970 - Tubing tested.

IV. Geology - Geophysics

A. Regional Geologic Setting - Northeast Flank of Sabine Uplift. The well is located on the northeast flank of the Sabine uplift and the sediments dip to the northeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___ no x).

(Ground elevation: 274) (Total well depth 110')

Datum for depth measurement Derrick Floor

Name	Age	Depth (top)	Thickness	Lithologic Description
Wilcox	Tertiary	Surface	800'	Sand and Shale
Arkadelphia	U-Cretaceous	800'	160'	Lime Shale and Shale
Nacatoch	U-Cretaceous	960'	150'	Sand and Lime and Shale

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Nacatoch	U-Cretaceous	[illegible]	[illegible]	Parlange - Ark, Tex, La

D. Engineering Description of Injection units

1. Porosity [illegible]
2. Permeability [illegible]
3. Original Reservoir Pressure [illegible]
4. Reservoir Temperature [illegible]
5. Chemical Character of Formation Water: [illegible]
6. Reservoir Fracture Pressure: [illegible]

IV. GEOLOGY & HYDROLOGY, OVERBURDEN 3.

B. Characteristics, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Physical Quality
Wilcox	30'	10'	Limestone	50 PPM Cl

F. Chemical Analyses (Cl and Hardness, Total, Sulphate, etc.)

None

V. WELL DATA AND CONSTRUCTION

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing	Depth Set	Type & Amount of Cement
Surface	24"	[illegible]	50'	Class A x 150 SXS
Intermediate				
Intermediate (with [illegible])	20"	[illegible]	300'	Class A x 250 SXS
Other	8-3/4"	[illegible]		

Injection Casing Data: [illegible] Perforations from [illegible] to [illegible]

Hole and Pipe [illegible]

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc:

Centralizers on 8" at 560', 460', 360', 300', 220', 140'

Centralizers on 10-3/4", at 1064', 1014', 945', 894', 820', 758', 550'

VI. Description of surface equipment

A. Holding tanks & flow lines Underground open top concrete pits and steel storage tank with 8 inch IPS flow lines

B. Filters None

C. Pumps #1 and #2 W. [illegible] have common pumps 4 - 175 GPM injection pum

D. Other None

VII. Cores, samples, drilling

A. Coring

From None Recovery

B. Drilling

No Drillers log No Drilling time

No Samples Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — Yes Gamma ray-neutron

Yes SP — No Temperature

No Caliper — Yes Cement bond

No Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of synthetic catalysts for the petroleum refining industry

B. Physical & chemical Description Waste water having the following approximate analysis

Na	1050 ppm		
Ca	0 ppm	pH	8.9
SiO_2	34[illegible] ppm		
Cr	0.[illegible] ppm	pentanitrophenol	200 ppm
Cl	3270 ppm	other cresolics	370 ppm
SO_4	601 ppm		

C. Volume 400 GPM average [illegible] injection. This well is spared with the #4 waste disposal well which only one well being used at a time.

IX. Preinjection water treatment pH Control, septic tank treatment of sewage

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	not recorded		Tubing was found to be intact

B. Treatments or stimulation

Zones Treated	Treatment used	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) August [illegible] [illegible] Maximum 700 GPM

" to [illegible] " to " "

" " " " " "

" " " " " "

2. Pressure (Well [illegible] Bottom Hole 780 PSIG)

Date(s) August [illegible] [illegible] 700 PSI Maximum 800 PSI

" to [illegible] " During " During

" " " Injection " injection

" " " " " "

" " " " " "

X. Well operation & operating history

D. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

E. Operating problems: None to date

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water sands. Casing and cementing of the well casing in the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the pressure between the tubing and the casing for tubing leaks.

C. Restrictions on operating [illegible] Waste [illegible]

XII. Economics

A. Total & unit costs of construction Total cost of completion of this well was approximately $100,000.00. Unit costs are unavailable.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons

XIII. Source(s) of Information and Published References None
Louisiana Geological Survey

WELL FILE NUMBER SWD #2 STATE L-5 UMR

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #1

Sec. 6, T.1[illegible], R.2[illegible]

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system pumping, construction & operation.

[illegible] General [illegible] was [illegible] in operation 9/10/59 to handle all [illegible] water flow [illegible] to our then existing processing units. [illegible] was [illegible] in the well [illegible] injected in the well at the [illegible] ft.

[illegible] 9/10 to 10/16/61 with an injection rate of [illegible] psig. On 10/16/61 the well was backwashed for the [illegible] pressure had increased to 80 psig [illegible] returned to 36 psig. The well was backwashed [illegible] of operation. On 10/18/64 the well [illegible] the past few years, the well was backwashed [illegible] to maintain adequate flows, but in 10/69 [illegible] and reperforated at the [illegible] ft. level. [illegible] level was limited to approximately 200 [illegible] allowed to rise back after several backwashings. In July [illegible] and completely abandoned.

IV. Geology & Geophysics.

A. Regional geology in vicinity: [illegible] clays to 60', backwamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene [illegible] gravels, some marine zones; 2500'-10,000', Miocene, marine, sands and shales. Regional structural dip: to SW [illegible] 75'/mile. Lying on W flank [illegible] area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ____).

(Ground elevation 10 ft.) (Total well depth 1910 ft.)

Datum for depth measurement 1' above rotary table @ 11'

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	130'	Sand, med. gr., uncemented
Zone 2	"	1800	100'	" " " "
Zone 3	"	1870'	90'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. No [illegible] applicable position.				
None considered.				

D. Engineering description of injection units

1. Porosity: [illegible]
2. Permeability: [illegible]
3. Original [illegible] 800 psi @ 1800 ft.

(estimate based upon [illegible] of psi/ft.)

4. Description of [illegible]

5. Chemical Character of Formation Water:

Brackish (at 1800 ft. salinity is approximately 15,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure inapplicable to unconsolidated formation

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
*"700' Sd."	700'	110'	Slightly brackish	600-2600 ppm Cl
"400' Sd."	350'	90'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	160'	Slightly brackish variable up to 650 ppm Cl.	

*Brackish below 500'

*Salt water below 1000' (est level 450' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources known at depths less than 2000' in this area.

Deepest well & plant is Disposal Well #5 @ 3565 ft.

V. Well design and construction (see attached Dwg. C-1432-1 and sketch A. Casing, Tubing and Equipment Schematic - Well No. 1")

Hole Size	Casing Size	Depth	Type & Amount of Cement
Surface	20 1/4"	45'	35 cement to surface
Intermed.		1319'	115 cement + 37 CFL to surface
Injection 6 7/8	24 [illegible]	1214'	355 Cement + 37 CFL to surface
Other (Backwash tubing)	2 3/8"	1250'	

Describe between hole completion methods

Perforated from 1230' to 1250' with 5 1/2" dia. holes per foot

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc: Centralizers @ 60 ft. intervals on bottom 500 ft. of 7 5/8" casing and @ 90 ft. intervals on remainder of string.

Well head - 6"-5000 tubing hanger (Cameron Iron works type "C D")

VI. Description of surface equipment (Well #1 never tied into below system)

A. Holding tanks & flow lines "Sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 135 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and others on flows to maintain constant pump suction pressure. Flow is also automatically totalized for each well.

VII. Cores, samples, & logs

A. Coring (Core)

From _____ to _____ Recovery _____

B. Drilling Logs (Mud)

____ Driller's log ____ Drilling time

____ Sample log ____ Other _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
X SP	Temperature
Caliper	Cement bond
Other	

VIII. Waste Characterization

A. Industrial Process from which waste is derived

Water from petroleum processing units.

B. Physical & chemical Description

Sour water (stripping steam and desalter water) with following characteristics:

1. Sulfides content, ppm < 1750
2. Phenols content, ppm < 25
3. Oil Content, ppm < 500
4. Suspended solids content, ppm < 100
5. pH : 8.5

C. Volume Well produces in this site prior to shut the average injection volume was approximately 9000 b/d.

IX. Reinjection Waste Structure Existing and all stimulated.

X. Well operation & operating history

A. Tests (No records)

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation (No records)

Zones Treated	Treatment Intervals	Description of Treatment and Results

C. Injection rates and pressures (Well abandoned 1/71)

1. Rate

Date(s)		Interval		Rate
	8/31/68		[illegible] gpm	
	10/1/68		[illegible]	"
"	4/1/69	"	[illegible]	"
"	7/13/69	"	[illegible] gpm	"
"	8/1/69	"	[illegible] gpm	"

2. Pressure (well head [illegible] psig (max) bottom hole [illegible] psig)@ [illegible]

Date(s)		Interval		Pressure
"	10/1/68	"	[illegible] psig	"
"	4/1/69	"	156 psig	"
"	7/13/69	"	177 psig	"
"	9/13/69	"	183 psig	"

7. Well construction & operating history

D. Description of operating program: Well plugged off and abandoned at present time. Was not in service. Is deep flow directly from one of the operating units. When injection pressure increased above desired level, the well was backwashed until sand was clean or flushed with fire water.

E. Operating problems: Well had to be backwashed on account of sand which came across before it was plugged.

8. Regulatory aspects.

A. Construction requirements.

1. Uniform Fire Division of Interpretive Standards to Firemen Code No. 7[illegible]

2. Building Contractor Permit - Letter of Intent of Construction Joint Permit [illegible] Fire Division [illegible]

B. Monitoring requirements: Below will be checked the Rate of Injection required [illegible] to operation to monitor January 1 and July 1 of each year. (1) Gross amount of water injected daily in gallons. (2) Total amount of water injected in the current month. (3) Monthly total of [illegible] (4) Monthly total of injection of water.

C. Restrictions on operation [illegible]

XII. Economics

A. Total & unit costs of construction

Well cost including pump and engine = $30,000 (1978)

B. Operating costs (assuming that individual pump and engine = $1,000 and a 1000 gal. tank

Approximately with some costs over 15-year period = $13,000 or $1,000/year

VIII. Sources(s) of Information and Published References

(1) Technical Recommendations for Water Wells and Springs, Sections, Chapter 2000, 2.1, Final, Draft (1) Revision

(2) Rural Water Supply Investigation - Study of Rural Quality Requirements, Section, 2000, 2.1, Complete, Draft (1) Complete

I. Operating Company & General Well Location

[illegible]

II. Well Location (Legal Description)

[illegible]

III. History, system planning, construction & operation.

[illegible]

IV. Geology & Geophysics

A. Regional structure setting. [illegible]

[illegible]

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no____).

(Ground elevation 10 ft.) (Total well depth 1934 ft.)

Datum for depth measurement 6' above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1830	50'	Sand, med. gr., uncemented
Zone 2	"	1660	150'	" " " "
Zone 3	"	1440	50'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-40%
2. Permeability: 1 - 3 darcies
3. Original Reservoir Pressure: Est. 840 psi @ 1800 ft.
   (Estimate based upon a gradient of .46 psi/ft.)
4. Reservoir temperature: [illegible] (est.)

5. Chemical Character of Formation Water:
Brackish (Below 1000 ft. salinity is approximately 15,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure impossible on unconsolidated formation.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	680'	100'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	350'	80'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	70'	Slightly brackish variable	up to 650 ppm Cl.

*Brackish below 740'

*Salt water below 1000' (FW level ±40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area. Deepest well @ plant is Disposal Well #5 @ 3500 ft.

V. Well design and construction (See attached drawing B-1191-C)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Intermed.	12 1/4"	[illegible]	[illegible]	[illegible]	[illegible]
	9 1/8"	[illegible]	[illegible]	[illegible]	[illegible]
Injection	7"	[illegible]	[illegible]	[illegible]	[illegible]

Other (Backwash water) [illegible]

Describe bottom hole completion method:

[illegible]

V. Well design and construction. continued 4.

E. Packers, centralizers, well head equipment, etc: Packer, 5" OD x 7" OD type TS-8 RE TWO for 7" OD 17#/ft. casing. (installed 1/69, abandoned 2/69).

Centralizers - Halliburton S-3 centralizers on bottom 3 joints of 9 5/8" casing.

Well Head - 7" flange and tubing hanger API 900 R-45

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour"water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 135 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and other or others to maintain constant pump suction pressure. Flow is also automatically totalized for each well.

VII. Cores, samples, & logs

A. Cores (none)

From _____ ft. _____ Recovery _____

B. Drilling Logs (none)

Gamma Log _____ Drilling time _____

Sample Log _____ Other _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

____ Caliper

X Other Casing inspection

X Gamma ray-neutron

____ Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing units.

B. Physical & chemical Description

Sour water (stripping steam and desalter water) with following characteristics

1. Sulfides content, ppm - 1150
2. Phenols content, ppm - 55
3. Oil content, ppm - [illegible]
4. Suspended solids content, ppm - [illegible]
5. pH - 8.[illegible]

C. Volume [illegible]

IX. Preinjection tests to [illegible] drilling and [illegible] mud

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Inj. test	few minutes	Zone 1	230 gpm @ 40 psig
(after 11/66 work over)			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1/68 Zone 1	15% Fe acid	Pump 2000 gal. acid @ 1 BPM - Max. pressure 50 psi.
1/69 Zone 1	15% Fe acid	Pump 2000 gal. acid @ 1 BPM - Max. pressure 50 psi.
9/3/69 Zone 1	Injection of 500 FLO S-30 followed by 400 gpm water	Injection 2 drums @ 40 gpm - pressure before = 190, after = 150
7/9/69 Zone 1	Injection of 500 FLO S-30 followed by 250 gpm water	Injection 4 drums @ 40 gpm - pressure before = 190, after = 265 (@ 250 gpm)

C. Injection rates and pressures (@ 1000-1600 ft. level)

1. Rate

Date(s)		Average		Maximum	
	3/20/71		115 gpm		120 gpm
	4/16/71		[illegible] gpm		200 gpm
	5/14/71		[illegible]		105 gpm
	7/7/71		[illegible]		65 gpm
	8/4/71		[illegible]		104 gpm

2. Pressure (well head 175 psig (est) bottom hole 215 psig)

Date(s)		Average		Maximum	
	3/20/71		175 psig		180 psig
	5/10/71		175 psig		215 psig
	7/7/71		111 psig		125 psig
	7/8/71		190 psig		215 psig
	8/4/71		135 psig		150 psig

X. Well operation & operating history

D. Description of operating procedure: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1 psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: From original startup of well to the 1/69 work over the high inflow of sands caused a continual problem which resulted in back-washing well and it once/month. Also coupled with the inflow of sands was the high level of solids and oil that were injected with the water at that time. Up to 47,000 ppm oil on 4/13/66 and up to 936 ppm suspended solids on 6/26/68.

XI. Regulatory aspects.

A. Construction requirements

1. Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2. Louisiana Geological Survey - Letter to Dept. of Conservation dated August 2, 1976, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements: The State of Louisiana requires the following information be reported by January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels, (2) Total amount of waste injected in the 6 month period, (3) Maximum and minimum pressure, (4) Chemical composition of waste.

C. Restrictions on [illegible] None

XII. Economics

A. Total & unit costs of construction

Completed well (not including pump, piping, etc.) - $34,000

B. Operating costs

Work over costs to date (9/7/71) approximately $50,000 (or approx. $7500/yr)
backwashing @ average of 10 times/year @ $200 per = $2,000/yr.

XIII. Source(s) of Information and Published References

(1) [illegible] Recommendations for Waste Disposal At Norco, Louisiana, August, 1969, W. G. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, G. E. Mansfield, Shell Oil Company

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #1

Sec. 4, T.12S, R.3E

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #1 was put in service on 10/13/63 to handle sour water produced by the Coker Unit which was completed at approximately that time. Sour water was collected in a holding tank and pumped directly to the well and injected at the 1500 ft. level. Original injection level was 100 gpm @ 50 psig.

On 11/16/65 the well was backwashed after the injection pressure had increased to 140 psig @ 96 gpm. After backwash injection ratio was 108 gpm @ 31 psig. Since 1967 well #1 has performed satisfactorily with periodic backwashing when pressure approached 140 psig. The well was tied into the new system described in section VI in 3/71. Since that time back flushing cycle has increased to about once per month.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10,000', Miocene, marine, sands and shales. Regional structural tilt to SW @ 175'/mile. Lying on W flank of Gonzales dome cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column Included -yes X ; no___).

(Ground elevation: 10 ft.) (Total well depth 1997 ft.)

Datum for depth measurements: 1 ft. above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1860'	120'	Sand, med. gr., unconsolidated
Zone 2	"	1910'	40'	" " " "
Zone 3	"	1980'	30'	" " " "

C. Geologic Description of Injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of Injection units

1. Porosity: 29-32%

2. Permeability: 1-3 darcies

3. Original Reservoir Pressure: Est. 880 psi @ -1950 Ft.

(Estimate based upon a pressure gradient of .45 psi/ft.

4. Reservoir Temperature: (Est. 98°F)

5. Chemical Character of Formation Water:

Brackish (below 2000 ft. salinity is approximately 35,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure inapplicable to unconsolidated formation.

IV. Geology & Hydrology, Continued 3.

A. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. Feet	Character	Chemical Quality
*"100' sd."	100'	100'	Slightly brackish	800-1600 ppm Cl.
"400' sd."	400'	100'	Slightly brackish reclaim	175-1700 ppm Cl.
"200' sd."	200'	40'	Slightly brackish reclaim	up to 150 ppm Cl.

*Brackish below 240'

*Salt water below 1000' (WT level 240' below surface on 7-20-55)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 3000' in this area. Deepest well 3 miles is Mineral Well #5 @ 3340 ft.

V. Well design and construction (See attached Dwg. B-2784-3)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface		32.3 lb/ft. Grade B-40		100 ft.	20-30 cement and Poz mix A
Intermed.	12 1/4"	32.3 lb/ft. H-40	[illegible]	[illegible] ft.	660 sacks
Injection	8 3/4"	17 lb/ft. H-40	7" OD	3000 ft.	660 sacks
Other (Backwash tubing)		4.2 lb/ft. J-55	2 3/8"	1648 ft.	

Describe bottom hole completion method:

Perforated with 4 1/2" dia. shots per foot at 1915 ft-1955 ft. level

V. B. Well design and construction, continued 2.

B. Packers, centralizers, well head equipment, etc: _____

Packers - None

Centralizers - Halliburton A-1 centralizers on Series I joints

Well Head - 7" flange and tubing hanger

VI. Description of surface equipment

A. Holding tanks & flow lines "Soft" water is drained from accumulators and valves & pipe in generating unit room, collected in a large drum and pumped from the units to a refinery collecting header which is the suction line for the main injection pump. From there from the "Soft" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 135 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always has pressure control and opens as needed to maintain constant pump suction pressure. Flow is also automatically totalized for each well.

VII. Cores, samples, & logs

A. Coring (None)

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs (None)

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, logs, continued

D. Other logs run

X Resistivity	Gamma ray-neutron
X SP	Temperature
X Caliper	Cement bond
Other	

VIII. Waste Characterization

A. Industrial Process from which waste is derived

Water from petroleum processing units

B. Physical & chemical Description Sour water (stripping steam and desalter water) with following characteristics:

1. Sulfide content, ppm - 1750
2. Phenols content, ppm - 85
3. Oil content, ppm - [illegible]
4. Dissolved solids content, ppm - 170
5. pH - 8.[illegible]

C. Volume 1900 BBL/day

IX. Prelaijection waste treatment Settling and oil skimming

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
11/6/68 Injection	few hours	Zone 1	up to 1000 gpm @ 275 psi with riverwater

B. Treatments to stimulation

Zones Treated	Treatment method	Description of Treatment and Results
3/31/69 Zone 1	Injection [illegible] followed by [illegible] gallons water	Injected [illegible] - 55 gal drums @ 40 gpm Pressure before = 130, after = 85
7/1/69 Zone 1	Same as above	Same as above except pressure after =90 psig
7/18/69 Zone 1	Same as above	Pressure before = 108, after = 110

C. Injection rates and pressures(@ 1915-1955 ft. level)

1. Rate

Date(s)		Average		Maximum	
	2/20/71		126 gpm		132 gpm
	4/16/71	"	[illegible] gpm	"	159 gpm
"	5/18/71		[illegible] gpm	"	90 gpm
"	7/2/71		[illegible] gpm	"	234 gpm
"	8/3/71		[illegible]2 gpm	"	189 gpm

2. Pressure (well head 130 psig (ave.) bottom hole 980 psig)

Date(s)		Average		Maximum	
"	2/20/71		152 psig		155 psig
	4/16/71	"	232 "	"	235 "
	5/10/71	"	145 "	"	150 "
"	7/2/71		78 "	"	90 "
"	8/3/71	"	42	"	70 "

X. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1 psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: No significant problems except periodic backwashing.

XI. Regulatory aspects.

A. Construction requirements 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - Letter to Dept. of Conservation dated August 5, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements: The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels. (2) Total amount of waste injected in the six-month period. (3) Cumulative total of injected waste. (4) Chemical composition of waste

C. Restrictions on operating procedure: None

XII. Economics

A. Total & unit costs of construction Approximate cost to Install well (not including pumps, piping, etc.) - $40,000.

B. Operating costs Assume present backflushing cycle of approximately 10 times per year @ $200 per = $2,000 per year

XIII. Source(s) of Information and Published References

(1) Geological Recommendations for Waste Disposal at Norco, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, C. R. Mansfield, Shell Oil Company

WELL FILE NUMBER SWDR #16 STATE L-8 UMR

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #4

Sec. 6, T.12S, R.8E

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #4 was put in service in approx. 8/67 to handle sour water produced by the Ethylene Plant which had just been constructed. Sour water was collected in a unit holding tank and pumped directly to the well and injected at the 1900 ft. level.

Since Disposal Well #4 was put in service, it has performed satisfactorily with periodic backwashing (approx. 2 times per year). The well was tied into the new system described in section VI in 3/71.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10,000', Miocene, marine, sands and shales. Regional structural tilt to SW @ ±75'/mi. Lying on W flank of Goodhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes X ; no ___).

(Ground elevation 10 ft.) (Total well depth 2029 ft.)

Datum for depth measurement 5.5 ft. above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1900'	90'	Sand, med. gr., uncemented
Zone 2	"	1350'	60'	" " " "

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%

2. Permeability: 1.5 darcies

3. Original Reservoir Pressure: [illegible] 880 psi @ 1950 ft.

(estimate based upon 3 [illegible] grad[illegible] .45 psi/ft.)

4. Reservoir Temperature: [illegible] 98°F)

5. Chemical Character of Formation Water:

Brackish (below 2000 ft. salinity is approximately 35,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure inapplicable to unconsolidated formation.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	700'	110'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	350'	80'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	160'	Slightly brackish variable	up to 650 ppm Cl.

*Brackish below 740'

*Salt water below 1000' (FW level ± 60' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.

Deepest well @ plant is Disposal Well #5 @ 3500 ft.

V. Well design and construction (See attached Dwg. B-3791-1)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Wgt. & Grade	Size	Depth Set	Type & Amount of Cement
Surface		55 lb/ft. drive pipe		100 ft.	
Intermed.	12 1/4"	32.8 lb/ft. H-40	10 3/4"	1005 ft.	Cemented to surfac
Injection	8 3/4"	17 lb/ft. H-40	7"OD	2000 ft.	Cemented to surfa

Other (Backwash tubing) 4 - 2 lb/ft. J-55 2-3/8"OD +1500 ft.

Describe bottom hole completion method: Perforated at 4 - 1/2" dia. shots per foot at 1940 ft. to 1960 ft. level.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Packers - none

Centralizers - Halliburton S-3 centralizers on bottom 3 joints of 9 5/8" casing

Well Head - 7" flange and tubing hanger

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1500 gpm at 150 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is intended to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and opens or closes to maintain constant pump suction pressure. Flow is also automatically metered for each well.

VII. Cores, Samples, & Logs

A. Coring (None)

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling Logs (None)

____ Drilling Log ____ Drilling time

____ Sample Log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity — Gamma ray-neutron

X SP — Temperature

X Caliper — X Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing units.

B. Physical & chemical description (oily water containing steam and desalter water) with following characteristics:

1. Sulfide content, ppm : 1750
2. Phenols content, ppm - 81
3. Oil content, ppm - [illegible]
4. Suspended solids content, ppm - 170
5. pH - 8.4

C. Volume 4800 bbl/day

IX. Preinjection waste treatment Settling and oil skimming

X. Well operation & operating history

A. Tests (None recorded)

Type	Duration	Zones tested	Description of test results

B. Treatments or stimulation (None recorded)

Zones Treated	Treatment period	Description of Treatment and Results

C. Injection rates and pressures (Top-hole fl. level)

1. Rate

Date(s)	3/30/71	Average	172 gpm	Maximum	180 gpm
"	4/10/71	"	[illegible] gpm	"	220 gpm
"	5/10/71	"	[illegible] gpm	"	140 gpm
"	5/18/71	"	[illegible] gpm	"	130 gpm
"	5/19/71	"	195 gpm	"	235 gpm

2. Pressure (well head 18 psig from bottom hole 1040 psig)

Date(s)	3/30/71	Average	170 psig	Maximum	205 psig
"	4/10/71	"	212 psig	"	225 psig
"	5/10/71	"	155 psig	"	265 psig
"	5/18/71	"	213 psig	"	250 psig
"	5/19/71	"	245 psig	"	300 psig

.. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1 psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: Since startup of the well, there have been no significant operating problems.

.I. Regulatory aspects.

A. Construction requirements 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - letter to Dept. of Conservation dated August 5, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels. (2) Total amount of waste injected in the six-month period. (3) Cumulative total of injected waste. (4) Chemical composition of waste.

C. Restrictions on operating procedures None

XII. Economics

A. Total & unit costs of construction Approximate cost to install well (not including pumps, piping, etc.) - $4[illegible],000

B. Operating costs Assuming 2 backwashes per year @ $200 per = $400 per year

XIII. Source(s) of Information [illegible]

(1) Geological Recommendations for Waste Disposal at Marrero, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, C. E. Mansfield, Shell Oil Company

WELL FILE NUMBER 711 STATE 4-9 UMR

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #5

Sec. 6, T.12S, R.8E

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #5 was drilled in [illegible] 1970, as part of an effluent improvements project that required installation of two injection pumps (each 1200 gpm at 135 psig BP), a refinery sour water collection header (suction line for injection pumps), distribution piping from the pumps to all 4 wells and instrumentation to individually meter and control the flow of sour water to the wells.

Well #5 was drilled and cased to a depth of 3500 ft. The well is constructed with a [illegible] string of casing to a depth of 1000 ft. (through fresh water zone) and a double string from 1000 ft. to 2040 ft. Backwash tube is installed to [illegible] (without gas lift valves). The well is encased in cement from [illegible] to the surface.

The well was [illegible] perforated at the 3500 ft. level, but attempts to [illegible] failed. This level was plugged and the 2700-2900 ft. level was perforated at 4 1/2" ø shots/ft. This proved unsatisfactory so perforations were increased to 8 1/2" ø shots/ft. Injection was initially good but when sand flow to the well could not be stopped during backwash, this level was plugged. The 2165-2275 ft. level was then perforated with 4 1/2" ø shots/ft. This level has proved satisfactory to date.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW @ ±75'/mile. Lying on W flank of Gardenhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

IV. Geology & Geophysics, continued 3.

5. Geologic description of rock with penetrated by well

Rock Grid Coordinate (from section -see I.1 on ____).

(Ground elevation [illegible]) Total well depth [illegible]

Datum for depth measurement [illegible]

Rock Unit Name	Age	Depth (ft.)	Thickness (ft.)	Lithologic Composition			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Zone 1 (Wind)	Pliocene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Zone 2	"	[illegible]	[illegible]	"	"	"	"
Zone 3	"	[illegible]	[illegible]	"	"	"	"
Zone 4	"	[illegible]	[illegible]	"	"	"	"
Zone 5	"	[illegible]	[illegible]	"	"	"	"
Zone 6	"	[illegible]	[illegible]	"	"	"	"
Zone 7	"	[illegible]	[illegible]	"	"	"	"
Zone 8	"	[illegible]	[illegible]	"	"	"	"
Zone 9	"	[illegible]	[illegible]	"	"	"	"

C. Geologic Description of Injection with a Complete Waste well in use

Rock Unit Name	Age	Depth (ft.)	Thickness (ft.)	Lithologic and Fossil Characteristics
Injection waste described above, see Sec. IV prestigeric section.				
None considered.				

D. Engineering Description of Injection Zone

1. Porosity: [illegible]

2. Permeability: [illegible] Darcies

3. Original Formation Pressure: [illegible] (estimate based upon a minimum gradient of [illegible] psi/ft.)

4. Reservoir Temperature: [illegible] + 80°F

5. Chemical Character of Formation Water: [illegible] described below [illegible], salinity is [illegible] [illegible]

6. Reservoir Fracture Pressure: [illegible] (a conservative estimate).

IV. [illegible], continued

6. [illegible] aquifers in vicinity

[illegible]	[illegible]	[illegible]	[illegible]	[illegible] quality
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] ppm Cl.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] ppm Cl.
[illegible]	[illegible]	[illegible]	[illegible]	up to [illegible] ppm Cl.

[illegible]

[illegible]

7. [illegible] (oil and gas, coal, [illegible], etc.)

[illegible] in this area.

[illegible]

8. [illegible]

b. [illegible]

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Amount of Cement
[illegible]		[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

[illegible]

[illegible]

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc:

(1) Retrievable casing packer (Baker Model "G") on end of 7" OD casing for 9 5/8" casing.

(2) Centralizers - Halliburton S-3 (3 - 13 3/4" and 3 - 9 5/8")

(3) Well head equip. designed and supplied by Gray Tool Co. for our 13 3/8" x 9 5/8" x 7" well.

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 115 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is maintained to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and other or others to provide constant pump suction pressure. This is also automatically monitored for each well.

VII. Logs, samples, & tests

A. Coring (Core)

Type	Depth	Recovery

B. Drilling logs (Mud)

____ Drillers log ____ Drilling time

____ Sample log ____ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

Caliper

X Other Conductivity

X Gamma ray-neutron

Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing units.

B. Physical & chemical Description Sour water (stripping steam and desalter water) with following characteristics:

1. Sulfides content, ppm - 1750
2. Phenols content, ppm - 85
3. Oil content, ppm - 300
4. Suspended solids content, ppm - 120
5. pH - 8.6

C. Volume 8,600 bbls./day

IX. Treatment Settling and oil skimming.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
g.Test) Injection		3500 ft.(1)	Failed to inject at 1200 psig
Injection	5/15/71	2700-2900 ft.	126 gpm @ 290 psi @ 4 shots/ft. pe
Injection	5/25/71	2700-2900 ft. (2)	750 gpm @ 210 psi @ 8 shots/ft. pe
Injection	10/15/71	2165-2235 ft.	240 gpm @ 60 psi @ 4 shots/ft. per

(1) Plugged and abandoned after all attempts to inject failed.

(2) Plugged and abandoned when sand could not be stopped from flowing into well during backwash.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
2700-2900 ft.	4000 gal. of 15% HCl	Inject. rate poor, 126 gpm @ 290 psi
2700-2900 ft.	2000 gal. acid w/matrazine	Inject. rate very poor, 210 gpm @ 810 p
2700-2900 ft.	Backwashed	See note (2) in Section A
2165-2235 ft.	4000 gal. of 15% HCl	550 gpm @ 1150 psi
2165-2235	Backwashed	240 gpm @ 60 psi

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
	10/15/70				240 gpm
"	10/30/70			"	233 gpm
"	3/20/71	"	220 gpm	"	238 gpm
"	5/10/71	"	178 gpm	"	180 gpm
"	8/3/71	"	227 gpm	"	279 gpm

2. Pressure (well head 212 psig (ave.) bottom hole 1192 psig)

Date(s)		Average		Maximum	
	10/15/70				60 psig
"	10/30/70	"		"	115 psig
"	3/20/71	"	190 psig	"	190 psig
"	5/30/71	"	242 psig	"	245 psig
"	8/3/71	"	205 psig	"	225 psig

V. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: Well has performed satisfactorily since injection as 2165-2235 ft. level was started in 10/70. Well flow to pressure ratio has averaged approximately 1 gpm/1 psi but ratio can be increased to 2 gpm/1 psi by pressuring well head as described in section D. The well has only been backwashed once since 10/71. This increased the ratio to 3 gpm/1 psi. This ratio decreased over a period of two weeks back to the 1 gpm/1 psi ratio.

VI. Regulatory aspects.

A. Construction requirements 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - letter to Dept. of Conservation dated August 5, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements: The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily or barrels. (2) Total amount of waste injected in the six-month period. (3) Cumulative total of injected waste. (4) Chemical composition of waste.

C. Recommendations on operating procedures: None

XII. Economics

A. Total & unit costs of construction

$125,000 - Disposal Well #5 Installation

$175,000 - Instrumentation, Collection & Distribution Piping and Main Injection Pumps

B. Operating costs Since well completed at 2165-2235 ft. level, operating costs have been nil. The work over costs involved in going from the 2700 ft. zone to the above zone was approximately $15,000.

XIII. Source(s) of Information and Published References

(1) Geological Recommendations for Waste Disposal at Norco, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October. 1969, G. E. Mansfield, Shell Oil Company

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Norco Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well location (legal description.)

Beginning at the Northwest corner Section 3 T 12S R 8E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 83° 45' 40" E a distance of 775.5 feet to the point of location of well.

III. History; system planning, construction & operation.

This well was drilled in 1956 (Work Permit No. WW DW No. 83) to a total effective depth of 1920 feet in order to obtain information on and experience with the sub-surface disposal of waste streams. It was originally perforated with six 5/8" M-2 bullets per foot from 1860' to 1900'. Between 1956 and 1959 experiments were conducted injecting various waste water streams; however, the well was not used continuously for the disposal of any one or more streams. In 1960 the well was dedicated to the disposal of aqueous wastes from a new Acrolein/Glycerine manufacturing complex and now operates in parallel with two other wells (Nos. 2 & 3) in the same service. The three well system has a common surface treating system which normally has two wells in service with the third on standby. (See attached Drawing VP-11829-0 for well details.)

Geology & Hydrology:

A. Regional geologic setting: Surface to 0', backswamp clays, etc.; 0'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, but gravels, more marine shales; 2500'-10000', continental, marine, sands and shales. Regional structural dip to SW at ± 75'/mile on W flank of Gonzales dome area cut by NW trending normal faults, downthrows to NE up to 100'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no).

(Ground elevation 10') (Total well depth 2216')

Datum for depth measurement 1' above Rotary Table at 11'.

Name	Age	Depth (Log)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, med. gr., uncemented
Zone 2	"	1590'	60'	" " " "
Zone 3	"	1500'	50'	" " " "
Zone 4	"	1330'	70'	" " " "

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (Log)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-5 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 ppm in injection zones. Typical Analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 29 ppm, Fe - 1 ppm, Al - 5 p
SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geologic & Geohydrologic Settings 3.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	650'	140'	Slightly brackish	600-2000 ppm Cl.
"400' Sd."	320'	160'	Slightly brackish	variable 175-1700 ppm Cl.
"200' Sd."	210'	90'	Slightly brackish	variable up to 650 ppm Cl.

* { Brackish below 740'
Salt water below 1000' (PW level ± 40' below surface on "400' sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources exist at depths less than 9000' in this area.

Deepest well at plant is No. 1 waste water well at 3216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface		16" OD x 42.8 lb/ft	16"	120'	Cemented to surface
Intermed.		10 3/4" OD x 40.5 lb/ft	10 3/4"	1960'	Cemented to surface
Production		7 5/8" OD x 24 lb/ft	7 5/8"	1897'	

(See attached Drawing 77-12[illegible]-0)

Bottom hole completion method: 10 3/4" casing plugged with concrete

[illegible]

V. Well design and construction, continued

H. Packers, Centralizers, well head equipment, etc: (See attached Drawing [illegible])

VI. Description of surface equipment - Common System Serving 3 Wells

A. Holding tanks & flow lines Two 5,000 gallon carbon steel holding t

B. Filters - Primary filters - Three rotary vacuum 10' diam. x 16' - 500 ft^2 each with associated filtrate, pumps, and slurry handling facilities. Polishers Polish with 10 micron cone cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 300 psi ΔP, cast iron with 125 HP drivers.

D. Other Instrument tank with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & logs

A. Coring None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

No Drillers Log

No Sonic Log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — Yes Gamma ray-neutron

No SP — No Temperature

No Caliper — No Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acetone, and Synthetic Glycerine.

B. Physical & chemical description: Typical stream data - Temp - 120°F, pH - 7, No suspended solids. Chemical Composition - 99 Water, 1% Soluble Organics. Exact organic breakdown is not known but compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related glycol ethers and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Pre-injection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No data.			

B. Treatments or Stimulation

Zones Treated	Treatment Tried	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Intermittent	Maximum
1956-1959			
1960-Present	200	"	500
"	"	"	
"	"	"	
"	"	"	

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
1960 to present	120	175
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: This well is one of three in a common system. Normally, two are operated in parallel and the third is in standby. Injectivity of standby well is maintained by injecting a low flow of clarified Mississippi River water.

E. Operating problems: Well injection tip or the sand in the formation adjacent to the tip slowly plugs with organic polymer. When injection pressure increases from 90 psig at well head to 150 psig the well is taken out of service, backflushed, and placed in standby until needed. Each well is backflushed about every two weeks. About every two years each well is reworked and the injection tip is replaced.

XI. Regulatory aspects. Louisiana State Department of Conservation & Health Regulations

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Schedule:

A. Total & data gaps of verification: Data will [illegible] before treatment system evaluation & well operation is possible [illegible]

B. Operating data: The three wells operating as monitor and one remediation system needs an estimated total [illegible] one year.

XIII. Source(s) of Information and Personnel Interviews:

Written communication - Lone Star Geological Survey

I. [illegible]

[illegible]

II. [illegible] (Draft description)

[illegible]

III. [illegible] [illegible]

[illegible]

IV. [illegible] & [illegible]

A. [illegible]

IV. Geology & Geophysics, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included - yes X ; no ___).

(Ground elevation ___ ft ___) (Total well depth 2216' ___)

Datum for depth measurement 3' above Rotary Table at 11'.

Group	Age	Depth (ft)	Thickness (ft)	Lithologic Description
Zone 1	Miocene	1110'	350'	Sand, red, or orange
Zone 2	"	1460'	60'	" " " "
Zone 3	"	1520'	90'	" " " "
Zone 4	"	1610'	70'	" " " "

C. Geologic Description of Injection Units & possible units not in use

Rock Unit

Name	Age	Depth (ft)	Thickness	Character and Areal Distribution
Information not required now. See Ly for stratigraphic section.				
None existing.				

D. Engineering description of injection units

1. Porosity: 30-35%
2. Permeability: 1-3 darcys
3. Original Reservoir Pressure: Ran 1 [illegible] psi at -1180'
4. Reservoir Temperature: 55° F (F. [illegible])
5. Chemical Character of Formation Water: Salt water ± 35000 ppm in injection zone. Typical analysis - Specific Gravity - 1.05, pH - [illegible], Cl - [illegible]%, Ca - 0.[illegible]%, Mg - 0.10%, Na & K - 2.01%, Total Dissolved Solids - [illegible]%, Silica - 20 ppm, Fe - 1 ppm, Al - 5 p. [illegible] - [illegible] ppm, [illegible] - 60 ppm, [illegible] - Nil, [illegible] - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these sheets [illegible], etc.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	330'	160'	Slightly brackish variable	170-1700 ppm Cl.
"200' Sd."	210'	90'	Slightly brackish variable up to 650 ppm Cl.	

* Brackish below 740'
Salt water below 1000' (FW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.
Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20"	16" OD x 42.8 lb/ft	16"	120'	Cemented to surface
Intermed.	15"	10 3/4" OD x 40.5 lb/ft	10 3/4"	1600'	
	15"	10 3/4" OD x 55 lb/ft	10 3/4"	1600-1900'	Cemented to surf.
Injection	10 3/4"	7 5/8" OD x 26.4 lb/ft	7 5/8"	1830	

Other (See attached drawing VP-11785-2)

Describe bottom hole completion method: (See attached drawing)

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached Drawing VP-13785-2)

VI. Description of surface equipment Common system serving three wells.

A. Holding tanks & flow lines Two 95,000 gallon carbon steel holding t

B. Filters Primary filters - Three rotary vacuum 10' Diam. x 16' - 500 ft^2 each with associated filtrate, precoat, and slurry handling facilities. Polish with 20 micron Cuno cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 200 psi ΔP, cast iron with 125 HP drivers.

D. Other Backwash basin with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

Yes Drillers Log

No Sample log

Yes Drilling time

Yes Other: Directional Drilling Lo

VII. --- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — Yes Gamma ray-neutron

No SP — No Temperature

No Caliper — No Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acetone, and Synthetic Glycerine

B. Physical & chemical Description Typical Stream data - Temp - 120°F pH - 7, No suspended solids. Chemical Composition - 99% Water, 1% Soluble Organics. Exact organic breakdown is not known but compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related soluble esters and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Preinjection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No data.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
1960-Present	200	500
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
1960 to present	120	175
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating program : This well is one of three in a common system. Normally, two are operated in parallel and the third is in standby. Injectivity of standby well is maintained by injecting a low flow of clarified Mississippi River water.

E. Operating problems: Well injection tip or the sand in the formation adjacent to the tip slowly plugs with organic polymer. When injection pressure increases from 90 psig at well head to 150 psig the well is taken of service, backflushed, and placed in standby until needed. Each well is backflushed about every two weeks. About every two years each well is reworked and the injection tip is replaced.

XI. Regulatory aspects. Louisiana State Department of Conservation & Health Regulations.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction This well - $57,000 Surface Treatment system serving 3 wells operating in parallel - $340,000.

B. Operating costs The three wells operating in parallel and the common surface treatment system costs an estimated total $500,000 per year.

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Bonnet Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well Location (legal description)

Beginning at the Northwest corner Section 3 T 12S R 8E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 85° 48' 40" E a distance of 77[illegible] feet; thence N 16° 51' E a distance of 30.0 feet to the point of location of the well.

III. History; system planning, construction & operation.

This well was proposed as a spare for Waste Water Disposal Wells Nos. 1 & 2 to be used for the disposal of acrolein effluent from the Acrolein/Glycerine complex. The well was located 30 feet north of Disposal Well No. 2 and directionally drilled so that the bottom was approximately 300 feet west of the surface location. The well was drilled in October, 1964 to a total depth of 1960 feet. The original slotted injection zip and subsequent reworks and reperforations are shown on the attached drawing (VP-11832-2). The well now operates in parallel with two other wells (Nos. 1 & 2) in the same service. The three well system has a common surface treating system which normally has two wells operating in parallel with the third on standby.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW at ± 75'/mi! Lying on W flank of Goodhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes X ; no).

(Ground elevation 10') (Total well depth 2216')

Datum for depth measurement 1' above Rotary Table at 11'.

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, med. gr., unconsol.
Zone 2	"	1580'	60'	" " " "
Zone 3	"	1520'	50'	" " " "
Zone 4	"	1230'	70'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-3 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 pp in injection zones. Typical analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 20 ppm, Fe - 1 ppm, Al - 5 p SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water equifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
"700' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	320'	140'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	20'	Slightly brackish variable up to 650 ppm Cl.	

Brackish below 240'
Salt water below 1000' (PZ level ± 60' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.
Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface		16" OD x 65 lb/ft	16"	92'	Cemented to surface
Intermed.		10 3/4" OD x 40.5 lb/ft	10 3/4"	1020'	Cemented to surface
Injection		7 5/8" OD x 26.4 lb/ft	7 5/8"	1528'	
		7" OD x 23.0 lb/ft	7	1528 to 1242	Cemented to 807

Other (See attached Drawing VP-11832-2)

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached Drawing VP-11822-2)

VI. Description of surface equipment Common system serving three wells.

A. Holding tanks & flow lines Two 95,000 gallon carbon steel holding tanks

B. Filters Primary filters - Three rotary vacuum 10' Diam. x 16' - 500 ft^2 each with associated filtrate, precoat, and slurry handling facilities. Polish with 70 micron Cuno cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 200 psi ΔP, cast iron with 125 HP drivers.

D. Other Backwash basin with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

Yes Drillers Log

Yes Sample log

Yes Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity

No SP

Yes Caliper

Yes Other Photoclinometer

Yes Gamma ray-neutron

Yes Temperature

No Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acetone, and Synthetic Glycerine

B. Physical & chemical Description Typical Stream data - Temp - 120°; pH - 7, No suspended solids. Chemical Composition - 99% Water, 1% Soluble Organics. Exact organic breakdown is not known but compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related soluble esters and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Preinjection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Zone Tested	Description of test results
No data.			

B. Treatments or Stimulations

Zones Treated	Treatment Method	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s)	1954 Present	Average	1955	Maximum	1956
•		•		•	
•		•		•	
•		•		•	
•		•		•	

2. Pressure (well head _____ bottom hole _____)

Date(s)	1954 to present	Average	1955	Maximum	1956
•		•		•	
•		•		•	
•		•		•	
•		•		•	

9. Will operation be operating entity?

a. Description of operating procedures. This will be one of three in a [illegible] Results can be viewed in [illegible] and the third is in [illegible]. Repairing of [illegible] will be performed by injecting a low flow of [illegible] [illegible].

b. Operating conditions. Will injection take place the sand in the formation adjacent to the [illegible] [illegible] purpose. When injection pressure increases from 90 psi to well head to 150 psig the well is taken of service, [illegible], and placed in standby [illegible] mode. Each well is backflushed about every [illegible]. About every two years each well is [illegible] and the injection rig is employed.

10. Regulatory aspects. Contact Ohio Department of Conservation & Public Regulations.

a. Construction requirements

b. Monitoring requirements

c. Notifications on operating requirements

III. Economics

A. Total 1 unit costs of construction. This well - $42,000 Surface Treatment system serving 3 wells operating in parallel - $240,000.

B. Operating costs. The three wells operating in parallel and the common surface treatment system cost as estimated total $500,000 per year.

IV. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER HCl Disposal Well No. 1 STATE L-13 UMR

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Bonne Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well location (legal description)

Beginning at the Northwest corner Section 3 T 12S R 8E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 83° 48' E a distance of 1342.5 feet; thence N 16° 51' E a distance of 649 feet to the point of location of the well.

III. History; system planning, construction & operation.

This well was proposed for the disposal of aqueous hydrochloric acid. The well was drilled to a total depth of 1,740 feet in May, 1967. Operational difficulties were encountered until a polypropylene injection tip designed to keep sand out of the injection tubing was installed in August, 1968. The well is now used only when alternate uses are not available for the plant's by-product hydrochloric acid. The attached drawing (YP-697-3) shows the details of the well design and installation.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW at ± 75'/mil lying on N flank of Goodhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no).

(Ground elevation 10') (Total well depth 2216')

Datum for depth measurement 1' above Rotary Table at 11'.

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, med. gr., uncemented
Zone 2	"	1580'	60'	" " " "
Zone 3	"	1500'	50'	" " " "
Zone 4	"	1230'	70'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-3 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 pp in injection zones. Typical analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 20 ppm, Fe - 1 ppm, Al - 5 pp SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	320'	160'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	90'	Slightly brackish variable up to 650 ppm Cl.	

* Brackish below 740'
Salt water below 1000' (FW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.

Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	22	16" OD x 62.6 lb/ft	16"	100'	Cemented to surface
Intermed.	16	11 3/4" OD x 42 lb/ft	11 3/4"	1000'	Cemented to surface
	12"	7" OD x 17 lb/ft	7"	1286'	
Injection					
Fibercast	12"	6 1/2" OD x 4.5 lb/ft	6"	1286 to 1730'	Cemented to surf
Injection	5	3 1/2" OD x 2.5 lb/ft Fibercast		1740	
Other	(See attached Drawing YP-697-3)				

Describe bottom hole completion method: (See attached drawing YP-697-3)

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached drawing YP-697-3)

VI. Description of surface equipment

A. Holding tanks & flow lines Plant HCl storage capacity is 64,000 gallons. Waste HCl is pumped through 2" plastic line to 650 gallon plastic surge tank and flows by gravity down well from surge tank.

B. Filters None

C. Pumps None

D. Other None

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
None		
"		
"		
"		
"		
"		

B. Drilling Logs

Yes Drillers Log

Yes Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity ____ Gamma ray-neutron

____ SP ____ Temperature

Yes Caliper Not needed Cement-bond

Yes Other Star recorder for directional drilling.

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Allyl chloride production unit

B. Physical & chemical Description 20° Baume' aqueous hydrochloric acid

C. Volume Injection rate has averaged 14,000 gallons per day over the last 2 1/2 years. The maximum short-term rate is 50,000 gallons per day.

IX. Preinjection waste treatment None - stream is a pure sales grade product.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	6/68 to 1/71	Average	13 gpm	Maximum	40 gpm
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head _____ bottom hole _____)

Date(s)	6/68 to 1/71	Average	0 psig	Maximum	20 psig
"		"		"	
"		"		"	
"		"		"	
"		"		"	

Well operation & operating history

D. Description of operating programs: This well is only used when alternate uses for the acid are not consuming production. During these periods excess is injected by gravity. Well is often in standby with no flow or injection.

E. Operating problems: None - Well is equipped with a patented rubber check valve which prevents sand from backing into the injection tube. As a result of this installation, the well can be blocked in and left in standby with no injection for extended periods.

XI. Regulatory aspects. Louisiana State Departments of Health and Conservation Regulations.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction $8,000

B. Operating costs This well costs an estimated $10,000 per year to operate.

III. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER

Waste Disposal Well No. 1 STATE L-14 UMR

I. Operating Company & General Well Location

Tenneco Oil Company

Chalmette Refinery

Chalmette, Louisiana

II. Well location (legal description)

Begin at Louisiana Geodetic Survey monument coordinates x=2,430, 247.94 y=462,333.65 in Sect. 7, T 13S, R 12E, in St. Bernard Parish, Louisiana, thence due East 339.79 feet, thence due North 188.94 feet to location in Section T.

III. History, system planning, construction & operation.

A System Planning - A feasibility study was concluded to determine the following:

1. Formation suitable for disposal with impermeable confining beds, no lateral problems, and receiving formation with good thickness, areal extent, porosity and permeability.
2. Compatibility of waste stream with formation fluid.
3. Well location studies and materials of construction.

B. Construction

Construction started on 3/12/60 and was completed on 3/16/60.

C. Operation

Well designed to handle 300 gpm with expected flow of 150 gpm.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located along the southern margin of the Gulf Coastal Plain. The stratigraphic section consists of alternating sands and shales of Iocene to to recent age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
See IES Log Attached				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Pliocene-Pleistocene		1850	120 Ft.	Blanket Sand

D. Engineering description of injection units

1. Porosity: 30%
2. Permeability: Unknown
3. Original Reservoir Pressure: 930 psi
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure: Not Applicable

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
See IES Log Attached				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Brine

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	40.5# J-55	10 3/4"	87'	50 Sacks Type A
Intermed.					
Injection	9 7/8"	20#/Ft. J-55	7"	3016'	600 Sacks Type A
Other		6.7#/Ft. J-55, Smls IPC	2 3/8"	1941'	None

Describe bottom hole completion method:

Perforated Casing 1962 1957 to 1963 Ft. 4 perforations per foot

Perforated Casing 1960 1948 to 1957 Ft. 4 hole/ft.

Perforated Casing 1962 1932 to 1933 Ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc.

No Packer

Centralizers on 7" OD Casing

Well Head - [illegible] W.H. Flange with Gasketed [illegible] Flange

Tapped for 2 [illegible] Tubing [illegible] Tee [illegible] Screwed [illegible]. Plug

valves and 1-2" Walworth [illegible] Gate Valve, 1 Subway line [illegible]

VI. Description of surface equipment

A. Holding tanks & flow lines 7500 BBL Holding Tank

6" Waste Effluent Flowline

B. Filters None

C. Pumps Two electric pumps for removal of holding tank.

D. Other Air compressor for Testing for both wells.

VII. Cores, samples, & logs

A. Coring

From	Size	to	Recovery

B. Drilling fluid

Drilling log — Drilling time

Sonic log — Other

VII. -- [illegible], [illegible], & [illegible], continued

F. Other logs run

[illegible] Radioactivity — Gamma ray-neutron

[illegible] Gr — Temperature

[illegible] Caliper — Casing Size

[illegible] Other — Yellow Tag

VIII. Waste Characterization

A. Radioactive Drainage from which waste is derived

Production Refining Chemical Data

B. Typical & chemical Description These waste streams enter at varying [illegible] and at different times. Unit mol [illegible] is as follows

	No. 1	No. 2	No. 3
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

C. Volume [illegible]

IX. Modification since inventory [illegible]

B. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones treated	Treatment intval	Description of treatment and Results
Deep rock water well is artesian with a [illegible] psi of 125 MCL and 24 N.P. Acid with 7.5 solution.		
This change in well quality [illegible] and Interior pressure product.		

C. Injection rates and pressures

A. None

Date(s)	[illegible]	Average [illegible] psi	Maximum [illegible] psi

B. Pressure fall off

Date(s)	[illegible]	Average [illegible]	Maximum [illegible]

X. Well operation & operating history

D. Description of operating programs: One holding tank with one pump injecting water into well.

E. Operating problems:

1. Well perforations plug have to acidize or backwash well with air.

2. Plugged perforations and had to reperforate once.

3. Plugged two inch backwash tubing with sand and had to replace about 50' of pipe.

XI. Regulatory aspects.

A. Construction requirements Permit obtained based on well casing pressure. Casing tested to 1000 psi for leaks.

B. Monitoring requirements Annual report on injected volume and injection pressure.

C. Restrictions on operating procedures None

XII. Economics

A. Total & unit costs of construction

B. Operating costs

III. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER

Waste Disposal Well No. 2 STATE L-15 UMR

I. Operating Company & General Well Location

Tenneco Oil Company

Chalmette Refinery

Chalmette, Louisiana

II. Well location (legal description)

313.16'E and 460.85'N from Louisiana Geodetic Survey Monument, located x=2,430,247.94', y=462,338.65' in Section 7, T13S, R12E, in St. Bernard Parish, Louisiana

III. History; system planning, construction & operation.

A. System Planning - A duplicate well to Well No. 1 was installed in the same service.

B. Construction

Construction started 1/26/63 and was completed 2/28/63

C. Operation

Averages flow of about 150 gpm

IV. Geology & Geohydrology

A. Regional geologic setting:

The well is located along the southern margin of the Gulf Coastal Plain. The stratigraphic section consists of alternating sands and shales of Tocene to Recent age.

V. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth 2029)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Not Available - See Report for Waste Disposal Well No. 1				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
	Pliocene-Pleistocene			Blanket Sand
*See Report for Waste Disposal Well No. 1 the same sand is used as injection unit for both wells. Probably Top of Sand 1850 with 120 ft thickness.				

D. Engineering description of injection units

1. Porosity: 20%
2. Permeability: Unknown
3. Original Reservoir Pressure: 930 psi
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure: Not Applicable

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not Available - See Report for Waste Disposal Well No. 1				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Brine

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	Driven	[illegible]	11-3/4"	103'	----------
Intermed.	9 7/8"	20,23,26,29#/ft [illegible]	7"	2209'	530 Sacks Class A + 12% Gel + 2%CaCl
Injection		9.5#/ft, J-55 EUC	4 1/2"	1935'	----------

Other

Describe bottom hole completion method: After Gamma Ray-Caliper Logging Well was perforated 1935-50' (15') was [illegible] 4 1/2" O.D. Casing with gas lift valves and nule shoe was set in the center of the perforated zone. 7" Csg. w/ 4 1/2 Csg. seal was provided by seal receptacle at 1938' Perforations from 1935 to 1950'.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

1-7"x5.25" I.D. seal receptacle set of 1835'

6-Centralizers (Weatherford-Bow), 2 on Float Jt., remaining @ 90' interval

14-Scratchers (Weatherford-Recip.), Every 20' from 2057' to 1700'

Wellhead-7" counterbore for weld x 4 1/2" type 6 National Casing head wit 8 5/8"x10" National series 600 x 900 Adapter flange.

VI. Description of surface equipment

A. Holding tanks & flow lines One 7500 BBL holding tank, disposal water pumped to well through 6" flow line.

B. Filters One Warner Lewis Model No. 4 MLL - 57PL liquid filter, 150 gpm max capacity, 300 psig max pressure. Used to filter water from backwash settling pond before reinjection into wells.

C. Pumps One electric centrifugal deep well pump for pumpout of holding tank, one union steam reciprocating for backwash settling pond pumpout with filter.

D. Other Backwash settling pond to allow foreign matter settlement from disposal well backwash before reinjection into disposal wells. Air compressor for backwashes.

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

B. Drilling Logs

X Drillers log

Sample log

Drilling time

Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

x Resistivity

____ SP

____ Caliper

x Other

x Gamma ray-neutron

____ Temperature

____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Petroleum Refining Process Units

B. Physical & chemical Description Three waste streams enter at varying rates and at different times. Well [illegible] analysis is as follows:

	No. 1	No. 2	No. 3
pH	8.6	8.4	8.[illegible]
Alkalinity, mg/l (As $CaCO_3$)	[illegible]	[illegible]	[illegible]
Chloride, mg/l	[illegible]	[illegible]	[illegible]
[illegible], %	[illegible]	[illegible]	[illegible]
[illegible], %	[illegible]	[illegible]	[illegible]

C. Volume 150 gpm

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
	None		

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

Once each year well is acidized with 8000 gals of 12% HCl and 3% H.F. Acid with F.E. additive. This cleans up well perforation and formation and decrease injection pressure required.

C. Injection rates and pressures

1. Rate

Date(s)	1968	Average 150 gpm	Maximum 300 gpm
"		"	"
"		"	"
"		"	"
"		"	"

2. Pressure (well head _____ Bottom hole _____)

Date(s)		Average 50	Maximum 275 psi
"		"	"
"		"	"
"		"	"
"		"	"

X. Well operation & operating history

D. Description of operating programs: One holding tank with one pump injecting water into well.

F. Operating problems: Well perforations plug - have to acidize or backwash well with air to unplug.

XI. Regulatory aspects.

A. Construction requirements: Permit application based upon well casing program. Casing tested at 1500 psi for leaks.

B. Monitoring requirements: Annual report on volume injected and injection pressure.

E. Restrictions on operating procedures: None

XII. Economics

A. Total & unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NO. [illegible]

I. Operating Company & Secondary Well Location

Manchester - EPA, Michoud Assembly Facility

New Orleans, Louisiana

II. Well Location (Legal Description)

East of Section 37 - T2N, R7E, New Orleans Easy

"Tomball Site No" June, 1981

III. History, system dimensions, construction & operation

The Michoud Chemical Disposal Well was authorized in 1963 for the National Aeronautics and Space Administration to secure the safe and permanent disposal of chemical waste from its Michoud installation. Chemicals are used in maintenance activities in the construction of launch vehicle tanks at the New Orleans Facility. The deep well chemical disposal system was installed in 1965 by Dow Chemical Company, Plaquemine, Ohio. The disposal system is designed to secure the safe and permanent disposal of chemical waste to prevent contamination of surface and subsurface water and mineral resources, and to permit of maintaining life.

The standard disposal well is 9,187 feet deep -- more than 1,800 feet deeper than the deepest fresh water-producing subsurface formation at the Michoud site. In an effort to [illegible], the well was drilled nearly 1,000 feet deeper than the depth of [illegible] provide for a representative [illegible] of the Michoud area. [illegible] work is still very necessary to [illegible] the original [illegible] well in the area [illegible] as indicated a [illegible] of the [illegible] of the well. [illegible] Permission [illegible] obtained.

IV. [illegible]

[illegible] and sand and [illegible] clay. From the surface to a depth of 30 feet, [illegible] 0" to 60". [illegible] 60" to 90".

[illegible] 90" to 180".

[illegible] 180" to 190".

[illegible] 190" to 1947". [illegible] 1947" has [illegible] and [illegible]. The well is [illegible] in the [illegible] of the [illegible] [illegible] and [illegible] high [illegible].

III. [illegible] system [illegible], [illegible] & [illegible].

[illegible] the [illegible] of [illegible]. Therefore, the chemicals that [illegible] [illegible] through the [illegible] [illegible] [illegible] will [illegible] [illegible] and [illegible] [illegible].

The chemical waste is piped from various locations in the [illegible] [illegible] [illegible], [illegible] [illegible] a [illegible] [illegible] [illegible] [illegible]. From there, the fluid is [illegible] to the well and injected under pressure to the 4,000 feet deep [illegible] [illegible].

The well's [illegible] inch injection pipe inside the casing is [illegible] with a [illegible] [illegible] material to prevent pipe corrosion. Inside the injection pipe is a [illegible] inch [illegible] [illegible] that [illegible] [illegible] flow of the well [illegible] "[illegible]" into the [illegible] [illegible] to [illegible] [illegible] [illegible] and [illegible] [illegible].

[illegible] 1 well was "plugged off" and [illegible] 2 well was placed in service in [illegible], [illegible].

[illegible] 2.

B. Geologic description of rock units penetrated by well
Rock Unit (Indicate failure including -yes____, no____).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement_____

Name	Age	Depth (feet)	Thickness	Lithologic Description

C. Geologic Description of Injection units & possible units not in use
Name Unit:

Name	Age	Depth (feet)	Thickness	Character and Areal Distribution

D. Engineering description of injection units
1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Physical Characteristics of Formation Water:_____
6. Naturally Fractured Reservoir:_____

[illegible]

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
----		100'	sand	High TDS

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil is produced in large amounts from numerous salt domes in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	H-40 48#/L.F.	11-3/4"	1200'	Trinity Lite Wat
Intermed.	10-5/8	J-5 26.4#/L.F.	7-5/8"	6600	3118 Sacks
Injection			5 1/2"	6600	
Other					

Describe bottom hole completion method: Hole was under reamed and gravel packed with .030" - .040" gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Packers 5½ Lynes special clearance external casing; centralizer casing 1-above float shoe 1-above float collar 1-per length of pipe up to 5,000 feet depth.

VI. Description of surface equipment

A. Holding tanks & flow lines Concrete holding pond 366' x 146', coated with an acide resistant epoxy cement.

B. Filters Two each, epoxy sand 1/2" thick, size of sand .030" - .040".

C. Pumps Oil well triplex plunger

D. Other Valves and piping

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling logs

X Drillers log

X Drilling time

Sample log

Other. _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity — X Gamma ray-neutron

SP — X Temperature

X Caliper — X Cement bond

X Other Casing collar log and perforating record.

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

The chemical disposal system consists of underground gravity flow network and pressurized pipe systems through a series of chemical manholes and lift stations discharging directly into the two million gallon chemical holding pond.

B. Physical & chemical Description The industrial waste is generated from metal surface treatment areas, tube and valve cleaning rooms, paint shops, machine and welding shops, laboratories, X-ray rooms and hydrostatic test areas, and other treatment areas.

C. Volume The daily average is 40[illegible],000 gallons of injected water-diluted chemical waste. Since February, 1964 through July 1971, 300 million gallons (± 5%) have been disposed of through the deep well method.

IX. Preinjection waste treatment No amount of oil and cyanide generated at Michoud are disposed by the well. These wastes are drummed and subsequently burned or chemically destroyed.

C. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
One	Acidizing with 5% Acid	Well head pressure lowered as a result of treatment and injection rate increased.

C. Injection rates and pressures

1. Rate

Date(s)	8-29-69	Average	200	Maximum	400
"	12-1-69	"	200	"	300
"	9-18-70	"	200	"	300
"	1-4-71	"	150	"	160
"	6-28-71	"	110	"	160

2. Pressure (well head X bottom hole)

Date(s)	8-29-69	Average	620	Maximum	1,140
"	12-1-69	"	540	"	575
"	9-18-70	"	420	"	665
"	1-4-71	"	760	"	800
"	6-28-71	"	900	"	920

X. Well operation & operating history

D. Description of operating programs: Well is operated by Mason-Rust Operating Engineers and monitored twenty-four hours a day.

E. Operating problems: The main problem is that the well "sands up" and the pressure builds up. The well is back washed to reduce the pressure and put back in service.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating pressure [illegible] reported

XII. Economics

A. Total & unit costs of construction

Cost of Well #1 - $339,122.75

Cost of Well #2 - $483,765.15

B. Operating costs

Annual operating cost, cost of utilities not included $21,396.00

XIII. Source(s) of Information and Published References

Mason-Rust, NASA records.

WELL FILE NUMBER Louisiana / STATE L-17 / UMR

I. Operating Company & General Well Location

Beacon Gasoline Company - Section 26, Township 21 North, Range 9 West, Webster Parish, Louisiana

II. Well location (legal description)

300' south and 350' east of the Northwest Corner of the Northwest Quarter of the Southeast Quarter, Section 26, Township 21 North, Range 9 West, Webster Parish, Louisiana.

III. History, system planning, construction & operation.

This well was drilled in 1964 to dispose of cooling tower overflow and other waste water from a gasoline plant at this same location.

IV. Geology & Geohydrology

A. Regional geologic setting: -- The well is located on the northeast flank of the Sabine uplift and the regional dip in this area is to the northeast. The stratigraphic section consists of Cretaceous and Tertiary sands and clays.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation _____) (Total well depth_____)

Datum for depth measurement _____

Name	Age	Depth (feet)	Thickness	Lithologic Description
--				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (feet)	Thickness	Character and Areal Distribution
--				
Injection zone - 1049' to 1280'				

D. Engineering description of injection units

1. Porosity: --
2. Permeability: --
3. Original Reservoir Pressure: --
4. Reservoir Temperature: --
5. Chemical Character of Formation Water: --
6. Reservoir Fracture Pressure: --

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
		--		

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Kind	Size	Depth Set	Type & Amount of Cement
Surface	9"				
Intermed.		[illegible]	6 5/8	1155	200 SKS S/A JRL 50 SKS COM
Injection		4 1/2	2 3/8"	1025	
Other		--		--	

Describe bottom hole completion method: Perforated 1049' - 1069' and 1078' - 1088' W/4 shots per foot

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines Pump suction vat is of concrete 20' square X 5' deep. Float controlled pump switch.

B. Filters _____

C. Pumps Peerless Triplex

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From -- to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____ Drillers Log ____ Drilling time

____ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Gas processing plant - cooling tower overflow and other waste water

B. Physical & chemical Description -- Not available

C. Volume Approximately 10 gpm per minute

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection Zones	Acidization	5,000 gal. HCl-reduced injection pressure from 1100psi to 625psi

C. Injection rates and pressures

1. Rate

Date(s)	12-28-64	Average	15gpm	Maximum	
"	10-01-70	"	15gpm	"	
"	4-01-71	"	10gpm	"	
"		"		"	
"		"		"	

2. Pressure (well head _____ bottom hole _____)

Date(s)	12-28-64	Average	450#	Maximum	
"	10-1-70	"	1100#	"	
"	4-1-71	"	625#	"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: Well operates intermittently controlled by float switch in suction vat.

E. Operating problems: Gradual pressure increase during injection.

XI. Regulatory aspects.

A. Construction requirements ---

B. Monitoring requirements ---

C. Restrictions on operating procedure ---

XII. Economics

A. Total & unit costs of construction $12,000.00

B. Operating costs Approximately $100.00 per month

XIII. Source(s) of Information and Published References

Louisiana Geological Survey

I. Operating Company & General Well Location

Pontchartrain Works, E. I. du Pont de Nemours & Company - St. John the Baptist Parish, La Place, Louisiana. The site is located on the East Bank of the Mississippi River between La Place and Reserve, Louisiana.

II. Well location (legal description)

Fee Id. S.W.D. No. 1; Sec. 20; T-11S; R-7E; St. John the Baptist Parish. (Normally referred to as Pontchartrain Works Disposal Well No. 1)

III. History; system planning, construction & operation.

The No. 1 well was drilled and completed under Louisiana Department of Conservation Work Permit No. S.W.D.H-4. Completion date was July 27, 1962. The well completion was designed for injection of NaCL brine resulting from the production of ny on intermediate neoprene. Surface facilities including storage, feed lines, filters, and appropriate instrumentation are provided for handling the waste stream.

Injection was commenced September 28, 1964. Operation of this facility has been on a non-continuous basis.

IV. Geology & Geohydrology

A. Regional geologic setting: Monoclinal dip with maximum dip of 140 feet per mile at 4000 ft. in a south-southwest direction. The well is located on the east flank of the Mississippi embayment which is on the northern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile to a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no____).

(Ground elevation 17 ft. above sea level) (Total well depth 5232 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Miocene & Younger			5232 ft.	Sand and Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
5000 Ft. Sd.	Miocene	5000 Ft.	140 Ft.	Sand-Infinite
4800 Ft. Sd.	Miocene	4775 Ft.	225 Ft.	Sand-Infinite
4600 Ft. Sd.	Miocene	4400 Ft.	150 Ft.	Sand-Infinite
4100 Ft. Sd.	Miocene	4000 Ft.	300 Ft.	Sand-Infinite
3800 Ft. Sd.	Miocene	3600 Ft.	140 Ft.	Sand-Infinite
3000 Ft. Sd.	Miocene	2820 Ft.	115 Ft.	Sand-Infinite
2600 Ft. Sd.	Miocene	[illegible] Ft.	215 Ft.	Sand-Infinite
2300 Ft. Sd.	Miocene	[illegible] Ft.	150 Ft.	Sand-Infinite
2100 Ft. Sd.	Miocene	2000 Ft.	260 Ft.	Sand-Infinite
1900 Ft. Sd.	Miocene	[illegible] Ft.	[illegible] Ft.	Sand-Infinite

D. Engineering description of injection units

1. Porosity: 15% in the 5232 Ft. Sand

2. Permeability: [illegible] Darcy in the 5232 Ft. Sand

3. Original Reservoir Pressure: 2138 psi at 5232 Ft. (Calculated)

4. Reservoir Temperature: 100°F at 5232 Ft. (Measured)

5. General Character of Formation Water: These samples were taken at 5232 Ft. in Dr. Ford's No. 1 (Repeat) Well*

Chloride Ion - [illegible]

Bicarbonate Ion - [illegible]

Sulfate Ion - [illegible]

[illegible]

Total dissolved solids - [illegible]

6. Reservoir Fracture Pressure: [illegible] (Calculated) 5232 feet.

*These samples could have been contaminated by fluid used in the well work activity.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Shallow Sand	800 ft.	800 ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	[illegible]	Weld Gauge	[illegible]	115 ft.	Electricity [illegible]
Intermed.	[illegible]	23 lbs. Wrought Iron Casing	10,[illegible]	1,[illegible] ft.	[illegible] sacks of Portland Cement [illegible]
Injection	[illegible]	26 lbs. Injection Casing	[illegible]	[illegible] ft.	[illegible] sacks of [illegible] 1,100 sacks of [illegible]

Other None

Describe bottom hole completion method: The casing was perforated from [illegible] ft. to [illegible] ft. on [illegible]. It was repaired from [illegible] ft. to [illegible] ft. and perforated from [illegible] ft. to [illegible] ft. on [illegible]. The hole is [illegible] ft. deep and well repaired is dated [illegible].

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc:

1- No Packers

2- A differential valve tool was positioned at 3034 feet.

3- Spring steel centralizers were run on 90 ft. spacing on the 5 1/2 inch casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Storage tanks and a clarifier provide combined holdup time of approximately 1.5 days. This is combined with additional storage surge capacity to handle up to 10 inches of rainfall. This system is also used for blending the waste material.

B. Filters Primary and secondary filters are provided to remove solids down to 10 microns.

C. Pumps 2 stage centrifugal pumps

D. Other Pressure relief protection is provided along with instrumentation to monitor and record pressure and flow continuously.

VII. Cores, samples, & Logs

A. Coring

From	No Cores	to	None	Recovery None
"	No Cores		None	None
"	No Cores		None	None
"	No Cores		None	None
"	No Cores		None	None
"	No Cores		None	None
"	No Cores		None	None
	No Cores		None	None

B. Drilling logs

___ Drillers log ___ Drilling time

___ Sample log ___ Other: _____

VII. -- Gamma, neutron, X-ray, neutron

C. Other logs run

___Resistivity X Gamma ray-neutron

X SP ___Temperature

X Caliper ___Cement bond

___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediate and monomers

B. Physical & Chemical Description Sodium chloride brine with miscellaneous ingredients.

NaCl.....5%-25%	Dissolved Solids....6%-22%
Cyanide.....0-150 PPM	pH.....7-11
Copper.....0-150 PPM	Density.....1.05-1.20gms
Nitrilotris(As Adipamide) 0-[illegible] PPM	
Ammonia.....50-150 PPM	

C. Volume 250,000 barrels per hour 28,100 gallons per hour; 670 barrels per hour.

IX. Pretreatment used prior to disposal Material blending, pH and chemical treatment, and solid separation and removal are provided.

V. Well Operation & Operating History

A. Tests *Sample data taken during normal operation.

Date	Duration	Zone Tested	Description of test results
9-24-1964	One Hour *	[illegible]	150,000#/hr.[illegible]-250 psig
8-14-1965	One Hour *	[illegible]	154,000#/hr.[illegible] psig
3-10-69	One Hour *	3,790'-3,910'	200,000#/hr.[illegible] psig
4-24-1969	One Hour *	3,790'-3,910'	170,000#/hr.[illegible] psig
2-7-1970	One Hour *	3,790'-3,910'	80,000#/hr.[illegible] psig
6-7-1970	One Hour *	3,790'-3,910'	100,000#/hr.[illegible] psig
9-2-1970	One Hour *	3,790'-3,910'	70,000#/hr.[illegible] psig
3-16-1971	One Hour *	3,790'-3,910'	140,000#/hr.[illegible] psig
5-1-1971	One Hour *	3,790'-3,910'	110,000#/hr.[illegible] psig
6-24-1971	One Hour *	3,790'-3,910'	120,000#/hr.[illegible] psig

B. Treatments or Stimulations

Zones Treated	Treatment Method	Description of Treatment and Results
4635'-4665'	Perforation @ 4 shots per foot	Successful
4635'-4665'	Acidize with 6% HF & 10% HCl	Successful
4635'-4665	Swab the well by pulling ~ 100' Sand	Successful
4635'-4665'	Acidize the well with 6% HF & 10% HCl	Successful
3790-3850	Reperforation @ 8 shots per foot	Successful
3790-3850	Acidize with 6% HF & 10% HCl	Successful
3790-3910	Reperforation @ 4 shots per foot	Successful

C. Injection rates and pressures

1. Rate

Date(s)	6-16-1971	Average	120M#/hr	Maximum	120M#/hr
"	6-20-1971	"	120M#/hr	"	120M#/hr
"	6-30-1971	"	110M#/hr	"	110M#/hr
"	7-11-1971	"	120M#/hr	"	120M#/hr
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)	6-16-1971	Average	180psig	Maximum	180psig
"	6-20-1971	"	280psig	"	280psig
"	6-30-1971	"	250psig	"	250psig
"	7-11-1971	"	260psig	"	260psig
"		"		"	

2. Well operation & operation history

3. Description of operating history: The well [illegible] will be used. Alternate will well [illegible] [illegible]

E. Operating problems: [illegible] conditions have [illegible] [illegible] and [illegible] conditions.

XI. Regulatory aspects. (See page below)

A. Construction requirements: [illegible] was separated from the [illegible] zone in the [illegible] differential valve cool. The casing was [illegible] in the [illegible] injection zone.

B. Monitoring requirements: Injection pressure and volume of waste injected are recorded.

C. Restrictions on operating procedure: Control of injection pressures, material composition, [illegible], temperature and solid content maintained.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

10. Remarks:

a. Table 1 with Work of Contractor

Excerpt prepared by [illegible] Corporation

b. Operating costs [illegible] operating costs for Lake Ontario with 1-4 and their related new [illegible] treatment stage (including well water operational new clean [illegible]).

11. Source(s) of Information and Published Information: Company files and information received and [illegible] Operating Service.