KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024300C
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: SWSESESW033425E Sample Type: WATER
Collection Site: SW5 - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 4-90 Time: 1940

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
ORTHO-CHLOROPHENOL	NOT DETECTED	2.0
2-NITROPHENOL	NOT DETECTED	2.0
PHENOL	NOT DETECTED	2.0
2,4-DIMETHYLPHENOL	NOT DETECTED	2.0
2,4-DICHLOROPHENOL	NOT DETECTED	2.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	2.0
4-CHLORO-M-CRESOL	NOT DETECTED	2.0
2,4-DINITROPHENOL	NOT DETECTED	50.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	10.0
PENTACHLOROPHENOL	NOT DETECTED	10.0
4-NITROPHENOL	NOT DETECTED	10.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Analyst: DENNIS L. DOBSON

DLD

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 002429OC
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: SWSESESW033425E Sample Type: WATER
Collection Site: SW5 - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 4-90 Time: 1940

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
HEXACHLOROETHANE	NOT DETECTED	2.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	2.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	2.0
HEXACHLOROBUTADIENE	NOT DETECTED	2.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	2.0
NAPHTHALENE	NOT DETECTED	2.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	2.0
2-CHLORONAPHTHALENE	NOT DETECTED	2.0
ACENAPHTHYLENE	NOT DETECTED	2.0
ACENAPHTHENE	NOT DETECTED	2.0
DIMETHYL PHTHALATE	NOT DETECTED	2.0
2,6-DINITROTOLUENE	NOT DETECTED	2.0
FLUORENE	NOT DETECTED	2.0
4-CHLOROPHENYL PHENYL ETHER	NOT DETECTED	2.0
2,4-DINITROTOLUENE	NOT DETECTED	2.0
DIETHYL PHTHALATE	NOT DETECTED	2.0
HEXACHLOROBENZENE	NOT DETECTED	2.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	2.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	2.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	2.0
FLUORANTHENE	NOT DETECTED	2.0
PYRENE	NOT DETECTED	2.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	2.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	10.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	2.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	10.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	2.0
BENZO(A)PYRENE	NOT DETECTED	2.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	2.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	2.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	2.0

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

PESTICIDE ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024280C
Report Date: 4-23-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: SWSESESW033425E Sample Type: WATER
Collection Site: SW5 - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 4-90 Time: 1940

RESULTS OF ANALYSIS

PRIORITY POLLUTANT PESTICIDES	Concentration (UG/L)	Detection Limit (UG/L)
ALDRIN	NOT DETECTED	0.025
ALPHA BHC	NOT DETECTED	0.025
BETA BHC	NOT DETECTED	0.050
DELTA BHC	NOT DETECTED	0.050
GAMMA BHC	NOT DETECTED	0.025
CHLORDANE	NOT DETECTED	0.20
P,P' DDD	NOT DETECTED	0.040
P,P' DDE	NOT DETECTED	0.020
P,P' DDT	NOT DETECTED	0.10
DIELDRIN	NOT DETECTED	0.050
ENDOSULFAN I	NOT DETECTED	0.020
ENDOSULFAN II	NOT DETECTED	0.020
ENDOSULFAN SULFATE	NOT DETECTED	0.10
ENDRIN	NOT DETECTED	0.10
HEPTACHLOR	NOT DETECTED	0.020
HEPTACHLOR EPOXIDE	NOT DETECTED	0.020
TOXAPHENE	NOT DETECTED	2.0
PCB-1016	NOT DETECTED	0.50
PCB-1221	NOT DETECTED	2.5
PCB-1232	NOT DETECTED	0.50
PCB-1242	NOT DETECTED	0.50
PCB-1248	NOT DETECTED	0.50
PCB-1254	NOT DETECTED	0.50
PCB-1260	NOT DETECTED	0.50

Analyst: JOHN GOULD

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024200C
Report Date: 4-13-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: SWSESESW033425E Sample Type: WATER
Collection Site: SW5 - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 4-90 Time: 1940

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Detection Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Division of Laboratories and Research
Radiation Chemistry Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1630

REPORT OF LABORATORY ANALYSES

Report To: Radiation Control Acct Code: RT Sample ID:

Location: GULF CHEMICAL SW5
Source: SWSESESW S03T34R25E
Type: Surface Water
Coll By: CHAFFEE/COOPER
Del By: CHAFFEE

Lab Number: 6826RC
Date Collected: 4- 4-90
Date Received: 4- 9-90
Date Reported: 4-18-90

Remarks: Gross Alpha less than 5 pCi/L.

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ANALYTICAL RESULTS

Results are in Units of Picocuries per Liter

Parameter	Concentration	Error	Det. Limit	Confidence Level
Gross Alpha	4	1		
Gross Beta	NA			
Tritium	NA			
Total Solid	NA			
Chromium-51	NA			
Manganese-54	NA			
Iron-55	NA			
Iron-59	NA			
Cobalt-57	NA			
Cobalt-58	NA			
Cobalt-60	NA			
Nickel-63	NA			
Zinc-65	NA			
Gallium-67	NA			
Strontium-89	NA			
Strontium-90	NA			
Zirconium-95	NA			
Molybdenum-99	NA			
Technetium-99m	NA			
Ruthenium-103	NA			
Ruthenium-106	NA			
Indium-111	NA			
Iridium-192	NA			
Iodine-123	NA			
Iodine-125	NA			

Sample Number:

Lab Number: 6826RC

Parameter	Concentration	Error	Det. Limit	Confidence Level
Iodine-129	NA			
Iodine-131	NA			
Cesium-134	NA			
Cesium-137	NA			
Barium-140	NA			
Ytterbium-169	NA			
Carbon-14	NA			
Phosphorus-32	NA			
Radium-226	NA			
Radium-228	NA			
Gross Uranium	NA			
Potassium	NA			

All results are expressed at the 95% confidence level except as noted.

NA - Not Analyzed
ND - Not Detected

Analyst: FZ

Copy: PAM CHAFFEE (BER)
RAD LAB

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: PAM CHAFFEE--BER
Address:

Lab Number: 1962PT
Account Code: BER
Matrix: WATER

Locality: GULF CHEMICAL 03011234 CRESTLINE
Time Collected: 1940

Collected By: CHAFFEE/COOPER
Depth Collected: ****

Sample ID: SWSESESW033425E
Date Collected: 4- 4-90
Date Received: 4- 9-90
Date Reported: 4-17-90

Comments: SW5 DISSOLVED HEAVY METALS

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Results expressed in Milligrams/Liter

Total Hard. (CaCO3)	166	pH	NA	Iron	0.07
		Turbidity	NA	Manganese	0.23
Calcium	56.5	Specific Cond.	NA	Arsenic	0.001
Magnesium	6.1	T. Dissolved Solids	NA	Barium	0.09
Sodium	9.1	Total Phosphorus (P)	NA	Cadmium	ND
Potassium	NA	Silica (SiO2)	NA	Chromium	ND
		Boron	NA	Copper	ND
Total Alk. (CaCO3)	104	Dissolved Oxygen	NA	Lead	ND
		BOD	NA	Mercury	ND
Chloride	10.0	COD	NA	Selenium	ND
Sulfate	50	Ammonia (N)	NA	Silver	0.002
Nitrate (N)	1.90	T. Sus. Solids	NA	Zinc	0.07
Fluoride	0.13			Aluminum	NA
				Beryllium	NA
Cyanides	NA	Carbonate Hardness	104.0	Nickel	NA
Oil/Grease	NA	Non-Carbonate Hard.	NA	Antimony	NA
Phenols	NA	NaHCO3 Alkalinity	NA	Thallium	NA
TDP	NA	MBAS	NA		
Sulfide	NA	Flash Point	NA		

Chemist: FD

NA - Not Analyzed

ND - Not Detected

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

PESTICIDE ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 002437OC
Report Date: 4-30-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: 0000NWNE043425E
Sample Type: WATER
Collection Site: IND WELL - GULF CHEMICAL 03011234, CRESTLINE, KS. (CK CO.)
Collected By: CHAFFEE/COOPER
Date: 4- 5-90
Time: 1225

RESULTS OF ANALYSIS

PRIORITY POLLUTANT PESTICIDES	Concentration (UG/L)	Detection Limit (UG/L)
ALDRIN	NOT DETECTED	0.025
ALPHA BHC	NOT DETECTED	0.025
BETA BHC	NOT DETECTED	0.050
DELTA BHC	NOT DETECTED	0.050
GAMMA BHC	NOT DETECTED	0.025
CHLORDANE	NOT DETECTED	0.20
P,P' DDD	NOT DETECTED	0.040
P,P' DDE	NOT DETECTED	0.020
P,P' DDT	NOT DETECTED	0.10
DIELDRIN	NOT DETECTED	0.050
ENDOSULFAN I	NOT DETECTED	0.020
ENDOSULFAN II	NOT DETECTED	0.020
ENDOSULFAN SULFATE	NOT DETECTED	0.10
ENDRIN	NOT DETECTED	0.10
HEPTACHLOR	NOT DETECTED	0.020
HEPTACHLOR EPOXIDE	NOT DETECTED	0.020
TOXAPHENE	NOT DETECTED	2.0
PCB-1016	NOT DETECTED	0.50
PCB-1221	NOT DETECTED	2.5
PCB-1232	NOT DETECTED	0.50
PCB-1242	NOT DETECTED	0.50
PCB-1248	NOT DETECTED	0.50
PCB-1254	NOT DETECTED	0.50
PCB-1260	NOT DETECTED	0.50

Analyst: JOHN GOULD JG

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024380C
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: 0000NWNE043425E Sample Type: WATER
Collection Site: IND WELL - GULF CHEMICAL 03011234, CRESTLINE, KS. (CK CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1225

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
HEXACHLOROETHANE	NOT DETECTED	2.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	2.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	2.0
HEXACHLOROBUTADIENE	NOT DETECTED	2.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	2.0
NAPHTHALENE	NOT DETECTED	2.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	2.0
2-CHLORONAPHTHALENE	NOT DETECTED	2.0
ACENAPHTHYLENE	NOT DETECTED	2.0
ACENAPHTHENE	NOT DETECTED	2.0
DIMETHYL PHTHALATE	NOT DETECTED	2.0
2,6-DINITROTOLUENE	NOT DETECTED	2.0
FLUORENE	NOT DETECTED	2.0
4-CHLOROPHENYL PHENYL ETHER	NOT DETECTED	2.0
2,4-DINITROTOLUENE	NOT DETECTED	2.0
DIETHYL PHTHALATE	NOT DETECTED	2.0
HEXACHLOROBENZENE	NOT DETECTED	2.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	2.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	2.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	2.0
FLUORANTHENE	NOT DETECTED	2.0
PYRENE	NOT DETECTED	2.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	2.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	10.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	2.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	10.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	2.0
BENZO(A)PYRENE	NOT DETECTED	2.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	2.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	2.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	2.0

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

DxC

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024390C
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: 0000NWNE043425E Sample Type: WATER
Collection Site: IND WELL - GULF CHEMICAL 03011234, CRESTLINE, KS. (CK CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1225

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
ORTHO-CHLOROPHENOL	NOT DETECTED	2.0
2-NITROPHENOL	NOT DETECTED	2.0
PHENOL	NOT DETECTED	2.0
2,4-DIMETHYLPHENOL	NOT DETECTED	2.0
2,4-DICHLOROPHENOL	NOT DETECTED	2.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	2.0
4-CHLORO-M-CRESOL	NOT DETECTED	2.0
2,4-DINITROPHENOL	NOT DETECTED	50.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	10.0
PENTACHLOROPHENOL	NOT DETECTED	10.0
4-NITROPHENOL	NOT DETECTED	10.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 002423OC
Report Date: 4-13-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: 0000NWNE043425E
Sample Type: WATER
Collection Site: IND WELL - GULF CHEMICAL 03011234, CRESTLINE, KS. (CK CO.)
Collected By: CHAFFEE/COOPER
Date: 4- 5-90
Time: 1225

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Detection Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	17.7	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: PAM CHAFFEE--BER
Address:

Lab Number: 1965PT
Account Code: BER
Matrix: WATER

Locality: GULF CHEMICAL 03011234 CRESTLINE
Time Collected: 1225

Collected By: CHAFFEE/COOPER
Depth Collected: ****

Sample ID: NWNE043425E
Date Collected: 4- 5-90
Date Received: 4- 9-90

Comments: IND WELL DISSOLVED HEAVY METALS
Date Reported: 4-27-90

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Results expressed in Milligrams/Liter

Total Hard. (CaCO3)	136	pH	NA	Iron	0.06
		Turbidity	NA	Manganese	0.02
Calcium	31.0	Specific Cond.	NA	Arsenic	0.003
Magnesium	14.2	T. Dissolved Solids	NA	Barium	0.17
Sodium	18.1	Total Phosphorus (P)	NA	Cadmium	ND
Potassium	NA	Silica (SiO2)	NA	Chromium	ND
		Boron	NA	Copper	ND
Total Alk. (CaCO3)	117	Dissolved Oxygen	NA	Lead	0.002
		BOD	NA	Mercury	ND
Chloride	13.0	COD	NA	Selenium	0.003
Sulfate	24	Ammonia (N)	NA	Silver	ND
Nitrate (N)	0.20	T. Sus. Solids	NA	Zinc	ND
Fluoride	0.52			Aluminum	NA
				Beryllium	NA
Cyanides	NA	Carbonate Hardness	117.0	Nickel	NA
Oil/Grease	NA	Non-Carbonate Hard.	NA	Antimony	NA
Phenols	NA	NaHCO3 Alkalinity	NA	Thallium	NA
TDP	NA	MBAS	NA		
Sulfide	NA	Flash Point	NA		

Chemist: FD

NA - Not Analyzed

ND - Not Detected

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024360C
Report Date: 4-23-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NESENWNE043425E Sample Type: WATER
Collection Site: MW3D - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1705

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
ORTHO-CHLOROPHENOL	NOT DETECTED	2.0
2-NITROPHENOL	21.3	2.0
PHENOL	10.9	2.0
2,4-DIMETHYLPHENOL	NOT DETECTED	2.0
2,4-DICHLOROPHENOL	NOT DETECTED	2.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	2.0
4-CHLORO-M-CRESOL	NOT DETECTED	2.0
2,4-DINITROPHENOL	NOT DETECTED	50.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	10.0
PENTACHLOROPHENOL	NOT DETECTED	10.0
4-NITROPHENOL	14.5	10.0
BENZOIC ACID	32.4	

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: NUMEROUS HYDROCARBONS ARE INDICATED AS PRESENT.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024350C
Report Date: 4-23-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NESENWNE043425E Sample Type: WATER
Collection Site: MW3D - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1705

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
HEXACHLOROETHANE	NOT DETECTED	2.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	2.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	2.0
HEXACHLOROBUTADIENE	NOT DETECTED	2.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	2.0
NAPHTHALENE	NOT DETECTED	2.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	2.0
2-CHLORONAPHTHALENE	NOT DETECTED	2.0
ACENAPHTHYLENE	NOT DETECTED	2.0
ACENAPHTHENE	NOT DETECTED	2.0
DIMETHYL PHTHALATE	NOT DETECTED	2.0
2,6-DINITROTOLUENE	NOT DETECTED	2.0
FLUORENE	NOT DETECTED	2.0
4-CHLOROPHENYL PHENYL ETHER	NOT DETECTED	2.0
2,4-DINITROTOLUENE	NOT DETECTED	2.0
DIETHYL PHTHALATE	NOT DETECTED	2.0
HEXACHLOROBENZENE	NOT DETECTED	2.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	2.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	2.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	2.0
FLUORANTHENE	NOT DETECTED	2.0
PYRENE	NOT DETECTED	2.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	2.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	10.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	2.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	10.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	2.0
BENZO(A)PYRENE	NOT DETECTED	2.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	2.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	2.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	2.0

Comment: NUMEROUS HYDROCARBONS ARE INDICATED AS PRESENT.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 002422OC
Report Date: 4-13-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NESENWNE043425E Sample Type: WATER
Collection Site: MW3D - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1705

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Detection Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	2.9	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	1240	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Comment: ETHYLTOLUENE WAS INDICATED.

Analyst: RICHARD L. PIERCE

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

PESTICIDE ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024340C
Report Date: 5-11-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NESENWNE043425E Sample Type: WATER
Collection Site: MW3D - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1705

RESULTS OF ANALYSIS

PRIORITY POLLUTANT PESTICIDES	Concentration (UG/L)	Detection Limit (UG/L)
ALDRIN	NOT DETECTED	0.13
ALPHA BHC	NOT DETECTED	0.13
BETA BHC	NOT DETECTED	0.25
DELTA BHC	NOT DETECTED	0.25
GAMMA BHC	NOT DETECTED	0.13
CHLORDANE	NOT DETECTED	1.0
P,P' DDD	NOT DETECTED	0.20
P,P' DDE	NOT DETECTED	0.10
P,P' DDT	NOT DETECTED	0.50
DIELDRIN	NOT DETECTED	0.25
ENDOSULFAN I	NOT DETECTED	0.10
ENDOSULFAN II	NOT DETECTED	0.10
ENDOSULFAN SULFATE	NOT DETECTED	0.50
ENDRIN	NOT DETECTED	0.50
HEPTACHLOR	NOT DETECTED	0.10
HEPTACHLOR EPOXIDE	NOT DETECTED	0.10
TOXAPHENE	NOT DETECTED	10.
PCB-1016	NOT DETECTED	2.5
PCB-1221	NOT DETECTED	2.5
PCB-1232	NOT DETECTED	2.5
PCB-1242	NOT DETECTED	2.5
PCB-1248	NOT DETECTED	2.5
PCB-1254	NOT DETECTED	2.5
PCB-1260	NOT DETECTED	2.5
RAMROD	NOT DETECTED	2.0

Analyst: JOHN GOULD

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: PAM CHAFFEE--BER
Address:

Lab Number: 1964PT
Account Code: BER
Matrix: WATER

Locality: GULF CHEMICAL 03011234 CRESTLINE
Time Collected: 1705

Collected By: CHAFFEE/COOPER
Depth Collected: ****

Sample ID: NESENWNE043425E
Date Collected: 4- 5 -90
Date Received: 4- 9-90
Date Reported: 4-20-90

Comments: MW3D DISSOLVED HEAVYS

* *

Results expressed in Milligrams/Liter

Total Hard. (CaCO3)	1356	pH	NA	Iron	0.07
		Turbidity	NA	Manganese	6.40
Calcium	464.5	Specific Cond.	NA	Arsenic	0.002
Magnesium	47.9	T. Dissolved Solids	NA	Barium	ND
Sodium	103.5	Total Phosphorus (P)	NA	Cadmium	0.022
Potassium	NA	Silica (SiO2)	NA	Chromium	ND
		Boron	NA	Copper	ND
Total Alk. (CaCO3)	332	Dissolved Oxygen	NA	Lead	ND
		BOD	NA	Mercury	ND
Chloride	5.6	COD	NA	Selenium	ND
Sulfate	555	Ammonia (N)	NA	Silver	ND
Nitrate (N)	191.00	T. Sus. Solids	NA	Zinc	0.22
Fluoride	0.08			Aluminum	NA
				Beryllium	NA
Cyanides	NA	Carbonate Hardness	332.0	Nickel	NA
Oil/Grease	NA	Non-Carbonate Hard.	NA	Antimony	NA
Phenols	NA	NaHCO3 Alkalinity	NA	Thallium	NA
TDP	NA	MBAS	NA		
Sulfide	NA	Flash Point	NA		

Chemist: FD

NA - Not Analyzed

ND - Not Detected

* *

Copy To: FILE

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024330C
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NENWNWNE043425E Sample Type: WATER
Collection Site: MW7S - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1435

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
ORTHO-CHLOROPHENOL	NOT DETECTED	2.0
2-NITROPHENOL	NOT DETECTED	2.0
PHENOL	NOT DETECTED	2.0
2,4-DIMETHYLPHENOL	NOT DETECTED	2.0
2,4-DICHLOROPHENOL	NOT DETECTED	2.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	2.0
4-CHLORO-M-CRESOL	NOT DETECTED	2.0
2,4-DINITROPHENOL	NOT DETECTED	50.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	10.0
PENTACHLOROPHENOL	NOT DETECTED	10.0
4-NITROPHENOL	NOT DETECTED	10.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Analyst: DENNIS L. DOBSON
DLD

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024320C
Report Date: 4-20-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NENWNWNE043425E Sample Type: WATER
Collection Site: MW7S - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1435

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (UG/L)	Detection Limit (UG/L)
HEXACHLOROETHANE	NOT DETECTED	2.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	2.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	2.0
HEXACHLOROBUTADIENE	NOT DETECTED	2.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	2.0
NAPHTHALENE	NOT DETECTED	2.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	2.0
2-CHLORONAPHTHALENE	NOT DETECTED	2.0
ACENAPHTHYLENE	NOT DETECTED	2.0
ACENAPHTHENE	NOT DETECTED	2.0
DIMETHYL PHTHALATE	NOT DETECTED	2.0
2,6-DINITROTOLUENE	NOT DETECTED	2.0
FLUORENE	NOT DETECTED	2.0
4-CHLOROPHENYL PHENYL ETHER	NOT DETECTED	2.0
2,4-DINITROTOLUENE	NOT DETECTED	2.0
DIETHYL PHTHALATE	NOT DETECTED	2.0
HEXACHLOROBENZENE	NOT DETECTED	2.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	2.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	2.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	2.0
FLUORANTHENE	NOT DETECTED	2.0
PYRENE	NOT DETECTED	2.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	2.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	10.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	2.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	10.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	2.0
BENZO(A)PYRENE	NOT DETECTED	2.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	2.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	2.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	2.0

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

PESTICIDE ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024310C
Report Date: 5- 1-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NENWNWNE043425E Sample Type: WATER
Collection Site: MW7S - GULF CHEMICAL 03011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1435

RESULTS OF ANALYSIS

PRIORITY POLLUTANT PESTICIDES	Concentration (UG/L)	Detection Limit (UG/L)
ALDRIN	NOT DETECTED	0.025
ALPHA BHC	NOT DETECTED	0.025
BETA BHC	NOT DETECTED	0.050
DELTA BHC	NOT DETECTED	0.050
GAMMA BHC	NOT DETECTED	0.025
CHLORDANE	NOT DETECTED	0.20
P,P' DDD	NOT DETECTED	0.040
P,P' DDE	NOT DETECTED	0.020
P,P' DDT	NOT DETECTED	0.10
DIELDRIN	NOT DETECTED	0.050
ENDOSULFAN I	NOT DETECTED	0.020
ENDOSULFAN II	NOT DETECTED	0.020
ENDOSULFAN SULFATE	NOT DETECTED	0.10
ENDRIN	NOT DETECTED	0.10
HEPTACHLOR	NOT DETECTED	0.020
HEPTACHLOR EPOXIDE	NOT DETECTED	0.020
TOXAPHENE	NOT DETECTED	2.0
PCB-1016	NOT DETECTED	0.50
PCB-1221	NOT DETECTED	2.5
PCB-1232	NOT DETECTED	0.50
PCB-1242	NOT DETECTED	0.50
PCB-1248	NOT DETECTED	0.50
PCB-1254	NOT DETECTED	0.50
PCB-1260	NOT DETECTED	0.50

Analyst: JOHN GOULD

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: PAM CHAFFEE
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 0024210C
Report Date: 4-13-90

SAMPLE COLLECTION INFORMATION

Sample Identification Number: NENWNWNE043425E Sample Type: WATER
Collection Site: MW7S - GULF CHEMICAL O3011234, CRESTLINE, KS. (CHEROKEE CO.)
Collected By: CHAFFEE/COOPER Date: 4- 5-90 Time: 1435

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Detection Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	50.3	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	57.9	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Division of Laboratories and Research
Radiation Chemistry Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1630

REPORT OF LABORATORY ANALYSES

Report To: Radiation Control Acct Code: RT Sample ID:

Location: GULF CHEMICAL MW7S
Source: NENWNWNE S04T34R25E
Type: Ground Water
Coll By: CHAFFEE/COOPER
Del By: CHAFFEE

Lab Number: 6827RC

Date Collected: 4- 4-90
Date Received: 4- 9-90
Date Reported: 4-18-90

Remarks: No uranium.

* * * * * * * * * * * * * * * * * * *

ANALYTICAL RESULTS

Results are in Units of Picocuries per Liter

Parameter	Concentration	Error	Det. Limit	Confidence Level
Gross Alpha	ND		1	
Gross Beta	NA			
Tritium	NA			
Total Solid	NA			
Chromium-51	NA			
Manganese-54	NA			
Iron-55	NA			
Iron-59	NA			
Cobalt-57	NA			
Cobalt-58	NA			
Cobalt-60	NA			
Nickel-63	NA			
Zinc-65	NA			
Gallium-67	NA			
Strontium-89	NA			
Strontium-90	NA			
Zirconium-95	NA			
Molybdenum-99	NA			
Technetium-99m	NA			
Ruthenium-103	NA			
Ruthenium-106	NA			
Indium-111	NA			
Iridium-192	NA			
Iodine-123	NA			
Iodine-125	NA			

Sample Number:

Lab Number: 6827RC

Parameter	Concentration	Error	Det. Limit	Confidence Level
Iodine-129	NA			
Iodine-131	NA			
Cesium-134	NA			
Cesium-137	NA			
Barium-140	NA			
Ytterbium-169	NA			
Carbon-14	NA			
Phosphorus-32	NA			
Radium-226	NA			
Radium-228	NA			
Gross Uranium	NA			
Potassium	NA			

All results are expressed at the 95% confidence level except as noted.

NA - Not Analyzed
ND - Not Detected

Analyst: FZ

Copy: PAM CHAFFEE (BER)
RAD LAB

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: PAM CHAFFEE--BER
Address:

Lab Number: 1963PT
Account Code: BER
Matrix: WATER

Locality: GULF CHEMICAL 03011234 CRESTLINE
Time Collected: 1435

Collected By: CHAFFEE/COOPER
Depth Collected: ****

Sample ID: NENWNWNE043425E
Date Collected: 4- 5-90
Date Received: 4- 9-90
Comments: MW7S DISSOLVED HEAVY METALS
Date Reported: 4-17-90

* *

Results expressed in Milligrams/Liter

Total Hard. (CaCO3)	294	pH	NA	Iron	0.25
		Turbidity	NA	Manganese	0.60
Calcium	90.0	Specific Cond.	NA	Arsenic	0.002
Magnesium	16.9	T. Dissolved Solids	NA	Barium	0.05
Sodium	173.8	Total Phosphorus (P)	NA	Cadmium	ND
Potassium	NA	Silica (SiO2)	NA	Chromium	ND
		Boron	NA	Copper	ND
Total Alk. (CaCO3)	99	Dissolved Oxygen	NA	Lead	0.001
		BOD	NA	Mercury	ND
Chloride	2.5	COD	NA	Selenium	ND
Sulfate	580	Ammonia (N)	NA	Silver	0.001
Nitrate (N)	3.70	T. Sus. Solids	NA	Zinc	0.13
Fluoride	0.20			Aluminum	NA
				Beryllium	NA
Cyanides	NA	Carbonate Hardness	99.0	Nickel	NA
Oil/Grease	NA	Non-Carbonate Hard.	NA	Antimony	NA
Phenols	NA	NaHCO3 Alkalinity	NA	Thallium	NA
TDP	NA	MBAS	NA		
Sulfide	NA	Flash Point	NA		

Chemist: FD

NA - Not Analyzed

ND - Not Detected

* *

Copy To: FILE

SPENCER CHEMICAL COMPANY

PROCESS DEVELOPMENT DEPARTMENT

APPLICATION FOR

SPECIAL NUCLEAR MATERIAL LICENSE

September 15, 1957

UNCLASSIFIED

Enclosure 1.

I
INTRODUCTION AND APPLICATION

his application for a special nuclear material license is submitted by Spencer Chemical Company. The company is incorporated in the state of Missouri and has its principal office in the Dwight Building in Kansas City, Missouri. The principal officers of the Company are:

K. A. Spencer - President

C. Y. Thomas - General Vice President (Operations)

J. P. Miller - General Vice President (Finance)

J. E. Culpepper - General Vice President (Marketing)

E. V. Friedrich - Vice President, Administration, and Assistant Secretary

J. R. Brown, Jr. - Vice President, Research and Development Division

J. C. Denton - Vice President, Agricultural Chemical Division

H. R. Dinges - Vice President, Industrial Chemical Division

F. L. Pyle - Vice President, Plastics Division

E. W. Morgan - Treasurer

A. Mag - Secretary

W. L. Elleman - Administrative Assistant

All these officers have their offices in the Dwight Building except for Mr. Mag whose address is 9 West Tenth Street, Kansas City, Missouri. All are natural born citizens of the United States. The company is not controlled by any alien, foreign corporation or foreign government.

This license is requested for the processing of any enrichment of uranium up to highly enriched. The uranium in the form of UF_6 or scrap is to be converted to the nitrate, or an oxide. The processing will be done at the Jayhawk Works of the Spencer Chemical Company located between Pittsburg, Kansas, and Joplin, Missouri, with a freight shipping designation of Military, Kansas.

The license is requested for 10 years.

Any enrichment of uranium up to highly enriched is to be processed. The uranium to be processed may be UF_6, a compound of uranium or a mixture of uranium and some metal such as might be generated in the fabrication of fuel elements. The product of the process will normally be finely divided UO_2 powder or pellets. When the nitrate is produced it will be in solution form. Oxides other than UO_2 may also be produced as finely divided powders or pellets.

The uranium will be processed for other licensees. Production is scheduled to begin December 1, 1957. The maximum design processing rate is 30 pounds of uranium per day. The actual processing rate will depend upon the exact nature of the feed material and upon customer demand. Inventory of U^{235} at the plant will not exceed 100 kg. Processing losses generally will be held to less than 1%, but may exceed this for small batches.

The Spencer Chemical Company is currently engaged in the manufacture of ammonia, nitric acid, N^{15}, polyethylene, nylon, urea, methanol and other similar products. It is accustomed to handling highly valuable materials on a commercial scale as exemplified by its current handling of a $200,000 inventory of platinum used as a catalyst. Also, the company has extensive experience in handling hydrogen and unstable compounds.

II
QUALIFICATIONS OF PERSONNEL

The processing of enriched uranium is the direct responsibility of L. H. Landrum, Director, Process Development. Mr. Landrum reports directly to Dr. John R. Brown, Jr., Vice President in charge of Research and Development for Spencer Chemical Company.

Dr. Brown holds a B.S. degree in chemistry from Oberlin College, an M.S. degree in chemistry from Ohio State and a Ph.D. degree in chemical engineering from Massachusetts Institute of Technology. From 1938 to 1946 Dr. Brown was employed by Esso Laboratories in Elizabeth, New Jersey, serving as assistant Director of the Chemical Division from 1941 through 1946. In 1946 he was made Director of Research for the Pro-phy-lac-tic Brush Company, a division of the Lambert Company in Florence, Massachusetts, and in 1949 transferred to the Lambert Pharmacal Company, a division of the Lambert Company, as Director of Research. In 1953 he became Vice President - Director of Research. Dr. Brown joined Spencer Chemical Company in August, 1953, as General Manager - Research and Development, and in February, 1957, became Vice President - Research and Development.

Mr. Landrum received his B.S. and M.S. degrees in Chemical Engineering from Missouri University and Washington University respectively. Before entering the atomic energy program, he had some ten years of industrial experience in process and engineering development with Carbide and Carbon Chemicals Corporation in South Charleston, West Virginia, and with Titanium Division of National Lead Company in St. Louis and Sayreville, New Jersey. He entered the atomic energy program in July, 1951, when American Cyanamid sent him to Oak Ridge as part of that company's contract with the Atomic Energy Commission to operate the Idaho Chemical Processing Plant. At Oak Ridge he was associated with the pilot plant at the X-10 laboratory and participated in the design of some special recovery facilities. He was transferred to Idaho Falls in December, 1951, and was placed in charge of Cyanamid's process engineering section. His efforts were directed toward design of facilities for recovering uranium from spent fuel used in the submarine reactors, and in studies connected with the main chemical processing plant.

Dr. Rankin graduated from Monmouth College in 1936 with a B.S. degree and a major in chemistry. He completed his M.S. and Ph.D. work at Purdue University in 1942 with a major in chemistry. He was employed at Penick and Ford, Ltd., Inc., as a research chemist during the years 1942-1943, and again in 1946-1947. In 1944-1945 he was naval officer in training activity. Dr. Rankin was employed as a research chemist and later as chief chemist of Lucidol Division, Wallace and Tiernan, Inc., whose principal products were peroxide catalysts and bleaching compounds. He joined Spencer Chemical Company in June, 1956, and was assigned to Process Development Department work on uranium scrap recovery and uranium dioxide production for the nuclear fuel cycles.

Dr. Mesler of the University of Kansas was consulted for criticality considerations. Dr. Mesler's background includes the Oak Ridge School of Reactor Technology, 1951-52, Ph.D., University of Michigan, 1955, Project Engineer for the Ford Nuclear Reactor and Assistant Professor of Nuclear Engineering, University of Michigan, 1955-1957. He is presently Associate Professor of Chemical Engineering at the University of Kansas.

III
PROCESSING AREA

The following equipment and facilities will be used to protect health and minimize danger to life and/or property.

The building used for uranium processing is a building formerly used as a high pressure laboratory. It is of frame construction containing 4 cells. These cells have a concrete roof and concrete walls on 3 sides, all a foot or more thick. One cell has been converted to a vault by adding a fourth concrete block wall. Another cell is used for the location of several storage vessels and a third cell for dissolving operations. The walls of these cells effectively isolate the contents criticalitywise, from anything outside.

The east end of the building has a partial second level. There is enough head room in the east end to accomodate the extraction columns and some other pieces of equipment. Lockers are provided at one end of the building for changing clothes. Film badges are provided for all personnel and ring film monitors are provided for those using the dry boxes. A Geiger counter survey meter with a range from 0.2 to 20 mr per hour is available for monitoring against contamination. Air sampling equipment and dust masks are available for monitoring building air. Film monitors will be mounted around the building to detect the occurrence of any spread of radioactivity.

A fence encompasses the entire Jayhawk plant works and entrance into the plant area is controlled by 24 hour guard force.

The concrete vault in the building is provided for storage of both raw materials and finished product. Another vault in a nearby building may also be used. Raw material will arrive in "always safe" geometry containers, packed in bird cages to maintain the necessary spacing between other containers. Watertight containers of "always safe" geometry along with their bird cages are provided for shipping out finished product.

IV
PRECAUTIONS FOR SAFETY

The following procedures are proposed to protect health and minimize danger to life and/or property.

All personnel working with uranium are required to pass a complete medical examination including chest x-ray before starting to work. Quarterly, or more frequently if justified, urine samples will be analyzed for uranium. Chest x-rays will be required annually. No smoking or eating will be allowed within the uranium processing building.

Good housekeeping will be exercised. Wet mopping will be performed in order to minimize air pollution.

Any minor spills (less than 20 grams) will be cleaned up immediately, both to recover the uranium and to avoid spread of contamination. Clean-up will be performed with rubber gloves and dust mask. Wash water will be collected and stored in safe containers awaiting return to process for recovery. Detergent may be useful for decontamination.

Major spills may necessitate orderly plant shutdown and reducing the inventory of uranium in the spill area to allow more freedom of movement. In handling cleanup solutions 1 liter graduates are to be used to transfer solution to safe storage, or transfer may be accomplished with small diameter tubing running to safe storage.

Clothing is to be monitored when leaving the building to prevent spread of contamination. The working areas will be continually surveyed for uranium on the floor and elsewhere.

Building and building exhaust air will be sampled to see that concentrations are below permissible limits of 5.0×10^{-11} and 1.7×10^{-12} microcuries per ml respectively.

Aqueous wastes will be discharged to the sanitary sewer which carries an average daily flow in excess of a million gallons away from the plant. The quantity of waste released to the sewer will be limited to that quantity which, if diluted by the average daily flow of sewage, will result in an average concentration less than 2×10^{-4} microcuries per ml. These conditions are set by Title 10, Part 20, Code of Federal Regulations.

Only one uranium container may be in motion at any one time and no uranium container may be moved unless all other uranium containers are in approved locations. No uranium container may enter the storage tank cell, the area behind the cells, or the main processing area. Chain guards prevent the movement of UF_6 cylinders, scrap containers, or finished material into these areas. A UF_6 cylinder and scrap may be safely moved by the processing area on the sidewalk outside the building.

Uranium containers are always to be in bird cages or in place in process except when removed and replaced one at a time.

Uranium shipments are to be shipped by Railway Express, Protective Signature. Shipment is to be made in bird cages with instructions to the carrier not to stack containers, but to secure them while in transit. No other enriched uranium shipment is to be handled in the same car. In the case of UF_6 cylinders, special additional instructions to the carrier will be as follows:

1. Avoid mechanical damage to container.

2. Protect from fire or excessive heat.

3. In case of leak as evidenced by a white fume, avoid exposure and notify shipper. Protect the public by prohibiting access to the general area.

The uranium processing building will be posted and uranium containers will be labeled according to Title 10, Part 20, Code of Federal Regulations. Outside shipping containers will be labeled according to ICC regulation.

Safe geometry storage is provided for all process streams. Before pumping any solution from safe storage to unsafe storage, it is to be sampled to assure that the uranium concentration is below 1 gram/liter. Unsafe vessels are to be inspected frequently for accumulation of uranium.

As much of the uranium inventory as possible will be kept in the vault where it is secure in the event of an emergency.

Fire in the frame constructed building presents three problems. First, the organic phase for extraction is inflammable. Second, the hydrogen is both inflammable and explosive. Third, water used in fighting a fire could mix with uranium and create a criticality condition. This is particularly true of the uranium in the dry box and furnaces. CO_2 will be used to control any fire in the uranium building and the plant fire department is instructed not to use water unless requested to do so by the uranium building supervisor. Care will be taken in handling UO_2 as it has been reported to burn. Explosion could occur as a result of the hydrogen, although precautions have been taken to prevent this. In the event of an explosion, the area will be surveyed for uranium containation.

Tornadoes are a possibility in Kansas. Material in the vault and in the vessel storage cell should be undisturbed by a tornado. Plant design is on the premise that a condition of criticality resulting from tornado damage would do negligible damage compared to that of the tornado.

The building site is 30 feet above any previous flood stage.

Loss of electrical power does not present any hazard except for loss of ventilation. Pumps, furnaces, vacuum system and dry box would be inoperative.

Criticality is avoided primarily by proper spacing of "always safe" geometry vessels. Concentration and mass control is exercised in handling dilute solutions. Mass and moderation control is exercised in handling dry UO_2 in the dry box, and in storing and shipping scrap uranium. A combination of mass, volume, and moderation control is used in specifying containers for shipping and storing UO_2 product. All safe parameters used are safe with a thick water reflector.

Process vessels are located so as to minimize interaction between vessels. In many instances advantage has been taken of the isolating effect of concrete walls thicker than 8". In other instances, spacing is used to minimize interaction.

A detailed process description, flow sheet and layout are presented in the Appendix with a discussion of the methods used for prevention of criticality.

V
INSURANCE COVERAGE

The company is negotiating for insurance to cover any possible loss of enriched uranium both while in process and in transit. Details of coverage will be supplied to the AEC when they are obtained.

VI
FINANCIAL QUALIFICATIONS

A copy of the 1957 annual report of the Spencer Chemical Company is submitted with this application in support of the company's financial qualifications to undertake the processing of enriched uranium.

SPENCER CHEMICAL COMPANY

PROCESS DEVELOPMENT DEPARTMENT

APPLICATION FOR

SPECIAL NUCLEAR MATERIAL LICENSE

September 15, 1957

APPENDIX I

A. PROCESS DESCRIPTION

This process is designed to produce primarily UO_2 from either UF_6 or scrap. The steps in the process include uranium dissolution, extraction, filtration, calcining, reducing, screening and grinding.

Starting with UF_6, a cylinder is first weighed and then placed in a heating chamber to liquefy the UF_6. The chamber is steam heated and the temperature is controlled at 160° F. A vacuum pump preceded by a cold trap and a chemical trap permits evacuation and leak testing of the UF_6 piping.

A batch of UF_6 for hydrolysis is prepared by filling a small vessel of safe design. Nitrogen is used to force UF_6 out of the UF_6 cylinder into a metering vessel and then to force UF_6 from this vessel into the hydrolyzer.

Before transferring UF_6 to the hydrolyzer, the hydrolyzer is first charged with an aqueous solution of $Al(NO_3)_3$. Acid may also be added to adjust the acidity.

The product of the hydrolyzer is transferred to one of two rich acid storage tanks, again with nitrogen pressure.

Starting with metallic scrap, a weighed quantity of the scrap is added to the empty dissolver. Acid is then added. The dissolver is fitted with a reflux condenser and with a jacket for heating and cooling the dissolver. After solution is developed, it is transferred to one of the rich acid storage tanks using nitrogen pressure.

Rich acid is pumped to the countercurrent extractor column using metering pump. An organic solvent is used as an extractant.

Rich acid and solvent flow to the extractor. The rich organic phase overflows from the extractor column into an intermediate storage tank. From this tank the rich organic is pumped to the stripper column. Raffinate from the extractor column exits through a jack leg to one of the two lean acid storage tanks. Here the lean acid is sampled and if the concentration of uranium is sufficiently low, it is then pumped to the remote aqueous waste tank or if the uranium concentration is too high for this routing, it will be recycled to process.

Water is the solvent in the stripper column. The stripped organic phase overflows to a system which continually cleans the solvent for reuse. The rich aqueous phase exits through a jack leg to the rich aqueous storage tank.

Rich aqueous is pumped continuously to the precipitator where ammonia is also added continuously. Slurry from the precipitator overflows to one of two filters. The filters remove water to produce a calciner feed.

Out of this furnace the material flows into the reducing furnace where reduction occurs. The reduced UO_2 from the second furnace is transferred to a dry box with a conveyor.

An inert helium atmosphere is maintained in the dry box so that the UO_2 can be screened and ground without oxidation.

B. PLANT LAYOUT AND EQUIPMENT DESCRIPTION

The building to house this facility is contained within the Jayhawk plant site. it is a two-level building with columns, furnaces, precipitator and filters in the two-story section. It is constructed of steel framework and covered by wooden siding. It contains four concrete cells originally built for conducting high pressure research work. Feed and product are stored in a vault in caged, safe containers. The flow of material is across a balance to the UF_6 heating chamber. Thence the uranium compounds flow through pipes and vessels. Movement of materials in other directions is hindered by chain guards.

Uranium scrap follows much the same path from the vault into the concrete cell containing the dissolver. Critically safe storage vessels are all located within another concrete cell.

Concrete trenches, lined with an acid-resistant coating are under these vessels. Accidental discharge of contents of any one of these vessels will be contained within trenches. The complete contents of more than 1 vessel would overflow into the cell. Similarly the columns, precipitator and filters are equipped with such trenches.

Various storage tanks for chemical feed solutions are on the north side. They are conveniently placed for the process and will contain no uranium. All feed to the aqueous recycle and remote aqueous waste tanks will have been analyzed and be at a low uranium level before storage.

The second level of the building at 11 feet covers approximately one quarter of the building. The floor consists of the tops of the concrete bays and access is obtained by stairway and walkway.

C. PREVENTION OF CRITICALITY

Many features of the process design are determined by the necessity of avoiding criticality. Criticality is the prime consideration in specifying shipping containers and in spacing and locating processing equipment.

Standard 5" Monel cylinders are used for transporting enriched UF_6. A bird cage keeps the cylinder upright and maintains a suitable axis to axis spacing between cylinders.

Containers for finished product of either UO_2 or uranyl nitrate solution have critically safe volumes and are watertight. The density of UO_2 packed, the volume of containers, the spacing of containers and the number of containers packed is such as to prevent forming a critical mass.

A heating chamber allows melting of UF_6 while keeping the UF_6 cylinder totally enclosed. The chamber is sized to allow the entire contents of a UF_6 cylinder to spill on the bottom without exceeding a "limited-safe" cylinder. Interaction between a portion spilled on the bottom and the remainder in the cylinder is prevented by spacing.

A dissolver with safe geometry allows dissolution of uranium feed material other than UF_6. It is located so as to be isolated from other uranium-containing vessels. The maximum quantity of U-235 which may be added to the dissolver is limited to a fully water reflected "limited-safe" mass the same as the shipping container above.

The extraction columns are within safe geometry through their own size and interspacing. Other equipment is separated for safe interaction. Auxiliary equipment for the columns consists in small tubing and pipe so as to maintain safe geometry.

Two furnaces are located in the same plane and spaced no less than 3-1/2'. The first furnace has a suitable ID so that when under no condition will the density of the uranium in this furnace exceed 3.2 grams of uranium-235 per cc, the furnace is of "always-safe" geometry. The second furnace has an ID of 6-1/2". The maximum depth of material in this furnace for effective operation is 1" which corresponds to about 12% of the cross-sectional area of the tube. Under no circumstances will it be possible for material to occupy more than 25% of the cross-sectional area of the tube. At 25% the area is equal to that of a 3-1/4" ID tube.

The precipitator and filters are on top of the storage vessel cell which has a 1'3" concrete slab as a roof. The concrete effectively isolates the precipitator and filter from other equipment. Both the precipitator and filter vessels are "critically safe". The precipitator is directly above one filter and the other filter is 2' away.

The feed end of the furnace is essentially the intersection of a 2" pipe teeing into 2" pipe. Experience with feeding a furnace has shown that there is no trouble with caking or buildup in the furnace tube. A short rod lying inside the furnace which rolls as the furnace turns has been found effective in insuring free flow through the furnace.

The feed end of the second furnace is essentially the intersection of a 2-1/2" pipe teeing into a 2" pipe. The discharge end contains a negligible holdup.

The first furnace is the most central item in the configuration and sees the precipitator, the filters, the second furnace, and other equipment including the closest extraction column. The precipitator and filter are partially isolated from the furnace by concrete, although this is not considered in analyzing for interaction. The total solid angle seen is less than 0.8 steradians.

The maximum quantity of uranium allowed in the dry box is limited to a safe mass and is based on a thick water reflector, on a maximum UO_2 density of 6.0 grams per cc and on an allowance for double batching. Inventory will be maintained low by daily packaging of all finished product.

The dry box has a controlled filtered atmosphere so that dust is not released into the building atmosphere. There are no water taps into the dry box and every precaution is taken to assure water (or any fluid hydrogenous material) never enters the dry box. A flange on the floor of the dry box permits loading product into finished product shipping containers.

The storage vessels in the cells are placed in two associated plane arrays. In each plane array the vessels are spaced critically safe. All tanks in the system which could conceivably contain U-235 at concentrations with significant amounts of uranium are of "always-safe" geometry.

Two tanks for very dilute uranium solutions are provided outside the building. Only after analyses are made to assure adequately low uranium concentration will solutions be pumped to these tanks. Since these tanks contain only dilute solutions of U-235, and because of their spacing, interaction is not a problem

Almost all piping which might conceivably carry a rich uranium solution is small tubing. Except for piping to a vessel, the closest approach of piping to a vessel is 8". ?

Metering pumps have such a small holdup volume that their criticality and interaction effects are negligible. Centrifugal pumps have even less holdup.

Spill pans are located under any vessel or point of operation where there might be a uranium leak. The pans are sized to allow accumulation from reasonable accidents without overflowing, and overflowing takes place into a curbed area, all designed to prevent appreciable interaction with other containers.

Several pieces of equipment will contain only minor amounts of uranium. These include the scrub columns, the cold trap, the chemical trap and the dry filter. The amount of uranium that these can contain is so small that their location is not considered in interaction.

SPENCER CHEMICAL COMPANY

NUCLEAR FUELS DEPARTMENT

70-340

APPLICATION FOR

SPECIAL NUCLEAR MATERIAL LICENSE

June 22, 1959

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APPENDIX

I

INTRODUCTION AND APPLICATION

1. This application for a special nuclear material license is submitted by Spencer Chemical Company. The company is incorporated in the state of Missouri and has its principal office in the Dwight Building in Kansas City, Missouri. The principal officers of the Company are:

K. A. Spencer - President

C. Y. Thomas - General Vice President (Operations)

J. P. Miller - General Vice President (Finance)

J. E. Culpepper - General Vice President (Marketing)

E. V. Friedrich - Vice President, Administration, and Assistant Secretary

J. C. Denton - Vice President, Agricultural Chemical Division

H. R. Dinges - Vice President, Industrial Chemicals Division

F. L. Pyle - Vice President, Plastics Division

N. C. Robertson - Vice President, Research and Development Division

E. W. Morgan - Treasurer

A. Mag - Secretary

2. All these officers have their offices in the Dwight Building except for Mr. Mag whose address is 9 West Tenth Street, Kansas City, Missouri. All are natural born citizens of the United States. The company is not controlled by any alien, foreign corporation or foreign government.

3. This license is requested for the processing of any enrichment of uranium up to and including 5%. The uranium in the form of UF_6 or scrap is to be converted to the oxide. The processing will be done at the Jayhawk Works of the Spencer Chemical Company located between Pittsburg, Kansas, and Joplin, Missouri, with a freight shipping designation of Military, Kansas.

4. The license is requested for ten years.

5. The product of the process normally will be finely divided UO_2 powder. Oxides other than UO_2 may also be produced as finely divided powders. Nitrates and sulphates may also be produced.

6. The uranium will be processed for other licensees. Plant start-up is scheduled for July 20, 1959. The maximum design processing rate is 300 pounds of uranium per day. The actual processing rate will depend upon the exact nature of the feed material and upon customer demand. Inventory of U-235 at the plant will not exceed 1,000 kilograms. Processing losses generally will be held to less

than one percent, but may exceed this for small lots.

7. The Spencer Chemical Company is currently engaged in the manufacture of ammonia, nitric acid, ammonium nitrate, polyethylene, nylon, urea, methanol and other similar products. Since December 1, 1957, Spencer has been operating a uranium oxide pilot plant (under license No. SNM-154) and has gained much valuable experience in the handling and processing of enriched uranium.

II

QUALIFICATIONS OF PERSONNEL

Landrum Process

1. The processing of uranium is the direct responsibility of Harold Lambertus, Manager, Nuclear Fuels. Mr. Lambertus reports directly to H. R. Dinges, Vice President, Industrial Chemicals Division.

2. Mr. Dinges received a B. S. degree in chemistry from College of William and Mary in 1938, where he also served as instructor from 1939 to 1941. He was employed by E. I. duPont de Nemours and Company 1941-42, and Olin Mathieson Chemical Company 1942-47 before joing Spencer Chemical Company in February, 1947. Since February, 1957, Mr. Dinges has been Vice President, Industrial Chemicals Division.

3. Mr. Lambertus received his B. S. and M. S. degrees in Mechanical Engineering from Purdue University and California Institute of Technology respectively. He was employed in 1946 by the American Bearing Corporation where he received a background in engineering, sales and production. He was a vice president at American Bearing prior to his leaving there in 1958, and was responsible for the planning, building and staffing of a nuclear fuel element manufacturing facility. Just prior to joining Spencer Chemical Company as Manager of the Nuclear Fuels Department in April, 1959, Mr. Lambertus served as a consultant to several manufacturers of nuclear fuel elements.

4. The operation of the uranium processing plant is the responsibility of George E. Chenoweth, Plant Superintendent. Mr. Chenoweth received a B. S. degree in chemical engineering from the University of Missouri in 1951. He was employed by Phillips Petroleum Company from 1951 to 1952, and joined Spencer Chemical Company in 1952. He has been responsible for much of the process equipment design for the experimental uranium facilities and has been in charge of the operation of the uranium pilot plant facility since January 1, 1959.

5. Mr. Sinesio A. Zagnoli has been responsible for a major portion of the process design. Mr. Zagnoli received his B. S. in chemical engineering from Purdue University and his M. S. in chemical engineering and M. S. in gas technology from Illinois Institute of Technology. He had some three years of industrial experience with petroleum and natural gas industry before his entry into

atomic energy activities in 1952. He entered the atomic energy program with Nuclear Power Group in Chicago representing the Commonwealth Edison Company. He participated in several studies made by the Public Service Company of Northern Illinois and Commonwealth Edison Company before the latter joined Nuclear Power Group. With NPG Mr. Zagnoli's work was with heat transfer, fuels processing and fuel element metallurgy. He joined Spencer Chemical Company in October 1955, and has helped plan and design experimental programs and facilities, and has made economic analyses of various projects in the atomic energy field.

6. Dr. Russell A. Mesler of the University of Kansas is our consultant for criticality considerations. Dr. Mesler's background includes the Oak Ridge School of Reactor Technology 1951-52; Ph.D., University of Michigan 1955; Project Engineer for Ford Nuclear Reactor and Assistant Professor of Nuclear Engineering, University of Michigan, 1955-57. He is presently Associate Professor of Chemical Engineering at the University of Kansas.

III

PROCESSING AREA

1. The following equipment and facilities will be used to protect health and minimize danger to life and/or property.

2. The building used for uranium processing is constructed of a steel framework and covered with transite siding. The building measures 45' x 112' and is 30' high except for a 50' high bay in the center of the building.

3. The processing equipment will be located along the east half of the building only. Storage area has been provided in the west side of the building.

4. A fence encompasses the entire Jayhawk plant works and entrance into the plant area is controlled by a 24-hour guard force.

5. Tornadoes are a possibility in Kansas. Plant design is on the premise that a condition of criticality resulting from tornado damage would do negligible damage compared to that of a tornado.

6. The building site is 30 feet above any previous flood stage.

7. Loss of electrical power presents the hazards of loss of ventilation and an inoperative radiation alarm system.

8. In compliance with section 70.24 a radiation alarm system will be installed in the plant. Two detectors will be located in the plant, one on the ground level near the hydrolysis and scrap dissolution area and one on the first balcony at the panel board. These positions are indicated on the plot plan

(Drawing No. 1-2600-4). Outside alarm horns will also be connected to these alarms which will be clearly audible in the surrounding area.

9. The monitoring system to be installed is the Nuclear Measurements Corporation Gamma Alarm system (GA-2). This system consists of individual integral units containing the detector, power supply, meter, alarm bell, alarm lights and relays for connecting external warning devices.

10. These units will be set to give an alarm when the meter reads 6 mr/hr. or more. The time constant of this instrument is 2 seconds so that a 6 mr/hr reading would occur after the following delay times when the radiation level at the detector is instantaneously changed to a higher value:

50 mr/hr	0.236 sec.
100 mr/hr	0.118 sec.
500 mr/hr	0.024 sec.

Once the meter reads 6 mr/hr, the alarm would sound within 0.1 second. The response time will be verified by tests after the system is installed.

11. The detector will be activated by a low level source installed at the probe so that the meter reads at least 0.1 mr/hr under normal conditions. If failure of the instrument causes the meter to drop to 0.05 mr/hr, a light on the unit (normally on) will go out. Another light on the unit indicates the instrument is drawing current.

IV

PRECAUTIONS FOR SAFETY

1. The following procedures are proposed to protect health and minimize danger to life and/or property.

2. All personnel working with uranium are required to pass a complete medical examination including a chest x-ray before starting to work. Monthly urine samples will be analyzed for uranium. Chest x-rays will be required annually. No smoking or eating will be permitted in the uranium processing building.

3. Coveralls, safety shoes, safety glasses, acid goggles, dust masks, and rubber gloves are furnished for all personnel working in the plant. A change house and locker room are provided so clothing may be changed before entering the plant area. A washing machine is provided and coveralls must be washed daily after use. Individual film badges are provided and are checked monthly.

4. Good housekeeping will be exercised. Wet mopping will be performed in order to minimize air polution.

5. Any minor spills will be cleaned up immediately both to recover the uranium and to avoid spread of contamination. Clean-up solutions will be stored in safe containers awaiting return to the process. Major spills may necessitate orderly plant shutdown and reducing of the inventory of uranium in the spill area to allow more freedom of movement.

6. Portable Geiger counters will be available in the plant for surveying working areas for contamination. Building and exhaust air will be sampled to see that concentrations are below permissible limits of 5.0×10^{-11} and 1.7×10^{-12} microcuries per ml respectively.

7. Aqueous wastes will be discharged to the sewer which carries an average daily flow in excess of ten million gallons away from the plant. The quantity of waste released to the sewer will be limited to a quantity which, if diluted by the average daily flow of sewage, will result in an average concentration less than 2×10^{-4} microcuries per ml. These conditions are set by Title 10, Part 20, Code of Federal Regulations.

8. Only one uranium container may be in motion at any one time and no uranium container may be moved unless all other uranium containers are in approved locations.

9. The uranium processing building will be posted and uranium containers will be labelled according to Title 10, Part 20, Code of Federal Regulations. Outside shipping containers will be labelled according to ICC regulations.

10. Safe geometry storage is provided for all process streams. Before pumping any solution from safe waste storage tanks to the sewer, it is to be sampled to assure that the uranium concentration is below the permissible level.

11. While the building housing the plant is essentially fireproof, a fire in the processing area presents three problems. First, the organic phase for extraction is inflammable. Second, the reducing atmosphere in the furnace is both inflammable and explosive. Third, water used in fighting a fire could mix with uranium and create a criticality condition. CO_2 will be used to control any fire in the uranium building and the plant fire department is instructed not to use water unless requested to do so by the Plant Supervisor. Precautions have been taken to prevent explosions of the atmosphere in the furnace. In the event of a fire or explosion, the area will be surveyed for uranium contamination prior to re-entry.

12. The radiation alarm detectors will be checked hourly and the meter reading recorded on log sheets. The built-in low-level source provides a calibration check at one point. A portable source will be used to check the instrument at higher levels. The calibration will be checked once per week.

13. A training program will be initiated for all personnel who would be affected by a high radiation incident. Instructional meetings will be held for all people involved in the handling and processing of uranium to familiarize them with the alarm system and the proper procedures for evacuating the area in the event of a radiation incident. Unannounced practice evacuation drills will be held once a week the first month, another one a month later and then once every three months.

14. Criticality is avoided primarily by proper spacing of "always safe" geometry vessels. Concentration and mass control is exercised in handling dilute solutions. Mass and moderation control is exercised in handling dry UO_2 and in shipping and storing scrap uranium. A combination of mass, volume and moderation control is used in specifying containers for shipping and storing UO_2 product. All safe parameters are safe with a thick water reflector. The interaction between all vessels containing uranium in significant concentrations is within allowable limits.

15. A process description and equipment layout are presented in the appendix with a discussion of methods used for prevention of criticality.

V

FINANCIAL QUALIFICATIONS

1. A copy of the 1958 annual report of the Spencer Chemical Company is submitted with this application in support of the company's financial qualifications to handle enriched uranium.

APPENDIX

I. PROCESS DESCRIPTION

1. This process is designed to produce primarily UO_2 from either UF_6 or scrap. With UF_6 as a starting material, a cylinder is weighed and then vaporized using steam heat. A vacuum pump preceded by a cold trap and a chemical trap permits evacuation and leak testing of the UF_6 piping.

2. The UF_6 is hydrolyzed by admitting the gas into a circulating stream of $AL(NO_3)_3$. Acid may also be added to adjust the acidity. The hydrolysis solution is transferred to rich acid storage.

3. With scrap UO_2 pellets, a weighed quantity of scrap is added to the empty dissolver and HNO_3 circulated through it and a rich acid storage tank until the desired concentration is reached. The dissolver vessel is jacketed to provide for heating or cooling.

4. Since "off-spec" product may be produced from time to time, provision is made for recycling it through the process. This scrap UO_2 powder is dissolved in a kettle using always mass safe batches, and then pumped to the rich acid storage tanks.

5. The rich acid is pumped to a countercurrent pulse extraction column. A solution of tri-butyl-phosphate in kerosene is used as the solvent. The rich organic phase from the extractor overflows to the scrub column. The raffinate flows to the waste storage tanks where it is sampled. From here it is either drained to the sewer or recycled to the system depending on the uranium concentration.

6. In the scrub column the rich organic is contacted with water. The water is recycled to the extraction column and the rich organic flows to the stripper where the uranium is stripped from it with water. The stripped organic phase overflows to a system which continuously cleans the solvent for reuse. The rich aqueous phase is fed to an evaporator to concentrate it and then precipitated with ammonia.

7. The ammonium diuranate precipitate is reduced to UO_2 in an electrically heated furnace. The UO_2 product is discharged through a mill to hoppers where it is sampled for moisture and other properties prior to being charged to the blender.

8. A dry atmosphere is maintained in the blender. Mass and moderation limits are used to determine the size of lots blended. After blending the UO_2 is discharged into approved shipping containers.

Appendix

II. PLANT LAYOUT AND EQUIPMENT DESCRIPTION

1. The building to house this facility is contained within the Jayhawk plant site. It is constructed of steel framework and covered with transite siding. All processing equipment is located along the east half of the building. High equipment such as the extraction columns is located in the 50' high bay in the center of the building. Layout of the equipment is shown on drawings 1-2600-4 and 1-2600-802.

2. The east wall behind the tanks and equipment is lined with stainless steel sheet to facilitate clean-up of spills and splashes. A stainless steel drip pan is provided along this wall under the equipment to contain leaks and spills. There are no floor drains to eliminate the possibility of a spill being lost to the sewer.

3. The UO_2 scrap pellet dissolver is 8.25" I.D. The dissolver for "off-spec" UO_2 powder is a kettle and will be used with mass safe batches. The cold trap is of 4" pipe and the evaporator is 8" Sch. 10 pipe. The pulse columns are 4" pipe with 8" pipe end section. All uranium-containing storage tanks are 10.25" maximum I.D.

4. The UF_6 cylinders are vaporized in a closed room. This room is provided with adequate forced ventilation. The exhaust air from the room is drawn through a scrubbing system to remove any UF_6 vapors. A fluorine detector is located in the duct carrying air from the room to detect any UF_6 leaks. The same fume scrubber system also is connected to a hood over the UO_2 powder dissolver to recover any uranium carry-over from the dissolutions.

5. Storage area is provided in the southwest quadrant of the processing building for feed materials and/or packaged product. Safe spacing will be maintained on all containers of uranium stored in this area. If more space is required, UF_6 cylinders may be stored outside in their bird cages on a concrete pad near the southwest corner of the building.

III. CRITICALITY CONSIDERATIONS

A. Criticality With UF_6 Feed

1. UF_6 in cylinders at enrichments no greater than 5% U-235 will be removed from storage or brought directly to the southwest corner of the processing area. Cylinders will be transported into the processing area on a monorail and placed in stations provided for the vaporization of the UF_6. With full UF_6 cylinders at all stations, the total U-235 inventory will be 66 kilograms. According to TID-7016, page 9, there are no mass limits on a non-hydrogenous chemical compound with a U-235/U-238 ratio of .05. The individual cylinders are spaced at distances of greater than 1 foot edge-to-edge according to K-1019 Rev. 4, page 25.

2. The UF_6 is reacted with water and the resulting solution is stored in vessels R-1, R-2, R-3, R-4, T-1, T-2, T-3, and T-4. The maximum concentration of uranium in these solutions is 100 grams per liter which corresponds to a maximum U-235 concentration of 5 grams per liter for 5% U-235 enrichments. According to K-1019 Rev. 4, page 20, 5.0 grams of U-235 per liter is an "always-safe" parameter. Further, according to page 24, interaction need not be considered for homogeneous solutions with a U-235 concentration no greater than 5 grams per liter. Vessels R-1, R-2, R-3, R-4, T-1, T-2, T-3 and T-4, are all 10-1/4 inch diameter vessels which is a "limited safe" parameter according to K-1019 Rev. 4, page 21, for 5% enrichment and below.

3. The UF_6 solution is pumped to the extraction columns where the uranium is extracted into an organic solution of TBP. The minimum ratio of H to U-235 in the organic phase is 6320. According to TID-7016, page 9, there are no restrictions for solutions if the atomic ratio of H/U-235 is greater than 2300. The maximum concentration of U-235 in the aqueous stream from the strip column (TA-3) is again 5 grams U-235 per liter for 5% U-235. In addition, the columns are 4 inches diameter with 8 inch separating sections. This stream flows to the neutralizer where the uranium concentration is slightly decreased. The neutralizer is a 10-1/4 inch diameter vessel as an extra precaution.

4. Out of the neutralizer the stream flows to E-3 on the first balcony. In E-3 the uranium concentration is increased to 450 grams per liter (22.5 grams U-235 per liter at 5% enrichment). E-3 is an 8 inch pipe with a 2 inch leg. By comparison to a "limited-safe" diameter of 10.25 inches, E-3 is considered safe. Interaction has been calculated between the evaporator and (1) the furnace, (2) vessel R-9, (3) the UO_2 hoppers, T-18 and T-19, (4) the blender M-5, (5) UO_2 packages on the first and second floors, and (6) vessels T-13 and T-14. The total solid angle viewed of these is less than 0.5 steradians.

5. The stream from E-3 is stored in two vessels, T-13 and T-14. These vessels are 10-1/4 inches I.D. x 8 feet tall, so that they are safe. Interaction must be considered between each other and the blender. The total interaction is .9 steradian which is less than the allowable 1.0 (K-1019 Rev. 4, page 24.)

6. From R-13 and R-14 the rich aqueous is pumped to R-9 on the second balcony. R-9 is a 10.25 inch diameter vessel. It sees even less than the neutralizer (R-8) which sees .50 steradians so that interaction is safe.

7. The product from R-9 is transferred to the furnace. The furnace proper is fitted with a 9 inch I.D. liner. The feed screw drops the uranium bearing material onto this furnace liner. There are three screws each operating in 2 inch pipe conveying the uranium. The furnace gases pass countercurrent to the uranium, and conceivably could carry light dried material into the breech where the gases leave the furnace. No significant carryover has ever been observed. The volume in the breech is .625 cubic foot compared to a safe volume of .95 cubic foot. The gas discharge line is steam traced to prevent condensation in the gas line before the condenser.

8. The furnace tube itself never operates more than one quarter full. It discharges into a breech of 1.465 cubic feet capacity. At a discharge rate of .25 cubic foot per hour, hourly inspection will prevent anything approaching an unsafe accumulation. Should the furnace exit gas temperature fall 50° below its normal value, the feed to the furnace will be shut off automatically. The furnace sees less than .9 steradians which is safe.

9. The furnace discharges into T-18 and T-19. The quantity of UO_2 allowed to accumulate in T-18 or T-19 will be kept below the safe amounts as limited by enrichment. (Table XVII, K-1019 Rev. 4). These vessels each have a k of .65 because they are mass safe (K-1019 Rev. 4, page 26). The allowable solid angle is 2.51 compared with an actual value of 1.28 steradians.

10. After a moisture analysis has been obtained on their contents, T-18 or T-19 can either be transferred to M-5 or to storage.

11. The entire inventory of UO_2 in M-5, SC-1 and at the bullion balance is limited to a safe mass quantity as limited by moderation. Table XIX of K-1019 Rev. 4 will be used to specify the safe mass to that corresponding to the highest H/U-235 ratio of any material added to the inventory. Table XIX is for UF_6, but since the density of UO_2 here is no greater than for UF_6, the table is applicable. The maximum solid angle of interaction at M-5, SC-1 or the bullion balance is .77 compared to a safe interaction of 1.0 steradians.

12. After filling the UO_2 containers, they are spaced at least one foot edge-to-edge from each other while they are weighed and transported to storage.

B. UO_2 Feed

1. General

a. The criticality conditions of the uranium process using UF_6 feed have already been described. Use of UO_2 feed alters the situation in the following respects:

(1) Dissolution of fired UO_2 represents a special problem because of the high density of fired UO_2.

(2) The solutions produced from UO_2 dissolution are more concentrated than those produced from UF_6.

b. The portion of the plant beyond the extraction columns operates the same regardless of the feed. However, there is more interaction which must be considered.

c. There are two types of UO_2 -- high density and low density. High density UO_2 is that which has been pressed and fired, while the low density material is characteristic of scrap generated in the process.

2. Low Density UO_2 Dissolution

a. Low density UO_2 (less than 3 grams per ml) is batch dissolved in R-5. The charge into R-5 is limited to the mass limits shown in Table XVII of K-1019 Rev. 4, page 22.

b. The UO_2 scrap is generated at T-18 and T-19. The scrap is drained from the hopper into a 5 gallon pail on the first balcony. After each pail is filled, it is carried down the north stairs to the first floor where it is weighed on SC-1. The pails will be marked with the weight and assay. From weighing, the pail is carried either to storage, or is carried to R-5. The route taken is to be over to the west side of the process line to the south stairs and up them to the UO_2 dissolver.

c. When dissolving a batch of low density UO_2, R-5 is first emptied. Then the safe mass or less is carried in 5 gallon pails to the dissolver. Never will the total quantity of uranium in the vicinity of R-5 or within R-5 exceed a safe mass. Before making up a batch, the supervisor is to certify that the quantity of uranium in pails is a safe batch.

d. When a batch is dissolved, it is pumped to storage. A check valve and a manually operated valve prevent solution in storage from increasing the uranium in R-5.

3. High Density UO_2 Dissolution

a. High density UO_2 is dissolved in R-13 which has safe dimensions. The UO_2 is hoisted to the first balcony on a monorail at the southwest corner of the process. The monorail carries the UO_2 to the north side of R-13. Only that amount of UO_2 which R-13 can accomodate at any one time is hoisted. The UO_2 is dumped into R-13. The total amount of UO_2 being added to R-13 is mass safe by moderation. R-13 must be emptied prior to re-charging.

b. The safe diameter for R-13 was determined in the following fashion: Calculations in HW-57861, page 24, show the maximum buckling for 5% U-235 metallic uranium rod in water lattices to be 150×10^{-4} cm^{-2}. Values for other parameters, near this maximum buckling, are as follows:

$$k_{\infty} = 1.65$$

$$L^2 = 1.1 \text{ cm}^2$$

$$\tau = 32.5 \text{ cm}^2$$

For an 8.25 inch diameter vessel, K-1380, page I-13 to 15, shows $B_1^2 = .0344$, $B_2^2 = 0.049$. The value for k effective is:

$$k = \frac{k_{\infty} e^{-B_1^2 \tau}}{1 + L^2 B_2^2} = 0.513$$

A value of 10.25 for the radius gives k = .7, but the actual vessel radius of 8.25 is specified as an added factor of safety. Another safety factor is included because UO_2 with its lower density shows lower maximum buckling than does the metallic uranium as discussed in HW-57861, page 19.

c. The random placement of the rods when merely dumped into a vessel presents some uncertainty. Lattice values given above are for orderly spaced, uniform rods. Preliminary experiments mentioned in HW-56919, page 20, indicate the randomness tends to lower the buckling. This was assumed also in TID-7016, page 21.

d. Interaction between R-13 and its neighbors is less than 1.75 steradians compared to an allowable of 3.9 steradians (see Table I).

4. Allowable Interactions With UO_2 Feed

a. The interactions between all vessels which contain uranium at concentrations above 5 grams U-235/liter with UO_2 feed have been conservatively estimated by the methods given in TID-7016, page 14. These estimates are shown in Table I. Where the

Table I

Vessel	Diameter (Inches)	Contents	Interaction (Steradians)
E-3	8.25	b*	1.6
F-4	7.75	a*	2.8
F-5	7.75	a	2.5
KL-1	9.0	---	2.32
M-5	---	UO_2	1.15
R-1	10.25	a	1.56
R-2	10.25	a	1.91
R-3	10.25	a	1.65
R-4	10.25	a	1.97
R-5	22.0	a	.45
R-8	10.25	a	1.56
R-9	10.25	b	.93
R-13	8.25	---	1.73
SC-1	---	UO_2	2.05
T-1	10.25	a	1.92
T-2	10.25	a	1.98
T-3	10.25	a	2.22
T-4	10.25	a	1.83
T-13	10.25	b	.86
T-14	10.25	b	.86
T-18 & T-19	9.0	UO_2	2.28
TA-1	4 & 8	a	1.80
Bullion Bal.	---	UO_2	1.92

"a" and "b" are process solutions containing uranium

interaction is below one steradian, there is no limit on what may be placed in the vessels since each vessel is "always-safe". The basis for this is a statement in K-1019 Rev. 4, page 25, which states that if the vessels meet "always-safe" parameters the k value may be assumed equal to 0.8 for which the maximum solid angle is 1.0 steradian.

b. For those vessels where the interaction is greater than one steradian, a limit is placed on the maximum concentration or mass of U-235 which can be placed in these vessels.

c. Uranium in the process is contained in aqueous solutions in two different concentrations above 5 grams U-235 per liter. The more dilute of these two is designated solution "a" in Table I, while the more concentrated solution is designated "b".

d. The maximum permissible concentration for solution "a" is calculated as follows: Among the vessels containing solution "a" and excluding F-4 and F-5, the maximum interaction is encountered with vessel T-3 at 2.215 steradians. The next highest is T-2 at 1.982 steradians. The maximum k for an allowable 2 steradians is 0.713 (K-1019 Rev. 4, page 39). Now $k = \eta f \, U_f \, U_{th}$ (page I-9, K-1380).

Assume $U_{th} = 1$ (conservative estimate)

$B_1^2 = .0242$ for D = 10.25" (K-1380, page I-13)

$U_f = .596$ (K-1380, page I-14)

$$\eta f = \frac{k}{U_f} = \frac{.713}{.596} = 1.195$$

This is the maximum value for ηf. Assuming the solution contains nitrogen, hydrogen, U-238 and U-235, an ηf less than 1.195 requires the following quantity to be greater than 455.

$$\frac{1.88\ N}{U\text{-}235} + \frac{.33\ H}{U\text{-}235} > 455,$$

where N/U-235 is the ratio of nitrogen atoms to U-235 atoms and similarly for H/U-235. If T-3 is in the system, this must be greater than 510.

e. Returning to F-4 and F-5, these vessels have a diameter of 7-3/4 inches and have an allowable solid angle of 3.5 when $\eta f = 1.195$. The allowable solid angle for R-13 was discussed above.

f. The maximum concentration of solution "b" is such that the minimum H/U-235 is 920. Under these conditions the maximum ηf is 1.36. This concentration gives the maximum allowable interaction for E-3 of 2.26 compared to the actual 1.6. T-13, T-14 and R-9 all have interactions less than 1 steradian.

g. The furnace has an I.D. of 9 inches. However, it never runs more than 25% full. This gives it an equivalent diameter less than 5 inches. The safe interaction for a 5 inch pipe is 3.2 steradians (Table XX, K-1019 Rev. 4) compared to the actual value of 2.32.

h. The quantity of UO_2 allowed in either T-18 or T-19 is limited to the safe mass as limited by enrichment, (Table XVII, K-1019 Rev. 4). The k for these mass safe vessels is taken as 0.65 (K-1019 Rev. 4, page 26), so that the allowable solid angle is 2.51 compared to the actual value of 2.28.

i. After a moisture analysis has been obtained on their contents, T-18 or T-19 can either be transferred to M-5 or to storage.

j. The entire inventory of UO_2 in M-5, SC-1 and at the bullion balance is limited to a mass safe quantity as limited by moderation. Table XIX of K-1019 Rev. 4 will be used to specify the safe mass to that corresponding to the highest H/U-235 ratio of any material added to the inventory. Table XIX is for UF_6, but since the density of UO_2 here is no greater than the density of UF_6, the table is applicable.

k. The k value for this total mass is taken as 0.65. This is in accordance with K-1019 Rev. 4, page 26 for safe masses. Although this reference is not specifically justified in this instance, a value of .65 is considered conservative for two reasons. First the uranium is at most 5% enriched, while Table XIX is for any enrichment. Secondly, all the mass will not be accumulated in a configuration approaching an optimum arrangement. For a k of .65, the allowable interaction is 2.51 steradians. The maximum interaction from M-5, SC-1 or the bullion balance is 2.05 steradians.

l. Almost all piping which might conceivably carry uranium solution is 1/2 inch which presents no interaction problem (K-1019 Rev. 4, page 24). In the front of the process, sizes no greater than 3 inches are used sparingly. They are all spaced at least 2 feet from any vessel and enter the vessels either near the top or bottom so that they are safe.

m. Drip pans beneath process vessels overflow at 1/2 inch so that they are safe (K-1019 Rev., page 24).

n. All pumps and pulsers are located on the floor and are of safe volume, each having less than a gallon holdup. They are included in interaction calculations as extensions of the process vessels.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

IN REPLY REFER TO.

LR:JJL
70-146

Spencer Chemical Company
Dwight Building
Kansas City 5, Missouri

Attention: Mr. N. A. Greenlee

Gentlemen:

In view of the pending changes in the corporate structure of your company, which may necessitate the transfer of your present licenses to another corporate entity, we have reevaluated the scope of your present authority as well as your pending application dated September 20, 1961.

Your Special Nuclear Material License No. SNM-154, as amended September 11, 1961, included authorization to ship ceramic UO_2 at enrichments up to and including six per cent (6%) U-235 in accordance with procedures submitted in your application dated August 3, 1961. Your application dated September 20, 1961, requested amendment of this license to authorize the shipping of fused UO_2 at enrichments up to and including five per cent (5) U-235.

In both applications the safe container capacity principle was used to justify the nuclear safety of the proposed shipments. The safe container capacity principle incorporates a nuclear safety factor of 1.33. However, in order to maintain this factor of safety it is necessary that the package containing the special nuclear material be of sufficient structural integrity to retain the special nuclear material in the event of an accident. Accordingly, we require the material to be packaged in inner containers meeting the following specifications:

1. Resistance to crushing and fracture shall be at least equivalent to that provided by Schedule 40 steel pipe.

2. The bottom shall be equivalent to a steel plate, at least equal in thickness to the wall of the pipe, welded or threaded to the bottom of the container.

AIR MAIL

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From GO - Hdqrs

3. The top closure shall be equivalent in strength and leaktightness to the container itself. A properly designed flanged and gasketed cover would meet this requirement.

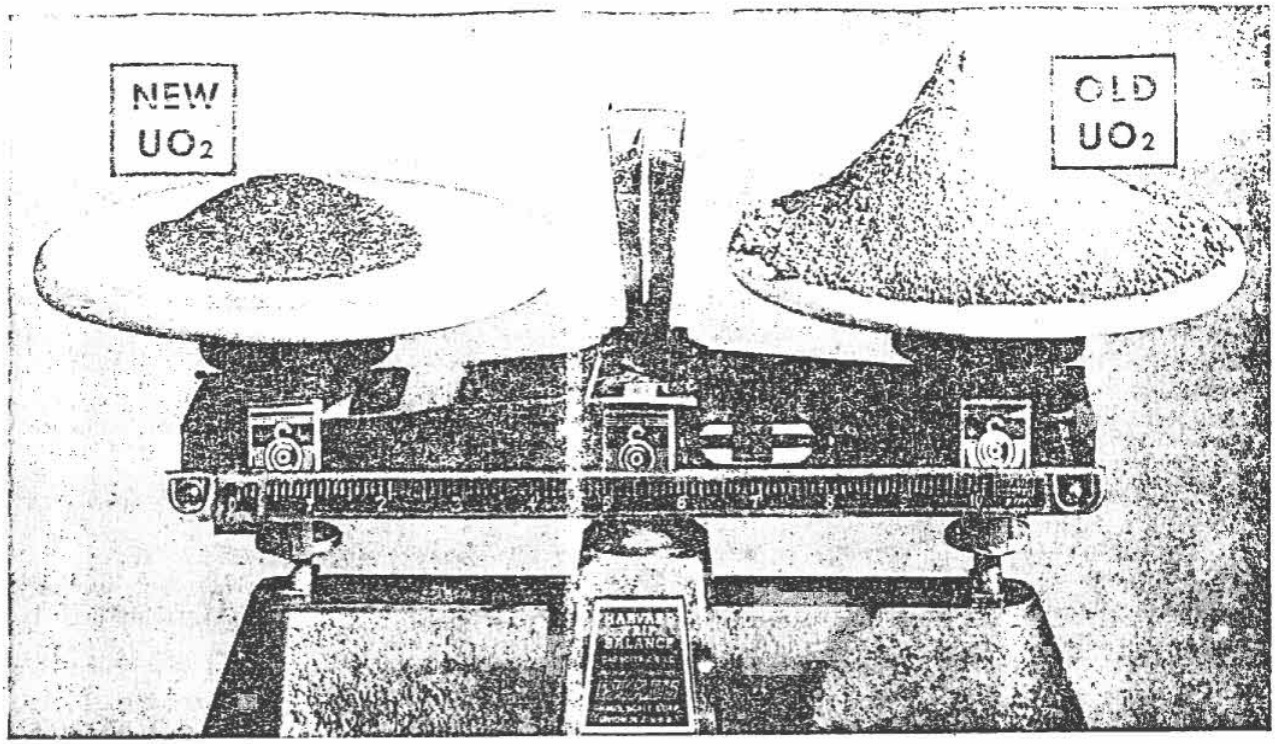
The use of light gauge metal pails for inner-containers, as described in your application of September 20, 1961, does not meet these packaging specifications; therefore, your application of that date is hereby denied without prejudice to the resubmission of a new application which takes into account the packaging requirements outlined above for those shipments where nuclear safety is based upon safe container capacity limits.

Further, we find upon review of shipping procedures in your Docket 70-1146 that the use of such pails was previously requested in your application dated August 3, 1961, with nuclear safety based on the safe container capacity principle, and was authorized by amendment to your license SNM-1514 on September 11, 1961. Since this authorization is no longer compatible with the safe-packaging criteria specified above, please advise us within thirty (30) days from the date of this letter of your plans for modification of this shipping container to take into account the packaging specifications outlined above.

FOR THE ATOMIC ENERGY COMMISSION

Lyall Johnson
Assistant Director for
Materials Licensing
Division of Licensing and Regulation

Distribution:
Compliance Hdqrs (2)



On this scale are equal weights of Spencer's new fused uranium dioxide (left) and old-type ceramic uranium dioxide. Because of its high density and great purity, Spencer fused UO_2 is considered a major breakthrough in the economical fabrication of fuel element core material.

Spencer Chemical Company Announces New Crystalline Nuclear Fuel Materials

In the ever increasing efforts of American industry to attain economically competitive electrical power from nuclear fuels, considerable attention has been focused upon fuel fabrication costs.

After concentrated research and development in this area, Spencer Chemical Company is proud to announce its new family of crystalline fuel materials that can be fabricated by simple and inexpensive techniques.

The new Spencer fused UO_2 was one of the fuels selected by the Hanford Works of the U. S. AEC, operated by the General Electric Company.

Recently in the United States—United Kingdom exchange of information under the Libby-Cockroft agreement, Hanford reported:

"A 6,000 lb. lot of arc-fused UO_2 was received from Spencer Chemical Company. The material meets our rigid specifications for purity and density. This amounts to a significant break-through in the preparation of fuel element core material. The UO_2 will be fabricated into both swaged and vibrationally compacted PRTR (Plutonium Recycle Test Reactor) fuel rods."

Initial irradiation tests indicate that the quality of the nuclear fuel will increase while the costs of fabrication are lowered.

Crystalline fuel materials currently available are:
Uranium Dioxide (UO_2)
Thorium Dioxide (ThO_2)
Urania-Thoria in solid solution (UO_2-ThO_2)
Triuranium Octoxide (U_3O_8)
Uranium Monocarbide (UC)
Uranium Dicarbide (UC_2)

For more detailed information on Spencer's new crystalline nuclear fuel materials, contact Spencer Nuclear Fuels Department at address below.

From: Chadron St. U. Stud. 12/1/87 74

SPENCER NUCLEAR FUELS

Produced by

SPENCER®

Spencer Chemical Company

America's Growing Name In Chemicals

General Offices: Dwight Building, Kansas City 5, Missouri

SEP 3 1962

Donald I. Walker, Director
Region IV, Division of Compliance

Roger T. Woolsey, Radiation Specialist (Reviewer)
Region IV, Division of Compliance

Original signed by
Roger T. Woolsey

SPENCER CHEMICAL, PITTSBURG, KANSAS

CO:IV:RTW

Recent correspondence indicates that this firm has been purchased by Kerr-McGee, and that they plan to move their operations to the "State" of Oklahoma.

Suggest that we determine what actions they plan to take towards releasing their present site.

cc: Glen Brown, Radiation Specialist (Supervisory)
Region IV, Division of Compliance

OFFICE ▶	CO:IV					
SURNAME ▶	RTWoolsey:ew					
DATE ▶	9/3/62					

Form AEC-318 (Rev. 9-63)

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KERR-McGEE OIL INDUSTRIES, INC.

Kerr-McGee Building • Oklahoma City 2, Oklahoma

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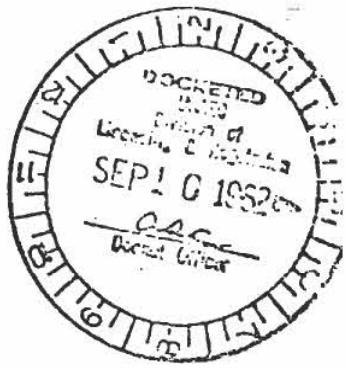

September 6, 1962

Mr. Lyall Johnson
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Johnson:

Kerr-McGee Oil Industries, Inc. recently forwarded a request for a source material license in connection with the work being performed by the Department acquired from Spencer Chemical Company. It is anticipated that in the very near future we will also be forwarding a request for a special nuclear material license involved in the same area of work.

It would be appreciated if you would mark your records to indicate that all communications concerning these licenses should be directed to Kerr-McGee as follows:

Mr. Harold Lambertus, General Manager
Nuclear Products Department
Kerr-McGee Oil Industries, Inc.
Kerr-McGee Building
Oklahoma City 2, Oklahoma

Yours very truly,

KERR-McGEE OIL INDUSTRIES, INC.

George H. Coob
Vice-President, Minerals

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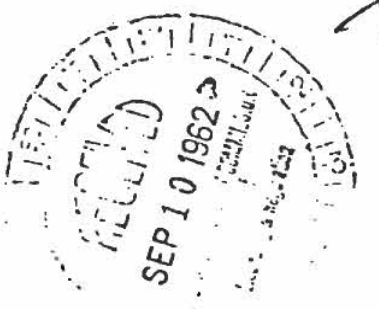


For Director of Compliance

SPENCER CHEMICAL COMPANY
Research Center
9009 West 67th Street
Merriam, Kansas

November 20, 1962

Mr. Lyall Johnson
Assistant Director for Materials Licensing
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D.C.

Dear Mr. Johnson:

This is in reply to your letter dated October 26, 1962, referring to our Special Nuclear Material License SNM-154 and our letters of August 3 and September 20, 1961.

The last shipment of enriched uranium held under SNM-154 was made to Station CCC on May 12, 1961. Our Material Status Report (AEC-578) for the period ending June 30, 1962, reported that Spencer had no special nuclear material on hand, and none has been received since that time.

Since we have discontinued all activities with special nuclear material and dismantled processing equipment, there is no need to keep SNM-154 active. Please advise if we need to take further action to terminate SNM-154.

Very truly yours,

N. A. Greenlee

MAG:fg

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

IN REPLY REFER TO:

LA:JJL
70-126 and 70-150

DEC 18 1962

Spencer Chemical Company
Research Center
9009 West 67th Street
Merriam, Kansas

Attention: Mr. M. A. Greenlee

Gentlemen:

This refers to your letter of November 20, 1962, informing us of your action to terminate License SM-154.

At least fifteen days prior to vacating this facility, or using it for any purpose other than authorized under your license you are requested to submit to us a report indicating the levels of fixed and removable uranium contamination existing in the facilities. We believe the following levels should not be exceeded:

1. For alpha radioactivity
   a. 25,000 d/m/100cm^2 peak
   b. 5,000 d/m/100cm^2 average
   c. 1,000 d/m/100cm^2 maximum removal by wiping the area with a dry filter or soft absorbent paper.

2. Beta and Gamma
   a. 1.0 millirad per hour maximum at one centimeter from any contaminated surface measured with a beta-gamma survey meter through a tissue equivalent absorber of not more than 7 mg/cm^2.
   b. 0.2 millirad per hour average, measured as above.
   c. 1,000 d/m/100cm^2 maximum removable by wiping the area with a dry filter paper or soft-absorbent paper.

Consideration will be given to cancellation of License SM-154 on receipt of your report of contamination levels. Please note that pipes, columns, ducts or other areas difficult to survey for built-up contamination must be treated as containing special nuclear material and should be disposed of prior to termination of the special nuclear material license.

J - Hdqrs.

DEC 18 1962

In connection with the expiration of License SNM-329 you are requested to submit at least fifteen days prior to vacating the facility under License SNM-329 or using it for any purpose other than previously authorized under your license a report indicating the levels of fixed and removable uranium contamination existing in the facility. We believe that the levels outlined in items 1 and 2 above should not be exceeded and similar consideration, as previously mentioned, should be given to those areas of equipment which are difficult to survey for built-up contamination.

FOR THE ATOMIC ENERGY COMMISSION

Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch
Division of Licensing and Regulation

Distribution:
Compliance Hdqrs (2) w/2c ltr dtd 11/20/62

JUN 26 1963

RE: SPENCER CHEMICAL COMPANY - LICENSE NO. SNM-154

In reply to the licensee's letter of November 20, 1962, requesting termination of the subject license, L&R informed the licensee by letter dated December 18, 1962, that surveys showing contamination levels of the facility should be sent to L&R at least fifteen days prior to vacating the facility. Has L&R received any such surveys, and if so, please send a copy to this office. If not, is there any information showing the current status of this license?

:obert C. Paulus
:O:HQ X

ORIGINAL SIGNED BY
G. D. BROWN

CO:IV					OFFICE ▶
GDBrown:eaw					SURNAME ▶
6/26/63					DATE ▶

DIVISION OF COMPLIANCE
Memo Route Slip

___Action___Information___Concur. .ce___Review
___Comment___Note & Return___Per Our Telecon___File

R. W. Kirkman Region I	
G. A. Blanc Region II	
R. C. Hageman Region III	
D. I. Walker Region IV	
R. W. Smith Region V	
Glen D. Brown Region IV	X

RE: SPENCER CHEMICAL COMPANY - LICENSE NO. SNM-154

This refers to your memo route slip, subject as above, dated June 26, 1963. LR personnel informed us that they have received no reply to their letter dated December 18, 1962. This letter is the latest piece of correspondence in their files. However, they plan a follow-up on the 12/18/62 letter in about three months. License No. SNM-154 does not expire until January 31, 1964, and therefore is a current valid license.

There is a possibility that Spencer Chemical Company has not received the letter of 12/18/62. Note that this letter was directed to the attention of Mr. N. A. Greenlee. Greenlee apparently has transferred to Kerr-McGee Oil Industries and may have left Spencer before receipt of the 12/18/62 letter. If you visit the Spencer facility, it would be appreciated if you would determine whether the 12/18/62 letter was received by Spencer Chemical Company.

FROM: Robert C. Paulus, CO:HQ DATE: JUL 9 1963

JAN 6 1964

LR:DAN
70-146

Spencer Chemical Company
Research Center
9009 West 67th Street
Merriam, Kansas

Attention: Mr. N. A. Greenlee

Gentlemen:

This is to inform you that Special Nuclear Material License No. SNM-154 expires on January 31, 1964. You had previously requested in your letter of November 20, 1962, that this license be terminated. Our letter of December 18, 1962, (copy enclosed) specified the conditions we believe should be met for termination of the license. We have not received a reply to this letter. Therefore, you are requested to submit to us prior to the expiration of SNM-154 a report indicating the levels of fixed and removable uranium contamination, including radiation levels, existing on buildings, equipment and other property where activities involving licensed material occurred.

If SNM-154 is allowed to expire prior to our determining that the contamination levels specified in our December 18, 1962, letter have been met, this could result in your possessing special nuclear material without a valid AEC license.

Distribution:
Doc. Rm.
Suppl
Br. & Div. rfs
Compliance (2) Hq

Very truly yours,

Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials
Branch
Division of Licensing and Regulation

Enclosure:
As stated

OFFICE ▶	LR					
SURNAME ▶	Nussbaumer/js					
DATE ▶	1/6/64					

Form AEC-318 (Rev. 9-53) U. S. GOVERNMENT PRINTING OFFICE 16—62761-3

70-146

SPENCER

Spencer Chemical Company

Research Center
9009 WEST 67TH STREET
Merriam, Kansas

January 29, 1964

Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Nussbaumer:

This is in reply to your letters of December 10, 1962 and January 6, 1964 requesting information prior to termination of SNM-134 (Docket No. 70-146).

Processing of uranium under this license was carried out in two separate buildings. The equipment was decontaminated and most of it transferred in the sale of the Nuclear Fuels Department. One of the buildings was decontaminated, dismantled, burned, and buried.

From original

The remaining building has been thoroughly checked with a Geiger counter. The highest radiation level detected anywhere in the building at 1 cm. from the surface was 0.5 mr/hr. for beta plus gamma radioactivity.

Smear samples have also been taken throughout the building and submitted for a radioactivity count. Results will be forwarded as soon as they are available.

Sincerely,

N. A. Greenlee

NAG:gb

RECEIVED
FEB 17 196
IN COMP

From CO - Hdqrs.

70-146

Spencer Chemical Company

Research Center

9009 WEST 67TH STREET

Merriam, Kansas

March 2, 1964

File: 9900

Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Nussbaumer:

This is to supplement our letter of January 29, 1964 concerning termination of SNM-154 (Docket No. 70-146).

We have now received the results of activity counts on smear samples taken at various points throughout the building. The highest alpha activity was 271 d/m/100 cm^2 and the highest beta activity was 874 d/m/100 cm^2. In all cases the gamma activity was found to be not significantly different from background.

Very truly yours,

N. A. Greenlee

NAG:gb

RECEI

IN COMPL

APR 7 1964

Leo Dubinski
Assistant Director for Materials, CO
THRU: R. G. Page, Chief, Enforcement Branch, SGLR
Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch
Division of Materials Licensing
SPENCER CHEMICAL COMPANY, MERRIAM, KANSAS, DOCKET NO. 70-146,
LICENSE NO. SNM-154.

DML:RLL

Enclosed is a letter dated March 2, 1964, from the subject licensee specifying the results of a survey of residual contamination remaining in their facilities. The licensee has requested termination of his license.

In view of the type and scope of work performed at this facility, we request that a close-out inspection of this facility be performed, and the results forwarded to this office so that we may close this license file.

Attachment:
Cy lttr. dtd. 3-2-64

OFFICE ▶	SGLR	SGLR	SGLR			
SURNAME ▶	RLayfield:vc	DNussbaumer	RPage			
DATE ▶	4/6/64	4/7/64	4/9/64			

Form AEC-318 (Rev. 9-53)

License SNM-154 ... on 1-31-64. No enforcement/Handling action req'd. DJS

File

Mr Page

MAY 2 0 1964

Leo Dubinski, Assistant Director for
Materials, Division of Compliance, HQ.

Donald I. Walker, Director
Region IV, Division of Compliance, Denver

Original Signed Donald I. Walker

SPENCER CHEMICAL COMPANY, MERRIAM, KANSAS - SPECIAL NUCLEAR MATERIAL LICENSE NO. SNM-154 (DOCKET NO. 70-146)

CO:IV:GHS

The subject licensee's "Jayhawk Works" was visited by George H. Smith, Radiation Specialist, Region IV, Division of Compliance, on April 30, 1964. The "Jayhawk Works" are located approximately twenty-two miles south of Pittsburg, Kansas. The purpose of the visit was to conduct a close-out inspection of the subject licensee's facilities as was requested by T. W. Brockett, CO Headquarters, in his memo route slip of April 13, 1964.

The following persons were contacted during the course of the visit:

George E. Chenoweth, Works Engineering Manager, Jayhawk Works, Pittsburg, Kansas

Ralph J. Jopp, Assistant Superintendent, Specialty Chemicals, Jayhawk Works, Pittsburg, Kansas

Norman A. Greenlee, Research Engineer, Merriam, Kansas

The writer was accompanied, during the course of the visit, by S. J. Reno, Director, Industrial Radiation and Air Hygiene, Kansas State Department of Health, and G. L. Oldfield, Supervisor, Radiation Hygiene Service, Kansas State Department of Health.

Mr. Chenoweth stated that, prior to the sale of their Nuclear Fuels Department to Kerr McGee Oil Industries, Inc. (Source Material License No. SMB-664 and Special Nuclear Material License No. SNM-695), he was Superintendent of the Nuclear Fuels Department, and that Mr. Jopp was the Assistant Superintendent of the Nuclear Fuels Department.

Mr. Chenoweth stated that all processing of radioactive material was conducted in Buildings 702 and 709. A description of the facilities was submitted with the licensee's letter to the Division of Licensing and Regulation dated April 7, 1959. Chenoweth stated that 95 percent of the processing was conducted in Building 702 and that the remaining 5 percent of the operation was conducted in Building 709. Chenoweth stated that one of the conditions of the sale of the Nuclear Fuels Department to Kerr McGee Oil Industries was that all equipment associated with the processees would be transferred to Kerr McGee.

Chenoweth stated that in September 1962 (he could not remember, nor did he have a record of the exact date), after Kerr McGee Oil Industries, Inc., had removed all of the equipment that they wanted from the two buildings, Building 702 was thoroughly washed down with soap and water. Chenoweth said that after the building was washed down, all remaining equipment was removed from the building and was transferred to the disposal pit. The disposal pit is located on Spencer Chemical Company property in an open field approximately 0.4 miles from the nearest "Jayhawk Works" building. It was observed that the pit is approximately one mile from the nearest perimeter fence of the licensee's property. Chenoweth stated that this pit was approximately 100 feet wide, 200 feet long, and 8 feet deep. Chenoweth said that, after all equipment had been removed, Building 702 was surveyed; Chenoweth said that a civil defense Geiger counter was borrowed from the Pittsburg, Kansas, Civil Defense Agency for the purpose of conducting this survey. Chenoweth said that a record of the survey was not maintained but that the survey indicated that the building was not highly contaminated. Chenoweth said that after the survey, the building was cut up into sections and transported to the disposal pit on a fork-lift truck. Chenoweth said that the sectioned building was then burned in the pit and the pit was filled and tamped. It should be noted that the licensee reported the incineration of the building in their letter to AEC of January 29, 1964. It was observed that the pit area has been planted in grass;Chenoweth said that the planting was done to prevent wind errosion. Chenoweth said that he was sure that Spencer Chemical Company would never sell the land on which the pit was located.

Jopp stated that after Building 709 was thoroughly washed down with soap and water, he surveyed the building for external radiation and contamination. Jopp stated that the civil defense Geiger counter was used for the external radiation survey and that the smears which were collected during the contamination

survey were sent to the Kansas State Department of Health for analysis. A review of the records showed that the survey consisted of taking external radiation readings and smears at six locations on the facility's floor and at two locations on the facility's walls; the direct radiation readings were recorded as ranging from a low of 0.05 to a high of 0.3 mr/hr beta-plus-gamma and a low of 0.04 to a high of 0.06 mr/hr gamma. The analysis results of the smears as reported by the Kansas State Department of Health ranged from a low of zero to a high of 271 dpm/100 cm^2 removable alpha; a low of 15 to a high of 874 dpm/100 cm^2 removable beta; and, all smears were reported as zero for removable gamma activity.

Chenoweth stated that the water which was used during the cleaning of the two buildings was released directly to the plant's sewage system. Chenoweth stated that the plant's sewage goes to a holding pond and is subsequently released to the Spring River. Chenoweth stated that he did not know the exact size of the holding pond, but that the liquid turnover in the pond (the plant input versus the quantity of liquid released to the river is equal), was approximately 25 million gallons per day and that this quantity represents a small fraction of the total liquid contained in the holding pond. Reno stated that the State had taken monthly liquid samples from the holding pond and the Spring River, but that they had stopped taking these samples in July 1962 (decontamination of the building was conducted in September 1962).

The writer observed that, with the exception of a few light fixtures and one work bench, Building 709 was completely stripped. Chenoweth stated that, as of April 30, 1964, Building 709 is used only for temporary storage of plant equipment, i.e., electrical motors, pumps, etc., which are held in standby, and that they "would like to tear the building down because it is nothing but an eyesore". It was observed that some of the inner walls of the building were of three-foot thick concrete and that these walls contained as many as sixty pipe penetrations.

The following instruments were utilized to conduct a survey of the facility:

1. A Frieseke Hoepfner, Model FH-40-T, which was calibrated by the Dow Chemical Company, Rocky Flats Division, on April 6, 1964. This instrument is equipped with an audible accessory and the detector tube has a tissue equivalent thickness of 30 milligrams/cm^2.

2. An Eberline Instrument Company "Portable Alpha Counter Scintillation Type", Model PAC-1SA. This instrument was calibrated by the Dow Chemical Company, Rocky Flats Division on April 7, 1964. This instrument has an active detector area of approximately 60 cm^2 and an efficiency of approximately 50 percent.

The survey was conducted as follows: approximately twenty smears were taken at random from the floor, walls, light fixtures, etc., of the facility. The facility was then thoroughly surveyed with the portable alpha and beta-gamma detection instruments; whenever a reading in excess of 200 cpm was noted on the alpha survey instrument, a smear of the area was taken (a reading of 200 cpm on the alpha survey instrument is equivalent to 675 dpm/100 cm^2). By utilizing the aforementioned technique, the writer collected a total of 38 smears. During the collection of the smears, Whatman 41 filter paper was utilized, and an area in excess of 100 cm^2 was smeared; the smears were analyzed by the Health Physics Section, Dow Chemical Company, Rocky Flats Division. A compilation of the results of the survey follows:

1. The maximum reading obtained with the portable alpha survey instrument was 5000 cpm (this reading is equivalent to 16,000 dpm/100 cm^2). This reading was noted on an electrical conduit on one wall of the facility. The next highest reading obtained was 2000 cpm (this reading is equivalent to 6,700 dpm/100 cm^2). This reading was noted in one corner of the floor of the facility. All other readings were less than 1500 cpm (the equivalent of 5000 dpm/100 cm^2).

2. All readings obtained with the portable beta-gamma survey instrument were background. The audible attachment was utilized with this instrument.

3. The maximum removable alpha contamination noted on one of the smears was 894 dpm/100 cm^2. This smear was taken from the top of a light fixture in the facility. The next highest quantity of removable alpha contamination was 346 dpm/100 cm^2; this smear was also collected from the top of a light fixture. With the exception of the two aforementioned smears, all removable contamination was less than 200 dpm/100 cm^2. Two smears were taken on the electrical conduit from which the highest reading was observed with the portable alpha survey instrument; these smears showed levels of 46 and 63 dpm/100 cm^2 removable alpha contamination.

4. The maximum amount of removable beta-plus-gamma contamination noted was 490 dpm/100 cm^2. This level was noted on one of the smears taken from a light fixture discussed in sub-paragraph 3, above. With the exception of the aforementioned smear, all smears were less than 200 dpm/100 cm^2, removable beta-plus-gamma contamination.

In conclusion it is noted that:

1. The licensee has not conducted a rigorous survey of the remaining facility. However, the survey which was conducted by the inspector indicates that the facility is not contaminated to levels exceeding the standards specified in AEC's letter of December 18, 1962.

2. The licensee did not retain a record of the survey which was conducted in September 1962, on Building 702, as specified in 10 CFR 20.401(b). Therefore, it cannot be determined if the licensee incinerated licensed material in violation of 10 CFR 20.305.

3. The licensee did not conduct a survey as required by 10 CFR 20.201(b), prior to releasing potentially contaminated water to the unrestricted area in order to determine compliance with the limits specified in 10 CFR 20.106(b).

The results of the writer's external radiation survey and the deficiencies noted were discussed with Chenoweth, Jopp and Greenlee at the termination of the inspection.

cc: R. G. Page DSLR
D. A. Nussbaumer DML

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : File

DATE: July 14, 1964

FROM : Philip S. Sandel, Radiation Specialist
Region IV, Division of Compliance, Denver

SUBJECT: SPENCER CHEMICAL COMPANY, KANSAS CITY, MISSOURI
LICENSE NO. SMB-471 - DOCKET NO. 40-1478

Telephone contact was made on July 14, 1964, with Mr. George E. Chenoweth, Works Engineering Manager, Jayhawk Works, Spencer Chemical Company.

Mr. Chenoweth stated that Spencer Chemical Company does not possess any uranium or thorium as licensed by License No. SMB-471 and has no plans for possession or use of source material for the immediate future.

On the basis of the information supplied by Mr. Chenoweth, License No. SMB-471 is considered noninspectable.

FROM L. D. Purcell AT Jayhawk

IN REPLY REFER TO

TO Dr. L. Max Scott AT Hammarville

DATE October 14, 1981

SOIL SAMPLES - BURN SITE
NUCLEAR FUEL R & D LAB - JAYHAWK

On October 9, 1981, samples were taken of the soil at various depths to ascertain the existence of absence of unwanted waste. Drilling was conducted using the "A" shot hole drilling rig and two operators supplied by P & M Coal Company. All samples were collected and tagged by Larry Purcell of Gulf Oil Chemicals Company, Jayhawk plant.

I. Procedures

A. Protection

1. P & M operators wore coveralls, boots, glasses and hats.
2. The samplers wore coveralls, boots, glasses, gloves and respirators (Cumfo II dual cartridge dust filter).

B. Equipment

1. A model E 500B giger counter (C. & G.) was used to sample beta radiation in the area prior to sampling, and at each drill hole during and after drilling.

   a) A calibration source CS-137 #863 was used to calibrate the instrument prior to sampling.
   b) Ambient readings were taken in the vehicle parking lot West of the Jayhawk administration building and approximately 1/4 mile South of the actual site. They were .025 Mr./Hr.

C. Samples were collected at various depths (indicated below), placed in numbered top-sealed plastic bags and were forwarded to G.S. & T., Health Physics to be analyzed.

D. The area being sampled contained a mature soybean field approximately two weeks from harvest.

II. Sample Information (See Attachment "A")

Sample #	Depth	G. C. Reading	Observation
1-A	2.5'	.02 Area	H_2O at 5'
1-B	4'	.02 hole	Metal at 5 1/2'
1-C	6'	.025 MTL.	Burnt mtl. at
2-A	4'	.02 Area	No sign of
2-B	5'	.02 hole	material
2-C	6'	.02 hole	
3-A	4'	.025 area	clay only
3-B	5'	.025 hole	no sign of
3-C	6'	.025 mtl.	material

II. Sample Information (continued from page 1)

Sample #	Depth	G. C. Reading	Observation
4-41	4'	.02 Area	
4-A	6'	.02 Area	Clay only
4-B	8'	.02 hole	burnt metal at 4'
4-C	10'	.02 MTL.	material
5-A	4'	.01 area	some unburnt material
5-B	5'	.02 hole	no sign of
5-C	6'	.02 MTL.	at 4 1/2 to 6'
6-A	2.5'	.03 area	burnt mtl. at
6-B	4'	.03 hole	about 2 1/2' to
6-C	6'	.025 MTL.	about 4' then clay
7-41	4'	.03 area	
7-A	6'	.03 area	metal at 4' H_2O
7-B	8'	.04 hole	at 5.03 G. C. reading
7-C	10'	.04 MTL.	clay at 6'
8-A	4'	.02 area	clay only no
8-B	5'	.02 hole	sign of material
8-C	6'	.02 MTL.	
9-A	2.5'	.02 area	metal at 2.5'
9-B	4'	.02 hole	burnt metal at 4'
9-C	6'	.02 MTL.	clay at 6'
10-A	4'	.03 area	metal at 4' wood
10-B	5'	.03 hole	unburnt burnt
10-C	6.5'	.03 MTL.	at 5' clay at 6.5'
11-A	NO SAMPLE		INTO CLAY
11-B	NO SAMPLE		ONLY -
11-C	NO SAMPLE		
12-A	4'	.02 area	clay only
12-B	5'	.02 hole	no sign of
12-C	6'	.02 MTL.	material

III. Summary

The site appears to have been approximately forty (40) feet wide, two hundred (200) feet long at a depth of six (6) feet a clay bed had been packed in, material was placed and burned. Eighty to ninety percent of the material appea to have been destroyed by fire and then covered with another foot of clay and rock mixture, then the top soil replaced to one foot of depth. Giger counter readings taken for Beta show only slightly above the ambient readings described earlier. Two holes(#1 and #7) had water standing at a depth of four and one half (4 1/2) to five (5) feet, however, no significant difference was noticed in G.C. readings on the materials or water found. It is felt, subject to analy by G. S. & T., that no problems exist and all findings were as previously indicated.

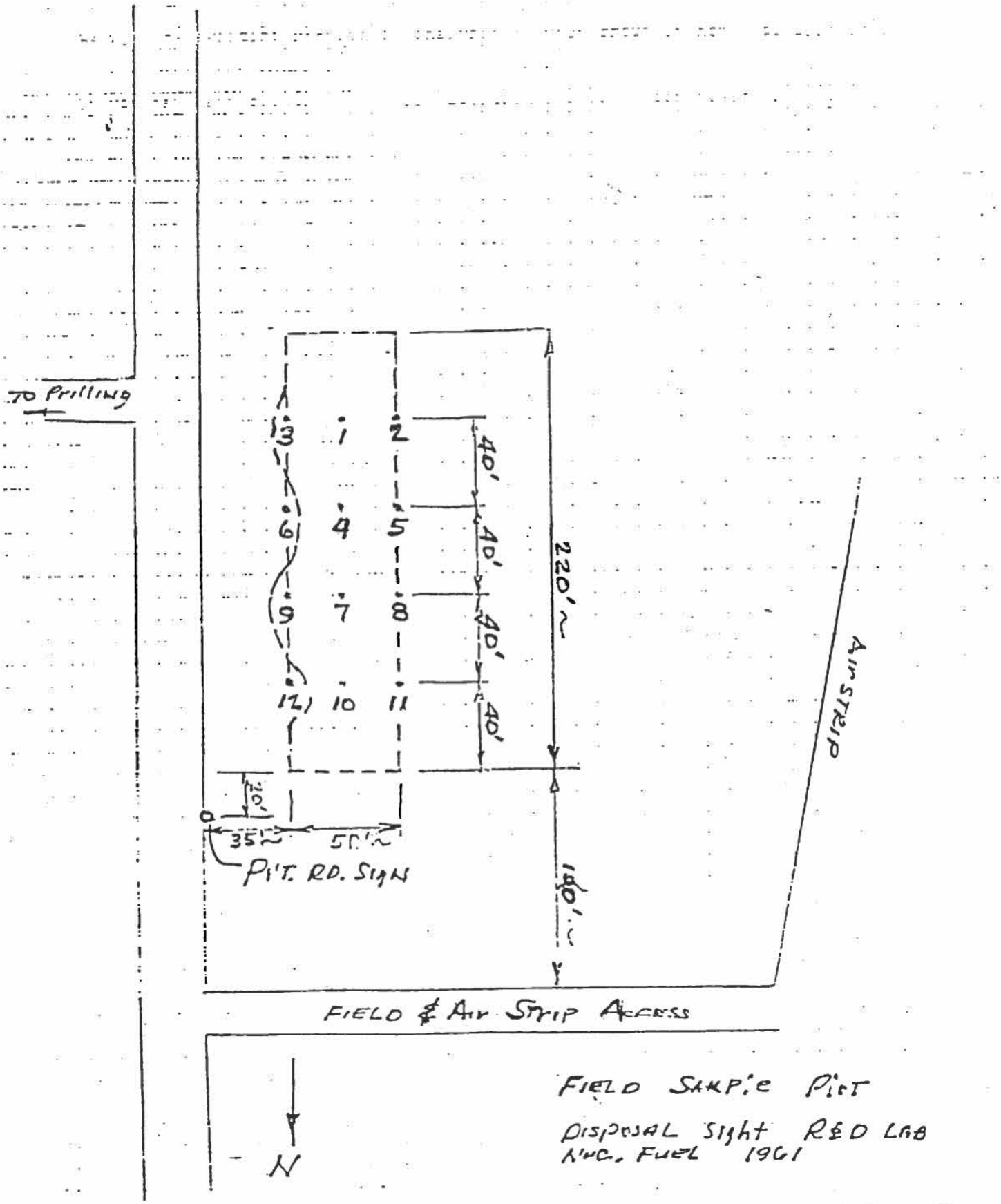
We will be awaiting results of analysis by your group in hopes of alleviating this matter.

If you have any questions or wish additional information please feel free to contact me.

Larry D. Purcell

LDP:sh

cc: G. M. McCormack
K. H. Autry
P. E. Wachter
G. E. Tolle
R. J. Jopp
S. Will



FIELD SAMPLE PIT

DISPOSAL SIGHT R&D LAB
ANC. FUEL 1961

LA Purcell 1

Gulf Oil Chemicals Company

INDUSTRIAL AND SPECIALTY CHEMICALS DIVISION

JAYHAWK PLANT
G. M. McCormack
PLANT MANAGER

P O Box 6200 B
Pittsburg, Kansas 66762

June 4, 1982

Attention: Mr. C. L. Cain, Radiation Specialist
United States Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Dear Mr. Cain:

The following is in response to your request dated May 12, 1982. During the 1950's, Spencer Chemical Company possessed a license to process natural uranium and thorium. It is unclear at this time how much, or even if, natural uranium or thorium was processed. It is known that all processing of radioactive material was confined to two buildings - the Advanced Materials plant/building and the pressure vessel test laboratory. The pressure vessel test laboratory, which was primarily a wood structure, was dismantled; the wood was burned; and the ashes buried. The stainless steel floor and partial walls in the Advanced Materials plant/building were removed.

Radiation surveys were conducted at both building sites in August, 1981. In addition, the area, where the ashes were buried, was core drilled and samples analyzed for natural uranium and thorium. Attached are the results of these surveys. It is our judgment that there are no detectable amounts of natural uranium or natural thorium at either building site.

Yours truly,

GULF OIL CHEMICALS COMPANY

G. M. McCormack
Plant Manager

GMM:as

Attachments

cc: Dr. R. M. Villiger - Overland Park
L. Max Scott - Harmarville
C. L. Richards - Houston
H. E. Runion - Harmarville
H. T. Miller - Pittsburgh

Gulf

RADIATION SURVEY

Natural Uranium and Natural Thorium
Advanced Materials Plant 1 Building

DATE OF SURVEY: August 10, 1981

SURVEY INSTRUMENTS:

Eberline Model PRM-5-3	Efficiency:	10%
Eberline Model PAC-1SAGA	Efficiency:	10%
Tracor Northern TN-1705 Limit of Detection,	Detector 3" x 3" NaI 2 gms natural uranium or natural thorium at 1 foot with 100-second count time	

SURVEY REGIMEN:

Alpha Survey: All surfaces where uranium or thorium dust or solutions could have deposited were surveyed by placing alpha detector in contact with the surface. Approximately 50 surveys were made.

Gamma Survey: All surfaces, floor cracks, and water drains were surveyed by placing the detector in contact with the surface. Measurement time was 100 seconds. Approximately 20 surveys were made.

RESULTS:

Alpha: No measurement above background of 50-100 counts per minute.

Gamma: No measurement above gamma background of $\sim$ 7500 counts per 100 seconds in the 175 - 200 KeV and 200 - 250 KeV regions.

The 186 KeV from ^{235}U and the 240 KeV from ^{212}Pb were used to measure natural uranium and natural thorium, respectively.

CONCLUSIONS:

1. With the above described instrumentation, no uranium or thorium was detected.

2. The amount of uranium or thorium which would not have been detected by the above regimen does not present any hazard. This building can be considered contamination-free.

L. Max Scott, Ph.D., C.H.P.

RADIATION SURVEY

Natural Uranium and Natural Thorium
Foundation Pressure Vessel Test Laboratory

DATE OF SURVEY: August 10, 1981

SURVEY INSTRUMENTS: Tracor Northern TN-1705 Detector 3" x 3" NaI
Limit of Detection, 2 gms natural uranium or natural thorium at 1 foot with 100-second count time

RESULTS:

No measurement above background of ~ 7500 counts per 100 seconds in the 175-200 KeV and 200-250 KeV regions.

The 186 KeV from ^{235}U and the 240 KeV from ^{212}Pb were used to measure natural uranium and natural thorium, respectively.

CONCLUSIONS:

1. With the above instrumentation, no uranium or thorium was detected.

2. The amount of uranium or thorium which would not be detected by the above regimen does not present any hazard. This building can be considered free of natural uranium and natural thorium.

L. Max Scott, Ph.D., C.H.P.

INVESTIGATION REPORT

Title: Gulf (formerly Spencer Chemical) Uranium in Spencer Lake. Jayhawk Works. South of Pittsburg, Kansas.

On August 7, 1984, Max Scott of Gulf Oil in Pennsylvania called Harold Spiker to report tentative data related to the decommissioning of a waste treatment facility (two surface ponds) at the Jayhawk facility. Mr. Scott indicated some records existed that reported from January 1, 1960 to March 23, 1961; 400.506 gallons of waste containing 21,206 grams of uranium were disposed. Totals disposed from November 5, 1957 through August 28, 1958, amounted to less than 3.0 kilograms. Flow through the pond was reported as 950,000 gallons/hour. Since the flow was essentially water from both sanitary sewer and other plant activities it did not decrease even though use of uranium reportedly ended prior to 1965 when the state became responsible for licensing. NRC records indicate termination before November 20, 1962. At that time records indicated no concentrations had been found in excess of the limits for release to uncontrolled areas.

When decommissioning of the ponds was begun, and pond #1 dry enough samples were collected of the bottom sediments and the reports are attached.

Mr. Scott sent copies to this office for review. The highest reported concentration was 10.3 pCi/gram of Uranium 234 and 4.9 pCi/gram of Uranium 238.

Calculations indicate that 10.3 pCi/gram is equal to 10.3 pCi/gram x 10^{-6} μCi/pCi = 10.3 x 10^{-6} μCi/gram and 4.9 x 10^{-6} μCi/gram. The maximum concentration of Uranium 234 in an uncontrolled area is regulated by K.A.R. 28-35-232 (Appendix A) and is 3 x 10^{-5} μCi/gram. The same value is appropriate for Uranium 238 whether soluble or insoluble. As can be seen, the highest Uranium 234 concentration is 1/3 of the limit and the highest Uranium 238 value is nearly 1/10th of the limit.

It was determined that prior to determining whether additional control would be needed additional information and samples would be needed. And arrangements were made to visit the site on August 9, 1984.

On August 9, the author drove to the site and met Mr. John Alford. Mr. Alford accompanied the inspector to the pond in question. The pond was discovered to be two ponds; one dry and one wet. (See drawings and photographs). They were located south of the main chemical plant (now operated by Allco Company).

The first samples collected were at the south end of the berm and road which separates the two ponds. Samples were taken from the dry bottom of the east pond near the point where water had been flowing from the east lake to the west (wet) lake. Sample locations are shown on the attached sketch. The Micro-R Meter was used to survey the surface of the road between the ponds and a level of 7 μR/hr. was obtained. The broken concrete blocks shown on sketch #2 attached were monitored and surface readings of 5-7 μR/hr. were obtained. Readings were

84-22

also taken over the holes and at the surface of the four sample sites at Station A (See sketch #2) and at Sample Sites 1, 2, 3, 4, and 5 at Station B. It had begun to rain lightly while the samples at Station A were being collected so alpha surveys were not attempted. After moving to Station B and performing the surface monitoring using the Micro-R Meter it began to rain very hard. The rain began at approximately 3:45PM. By 4:30PM hail and very hard rain continued and the dry pond was rapidly filling. Sampling was discontinued and the investigator returned to Topeka. Samples were delivered to the laboratory August 10 at 8:30AM.

On Monday August 14, the author returned to Gulf Jayhawk and met with Max Scott and John Alford and resumed sample collection. The dry pond was not yet dry from the rain August 9, but Station B was dry enough to walk around. Samples were taken as shown on sketch #3.

In addition, Mr. Scott had a Ludlum air proportional alpha survey meter. This was compared to the bureau's alpha check source and found to indicate 3,000 cpm for a source known to have a 5,500 cpm output in 2π geometry. This indicates that the air proportional counter was about 45% of 2π . Alpha readings were taken at sample Station B at locations marked #2, 1B at sample Station A at location marked #1, #3, of the broken concrete at location marked #4 on sketch #3 and broken concrete at location marked #5 on sketch #3. At all locations no indication of alpha activity was noted.

Mr. Jim Bergen, a long time employee of the facility was interviewed and he indicated that none of the broken concrete along the road came from the uranium project of the 50's and 60's. He was unsure of that on the east side of the east pond.

Total area of the pond was reportedly 80 acres, depth appears to be 2 to 4 feet.

It was reported by Mr. Scott that an attempt to disc or "turnover" the upper layer of material was to be begun the following day. He was asked if air sampling had been arranged and he replied it had, both between the pond and the chemical plant north and on the vehicle used to disc the pond. He also anticipated collecting a large number of additional samples which he offered to share with the department. Since, no indications of concentrations in excess of exempt concentration had been reported or found no further action was taken.

A comparison of the results of previous Gulf analysis and the NRC data seems to indicate that the highest concentrations are in the west pond and that pond is not expected to be dry for some weeks according to Mr. Alford.

The investigator returned to Topeka and the samples were delivered to the laboratory at 8:30AM August 15, 1984.

Results for samples #1sub, 1sub^2, 3sub and 3sub^2 were provided by the laboratory August 20, 1984. These (attached) show no measurable gross alpha and no Uranium 235 or uranium above 5 pCi/gram (minimum detection limit).

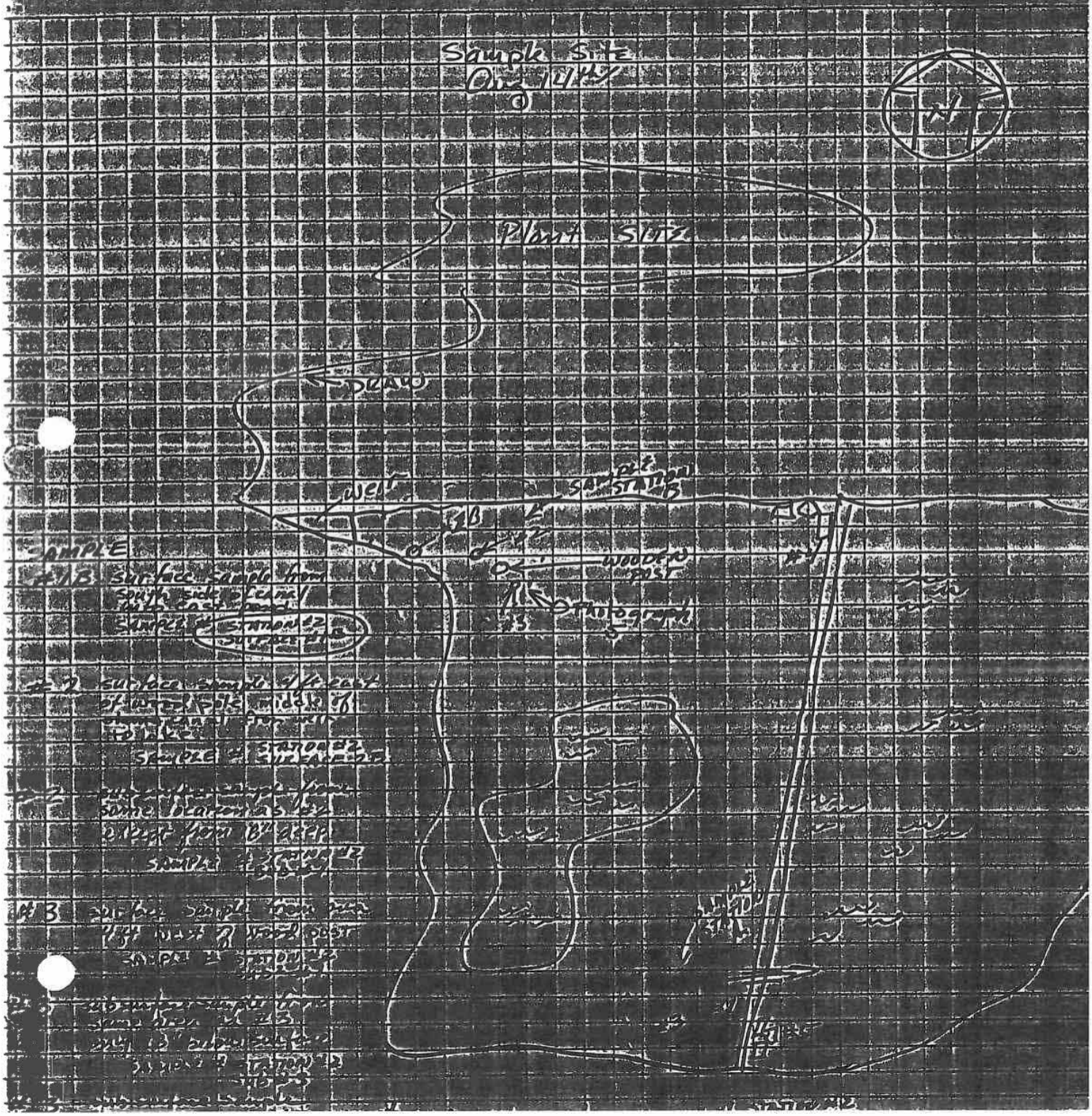
G. W. Allen

p^{2}a

KANSAS BUREAU OF RADIATION CONTROL

Subject: City of Spencer Lake — Date: Aug. 14, 1984

Reviewed by: _____ Checked: _____ Sketch Sheet 3 of Sketches

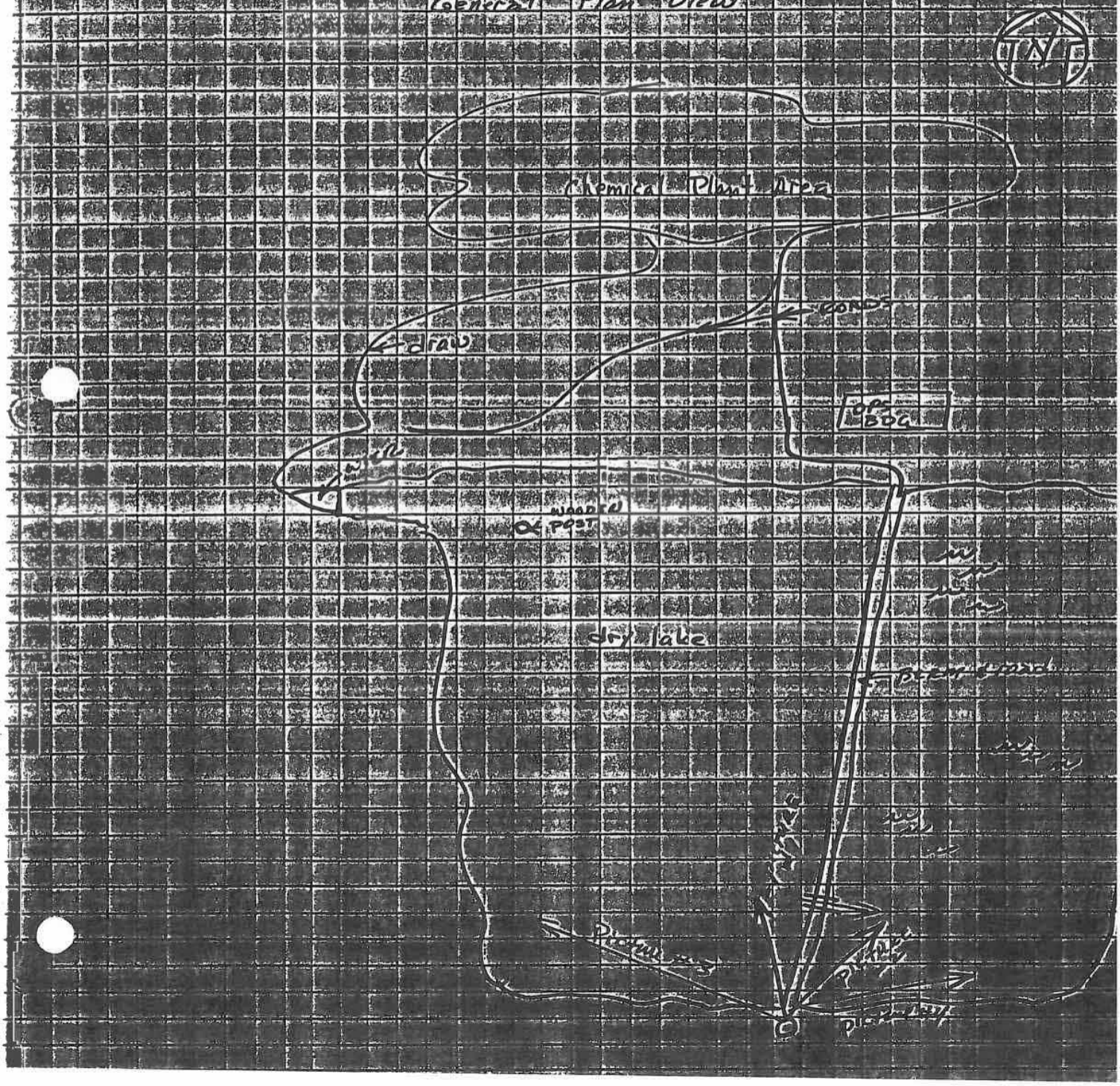


KANSAS BUREAU OF RADIATION CONTROL

Subject Gulf (Spinner) Lake — Date Aug 7 1964

G.W. Allen

Reviewed by _____ Checked _____ Sketch Sheet 1 of _____ Sketch Sheets



REPORT OF RADIOLOGICAL ANALYSIS

STATE OF KANSAS
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Lab. No. 500026
Account
Bottle No.
Copies to:
G.W.Allen, (BRC)

Locality Spencer Lake, Jahyawk plant

Source	Collected by	Date Collected	Date Received
~~Surface # 1~~	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha 9±6	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Rail: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt	
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	U-234 and U-238 were not analyzed because alpha spectrometer was not set up to perform these analyses.
89-Strontium	63-Nickel	*Gross Uranium LT 5	
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Date Reported SEP 5 1984

Items failing to meet accepted standards are circled

Chemist Bell

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Division of Environment

Lab. No. 1030UR
Account
Bottle No.
Copies to:

G.W.Allen (BRC)

Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
#1sub	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha . . . . . 3±6	Gamma Scan	144-Cerium. .	Remarks:
Gross Beta	Potassium (g/l) . . .	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt . . .	U-234, U-238 were not
226-Radium	137-Cesium.	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium. .	Spectrometer was not set up
89-Strontium	63-Nickel	*Gross Uranium LT5	to perform these analyses
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium . . .		
Total Solids (g/l) . . .	106-Ruthenium . . .		

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Lab. No. 500032UR
Account
Bottle No.
Copies to:
G.W.Allen (BRC)

Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
#1sub2	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha 3±6	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Mail: pl/fax
Tritium nCi/l	140-Barium	60-Cobalt	
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	
89-Strontium	63-Nickel	Gross Uranium LT5	U-234 U-238 were not
90-Strontium	95-Zirconium	U-235 LT2	analyzed because alpha
Calcium (g/l)	103-Ruthenium		spectrometer was not set
Total Solids (g/l)	106-Ruthenium		up to perform these analyses

Date Reported AUG 17 1984

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Chemist D.B. RTS

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Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
~~surface #2~~	~~G.W.Allen~~	~~8/9/84~~	~~8/10/84~~

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha ..... 9±6	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt	U-234, U-238 were not analyzed because alpha spectrometer was not set up to perform these analyses
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	
89-Strontium	63-Nickel	*Gross Uranium LT5	
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Date Reported SEP 5 1984

Items failing to meet accepted standards are circled

Chemist Beck

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Lab. No. 0028UR
Account
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Copies to:
G.W.Allen (BRC)

Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
Surface #3	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha 7I5	Gamma Scan	144-Cerium..	Remarks:
		51-Chromium	
Gross Beta	Potassium (g/l)...	60-Cobalt ...	Unit: pCi/gm
	140-Barium.....	65-Zinc.....	
Tritium nCi/l	137-Cesium.....	134-Cesium..	U-234, U-238 were not analyzed
226-Radium	131-Iodine	*Gross Uranium LT 5	because alpha spectrometer
228-Radium	63-Nickel		was not set up to perform
89-Strontium.....	95-Zirconium	*U-235 LT 2	these analyses
90-Strontium.....	103-Ruthenium...		
Calcium (g/l)	106-Ruthenium...		
Total Solids (g/l) ...			

Date Reported SEP 5 1984

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Chemist Bell, MC

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Address Inquiries to:
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Lab. No. 500033UR
Account
Bottle No.
Copies to:
G.W.Allen (BRC)

Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
#3sub2	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

#Gross Alpha . . . . 3±4	Gamma Scan . . .	144-Cerium . .	Remarks:
Gross Beta	Potassium (g/l) . . .	51-Chromium	Unit: pCi/l
Tritium nCi/l	140-Barium	60-Cobalt . . .	U-234, U-238 were not
226-Radium	137-Cesium	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium . .	spectrometer was not set
89-Strontium	63-Nickel	Gross Uranium LT5	up to perform these analyses
90-Strontium	95-Zirconium	U-235 LT2	
Calcium (g/l)	103-Ruthenium . . .		
Total Solids (g/l) . . .	106-Ruthenium . . .		

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Chemist JG. KEY

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Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Received
#3sub	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha 216	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt	U-234, U-238 were not
226-Radium	137-Cesium	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium	spectrometer was not set
89-Strontium	63-Nickel	*Gross Uranium LT5	up to perform these analyses
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Date Reported AUG 27 1984

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Chemist D.B. DCB

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G.W.Allen (BRC)

Locality Spencer Lake, Jayhawk plant

Source	Collected by	Date Collected	Date Receiv
Surface #4	G.W.Allen	8/9/84	8/10/84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha . . . . . 12±5	Gamma Scan . . .	144-Cerium. .	Remarks:
Gross Beta	Potassium (g/l) . . .	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt . . .	U-234, U-238 were not analyzed because alpha spectrometer was not set up to perform these analyses.
226-Radium	137-Cesium.	65-Zinc	
228-Radium	131-Iodine	134-Cesium. .	
89-Strontium	63-Nickel	*Gross Uranium LT 5	
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium . . .		
Total Solids (g/l) . . .	106-Ruthenium . . .		

Date Reported SEP 5 1984

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Address Inquiries to:
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Lab. No. 500037 UR
Account
Bottle No.
Copies to:
G.W.Allen (BRC)

Locality Spencer Lake

Source	Collected by	Date Collected	Date Received
Station F2, surface #2B (soil)	G.W.Allen	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

Gross Alpha	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	
Tritium nCi/l	140-Barium	60-Cobalt	Unit: pCi/gm
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	U-234 U-238 were not
89-Strontium	63-Nickel	* Gross Uranium LT 5	analyzed because alpha
90-Strontium	95-Zirconium	*U-235 LT 2	spectrometer was not set
Calcium (g/l)	103-Ruthenium		up to perform these analyses
Total Solids (g/l)	106-Ruthenium		

Date Reported SEP 5 1984

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Chemist Bell, MC

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Lab. No. 500038UR
Account
Bottle No.
Copies to:
G.W.Allen (BRC)

Locality Spencer Lake

Source	Collected by	Date Collected	Date Received
Station #2 sub #1 (soil)	G.W.ALlen	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

Gross Alpha	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Unit: pCi/gm.
Tritium nCi/l	140-Barium	60-Cobalt	U-234, U-238 were not analyzed because alpha spectrometer was not set up to perform these analyses
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	
89-Strontium	63-Nickel	*Gross Uranium LT 5	
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

SEP 5 1984
Date Reported

Items failing to meet accepted standards are circled

Chemist Bell, RC

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Lab. No. 500135UR
Account
Bottle No.
Copies to: G.W.Allen (BRC)

Locality Spencer Lake

Source	Collected by	Date Collected	Date Received
Station #2 sub2 #1 (soil)	G.W.Allwn	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

Gross Alpha	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt	U-234 U-238 were not
226-Radium	137-Cesium	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium	spectrometer was not
89-Strontium	63-Nickel	*Gross Uranium LT5	set up to perform these
90-Strontium	95-Zirconium	*U-235 LT2	analyses.
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Date Reported SEP 5 1984

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Chemist Bell, JC

please investigate

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Lab. No. 500137UR
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G.W. Allen (BRC)

Locality Spencer aLake

Source	Collected by	Date Collected	Date Received
Station #2 surface #6 (soil)	G.W.Allen	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

Gross Alpha	Gamma Scan	144-Cerium	
Gross Beta	Potassium (g/l)	51-Chromium	
Tritium nCi/l	140-Barium	60-Cobalt	
226-Radium	137-Cesium	65-Zinc	
228-Radium	131-Iodine	134-Cesium	
89-Strontium	63-Nickel	* Gross Uranium	LT 5
90-Strontium	95-Zirconium	* U-235	LT 2
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Remarks:

Unit: pCi/gm

U-234, U-238 were not analyzed because alpha spectrometer was not set up to perform these analysis

Date Reported SEP 14 1984

Items failing to meet accepted standards are circled

Chemist HC Bell

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Lab. No. 500136UR
Account
Bottle No.
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Locality Spencer Lake

Source	Collected by	Date Collected	Date Received
Station #2 sub #3 (soil)	G.W.Allen	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

Gross Alpha	Gamma Scan	144-Cerium	Remarks:
Gross Beta	Potassium (g/l)	51-Chromium	Unit: pCi/gm
Tritium nCi/l	140-Barium	60-Cobalt	U-234, U-238 were not
226-Radium	137-Cesium	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium	spectrometer was not set
89-Strontium	63-Nickel	*Gross Uranium LT 5	up to perform these analyses
90-Strontium	95-Zirconium	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium		
Total Solids (g/l)	106-Ruthenium		

Date Reported SEP 14 1984

Items failing to meet accepted standards are circled

Chemist HC. Bell

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FORBES, BLDG. 740, TOPEKA, KANSAS 66620

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Address Inquiries to:
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Lab. No. 500036UR
Account
Bottle No.
Copies to:
B. Allen (BRC)

Locality Spencer aLake

Source	Collected by	Date Collected	Date Received
Station #2 Surface 1B (soil)	G.W.Allen	8-13-84	8-14-84

☐ Composite Sample

Results are expressed in Picocuries per liter at the 95% C.L. except as noted

*Gross Alpha . . . 15 ± 6	Gamma Scan	144-Cerium. .	Remarks:
Gross Beta	Potassium (g/l) . . .	51-Chromium	Unit. pCi/gm.
Tritium nCi/l	140-Barium	60-Cobalt . . .	U-234 U-238 were not
226-Radium	137-Cesium.	65-Zinc	analyzed because alpha
228-Radium	131-Iodine	134-Cesium. .	spectrometer was not set
89-Strontium.	63-Nickel	*Gross Uranium LT 5	up to perform these analyses
90-Strontium.	95-Zirconium . . .	*U-235 LT 2	
Calcium (g/l)	103-Ruthenium . . .		
Total Solids (g/l) . . .	106-Ruthenium . . .		

Date Reported SEP 14 1984

Items failing to meet accepted standards are circled

Chemist HC, RLL

12-29-83

Telephone call:

Glenn Tolle, Gulf Oil Chem Co.
Jayhawk Plant

Second decontamination completed - ready for our final survey.

T&S

COPY

STATE OF KANSAS
RADIOACTIVE MATERIALS LICENSE

Su, ementary Sheet

License Number 26-C229-02

Amendment No. 1

Gulf Oil Corporation
Jayhawk Chemical Plant
20 South Pittsburg Highway 26
Pittsburg, Kansas 66762

License number 26-C229-02 is hereby terminated in its entirety in accordance with the letter dated June 15, 1983, signed by G.E. Tolle.

JUL 7 1983

Date

FOR THE STATE DEPARTMENT OF HEALTH & ENVIRONMENT

By

Gerald W. Allen, Director
Bureau of Radiation Control