WSRC-RP-89-9

SRL
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DELISTING PETITION

For
300-M Saltstone (Treated F006 Sludge)
From The
300-M Liquid Effluent Treatment Facility (U)

UNITED STATES DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE

Aiken, South Carolina

April 4, 1989

Derivative Classifier
H. Stevens Jr.

DELISTING PETITION
FOR
300-M SALTSTONE (TREATED F006 SLUDGE)
FROM THE
LIQUID EFFLUENT TREATMENT FACILITY (u)

SAVANNAH RIVER SITE

OWNED AND OPERATED BY
U. S. DEPARTMENT OF ENERGY

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EXECUTIVE SUMMARY

The Savannah River Operations Office of the U.S. Department of Energy is submitting this Delisting Petition to the U.S. Environmental Protection Agency. This petition seeks exclusion from the hazardous waste regulations of 40 CFR, Part 261, for a waste by-product classified as an F006 listed waste. Specifically, this petition seeks exclusion for stabilized and solidified sludge material generated by treatment of wastewater from the 300-M aluminum forming and metal finishing processes. The waste contains both hazardous and radioactive components and is classified as a mixed waste.

The objective of this petition is to demonstrate that the stabilized sludge material (saltstone), when properly disposed, will not exceed the health-based standards for the hazardous constituents. This petition contains sampling and analytical data which justify the request for exclusion. The results show that when the data are applied to the EPA Vertical and Horizontal Spread (VHS) Model, health-based standards for all hazardous waste constituents will not be exceeded during worst case operating and environmental conditions.

Disposal of the stabilized sludge material in concrete vaults will meet the requirements of DOE Order 5820.2A and the March 9, 1988 DOE Record of Decision pertaining to Waste Management Activities for Groundwater Protection at the Savannah River Site in Aiken, S.C., which outline criteria for low-level radioactive waste disposal. These documents set forth performance objectives and disposal options for low-level radioactive waste disposal. Concrete vaults specified for disposal of 300-M saltstone (treated F006 sludge) assure that these performance objectives will be met.

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A. Petitioner

U.S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

B. RCRA Number

RCRA Generator ID No. SC 189 000 8989

C. Facility

Savannah River Site

D. Facility Contacts

Name	Title	Telephone
S. R. Wright	Director Environmental Division U.S. Dept. of Energy Savannah River Site Aiken, SC 29808	803-725-6211

E. Statement of Certification

This delisting petition is submitted pursuant to the U.S. Code of Regulations 40 CFR 260.22, to exclude a waste produced at a particular facility.

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

____
(signature of responsible individual)

____
(name of responsible individual)

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(title)

____

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____
(address)

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(telephone number)

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(date)

II. PETITIONER'S INTEREST

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The Savannah River Site (SRS), located near Aiken, South Carolina, is a major installation of the U.S. Department of Energy (DOE). The 300-square mile area encompasses portions of Aiken, Barnwell, and Allendale counties and is bordered on the southwest by the Savannah River, as indicated in Figure 1. The plant, which began operation in the early 1950s, produces nuclear defense materials, primarily plutonium and tritium.

The M-Area production facility is one of 14 major SRS operating areas. The M-Area operations produce reactor components which consist of aluminum housings, aluminum-canned depleted uranium metal targets; extruded enriched uranium-aluminum alloy fuel tubes and lithium-aluminum alloy target tubes and control rods. The manufacturing process is described in greater detail in Section V.

The waste effluent generated during production operations generally can be characterized as waste from aluminum forming and metal finishing processes, which include a nickel electroplating line. The process waste effluents contain rinsewater, stack acid scrubber effluents, and spent process solutions from three production buildings (313-M, 320-M, and 321-M) and two support laboratories (320-M and 322-M). Since July, 1985, process wastewaters have been discharged to the M-Area Liquid Effluent Treatment Facility (LETF), a wastewater treatment system using the Best Available Technology Economically Achievable (BAT) for the aluminum forming and metal finishing industries. A further discussion of the M-Area waste treatment system is contained in Section VI.

The LETF is composed of three closed-coupled treatment facilities: the Dilute Effluent Treatment Facility (DETF), the Chemical Transfer Facility (CTF), and the Process Waste Interim Treatment/Storage Facility (PWITSF). The DETF treats dilute wastewater from production facilities. This wastewater is primarily composed of

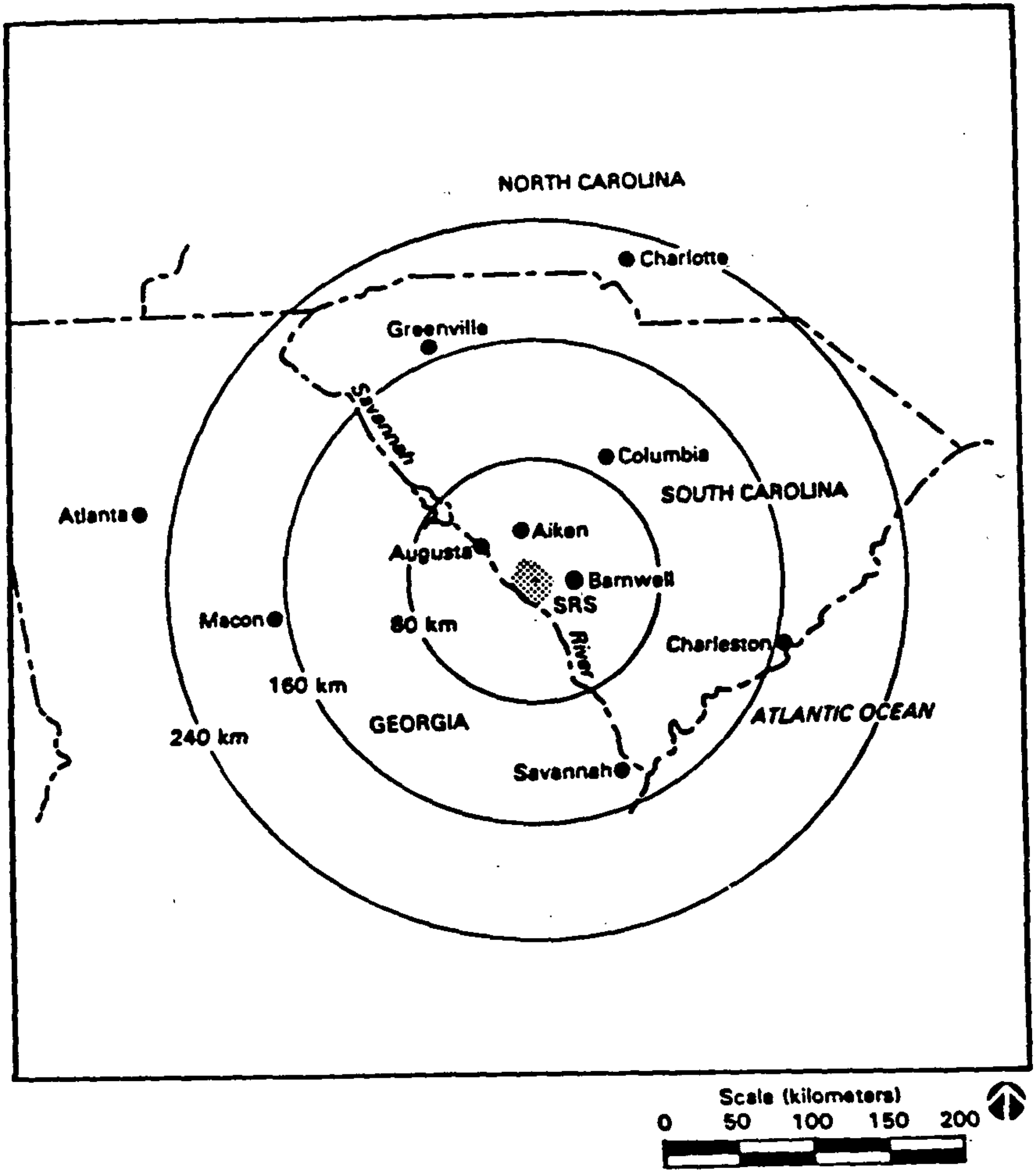

Figure 1. SRS Location in Relation to Surrounding Population Centers

rinse streams used to remove drag-out liquids from the plating and treatment baths. The DETF process employs conventional physical-chemical treatment, including equalization, pH-adjustment, precipitation, flocculation, and filtration.

The CTF consists of autoclave wastewater equalization and pressure filtration, uranium rinse wastewater equalization and evaporization, and concentrated spent process solution equalization and pH-adjustment for transfer to PWITSF storage tanks.

The PWITSF is a tank farm in which the slurried waste is contained for supernatant/sludge separation prior to chemical stabilization and solidification for permanent disposal. The slurried waste separates in the PWITSF to form a clear liquid supernatant and a denser sludge consisting of solid filter aid and precipitates. A wastewater treatment permit modification has been requested and obtained from SCDHEC for decanting the supernatant from these tanks and treating it in the DETF. The remaining sludge will be chemically stabilized and solidified in a mixture of cementitious solids for final disposal. Process/waste interim treatment/storage facility tanks (PWITSF) No. 1 through 6 (35,000 gallons each) and PWITSF tanks No. 7 and 8 (500,000 gallons) are full. PWITSF tank No. 10 (500,000 gallon) is now filling, and three additional PWITSF tanks are being constructed.

It is the intent of the Savannah River Site to demonstrate that the stabilized and solidified waste containing the 300-M treatment facility sludge does not meet the criteria for listing as a F006 hazardous waste as defined in 40 CFR, Part 261. The accompanying information, including process information, waste treatment system description, sampling and analytical procedures, and analytical data, is submitted to the United States Environmental Protection Agency (USEPA) in support of a metal finishing wastewater treatment sludge (F006) delisting petition.

III. DESCRIPTION OF PROPOSED ACTION

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The sludge from the PWITSF tanks is currently classified as an F006 listed hazardous waste. (Tank 10 is an exception because it only contains aluminum forming wastewater, which is not a listed waste.) A waste treatment process based on stabilizing the sludge in a cementitious matrix has been developed. The treated material is called 300-M saltstone.

Savannah River Laboratory (SRL) designed and conducted a sampling and analysis program to demonstrate that disposal of 300-M saltstone will not result in exceeding health-based standards for hazardous constituents. A total of 32 samples were collected from the eight filled PWITSF tanks. Sludge samples were collected in April, 1988, by SRL personnel. The sludge samples were treated (stabilized and solidified) at SRL and then the saltstone samples were shipped, using appropriate chain of custody procedures, to an outside, independent laboratory for analysis. Samples were analyzed for total metals and also extracted for metals using the EP toxicity method.

Thirty-two (32) samples were extracted for volatile organics using Toxicity Characteristic Leaching Procedure (TCLP) methodology. One sample from each of the 8 tanks was analyzed by the Multiple Extraction Procedure (MEP).

The sampler and laboratory qualifications, sampling and handling procedures, and analytical procedures and equipment are described in Section VII. Analytical data are summarized in Section VIII. Results were applied to the Vertical and Horizontal Spread (VHS) model to demonstrate that health-based standards of RCRA hazardous constituents would not be exceeded at a "compliance point" during a worst-case land disposal application scenario (Section IX).

IV. NEED AND JUSTIFICATION FOR ACTION

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Wastewater sludge and slurry from the DETF and the CTF are transferred to and allowed to settle in the PWITSF tanks. An LETF wastewater treatment facility permit modification to allow supernatant to be pumped from the PWITSF to the DETF equalization tanks for treatment has been submitted to the South Carolina Department of Health and Environmental Control (SCDHEC). The PWITSF sludge will be treated in an environmentally acceptable manner and permanently disposed in concrete vaults at SRP.

DOE-Savannah River is submitting this petition as justification for delisting this treated F006 waste (300-M saltstone) which contains sludge from aluminum forming and metal finishing processes that is stabilized with cementitious solids (cement, slag and flyash). Analytical data show that leaching of all hazardous constituents is sufficiently low so that VHS model delisting criteria are not exceeded. For this reason, the Savannah River Site is seeking to delist 300-M saltstone so that the accumulated waste volume and future volumes generated can be disposed as non-hazardous, low-level radioactive waste.

If the 300-M saltstone delisting petition is approved, the saltstone will be disposed on-site in a permitted, solid waste facility designed for non-hazardous, low-level radioactive waste. The management of this facility, including administrative controls, will ensure that no health or environmental risks will ensue from these activities.

V. DESCRIPTION OF MANUFACTURING PROCESS

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A. Process

The M-Area operations facility produces components for the SRS reactors. In the three production buildings (313-M, 321-M, and 320-M) aluminum housings, aluminum canned depleted uranium metal targets, extruded enriched uranium-aluminum alloy fuel tubes, and lithium-aluminum alloy target tubes and control rods are fabricated. A brief description of the process operations for each of the three buildings appears below.

A.1 Depleted Uranium Metal Target Fabrication (Building 313-M)

Depleted uranium (less than natural U-235 isotope concentration) cores are cleaned with hot nitric acid, water rinsed, and then treated by a phosphoric acid and hydrochloric acid anodic etch. After further cleansing in nitric acid and rinsing, nickel is plated on the cores as indicated in Figure 2, using a standard Watts' bath process (nickel chloride, nickel sulfate and boric acid). The cores, approximately 22.9 cm long by 5.1 cm to 7.6 cm in diameter (inner and outer core), are then water rinsed and dried.

Aluminum cans and caps are received from an off-site manufacturer. The aluminum components were degreased with 1,1,1-trichloroethane until September, 1987, when chlorocarbon degreasing was suspended in Building 313-M. The cans and caps are etched to specified dimensions in a hot solution of sodium hydroxide and sodium nitrate. The cans and caps are then desmutted in nitric acid, followed by a

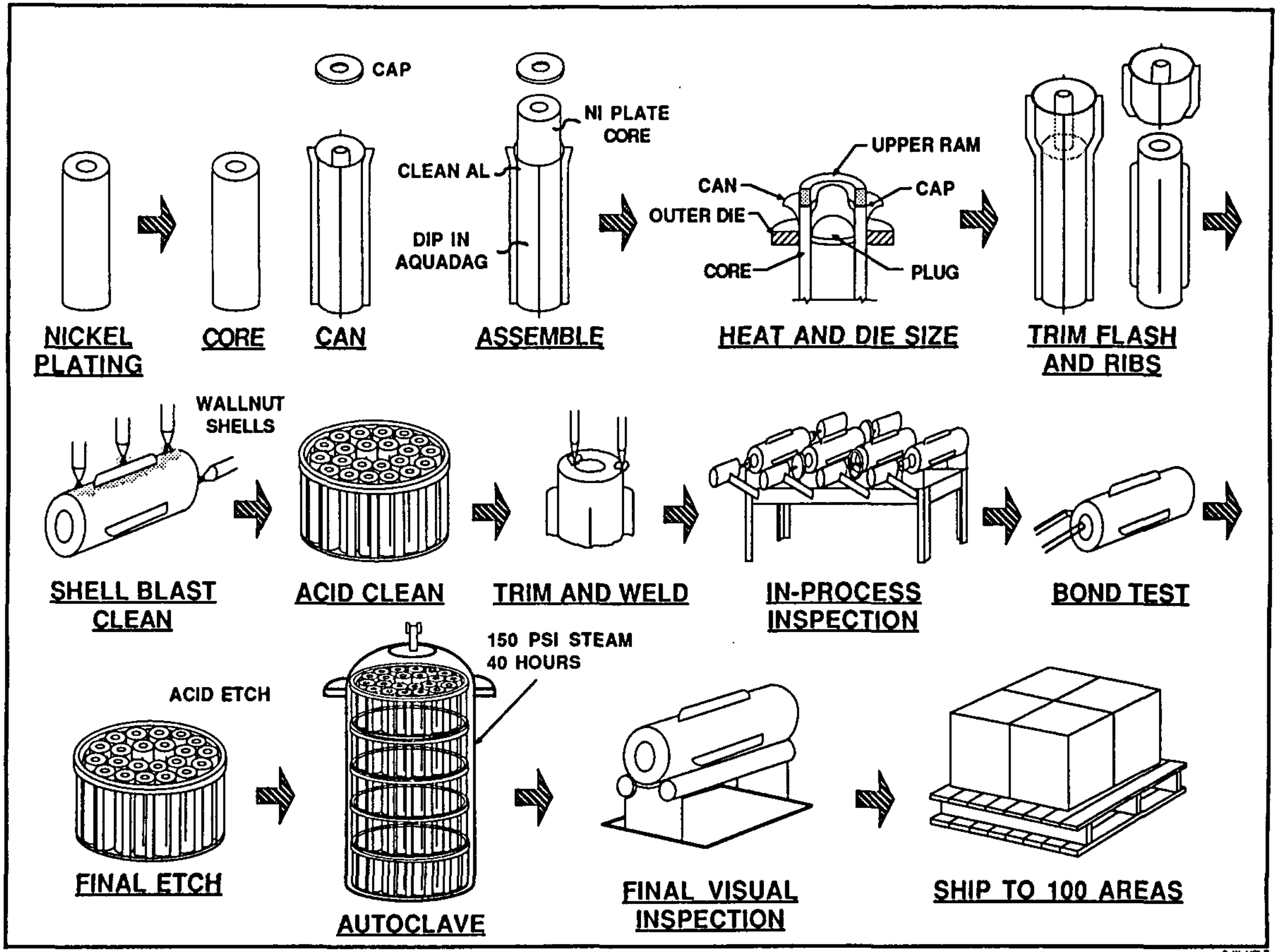

Figure 2. Building 313-M Hot Die Size Bonding Process Flow Diagram

phosphoric acid bath surface treatment. They are then rinsed and dried. The nickel plated uranium cores are then assembled into the clean cans and the caps placed on top of the cores.

The above mentioned assemblies are dipped in a carbon and water mixture and dried. They are placed in a furnace, where the blackened cans are heated and the aluminum is bonded to the nickel through hot die size bonding (HDSB). A cut-off saw trims the excess (flash) from the cans and trims the slug ends (ribs). The bonded slug is cleaned with a high-pressure walnut shell blast, nitric acid cleaned, trimmed, and arc welded. The slugs are then inspected and bond tested.

The slugs are passed through a final cleansing step, using hot nitric acid surface cleaning and water rinse. The cleansed slugs are tested in 150 psig steam autoclaves to check for defects in the aluminum cladding. The slugs undergo a final inspection and then are stored in boxes for shipment to SRP reactors.

Plated cores and slugs that fail inspection are recovered for recycle. The aluminum cladding is removed by etching in hot sodium hydroxide and sodium nitrate. The nickel is removed by hot nitric acid. The recovered cores are water rinsed and inspected. Rejected cores are returned to the supplier for recycle.

M-Area process dies and tooling are periodically cleaned. Aluminum is etched from the die surface by a hot sodium hydroxide solution.

A.2 Enriched Uranium Fuel Tube Fabrication (Building 321-M)

The process flow diagram for Building 321-M operations appears in Figure 3. Enriched uranium and high-purity aluminum ingots are melted by induction heat in graphite crucibles. The molten uranium-aluminum alloy is cast in tubular graphite molds. The casting is machined into cores, using Freon[R] as a machining lubricant. The castings are assembled inside clean aluminum housing components to form a semi-finished metal bar (pre-extrusion billet).

The aluminum components for fuel billet assembly are sequentially cleaned in hot sodium hydroxide, water rinse, nitric acid, cold and then hot water rinse, and then dried.

The assembled pre-extrusion billet is seal-welded, heated, and outgassed in a vacuum oven. The billet is dipped in a carbon and water mixture, heated in an induction furnace, and extruded through lubricated dies into a tubular log. The aluminum-clad surface of the log is cleaned, and the log is sawed and machined into smaller cores. These cores are assembled inside cleaned aluminum housing components and sealed with magnesium-aluminum alloy end plugs. The billets are welded, heated, outgassed, dipped in carbon solution, heated and extruded into fuel tubes (approximately 18 feet by 1-1/2 to 3 inch diameter). After removal of end scrap, the aluminum surface is cleaned in Freon TF[R]. The chlorocarbon degreasing bath is designed to minimize carry-over of the degreasing agent. This is followed by hot caustic and hot nitric rinses. The tubes are drawn through oil-lubricated dies and stretch straightened.

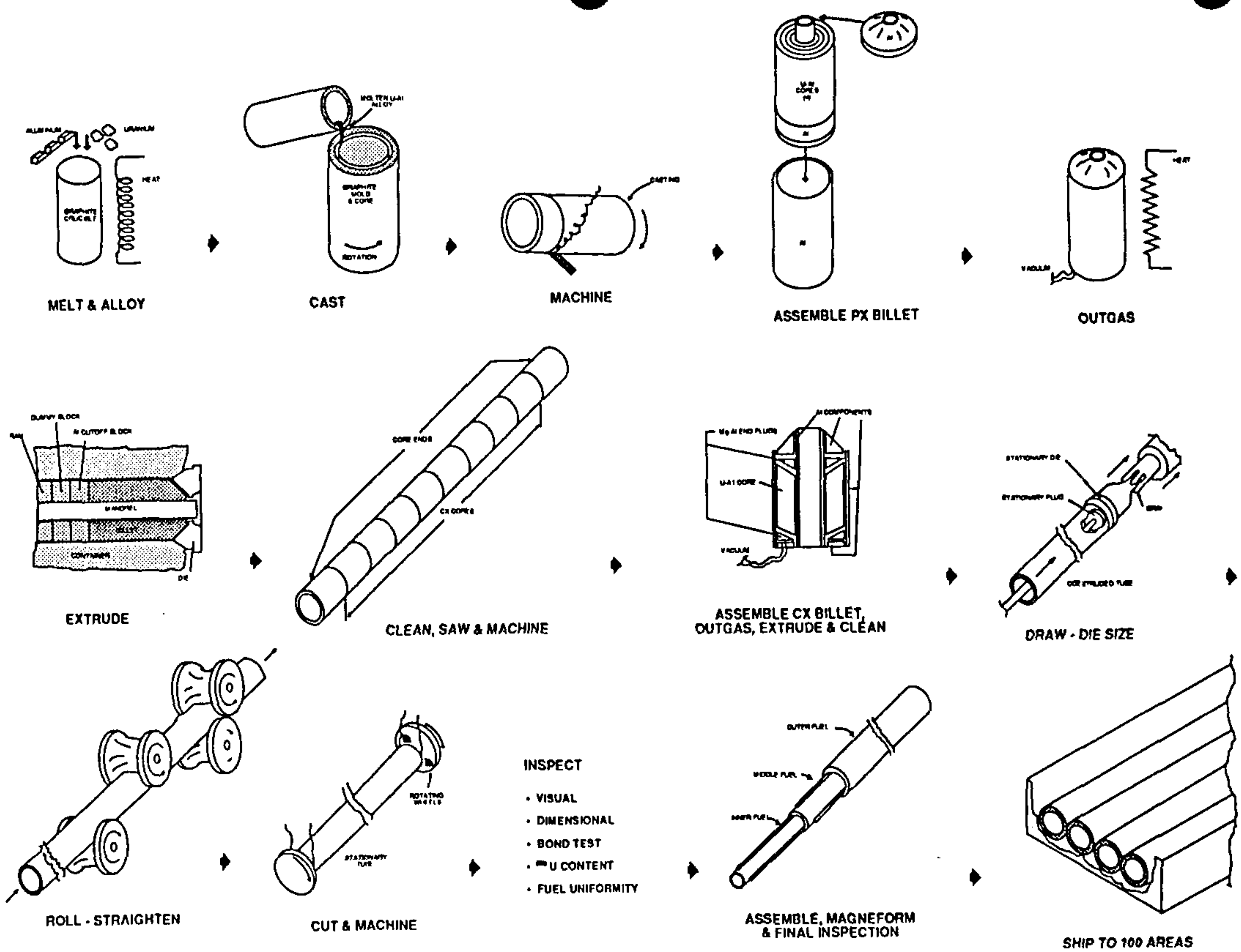

Figure 3. Building 321-M Fuel Fabrication Process Flow Diagram

It should be noted that 1,1,1-trichloroethane was used as a degreasing agent until September, 1987, when it was replaced with Freon TF^R (1,1,2-trichloro-1,2,2-trifluoroethane).

Following further cleaning, cutting, machining, and final cleansing, the tubes are inspected and tested. The tubes are assembled (inner tube into middle tube, etc.), and fittings are installed, and the assemblies are cleaned and inspected for shipment to SRP reactors.

The aluminum clad fuel logs and the fuel and target tubes are cleaned in hot Freon^R. They are then sequentially cleaned in hot sodium hydroxide, water rinse, hot nitric acid, and cold and hot water rinses.

The tubes are assembled in a very dilute aqueous detergent solution (Cindol^R) that lubricates the aluminum surfaces.

Target billets with lithium-aluminum alloy cores from logs fabricated in Building 320-M (see Section A.3) are also welded and extruded in Building 321-M. These lithium-aluminum core billets are treated similarly to the uranium-aluminum core billets, i.e., after extrusion they are cleaned in Freon^R, and then sequentially cleaned in hot caustic, rinsed, cleaned in hot nitric acid, and cold and hot water rinsed.

A.3 Lithium-Aluminum Target Fabrication (Building 320-M)

The process flow for target tubes and control rod fabrication in Building 320-M is shown in Figure 4. Lithium-aluminum

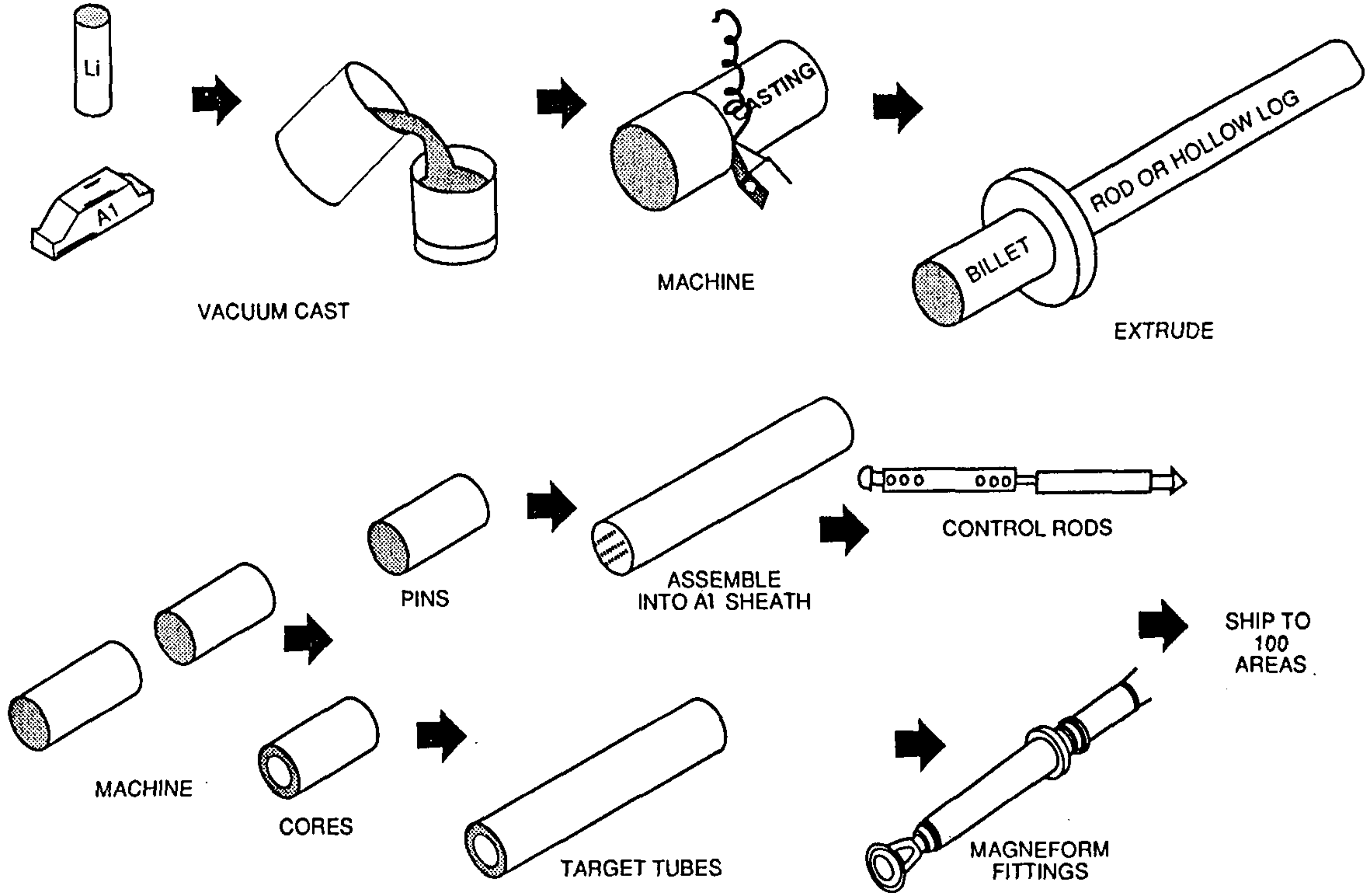

Figure 4. Building 320-M LiAl Tubes and Rods Process Flow Diagram

alloy is cast and extruded into rods or logs. The rods and logs are sawed and machined into control rod pins and target cores, respectively. The machined alloy as well as aluminum housing components are assembled into billets that are sent to Building 321-M for processing into completed target tubes. The control rod pins are inserted into the aluminum housing tube, and cleaned fittings are welded to the ends. The rods, approximately 5.5 m long by 2.5 cm diameter, are cleaned, tested, and inspected for shipment to SRS reactors.

Lithium-aluminum alloy pins and cores and aluminum housing components, and fittings, tubes, and inserts are also fabricated in Building 320-M. The aluminum components were degreased in 1,1,1-trichloroethane until September 1987, when chlorocarbon degreasing was discontinued in Building 320-M. The components are sequentially cleaned in sodium hydroxide water rinse, nitric acid, and cold and then hot water rinse.

B. Process Materials Used

Process materials used in the target and fuel tube fabrication are summarized in Table 1. Material Safety Data Sheets (MSDS) for each process component appear in Appendix A.

C. Waste Streams

Waste streams from M-Area operations are discharged to the M-Area Liquid Effluent Treatment Facility (LETF) prior to disposal. The LETF, which combines and treats process wastewaters generated in M-Area, was started up on July 16, 1985. A description of the M-Area waste treatment system is contained in Section VI.

Table 1. Raw Materials By Process

Process	Trade Name	Chemical Description	Remarks
A. Main Process Chemicals			
313-M, 320-M, 321-M	Aluminum	Base metal	Used to encapsulate cores, 321-M and to prepare Li/Al and U/Al assemblies
DETF*	Aluminum sulfate	Aluminum alum, aluminum sulfate solid, aluminum salt (3:2), octadeca hydrate	Used in DETF as precipitant/coagulant
313-M, 321-M	Aluminux^R	Alkaline etchant for aluminum	Used as a cleaning agent
313-M, (Core Plating Line Process)	Boric acid	Hydrogen borate, weak acid	Used in plating solution
313-M, Cap-Can Cleaning Process	Chlorothene VG Solvent	1,1,1-Trichloroethane	Used as degreasing agent until September, 1987
Uranium Recovery Process	Diatomaceous earth	Silica	Used as a filter aid in CTF**
313-M (Hot Die Size Bonding Process)	Fiske Lubricant	Aluminum and graphite in mineral oil	HDSB press lubricant
321-M	Freon TF^R	Trichlorotrifluoroethane	Used as machining lubricant, and used as degreasing agent after September, 1987
313-M, 321-M	GRAFO^R	Graphite in mineral oil	Used as a heat transfer medium for aluminum extrusion or bonding
313-M (Core Plating Line Process)	Hydrochloric acid	Hydrochloric acid	Used in anodic etching solution

*DETF = Dilute Effluent Treatment Facility
**CTF - Chemical Transfer Facility

Process	Trade Name	Chemical Description	Remarks
321-M	Lead	Base metal	Used to lubricate extrusion press until April 10, 1988
320-M, 321-M	Lithium	Base metal	Alloyed with Al to form Li/Al assemblies
313-M (Core Plating Line Process)	Nickel slugs	Base metal	Used in plating bath
313-M (Core Plating Line Process)	Nickel carbonate hydrate	Nickel (II) carbonate hydrate	Used in treatment of plating bath solution
313-M (Core Plating Line Process)	Nickel chloride	Nickelous chloride hexahydrate	Used in plating solution
313-M (Core Plating Line Process)	Nickel (II) sulfate, hexahydrate	Inorganic salt	Used in plating solution
313-M, 320-M, 321-M	Nitric acid	Inorganic acid	Used in cleaning and etching solutions
DETF	PerFLO 30	Perlite; fused sodium potassium aluminum silicate	Used as a filter aid in pressure filters in DETF
313-M (Core Plating Line Process & Cap-Can Cleaning Process	Phosphoric acid	Mineral acid	Used in anodic etching solutions
313-M, 320-M, 321-M	Rando oil HD 68	Hydraulic oil	Used as an industrial lubricant
313-M, 320-M, 321-M	Sodium hydroxide	Inorganic base	Used in etching and cleaning
313-M (Core Recovery Process)	Sodium nitrate	Sodium nitrate	Used in core recovery solution

Process	Trade Name	Chemical Description	Remarks
313-M (Hot Die Size Bonding Process)	Solka-Floc®	Cellulose; filter aid	Used to remove oils from recycled quench water
DETF	Sulfuric acid	Inorganic acid	Used in DETF as pH control
321-M	Tin	Base metal	Used to lubricate extrusion press after April 11, 1988
313-M, 320-M, 321-M	1,1,1-Trichloroethane (inhibited 1,1,1-trichloroethane)	1,1,1-Trichloroethane	Used as degreasing agent until September, 1987
313-M, 321-M	Uranium	Actinide metal; core metal	Core metal

B. Auxiliary Process Chemicals**

	Trade Name	Chemical Description	Remarks
	Charcoal	Activated carbon	Used to purify the plating bath solution
	CINDOL®	Aqueous detergent	Tube assembly wetting agent
	Doubleteam®	Synthetic coolant	Used as a cleaning agent
	Filterbestos®	Cellulose; Filter aid	Used to purify the plating bath solution
	Hydrogen peroxide	Hydrogen peroxide	Used in plating bath adjustment
	Isopropyl alcohol	Alcohol	Used as a cleaning agent
	Monolec Industrial Lubricant	Petroleum hydrocarbon	Used as an industrial lubricant
	W & B Coolant	Fatty acid soap	Grinding and polishing agent

**Chemicals used in low volumes; i.e., approximate volumes consumed less than 100 gallons/year

The concentrated and dilute wastewater streams are segregated within the LETF. Concentrated wastewaters are sent to the Chemical Transfer Facility (CTF). Dilute rinsewaters are sent to the Dilute Effluent Treatment Facility (DETF). Waste slurry from the CTF and filtercake from the DETF are combined and transferred to the PWITSF tanks for treatment prior to permanent disposal.

System controls such as air drying were designed and implemented to prevent carryover and possible excess discharge of process solvents to the LETF. Spill control and containment for solvents and other concentrated chemicals is also practiced to eliminate unintentional discharges to the treatment facility.

The M-Area waste stream sources and treatment/disposal pathways are discussed in the following sections.

C.1 Uranium Metal Target Fabrication (Building 313-M)

A process diagram depicting the generated M-Area waste streams and resultant treatment/disposal pathways appears in Figure 5. In Building 313-M, the spent nickel-plating bath solutions (Watts baths of nickel chloride, nickel sulfate, and boric acid) are circulated through filters and dummy plates to remove impurities. The sludge from this treatment, containing activated carbon and filterbestos added as absorption agents, as well as spent dummy plate cleaning acid, spent anodic etchant, and spent nitric acid are discharged to the CTF.

Contact quench water from the hot die/size bonding operations is discharged to the DETF, after any standing oil is decanted and residual oil is removed by cellulose filtration. The decanted oil is drummed for subsequent off-

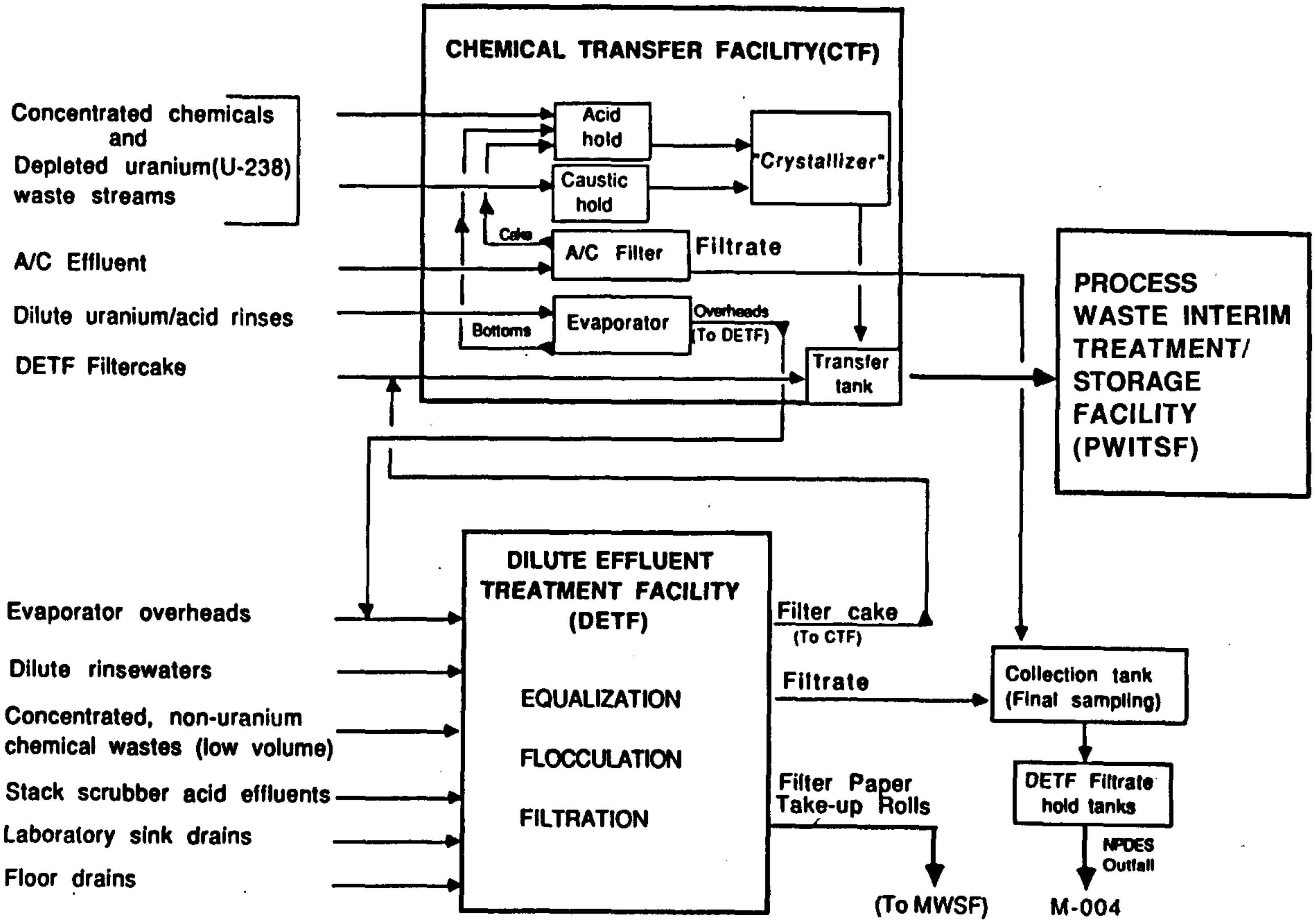

Figure 5. M-Area Liquid Effluent Treatment Facility

site incineration. The water containing residual walnut shells from the cleaning of bonded slugs is discharged to the DETF.

Steam condensate, cooling water, and flush water (in the case of slug failure) from the autoclaves are all discharged to the CTF. The discharges are first filtered in an Oberlin pressure filter, which uses diatomaceous earth and/or PerFlo 30 (Zeolite) as a filter aid. The used filter aid is blown from the filter press and transferred to the PWITSF tanks. The filter press effluent is then polished in one of two parallel sintered metal (Mott-0.5 micron) filters, to remove particulate UO_2. The final filtrate is discharged directly to the LETF discharge hold tank. The Mott filters are back flushed, and the back flush effluent is recirculated through the Oberlin filter press.

Rinsewater effluents which contain uranium are evaporated. The dilute overheads are sent to the DETF, and the concentrated bottoms sent to CTF. Spent caustic etch solution and spent nitric acid solutions containing uranium are also discharged to the CTF. Spent nitric acid and caustic etch solutions which do not contain residual uranium are discharged to the DETF if capacity is available (or to the CTF). Also, stack acid scrubber and rinse waters that do not contain uranium are sent to the DETF.

M-Area process dies and tooling are cleaned as needed in the Building 313-M tool cleaning tanks. Small volumes of spent tool-cleaning solutions and rinsewater are discharged to the CTF or DETF.

The 1,1,1-trichloroethane was used in Building 313-M until September, 1987. Chlorocarbon degreasing was eliminated in 313-M at that time. The spent solvent from the degreaser was collected, stored, and eventually disposed by off-site reclamation or incineration.

C.2 Lithium-Aluminum Target Fabrication (Building 320-M)

All spent aqueous solutions and rinsewaters from Building 320-M cleaning tank operations are discharged to the LETF.

The 1,1,1-trichloroethane was used in Building 320-M until September, 1987, at which time the use of chlorocarbon degreasing agents in 320-M was eliminated. The 1,1,1-trichloroethane was recovered by distillation. Concentrates from the degreaser or still were sent to the SRS hazardous waste storage facility for subsequent off-site reclamation or incineration.

C.3 Fuel Tube Fabrication (Building 321-M)

All spent solutions and rinse waters from Building 321-M are discharged to the LETF. Floor washings are collected in a "mop sink" and filtered to remove uranium fines, and the effluent is sent to the LETF.

The degreasing agents (1,1,1-trichloroethane prior to September, 1987, and Freon TF^{R} after that date) are purified by distillation and recycled. Concentrates from the degreaser and/or still are sent to the permitted SRS hazardous waste storage facility, prior to eventual off-site reclamation or incineration.

The used extrusion press lubricant (a metal powder/oil mixture) is collected from the extrusion press sump and sent to the SRS hazardous waste storage facility. Prior to April 11, 1988, this material contained lead powder (used as a metal lubricant). The lead was replaced with tin on April

11, 1988. This material is eventually shipped off-site for reclamation or incineration.

C.4 Laboratories

In addition to production facilities, building 320-M also contains a wet chemical laboratory that routinely analyses the M-Area solutions for process control. Building 322-M is a metallurgical laboratory that routinely monitors the quality of M-Area raw materials and product. Wastewaters from both laboratories are discharged to the DETF. The grinding and polishing coolants from the metallurgical laboratory (Bldg. 322-M) are filtered to remove any metallic particles, and the filtrate is discharged to the CTF and DETF.

All residual enriched uranium (U-235) is recovered and returned to Oak Ridge for recycle.

C.5 Atmospheric Emissions Control

Process tanks requiring ventilation in the 313-M Area are vented to scrubbers for reduction of NO_X emissions. The scrubber wastewater is discharged to the DETF.

C.6 Auxiliary Flows

The floor drains from Buildings 313-M, 320-M, and 321-M discharge to the DETF. No sanitary sewage is discharged to the LETF. Non-contact cooling water and steam condensate, and rain water run-off are discharged directly to the NPDES outfall A-014.

VI. DESCRIPTION OF WASTE TREATMENT SYSTEMS

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A. M-Area Waste Treatment History

Prior to 1985, M-Area process wastewaters (excluding nickel plating wastes from M-Area) were discharged to the M-Area Hazardous Waste Management Facility (HWMF). The HWMF consisted of an unlined, surface impoundment (known as the M-Area Settling Basin) and overflow areas (composed of a natural seepage area and a shallow depression known as Lost Lake). An overflow drainage ditch (connecting the basin with the overflow areas) is also contained in the HWMF. Wastewater discharge to the HWMF was discontinued March 15, 1985 for construction of the LETF. Operation of the M-Area Liquid Effluent Treatment Facility (LETF) began in July, 1985. The location of the M-Area HWMF in relation to the M-Area production buildings is shown in Figure 6.

An initial analytical characterization of the basin, overflow area, seepage area, and Lost Lake was conducted in late 1981 and early 1982. An extended characterization program for the M-Area HWMF and the process sewer line was started in November, 1984 and completed in March, 1985. The characterization programs addressed the inorganic and organic constituents in the basin liquid, in the soil and sludge at the bottom of the settling basin, in the soils of the seepage area and Lost Lake, in the soils underneath the process sewer, and in nearby background areas. Elevated levels of chlorocarbons, metals, and other constituents were found.

Chlorocarbon degreaser solvent contamination was first detected in the groundwater beneath the M-Area settling basin in June 1981. Since then, an extensive network of monitoring wells has been installed to define the extent, concentration distribution, and migration rate of the chlorocarbon plume. A groundwater quality assessment program was instituted at that time.

Date: 7/15/86

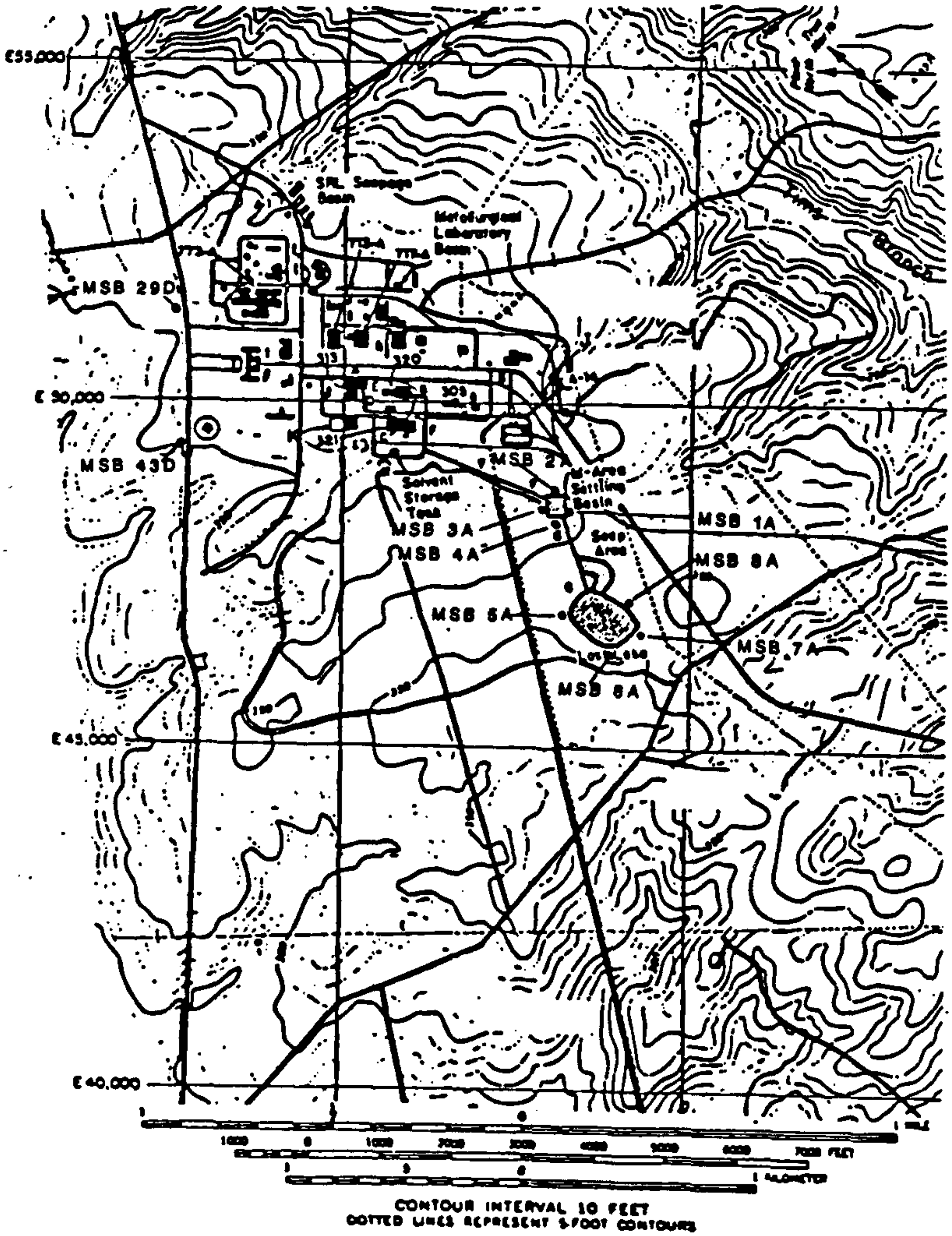


Figure 6. Location of the M-Area Hazardous Waste Management Facility and Associated POC Groundwater Monitoring Wells

Monitoring well results have revealed that the potential sources of chlorocarbon degreaser solvents in the groundwater include the M-Area settling basin, previous spills near the solvent storage tanks behind Building 321-M, the process sewer line to the basin, and the NPDES outfall A-014 (the Tims Branch area where some wastewater previously had been discharged). There have been no discharges to these facilities (except permitted wastewater to NPDES outfall A-014) since the start-up of the Liquid Effluent Treatment Facility. The process sewer lines to the settling basin and to the A-014 outfall were relined in 1983.

Groundwater monitoring data appear in Appendix B. These data were collected from the M-Area Hazardous Waste Management Facility (HWMF) Point of Compliance (POC) monitoring wells shown in Figure 6.

A comprehensive M-Area corrective action program is currently in progress to clean up residual chlorocarbons from the pre-1985 discharges. Based on water quality and geohydrologic data, an engineering feasibility study was conducted to evaluate remedial action alternatives. The preferred corrective action alternative proposed from the study involved the use of recovery (extraction) wells to contain the vertical and horizontal migration of the chlorocarbon contaminant plume. An air stripping system has been installed to remove the chlorocarbon solvents from the recovered groundwater. Degreaser solvent removal efficiencies in excess of 99.99 percent and residual chlorocarbon levels in the stripper effluent below detection limits (1 ppb) have been achieved.

A RCRA Part B hazardous waste permit for the post closure care of the M-Area Hazardous Waste Management Facility was issued on September 30, 1987, by the South Carolina Department of Health and Environmental Control (SCDHEC). Closure activities for the 300-M HWMF are currently underway.

B. Liquid Effluent Treatment Facility - Current Waste Treatment

The Liquid Effluent Treatment Facility (LETF) is a batch treatment system utilizing equalization, neutralization, precipitation, flocculation, and filtration techniques. This system represents Best Available Technology Economically Achievable (BAT) for the aluminum forming and metal finishing industries. The LETF first received M-Area process waste in July 1985. The two principle components of the LETF are the Chemical Transfer Facility (CTF) and the Dilute Effluent Treatment Facility (DETF) as shown previously in Figure 5 (Section V, Part C). Concentrated chemicals and radioactive constituents are sent to the CTF. Dilute wastewaters from all production buildings, laboratories, and evaporator overheads from the CTF, are discharged to the DETF. Treated waste slurry from the CTF and filtercake from the DETF are transferred to above ground tanks in the PWITSF, the third component of the LETF, for final treatment and disposal.

B.1 Chemical Transfer Facility

In the CTF, water and insoluble metallic oxides (including uranium dioxide) from the autoclaves are routed to a holding tank, mixed with filter aid, and fed to an automatic Oberlin pressure filter. Filtrate from the press passes through a Mott polishing filter and is mixed with DETF filtrate for analysis, prior to discharge to the permitted NPDES outfall M-004. Cake from the filter press is fed to the nitric acid hold tank, and subsequently transferred to the PWITSF tanks.

Rinsewaters that contain soluble uranium are fed to an evaporator. The evaporator bottoms are routed to the acid hold tank and the overhead condensate is transferred to the DETF.

Waste acid and caustic hold tanks are installed in the CTF to receive the spent strong acid and caustic solutions. The spent acid and caustic solutions are sent to the "crystallizer", and pH adjusted to greater than 8.5 for pumping and storage, prior to mixing with the DETF filtercake. This mixture is sent to the PWITSF tanks. The sludge undergoes initial treatment in the PWITSF tanks to separate supernate from sludge by gravity settling so that the sludge can be stored until final treatment and disposal.

B.2 Dilute Effluent Treatment Facility

The DETF consists of a treatment system for M-Area dilute process effluents. Dilute wastewater (rinse water, quench water, stack scrubber wastewater, CTF evaporator overheads, laboratory sinks rinse water, and floor sump wastewater) from all M-Area production buildings is discharged to the process sewer and then to a collection sump, as shown in Figure 7. Trace oil is skimmed from the liquid in this sump and drummed for subsequent incineration.

Wastewater is then pumped from the collection sump to one of two 65,000-gallon equalization tanks. One tank collects wastewater while the wastewater in the other equalization tank is being processed through the flocculation/filtration system. The filtercake is transported to the CTF transfer tanks where it is slurried and pumped to the PWITSF. The DETF filtrate is combined with the CTF autoclave filtrate, sampled, and pumped to one of three filtrate holding tanks, as indicated in Figure 7.

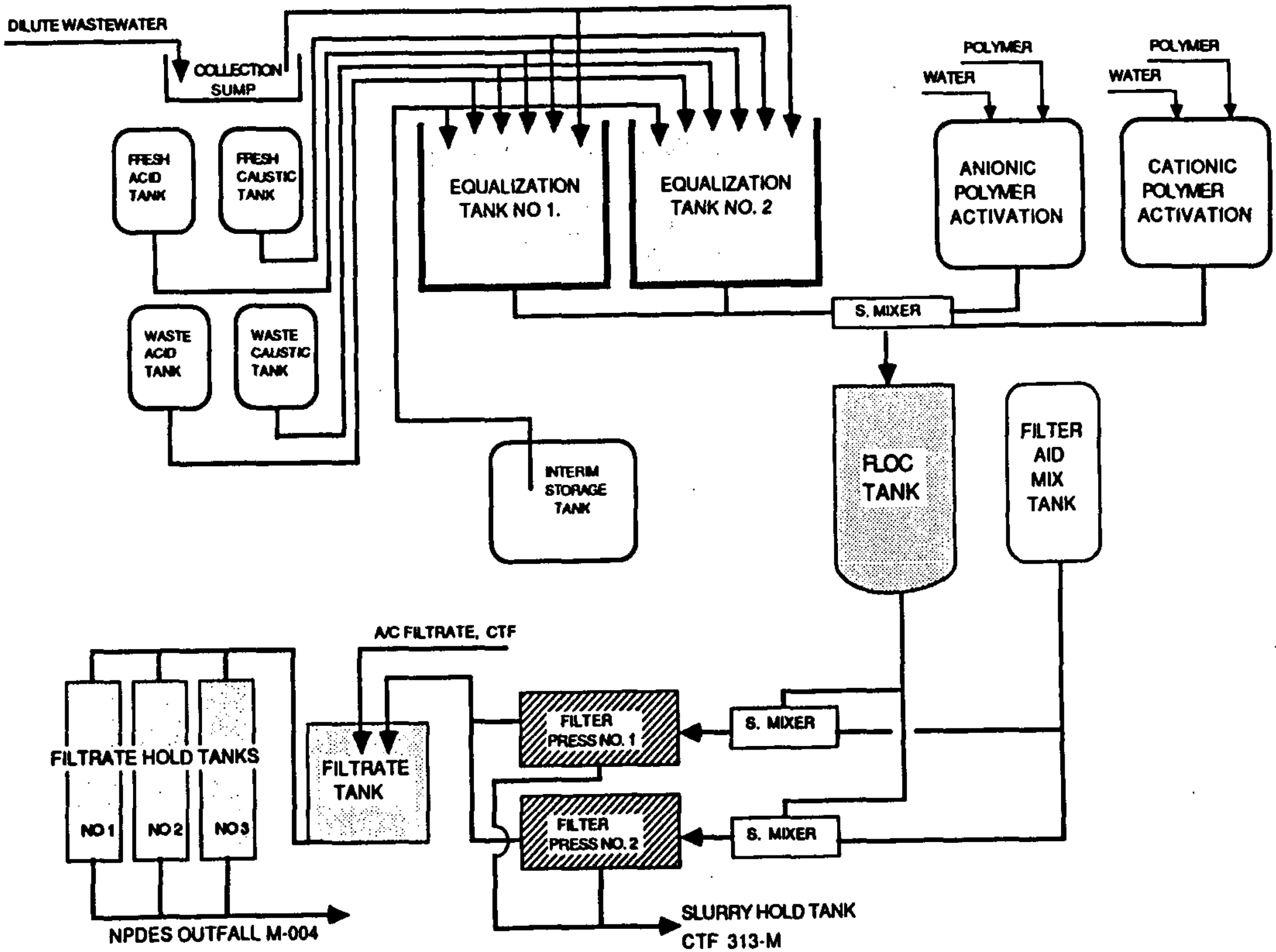


Figure 7. Dilute Effluent Treatment Facility (DETF) Flow Sheet

Composite samples of the filtrate batch are analyzed before discharge to outfall M-004. In the unlikely occurrence of a constituent exceeding NPDES permit guidelines, the filtrate batch can be recycled from the filtrate hold tank back to the DETF equalization tank. The M-004 outfall effluent discharges to a sewer which also receives M-Area noncontact steam condensate and cooling water, storm water drain discharge, and the M-Area groundwater stripper effluent. This sewer flows to permitted NPDES outfall A-014.

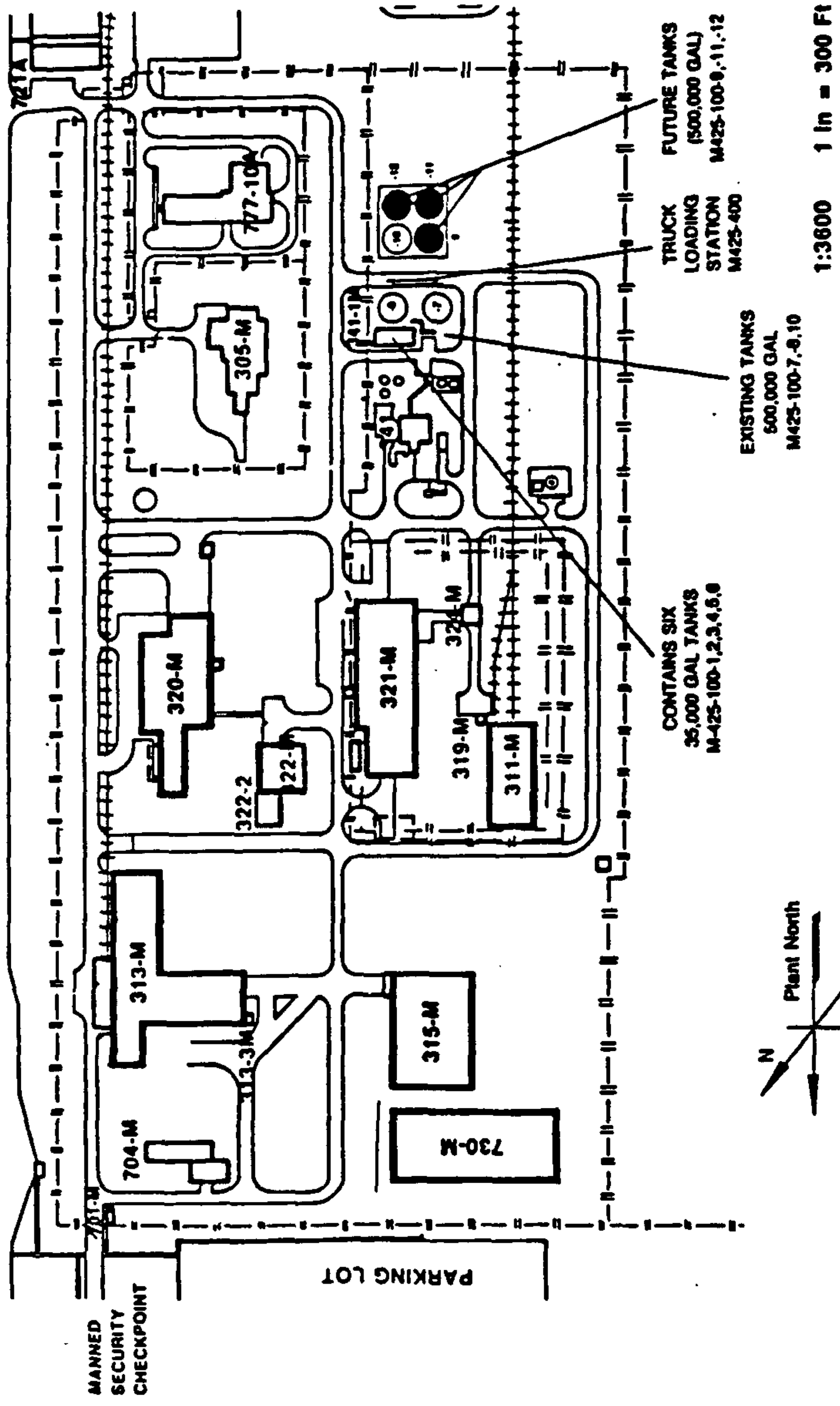
B.3 Process Water Interim Treatment/Storage Facility

The PWITSF presently consists of six 35,000 gallon storage tanks (Tanks M425-100-1, 2, 3, 4, 5, and 6) on a single diked pad inside a structure (Building 341-1M) with roof and full siding, three 500,000 gallon storage tanks (Tanks M425-100-7, 8, and 10), and a truck loading ramp facility (M425-400) as shown in Figure 8. Total present storage capacity is 1,710,000 gallons. The tanks are located in an area south of the DETF (Building 341-M). The six 35,000 gallon tanks, building, truck facility, and the two 500,000 gallon tanks (Tanks M425-100-7,8) were constructed under SCDHEC Permit Number 10,287. Construction of the third 500,000 gallon tank (Tank M425-100-10) was recently completed under a SCDHEC-approved expansion of interim status facilities. In April 1988, SRS personnel began constructing three additional 500,000 gallon tanks (Tanks M425-100-9, 11, and 12) as a second SCDHEC-approved expansion of interim status facilities. Completion of these three additional tanks will expand the future storage capacity to 3,210,000 gallons.

The six 35,000 gallon tanks are single-shell, carbon steel horizontal treatment and storage tanks mounted on steel saddle mounts inside a steel structure on a concrete slab and foundation providing secondary containment. These six

FIGURE 8

M-AREA PROCESS WASTE
INTERIM STORAGE/TREATMENT
FACILITY (PWISTF)



tanks are 40 feet in length, 12 feet in diameter, with a shell thickness of 7/16 of an inch, and corrosion allowance of 1/16 of an inch. The volume of each of these tanks is 35,955 gallons. Each of these six tanks currently contains 34,000 gallons of waste. This waste consist primarily of supernatant and a small volume of F006 sludge (see Table 2).

The 500,000 gallon tanks are double-walled, covered carbon steel tanks which have been designed and are field constructed in accordance with the American Petroleum Institute Standard (API) 650. The primary tanks are 62 feet in diameter by 24 feet high, with an additional 18 inches of annular space between the inner and outer walls. The bottoms of the 500,000 gallon tanks are also double-walled. The outer wall of the tank serves as secondary containment. Shell thickness is at least 5/16 of an inch, and corrosion allowance is 1/16 of an inch. The design volume of these tanks is 500,000 gallons (tank and annular space), however, the tanks will be filled to 485,000 gallons, since overflow occurs at 495,000 gallons. Waste in these tanks consist primarily of supernatant and a relatively small amount of F006 sludge (see Table 2).

The filtercake from the DETF and wastewater from the CTF are blended in a slurry hold tank at the CTF. The blended waste is pumped via an overhead pipeline to the PWITSF. The transfer system includes two slurry pumps, one of which is in standby capacity, as well as piping and ancillary equipment. The piping includes a return line to allow flow recirculation as a preventative measure against sedimentation and subsequent blockage in the transfer piping. A control valve is used to divert part of the recirculating flow to the PWITSF tanks when the CTF slurry holding tank approaches full capacity. A tank is preselected for filling and the valve opened to that tank.

TABLE 2
300-M PROCESS WASTE INTERIM STORAGE/TREATMENT FACILITY
SUPERNATANT AND SLUDGE VOLUMES

Tank	Depth (Ft)*			Volume (Gal)		Total Tank	Volume %**	
No.	Freeboard	Supernatant	Sludge	Supernatant	Sludge	Volume (Gal)	Supernatant	Sludge
1	1'1"	10'6"	<1"	33,600	<300	33,900	100	-
2	8"	9'3"	1'7"	31,900	2,600	34,500	92.5	7.5
3	12"	8'3"	2'3"	28,800	4,800	33,600	85.7	14.3
4	7"	8'11"	2'0"	30,800	3,700	34,500	89.3	10.7
5	8"	8'9"	2'1"	30,500	4,000	34,500	88.6	11.4
6	12"	9'0"	1'6"	30,900	2,600	33,500	92.3	7.7
7	3'6"	18'4"	3'2"	366,600	63,300	429,900	85.3	14.7
8	3'6"	18'0"	3'6"	360,000	70,000	430,000	83.7	16.3
Total				913,100	151,300	1,064,400		

* Depth measurements based on tank sampling and rodding by SRL personnel, April 1988.

** Volume % based on total volume of supernatant + sludge.

Valves on all other tanks remain closed. Specific operating procedures are followed during the waste slurry transfer to the PWITSF.

Tanks 1-6 contain a mixer which agitated the wastewater during filling operations. Once a tank had been filled to capacity, the mixer was stopped and solids were allowed to settle in the tank. The supernatant will be decanted from the tanks and pumped to the DETF equalization tanks for treatment pending modification of the LETF wastewater treatment facility permit by SCDHEC. The remaining F006 sludge is proposed to be treated per the process described in this delisting petition.

C. Proposed F006 Waste Sludge Treatment Facility and Disposal Method

Supernatant will be decanted and processed in the DETF pending SCDHEC approval of the LETF permit modification (Waste Water Treatment Facility Permit 10,287 Modification Request Project S-4138 Modification). The remaining F006 sludge plus supernate will be slurried and transferred to the waste solidification/ stabilization facility where it will be mixed with cementitious dry solids to form a solid non-hazardous, low-level waste.

This treatment facility (Figure 9) will consist of a dry solids (cement, fly, slag) storage unit, pneumatic transfer system, mixer capable of intimately mixing the waste and dry solids, and equipment control console. The system will also include a mixer flush and/or clean out system and vessel ventilation to meet air quality control criteria. All equipment for processing 300-M saltstone will comply with applicable ANSI, NEC, OSHA, and all Federal regulatory rules and provisions that apply to equipment of this type.

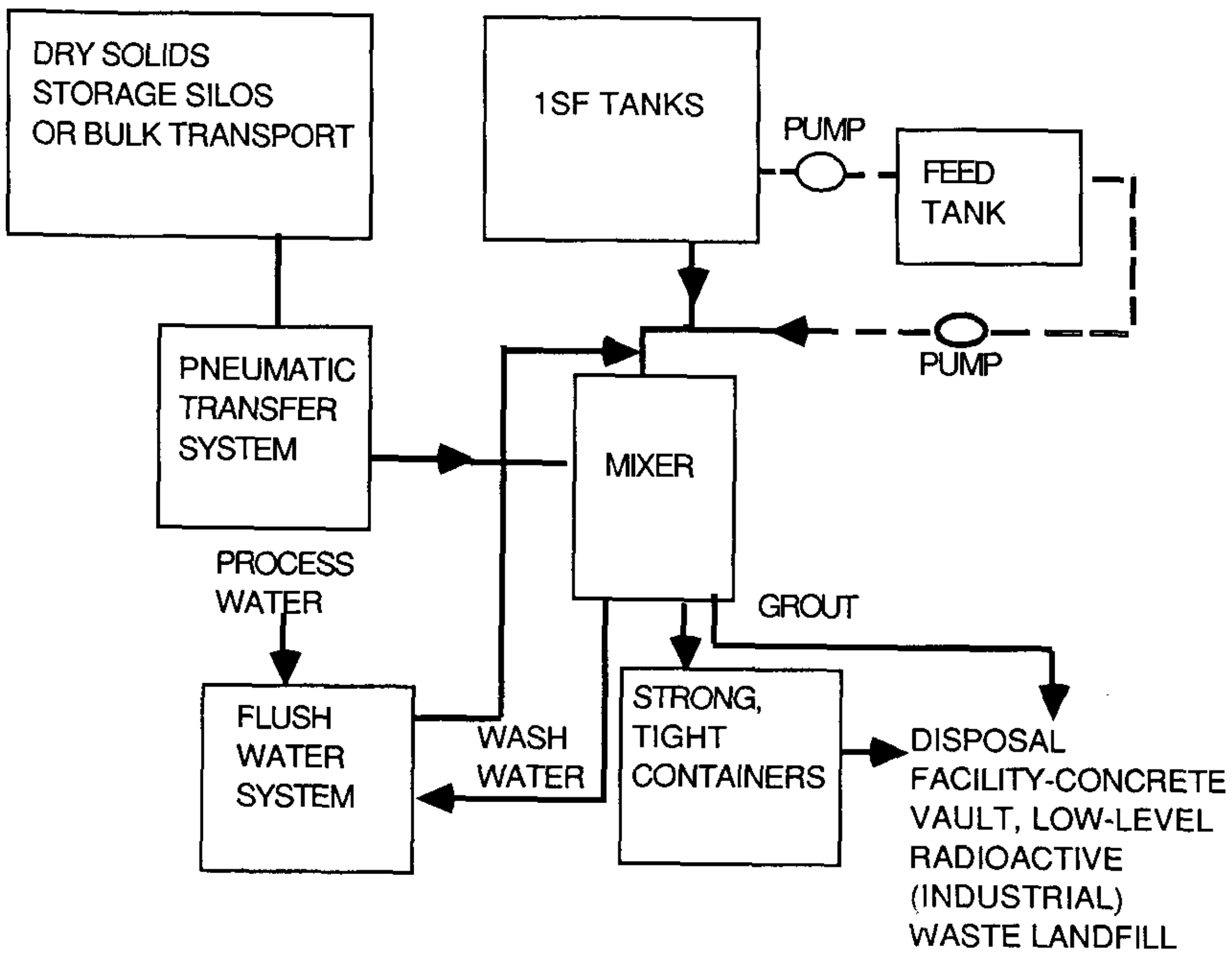


FIGURE 9. 300-M SALTSTONE PROCESS

Operations will consist of metering the required ratio of dry solids and adjusted slurry to the mixer. The mixer will discharge to a permitted, solid waste disposal vault or to strong, tight containers. If saltstone containers are used, they will be sealed, labeled and transported to the permitted, solid waste disposal vault.

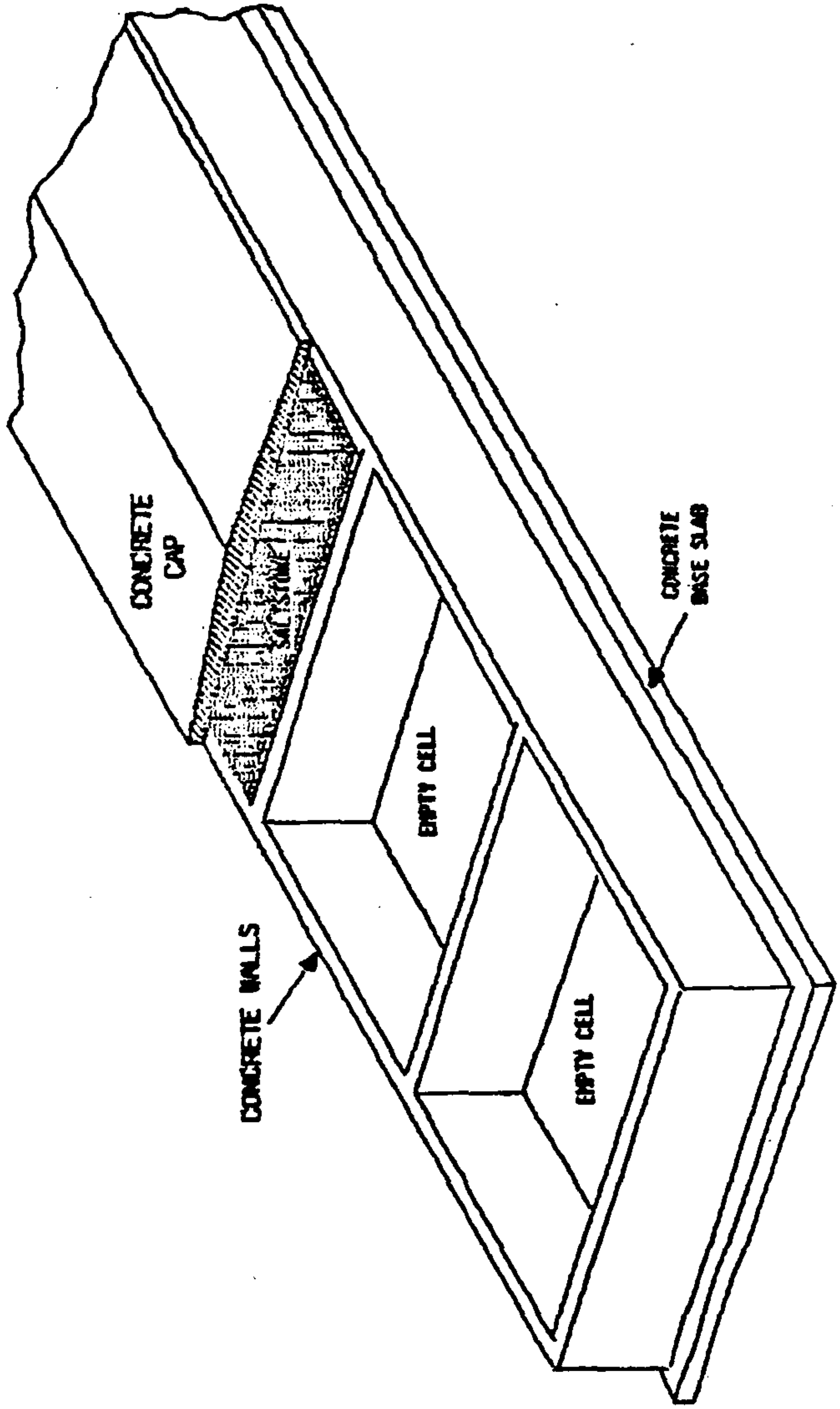
The disposal facility will be similar to the SRS Z-Area Saltstone Disposal Facility permitted as an Industrial Solid Waste Landfill (SCDHEC Permit No. 12683). The facility will provide state-of-the-art protection of personnel and the environment from potential release of chemical and radioactive materials (see Figure 10).

The facility will include reinforced concrete vaults designed to prevent groundwater and rain water from contacting the waste (see Figure 10). The vaults will be located sufficiently above the historic high water table to avoid disposal of waste in a zone of water table fluctuations. Also they will be covered before, during, and after waste emplacement to prevent water accumulation in the vault and contact of rain water with waste. The entire disposal facility will be fenced and have controlled access gates. Although the 300-M saltstone contains only non-toxic levels of hazardous constituents, this disposal method was designed to effectively isolate the waste from the environment and protect groundwater.

Process quality control for the saltstone process will be maintained by controlling the waste to dry solids ratios. Verification of saltstone physical properties (set and free water), and periodic submission of saltstone samples for EP toxicity testing will also be carried out to assure 300-M saltstone quality. All operations will be conducted by trained personnel using documented, operating procedures.

FIGURE 10

SALTSTONE SURFACE VAULT
ISOMETRIC



Approximately 151,300 gallons of F006 sludge have been generated by M-Area operations between July, 1985 and June, 1988 (Table 2). Since solidification of the pH adjusted sludge results in approximately a 2X volume increase, the amount of saltstone that will be generated from the currently stored sludge will be about 302,600 gallons (1,500 cu. yd.).

Although current 300-M production rates are less than the rates of the previous years because SRS reactors are operating at less than capacity, conservative future maximum production rates can be calculated based on the project basic data for the PWITSF, which used a transfer rate of 40,000 gallons/month (480,000 gallons/year). The operating history has shown that this material separates on standing into a supernatant and sludge, with the sludge being less than (or equal to) about 25% by volume. This results in a maximum sludge production rate of 120,000 gallons/year or 10,000 gallons/month (~ 600 yd^3/year or ~50 yd^3/month), that will generate a maximum of 1200 yd^3/year (or 100 yd^3/month) of M-Area saltstone. This projected maximum yearly rate (1200 yd^3) is less than the volume of saltstone that will be generated from the sludge currently in storage (about 1500 yd^3).

VII. DESCRIPTION OF F006 SLUDGE SAMPLING AND TREATMENT AND TESTING

VII. DESCRIPTION OF F006 SAMPLING AND TREATMENT AND TESTING

A sampling program for the M-Area sludge was conducted in April, 1988. After collection, samples were taken to the Savannah River Laboratory where a saltstone treatment process was developed. The sludge samples were stabilized using the experimental saltstone process. The resulting samples were then transferred using appropriate chain of custody procedures to Enwright Laboratories in Greenville, South Carolina, for analysis.

A. Laboratory Personnel Qualifications

1. SR Personnel

The sampling program was conducted by W.H. Harley, J. P. Harley and C. A. Langton, SRL. The qualifications of personnel responsible for sampling of the M-Area sludge are summarized in the resumes in Appendix C. All personnel involved in sludge sampling are full-time employees of Westinghouse Savannah River Company (formerly E. I. du Pont de Nemours & Co., Inc.) and have been employed at SRS for at least 5 years. (These personnel were previously employed by the former operating contractor, E. I. du Pont de Nemours & Co., Inc.). They are all members of the Interim Waste Technology Division (IWT).

2. Enwright Personnel

Saltstone samples were analyzed by Enwright Laboratories, Inc., a full service environmental and research laboratory located in Greenville, South Carolina. The SCDHEC laboratory certification number for Enwright Laboratories, Inc. is 23127. Analytical facilities include a 6,000 square foot chemical/biological laboratory equipped to service a broad spectrum of environmental needs, including mixed waste analysis and treatment.

Enwright Laboratories' professional staff includes organic and inorganic chemists, biologists, toxicologists, and chemical and environmental engineers. The project manager for the saltstone analytical program was Dr. Steven Hoeffner, Geochemist. Other Enwright Laboratories personnel involved in project management were Dr. Charles Reece, Laboratory Manager. A general statement of Enwright Laboratories' qualifications, experience, and certification appears in Appendix C. The Enwright personnel specifically involved with the sample analyses were:

- Dr. Steven Hoeffner, Geochemist
- James Westmoreland, Special Project Chemist
- Chris G. Teal, Organic Analytical Chemist
- Tammy J. Cleveland, Organics Preparation Technician
- Letitia Holcombe, Inorganics Supervisor

Subcontractors involved with the sample analyses were:

- Ron Keil, Lab Director - Natural Resources Laboratory
- Julianna Lucere, Laboratory Technician - Controls for Environmental Pollution
- Elvin Chavez, Laboratory Technician - Controls for Environmental Pollution

The resumes of these individuals are given in Appendix C.

B. Sampling Methodology

Each of the eight filled PWITSF tanks were sampled at four different tank locations in April, 1988. EPA tank sampling protocol (SW-846) was followed in order to obtain samples representative of the tank contents. Complete vertical sections of sludge were collected at each location in each tank.

A Nasco "Sludge Judge" sampler was used to collect the vertical composite samples (Figure 11). The sampler was slowly lowered to the bottom of each tank. The check valve at the bottom of the sampler was closed and the unit was raised with the full vertical section of sludge. The sludge was emptied into one gallon polypropylene bottles, capped, and sealed with tamper-proof tape. The SRL sampling procedure and chain of custody documentation are included in Appendix D.

Details of the sampled locations for each tank are given below:

1. *Six Horizontal 35,000 Gallon Tanks (M-425-100-1 to 6).* A 4 x 6 foot access port is located on the top of each tank midway along the horizontal (long) axis. The port is located near a catwalk over all 6 tanks and was therefore easily accessible. The port cover was removed and vertical cores were collected from each of the four corners of this port.

   Samples are representative of the tank contents since these tanks were agitated while being filled. After filling, the agitators were turned off and the sludge settled to the bottom.

2. Two vertical 500,000 Gallon Tanks (M-425-100-7 and 8). Four 12-inch diameter access ports are located on top of each of these tanks, one in each of the four quadrants. A full vertical sludge sample was collected from each access port.

C. <u>300-M Saltstone Development</u>

Samples were taken to the SR Laboratory for development of a waste treatment process. Scoping studies were carried out by C. A. Langton and W. H. Harley to evaluate waste to cementitious solids proportioning, and mixing, settling and leaching

FIGURE 11

Instructions for

SLUDGE JUDGE

ASSEMBLY

A. The <u>bottom pipe</u> – has the ball check valve on one side and male threads on the other.

B. The <u>middle pipe</u> – has female on one end and male threads on the other.

C. The <u>top pipe</u> – has female threads on one end and a rope on the other.

EXTRA PARTS
CAN BE ORDERED THROUGH NASCO

C9250 5 ft. bottom section
C9251 5 ft. middle section
C9252 5 ft. top section
C9253 Teflon seal tape
C9249 Canvas storage case

ASSEMBLY

Screw the three sections of pipe together until they are fairly tight. It is not necessary to turn the threads all the way in.

STORAGE

Please store this unit where it cannot be damaged, especially by foot traffic, doors, or machinery.

HOW TO USE

Lower the Sludge Judge to the bottom of the tank from which you would like to take a sample. When the bottom has been reached, and the pipe has filled to the surface level, tug slightly on the rope as you begin to raise the unit. This will seat the check valve, trapping the column of sludge and water in the Sludge Judge.

When the unit has been raised clear of the water, the amount of sludge in the sample can be read using the one foot increments marked on the pipe sections.

To release the material in the unit, touch the pin extending from the bottom section against a hard surface. This opens the check valve to drain the liquid and sludge.

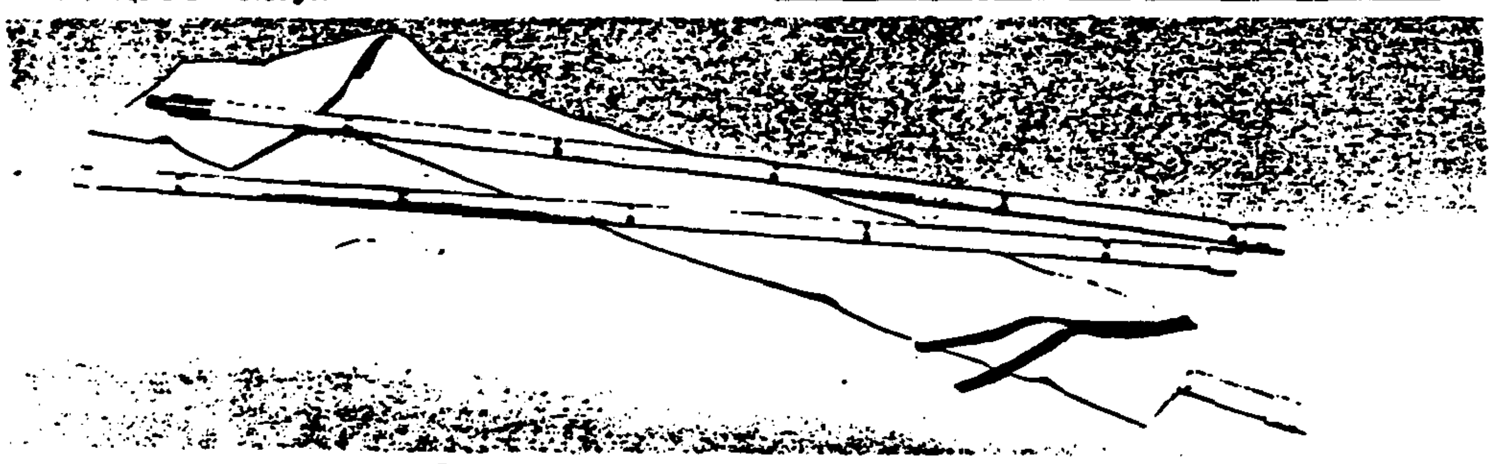
CARE OF THE SLUDGE JUDGE

This unit has been designed so that a minimum amount of material will build up on the inside of the tubing. However, if it should become dirty, flush it with a mild soap or a vinegar and water solution.

READ CAREFULLY

This unit should be lowered slowly and <u>not</u> plunged to the bottom of the tank. Plunging the unit will result in an <u>inaccurate</u> reading and <u>breakage</u> of the bottom valve. PLEASE LOWER SLOWLY.

We suggest two methods to help protect the bottom valve for those who will not lower the unit slowly. 1) Add a small piece of hose to cushion the bottom. 2) Put tape on the unit at the water line when the bottom valve is 2" from the bottom of the tank. <u>Never</u> *lower the unit beyond this 2" mark. (This is the preferred method.)*



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58 Dawson Rd., Guelph, Ontario, Canada N1H 6P9
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characteristics of various 300-M saltstone formulations. Selection of the 300-M saltstone formulation (Appendix E) for the F006 sludge waste was based on the following factors: processable mix; low leaching; low volume increase. Adjustment of the waste pH to $\geq$12.5 was necessary to activate cement, slag, and fly ash hydration and thereby produce a stabilized solid waste material. Copies of data recorded in SR Laboratory notebooks pertaining to 300-M saltstone development are included in Appendix D.2.

D. Sample Chain of Custody Procedures

The chain of custody for the sludge samples was tracked by recording unique numbers on tamper proof seals placed on each one-gallon sample collected from the PWITSF tanks. Transfer of the samples from 300-Area to SRL was supervised by J. P. Harley, SRL. Upon delivery of the samples to SRL they were received by W. W. Harley and stored in the IWT saltstone laboratory.

Saltstone samples prepared for off-site analysis were placed in containers and sealed with new numbered tamper proof seals. Chain of custody sheets for transfer of the saltstone material from SRL to Enwright were initiated by W. W. Harley, SRL, and accepted in person by R. A. Mabry, Enwright, who picked up the samples at SRL Building 773-A for hand delivery to Enwright Associates. Chain of custody forms are contained in Appendix D.3.

E. Saltstone Evaluation - Analytical Parameters, Techniques, and Equipment

The sludge and, therefore, 300-M saltstone are generically listed as an F006 waste for the following hazardous constituents: cadmium, chromium, nickel, and complexed cyanide. Saltstone made from each of the 32 sludge samples (4/tank) were analyzed as follows between the dates of August 2, 1988 to October 21, 1988 (See Appendix F.3):

- o Total Analysis - Saltstone analysis for As, Ba, Cd, Cr, Pb, Hg, Se, and Ag, plus Ni, Zn, oil and grease, ignitability, and reactivity (sulfide and cyanide)

- o EP Toxicity Procedure (EP Tox)

    - Extract analysis for metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag, plus Ni, Zn)

- o Toxicity Characteristic Leaching Procedure (TCLP)

    - Extract analysis for TCLP volatile organics

Eight saltstone samples (1/tank) were analyzed as follows:

- o Multiple Extraction Procedure (MEP)

    - Extract analysis for metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag, plus Ni, Zn)

A full Appendix VIII analysis was not conducted because a complete description of the manufacturing process, included in this petition, indicates these potential waste constituents are not used in the process.

Sample extraction analyses were conducted by Enwright in accordance with EPA-approved procedures. A list of test methods used by Enwright Laboratories for the analysis of the M-Area saltstone samples are given in Table 3. Specific equipment brands and model numbers used in sample analyses are summarized

TABLE 3

TEST METHODS USED FOR THE ANALYSIS
OF 300-M SALTSTONE LEACHING

Test	Method
Aluminum	EPA Method 202.1
Nickel	EPA Method 249.1 (SW846 - 7520)
Copper	EPA Method 220.1
Lead	EPA Method 239.1 (SW846 - 7420)
Cadmium	EPA Method 213.1 (SW846 - 7090)
Chromium	EPA Method 218.1 (SW846 - 7190)
Zinc	EPA Method 289.1
Sodium	EPA Method 273.1
Lithium	Thermo Jarrel Ash Method No. 42208-01
Total Phosphate	EPA Method 365.2 Colorimetric
pH	EPA Method 150.1 (SW846 - 9041)
Viscosity	ASTM - D445-74 (Viscometer Tube Method)
Specific Gravity	Standard Method 213.E
Total Solids	EPA Method 160.3 Gravimetric
Mercury	Method 245.1 (SW846 - 7470 and 7471) Cold Vapor Technique
Selenium	Method 270.2 (SW846 - 7741) AA Furnace Technique
Arsenic	Method 206.2 (SW846 - 7061) AA Furnace Technique
Toxic Extraction Procedure	SW846 - 1310
Cyanide	EPA Method 335.2 Titrimetric
Sulfide	Hach Method (lead acetate indicator paper)
Toxicity Characteristic Leaching Procedure	Fed. Reg. Vol. 51, No. 216, p. 40644
Volatiles	SW846 - 8270
Semi-Volatiles	SW846 - 8240
Pesticides	Standard Method 509A
Herbicides	Standard Method 509.B
Paint Filter Test	SW846 - 9095
Multiple Extraction Procedure	SW846-1320

in Table 4. A summary of additional available Enwright Laboratory equipment appears in Appendix C.

Enwright Laboratories, Inc. maintains a strict Quality Assurance Program in accordance with South Carolina Department of Health and Environmental Control (DHEC) regulations and with 10 CFR 50 Quality Assurance Criteria for Nuclear Power Plants. Appendix C contains a copy of Enwright's state certification and a copy of the license to handle low-level radioactive wastes.

TABLE 4

ANALYTICAL EQUIPMENT LIST*

Item	Brand	Model No.
Gas Chromatograph	Varian Vista	6000
Control Data System	Varian Vista	401-2
Atomic Absorption Spectrophotometer	IL	951
Flameless Atomizer	IL	Furnace 188
AA/AE Spectrophotometer	IL	551
Flameless Atomizer	IL	555
Atomic Absorption Spectrophotometer	IL	951
Flameless Atomizer	IL	Furnace 188
Analytic Balance	Mettler	H45
TEP Extractor	-	-
Water Purifier	Corning	LD5
Vacuum Pump	GE	5KH33GN293X
AA/AE Spectrophotometer	IL	951
Zero Head Extractor	Associated Design and Manuf. Co.	3740-ZHB
MEP Extractor	--	--

* Equipment used by Enwright Laboratories for analyses of saltstone material samples.

VIII. CHEMICAL CHARACTERIZATION OF WASTE

VIII. CHEMICAL CHARACTERIZATION OF WASTE

A. Rationale for Including Data and Limiting Analyses

A.1 Groundwater Data for the 300-M Area

The groundwater monitoring information for 300-M Area is tabulated in Appendix B and briefly discussed in Section VI. It is included for two reasons:

1. The EPA normally wishes to inspect the available groundwater monitoring information.

2. Groundwater data from the 300-M facility support the contention that 300-M saltstone should be delisted, i.e., treated as non-hazardous waste. A higher level of groundwater protection will be achieved by the proposed treatment and disposal method (saltstone and engineered landfill) compared to that previously used, i.e., an unlined surface impoundment. Since the groundwater monitoring data from RCRA compliance point wells near the unlined M-Area settling basin indicate that the concentrations of Ni and 1,1,1-trichloroethane (the only Appendix VIII constituents currently in the waste) are below the protection standards (0.500 and 0.200 mg/L, respectively) and since the total amount of Ni and 1,1,1-trichloroethane in the PWITSF tanks is much less than that discharged to the M-Area settling basin (15,000 and 1,000 kg, respectively), current groundwater quality at the perimeter of the engineered saltstone landfill is expected to be maintained as the result of the proposed treatment and disposal practices.

A.2 Justification for Limiting Constituent Analyses

Nickel and 1,1,1-trichloroethane are the only hazardous materials (Appendix VIII) currently or recently used in the 300-M processes. The other hazardous materials, trichloroethylene, tetrachloroethylene, and their decomposition products, 1,1-dichloroethylene and t-1,2-dichloroethylene, detected in 300-M groundwater monitoring wells have not been used in the M-Area processes since 1979.

The supernatant solutions in the PWITSF were analyzed for 1,1,1-trichloroethane and other process chemicals. The results of these analyses are included in Appendix B. No I,I,I-trichloroethane was detected in concentrations above the minimum detection limit of 5 ug/L (ppb) in any of the PWITSF tanks.

Based on these comparisons and data, we believe that neither nickel nor 1,1,1-trichloroethane from the saltstone material would cause the groundwater concentration to be significantly elevated above groundwater protection standards even if the saltstone material were disposed in an unlined land trench. However, we propose disposal in an engineered landfill which includes emplacement of the stabilized waste in covered concrete vaults according to DOE order 5820.2A (Appendix G.3) and the March 9, 1988 DOE Record of Decision pertaining to Waste Management Activities for Groundwater Protection at the Savannah River Site, Aiken, S.C. (Appendix G.2).

B. 300-M Saltstone Analysis

Based on the knowledge of the 300-M aluminum forming and metal finishing processes and Section VIII-A above, the following analyses were performed on the 300-M saltstone.

B.1 Total Analyses

Total concentration analyses were conducted on the 300-M saltstone for EP Toxic Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), zinc, nickel, lithium, and 1,1,1-trichloroethane. Total cyanide and oil and grease were also analyzed. The complete set of analytical data are included in Appendix F. A summary of the maximum concentration of the four samples taken from each tank is included in Table 5.

B.2 Reactivity, Ignitability, and Corrosivity

Reactivity and ignitability tests of 40 CFR Part 261 Subpart C were performed on the 300-M saltstone. None of the samples from the eight tanks exhibited the characteristics of reactivity or ignitability. Complete analytical data are included in Appendix F.

The corrosivity characteristic test was not performed because the 300-M saltstone material is a solid not a corrosive liquid.

B.3 Extraction Analyses

The Extraction Procedure of 40 CFR Part 261 was used to evaluate the characteristic of toxicity for the 300-M saltstone samples for the EP Toxic Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), zinc, and nickel. The minimum to maximum leachate concentration range for each constituent is summarized in Table 6. The complete set of analytical data for each tank are included in Appendix F.

TABLE 5

TOTAL 300-M SALTSTONE CONCENTRATIONS

Constituent (mg/kg)	PWITSF TANKS 1	2	3	4	5	6	7	8
Ag	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
As	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Ba	200.0	210.0	250.0	260.0	300.0	210.0	230.0	210.0
Cd	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cr	35.0	41.0	34.0	37.0	46.0	37.0	38.0	40.0
Hg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pb	80.0	67.0	45.0	55.0	62.0	55.0	50.0	40.0
Se	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Ni	1500.0	1900.0	290.0	790.0	1400.0	1300.0	2100.0	1300.0
Zn	100.0	84.0	74.0	57.0	85.0	74.0	57.0	64.0
Li	0.4	0.4	0.5	0.5	0.6	0.4	0.5	0.4
Total CN	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0*	<10.0*
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

* *Matrix interference on these samples*

- Results for each tank shown above are the maximum concentration of the four samples taken from each tank.

TABLE 6

EP TOXIC LEACHATE CONCENTRATIONS
OF 300-M SALTSTONE

Constituent	Minimum to Maximum EP Toxic leachate Concentrations for all 8 Tanks (mg/l)
Ag	<0.5 to <0.5
As	<0.05 to <0.05
Ba	0.8 to 2.7
Cd	<0.01 to <0.01
Cr	<0.05 to <0.05
Hg	<0.0005 to <0.0005
Pb	0.2 to 0.3
Se	<0.01 to <0.01
Ni	0.3 to 2.5
Zn	0.1 to 0.4

B.4 Multiple Extraction Procedure (MEP)

One sample from each of the eight tanks were analyzed for the eight EP Toxic metals, zinc, and nickel using the Multiple Extraction Procedure described in "Test Methods for the Evaluation of Solid Wastes, Physical/Chemical Methods SW-846, 1984" (or latest edition) Method 1320. Results for these constituents are below minimum detection levels. The complete analytical data are included in Appendix F.

B.5 TCLP - Volatile Organics

The 300-M saltstone samples were analyzed for volatile organics using the Toxicity Characteristic Leaching Procedure (TCLP) according to 40 CFR 268 Appendix I. All of the samples were below minimum detection levels for all volatile organic constituents. Complete analytical data for the TCLP volatile organics are included in Appendix F.

IX. VHS MODEL RESULTS FOR HAZARDOUS CONSTITUENTS

IX. VHS MODEL RESULTS FOR HAZARDOUS CONSTITUENTS

For delisting petitions, EPA requires that the Vertical and Horizontal Spread (VHS) Model be used for predicting the impact of waste disposal on the ground water (under worst case operating and environmental conditions). The VHS model utilizes a dilution factor calculated on the basis of waste volume. This factor is multiplied by the EP toxic leaching data and results are compared to Primary Drinking Water Standards. In addition, EPA requires that for stabilized material, the same calculations and comparisons be made using Multiple Extraction Procedure (MEP) leaching data.

The 300-M saltstone volume was calculated on three different bases, current stored volume, maximum annual volume, and the averaged historic volume (average over the last three years of operation). The highest (worst case) EP and MEP leachate values for any of the 32 samples tested were used to calculate the maximum VHS Model compliance point concentration in this section.

A. VHS Model Dilution Factors for 300-M Saltstone

The cumulative volume of saltstone, made from sludge collected over three years (Section VI), amounts to 1500 cubic yards. Based on this fact, the EPA VHS Model utilizes a dilution factor of 11.2 to predict the maximum concentration of diluted constituents at the hypothetical compliance point (located 500 feet from the disposal site).

The projected maximum production rate of 300-M saltstone is 1200 cubic yards per year based on the manufacturing facility design capacity described in Section VI. Based on this maximum annual waste volume, the EPA VHS Model utilizes a worst case dilution factor of 13.5 to predict the maximum concentration of diluted constituents at the hypothetical compliance point (located 500 feet from the disposal site).

The average production rate of 300-M saltstone based on the last three years operation is approximately 500 cubic yards per year. Based on this actual average waste volume, the EPA VHS Model utilizes a dilution factor of 30.0 to predict the concentration of diluted constituents at the hypothetical compliance point (located 500 feet from the disposal site).

B. 300-M Saltstone Leachate Versus VHS Model Compliance Point Concentrations

EP Toxic Leachate

To determine the maximum compliance point concentration, the maximum parameter value for the 32 EP Toxic leachate samples was divided by the dilution factor of 11.2. This is the lowest dilution factor (worst case) and applies to the entire volume of sludge (three years production) currently stored in the 300-M waste tanks. Table 7A compares the maximum calculated compliance point concentration for each parameter analyzed to the EPA Primary Drinking Water maximum concentration standard. Tables 7B and 7C compare the maximum calculated compliance point concentrations for each parameter analyzed using dilution factors of 13.5 and 30.0 (maximum annual and historical annual average waste volumes, respectively) to the EPA Primary Drinking Water maximum concentration standards.

MEP Leachate

The maximum parameter values for the 8 Multiple Extraction Procedure (MEP) samples were divided by the worstcase (existing inventory) dilution factor of 11.2. Table 8A compares the maximum calculated compliance point concentration for each parameter analyzed to the EPA Primary Drinking Water maximum concentration standard.

TABLE 7A

300-M SALTSTONE LEACHATE COMPARISON TO VHS MODEL (DILUTION FACTOR OF 11.2)

Constituent	Maximum EP Toxic Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.05	<0.0045	0.05
As	<0.05	<0.0045	0.05
Ba	2.7	0.24	1.0
Cd	<0.01	<0.0009	0.01
Cr	<0.05	<0.0045	0.05
Hg	0.0005	0.000045	0.002
Pb	0.3	0.0268	0.05
Se	<0.01	<0.0009	0.01
Ni	2.5	0.223	0.5
Zn	0.4	---	Not Applicable
Cn	Not in Waste	---	---

TABLE 7B

300-M SALTSTONE LEACHATE COMPARISON TO VHS MODEL (DILUTION FACTOR OF 13.5)

Constituent	Maximum EP Toxic Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.05	<0.0037	0.05
As	<0.05	<0.0037	0.05
Ba	2.7	0.20	1.0
Cd	<0.01	<0.0007	0.01
Cr	<0.05	<0.0037	0.05
Hg	0.0005	0.000037	0.002
Pb	0.3	0.0222	0.05
Se	<0.01	<0.0007	0.01
Ni	2.5	0.185	0.5
Zn	0.4	---	Not Applicable
Cn	Not in Waste	---	---

TABLE 7C

300-M SALTSTONE LEACHATE COMPARISON
TO VHS MODEL
(DILUTION FACTOR OF 30.0)

Constituent	Maximum EP Toxic Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.05	<0.0017	0.05
As	<0.05	<0.0017	0.05
Ba	2.7	0.09	1.0
Cd	<0.01	<0.00033	0.01
Cr	<0.05	<0.0017	0.05
Hg	0.0005	0.000017	0.002
Pb	0.3	0.01	0.05
Se	<0.01	<0.00033	0.01
Ni	2.5	0.083	0.5
Zn	0.4	---	Not Applicable
Cn	Not in Waste	---	---

Reference: 50 Federal Register, pp 48886 thru 48910, November 27, 1985.

TABLE 8A

300-M SALTSTONE MULTIPLE EXTRACTION PROCEDURE
LEACHATE COMPARISON TO VHS MODEL
(DILUTION FACTOR OF 11.2)

Constituent	Maximum MEP Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.01	<0.0009	0.05
As	<0.1	<0.009	0.05
Ba	<0.1	<0.009	1.0
Cd	<0.01	<0.0009	0.01
Cr	<0.05	<0.0045	0.05
Hg	0.0005	<0.000045	0.002
Pb	<0.1	<0.009	0.05
Se	<0.01	<0.0009	0.01
Ni	<0.05	<0.0009	0.5
Zn	<0.01	<0.0009	Not Applicable
Cn	Not in Waste	---	---

TABLE 8B

300-M SALTSTONE MULTIPLE EXTRACTION PROCEDURE
LEACHATE COMPARISON TO VHS MODEL
(DILUTION FACTOR OF 13.5)

Constituent	Maximum MEP Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.01	<0.0007	0.05
As	<0.1	<0.0074	0.05
Ba	<0.1	<0.0074	1.0
Cd	<0.01	<0.0007	0.01
Cr	<0.05	<0.0037	0.05
Hg	<0.0005	<0.000037	0.002
Pb	<0.1	<0.0074	0.05
Se	<0.01	<0.0007	0.01
Ni	<0.05	<0.0037	0.5
Zn	<0.01	<0.0007	Not Applicable
Cn	Not in Waste	---	---

The maximum parameter values for the 8 MEP samples were also divided by the projected maximum annual dilution factor and the historic average annual dilution factor (13.5 and 30.0 respectively). The resulting compliance point concentrations are compared to EPA Primary Drinking Water maximum concentrations in Tables 8B and C, respectively.

C. Conclusion

In comparing the calculated compliance point EP Toxic leachate and MEP concentrations, all parameters predict a maximum compliance point concentration below the Primary Drinking Water Standards. Using worst case leaching data in addition to maximum projected waste volume (lowest dilution factor), generated compliance point concentrations which were below the primary drinking waste concentration for these metals. Therefore, the analytical data justifies this request for exclusion from the hazardous waste regulations of 40 CFR, Part 261, for a waste by-product classified as an F006 Listed Waste.

TABLE 8C

300-M SALTSTONE MULTIPLE EXTRACTION PROCEDURE
LEACHATE COMPARISON TO VHS MODEL
(DILUTION FACTOR OF 30.0)

Constituent	Maximum MEP Leachant Concentration(mg/l)	Maximum Calculated VHS Model Compliance Point Concentration (mg/l)	Primary Drinking Water Standards (mg/l)
Ag	<0.01	<0.0003	0.05
As	<0.1	<0.0033	0.05
Ba	<0.1	<0.0033	1.0
Cd	<0.01	<0.0003	0.01
Cr	<0.05	<0.0017	0.05
Hg	<0.0005	<0.000017	0.002
Pb	<0.1	<0.0033	0.05
Se	<0.01	<0.0003	0.01
Ni	<0.05	<0.0017	0.5
Zn	<0.01	<0.0003	Not Applicable
Cn	Not in Waste	---	---

Reference: 50 Federal Register, pp 48886 thru 48910, November 27, 1985.

Multiple Extraction Procedure described in "Test Methods for the Evaluation of Solids Waste, Physical/Chemical Methods - SW-846, 1984" (or latest edition), Method 1320.

X. SUMMARY

X. SUMMARY

This petition seeks exclusion from the hazardous waste regulations of 40 CFR, Part 261, for a waste by-product classified as an F006 listed waste. Specifically, sludge from the Process Waste Interim Storage/Treatment Facility (PWISTF) tanks, which is generated by treatment of wastewater from the 300-M aluminum forming and metal finishing processes, is currently classified as an F006 listed hazardous waste. The waste contains both hazardous and radioactive components and is classified as a mixed waste. A waste treatment process based on stabilizing the sludge in a cementitious matrix has been developed. The treated material is called 300-M saltstone.

The objective of this petition is to demonstrate that the 300-M saltstone, when properly disposed, will not exceed the health-based standards for the hazardous constituents. This petition, therefore, contains sampling and analytical data, as summarized below, which justify the request for this exclusion.

- For delisting petitions, EPA requires that the Vertical and Horizontal Spread (VHS) Model be used for predicting the impact of waste disposal on the ground water (under worst case operating and environmental conditions). The VHS model utilizes a dilution factor calculated on the basis of waste volume. This factor is multiplied by the EP toxic leaching data and results are compared to Primary Drinking Water Standards. In addition, EPA requires that for stabilized material, the same calculations and comparisons be made using Multiple Extraction Procedure (MEP) leaching data.

  In comparing the calculated compliance point EP Toxic leachate and MEP concentrations for all of the EP Toxic Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), zinc, and nickel, all parameters predict a maximum compliance point concentration below the Primary Drinking Water Standards.

- Total concentration analyses were conducted on the 300-M saltstone for all of the EP Toxic Metals, zinc, nickel, lithium, and 1,1,1-trichloroethane. Total cyanide and oil and grease were also analyzed and found to be below minimum detection levels for all samples. The complete set of analytical data are included in Appendix F. A summary of the maximum concentration of the four samples taken from each tank is included in Table 5.

- The 300-M saltstone samples were analyzed for volatile organics using the Toxicity Characteristic Leaching Procedure (TCLP) according to 40 CFR 268 Appendix I. All of the samples were below minimum detection levels for all volatile organic constituents. Complete analytical data for the TCLP volatile organics are included in Appendix F.

- Semi-volatile organics were not analyzed because these compounds are not present in the process. (See Section VIIIA and Table I.)

- Reactivity and ignitability tests of 40 CFR Part 261 Subpart C were performed on the 300-M saltstone. None of the samples from the eight tanks exhibited the characteristics of reactivity or ignitability. Complete analytical data are included in Appendix F.

  The corrosivity characteristic test was not performed because the 300-M saltstone material is a solid, not a corrosive liquid.

APPENDICES

APPENDICES

APPENDIX A

MATERIAL SAFETY DATA SHEETS

A.1 Main Process Chemicals

Aluminum

Aluminum Sulfate

Aluminux[R]

Boric Acid

Chlorothene[R] (1,1,1-Trichloroethane)

Diatomaceous Earth

- Calcined Diatomaceous Earth
- Natural Diatomaceous Earth

Fiske's 604 Hot Die Size Lubricant

Freon TF[R] (Trichlorotrifluoroethane)

Grafo[R] Hydrograf (Aquadag)

Hydrochloric Acid

Lead

Lithium

Nickel

Nickel (II) Carbonate Hydrate

- Nickelous Carbonate

Nickel Chloride

Nickel(ous) Sulfate

Nitric Acid

Perlite (Sodium potassium aluminum silicate)

- Mappco Perflo 10
- Mappco Perflo 20
- Mappco Perflo 30
- Nord Perlite

Phosphoric Acid

Rando Oil HD 68

Sodium Hydroxide

Sodium Nitrate

Solka Floc

Sulfuric Acid

Tin

1,1,1-Trichlorethane (Inhibited)

Uranium

4,8,5

MOHAWK ALUMINUM CORP.

MATERIAL SAFETY DATA SHEET

Company	Issue Date	Identification Number
MOHAWK ALUMINUM CORP. 34 Barnes Industrial Road Wallingford, Ct. 06492	November 25, 1985	1
Trade Name (Common Name or Synonym) Aluminum Alloys Series 1 xxx, 2 xxx, 3 xxx, 4 xxx, 5 xxx, 6 xxx, 7 xxx	Emergency Phone Number 203-265-1567	
Chemical Name Aluminum	Formula AL	DOT Identification Number NA

I. INGREDIENTS

Material or Component	CAS Number	% Weight	Exposure Limits	
			1984-85 ACGIH TLV (mg/m^3)	OSHA 1910.1000 PEL (mg/m^3)
Base Metal				
Aluminum (Al)	7429-90-5	90-99.7	10.0 as metal dust and oxide 5.0 as welding fume	Not established Not established
Alloying Elements				
Cobalt (Co)	7440-48-4	< 1.0 - 10.00	0.1	0.1
Copper (Cu)	7440-50-8	< 1.0 - 10.00	0.2 as fume	0.1 as fume
Iron (Fe)	1309-37-1	< 1.0 - 10.00	5.0 as fume	10.0 as fume
Lead (Pb)	7439-92-1	< 0.2 - 0.7	0.15 as dust and fume	0.05 as dust and fume
Magnesium (Mg)	1309-48-4	< 1.0 - 10.00	10.0 as fume	15.0 as fume
Manganese (Mn)	7439-96-5	< 1.0 - 10.00	1.0 as fume	5.0 ceiling
Silicon (Si)	7440-21-3	< 1.0 - 10.00	10.0 as total dust	Not established
Tin (Sn)	7440-31-5	< 1.0 - 10.00	2.0 as oxide and metal	2.0 as inorganic compounds
Zinc (Zn)	1314-13-2	< 1.0 - 10.00	5.0 as fume	5.0 as fume

Note: Aluminum alloys will be comprised of various combinations of the elements shown here. In addition, other alloying may be present in minute quantities.

II. PHYSICAL DATA

Material is (At Normal Conditions):			Appearance and Odor
☐ Liquid ☒ Solid ☐ Other			Silver Metallic - No Odor
Acidity/Alkalinity pH = NA	Melting Point 900 - 1215 °F Boiling Point NA °F	Specific Gravity (H_2O = 1) 2.5 - 2.9 Solubility in water (% by weight) NIL	Vapor Pressure (mm Hg at 20°C) NA

III. PERSONAL PROTECTIVE EQUIPMENT

Appropriate personal protective equipment is required when melting, casting, drawing, stamping, machining, forging, or otherwise processing. The nature of the processing activity will determine what form of equipment is necessary, i.e., glasses, NIOSH/MSHA approved respirator, protective clothing and ear protection.

IV. EMERGENCY MEDICAL PROCEDURES

For skin contact, remove particles by thoroughly washing with soap and water.

For eye contact, flush with water for at least 15 minutes. Get medical attention if irritation persists.

331 (11-85)

NA = Not Applicable

V. HEALTH/SAFETY INFORMATION

Health

For standard operations (e.g., melting, cutting, grinding), aluminum alloys present a low health risk by inhalation and are usually considered a nuisance dust. Toxicity by ingestion - none expected. Skin and eyes - not an irritant. Welding and plasma cutting of alloys high in copper (2000 and 7000 series) may present the potential for overexposure to copper fume which can result in upper respiratory tract irritation, nausea, and metal fume fever. Nickel and chromium are other alloying elements considered hazardous as fume; however, they do not present a carcinogenic or other health concerns due to their low concentrations of the chemical form in which they are present. Overexposure to lead fumes over an extended period of time can result in such toxic effects as central nervous system disturbances, renal changes, peripheral neuropathy, gastrointestinal disturbances, anemia, and chromosomal changes.

Threshold Limit Value: See Ingredients Section.

Fire and Explosion

Flash Point °F	Auto Ignition Temperature °F	Flammable Limits in Air	Extinguishing Media
NA	NA	Lower % Upper NA %	Dry powder or sand.

Unusual Fire and Explosion Hazards: Damp aluminum dust may spontaneously heat with liberation of hydrogen to form explosive air mistures. SEE ADDITIONAL INFORMATION.

Extinguishing Media Not to be Used: Do not use water or halogen on dust fires.

Reactivity

Stability: [X] Stable [ ] Unstable

Incompatibility (Materials to Avoid): Anhydrous bromine, strong acids and/or alkaline material.

Conditions to Avoid: See Fire and Explosion Section. SEE ADDITIONAL INFORMATION.

Hazardous Decomposition Products: See Fire and Explosion Section. SEE ADDITIONAL INFORMATION.

VI. ENVIRONMENTAL

Spill or leak procedures

NA

Waste Disposal Methods*

Used or unused product should be tested to determine hazard status and disposal requirements under federal, state, or local laws and regulations. Recycling of aluminum scrap is encouraged by the Aluminum Industry.

*Disposer must comply with Federal, State and Local disposal or discharge laws.

VII. ADDITIONAL INFORMATION

1. Halogen acids and sodium hydroxide in contact with aluminum may generate explosive mixtures of hydrogen.
2. Finely divided aluminum will form explosive mixtures in air. It will also form explosive mixtures in air in the presence of bromates, iodates, or ammonium nitrate.
3. When remelting aluminum scrap, entrapped moisture or the presence of strong oxidizers such as ammonium nitrate could cause an explosion. This applies to the collection of moisture in sow cavities as well. Moisture must be driven off prior to remelting.
4. Do not touch cast aluminum metal or heated aluminum product without knowing metal temperature. Aluminum experiences no color change during heating. If metal is hot and touched, burns can result.
5. Aluminum powder must be packaged and shipped as a Flammable Solid, UN1396.
6. Hard alloy ingots in the 2000 and 7000 series must be stress-relieved to prevent explosion when sawed.
7. The welding of aluminum alloys may generate carbon monoxide, carbon dioxide, ozone, nitrogen oxides, infra-red radiation and ultra-violet radiation.

Mallinckrodt®

ALUMINUM SULFATE

Material Safety Data Sheet

Mallinckrodt Inc.
Science Products Division
P.O. Box M
Paris, Kentucky 40361

Emergency Telephone Number
314-982-5000

Effective Date: 08-13-85

PRODUCT IDENTIFICATION:

Synonyms: Aluminum alum, aluminum sulfate solid, sulfuric acid, aluminum salt (3:2), octadeca hydrate

Formula CAS No.: 7784-31-8 (Hydrated)
TSCA CAS No.: 10043-01-3 (Anhydrous)

Molecular Weight: 666.44 (approx.)

Hazardous Ingredients:

Not applicable.

Chemical Formula: $Al_2(SO_4)_3\ 18H_2O$ (approx.)

PRECAUTIONARY MEASURES

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION.

Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.

EMERGENCY/FIRST AID

If swallowed, induce vomiting immediately by giving two glasses of water, or milk if available and sticking finger down throat. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes.
In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: ORM-E

Physical Data — SECTION 1

Appearance: White, granular powder.

Odor: Odorless.

Solubility: 50% @ 0°C (32°F).

Boiling Point: Loses water at about 250°C (482°F).

Vapor Density (Air=1): No information found.

Melting Point: Liquifies on gradual heating.

Vapor Pressure (mm Hg): No information found.

Specific Gravity: 1.61

Evaporation Rate: No information found.

Fire and Explosion Information	SECTION 2
Fire:	Not considered to be a fire hazard.
Explosion:	Not considered to be an explosion hazard.
Fire Extinguishing Media:	Use any means suitable for extinguishing surrounding fire.
Special Information:	In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Reactivity Data	SECTION 3
Stability:	Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:	Hydrolyzes to form dilute sulfuric acid. Toxic and corrosive oxides of sulfur at temperatures above 760°C (1400°F).
Hazardous Polymerization:	This substance does not polymerize.
Incompatibilities:	Alkalies, water reactive materials such as oleum.

Leak/Spill Disposal Information SECTION 4

Ventilate the area of the leak or spill.

Spills: Sweep up or vacuum spilled material and place in a suitable container for disposal. Neutralize residue with soda ash. The area may then be flushed with plenty of water. Adequate ventilation is required.
Disposal: Large quantities may be sent to an approved waste facility or recovered. Smaller amounts may be dissolved in water, treated with soda ash to neutralize and sent to the sewer with ample water.

Reportable Quantity (RQ)(CWA/CERCLA) : 5000 lbs.

Ensure compliance with local, state and federal regulations.

Health Hazard Information — SECTION 5

A. Exposure/Health Effects

Inhalation:	Dust may act as an irritant to the respiratory system, mainly due to the formation of acidic sulfur compounds via hydrolysis. Coughing or sneezing, sore throat and breathing difficulty may be noted.
Ingestion:	May cause abdominal pain, stricture, gastrointestinal upset due principally to acid formed by hydrolysis. May produce nausea and vomiting. Large amounts have caused gastrointestinal inflammation.
Skin Contact:	May cause irritation, especially under repeated or prolonged contact, or when moisture is present.
Eye Contact:	May cause irritation. Crystals may be abrasive. Splashes from solutions may cause severe irritation or burns.
Chronic Exposure:	Not expected to be a health hazard.
Aggravation of Pre-existing Conditions:	No adverse effects expected.

B. FIRST AID

Inhalation:	Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:	If swallowed, induce vomiting immediately by giving two glasses of water, or milk if available and sticking finger down throat. Call a physician immediately. Never give anything by mouth to an unconscious person.
Skin Exposure:	Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Eye Exposure:	Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Oral mouse LD50: 6027 mg/kg (Anhydrous)
Reproductive effects cited (Anhydrous)

Occupational Control Measures SECTION 6

Airborne Exposure Limits:

-ACGIH Threshold Limit Value (TLV):
2 mg (Al)/m^3 (TWA)

Ventilation System:

A system of local exhaust is recommended to keep employee exposures below the Airborne Exposure Limits Local exhaust ventilation is generally preferred because it can control the emissions of the dust or vapor at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators (NIOSH Approved)

If the TLV is exceeded, a dust/mist respirator with chemical goggles may be worn, in general, up to ten times the TLV. Consult respirator supplier for limitations. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Contact lenses should be worn when working with this material.

Maintain eye wash fountain and quick-drench facilities in work area.

Storage and Special Information SECTION 7

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Aluminum sulfate absorbs moisture and becomes a safety hazard when spilled because it absorbs moisture and becomes slippery.

****
The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, Mallinckrodt, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for a particular purpose. Accordingly, Mallinckrodt, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information. NO REPRESENTATIONS, OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR TO THE PRODUCT TO WHICH THE INFORMATION REFERS.
****

Dearsey/Wyandotte Corporation
1532 Biddle Avenue
Wyandotte, Michigan 48192

Material Safety Data Sheet

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Emergency Telephone (313) 281-0930

D-16

SECTION I — PRODUCT IDENTIFICATION

		Product [redacted] ALUMINUX®
PC 2226/2754F	R 10/81	Description Chemical Mixture — Alkaline Etchant for Aluminum

SECTION II — HAZARDOUS INGREDIENTS

CAS Number	Chemical Component	%	TLV (Units)	Hazard Data
1310-73-2	Sodium hydroxide	>95	2 mg/m^3	Corrosive to eyes, skin and mucous membranes.

SECTION III — PHYSICAL DATA

XX Solid Liquid	Appearance and Odor White, granular beads with no odor
Specific Gravity Bulk density 62 lbs/ft^3	pH at 25°C N.A.
Solubility in Water Complete	Freezing Point N.A.
Percent Volatiles (by weight) None	Phosphorus None

SECTION IV — FIRE AND EXPLOSIVE HAZARD DATA

Flash Point (method)	Flammable Limits	LFL	UFL
Not combustible	N/A		

Extinguishing Media Not a fire hazard. Water fog.

Special Fire Hazards and Equipment Required Forms corrosive caustic soda solutions. Avoid contact with skin. Although this product is not combustible, good fire-fighting practice dictates the use of self-contained breathing apparatus and turn-out gear for fires in area where product is stored.

SECTION V — REACTIVE HAZARDS

Product Stable Yes	Unstable at — °F — °C	Hazardous Polymerization None Will Not Occur

Conditions to avoid: Use caution when mixing with acids as violent reaction will occur. Add slowly to water to prevent generation of localized heating and spattering. Use plastic scoop for removal from drum.

Incompatibility (Materials to Avoid): Do not mix with acids, flammable liquids, organic halogens or soft metals. Hydrogen gas and severe corrosion will occur if solutions of concentrated product contacts aluminum.

Hazardous Decomposition Products: None known.

Product ALUMINUX

SECTION VI — HEALTH HAZARDS

Eyes Corrosive. Causes severe burns, possible irreversible eye damage, or irritation.

Corrosive. Causes severe burns or irritation.

Ingestion POISON. CORROSIVE. May be fatal if swallowed. May cause esophogical or gastric perforation. Causes severe burns to mouth, throat and mucous membranes.

Inhalation May cause moderate to severe pulmonary irritation if mist or dust is inhaled.

Threshold Limit Value
2 mg/m^3 for NaOH

Principal Routes of Absorption
Direct contact with skin or eyes. Ingestion or inhalation of liquid or mis

Acute Effects of Overexposure
Corrosive. Causes severe irritation or burns.

Chronic Effects of Overexposure
None known.

FIRST AID PROCEDURE—*NEVER GIVE FLUIDS* OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAVING CONVULSIONS. CALL A PHYSICIAN.

Eyes Flush immediately with plenty of water for at least 15 minutes. Upper and lower eyelids should be raised to insure complete removal of caustic soda. Get prompt medical attention.

Skin Flush immediately with water while removing contaminated clothing and shoes. Get prompt medical attention. Launder clothing before reuse.

Ingestion If swallowed, rinse mouth with water. Drink large amounts of water or milk. DO NOT induce vomiting. If patient vomits, rinse mouth and repeat drinking water. Get medical attention.

Inhalation Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Get medical attention.

SECTION VII — NORMAL HANDLING PROCEDURES

Precautions to be taken in Handling and Storage. Store in a dry area away from acids. Keep container closed when moving or not in use. KEEP OUT OF REACH OF CHILDREN. Wash thoroughly after handling or using product. Add slowly to water with mixing to avoid spattering. Do not store with food.

Protective Equipment

Eyes Goggles, face shield or side-shield safety glasses.

Gloves Rubber or caustic resistant.

Other Clothing to prevent skin contact. Eye wash in area of use.

Ventilation Requirements Mechanical to maintain 2 mg/m^3 TLV. Wear NIOSH approved alkaline cartridge respirator in areas where mist or dust exceed TLV.

Corrosive Action on Materials Corrosive to aluminum, copper, brass, tin and other soft metals. May remove paint and organic coatings.

SECTION VIII — SPILL OR LEAK CONTROL PROCEDURES

Steps to be taken in case of Spills. Forms corrosive liquid in water. Sweep up and store in a metal container. Dissolve in water and neutralize with dilute acids or carbon dioxide. Discharge neutralized solution to sanitary sewer or bury in chemical landfill. Consult local environmental regulations. Wash spill area thoroughly. Liquid waste solution is strongly alkaline.

Waste Disposal Methods Neutralize to a specific pH with dilute acid before disposal to sewer. Consult local regulations. Alkaline solutions are toxic to fish and wildlife. Do not discharge to lakes, streams or ponds.

The above information is believed to be accurate and discloses the known hazards for this product as of this date. No additional warranties are made.

JAN 31 1986

Date

[signature]

2, 4, 8 (14)

MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT
120 ERIE BOULEVARD
SCHENECTADY, N.Y. 12305

MATERIALS INFORMATION SERVICES

NO. 4
BORIC ACID
Revision B
DATE March 1983

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: BORIC ACID
OTHER DESIGNAITONS: Orthoboric Acid, Boracic Acid, Hydrogen Borate, H_3BO_3, GE Material D4A6, CAS #010 043 353
MANUFACTURER: Available from several suppliers, including:

Kerr-McGee Chem. Corp.	Ashland Chem. Co.	U.S. Borax & Chem. Co.
Kerr-McGee Center	P.O. Box 2219	3075 Wilshire Blvd.
Oklahoma City, OK 73125	Columbus, OH 43216	Los Angeles, CA 90010

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Boric Acid *Control as a Nuisance Particulate has been recommended: 10 mg/m^3 total dust, or 5 mg/m^3 respirable dust. Animal studies (dog and rat) have shown infertility and damage to testes can result from acute or chronic ingestion of boric acid. Evidence on reproductive toxic effects in humans is inadequate.	ca 100	No TLV Established* Infant, Oral LDLo 934 mg/kg Man, Inhalation TCLo 22 mg/m^3 (10-yr intermittent) Toxic glandular effects Rat, Oral LD_{50} 2660 mg/kg

SECTION III. PHYSICAL DATA

Vapor pressure, 21C, mm Hg --- 15 (due to water)
Solubility in water, g/100g @ 0C ----------- 2.6
@ 20C ---------- 4.9
@ 100C --------- 28
Melting point, deg C --------------- 170-180

Specific gravity, 20/4C ------ 1.435
pH @ 20C, 1% aqueous soln --- ca 5.2
4% aqueous soln ---- ca 3.9
Molecular weight ------------ 61.84

Appearance & Odor: Colorless crystals or a fine or granular white powder. No odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
Non-combustible				

Extinguishing media: Use that which is most appropriate for the surrounding fire. Boric acid does not support combustion and is non-combustible. Material decomposes on heating, giving off water (see Sect V); used as fire retardant.

SECTION V. REACTIVITY DATA

This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not polymerize.

A weak acid. Loses chemically combined water upon heating, forming metaboric acid (HBO_2) at 100-105C, then pyroboric acid ($H_2B_4O_7$) at 140-160C, and at higher temperatures, boric anyhydride (B_2O_3).

Reacts with basic materials such as alkali carbonates and hydroxides to form borate salts.

A mixture of potassium and boric acid may explode on impact. Mixture with acetic anhydride can react violently when heated to 58-60C.

If moisture is present boric acid can be corrosive to iron.

GENERAL ELECTRIC

SECTION VI. HEALTH HAZARD INFORMATION

TLV None established (See Sect II)

Excessive inhalation of dust can cause irritation to mucous membranes of the respiratory tract. Not significantly absorbed through intact skin. Readily absorbed through damaged, abraded and burned skin, or open wounds and areas of active dermatitis when exposed to dry materials or aqueous solutions. Ingestion or absorption may cause nausea, vomiting, anuria, erythematous lesions on skin and mucous membranes, abdominal cramps, circulatory failure, and coma. Chronic exposures may cause dry skin, eruptions, and gastric disturbances. Poisoning can be acute or chronic. Adult acute fatal dose reported at 5 to >30g (moderate to slightly toxic)

FIRST AID:

Eye Contact: Flush thoroughly with running water for 15 min. including under eyelids.

Skin Contact: Remove grossly contaminated clothing under safety shower. Flush affected area well with water.

Inhalation: Remove to fresh air. Restore and/or support breathing as required.

Ingestion: If conscious, rinse mouth with water. Give several glasses of water to drink to dilute. Induce vomiting.

Seek medical assistance for further treatment, observation and support after first aid.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Provide adequate ventilation. Clean-up personnel need protection to avoid inhalation of dust. Keep airborne particulate at a minimum when sweeping up. Collect solid spills and place in appropriate containers for reclaim or disposal. Liquid spills can be absorbed with inert solid. Residue and traces can be flushed to sewer with high dilution.

DISPOSAL: Reclaim dry material for salvage or reuse. Unsalvageable waste may be buried in approved landfill. (Note that this material can have herbicidal properties.)

Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide sufficient ventilation in the workplace to keep airborne particulate at a low level. Dust respirators should be available for dusty conditions.

Use protection (rubber gloves, aprons, etc) appropriate for work situation to minimize skin contact. Avoid eye contact by use of chemical safety goggles where dusty conditions occur or solution splashing is possible.

Provide periodic medical examinations to those regularly exposed to boric acid with emphasis on liver and kidney function.

Eyewash stations and safety showers should be accessible to areas of large quantity use or handling especially if splashing is possible.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, area. Storage bins should have a 60° sloping cone bottom with provision to prevent ingress of water. Carbon steel or aluminum containers are suitable for this dry storage. (Stainless steel needed for moist conditions.)

Use good housekeeping practices to prevent accumulation of dust and follow sound cleaning techniques that will keep airborne particulate at a low level.

Avoid breathing dust. Do not ingest. Avoid contact, especially when skin is cut or abraded or active dermatitis is present. Wash hands and face before eating, drinking or smoking after handling this material.

DATA SOURCE(S) CODE: 1,4-11,14,25,26,34,37,48,49

APPROVALS: MIS/CRD	J. M. [illegible]
INDUST. HYGIENE/SAFETY	[illegible] 3-9-83
MEDICAL REVIEW:	21 March 1983

8

MATERIAL SAFETY DATA SHEET

(APPROVED BY THE U.S. DEPARTMENT OF LABOR AS - "essentially similar" to form OSHA-20)

DOW

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

Section 1 NAME & PRODUCT

MANUFACTURER'S NAME	CITY, STATE, ZIP CODE	EMERGENCY PHONE NO. - 24 HOUR
DOW CHEMICAL U.S.A.	MIDLAND, MICHIGAN 48640	517 - 636 - 4400

DATE THIS FORM WRITTEN: January 3, 1974

PREPARED BY (Signature): [signature]

TRADE NAME: CHLOROTHENE® VG Solvent

SYNONYMS:

Section 2 INGREDIENTS

	%	TLV (units)
1,1,1-Trichloroethane (Minimum)	94.5	350p
3/10/78 Contains 2% Dioxane JH		
CAS 000-071-556 (Not a specification value)		

Section 3 PHYSICAL DATA

BOILING POINT (°F.)	165 (74°C)	SOLUBILITY IN WATER	0.7 gm/100gm @25°
VAPOR PRESSURE (mmHg at 20°c)	100	SPECIFIC GRAVITY (H_2O = 1)	1.321 @ 25/25°C
VAPOR DENSITY (air = 1)	4.55	% VOLATILE BY VOLUME	100 (essentially)

APPEARANCE: Colorless liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (AND METHOD USED): None °F T.O.C., T.C.C., C.O.C.

FLAMMABLE LIMITS (STP IN AIR) @ 25°C — L.F.L. 8.0 — U.F.L. 10.5

EXTINGUISHING MEDIA: [X] WATER FOG [ ] FOAM [ ] ALCOHOL FOAM [ ] CO_2 [ ] DRY CHEMICAL [ ] OTHER

SPECIAL FIRE FIGHTING PROTECTION EQUIPMENT AND HAZARDS

Self-contained respiratory equipment. Not considered a flammable liquid hazard under normal industrial use conditions.

Section 5 REACTIVITY DATA

STABILITY (NORMAL CONDITIONS): X STABLE / UNSTABLE

CONDITIONS TO AVOID: Open flames, welding arcs or other high temperature sourc which induce thermal decomposition.

INCOMPATIBILITY — MATERIALS TO AVOID: [X*] WATER [ ] ACID [ ] BASE [ ] CORROSIVE [ ] OXIDIZING MATERIAL

OTHER [ ] *Slow hydrolysis produces corrosive acid.

HAZARDOUS DECOMPOSITION PRODUCTS

Open flames and welding arcs can cause thermal degradation with the evoluti of hydrogen chloride and very small amounts of phosgene and chlorine.

HAZARDOUS POLYMERIZATION: MAY OCCUR / X WILL NOT OCCUR

CONDITIONS TO AVOID:

Section 6 SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Use proper protective equipment. Small leaks: Mop up, wipe up, or soak up immediately. Remove to out of doors. Large spills: Evacuate area. Contain liquid; transfer to closed metal containers. Keep out of water supply

DISPOSAL METHOD

Send solvent to a reclaimer. In some cases it can be transported to an are where it can be placed on the ground and allowed to evaporate safely. Refe to Chemical Safety Data Sheet SD-90, Manufacturing Chemists Association, 1825 Connecticut Avenue, Washington, D.C. 20009.

CHLOROTHENE VG Solvent

MATERIAL SAFETY DATA SHEET (CONT.)

DOW CHEMICAL U.S.A.
MIDLAND, MICHIGAN 48640

Section 7 HEALTH HAZARD DATA

INGESTION

Very low toxicity. LD_{50} (laboratory animals) ranges from 8.6 to 14.0 g/kg. Based on these data it is estimated that the lethal dose for a 150 pound person is estimated between ½ to one pint.

EYE CONTACT

Mild irritation, but essentially no corneal injury.

SKIN CONTACT

Short contact - no irritation. Prolonged or frequent exposure - minor irritations. If confined to the skin - up to moderate irritation, even a burn.

SKIN ABSORPTION

Very low. LD_{50} (rabbits) - 24 hour exposure - greater than 1.5 g/kg.

INHALATION

TLV: 350 ppm (1972)

EFFECTS OF OVEREXPOSURE

Anesthetic effects - may occur in the range of 500 to 1000 ppm.

FIRST AID PROCEDURES

EYE: FLUSH WITH FLOWING WATER

EYES AND SKIN: Flush eyes with plenty of water. For both eyes and skin get medical attention if irritation or injury develops. INHALATION: If breathing stops, give artificial respiration. Get medical help. Remove to fresh air; keep warm and quiet until recovered. INGESTION: Induce vomiting. Call a physician immediately. No specific antidote known. Treat symptomatically.* CAUTION: with some solvents, drinking alcohol shortly before, during or after exposure may cause undesirable effects.

NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAVING CONVULSIONS

Section 8 SPECIAL PROTECTION INFORMATION

VENTILATION

Limit concentration in air to TLV.

RESPIRATORY PROTECTION (Specify type) Below 350 ppm - none. Respiratory protection required in the absence of environmental control. For levels up to 2% for ½ hour or less, a suitable full face mask with organic canister should be used. Above 2% and for emergencies, use a self-contained breathing apparatus.

PROTECTIVE CLOTHING

No special protective clothing needed.

EYE PROTECTION

- [ ] NOT NORMALLY NECESSARY
- [X] SAFETY GLASSES WITHOUT SIDE SHIELDS
- [ ] SAFETY GLASSES WITH SIDE SHIELDS
- [ ] CHEMICAL WORKERS GOGGLES
- [ ] GAS TIGHT GOGGLES OR EQUIVALENT
- [X] OTHER Eye wash stations and safety showers should be readily available.

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Handle with reasonable care. Avoid breathing vapors. Store in a cool dry place.

*NOTE TO PHYSICIAN: Overexposure to many of the chlorinated solvents especially if accompanied by anoxia, may temporarily increase cardiac irritability. Maintain adequate oxygenation until recovery. Avoid sympatomimetic amines, such as epinephrine, which may precipitate arrhythmias.

OSR 4-288

HEALTH HAZARD REPORT

CC
- [ ] Medical Department Superintendent, 719-A
- [x] N. WOLFE - 773A
SAFETY ENGINEER AREA

TO
1. T.S. McMILLAN
2. J.H. CRAWFORD
3.

DATE 3/6/76

REF
- [x] PURCHASE REQUISITION NO. K-78876

OR
- [ ] STORES STOCK REQUEST NO.

4/27/76 McMILLAN
DATED ORIGINATOR

FROM
INDUSTRIAL HYGIENIST
Bldg 735-A, Ext 2652

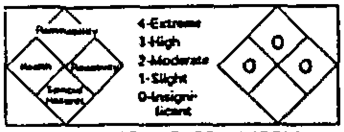
As required by SRP Safety Manual Item 31, the material referred to in the referenced requisition/request has been reviewed for potential health hazards with the following conclusions:

- [x] No special precautions are needed other than those usually required for this type of material. See comments.
- [ ] Special precautions are required for use of this material. Appropriate references and/or Data Sheets containing recommended practices are furnished with this form.
- [ ] This material presents an extreme hazard. Cancellation of the order is advised. Alternatively, if use of this material is essential, a meeting of all interested groups must be held to develop safe handling procedures. See comments.

COMMENTS
DEGREASING AGENT = 1,1,1-TRICHLOROETHANE.
(METHYL CHLOROFORM) (Chlorothene) CH_3CCl_3

HAZARD
POTENTIAL SOLVENT EXPOSURE to METHYL CHLOROFORM.
TLV = ~~100~~ 350 PPM (~~1900~~ mg/m^3). NON-FLAMMABLE, TOXIC SOLVENT

RECOMMENDATIONS
LOCATE DEGREASER AND HANDLE ACCORDING to STANDARD DEGREASING PROCEDURES. USE TRICHLOROETHYLENE AS A GUIDE.



NFPA FIRE HAZARD SYMBOL†
See NFPA 704 for detailed explanation.

MATERIAL SAFETY DATA SHEET

Manville

No.: 2415 Rev. No.: 2
Date Prepared: 03/27/85

I. PRODUCT IDENTIFICATION

Trade Name(s): CELITE 500
Generic Name: NATURAL DIATOMACEOUS EARTH
Chemical Name: SILICA
CAS #: 7631-86-9
Formula: SiO_2

Manufacturer: MANVILLE INTERNATIONAL CORP.
Address: P.O. BOX 5108
City: DENVER State: CO Zip: 80217
Telephone: (303)978-3120
Emergency:

II. PRODUCT INGREDIENTS

INGREDIENT NAME	CAS NUMBER	%	PEL and TLV (except as noted)
NATURAL DIATOMACEOUS EARTH-AMORPHOUS SILICA	7631-86-9	>97	2.00 mg/m³
CRYSTALLINE SILICA-QUARTZ	14808-60-7	<3	RESPIRABLE QUARTZ (OSHA)

III. PHYSICAL DATA

Appearance and Odor: FINE GRAY POWDER, NO ODOR.

Boiling Point: NA
Vapor Pressure: NA
Water Solubility (%): NEGLIGIBLE
Vapor Density (Air=1): NA
Evaporation Rate (= 1): NA
Specific Gravity (water = 1): 2.3
Melting Point: ND
% Volatile by Volume: NIL

IV. FIRE AND EXPLOSION DATA

Flash Point (Method): NONFLAMMABLE
Flammable Limits: LEL: % UEL: NA %
Extinguishing Media: NA
Unusual Fire or Explosion Hazards: NONE
NFPA Flammable/Combustible Liquid Classification: NA
Auto-Ignition Temperature: NA

Special Fire-Fighting Procedures: NONE

V. HEALTH HAZARDS A. Summary/Risks

Summary: RESPIRABLE DUST FROM THIS PRODUCT WILL TYPICALLY CONTAIN UP TO 3% FREE CRYSTALLINE SILICA (QUARTZ). AS SUCH IT REPRESENTS A RISK TO THE RESPIRATORY SYSTEM.

THIS PRODUCT IS NOT CONSIDERED A CARCINOGEN.

Medical conditions which may be aggravated: PRE-EXISTING UPPER RESPIRATORY AND LUNG DISEASE SUCH AS, BUT NOT LIMITED TO BRONCHITIS, EMPHYSEMA AND ASTHMA.
Target Organ(s): LUNGS
Acute Health Effects: TRANSITORY UPPER RESPIRATORY IRRITANT.

Chronic Health Effects: LONG TERM, UNPROTECTED EXPOSURE TO DUST LEVELS IN EXCESS OF THE PEL MAY CAUSE LUNG DISEASE (SILICOSIS). FOLLOW THE SAFE HANDLING PRACTICES SHOWN ON THE LABEL.

Primary Entry Route(s): INHALATION.

V. HEALTH HAZARDS B. Signs/Symptoms of Overexposure

Inhalation: CONGESTION AND IRRITATION OF THE THROAT, NASAL PASSAGES AND UPPER RESPIRATORY SYSTEM.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NOT HAZARDOUS WHEN INGESTED. GENERALLY REGARDED AS SAFE BY THE FDA.

Eyes: TEMPORARY IRRITATION AND INFLAMMATION.

V. HEALTH HAZARDS C. First Aid/Emergency Procedures

Inhalation: REMOVE TO FRESH AIR. DRINK WATER TO CLEAR THROAT AND BLOW NOSE.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NA

Eyes: FLUSH WITH COPIOUS QUANTITIES OF WATER FOR A MINIMUM OF 15 MINUTES.

VI. REACTIVITY DATA

MATERIAL IS STABLE. HAZARDOUS POLYMERIZATION CANNOT OCCUR.
Chemical Incompatibilities: HYDROFLUORIC ACID
Conditions to Avoid: NONE IN DESIGNED USE.

Hazardous Decomposition Products: NONE DETERMINED.

VII. SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak: VACUUM CLEAN SPILLAGE. IF SWEEPING IS NECESSARY USE A DUST SUPPRESSANT.

Waste Management: WASTES GENERATED DURING APPLICATION, DEMOLITION, BREAKAGE OR SPILLAGE ARE NOT HAZARDOUS WASTES AS DEFINED BY RCRA (40 CFR PART 261). COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. METHOD OF DISPOSAL-LANDFILL. RQ-N/A.

VIII. SPECIAL PROTECTION INFORMATION

Goggles: NOT NORMALLY REQUIRED.
Gloves: NOT NORMALLY REQUIRED.
Respirator: USE A RESPIRATOR SUCH AS 3M 8900 OR EQUIVALENT FOR PROTECTION AGAINST PNEUMOCONIOSIS PRODUCING DUSTS.
--- ADEQUATE EXHAUST VENTILLATION OR DUST COLLECTION.

Other: NA

Special Considerations for repair/maintenance of contaminated equipment: INSURE PROPER RESPIRATORY PROTECTION.

IX. SPECIAL PRECAUTIONS

Storage Segregation Hazard Classes: NA
*** ALWAYS SEGREGATE MATERIALS BY MAJOR HAZARD CLASS ***
Special Handling/Storage: REPAIR ALL BROKEN BAGS IMMEDIATELY.

Special Workplace Engineering Controls: NOT NORMALLY REQUIRED.

Other: NA

Prepared/Revised by: KENNETH A. ROBERTS **Title:** MGR., ENVIRONMENTAL SERVICES

4-Extreme
3-High
2-Moderate
1-Slight
0-Insignificant

0 0 0

NFPA FIRE HAZARD SYMBOL
See NFPA 704 for detailed explanation.

MATERIAL SAFETY DATA SHEET

No.: 2420 Rev. No.: 2
Date Prepared: 03/27/85

Manville

I. PRODUCT IDENTIFICATION

Trade Name(s) : CELITE 505, 512, 577, 587, 589 STANDARD SUPER-CEL
Generic Name: CALCINED DIATOMACEOUS EARTH
Chemical Name: SILICA

CAS #: 61790-53-2
Formula: SiO_2

Manufacturer: MANVILLE INTERNATIONAL CORP.
Address: P.O. BOX 5108
City: DENVER State: CO Zip: 80217

Telephone: (303)978-3120
Emergency:

II. PRODUCT INGREDIENTS

INGREDIENT NAME	CAS NUMBER	%	PERMISSIBLE EXPOSURE LIMIT
CALCINED DIATOMACEOUS EARTH CRYSTALLINE SILICA-CRISTOBALITE PEL IS CALCULATED ON THE BASIS THAT THIS PRODUCT MAY CONTAIN UP TO 10% CRYSTALLINE SILICA (CRISTOBALITE, CAS.14464-46-1)	61790-53-2	100	0.45 mg/m^3 RESPIRABLE CRISTOBALITE (OSHA)

III. PHYSICAL DATA

Appearance and Odor: FINE PINK POWDER, NO ODOR.

Boiling Point: NA
Vapor Pressure: NA
Water Solubility (%) : NEGLIGIBLE
Vapor Density (Air=1) : NA

Evaporation Rate (= 1) : NA
Specific Gravity (water = 1) : 2.3
Melting Point: ND
% Volatile by Volume: NIL

IV. FIRE AND EXPLOSION DATA

Flash Point (Method) : NONFLAMMABLE
Flammable Limits: LEL: % UEL: NA %
Extinguishing Media: NA
Unusual Fire or Explosion Hazards: NONE

Special Fire-Fighting Procedures: NONE

NFPA Flammable/Combustible Liquid Classification: NA
Auto-Ignition Temperature: NA

V. HEALTH HAZARDS A. Summary/Risks

Summary: RESPIRABLE DUST FROM THIS PRODUCT WILL TYPICALLY CONTAIN UP TO 10% FREE CRYSTALLINE SILICA (CRISTOBALITE). AS SUCH IT REPRESENTS A RISK TO THE REPIRATORY SYSTEM.

THIS PRODUCT IS NOT CONSIDERED A CARCINOGEN.

Medical conditions which may be aggravated: PRE-EXISTING UPPER RESPIRATORY AND LUNG DISEASE SUCH AS, BUT NOT LIMITED TO BRONCHITIS, EMPHYSEMA AND ASTHMA.
Target Organ(s) : LUNGS
Acute Health Effects: TRANSITORY UPPER RESPIRATORY IRRITANT.

Chronic Health Effects: LONG TERM, UNPROTECTED EXPOSURE TO DUST LEVELS IN EXCESS OF THE PEL MAY CAUSE LUNG DISEASE (SILICOSIS). FOLLOW THE SAFE HANDLING PRACTICES SHOWN ON THE LABEL.

Primary Entry Route(s) : INHALATION.

V. HEALTH HAZARDS B. Signs/Symptoms of Overexposure

Inhalation: CONGESTION AND IRRITATION OF THE THROAT, NASAL PASSAGES AND UPPER RESPIRATORY SYSTEM.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NOT HAZARDOUS WHEN INGESTED. GENERALLY REGARDED AS SAFE BY THE FDA.

Eyes: TEMPORARY IRRITATION AND INFLAMMATION.

V. HEALTH HAZARDS C. First Aid/Emergency Procedures

Inhalation: REMOVE TO FRESH AIR. DRINK WATER TO CLEAR THROAT AND BLOW NOSE.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NA

Eyes: FLUSH WITH COPIOUS QUANTITIES OF WATER FOR A MINIMUM OF 15 MINUTES.

VI. REACTIVITY DATA

MATERIAL IS STABLE. HAZARDOUS POLYMERIZATION CANNOT OCCUR.
Chemical Incompatibilities: HYDROFLUORIC ACID
Conditions to Avoid: NONE IN DESIGNED USE.

Hazardous Decomposition Products: NONE DETERMINED.

VII. SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak: VACUUM CLEAN SPILLAGE. IF SWEEPING IS NECESSARY USE A DUST SUPPRESSANT.

Waste Management: WASTES GENERATED DURING APPLICATION, DEMOLITION, BREAKAGE OR SPILLAGE ARE NOT HAZARDOUS WASTES AS DEFINED BY RCRA (40 CFR PART 261). COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. METHOD OF DISPOSAL-LANDFILL. RQ-N/A.

VIII. SPECIAL PROTECTION INFORMATION

Goggles: NOT NORMALLY REQUIRED.
Gloves: NOT NORMALLY REQUIRED.
Respirator: USE A RESPIRATOR SUCH AS 3M 9900 OR EQUIVALENT FOR PROTECTION AGAINST PNEUMOCONIOSIS PRODUCING DUSTS.
Ventilation: USE ADEQUATE EXHAUST VENTILLATION OR DUST COLLECTION.

Other: NA

Special Considerations for repair/maintenance of contaminated equipment: INSURE PROPER RESPIRATORY PROTECTION.

IX. SPECIAL PRECAUTIONS

Storage Segregation Hazard Classes: NA
*** ALWAYS SEGREGATE MATERIALS BY MAJOR HAZARD CLASS ***
Special Handling/Storage: REPAIR ALL BROKEN BAGS IMMEDIATELY.

Special Workplace Engineering Controls: NOT NORMALLY REQUIRED.

Other: NA

Prepared/Revised by: KENNETH A. ROBERTS Title: MGR., ENVIRONMENTAL SERVICES

MS01

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 69

NATURAL DIATOMACEOUS EARTH

Date September 1980

SECTION I. MATERIAL IDENTIFICATION

Reviewed: February 1982

MATERIAL NAME: NATURAL DIATOMACEOUS EARTH
DESCRIPTION: Submicroscopic siliceous skeletons of prehistoric diatoms.
OTHER DESIGNATIONS: Diatomite, Amorphous Silica, Kieselguhr, Silicon Dioxide, SiO_2, GE Materials D4E13 and D4E16 (natural grades), CAS #061 790 532
MANUFACTURER: Available from several suppliers, including:

Johns-Manville Sales Corp., Ken Caryl Ranch
Denver, CO 80202 Phone: (303) 979-1000
CELITE (Natural Grades)

Grefco, Inc., 3450 Wilshire Blvd.
Los Angeles, CA Phone: (213) 381-5081
DICALITE (Natural Grades)

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Diatomaceous Earth (Natural) with ca 4% free moisture*	ca 100	8-hr TWA 1.5 mg/m^3** (Respirable Mass)

Composition (SiO_2)	%	8-hr TWA** Resp. Mass	8-hr TWA** Total Mass
Amorphous Silica	>95	3 mg/m^3	6 mg/m^3
Quartz	< 5	0.1	0.3
Cristobalite	Trace	0.05	0.15
Tridymite	Trace	0.05	0.15

*May contain small amounts of oxides of potassium, calcium, aluminum and iron, depending on ore source; 3-4% combined H_2O

**ACGIH 1981 TLV. The current OSHA standard for amorphous silica and natural diatomaceous earth is 20 mppcf or 80/% quartz content mg/m^3.

Rat, Oral
LD_{50} 3160 mg/kg

SECTION III. PHYSICAL DATA

Boiling point, at 760 mm Hg, deg C	2230	Softening point, deg C	1427
Solubility in water	insoluble	Melting point, deg C	1710
Density	2.2	Molecular weight	60.09
Particle size, microns	<10		

Appearance & Odor: Light gray or buff colored powder (also supplied in the form of blocks or bricks); odorless.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
N/A				

Extinguishing Media: Use media appropriate to surrounding fire.
This material is noncombustible, but avoid generating airborne dust.
When heated to extreme temperatures, it can crystallize or melt into a glass.

Firefighters may need respiratory protection under dusty conditions.

SECTION V. REACTIVITY DATA

Material is stable under ordinary circumstances. Does not polymerize.
Reacts with hydrofluoric acid to produce toxic silicon tetrafluoride gas and with xenon hexafluoride to produce explosive xenon trioxide. Heating with alkali carbonates can produce a vigorous reaction; when wet and heated with Mg, it can explode. It can react exothermally with oxygen difluoride and explosively with chlorine trifluoride.
It can absorb up to 4 times its weight in water, and when finely divided, is soluble in strong or molten alkalis.
When heated to high temperature, as in calcining (especially in the presence of alkaline flux), this material forms crystalline silicas, cristobalite and tridymite, both of which are very active in causing silicosis when inhaled.

(618) 734-4172

ILLINOIS MINERALS CO.
2035 WASHINGTON, CAIRO, ILL. 62914

MATERIAL SAFETY DATA SHEET

FEBRUARY 1, 1985

SECTION I — IDENTIFICATION OF MATERIAL

CHEMICAL NAME OR COMPOSITION

Amorphous Silica

SILICON DIOXIDE — MICROCRYSTALLINE

HMIS NPCA RATING

Health	*
Flammability	0
Reactivity	0
Personal Protection	E

TRADE NAME & SYNONYMS

	0	AIR FLOATED
IMSIL A-108®	1240	AIR FLOATED
IMSIL A-10®	1160	AIR FLOATED
IMSIL A-15®	54	AIR FLOATED
IMSIL A-25®	250	AIR FLOATED
	200	AIR FLOATED

CHEMICAL FAMILY

OXIDE

MOLECULAR FORMULA

SiO_2

SECTION II — SIGNIFICANT COMPONENTS AND CONTAMINANTS

CAS NO.	COMPONENT	PERCENT	PERMISSIBLE EXPOSURE LIMIT	SHORT TERM EXPOSURE LIMIT	DOT HAZARD
14808-60-7	SILICON DIOXIDE	99.5+	0.1mg/m3	-------	Non-Hazardous

SECTION III — PHYSICAL DATA

PHYSICAL CHARACTERISTICS

WHITE, ODORLESS POWDER

BOILING POINT: NA	FREEZING POINT: NA	SPECIFIC GRAVITY (WATER=1.0): 2.65
VAPOR PRESSURE (mm OF MERCURY): NA	pH: 6.5 - 7.0	
VAPOR DENSITY (AIR =1): NA	SOLUBILITY IN WATER: INSOLUBLE	

SECTION IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (SPECIFY METHOD)

NA

FLAMMABLE (EXPLOSIVE) LIMITS (PERCENTAGE BY VOLUME)

LOWER EXPLOSIVE LIMIT	UPPER EXPLOSIVE LIMIT
NA	NA

FIRE EXTINGUISHING MEDIA

NA

SPECIAL FIRE FIGHTING PROCEDURES

NA

UNUSUAL FIRE AND EXPLOSION HAZARDS

NA

*Warning - Chronic Health effect possible - Inhalation of silica dust may cause delayed lung injury/disease (Silicosis). Take appropriate measures to avoid breathing dust. For further information please refer to "Guidelines for handling of Silica Dust" provided upon request.

SECTION V — HEALTH HAZARD DATA

TOXICITY		NON—TOXIC
EFFECTS OF OVEREXPOSURE	ACUTE	NOT APPLICABLE
	CHRONIC	PROLONGED OVEREXPOSURE BY INHALATION MAY CAUSE DELAYED LUNG INJURY.
EMERGENCY AND FIRST AID PROCEDURES		EYES: FLUSH WITH WATER OR OTHER SUITABLE LIQUID

SECTION VI — REACTIVITY DATA

GENERAL REACTIVITY	STABLE — INERT		
INCOMPATABILITY (MATERIALS TO AVOID)	HYDROFLUORIC ACID		
HAZARDOUS DECOMPOSITION PRODUCTS	NONE		
HAZARDOUS POLYMERIZATION	NONE	CONDITIONS TO AVOID	NONE KNOWN

SECTION VII — SPILL/DISPOSAL REQUIREMENTS

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

NOT CONSIDERED A HAZARDOUS WASTE UNDER FEDERAL RCRA REGULATIONS

WASTE DISPOSAL METHOD: VACUUM, SWEEP OR FLUSH FOR NORMAL DISPOSAL

CONTAINER DISPOSAL: NORMAL METHOD FOR NON—HAZARDOUS WASTE

SECTION VIII — SPECIAL PROTECTION INFORMATION (SPECIFY IN DETAIL)

EYE PROTECTION	NOT NECESSARY BUT RECOMMENDED	GLOVES	NOT NECESSARY
RESPIRATORY	APPROVED RESPIRATOR FOR DUSTS RECOMMENDED FOR CONCENTRATION ABOVE TLV		
VENTILATION	ADEQUATE FOR DUSTY ENVIRONMENTS	OTHER	NPCA — HMIS CODE E

SECTION IX - SPECIAL PRECAUTIONS

NONE

SECTION X — SHIPPING REGULATIONS (D.O.T. NOMENCLATURE)

PROPER SHIPPING NAME: ILLINOIS MINERALS COMPANY MICROCRYSTALLINE SILICA

HAZARD CLASS	NA	TYPE OF PACKAGING	NA	LABEL	NA
PLACARD	NA	MARKING	NA	EXEMPT	NA

(618) 734-4172

ILLINOIS MINERALS CO.
2035 WASHINGTON, CAIRO, ILL 62914

GUIDELINES FOR SAFE HANDLING OF SILICA DUST

INTRODUCTION

These guidelines are provided to inform our customers of the potentially harmful health effects and the increase of risk of disease caused by the inhalation of any crystalline silica dust. The medical and scientific evidence suggested that as the amount and/or duration of silica dust inhalation increases, the risk of serious respiratory disease also increases. While Illinois Minerals is not in a position to agree or disagree with the various scientific and medical studies, we do believe that various precautions will minimize the risk associated with silica dust inhalation. These guidelines also provide information which may assist you in the implementing, monitoring and evaluating of your own industrial hygiene and dust control programs to minimize potentially harmful exposures. While Illinois Minerals cannot assure that these procedures will eliminate risk, they should tend to reduce the risk.

HEALTH EFFECTS

The prolonged inhalation of dusts containing crystalline silica may result in the development of a disabling lung disease known as silicosis. This is a chronic condition brought on by the entrapment of very fine silica particles in the aveoli of the lung causing scaring tissue or nodules to form over time. The accumulation of nodules will eventually cause the lungs to lose a portion of their ability to transfer and absorb oxygen, thus, resulting in lessened physical abilities. Chronic silicosis, generally is produced 5-20 years after the chronic silica inhalation. In addition to causing silicosis, the inhalation of silica dust can otherwise weaken the lungs and their natural cleansing process. As a result, the inhalation of silica dust may be a contributing factor leading to other respiratory diseases. Also, it has been generally stated that the duration of dust inhalation is of extreme importance. Persons who for many years have continuously inhaled silica dust have a greater likelihood of contracting a silica related disease. Those who only intermittently inhale the dust have less risk of injury. In addition, those persons who smoke will increase the risk which otherwise exists.

THRESHOLD LIMIT VALUE (TLV)

TLV's or Threshold Limit Value of mineral dusts are time weighted average concentrations considered permissible for exposures of eight hours per day, five days per week that are published by the American Conference of Governmental Industrial Hygienists (ACGIH). Most of these values have been promulgated as Permissible Exposure Limits (PEL) in the OSHA Standards.

These values have been obtained from laboratory studies on animals. They are reviewed annually and changed as necessary on the basis of experience. Copies of TLV's may be obtained by writing to:

American Conference of Industrial Governmental Hygienists
U.S. Public Health Service
P.O. Box 1937
Cincinnati, OH 45201

The current OSHA Permissible Exposure Limit (PEL) for respirable crystalline silica dust is 10mg/m^3 divided by the percent free silica plus two, averaged over an 8 hour work shift.

VENTILATION

The primary means of controlling airborne dust is through use of proper ventilation. For detailed information, refer to the ACGIH publication, "Industrial Ventilation, a Manual of Recommended Practices."

PROTECTIVE EQUIPMENT

Respiratory protection should be used by personnel working in dust environments. A combination of both proper ventilation and respiratory protection would tend to eliminate most risks.

For details on use of respirators, refer to the ANSI standard, z88.2-1969 "Practices for Respiratory Protection."

At locations where dust levels may exceed PEL's, a NIOSH approved half face piece respirator can be used for exposures up to 10X PEL. For exposures up to 100X PEL, use full face piece respirator with replaceable dust filter. Higher exposures need an approved air supply respirator.

U.S. DEPARTMENT OF LABOR

Occupational Safety & Health Administration

MATERIAL SAFETY DATA SHEET

SECTION I

MANUFACTURER'S NAME: FISKE BROTHERS REFINING CO.	EMERGENCY TELEPHONE NO.: (419) 691-2491
ADDRESS (Number, Street, City, State, and ZIP Code): P. O. BOX 8038, STATION A, 1500 OAKDALE, TOLEDO, OHIO 43605	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS: FISKE'S 604 HOT DIE LUBRICANT
CHEMICAL FAMILY: ORGANIC HYDROCARBON	FORMULA: Lubricating oil thickened with inorganic thickener plus graphite, aluminum powder

SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
NON-HAZARDOUS		

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	NON-MELT	SPECIFIC GRAVITY (H_2O=1)	
VAPOR PRESSURE (mm Hg.)		PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (______=1)	
SOLUBILITY IN WATER	NIL		
APPEARANCE AND ODOR	SILVER COLOR - BLAND ODOR		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	600°F. COC	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA	CO_2 WATER MIST FOAM			
SPECIAL FIRE FIGHTING PROCEDURES	AS WITH OIL PRODUCTS			
UNUSUAL FIRE AND EXPLOSION HAZARDS	NONE			

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SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	--
EFFECTS OF OVEREXPOSURE	--
EMERGENCY AND FIRST AID PROCEDURES	EXTERNAL - NORMAL GOOD HYGIENE INTERNAL - CONSULT A PHYSICIAN

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATABILITY (*Materials to avoid*)	--		
HAZARDOUS DECOMPOSITION PRODUCTS	--		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

NORMAL CLEAN UP PROCEDURE PLUS OIL ABSORBING MATERIAL

WASTE DISPOSAL METHOD

INCINERATE OR APPROVED LAND FILL

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (*Specify type*)			
VENTILATION	LOCAL EXHAUST: X	SPECIAL	
	MECHANICAL (*General*)	OTHER	
PROTECTIVE GLOVES	NOT NORMALLY REQUIRED	EYE PROTECTION	SAME AS AGAINST ANY FOREIGN OBJECT
OTHER PROTECTIVE EQUIPMENT	NONE NORMALLY REQUIRED		

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

NO SPECIAL REQUIREMENTS

OTHER PRECAUTIONS NONE

COMPANY NAME FISKE BROTHERS REFINING CO.

DATE PREPARED 6/18/86

PREPARED BY: O. P. Kuhlman

Technical Advisor

MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT

SCHENECTADY, N. Y. 12305

MATERIALS · INFORMATION · SERVICES

NO. 314 2 3 4

TRICHLOROTRIFLUOROETHANE 8
Revision B (12)

Date July 1979 5

SECTION I. MATERIAL IDENTIFICATION (14)

MATERIAL NAME: TRICHLOROTRIFLUOROETHANE (10)
OTHER DESIGNATIONS: 1,1,2-Trichloro-1,2,2-trifluoroethane, FCl_2CClF_2, GE Materials D5B77 and D5B81A, CAS# 000 076 131 9
MANUFACTURER: Available from many suppliers
TRADE NAMES: ARKLONE P-113, BLACO-TRON TF, FREON TF, FREON 113, FRIGEN 113TR-T, GENETRON 113, GENESOLV D, ISOTRON 113, REFRIGERANT 113, UCON 113

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Trichlorotrifluoroethane *Material is commercially available in refrigerant and high purity solvent grades. Stabilizers are not normally used.	ca 100*	8-hr TWA 1000 ppm or 7600 mg/m3 Human, inhalation TCLo 4500 ppm (central nervous system) Rat, oral LDLo 45 mg/kg

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg F (C) --	117.6 (47.6)	Specific gravity (20/4C) --	1.57
Vapor pressure at 70 F, mm Hg ----	285	Volatiles, % -------------	ca 100
Vapor density (Air=1) ------------	ca 6	Evaporation rate (Acetone=1)	0.45
Solubility in H_2O at 70 F, % -----	0.028	Melting point, deg C ------	-35 to -36
		Molecular weight ---------	187.39

Appearance & odor: Clear, colorless liquid with a slight ethereal odor whose recognition threshold (100% of test panel for UCON-113) is 135 ppm in air. (Vapor may be detected below 50 ppm, unfatigued.)

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
None	None	None	-	-

Extinguishing media: Use that which is appropriate for the surrounding fire.
This is a nonflammable material; however, when it is involved in a fire, the firefighters should use self-contained breathing apparatus for protection against suffocating vapors and toxic and corrosive decomposition products.

SECTION V. REACTIVITY DATA

Trichlorotrifluoroethane is a stable material under normal use and storage conditions. It does not undergo or cause hazardous polymerization. Thermal-oxidative decomposition begins at about 250 C to give halogen acids, halogens, and carbonyl halides which are toxic and corrosive.
It can react violently with active metals such as sodium, potassium, and barium; and finely divided aluminum, zinc, magnesium and beryllium can also react, especially at high temperature.

SECTION VI. HEALTH HAZARD INFORMATION	TLV 1000 ppm or 7600 mg/m^3

This material is low in toxicity. It is an anesthetic and inhalation of high concentrations can produce asphyxiation. At levels of about 2500 ppm in air there begins to be interference with psychological and psychomotor functions, expressed as excitement and incoordination. Possible cardiac arrhythmias at high concentration. Repeated or prolonged skin contact will cause defatting and possible dermatitis. Eye contact with liquid produces irritation and mild conjunctivitis.

FIRST AID:

Inhalation: Remove to fresh air and apply artificial respiration, if required. Contact physician; advise against use of epinephrin-type drugs.

Skin contact: Prevent repeated exposure. Apply lanolin-type cream.

Eye contact: Flush eyes with copious amounts of water for 15 minutes. Get prompt medical attention.

Ingestion: Induce vomiting. Contact a physician; advise against use of epinephrin-type drugs.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

When spills of significant size occur, evacuate the area. Remove ignition sources. Provide ventilation. Those involved in clean-up should use self-contained respirators. Recover as much liquid as feasible and place in covered metal container. Residues or small spills can be picked up with an absorbent, such as vermiculite, and held in a covered metal container for disposal as solid waste or for evaporation in an area remote from buildings and people.

Waste solvent should be recovered when possible by filtration and distillation processes or disposed of via a licensed solvent waste disposal company.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate exhaust ventilation to keep below the TLV level. Self-contained breathing apparatus should be available for emergency use. Approved cannister respirators can be used for short periods up to 2-3 times the TLV level for nonroutine requirements.

Supply ventilation for sumps and low lying areas where the dense vapors of this material might collect.

Skin contact should be prevented by use of proper procedures and equipment and by protective gloves, aprons, etc. (Polyvinyl alcohol gloves offer the greatest protection against trichlorotrifluoroethane but are attacked by water.)

Face shields or safety goggles should be used where splashing of solvent is possible. Provide eyewash stations where splashing is probable.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store sealed containers in a cool (below 125 F), well-ventilated place. Keep vapors of this material away from flames, arc welding, high temperature surfaces, etc to avoid toxic and corrosive decomposition products. Space heaters in an atmosphere containing halocarbon vapors well below the TLV can suffer extensive corrosion damage in the combustion and chimney areas. No smoking in areas of use.

DATA SOURCE(S) CODE: 1,2,4,7,8,12,21,26

APPROVALS: MIS, CRD J.M. Nelson

Industrial Hygiene and Safety G.J. White

MEDICAL REVIEW: 12/79

Revised 3/28/85 U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

NOV 25 1985

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Grafo Colloids Corporation	EMERGENCY TELEPHONE NO. 412/981-1773
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 725, Sharon, PA 16146	
CHEMICAL NAME AND SYNONYMS Aquadag	TRADE NAME AND SYNONYMS Grafo Hydrograf
CHEMICAL FAMILY	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES		%	TLV (Units)
Ammonium Hydroxide	Max.	0.6	25 ppm
Dowcide A (Sodium Ortho-phenyl phenol)	Max.	0.08	5 mg/m
Graphite	Max.	20	15 mppc

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	212	SPECIFIC GRAVITY (H_2O=1)	Approx.	1.1
VAPOR PRESSURE (mm Hg.) 20° C	17.5	PERCENT, VOLATILE BY VOLUME (%)	Approx.	78
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____ =1)		
SOLUBILITY IN WATER	Appreciable			
APPEARANCE AND ODOR	Black, heavy liquid or paste; slight ammonia odor			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) none	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA not flammable			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS Avoid contact with strong oxidizing agents			

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Not determined on mixture; see section II

EFFECTS OF OVEREXPOSURE
Repeated and prolonged exposure to ammonia fumes in concentrate may result in temporary respiratory discomfort.

EMERGENCY AND FIRST AID PROCEDURES
Inhalation: provide fresh air. Skin: wash with soap and water. Eye: Flush with conius amounts of warm water; seek medical aid if irritation persists.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATABILITY *(Materials to avoid)*	Avoid contact with strong oxidizing agents.		
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash area with soap and water.

WASTE DISPOSAL METHOD
Soak up excess with absorbent material, dispose of in approved landfill area.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* Use of inhalator is advisable.

VENTILATION	LOCAL EXHAUST to remove local airborne particles	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES
Waterproof if needed to avoid skin stains

EYE PROTECTION
Goggles if splashing likely.

OTHER PROTECTIVE EQUIPMENT
Waterproof apron if needed to protect personal clothing from stains.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Keep container closed when not in use to prevent drying out. Protect from freezing during storage.

OTHER PRECAUTIONS
Produces black stains on fabrics which are difficult to remove.

 The information on this form is furnished solely for the purpose of compliance with OSHA Act, and shall not be used for any other purpose. The information herein is given in good faith and is based on the data considered accurat However, no warranty, expressed or implied, is made regarding the accuracy of these d the results to be obtained from the use thereof.

Form OSHA
Rev. May

J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone – (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

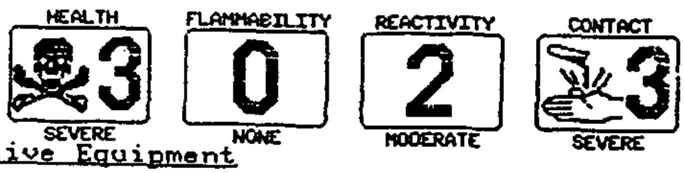
MATERIAL SAFETY DATA SHEET

SECTION I - PRODUCT IDENTIFICATION

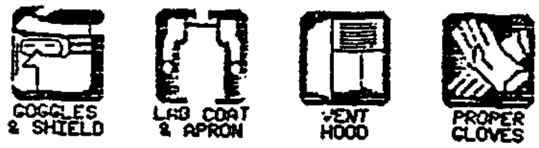
Product Name:	Hydrochloric Acid
Formula:	HCl
Formula Wt:	36.46
CAS No.:	07647-01-0
NIOSH/RTECS No.:	MW4025000
Common Synonyms:	Muriatic Acid; Chlorohydric Acid; Hydrochloride
Product Codes:	9543,9539,9535,5367,9534,9544,9529,9542,4800,9549,9530,9548 9540,9547,9546,9537

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

POISON! DANGER!
CAUSES SEVERE BURNS
MAY BE FATAL IF SWALLOWED

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Hydrochloric Acid	35-40	7647-01-0

SECTION III - PHYSICAL DATA

Boiling Point:	110°C (230°F)	Vapor Pressure(mmHg):	212
Melting Point:	N/A	Vapor Density(air=1):	1.3

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 1.19 Evaporation Rate: N/A
(H_2O=1) (Butyl Acetate=1)

Solubility(H_2O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless or slightly yellow fuming liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0

Fire Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures
Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area, if it can be done without risk. Use water to keep fire exposed containers cool; do not get water inside containers.

Toxic Gases Produced
hydrogen chloride

SECTION V - HEALTH HAZARD DATA

Toxicity:	LC_{50} (inhl-rat-1H) (ppm)	-	3124
	LD_{50} (ipr-mouse)(mg/kg)	-	40
	LD_{50} (oral-rabbit)(mg/kg)	-	900

Effects of Overexposure
Liquid may cause severe burns to skin and eyes.
Inhalation of vapors may cause severe irritation of the respiratory system.
Inhalation of vapors may cause coughing and difficult breathing.

Emergency and First Aid Procedures
If swallowed, do NOT induce vomiting. Give water, milk, or milk of magnesia.
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash clothing before re-use.

Continued on Page: 3

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, moisture

Incompatibles: most common metals, water, strong bases, amines, carbonates, metal oxide

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

J. T. Baker Neutrasorb[R] or Neutrasol[R] "Low Na+" acid neutralizers are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002 (Corrosive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep vapor and mist levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, a chemical cartridge respirator with acid cartridge is recommended. If concentration exceeds capacity of cartridge respirator, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA[TM] Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

Continued on Page: 4

SECTION IX - STORAGE AND HANDLING PRECAUTIONS (Continued)

Do not store near oxidizing materials.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hydrochloric acid
Hazard Class	Corrosive material (liquid)
UN/NA	UN1789
Labels	CORROSIVE
Reportable Quantity	5000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hydrochloric acid, solution
Hazard Class	8
UN/NA	UN1789
Labels	CORROSIVE

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is e user's responsibility to determine the suitability of this information for e adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

7, 8, 5

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME O. G. KELLEY & CO., INC.	EMERGENCY TELEPHONE NO. 615/926-7166
ADDRESS (Number, Street, City, State, and ZIP Code) 724 W. Walnut Street, Johnson City, TN 37601	
CHEMICAL NAME AND SYNONYMS Lead	TRADE NAME AND SYNONYMS Lead Pipe, Lead Pig, Lead Sheet, Ingot Lead
CHEMICAL FAMILY	FORMULA Pb

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS LEAD		0.05 mg/M3
OTHERS			LEAD		0.15 mg/M3

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	1525 (C)	2777 (F)	SPECIFIC GRAVITY (H_2O=1)	11.35
VAPOR PRESSURE (mm Hg.)			PERCENT, VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)			EVAPORATION RATE (________ =1)	
SOLUBILITY IN WATER		Insoluble	melting point 621 (F)	327.5(C)
APPEARANCE AND ODOR	Gray odorless solid			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	FLAMMABLE LIMITS N/A	Lel	Uel

EXTINGUISHING MEDIA
N/A

SPECIAL FIRE FIGHTING PROCEDURES
N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS
N/A

(Continued on reverse side)

Form OSHA-20

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

EFFECTS OF OVEREXPOSURE
Gastrointestinal disturbances and anemia with prolonged absorption of Lead. With more serious intoxication there is neuromuscular dysfunction while the most severe lead exposure may result in encephalopathy.

EMERGENCY AND FIRST AID PROCEDURES
Eyes-N/A Skin-wash with soap & water inhalation-remove from exposure and get medical attention ingestion-get medical attention

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
Stable	UNSTABLE		NONE
	STABLE		

INCOMPATABILITY *(Materials to avoid)*
NONE

HAZARDOUS DECOMPOSITION PRODUCTS
Temperatures above the melting point may produce fume.

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
NONE	MAY OCCUR		NONE
	WILL NOT OCCUR		

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
N/A

WASTE DISPOSAL METHOD

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Respirators required NIOSH/MSHA-approved for Lead dust/fume

VENTILATION	LOCAL EXHAUST	SPECIAL
General is adequate	use exhaust ventilation when working with molten lead.	
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
Gloves required Impervious	

OTHER PROTECTIVE EQUIPMENT
Full body clothing should be utilized to prevent skin contact. Change rooms, wash up procedures and shower facilities recommended.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

OTHER PRECAUTIONS

11

LITHIUM

LITHIUM
LITHIUM
LITHIUM

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS
GASTON L. PILLORI
(201) 796-7100

DATE: 06/13/86
PO NBR: N/A
ACCT: 220066-01
INDEX: N/A
CAT NO: L11125

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 7439-93-2

SUBSTANCE: **LITHIUM**

TRADE NAMES/SYNONYMS: LITHIUM METAL; L-111

CHEMICAL FAMILY:
INORGANIC METAL

MOLECULAR FORMULA: LI   MOL WT: 6.941

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=3 REACTIVITY=3 PERSISTENCE=3

COMPONENTS AND CONTAMINANTS

PERCENT: 100   COMPONENT: LITHIUM

OTHER CONTAMINANTS: NONE.

EXPOSURE LIMITS:
NONE ESTABLISHED.

PHYSICAL DATA

DESCRIPTION: SOFT, SILVER-WHITE METAL.   BOILING POINT: 2448 F (1342 C)

MELTING POINT: 357 F (181 C)   SPECIFIC GRAVITY: 0.5

VAPOR PRESSURE: 1 MMHG @ 1333 F   SOLUBILITY IN WATER: REACTS

SOLVENT SOLUBILITY: LIQUID AMMONIA.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
FINELY DIVIDED METAL MAY IGNITE IN AIR AT AMBIENT TEMPERATURE, AND MASSIVE METAL AT TEMPERATURES ABOVE THE MELTING POINT, ESPECIALLY IF OXIDE OR NITRIDE IS PRESENT. SINCE LITHIUM WILL BURN IN OXYGEN, NITROGEN, OR CARBON DIOXIDE, AND MAY REACTS WITH SAND, SODIUM CARBONATE, ETC., IT IS DIFFICULT TO EXTINGUISH ONCE ALIGHT.

FLASH POINT: FLAMMABLE SOLID UPPER EXPLOSION LIMIT: NOT AVAILABLE

LOWER EXPLOSION LIMIT: NOT AVAILABLE

FIREFIGHTING MEDIA:
DRY CHEMICAL, SODA ASH OR LIME
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGE FIRES: WITHDRAW FROM AREA AND LET FIRE BURN
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAME WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; ELSE WITHDRAW AND LET FIRE BURN (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

DO NOT USE WATER, USE GRAPHITE, SODA ASH, POWDERED SODIUM CHLORIDE, OR SUITABLE DRY POWDER. AVOID BREATHING FUMES FROM BURNING MATERIAL (BUREAU OF EXPLOSIVES, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

CARCINOGEN STATUS: NONE. TERATOGENIC DATA: RTEC.
LITHIUM IS AN ALKALI METAL WHOSE TOXICITY IS NOT WELL CHARACTERIZED BECAUSE THE SAFETY HAZARD IS EXTREMELY ACUTE. EYE OR SKIN CONTACT WILL CAUSE BURNS.

HEALTH EFFECTS AND FIRST AID

INHALATION:

ACUTE EXPOSURE- IGNITES IN PRESENCE OF MOISTURE, RELEASING CORROSIVE LITHIUM HYDROXIDE AND FLAMMABLE HYDROGEN GAS.

CHRONIC EXPOSURE- NOT REPORTED IN HUMANS.

FIRST AID- REMOVE PERSON FROM EXPOSURE AREA TO FRESH AIR IMMEDIALTEY. GIVE ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED OR IS DEPRESSED. MAINTAIN AIRWAY AND BLOOD PRESSURE. KEEP VICTIM WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
CORROSIVE.
ACUTE EXPOSURE- REACTION WITH MOISTURE ON SKIN MAY RESULT IN SERIOUS BURNS. THERE MAY BE IRRITATION. SMALL SEPTIC BLISTERS MAY FORM.

CHRONIC EXPOSURE- HAS NOT BEEN OBSERVED IN HUMANS.

FIRST AID- (WATER REACTIVE!) WIPE MATERIAL FROM SKIN IMMEDIATELY, THEN FLUSH AFFECTED AREA WITH LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS.

EYE CONTACT:
CORROSIVE.
ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE SERIOUS CORNEAL BURNS.

CHRONIC EXPOSURE- HAS NOT BEEN REPORTED IN HUMANS.

FIRST AID- WIPE MATERIAL AWAY FROM AROUND THE EYES, THEN WASH EYES WITH LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS. IN THE PRESENCE OF BURNS, APPLY STERILE DRESSING.

INGESTION:

ACUTE EXPOSURE- CONTACT WITH TISSUE WILL CAUSE IGNITION WITH BURNS OF THE GASTROINTESTINAL TRACT.

FIRST AID- IF VICTIM IS CONSCIOUS, GIVE HIM LARGE QUANTITIES OF WATER IMMEDIATELY TO DILUTE. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
BURNS VIOLENTLY IN AIR. DANGEROUS WHEN WET!

INCOMPATIBILITIES:
AIR: IGNITION.
ARSENIC: VIOLENT REACTION WITH STRONGLY HEATED ARSENIC.
BERYLLIUM: MOLTEN LITHIUM @ 180 C ATTACKS BERYLLIUM SEVERELY.
BROMINE: POSSIBLE EXPLOSION.
BROMINE PENTAFLUORIDE: IGNITION.
BROMOFORM: LITHIUM MIXED WITH BROMOFORM CAN EXPLODE ON IMPACT.
CARBIDES: MOLTEN LITHIUM ATTACKS CARBIDES.
CARBON OXIDES: IGNITION OR EXPLOSION.
CARBON MONOXIDE AND WATER: THE PRODUCT OF THE REACTION BETWEEN LI AND CO, LITHIUM CARBONYL, DETONATES VIOLENTLY WITH WATER, IGNITING GASEOUS PRODUCTS.
CARBON TETRABROMIDE: POSSIBLE EXPLOSION BY IMPACT.
CARBON TETRACHLORIDE: POSSIBLE EXPLOSION.
CHLORINE: REACTS WITH LUMINOUS FLAME.
—CHLOROFORM: POSSIBLE EXPLOSION.
CHROMIC OXIDE: REACTION OCCURS AROUND 180 C WITH TEMPERATURE RISE TO 965 C.
CHROMIUM TRIOXIDE AND NITROGEN: VIOLENT COMBUSTION.
CHROMIUM: MOLTEN LITHIUM @ 180 C ATTACKS CHROMIUM SEVERELY.
CHROMIUM TRICHLORIDE: ON DUSTING A LITHIUM STRIP WITH CHROMIUM, THEN WAVING IN A NITROGEN ATMOSPHERE, THE LITHIUM BURNS VIGOROUSLY.
COBALT ALLOYS: MOLTEN LITHIUM ATTACKS COBALT ALLOYS.
DIAZOMETHANE: POSSIBLE EXPLOSION.
—DIBORANE: IGNITION.
—FERROUS SULFIDE: REACTION OCCURS @ 180 C WITH CONSEQUENT TEMP. RISE TO 945 C.
HALOCARBONS: POSSIBLE IGNITION BY IMPACT.

II

HALOGENS: VIOLENT EXOTHERMIC REACTIONS OR POSSIBLE EXPLOSION.
HYDROGEN: LITHIUM BURNS IN GASEOUS HYDROGEN.
IODINE: A HIGHLY LUMINOUS REACTION OCCURS.
IODOFORM: THE MIXTURE CAN EXPLODE ON IMPACT.
IRON ALLOYS: MOLTEN LITHIUM ATTACKS IRON ALLOYS.
MALEIC ANHYDRIDE: EXPLOSIVE DECOMPOSITION.
MANGANESE ALLOYS: MOLTEN LITHIUM ATTACKS MANGANESE ALLOYS.
MERCURY: VIOLENT EXOTHERMIC REACTION OR POSSIBLE EXPLOSION.
METAL OXIDES: INTENSE EXOTHERMIC REACTION.
METHYL DICHLORIDE: THE MIXTURE CAN EXPLODE ON IMPACT.
METHYL DIIODIDE: THE MIXTURE CAN EXPLODE ON IMPACT.
MOLYBDENUM TRIOXIDE: THE REACTION OCCURS @ 180 C WITH CONSEQUENT TEMPERATURE RISE TO 1400 C.
MONOFLUOROTRICHLOROMETHANE: POSSIBLE EXPLOSION.
NICKEL ALLOYS: MOLTEN LITHIUM ATTACKS NICKEL ALLOYS.
NIOBIUM PENTAOXIDE: THE REACTION OCCURS @ 320 C WITH CONSEQUENT TEMPERATURE RISE TO 490 C.
NITRIC ACID: IGNITION.
NITROGEN: IGNITION.
ORGANIC MATTER: MOLTEN LITHIUM ATTACKS PLASTICS AND RUBBER.
OXYGEN: IGNITION.
PHOSPHORUS: VIOLENT REACTION WITH STRONGLY HEATED PHOSPHORUS.
PLATINUM: INTENSE REACTION @ 550 C.
?POLY-1,1-DIFLUOROETHYLENE-HEXAFLUOROPYLENE: IGNITION BY HEATING.
SILICATES: MOLTEN LITHIUM ATTACKS SILICATES.
Soda Ash? SODIUM CARBONATE: VIOLENT REACTION.
SODIUM CHLORIDE: VIOLENT REACTION.
SODIUM NITRITE: FORMATION OF LITHIUM SODIUM HYPONITRITE WHICH DECOMPOSES VIOLENTLY AROUND 100-130 C.
SULFUR: EXPLOSIVE REACTION.
TANTALUM PENTOXIDE: THE REACTION OCCURS AROUND 410 C WITH CONSEQUENT TEMPERATURE RISE TO 595 C.
TETRACHLOROETHYLENE: FORMATION OF EXPLOSIVE MIXTURE.
TITANIUM DIOXIDE: REACTS @ 200 C WITH A FLASH OF LIGHT; TEMP CAN REACH 900 C.
TRICHLOROETHYLENE: FORMATION OF EXPLOSIVE MIXTURE.
TRICHLOROTRIFLUOROETHANE: FORMATION OF EXPLOSIVE MIXTURE.
TRIFLUOROMETHYL HYPOFLUORITE: VIOLENT EXOTHERMIC REACTION.
TUNGSTEN TRIOXIDE: THE REACTION OCCURS @ 200 C WITH SUBSEQUENT TEMPERATURE RISE TO 1030 C.
VANADIUM: MOLTEN LITHIUM ATTACKS VANADIUM SEVERELY.
VANADIUM PENTOXIDE: THE REACTION OCCURS @ 400 C WITH SUBSEQUENT RISE IN TEMP. TO 768 C.
WATER (HOT): INTENSE REACTION.
ZIRCONIUM TETRACHLORIDE AND NITROGEN: VIOLENT COMBUSTION BY HEATING.

DECOMPOSITION:
DECOMPOSES ON CONTACT WITH WATER TO FORM CORROSIVE LITHIUM HYDROXIDE AND FLAMMABLE HYDROGEN GAS.

POLYMERIZATION:
NOT KNOWN TO OCCUR.

****
CONDITIONS TO AVOID

MAY IGNITE ITSELF IF EXPOSED TO AIR OR IN PRESENCE OF MOISTURE. MAY RE-IGNITE AFTER FIRE IS EXTINGUISHED. VIOLENT REACTION WITH WATER PRODUCES FLAMMABLE

GAS. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. DO NOT GET WATER ON SPILLED MATERIAL OR INSIDE THE CONTAINER. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; MOVE CONTAINERS FROM SPILL AREA. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE SPILL FOR LATER DISPOSAL. COVER POWDER SPILLS WITH PLASTIC SHEET OR TARP TO MINIMIZE SPREADING. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION SYSTEM.

RESPIRATOR:
HIGH LEVELS- SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 01/18/85 REVISION DATE: 09/04/85

-ADDITIONAL INFORMATION-

10/85 82120-0551

INCO S-ROUNDS® Electrolytic Nickel

INCO®
MATERIAL SAFETY DATA SHEET

September 13, 1985

TYPICAL COMPOSITION %

Ni	C	Cu	Co	Fe	S
99.9	0.003	0.002	0.065	0.0005	0.025

HAZARDOUS INGREDIENTS

Hazardous Ingredients	Calculated Composition %	C.A.S. No.	PEL[1]-mg/m^3	TLV[2]-mg/m^3
Nickel metal (Ni)	99.9	7740-02-0	1	1

PHYSICAL and CHEMICAL DATA

Silver-gray, odorless metal discs of approximately 1 in. (25 mm) diameter and ¼ in. (6 mm) thickness.

Ingredient	Mol. wt.	Density g/cm^3	m.p. °C	b.p. °C	Sol. in H_2O g/100 ml	Magnetic properties
Ni	58.71	8.9	1453	2732	0	ferromagnetic

PHYSICAL HAZARDS

None

HEALTH HAZARDS[3]

Inhalation: The National Toxicology Program has listed nickel as a possible cancer hazard. The International Agency for Research on Cancer concluded there was sufficient evidence that nickel refining was carcinogenic to humans and limited evidence that nickel and certain nickel compounds were carcinogenic to humans. IARC could not state with certainty which forms of nickel are human carcinogens but said "....metallic nickel seems less likely to be so than nickel subsulphide or nickel oxides.". The inhalation of nickel powder has not resulted in an increased incidence of malignant tumors in rodents. Studies of workers exposed to nickel powder and to dust and fume generated in the production of nickel alloys and of stainless steel have not indicated a respiratory cancer hazard.

Inhalation of airborne nickel powder at concentrations fifteen times the PEL irritated the respiratory tract in rodents.

Skin Contact: Repeated contact with metallic nickel can cause nickel sensitivity resulting in allergic skin rashes.

Wounds: Nickel powder and nickel oxide have caused tumors at the site of injection in rodents. However, studies of nickel-containing prostheses do not suggest a significant risk for humans.

Ingestion: Nickel metal has a low oral toxicity (oral rat LD_{50} > 9000 mg/kg). The U.S. Food and Drug Administration concluded that nickel and its inorganic compounds are not carcinogenic when ingested.

Preexisting Conditions: Sensitized individuals may experience an allergic skin rash.

PRECAUTIONS FOR SAFE STORAGE, HANDLING AND USE

If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne nickel below the PEL. If ventilation alone cannot so control exposure, use NIOSH-approved respirators selected according to OSHA 29 CFR 1910.134. Maintain airborne nickel levels as low as possible.

Avoid repeated skin contact. Wear suitable gloves. Wash skin thoroughly after handling. Launder clothing and gloves as needed.

Do not store near acids. Like other metals, nickel can react with acids to liberate hydrogen gas which can form explosive mixtures in air.

Under special conditions nickel can react with carbon monoxide in reducing atmospheres to form nickel carbonyl, $Ni(CO)_4$, an extremely toxic gas.

SPILL, LEAK AND DISPOSAL PROCEDURE

Pick up and replace in original container.

Nickel-containing waste is normally collected to recover nickel values. Should waste disposal be deemed necessary follow EPA and local regulations.

EMERGENCY AND FIRST AID PROCEDURES

or skin rashes seek medical attention.

Cleanse wounds thoroughly to remove any nickel particles.

If exposure to nickel carbonyl is suspected, seek medical attention immediately.

INTERNATIONAL NICKEL INC.
Park 80 West, Plaza Two
Saddle Brook, NJ 07662

Tel: (201) 843-8600

Trademark of the INCO family of companies.

[1] OSHA Permissible Exposure Limit

[2] Threshold Limit Value of the American Conference of Governmental Industrial Hygienists.

[3] Describes possible health hazards of the nickel product supplied. If user operations change it to other chemical forms, whether as end products, intermediates or fugitive emissions, the possible health hazards of such forms must be determined by the user.

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aldrich chemical co.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

ATTN: SAFETY DIRECTOR
ECHNISERV
. I DUPONT
BLDG 723/9A
SAVANNAH RIVER PLANT
AIKEN SC 29801
RUSTY REED

DATE: 06/09/86
CUST # 923392 P.O. #

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 24408-2 NAME: NICKEL(II) CARBONATE HYDRATE

TOXICITY HAZARDS

RTECS # QR6200000
NICKEL(II) CARBONATE (1:1)
REVIEWS, STANDARDS, AND REGULATIONS
CARCINOGENIC REVIEW:ANIMAL POSITIVE IARC** 11,75,76
OSHA STANDARD-AIR:TWA 1 MG(NI)/M3 FEREAC 39,23540,74
MSHA STANDARD-AIR:TWA 1 MG(NI)/M3 DTLVS* 3,178,71
NIOSH REL TO INORGANIC NICKEL-AIR:TWA 0.015 MG(NI)/M3 MMWR** 34(1S), 23S,85
NTP FOURTH ANNUAL REPORT ON CARCINOGENS, 1984
REPORTED IN EPA TSCA INVENTORY, 1983
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

HEALTH HAZARD DATA

ACUTE EFFECTS
HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
MAY CAUSE IRRITATION.
EXPOSURE CAN CAUSE:
GASTROINTESTINAL DISTURBANCES
CHRONIC EFFECTS
CARCINOGEN.
LUNG IRRITATION
DERMATITIS
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
DISCARD CONTAMINATED CLOTHING AND SHOES.

PHYSICAL DATA

NO PHYSICAL DATA AVAILABLE

FIRE AND EXPLOSION HAZARD DATA

EXTINGUISHING MEDIA
WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
UNUSUAL FIRE AND EXPLOSION HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

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CATALOG # 24408-2   NAME: NICKEL(II) CARBONATE HYDRATE

REACTIVITY DATA

INCOMPATIBILITIES
STRONG OXIDIZING AGENTS
STRONG ACIDS
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
LEAD, LEAD OXIDES

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
WEAR DISPOSABLE COVERALLS AND DISCARD THEM AFTER USE.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
WASTE DISPOSAL METHOD
BURY IN A LANDFILL SITE APPROVED FOR THE DISPOSAL OF CHEMICAL AND HAZARDOUS WASTES.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE OSHA/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE DUST.
AVOID ALL CONTACT.
WASH THOROUGHLY AFTER HANDLING.
CARCINOGEN.
HARMFUL SOLID.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

ADDITIONAL PRECAUTIONS AND COMMENTS

NOT APPLICABLE

USA Aldrich Chemical Co., Inc. 940 West Saint Paul Avenue Milwaukee, Wisconsin 53233 Telephone: (414) 273-3850 TWX: (910) 262-3052 Aldrichem Ml Telex: 26 843 Aldrich Ml FAX: (414) 273-4979

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France Aldrich-Chimie S.a.r.l. 27, Fossé des Treize F-67000 Strasbourg Telephone: (88) 327010 Telex: 890076 Aldrich F FAX: (88) 75 12 83

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United Kingdom Aldrich Chemical Co., Ltd. The Old Brickyard, New Road Gillingham, Dorset SP8 4JL Telephone: (07476) 2211 Telex: 417238 Aldrch G FAX: (07476) 3779

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NICKELOUS CARBONATE
NICKELOUS CARBONATE
NICKELOUS CARBONATE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
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GASTON L. PILLORI
(201) 796-7100

DATE: 06/13/86
PO NBR: N/A
ACCT: 220066-01
INDEX: N/A
CAT NO: N51500

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 3333-67-3

SUBSTANCE: **NICKELOUS CARBONATE**

TRADE NAMES/SYNONYMS: CARBONIC ACID, NICKEL SALT (1:1); C.I.77779;
NICKEL (II) CARBONATE; N-51

CHEMICAL FAMILY:
INORGANIC SALT

MOLECULAR FORMULA: C-NI-O3 MOL. WT: 118.72

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=3

COMPONENTS AND CONTAMINANTS

PERCENT: 100 COMPONENT: NICKELOUS CARBONATE

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
1 MG(NI)/M3 ACGIH TWA;
15 UG(NI)/M3 NIOSH RECOMMENDED TWA

PHYSICAL DATA

DESCRIPTION: RHOMBIC, LIGHT GREEN CRYSTAL OR BROWN POWDER

MELTING POINT: DECOMPOSES SPECIFIC GRAVITY: 2.6

SOLUBILITY IN WATER: INSOLUBLE SOLVENT SOLUBILITY: AMMONIA, DILUTE ACIDS

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE AND EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: NON-COMBUSTIBLE

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

EXTINGUISH USING AGENT INDICATED. USE FLOODING AMOUNTS OF WATER AS A FOG. AVOID BREATHING DUSTS AND FUMES FROM BURNING MATERIAL; KEEP UPWIND. (BUREAU OF EXPLOSIVE, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

32 MG/KG SUBCUTANEOUS-GUINEA PIG; LDLO; MUTAGENIC DATA (RTECS); POSITIVE ANIMAL CARCINOGEN (IARC). EPIDEMIOLOGICAL STUDIES CONCLUSIVELY DEMONSTRATE AN INCREASED RISK OF NASAL CAVITY AND PULMONARY CANCER IN WORKERS IN NICKEL REFINERIES. IT IS LIKELY THAT NICKEL IN SOME FORM(S) IS CARCINOGENIC TO MAN. NICKEL COMPOUNDS ARE EYE, MUCOUS MEMBRANE, AND SKIN IRRITANTS AND PULMONARY AND SKIN SENSITIZERS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
IRRITANT/SENSITIZER.

ACUTE EXPOSURE- INHALATION OF NICKEL DUST AND FUME MAY CAUSE RESPIRATORY IRRITATION, COUGH, ASTHMA, PULMONARY FIBROSIS, AND PNEUMONITIS WITH FEVER. PULMONARY SENSITIZATION MAY OCCUR IN PREVIOUSLY EXPOSED WORKERS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE MUCOUS MEMBRANE IRRITATON AND PULMONARY SENSITIZATION. AN INCREASE INCIDENCE OF LUNG AND NASAL CAVITY CANCERS HAS BEEN NOTED AMONG WORKMEN IN NICKEL SMELTERS AND REFINERIES. SEE ANIMAL CARCINOGENIC, MUTAGENIC AND TUMORIGENIC REFERENCES IN TOXICITY SECTION.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
IRRITANT/SENSITIZER.

ACUTE EXPOSURE- DUST MAY CAUSE IRRITATION AND CONTACT OR SENSITIZATION DERMATITIS.

CHRONIC EXPOSURE- MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
IRRITANT.

ACUTE EXPOSURE- MAY CAUSE REDNESS AND IRRITATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE IRRITATION AND CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

INGESTION:

ACUTE EXPOSURE- NO EFFECTS HAVE BEEN REPORTED IN HUMANS.

FIRST AID- IF VICTIM IS CONCIOUS, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER. INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. GET MEDICAL ATTENTION IMMEDIATELY.

FIRST AID- IF VICTIM IS CONSCIOUS, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER, AND INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES, UP TO THE MELTING POINT, WHERE DECOMPOSITION OCCURS.

INCOMPATIBILITIES:
NONE KNOWN.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC FUMES OF CARBON MONOXIDE AND OXIDES OF NICKEL.

POLYMERIZATION:
NOT KNOWN TO OCCUR.

****

CONDITIONS TO AVOID

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
NO SPECIAL PRECAUTIONS INDICATED.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION OR GENERAL DILUTION VENTILATION TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:
1000 MG(NI)/M3- SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE, HELMET, OR HOOD.

>1000 MG(NI)/M3- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 03/15/85 REVISION DATE: 04/26/85

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MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT

SCHENECTADY, N. Y. 12305

MATERIALS · INFORMATION · SERVICES

NO. 36

NICKEL CHLORIDE

Date September 1978

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: **NICKEL CHLORIDE**

OTHER DESIGNATIONS: Nickelous Chloride Hexahydrate, $NiCl_2 \cdot 6H_2O$, GE Material D4G8, CAS# 007 791 200

MANUFACTURER: Allied Chemical Corporation
Specialty Chemicals Div.
Columbia Rd., Morristown, NJ 07960
Phone: (201) 455-2000

McGean Chemical Co., Inc.
1250 Terminal Tower
Cleveland, OH 44113
Phone: (216) 621-6425

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Nickel(II)Chloride Hexahydrate	ca 99	8-hr TWA 0.1 mg/m^3* (as Ni)
*Current OSHA regulation is 1 mg/m^3; ACGIH (1977) 8-hr TWA is 0.1 mg/m^3 (as Ni) with STEL of 0.3 mg/m^3. NIOSH has proposed TWA of 0.015 mg/m^3 (as Ni) for all inorganic nickel compounds and considers all inorganic nickel compounds to be carcinogenic when airborne (under dispute).		Mouse, intraperitoneal LD_{50} 48 mg/kg Dog, intraveneous LD 40-80 mg/kg

SECTION III. PHYSICAL DATA

Solubility in water, g/100 cc at 20 C — 254
at 100 C - 599
pH of aqueous solution ——————— ca 4

Vapor pressure of this material is water vapor only at room temperature
Molecular weight ————— 237.70

Appearance & Odor: Green, deliquescent crystals or crystalline powder.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
N/A	N/A	N/A		

This material is non-flammable. Use extinguishing media which is appropriate for the flammables involved in the fire.
No unusual fire or explosion hazards are associated with this material.
Firefighters should use an approved self-contained respirator if this material is involved in a fire situation.

SECTION V. REACTIVITY DATA

This material is stable in <u>closed</u> containers at room temperature. (It will pick up moisture from the air and go into solution if exposed in open containers.)
A water solution of this material is acidic.

SECTION VI. HEALTH HAZARD INFORMATION	TLV 0.1 mg/kg (See Sect. II)

Irritating and harmful when swallowed. Irritating and damaging to the eyes on contact. Irritating to the skin; may produce allergic sensitization. "Nickel itch" is a form of dermatitis that can occur in those handling nickel compounds or metallic nickel plate. Inhalation of dust or mist is irritating to the upper respiratory tract.

NIOSH has proposed that all "airborne nickel" be considered carcinogenic; this is under dispute, but any inhalation of dusts or mists containing nickel should be avoided. (Evidence is good that inhalation exposure to certain nickel refining processes has produced cancer in the respiratory passages and lungs.) Inorganic nickel compounds are not considered carcinogenic by ingestion. FIRST AID:

Eye contact: Flush well, including under eyelids, with running water for 10-15 minutes; then get medical attention promptly.

Skin contact: Flush exposed areas with water, then wash with soap and water. Get medical attention if irritation persists.

Inhalation: Remove to fresh air. If discomfort persists, get medical attention.

Ingestion: Contact physician immediately for instructions!

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Those involved in clean up must have protection against skin or eye contact and inhalation of dust or mist. Pick up promptly for recovery or disposal by a method that does not generate dust. Notify safety and health personnel if large spills occur.

DISPOSAL: All disposal must be done in accordance with Federal, State, and local regulations. Nickel content of effluent must be properly regulated for discharge. Disposal may require precipitating nickel under alkaline conditions, filtering, neutralizing the filtrate for discharge and, placing nickel-containing sludge in an approved landfill.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate general ventilation and local exhaust ventilation to meet the TLV requirements. (General ventilation may be adequate where no dust or misting occur.) Whenever dust or mist problems occur, local exhaust ventilation should have a face velocity greater than 100 lfm at the inlet at the working station and workers should be equipped with approved respiratory protection.

Protective rubber gloves and safety glasses are required. Protective clothing and a chemical apron should be worn where gross contact is probable. An eye wash station should be near the work area.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store this material in closed containers that are well protected from physical damage. Handle in a manner that avoid dusting or misting conditions.

Avoid breathing of dust or of mists containing this material. Avoid contact with the skin, eyes or clothing. Wash thoroughly after handling. Follow good hygienic practice.

Preclude from exposure those individuals who have become sensitized to nickel compounds and those who have problems with skin, sinus and pulmonary diseases. Because of possible carcinogenic risk, medical surveillance as presented in NIOSH recommended inorganic nickel standard should be conducted.

DATA SOURCE(S) CODE: 1-6, 10, 12, 20

APPROVALS: MIS, CRD	J. M. Nielsen
Industrial Hygiene and Safety	[signature]
Corporate Medical Staff	George F. Martelon MD

GENERAL ELECTRIC

H,85

NICKEL(OUS) SULFATE, HEXAHYDRATE
NICKEL(OUS) SULFATE, HEXAHYDRATE
NICKEL(OUS) SULFATE, HEXAHYDRATE

MATERIAL SAFETY DATA SHEET

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(201) 796-7100

DATE: 02/27/86
PO NBR: N/A
ACCT: 220066-01
INDEX: 15-8605-10047
CAT NO: N73500

SUBSTANCE IDENTIFICATION

CAS-NUMBER 10101-97-0

SUBSTANCE: **NICKEL(OUS) SULFATE, HEXAHYDRATE**

TRADE NAMES/SYNONYMS: NICKEL(II) SULFATE, HEXAHYDRATE (1:1:6); BLUE SALT; SINGLE NICKEL SALT; SULFURIC ACID, NICKEL(2+) SALT, HEXAHYDRATE; N-72; N-73

CHEMICAL FAMILY:
INORGANIC SALT

MOLECULAR FORMULA: NI-04-S.6 H2-0 MOL WT: 262.86

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=3

COMPONENTS AND CONTAMINANTS

PERCENT: 100 COMPONENT: NICKEL SULFATE, HEXAHYDRATE

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
1.0 MG(NI)/M3 OSHA TWA; 0.1 MG(NI)/M3 ACGIH TWA;
25 UG(NI)/M3 NIOSH RECOMMENDED TWA

PHYSICAL DATA

DESCRIPTION: ODORLESS, BLUE OR EMERALD GREEN, EFFLORESCENT CRYSTALS

WITH A SWEET ASTRINGENT TASTE BOILING POINT: 217 F (103 C) DEHYD.

MELTING POINT: 128 F (53 C) SPECIFIC GRAVITY: 2.1 PH: ABOUT 4.5 IN SOL.

SOLUBILITY IN WATER: 62.5%

SOLVENT SOLUBILITY: METHANOL; SLIGHT SOL ALCOHOL, AMMONIUM HYDROXIDE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE AND EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: NON-COMBUSTIBLE

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. DO NOT SCATTER SPILLED MATERIAL WITH MORE WATER THAN NEEDED FOR FIRE CONTROL. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS VAPORS OR DUSTS, KEEP UPWIND (BUREAU OF EXPLOSIVES, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

500 MG/KG SUBCUTANEOUS-DOG LDLO; 500 MG/KG SUBCUTANEOUS-CAT LDLO; 500 MG/KG SUBCUTANEOUS-RABBIT LDLO; 62 MG/KG SUBCUTANEOUS-GUINEA PIG LDLO; 89 MG/KG INTRAVENOUS-DOG LDLO; 72 MG/KG INTRAVENOUS-CAT LDLO; 36 MG/KG INTRAVENOUS-RABBIT LDLO; MUTAGENIC DATA (RTECS); CARCINOGEN STATUS: NONE.
NICKEL SULFATE, HEXAHYDRATE IS AN EYE, MUCOUS MEMBRANE, RESPIRATORY TRACT, AND SKIN IRRITANT, AND A SKIN AND PULMONARY SENSITIZER. IT IS MODERATELY TOXIC BY INGESTION AND MAY EFFECT THE CENTRAL NERVOUS SYSTEM.

HEALTH EFFECTS AND FIRST AID

INHALATION:
IRRITANT/SENSITIZER.

ACUTE EXPOSURE- INHALATION OF NICKEL DUST AND FUME MAY CAUSE RESPIRATORY IRRITATION, COUGH, ASTHMA, PULMONARY FIBROSIS, AND PNEUMONITIS WITH FEVER. PULMONARY SENSITIZATION MAY OCCUR IN PREVIOUSLY EXPOSED WORKERS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE MUCOUS MEMBRANE IRRITATON AND PULMONARY SENSITIZATION. AN INCREASE INCIDENCE OF LUNG AND NASAL CAVITY CANCERS HAS BEEN NOTED AMONG WORKMEN IN NICKEL SMELTERS AND REFINERIES. SEE ANIMAL MUTAGENIC REFERENCE IN TOXICITY SECTION.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
IRRITANT/SENSITIZER.
ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION AND SENSITIVITY DERMATITIS. "NICKEL ITCH" IS A DERMATITIS WITH PURITIS, ERYTHEMATOUS OR FOLICULAR ERUPTION, FOLLOWED, POSSIBLY, BY ECZEMA OR ULCERS.

CHRONIC EXPOSURE- MAY CAUSE SENSITIZATION DERMATITIS WITH SYMPTOMS AS WITH ACUTE EXPOSURE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
IRRITANT.
ACUTE EXPOSURE- MAY CAUSE REDNESS AND IRRITATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE IRRITATION AND CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

INGESTION:

ACUTE EXPOSURE- NICKEL AND SALTS MAY CAUSE NAUSEA, VOMITING, STOMATITIS, AND COLLAPSE, WITH WATERY OR BLOODY DIARRHEA, HEMOLYSIS, ANURIA, HEMATURIA, JAUNDICE, CYANOSIS, HYPOTENSION, CONVULSIONS, AND COMA. MAY ALSO CAUSE WEAKNESS, DIZZINESS, AND LASSITUDE.

FIRST AID- IF VICTIM IS CONSCIOUS, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER, AND INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
NONE KNOWN.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS INCLUDE HIGHLY TOXIC FUMES OF SULFUR OXIDES.

POLYMERIZATION:
NONE KNOWN.

****

CONDITIONS TO AVOID

NO REPORTS FOUND.

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG A HOLDING AREA SUCH AS PIT, POND OR LAGOON TO CONTAIN SPILLED MATERIAL. USE PROTECTIVE COVER SUCH AS A PLASTIC SHEET TO PREVENT DISSOLVING IN FIRE-FIGHTING WATER OR RAIN.

WATER SPILL:
NEUTRALIZE WITH CAUSTIC SODA.

ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

USE DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

OCCUPATIONAL SPILL:
STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CLEAN, DRY CONTAINERS FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION OR GENERAL DILUTION VENTILATION TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:

10 MG(NI)/M3- SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

50 MG(NI)/M3- SUPPLIED-AIR RESPIRATOR WITH A FULL FACE-PIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

1000 MG(NI)/M3- POWERED AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
TYPE 'C' SUPPLIED-AOR RESPIRATOR OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE OR CONTINUOUS-FLOW MODE.

2000 MG(NI)/M3- TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITVE PRESSURE-MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS FLOW-MODE.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 03/20/85 REVISION DATE: 04/26/85

-ADDITIONAL INFORMATION-

4
14
7
5
12

NITRIC ACID
NITRIC ACID
NITRIC ACID

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC CHEMICAL DIVISION 1 REAGENT LANE FAIR LAWN NJ 07410 (201) 796-7100	EMERGENCY CONTACTS GASTON L. PILLORI (201) 796-7100	DATE: 12/22/85 PO NBR: N/A ACCT: 220066-01 INDEX: 15-8535-30347 CAT NO: A200500

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 7697-37-2

SUBSTANCE: **NITRIC ACID**

TRADE NAMES/SYNONYMS: AQUA FORTIS; HYDROGEN NITRATE; AZOTIC ACID; NITRYL HYDROXIDE; A-200; A-200C; A-200S; A-198; A-202; A-206-C

CHEMICAL FAMILY:
INORGANIC ACID

MOLECULAR FORMULA: H-N-O3   MOL WT 63.02

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=0

COMPONENTS AND CONTAMINANTS

PERCENT: 70   COMPONENT: HYDROGEN NITRATE

PERCENT: 30   COMPONENT: WATER

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
2 PPM (5 MG/M3) OSHA TWA; 2 PPM NIOSH RECOMMENDED TWA;
2 PPM ACGIH TWA; 4 PPM ACGIH STEL

PHYSICAL DATA

DESCRIPTION: COLORLESS FUMING LIQUID WITH AN ACRID ODOR; SUFFOCATING FUMES. THE ODOR IS NOT CONSIDERED AN ADEQUATE WARNING PROPERTY.

BOILING POINT: 181 F (83 C)   MELTING POINT: -44 F (-42 C)

SPECIFIC GRAVITY: 1.5   VAPOR PRESSURE: 62 MMHG @ 25 C

EVAPORATION RATE: NOT AVAILABLE SOLUBILITY IN WATER: MISCIBLE

SOLVENT SOLUBILITY: ETHER ODOR THRESHOLD: <5.0 PPM VAPOR DENSITY: 2.2

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
INCREASES THE FLAMMABILITY OF COMBUSTIBLES, ORGANIC MATERIAL, AND READILY OXIDIZABLE MATERIALS, CAUSING IGNITION OF SOME. SEVERE EXPLOSION HAZARD BY REACTION WITH MANY INCOMPATIBLES, INCLUDING METALLIC POWDERS, CARBIDES, HYDROGEN SULFIDE, AND TURPENTINE. IN OR NEAR FIRE, MATERIAL EMITS TOXIC AND REACTIVE NITROGEN OXIDES AS GASES.

FLASH POINT: NONCOMBUSTIBLE

FIREFIGHTING MEDIA:
WATER SPRAY

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; ELSE WITHDRAW FROM AREA AND LET FIRE BURN (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

EXTINGUISH USING AGENTS INDICATED. IF LARGE AMOUNTS OF COMBUSTIBLE MATERIALS ARE INVOLVED, USE WATER SPRAY OR FOG IN FLOODING AMOUNTS. USE WATER SPRAY TO ABSORB CORROSIVE VAPORS. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS; KEEP UPWIND

TOXICITY

430 MG/KG ORAL-HUMAN LDLO; 110 MG/KG UNKNOWN-MAN LDLO;
CARCINOGEN STATUS: NONE.
NITRIC ACID IS A SEVERE EYE, MUCOUS MEMBRANE, AND SKIN IRRITANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:
CORROSIVE. 100 PPM IS IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.
ACUTE EXPOSURE- MAY CAUSE COUGHING, HEADACHE, DIZZINESS, AND WEAKNESS. DELAYED SYMPTOMS MAY INCLUDE DRYNESS OF THE THROAT AND NOSE, CHEST PAIN OR TIGHTNESS, DYSPNEA, FROTHY SPUTUM, HYPOTENSTION AND CYANOSIS FOLLOWED BY PNEUMONITIS AND PULMONARY EDEMA, WHICH MAY BE FATAL. IF PATIENT RECOVERS, SCAR TISSUE MAY CAUSE STRICTURE OF THE PYLORUS OR ESOPHAGUS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE CAUSES DENTAL EROSION FOLLOWED BY JAW NECROSIS, CHRONIC COUGH AND BRONCHITIS OR CHEMICAL PNEUMONITIS AND GASTROINTESTINAL DISTURBANCES.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST.

SKIN CONTACT:
CORROSIVE.
ACUTE EXPOSURE- DIRECT CONTACT WITH LIQUID OR CONCENTRATED VAPOR CAUSES IMMEDIATE SEVERE AND PENETRATING BURNS, STAINING THE SKIN YELLOW OR YELLOWISH-BROWN.

CHRONIC EXPOSURE- PROLONGED OR REPEATED EXPOSURE MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION.

EYE CONTACT:
CORROSIVE.
ACUTE EXPOSURE- DIRECT CONTACT WITH THE LIQUID MAY CAUSE PAIN, PHOTOPHOBIA, TEARING, EDEMA, CORNEAL ULCERATION, SEVERE BURNS, AND NECROSIS OF THE DEEPER TISSUES WITH PERMANENT DAMAGE AND BLINDNESS IS POSSIBLE.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IN PRESENCE OF BURNS, APPLY STERILE BANDAGES LOOSELY WITHOUT MEDICATION. GET MEDICAL ATTENTION.

INGESTION:
CORROSIVE.
ACUTE EXPOSURE- IMMEDIATE PAIN IN THE MOUTH, THROAT, AND STOMACH MAY BE FOLLOWED BY VOMITING, AND DIARRHEA OF DARK PRECIPATED BLOOD. HYPOTENSION, OLIGURIA, ANURIA, SEVERE, POSSIBLY FATAL, CIRCULATORY COLLAPSE, AND ASPHYXIA FROM EDEMA OF THE GLOTTIS ARE POSSIBLE. BURNS OF THE GASTROINTESTINAL TRACT MAY BE SEVERE ENOUGH TO CAUSE PERFORATION OF THE ESOPHAGUS AND STOMACH WHICH MAY BE FOLLOWED BY MEDIASTINITUS OR PERITONITIS, INDICATED BY FEVER.

FIRST AID- IF VICTIM IS CONSCIOUS, GIVE HIM LARGE QUANTITIES OF WATER IMMEDIATELY TO DILUTE THE ACID. DO NOT INDUCE VOMITING. GIVE PATIENT 1 OUNCE (30 ML) OF MILK OF MAGNESIA. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES. HOWEVER NITRIC VAPOR AND/OR NITRIC OXIDES ARE QUIETLY EVOLVED. ALSO SUNLIGHT CATLAYSES THE FORMATION OF THE OXIDES AND THIS GIVES A YELLOW COLOR TO THE CONCENTRATED ACID.

INCOMPATIBILITIES:
EASILY OXIDIZED SUBSTANCES, EXAMPLES FOLLOW:

EXPLOSION: ACETONITRILE, CESIUM CARBIDE, CUPRIC NITRIDE, CYANIDES, 1,2-DIAMINOETHANE BISTRIMETHYL GOLD, DINITROTOLUENE, EPICHLOROHYDRIN, 5-ETHYL-2-METHYL PYRIDINE, CYCLOPENTADIENE, BENZENE, TOLUENE, METALS, METAL CARBIDES, 4-METHYLCYCLOHEXANONE, NITROBENZENE AND WATER, NITROMETHANE, POLYDIBROMOSILANES, PHOSPHORUS TRICHLORIDE, POTASSIUM HYPOPHOSPHITE (ON EVAPORATION), RUBIDIUM CARBIDE, SELENIUM IODOPHOSPHIDE, SULFUR DIOXIDES, THIOCYANATES,

THIOCYANIC ACID METAL SALTS, THIOPHENES, TETRABORANE, TRICADMIUM DIPHOSPHIDE, TRITHIOACETONE.
PROBABLE EXPLOSION: ACETONE AND ACETIC ACID, SULFURIC ACID AND GLYCERIDES, TRIAZINE AND TRIFLUOROACETIC ANHYDRIDE @ 36 C.
POSSIBLE EXPLOSION: ACETIC ACID, I-AMINOTHIAZOLE AND SULFURIC ACID, CYANATES, 1,3-CYCLOPENTADIENE, FLURORINE, LACTIC ACID AND HYDROGEN FLUORIDE, MESITYLENE, ORGANIC SUBSTANCES AND SULFURIC ACID, ORGANIC SUBSTANCES AND PERCHLORATES, PHTHALIC ACID OR PHTHALIC ANHYDRIDE AND SULFURIC ACID, REDUCING AGENTS, SULFURIC ACID, TITANIUM ALLOY.
EXPLOSION BY FRICTION OR IMPACT: ACETIC ANHYDRIDE.
EXPLOSIVE OXIDATION: NON-METAL OXIDES- ARSINE, PHOSPHINE, OR TETRABORANE, DIPHENYLDISTIBENE.
POSSIBLE EXPLOSION BY IMPACT : TITANIUM-MAGNESIUM ALLOY.
VIOLENT REACTION: ACRYLONITRILE, ALCOHOLS, ARSINE, CARBON (PULVERIZED), CHLORINE TRIFLUORIDE, CUPROUS NITRIDE, CYCLIC KETONES, CYCLOHEXANOL, ETHANOL, GERMANIUM, HYDRAZINE, SULFUR HALIDES, SULFURIC ACID AND TEREPHTHALIC ACID, THIOALDEHYDES OR THIOKETONES, URANIUM, URANIUN ALLOYS.
VIOLENT OXIDATION: ACETONE AND SULFURIC ACID, SULFAMIC ACID.
VIOLENT DECOMPOSITION: BUTANETHIOL, PHOSPHINE.
VIOLENT DECOMPOSITION RESULTING IN IGNITION: CROTONALDEHYDE, TETRAPHOSPHORUS TRIIODIDE.
POSSIBLE VIOLENT REACTION: ANTIMONY.
POSSIBLE VIOLENT EXOTHERMIC REACTION: ANION EXCHANGE RESIN.
INTENSE EXOTHERMIC REACTION: ACROLEIN, ALLYL ALCOHOL, ALLYL CHLORIDE, 2-AMINOETHANOL, AMMONIUM HYDROXIDE, BISMUTH, N-BUTYRALDEHYDE, CHLOROSULFONIC ACID, CRESOL, CUMENE, DIISOPROPYL ETHER, ETHYLENEDIAMINE, POLYALKENES, GLYOXAL, ISOPRENE, MESITYL OXIDE, 2-METHYL-5-ETHYLPYRIDINE, OLEUM, PROPYLENE OXIDE, PROPIOLACTONE (BETA-), PYRIDENE, SODIUM HYDROXIDE, VINYL ACETATE, VINYLDENE CHLORIDE,.
INTENSE REACTION: DIETHYLETHER, HYDRAZOIC ACID, P-XYLENE IN THE PRESENCE OF SULFURIC ACID, SELENIUM, SODIUM AZIDE, TOLUENE, TRIMETHYLTRIOXANE.
IGNITION WITH POSSIBLE EXPLOSION: HYDROGEN TELLURIDE.
IGNITION: ANILINE, BORON PHOSPHIDE, BROMINE PENTAFLUORIDE, N-BUTYLMERCAPTAN, CALCIUM HYPOPHOSPHITE, DIBORANE, DIPHENYL TIN, M-ETHYL ANILINE, ETHYL PHOSPHINE, FURFURYL ALCOHOL, HALOGEN PHOSPHIDES, HYDROGEN IODIDES, LITHIUM, METALS, PHOSPHONIUM IODIDE, PHOPHORUS, SELENIUM HYDRIDE, SODIUM, TERPENES, TOLUIDINE, TRIETHYLGALLIUM MONOETHYL ETHER COMPLEX, UNS-DIMETHYLHYDRAZINE.
POSSIBLE IGNITION: AMMONIA, ANION EXCHANGE RESIN AND CHROMITES OR DICHROMATE, AROMATIC AMINES, DIVINYL ETHER, DIENE OR ACETYLENE DERIVATIVES, LITHIUM, REDUCING AGENTS.
INCANDESCENT REACTION: BORON, FERROUS OXIDE (POWDER), HYDROGEN SULFIDE, LITHIUM SILICIDE, SELENIUM HYDRIDE, MAGNESIUM PHOSPHIDE, MANGANESE, ZINC.
FORMATION OF HIGHLY EXPLOSIVE PRODUCTS: NITROAROMATIC HYDROCARBONS.
FORMATION OF EXPLOSIVE PRODUCTS: ACETYLENE, 4-CHLORO-2-NITROANILINE, CYCLOHEXANE, CYCLOHEXYLAMINE, 2,6-DI-T-BUTYL PHENOL, DICHLOROMETHANE, ETHANOL AND SILVER, 5-ETHYL-2-PICOLINE, HYDROGEN PEROXIDE AND KETONES, HYDROGEN PEROXIDE AND MERCURIC OXIDE, HYDROGEN PEROXIDE AND THIOUREA, INDANE AND SULFURIC ACID, METAL SALICYLATES, PHENYLORTHOPHOSPHORIC ACID DISODIUM SALT, TITANIUM.
FORMATION OF POSSIBLY EXPLOSIVE PRODUCTS: BENZOTHIOPHENE DERIVATIVES.
FORMATION OF EASILY COMBUSTIBLE ESTER: CELLULOSE.
DETONATABLE MIXTURE (DEPENDING ON AMOUNT OF WATER PRESENT): NITROBENZENE.

DECOMPOSITION:
DECOMPOSES ON EXPOSURE TO AIR OR ORGANIC MATTER, OR WITH HEAT, TO RELEASE HIGHLY TOXIC FUMES OR OXIDES OF NITROGEN, INCLUDING NITRIC OXIDE AND NITROGEN DIOXIDE, AND HYDROGEN NITRATE. REACTS WITH THE FOLLOWING TO RELEASE TOXIC GASES: SULFIDES, CARBONATES, CYANIDES. VIOLENT REACTION WITH ALL CARBIDES, GAS MIXTURE EVOLVED (N_2O_4) REACTS STRONGLY WITH HYDROCARBONS, FLUORINE, OR

FORMALDEHYDE.

POLYMERIZATION:
WILL NOT OCCUR.

****

CONDITIONS TO AVOID

MAY IGNITE COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.). REACTS VIOLENTLY WITH WATER AND FUELS. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN TANKS AND HOPPER CARS. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD. AVOID CONTACT WITH OR STORAGE WITH INCOMPATIBLE MATERIALS, INCLUDING THOSE MATERIALS AND CLASSES OF MATERIALS LISTED IN THE REACTIVITY SECTION. HEATING MAY INCREASE THE EVOLUTION OF NITRIC ACID VAPOR AND/OR NITROGEN OXIDES (GASES) BEYOND AN ACCEPTABLE LEVEL.

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
KEEP COMBUSTIBLES (WOOD, PAPER, OIL AND OTHER EASILY OXIDIZABLE MATERIALS) AWAY FROM SPILLED MATERIAL. WEAR PERSONAL PROTECTIVE EQUIPMENT. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DILUTE SPILLS OR LEAKS WITH PLENTY OF WATER. NEUTRALIZE RESIDUE WITH (A) ALKALI, SUCH AS SOLDA ASH, LIME, LIMESTONE; OR (B) OTHER SUITABLE NEUTRALIZATION MATERIALS. ADEQUATE VENTILATION IS REQUIRED TO ELIMINATE ANY NITROGEN OXIDES RELEASED AND, IF SODA ASH OR LIMESTONE IS USED, CO2. ABSORB WITH EXCESS SODA ASH, SCOOP UP AND PLACE IN A SUITABLE E.G. GLASS OR PLASTIC CONTAINER AND CLOSE. LABEL 'OXIDIZER'. KEEP OUT OF SEWERS AND WATER SOURCES. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION, PROCESS ENCLOSURE OR GENERAL DILUTION VENTILATION TO MEET PERMISSABLE EXPOSURE LIMITS REQUIREMENTS. EQUIPMENT MUST BE CORROSION-RESISTANT.

RESPIRATOR:
EXPOSURE LIMIT TO 100 MG/M3-
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.
TYPE 'C' SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE OR CONTINUOUS FLOW MODE.

> 100 MG/M3, INCLUDING THE IDLH LEVEL, 250 MG/M3-
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE, OR USE EQUIVALENT RESPIRATOR.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR IMPERVIOUS CLOTHING AS NECESSARY TO AVOID ANY POSSIBILITY

OF CONTACT WITH CHEMICAL.

GLOVES:
WEAR IMPERVIOUS GLOVES AS NECESSARY TO AVOID ANY POSSIBLILITY OF CONTACT WITH SUBSTANCE. PREFERRED MATERIALS: VITON OR SARANEX.

EYE PROTECTION:
WEAR FACESHIELD (8 INCH MINIMUM) AND VENTED SAFETY GOGGLES. DO NOT WEAR CONTACT LENSES WHEN WORKING WITH CHEMICALS.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 02/10/85 REVISION DATE: 10/21/85

-ADDITIONAL INFORMATION-
THE INFORMATION BELOW IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

Material Safety Data Sheet
May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(As Used on Label and List)*

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: MID-ATLANTIC PERLITE PRODUCTS CO.	Emergency Telephone Number: (717) 236-4004
Address *(Number, Street, City, State, and ZIP Code)*: 1500 N. Cameron Street, Harrisburg, PA 17103	Telephone Number for Information: (717) 236-4004
	Date Prepared: 5-15-86
	Signature of Preparer *(optional)*

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% *(optional)*
N/A				

This material is the expanded form of Perlite; it is chemically inert and is approved by the Food-Chemical Codex for filtering liquid food.
Sodium Potassium Aluminum Silicate.
Trade names - MAPPCO PerFIL and PerFLO.

Section III — Physical/Chemical Characteristics

Boiling Point		Specific Gravity (H_2O = 1)	
Vapor Pressure (mm Hg.)		Melting Point	
Vapor Density (AIR = 1)		Evaporation Rate (Butyl Acetate = 1)	

Solubility in Water: Insoluble

Appearance and Odor: Off white, no odor

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
None (non-flammable)			

Extinguishing Media: Inert mineral, does not burn, CO^2 compatable

Special Fire Fighting Procedures: Will not support combustion

Unusual Fire and Explosion Hazards: None

(Reproduce locally)

Reactivity Data

Stability			Conditions to Avoid
	Unstable		None - inert and stable
	Stable	X	

Incompatibility (*Materials to Avoid*)
None - incompatable with concentrate hydro fluoric acid (will partially dissolve).

Hazardous Decomposition or Byproducts
None

Hazardous Polymerization			Conditions to Avoid
	May Occur		
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? Yes Skin? Ingestion?

Health Hazards (*Acute and Chronic*)

Carcinogenicity: NTP? IARC Monographs? OSHA Regulated?

Signs and Symptoms of Exposure
Nuisance dust - chemically inert

Medical Conditions
Generally Aggravated by Exposure

Emergency and First Aid Procedures
Eye discomfort - treat by eyewash, no emergency procedure required

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled
Sweep into container and discard. This is an innocuous white mineral powder, not harmful to touch or to handle. It is easily suspended in air in windy locations, suggest using respirator such as MSA-77 and possible use of goggles.

Waste Disposal Method
Landfill acceptable, no special procedures

Precautions to Be Taken in Handling and Storing
None required

Other Precautions
None

Section VIII — Control Measures

Respiratory Protection (*Specify Type*)
none.

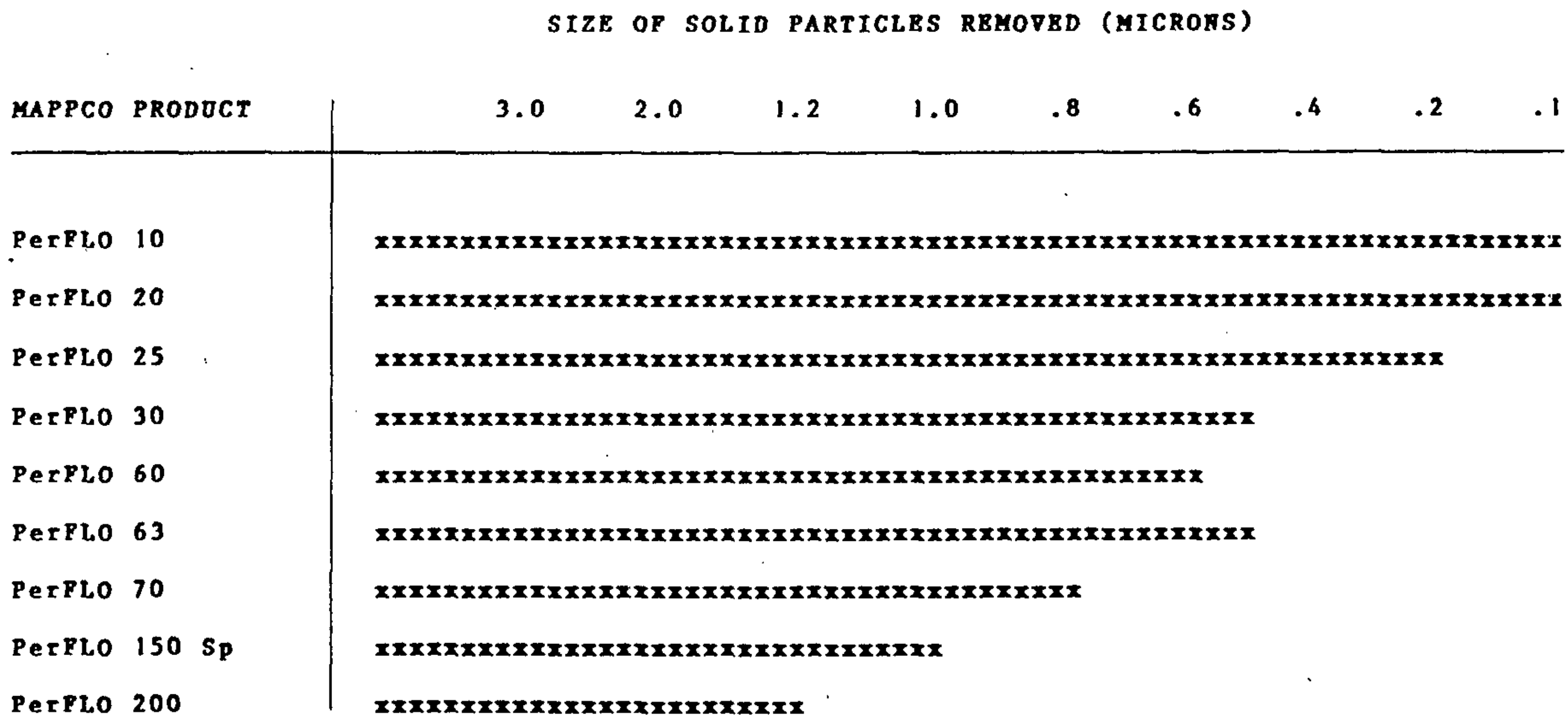
Ventilation			
	Local Exhaust X	Special	
	Mechanical (*General*) At bag dumping stations	Other	

Protective Gloves	Eye Protection
None required	Goggles in windy dump area

Other Protective Clothing or Equipment
Dump material in slurry tranks under negative pressure to reduce dusting.

Work/Hygienic Practices

☆ U.S.G.P.O.: 1986-491-529/45775



Represent average removal percentages.

MAPPCO PERFLO PERLITE FILTERAID DATA
PHYSICAL AND CHEMICAL CHARACTERISTICS

TRADE NAME:	PerFLO 10
PRODUCER:	Mid-Atlantic Perlite Products Co.
SHIPPING POINT:	Harrisburg, PA.
MINERALOGICAL:	Amorphous mineral of volcanic origin, geologically known as Perlite, a fused sodium potassium aluminum silicate.
TYPE:	Expanded, milled, particle classified.
COLOR:	White
SPECIFIC GRAVITY:	2.3
WET APPARENT DENSITY:	18 - 20 Lbs/Cu.Ft.
SCREEN RETENTION:	U.S. STD. 325M 1% (Wet Screening)
pH (10% suspension):	6.5 - 7.5
Ignition Loss*	1 Hr. @ 1200°F 1.27 - 2.20
Ignition Loss*	4 Hr. @ 1700°F 2.10 - 3.25
Median Particle Diameter:	Typical Range 3.4 - 4.4μ

* Combined Water

Ismael Mendoza
Revised September 1986

MAPPCO PERLITE FILTERAID DATA
GENERAL CHARACTERISTICS
(TYPICAL VALUE OR RANGE)

TRADE NAME:	PerFLO 20
PRODUCER:	Mid-Atlantic Perlite Products Co.
SHIPPING POINT:	Harrisburg, PA.
MINERALOGICAL:	Amorphous mineral of volcanic origin, geologically known as Perlite, a fused sodium potassium aluminum silicate.
TYPE:	Expanded, milled, particle classified.
COLOR:	White
SPECIFIC GRAVITY:	2.34
REFRACTIVE INDEX:	1.45
WET APPARENT DENSITY (Lbs/Cu.Ft.):	14 - 16
FLUFFED LOOSE WEIGHT: (Lbs/Cu.Ft.):	5.5 - 6.5
pH (10% slurry)	6.5 - 8.5
FREE MOISTURE (Max.):	0.5%
RETAINED ON U.S. STD. SIEVE N° 325:	5%
GE BRIGHTNESS:	82 - 85

Ismael Mendoza
Revised September 1986

MAPPCO

MID-ATLANTIC PERLITE PRODUCTS CO., LTD. ★ 1500 North Cameron Street ★ Harrisburg, PA 17103

MAPPCO PERLITE FILTERAID DATA
GENERAL CHARACTERISTICS
(TYPICAL VALUE OR RANGE)

TRADE NAME:	PerFLO 30
PRODUCER:	Mid-Atlantic Perlite Products Co.
SHIPPING POINT:	Harrisburg, PA.
MINERALOGICAL:	Amorphous mineral of volcanic origin, geologically known as Perlite, a fused sodium potassium aluminum silicate.
TYPE:	Expanded , milled, particle classified.
COLOR:	White
GE BRIGHTNESS (Typical):	82 - 85
SPECIFIC GRAVITY:	2.34
WET APPARENT DENSITY:	13 - 14 Lbs/Cu.Ft.
FLUFFED LOOSE WEIGHT:	4 - 5 Lbs/Cu.Ft.
FREE MOISTURE, % :	1.0
IGNITION LOSS, % COMBINED WATER:	1.5
RETAINED ON U.S. STD. SIEVE N° 325 (WET SCREENING):	1 - 7%
pH (10% slurry):	7 - 8.5
MEAN PARTICLE DIAMETER IN MICRONS:	5 - 5.5
ODOR:	Imparts no odor, absorbs no odor.

Ismael Mendoza
Revised September 1986

MATERIAL SAFETY DATA SHEET

NORD PERLITE

No.: 1 Rev. 1
Date Prepared: 9/88

I. PRODUCT IDENTIFICATION

Trade Name(s): 734, 634, 443, 332, 272, GS1400, 190, 909, EC216, UC216, UCA350, PF10, PF20, PF30, 30SP, PF60, PF70, 70LF, PF150, 150SP, 150LF, PF200, 200SP, PF300, 101F, 102F

Generic Name: PERLITE
Chemical Name: SODIUM POTASSIUM ALUMINUM SILICATE.

CAS #: 93763-70-3
Formula: Na_2O, K_2O, Al_2O_3, SiO_2

Manufacturer: NORD PERLITE COMPANY
Address: 8150 WASHINGTON VILLAGE DRIVE
City: DAYTON State: OHIO Zip: 45458

Telephone: (513) 433-5782
Emergency: (513) 433-5782

II. PRODUCT INGREDIENTS

INGREDIENT NAME	CAS NUMBER	%	PERMISSIBLE EXPOSURE LIMIT
EXPANDED PERLITE	93763-70-3	100	TLV: 10mg/m^3 Total Dust PEL: 10mg/m^3 Total Dust
This Product Contains Greater Than 0.1% but less than 1.0% Crystalline Silica			*This level is based upon current ACGIH recommendations and proposed OSHA regulations, and is the same for their recommendation for nuisance dust.

III. PHYSICAL DATA

Appearance and Odor: FINE WHITE POWDER, NO ODOR

Boiling Point: NA
Vapor Pressure: NA
Water Solubility (%): NEGLIGIBLE
Vapor Density (air = 1): NA

Evaporation Rate: NA
Specific Gravity (water = 1): 2.3
Melting Point: NA
% Volatile by Volume: NIL

IV. FIRE AND EXPLOSION DATA

Flash Point (method): NONFLAMMABLE
Flammable Limits: NA

NFPA Flammable/Conbustable Liquid Classification: NA
Auto-Ignition Temperature: NA

Extinguishing Media: NA

Unusual Fire or Explosion Hazards: NONE

Special Fire-Fighting Procedures: NONE

V. HEALTH HAZARDS A. Summary Risks

Summary: THIS PRODUCT CONTAINS TRACE LEVELS OF CRYSTALLINE SILICA. IARC HAS CONCLUDED THAT THERE IS "LIMITED CARCINOGENICITY OF CRYSTALLINE SILICA TO HUMANS". HOWEVER, TO NORD'S KNOWLEDGE THERE IS NO CREDIBLE EVIDENCE TO INDICATE THAT THE TRACE AMOUNTS OF CRYSTALLINE SILICA PRESENT IN THIS PRODUCT HAVE A CARCINOGENIC EFFECT. THIS PRODUCT IS CONSIDERED A NUISANCE DUST BY THE ACGIH AND OSHA.

Medical conditions which may be aggravated: PRE-EXISTING UPPER RESPIRATORY AND LUNG DISEASE SUCH AS, BUT NOT LIMITED TO BRONCHITIS, EMPHYSEMA AND ASTHMA.

Target Organ(s): LUNGS

Acute Health Effects: TRANSITORY UPPER RESPIRATORY IRRITANT.

Chronic Health Effects: INHALATION OF HIGH LEVELS OF ANY NUISANCE DUST OVER LONG PERIODS OF TIME MAY AFFECT LUNG CAPACITY.

Primary Entry Route(s): INHALATION.

V. HEALTH HAZARDS B. Signs/Symptoms of Overexposure

Inhalation: RESPIRATORY IRRITATION. IN EXTREME EXPOSURES SOME CONGESTION MAY OCCUR.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NOT HAZARDOUS WHEN INGESTED.

Eyes: TEMPORARY IRRITATION AND INFLAMMATION.

V. HEALTH HAZARDS C. First Aid/Emergency Procedures

Inhalation: REMOVE TO FRESH AIR. DRINK WATER TO CLEAR THROAT AND BLOW NOSE TO EVACUATE DUST.

Skin Contact: NA

Skin Absorption: NA

Ingestion: NA

Eyes: FLUSH EYES WITH COPIOUS AMOUNT OF WATER. IF IRRITATION PERSISTS CONSULT A PHYSICIAN.

VI. REACTIVITY DATA

MATERIAL IS STABLE. HAZARDOUS POLYMERIZATION CANNOT OCCUR.

Chemical Incompatibilities: HYDROFLUORIC ACID.

Conditions to Avoid: NONE IN DESIGNED USE.

Hazardous Decomposition Products: MAY REACT WITH HYDROFLUORIC ACID TO FORM TOXIC SILICON TETRAFLOURIDE GAS.

VII. SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak: VACUUM CLEAN SPILLAGE. IF SWEEPING IS NECESSARY USE A DUST SUPPRESSANT.

Waste Management: DISPOSE OF IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.

VIII. SPECIAL PROTECTION INFORMATION

Goggles: CHEMICAL SAFETY GOGGLES,

Gloves: NOT NORMALLY REQUIRED.

Respirator: OSHA/NIOSH APPROVED RESPIRATOR FOR PROTECTION AGAINST NUISANCE DUST.

Ventilation: LOCAL IF NECESSARY TO MAINTAIN ALLOWABLE PEL OR TLV LEVELS.

Other: NA

Special Considerations for Repair/Maintenance of Contaminated Equipment: INSURE PROPER RESPIRATORY PROTECTION.

IX. SPECIAL PRECAUTIONS

Storage Segregation Hazard Classes: NA

Special Handling/Storage: REPAIR ALL BROKEN BAGS IMMEDIATELY. MAINTAIN GOOD HOUSEKEEPING PRACTICES.

Special Workplace Engineering Controls: NOT NORMALLY REQUIRED.

Other: NA

CALCINED DIATOMACEOUS EARTH FILTER AIDS

vs NORD PERLITE FILTER AIDS

CRYSTALLINE SILICA COMPARISON

The level of crystalline silica found in commercially available filter aids varies greatly with respect to the raw materials used in the manufacturing process, as well as processing methods. To illustrate the dramatic variation in crystalline silica levels found in commercial filter aids, ranges of crystalline silica found in typical Diatomaceous Earth products and in Nord Perlite products are shown below.

Comparative levels of Crystalline Silica Found in Calcined Diatomaceous Earth and Nord Perlite Filteraids:

Typical Filter Aid Type	Crystalline Silica Content
"Straight" Calcined Diatomaceous Earth	10 - 25%
"Flux" Calcined Diatomaceous Earth	25 - 60%
Nord Perlite	Less Than 1.0%

Nord Perlite Company has recently learned the International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence in animals and limited evidence in humans that crystalline silica is a carcinogen. Specifically, IARC's recently published Supplement 7 classifies crystalline silica as a category 2A material - "limited evidence for the *carcinogenicity* of crystalline silica to humans". The Occupational Safety and Health Administration (OSHA) considers crystalline silica to be a pneumoconiosis producing dust.

General Health Considerations

Calcined Diatomaceous Earth Filter Aids:

For use as filter aid material, Diatomaceous earth is heat treated, or calcined, a process which converts up to 25% of the amorphous silica to cristobalite - a form of crystalline silica. If an alkaline fluxing agent such as soda ash is used in calcining, the cristobalite level may reach as high as 60% or more.

Exposure to Diatomaceous Earth can cause pneumoconiosis. Nearly all cases of disabling pneumoconiosis from exposure to Diatomaceous Earth have been associated with cristobalite exposure, and the extent and severity of Diatomaceous Earth pneumoconiosis correlates with the cristobalite content as well as the duration of exposure. In addition to the large cristobalite crystalline silica fraction, Diatomaceous Earth can contain from 3% to 5% quartz crystalline silica.

The current Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) for Diatomaceous Earth are determined by the percentage of the total crystalline silica species present in the material. As a result, the PEL for Diatomaceous Earth can range from $1.0 mg/m^3$ for the straight calcined grades, to less than $0.1 mg/m^3$ for the flux calcined grades. A flux calcined Diatomaceous Earth product for example, containing 60% cristobalite crystalline silica and 3% quartz crystalline silica would require dust control to maintain the Time Weighted Average (TWA) below 0.08mg of respirable dust per cubic meter of air.

Nord Perlite Filter Aids:

Nord Perlite filter aids are produced from natural perlite *from* Nord Perlite's mines in Arizona, which are considered among the world's richest and purest deposits. No Chemicals or fluxing additives are used in the manufacturing process. Nord Perlite is essentially an amorphous mineral consisting of fused sodium potassium aluminum silicate. Nord Perlite contains greater than 0.1% but less than 1.0% crystalline silica.

There are no published medical reports to indicate that exposure to perlite dust, either *to ore* or to the expanded form, has resulted in adverse physiological effects. To Nord's knowledge there is no credible evidence to indicate that the trace amounts of crystalline silica present in Nord Perlite Products have a carcinogenic effect.

Since Nord Perlite products contain less than 1.0% crystalline silica, OSHA currently regulates Nord Perlite as a nuisance dust, and proposes a PEL of $10 mg/m^3$ TWA for total dust. The ACGIH also considers Nord Perlite to be a nuisance dust and recommends a TLV of $10 mg/m^3$ total dust.

MONSANTO PRODUCT NAME

PHOSPHORIC ACID

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

PRODUCT IDENTIFICATION

Synonym(s):	Phos acid; Orthophosphoric acid
Chemical Name:	Phosphoric acid
Chemical Formula:	H_3PO_4
Chemical Family:	Mineral acid
CAS No.:	7664-38-2
TSCA Inventory:	Phosphoric acid appears on the Inventory of Chemical Substances published by the U. S. Environmental Protection Agency (EPA) under authority of the Toxic Substances Control Act (TSCA).
Dot Proper Shipping Name:	Phosphoric Acid
Dot Hazard Class/ I.D. No.:	Corrosive material/UN1805
DOT Label(s):	Corrosive
U.S. Surface Freight Classification:	Phosphoric Acid
Reportable Quantity (RQ) Under U.S. EPA CERCLA Regulations:	5,000 lbs.
Hazardous Chemical(s) Under OSHA Hazard Communication Standard:	The substance listed below is identified as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

Phosphoric acid, CAS Reg. No. 7664-38-2

WARNING STATEMENTS

DANGER!
CAUSES BURNS TO EYES AND SKIN

PRECAUTIONARY MEASURES

Do not get in eyes, on skin, on clothing.
Avoid breathing mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

RECEIVED
1985 NOV 15
ENG. SYST. DEPT.

[illegible]ptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

CORROSIVE TO MILD STEEL

MATERIAL SAFETY DATA

Phosphoric Acid

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES OR ON SKIN, immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

IN CASE OF: SPILL OR LEAK, contain spills and leaks to prevent discharge to the environment.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical safety goggles to prevent eye contact. Have eye baths immediately available where eye contact can occur.

Skin Protection: Wear appropriate impervious gloves and protective clothing to prevent skin contact. Wear face shields and impervious aprons when splashing is likely. Remove contaminated clothing promptly and launder before reuse. Provide safety shower at any location where skin contact can occur. Wash contaminated skin promptly.

Respiratory Protection: Use NIOSH approved equipment with full facepiece when airborne exposure limits are exceeded. Consult respirator manufacturer to determine appropriate type equipment for given application.

Ventilation: Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

Airborne Exposure Limits:

Typical Product Composition: Phosphoric acid in water

OSHA PEL/TWA: 1 mg/m^3
ACGIH TLV®/TWA: 1 mg/m^3
TLV®/STEL: 3 mg/m^3

FIRE PROTECTION INFORMATION

Extinguishing Media: Although phosphoric acid is not combustible, it can react with metals to liberate hydrogen, a flammable gas.

REACTIVITY DATA

Materials To Avoid: Avoid contact with materials such as sulfides and sulfites which could release toxic gases, and be cautious in mixing with strong bases because high heat of reaction can generate steam.

Hazardous Decomposition Products: None.

Hazardous Polymerization: Does not occur.

... SUMMARY

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of phosphoric acid on the health of industrially exposed individuals and to support the Precautionary Statements and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

Human Experience

Dermal contact is expected to be the primary route of occupational exposure to phosphoric acid. Phosphoric acid is considered to be corrosive to the eyes and skin. Phosphoric acid may not produce an immediate burning sensation upon skin contact, delaying the awareness of the worker that contact has occurred. Occupational exposure to this material has not been reported to cause significant adverse health effects when recommended safety precautions are followed.

Toxicological Data

Data from Monsanto studies indicate the following:

	Acute Oral LD_{50} (Rat)	Acute Dermal LD_{50} (Rabbit)	Eye Irritation FHSA 24-hr Rabbit	Skin Irritation FHSA 24-hr Rabbit	Skin Irritation 4-hr DOT Rabbit
Phosphoric acid 75%	4,400 mg/kg, Slightly Toxic	Greater than 3,160 mg/kg, Slightly Toxic	Corrosive	Corrosive	Noncorrosive
Phosphoric acid 80%	4,200 mg/kg, Slightly Toxic	Greater than 3,160 mg/kg, Slightly Toxic	Corrosive	Corrosive	Noncorrosive
Phosphoric acid 85%	3,500 mg/kg, Slightly Toxic	Greater than 1,260 mg/kg, Slightly Toxic	Corrosive	Corrosive	Corrosive

The results of the acute oral and dermal tests indicate that these concentrations of phosphoric acid are slightly toxic by ingestion in single oral doses and by single dermal applications. Following a 24-hour exposure, irreversible eye and skin damage occurred at all tested concentrations of phosphoric acid.

Additional Information

Phosphoric acid has a low vapor pressure at room temperature and is not expected to present a significant inhalation hazard under ambient conditions. Phosphoric acid, however, can be irritating to the respiratory tract if inhaled as a mist or if the material is vaporized.

PHYSICAL DATA

Appearance and Odor:	Clear, colorless, syrupy liquid; no foreign odor		
Vapor Pressure @ 20°C (mm Hg):	0.0285 (100% acid)		
Solubility in Water:	Complete		
	75%	80%	85%
Boiling Point (760 mm Hg):	135°C	144°C	154°C
Freezing Point:	−17.5°C	+4.6°C	+21.1°C
Viscosity @ 25°C (centistokes):	12	17	23
Specific Gravity @ 25°C/15.5°C:	1.575	1.633	1.692
% Equivalent H_3PO_4:	75.1	80.35	85.5
Lbs./gallon @ 25°C:	13.17	13.66	14.15

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

SPILL, LEAK & DISPOSAL INFORMATION

Emergency Spill and Leak Information: Contain spills and leaks to prevent discharge to the environment. Neutralize cautiously with a base such as soda ash.

Phosphoric acid, as currently defined, is a *hazardous substance* under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). If 5,000 pounds or more are released into the environment, it must be reported to the National Response Center (800-424-8802 or 202-426-2675). Since local, state and federal laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

Keep product out of sewers, watersheds and water systems.

Disposal Information: Dispose of in accordance with all applicable federal, state and local regulations.

As currently defined in the federal Resource Conservation and Recovery Act (RCRA), unneutralized phosphoric acid, when discarded, is a *hazardous waste* exhibiting the characteristics of corrosivity (D-002). See 40 CFR 261.22. Its disposal, therefore, is regulated by federal RCRA regulations. Consult your attorney or appropriate regulatory officials for information regarding additional state and local waste disposal requirements.

ADDITIONAL COMMENTS

Store in rubber-lined or 316 stainless steel tanks designed for H_3PO_4. Store drums away from heat and out of direct sunlight.

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

Product Acceptability Coordinator
Detergent Materials
Monsanto Industrial Chemicals Co.
314-694-2096
(A Unit of Monsanto Company)

TLV® is a registered trademark of the American Conference of Governmental Industrial Hygienists (ACGIH).

e/c (10) 9

TEXACO INC.
INDUSTRIAL HYGIENE, TOXICOLOGY, AND MATERIAL SAFETY DATA SHEET

NOTE: NO REPRESENTATION IS MADE AS TO THE ACCURACY OF THE INFORMATION HEREIN. SEE PAGE 7 FOR CONDITIONS UNDER WHICH DATA ARE FURNISHED.

Trade Name and Synonyms
01659 RANDO OIL HD 68

Manufacturer's Name
Texaco Inc.

Emergency Telephone No.
(914) 831-3400 ext. 204

Address
P.O. Box 509 Beacon, NY 12508

Chemical Name and/or Family or Description
Hydraulic Oils

THIS PRODUCT IS CLASSIFIED AS: X NOT HAZARDOUS:

____ HAZARDOUS BY DEFINITION NO.(S) ____ ON ATTACHED EXPLANATION SHEETS

WARNING STATEMENT:
NONE CONSIDERED NECESSARY

OCCUPATIONAL CONTROL PROCEDURES

Protective Equipment (Type)

Eyes: Chemical type goggles or face shield optional.

Skin: Exposed employes should exercise reasonable personal cleanliness; this includes cleansing exposed skin areas several times daily with soap and water, and laundering or dry cleaning soiled work clothing at least weekly.

Inhalation: None required if exposures are within permissible concentrations; see below.

Ventilation: Normal

Permissible Concentrations:

Air: 5 mg/cubic meter of air for mineral oil mist averaged over an 8 hour daily exposure (ACGIH, 1984-85).

EMERGENCY AND FIRST AID PROCEDURES

First Aid

Eyes: As with most foreign materials, should eye contact occur, flush eyes with plenty of water.

Skin: Wash exposed areas with soap and water.

Ingestion: None considered necessary.

Inhalation: None considered necessary.

Other Instructions: None.

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than

PHYSIOLOGICAL EFFECTS:

Code No. 01659

Effects of Exposure

Acute:

Eyes: Believed to be minimally irritating.

Skin: Believed to be slightly irritating with possible redness, edema, or drying of the skin.

Respiratory System: Believed to be minimally irritating if not in excess of permissible concentrations; see page 1.

Chronic: N.D.

Other: -

Sensitization Properties:

Skin: Yes ___ No ___ Unknown X   Respiratory: Yes ___ No ___ Unknown X

Median Lethal Dose (LD_{50} LC_{50})(Species)

Oral: Similar product >22.4 g/kg (rat); practically nontoxic

Inhalation: N.D.

Dermal: Similar product >3.0 g/kg (rabbit); practically nontoxic

Other: N. D.

Irritation Index, Estimation of Irritation (Species)

Skin: Similar product 2.08/8.0 (rabbit); slightly irritating

Eyes: Similar product 9.83/110 (rabbit); no appreciable effect

Symptoms of Exposure: See above.

FIRE PROTECTION INFORMATION

Ignition Temp.°F. N.D.   Flash Point °F. (Method) 425 °F (COC)

Flammable Limits (%) Lower N.D.   Upper N.D.

Products Evolved When Subjected to Heat or Combustion:

Carbon monoxide, carbon dioxide, aldehydes and ketones, combustion products of nitrogen and sulfur.

Recommended Fire Extinguishing Agents And Special Procedures:

According to the National Fire Protection Association Guide, use water spray, dry chemical, foam, or carbon dioxide.
Water or foam may cause frothing. Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for persons attempting to stop the leak.

Unusual or Explosive Hazards:

None.

N.D. - Not Determined   N.A. - Not Applicable

< - Less Than   > - Greater Than

ENVIRONMENTAL PROTECTION

Code No. 01659

Waste Disposal Method:

Under RCRA, it is the responsibility of the user of products to determine, at the time of disposal, whether product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixture, processes, etc. may render the resulting material hazardous. (See Remarks for Waste Classification.)

Procedures in Case of Breakage or Leakage: (Transportation Spills Call CHEMTREC (800) 424-9300)

Contain spill if possible. Wipe up or absorb on suitable material and shovel up.

Remarks:

Waste Classification: Product (as presently constituted) has the RCRA characteristics of barium toxicity and if discarded in its purchased form would have the hazardous waste number D005.

PRECAUTIONS

NONE CONSIDERED NECESSARY

Requirements for Transportation, Handling and Storage:

Minimum feasible handling temperatures should be maintained. Periods of exposure to high temperatures should be minimized. Water contamination should be avoided.

DOT Proper Shipping Name: N.A.

DOT Hazard Class (if applicable): N.A.

CHEMICAL AND PHYSICAL PROPERTIES

Boiling Point (°F) N.D.

Vapor Pressure N.D. (mmHg)

Specific Gravity .8816 (H_2O=1)

Vapor Density N.D. (Air=1)

Appearance and Odor pale liquid

pH of undiluted product N.A.

Solubility N.D.

Percent Volatile by Volume N.D.

Evaporation N.D. ( )=1

Viscosity 64.5 cSt @ 40 °C

Other –

Hazardous Polymerizations ____ Occur X Do not occur

The Material Reacts Violently With: (If others is checked below, see additional comments on page 6 for futher details)

Air	Water	Heat	Strong Oxidizers	Others	None of These
					X

N.D. – Not Determined N.A. – Not Applicable

< – Less Than > – Greater Than

COMPOSITION

Code No. 01659

Chemical/Common Name	CAS No.	Exposure Limit	Range in %
Solvent-dewaxed heavy paraffinic petroleum distillates	64742650	5.0 mg/m3 TWA	95.00 - 99.99

To the best of our knowledge, none of the above listed components is hazardous according to OSHA (1910.1200) or one or more state Right-To-Know lists.

PRODUCT SHIPPING LABEL

Code No. 01659

01659 RANDO OIL HD 68

NONE CONSIDERED NECESSARY

Chemical/Common Name	CAS No.	Exposure Limit	Range in %
Solvent-dewaxed heavy paraffinic petroleum distillates	64742650	5.0 mg/m3 TWA	95.00 - 99.99

To the best of our knowledge, none of the above listed components is hazardous according to OSHA (1910.1200) or one or more state Right-To-Know lists.

HMIS

Health : 1 Reactivity : 0
Flammability: 1 Special : -

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

HEALTH EMERGENCY TELEPHONE: (914) 831-3400 (EXT. 204)

Texaco Inc.
2000 Westchester Avenue
White Plains, New York 10650

For Additional Information Concerning:

Fuels/Lubricants/Antifreezes
call (914) 831-3400 (EXT.204)
Chemicals/Additives
call (409) 722-8381
Transportation Spills
call CHEMTREC (800) 424-9300

ADDITIONAL COMMENTS

Code No 01652

TEXACO INTENDS TO COMPLY FULLY WITH PROVISIONS OF THE TOXIC SUBSTANCES CONTROL ACT
STATE OF MICHIGAN CRITICAL MATERIALS ACT (REVISED 1985)
0.038% zinc; conversion factor 7.3 pounds per gallon

To determine applicability or effect of any law or regulation with respect to the product, users should consult his legal advisor or the appropriate government agency. Texaco does not undertake to furnish advice on such matters.

By R. T. Richards Title Mgr. Env. Conservation & Toxicology

Date 11-20-85 ☐ New ☒ Revised. Supersedes 10-16-85

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than

NOTE: THIS DATA IS FURNISHED GRATUITOUSLY INDEPENDENT OF ANY SALE OF THE PRODUCT. ONLY FOR YOUR INVESTIGATION AND INDEPENDENT VERIFICATION. WHILE THE INFORMATION IS BELIEVED TO BE CORRECT, TEXACO INC. MAKES NO REPRESENTATION AS TO THE ACCURACY OF THE INFORMATION CONTAINED HEREIN. TEXACO INC. SHALL IN NO EVENT BE RESPONSIBLE FOR ANY DAMAGES OF WHATSOEVER NATURE DIRECTLY OR INDIRECTLY RESULTING FROM THE PUBLICATION OR USE OF OR RELIANCE UPON DATA CONTAINED HEREIN. NO WARRANTY, EITHER EXPRESS OR IMPLIED OF MERCHANTABILITY OR FITNESS OF ANY NATURE WITH RESPECT TO THE PRODUCT OR TO THE DATA HEREIN IS MADE HEREUNDER. DATA SHEETS ARE AVAILABLE FOR ALL TEXACO PRODUCTS. *YOU ARE URGED TO OBTAIN DATA SHEETS FOR* ALL TEXACO PRODUCTS YOU BUY, PROCESS, USE, OR DISTRIBUTE, AND ENCOURAGED TO ADVISE ANYONE WORKING WITH OR EXPOSED TO SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

EXPLANATION OF THE INDUSTRIAL HYGIENE, TOXICOLOGY, AND MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name and Synonyms

Refer to the code number and name under which the product is marketed and the common commercial name of the product.

Manufacturer's Name and Address Self explanatory.

Chemical Name and/or Family or Description

Refer to chemical, generic, or descriptive name of single elements and compounds.

For purposes of this form, a product is defined as hazardous if it possesses one or more of the following charateristics: (1) has a flash-point below 200 degrees Farenheit, closed cup or subject to spontaneous heating; (2) has a threshold limit value below 500 ppm gases and vapor below 5 mg/m^3 for dust, fumes and mist, and below 25 MPPCF for mineral dust; (3) a single dose oral LD50 below 500 mg/kg; (4) causes burns to the skin in the short-term exposure or is systemically toxic by skin contact; (5) has been demonstrated to be a skin or eye irritant or causes respiratory irritation; (6) may cause skin or respiratory sensitization; (7) has teratogenic, mutagenic or other toxic effects; (8) may cause asphyxia or pneumoconiosis; (9) in the course of normal operations may produce dusts, gases, fumes, vapor, mist, or smoke which have one or more of the above characteristics; (10) contains a component which may be carcinogenic according to NTP (National Toxicology Program), IARC (International Agency for Research on Cancer), OSHA (Occupational Safety and Health Administration), EPA (Environmental Protection Agency) and/or NCI (National Cancer Institute.); (11) has a median LC50 in air of 200 ppm or less by volume of gas or vapor, or 20 mg/l or less of mist, fume or dust when administered by inhalation.

OCCUPATIONAL CONTROL PROCEDURES

(Consult your Industrial Hygienist or Occupational Health Specialist.)

Protective Equipment

Type of protective equiment that is necessary for the safe handling and use of this product.

Ventilation

Normal means adequate to maintain permissible concentrations.
Ventilation: type, i.e. local exhaust, mechanical, etc.

Permissible Concentrations

Indicates Threshold Limit Value (TLV) and/or Time Weighted Average (TWA) as established by the American Conference of Govermental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

EMERGENCY AND FIRST AID PROCEDURES

Administer first aid and emergency procedures in case of eye and/or skin contact, ingestion and inhalation.

PHYSIOLOGICAL EFFECTS

Acute Exposures (Eye, Skin, Respiratory System)

Refers to the most common effects that would be expected to occur from direct contact with the product.

Chronic

Refers to the *effects that are most likely to occur* from repeated or prolonged exposure.

Sensitizer

Means a substance which will cause on or in normal living tissue, through an allergic or photodynamic process, a hypersensitivity which becomes evident on reapplication of, or exposure to, the same substance.

Median Lethal Dose or Concentration (LD50,LC50)

Refers to that dose or concentration of the material which will produce death in 50 per cent of the animals. For inhalation, exposure time is indicated.

Irritation Index

Refers to an empirical score (Draize Method) for eye and skin irritation which tested by the method described. if numbers are not available, a yes or no answer indicates whether or not the material is an irritant.

FIRE PROTECTION INFORMATION

Ignition Temperature

Refers to the temperature in degrees Farenheit, at which a liquid will give off enough flammable vapor to ignite and burn continuously for 5 seconds.

Flash Point (State Method used)

Refers to the temperature in degrees Farenheit, at which a liquid will give off enough flammable vapor to ignite.

Flammable Limits

Refers to the range of gas or vapor concentration (percent by volume in air) which will burn or explode if an ignition source is present. Lower means the the lower flammable limit and upper means the upper flammable limit given in percent.

Products Evolved When Subjected to Heat or Combustion.

The products evolved when this material is subjected to heat or combustion. Includes temperature at which oxidation or other forms of degradation occurs.

Recommended Fire Extinguishing Agents and Special Procedures

Specifies the fire fighting agents that should be used to extinguish fires. If unusual fire hazards are involved or special procedures indicated, this is specified.

Unsusual Fire or Explosive Hazards

Specifies hazards to personnel in case of fire, explosive danger.

ENVIRONMENTAL PROTECTION

Specifies how this product can be successfully disposed of.

Indicates precautions necessary in the event that leakage or breakage occurs. Included are (a) clean-up procedures, (b) personal protective equipment if necessary, (c) hazards that may be created, i.e. fire, explosion, etc.

PRECAUTIONARY LABEL

Label that is required or recommended.

Requirements for Transportation, Handling and Storage

Specifies handling and storage procedures. Gives ICC, DOT, or other regulations related to safety and health for transportation.

CHEMICAL AND PHYSICAL PROPERTIES

Boiling Point (or Range)

In degrees Farenheit or Celsius Boiling Point at 760 mmHg.

Vapor Pressure

Pressure exerted when a solid or liquid is in equilibrium with its own vapor.

Specific Gravity

The ratio of the density of the product to the density of water.

Vapor Density

The ratio of the density of the vapor at saturation concentration (20 degrees Celsius or 68 degrees Farenheit) to the density of air at 760 mmHg.

Appearance and Odor

Refers to the general characterization of the material, e.g. powder, colorless liquid, aromatic odor, etc.

pH

Refers to the degree of acidity or basicity of the material in a specific concentration.

pH1-5 - STRONGLY ACIDIC
pH5-7 - WEAKLY ACIDIC
pH7-9 - WEAKLY BASIC
pH9-14 - STRONGLY BASIC

Solubility

Refers to the solubility of a material by weight in water at room temperature. The term negligible, less than 0.1 %; slight, 0.1 to 1%; moderate, 1 to 10%; appreciable, 10% or greater. Gives solubility in organic solvents where appropriate.

Percent Volatile By Volume

Refers to the amount volatized at 20 degrees Celsius or 68 degrees Farenheit when allowed to evaporate.

Evaporation

Gives the rate of evaporation compared to a standard

Viscosity

Measure of flow characteristics in Kinematic viscosity in Centistokes.

Hazardous Polymerization

Hazardous polymerization is that reaction which takes place at a rate which produces large amounts of energy. Indicates whether it may or may not occur and under what storage conditions.

Does the Material React Violently

Indicates whether the material will react violently, releasing large amounts of energy when exposed under conditions listed.

Composition

Components of the product as manufactured.

Texaco Inc.
2000 Westchester Avenue
White Plains, New York 10650
Phone (914) 831-3400 (Beacon)

1, 2, 3, 4, 6
7, 6, 3, 12
5, 14,

SODIUM HYDROXIDE
SODIUM HYDROXIDE
SODIUM HYDROXIDE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC CHEMICAL DIVISION 1 REAGENT LANE FAIR LAWN NJ 07410 (201) 796-7100	EMERGENCY CONTACTS GASTON L. PILLORI (201) 796-7100	DATE: 02/18/86 PO NBR: N/A ACCT: 220066-03 INDEX: N/A CAT NO: S318100

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 1310-73-2

SUBSTANCE: **SODIUM HYDROXIDE**

TRADE NAMES/SYNONYMS: CAUSTIC SODA; SODA LYE; LYE; WHITE CAUSTIC; CAUSTIC ALKALI; CAUSTIC SODA, BEAD; CAUSTIC SODA, DRY; CAUSTIC SODA, FLAKE; CAUSTIC SODA, GRANULAR; CAUSTIC SODA, SOLID; SODIUM HYDRATE; SODIUM HYDROXIDE, BEAD; SODIUM HYDROXIDE, FLAKE; SODIUM HYDROXIDE, DRY; SODIUM HYDROXIDE, SOLID; S-613 ASCARITE; S-318; S-320; S-612

CHEMICAL FAMILY:
INORGANIC BASE

MOLECULAR FORMULA: NA-O-H MOL WT: 40.00

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=1 PERSISTENCE=0

COMPONENTS AND CONTAMINANTS

PERCENT: 97 COMPONENT: SODIUM HYDROXIDE

PERCENT: 0.50 COMPONENT: SODIUM CARBONATE

PERCENT: .008 COMPONENT: SODIUM CHLORIDE

PERCENT: <0.1 COMPONENT: SODIUM SULFATE

PERCENT: 0.1 COMPONENT: POTASSIUM, CALCIUM, AND MAGNESIUM

OTHER CONTAMINANTS: SILICON DIOXIDE (0.03%) AND OTHER METALS (0.01%).

EXPOSURE LIMITS:
2 MG/M3 OSHA TWA; 2 MG/M3 ACGIH CEILING; 2 MG/M3 NIOSH RECOMMENDED 15 MINUTE CEILING.

PHYSICAL DATA

DESCRIPTION: ODORLESS, WHITE OR OFF-WHITE HYGROSCOPIC SOLID.

BOILING POINT: 2534 F (1390 C)   MELTING POINT: 605 F (318 C)

SPECIFIC GRAVITY: 2.1   VAPOR PRESSURE: 42 MMHG @ 1000 C

PH: 14 FOR A 5% AQ SOLN   SOLUBILITY IN WATER: 42%

SOLVENT SOLUBILITY: ALCOHOL, GLYCEROL.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE AND EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: NON-FLAMMABLE

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE FLOODING QUANTITIES OF WATER.

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

TOXICITY

1%/24 HOURS EYE-MONKEY SEVERE IRRITATION; 50 MG/24 HOURS SKIN-RABBIT SEVERE IRRITATION; 1% EYE-RABBIT SEVERE IRRITATION; 50 UG/24 HOURS EYE-RABBIT SEVERE IRRITATION; 1 MG/24 HOURS EYE-RABBIT SEVERE IRRITATION;
CARCINOGEN STATUS: NONE.
SODIUM HYDROXIDE IS AN EYE AND MUCOUS MEMBRANE IRRITANT AND SEVERE SKIN IRRITANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:
CORROSIVE. 200 MG/M3 IS IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.
ACUTE EXPOSURE- THE EFFECTS OF THE DUST OR MIST WILL VARY FROM MILD IRRITATION OF THE NOSE @ 2 MG/M3 TO SEVERE PNEUMONITIS DEPENDING ON THE SEVERITY OF EXPOSURE. LOW CONCENTRATIONS MAY CAUSE SORE THROAT, COUGHING, AND LABORED BREATHING. INTENSE EXPOSURES MAY RESULT IN DELAYED PULMONARY EDEMA.

CHRONIC EXPOSURE- PROLONGED EXPOSURE MAY CAUSE BRONCHIAL IRRITATION, COUGHING, BRONCHIAL PNEUMONIA, AND GASTROINTESTINAL DISTURBANCES.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING

HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. KEEP AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION AS SOON AS POSSIBLE.

SKIN CONTACT:
CORROSIVE.

ACUTE EXPOSURE- ON THE SKIN, SOLUTIONS OF 25 TO 50% MAY CAUSE THE SENSATION OF IRRITATION WITHIN ABOUT 3 MINUTES. WITH SOLUTIONS OF 4% THIS DOES NOT OCCUR UNTIL AFTER SEVERAL HOURS. IF NOT REMOVED FROM THE SKIN, SEVERE BURNS WITH DEEP ULCERATION MAY OCCUR. EXPOSURE TO THE DUST OR MIST MAY CAUSE MULTIPLE SMALL BURNS AND TEMPORARY LOSS OF HAIR.

CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING WHILE RUNNING STREAMS OF WATER UNDER CLOTHING. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER (APPROXIMATELY 15-20 MINUTES) UNTIL NO EVIDENCE OF CHEMICAL REMAINS. FOR CHEMICAL BURNS, APPLY STERILE BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION.

EYE CONTACT:
CORROSIVE.

ACUTE EXPOSURE- CONTACT MAY CAUSE DISINTEGRATION AND SLOUGHING OF CONJUNCTIVAL AND CORNEAL EPITHELIUM, CORNEAL OPACIFICATION, MARKED EDEMA AND ULCERATION; AFTER 7 TO 13 DAYS EITHER GRADUAL RECOVERY BEGINS OR THERE IS PROGRESSION OF ULCERATION AND CORNEAL OPACIFICATION. COMPLICATIONS OF SEVERE EYE BURNS ARE SYMBLEPHARON WITH OVERGROWTH OF THE CORNEA BY A VASCULARIZED MEMBRANE, PROGRESSIVE OR RECURRENT CORNEAL ULCERATION AND PERMANENT CORNEAL OPACIFICATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED VAPOR CONTACT AT LOW LEVELS OF EXPOSURE MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

INGESTION:
CORROSIVE.

ACUTE EXPOSURE- SEVERE ABDOMINAL PAIN, CORROSION OF THE LIPS, MOUTH, TONGUE, AND PHARYNX, AND VOMITING OF LARGE PIECES OF MUCOSA. ASPHYXIA CAN OCCUR FROM SWELLING OF THE THROAT. PERFORATION OF THE ESOPHAGUS AND STOMACH CAN OCCUR. CASES OF SQUAMOUS CELL CARCINOMA OF THE ESOPHAGUS HAVE OCCURRED WITH LATENT PERIODS OF 12 TO 42 YEARS AFTER INGESTION; A RESULT TISSUE DESTRUCTION AND POSSIBLY SCAR FORMATION RATHER THAN THE RESULT OF DIRECT CARCINOGENIC ACTION.

FIRST AID- IF VICTIM IS CONSCIOUS, GIVE HIM LARGE QUANTITIES OF WATER IMMEDIATELY TO DILUTE THE ALKALI. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
THE SUBSTANCE IS A STRONG BASE. IT REACTS EXOTHERMICALLY WITH WATER RELEASING CORROSIVE FUMES OF SODIUM HYDROXIDE.

INCOMPATIBILITIES:

ACETALDEHYDE: RESULTS IN VIOLENT POLYMERIZATION OF ACETALDEHYDE.
ACETIC ACID: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE
ACETIC ANHYDRIDE: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
ACROLEIN: RESULTS IN AN EXTREMELY VIOLENT POLYMERIZATION OF ACROLEIN.
ACRYLONITRILE: VIOLENT POLYMERIZATION.
ALLYL ALCOHOL: AS A BENZENE EXTRACT OF ALLYL BENZENESULFONATE WAS PREPARED FROM ALLYL ALCOHOL AND BENZENE SULFONYL CHLORIDE IN THE PRESENCE OF AQUEOUS SODIUM HYDROXIDE, UNDER VACUM DISTILLATION TWO FRACTIONS CAME OFF, THEN THE TEMPERATURE ROSE TO 135 C, WHEN THE RESIDUE DARKENED AND EXPLODED.
ALLYL CHLORIDE: IN CONTACT WITH DRY CAUSTIC SODA BEADS, HYDROLYSIS MAY TAKE PLACE PRODUCING ALLYL ALCOHOL.
ALUMINUM: VIGOROUS REACTION WITH THE EVOLUTION OF FLAMMABLE HYDROGEN GAS.
CHLORINE TRIFLUORIDE: VIOLENT REACTION.
CHLOROFORM AND METHYL ALCOHOL: EXOTHERMIC REACTION.
CHLOROHYDRIN: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
CHLORONITROTOLUENES: POSSIBLE EXPLOSION.
CHLOROSULFONIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
1,2-DICHLOROETHYLENE: MAY FORM SPONTANEOUSLY FLAMMABLE MONOCHLOROACETYLENE.
ETHYLENE CYANOHYDRIN: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
GLYOXAL: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
HALOGENATED HYDROCARBONS: VIOLENT REACTION.
HYDROCHLORIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
HYDROFLUORIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
HYDROQUINONE: RAPID DECOMPOSITION OF HYDROQUINONE WITH EVOLUTION OF HEAT.
MALEIC ANHYDRIDE: EXPLOSIVE DECOMPOSITION.
METALS: CORRODES METALS, REACTING TO FORM FLAMMABLE HYDROGEN GAS.
NITRIC ACID: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE
NITROETHANE: FORMS AN EXPLOSIVE SALT.
NITROMETHANE: FORMS AN EXPLOSIVE SALT.
NITROPARAFFINS: THE NITROPARAFFINS, IN THE PRESENCE OF WATER, FORM DRY SALTS WITH ORGANIC BASES. THE DRY SALTS ARE EXPLOSIVE.
NITROPROPANE: FORMS AN EXPLOSIVE SALT.
OLEUM: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
PENTOL (3-METHYL-2-PENTEN-4-YN-1-OL): POSSIBLE EXPLOSION.
PHOSPHORUS: PHOSPHORUS BOILED WITH ALKALINE HYDROXIDES YIELDS MIXED PHOS PHINES WHICH MAY IGNITE SPONTANEOUSLY IN AIR.
PHOSPHORUS PENTOXIDE: EXTREMELY VIOLENT REACTION WHEN INITIATED BY LOCAL HEATING.
B-PROPIOLACTONE: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERA TURE AND PRESSURE.
SULFURIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERAURE AND PRESSURE.
TETRACHLOROBENZENE AND METHYL ALCOHOL: POSSIBLE EXPLOSION.
TETRAHYDROFURAN: SERIOUS EXPLOSIONS CAN OCCUR.
TRICHLOROETHYLENE: FORMATION OF EXPLOSIVE MIXTURES OF DICHLOROACETYLENE.
WATER: CAUSTIC SODA BEADS IN CONTACT WITH WATER MAY GENERATE ENOUGH HEAT TO IGNITE ADJACENT COMBUSTIBLES.

DECOMPOSITION:
MAY RELEASE TOXIC FUMES OF SODIUM OXIDE, WHICH CAN REACT WITH WATER OR STEAM TO PRODUCE HEAT AND FLAMMABLE HYDROGEN VAFORS.

POLYMERIZATION:
NOT KNOWN TO OCCUR.

****

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN TANKS AND HOPPER CARS. MAY IGNITE COMBUSTIBLES (WOOD, PAPER, OIL, ETC.).

****

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

USE PROTECTIVE COVER SUCH AS A PLASTIC SHEET TO PREVENT MATERIAL FROM DISSOLVING IN FIRE EXTINGUISHING WATER OR RAIN.

WATER SPILL:
ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

OCCUPATIONAL SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER. MOVE CONTAINERS FROM SPILL AREA. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:

100 MG/M3- HIGH-EFFICIENCY PARTICULATE RESPIRATOR WITH A FULL FACEPIECE.
SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

200 MG/M3- POWERED AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER AND A FULL FACEPIECE.
TYPE C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET, OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

ESCAPE- DUST MASK, EXCEPT SINGLE-USE AND QUARTER-MASK RESPIRATORS.
SELF-CONTAINED BREATHING APPARATUS.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 01/21/85 REVISION DATE: 05/01/85

-ADDITIONAL INFORMATION-
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2,3,7,1,8,9

Olin

EMERGENCY PHONE (203) 356-2345
Olin Corporation, 120 Long Ridge Road
Stamford, Conn. 06904

FLAMMABILITY 0 REACTIVITY 0 HEALTH 0 HAZARD RATING SPECIAL OXY

MATERIAL SAFETY DATA

SECTION I — IDENTIFICATION

CHEMICAL NAME & SYNONYMS
Sodium Nitrate

CHEMICAL FAMILY

FORMULA $NaNO_3$

TRADE NAME
Sodium Nitrate

DESCRIPTION
White-yellow solid

CAS NO.
7631-99-4

SECTION II — NORMAL HANDLING PROCEDURES

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Do not get in eyes, on skin or on clothing. Do not take internally. Avoid breathing dust. Use only with adequate ventilation. Protect against physical damage. Store in a cool, dry place. Separate from combustibles, organic or other readily oxidizable materials. Avoid storage on wood floors. Immediately remove and dispose of any spilled material.

CORROSIVE ACTION ON MATERIALS (Metals, Plastic, Rubber, Etc.)

PROTECTIVE EQUIPMENT
Eyes Goggles
Gloves Impervious
Other Coveralls and impervious boots

VENTILATION REQUIREMENTS
Local exhaust or general ventilation required as dictated by airborne concentrations.

SECTION III — HAZARDOUS INGREDIENTS

BASIC MATERIAL	APPROX. %	OSHA PEL	LD 50	LC 50	SIGNIFICANT EFFECTS

SECTION IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT METHOD	OSHA CLASSIFICATION	FLAMMABLE EXPLOSIVE LIMITS	LOWER	UPPER
	Class 1 Oxidizer			

EXTINGUISHING MEDIA Flood with water in early stages. Nitrate may fuse or melt in large fires and water may result in scattering of molten material. Water should not be applied to molten salt baths.

SPECIAL FIRE HAZARD & FIRE FIGHTING PROCEDURES Use NIOSH/MSHA approved self-contained breathing apparatus where this material is involved in a fire.

SECTION V — HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
None established.

SYMPTOMS OF OVER EXPOSURE Dizziness, abdominal cramps, vomiting, headache, mental impairment, cyanosis. May cause eye, skin and mucous membrane irritation.

EMERGENCY FIRST-AID PROCEDURES

SKIN Flush thoroughly with water.

EYES Flush with water for 15 minutes, call a physician.

INGESTION Drink water, induce vomiting by sticking finger down throat, call a physician.

INHALATION Remove victim to fresh air, call a physician.

CHEMICAL NAME Sodium Nitrate

SECTION VI – TOXICOLOGY (Product)

ACUTE ORAL LD 50	4.3 g/kg (rats)	CARCINOGENIC	Not known to be carcinogenic.
		MUTAGENIC	Mutagenic in laboratory studies.
ACUTE DERMAL LD 50	Not determined	EYE IRRITATION	May be an irritant
		PRIMARY SKIN IRRITATION	May be an irritant
ACUTE INHALATION LC 50	Not determined		

PRINCIPAL ROUTES OF ABSORPTION
Oral, inhalation

EFFECTS OF ACUTE EXPOSURE Dizziness, abdominal cramps, vomiting, headache, mental impairment, cyanosis. May cause eye, skin and mucous membrane irritation.

EFFECTS OF CHRONIC EXPOSURE
None expected at industrial use levels.

SECTION VII – SPILL OR LEAKAGE PROCEDURES (Control Procedures)

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Remove all sources of ignition. Wear NIOSH/MSHA approved dust respirator. Follow OSHA regulations for respirator use. (See 29 CFR 1910.134). Wear goggles, coveralls, impervious gloves and boots. Clean up in a manner to minimize contamination with organic material. Do not return material to original container. Place in a fresh container and isolate outside or in a well ventilated area. Do not seal the container. Flush any residual material with water. Wash all contaminated clothing before reuse. In the event of a large spill use the emergency telephone number shown on the front of this sheet.

WASTE DISPOSAL METHOD

Dispose of contaminated product and materials used in cleaning up spills or leaks in a manner approved for this material. Consult appropriate federal, state and local regulatory agencies to ascertain proper disposal procedures.

SECTION VIII – REACTIVITY DATA

STABLE	UNSTABLE AT ____ °C ____ °F	HAZARDOUS POLYMERIZATION	MAY OCCUR
			WILL NOT OCCUR

CONDITIONS TO AVOID

INCOMPATABILITY (Materials To Avoid) Organic materials, cyanides, reducing materials.

HAZARDOUS DECOMPOSITION PRODUCTS Oxides of Nitrogen

SECTION IX – PHYSICAL DATA

MELTING POINT	306 °C	VAPOR PRESSURE		VOLATILES	
BOILING POINT		SOLUBILITY IN WATER	Soluble	EVAPORATION RATE	
SPECIFIC GRAVITY ($H_2O = 1$)	2.26	pH		VAPOR DENSITY (Air = 1)	

INFORMATION FURNISHED BY: A. L. Gaudreau DATE August 1, 1980 (Revision 2, May 30, 1984)

Department of Environmental Hygiene and Toxicology
Olin CORPORATION

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

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MATERIAL SAFETY DATA SHEET

November 6, 1985

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME James River Corporation - Berlin-Gorham Group	EMERGENCY TELEPHONE NO. (603) 752-4600
ADDRESS (Number, Street, City, State, and ZIP Code) 650 Main Street, Berlin, NH 03570	(213) 517-0765
CHEMICAL NAME AND SYNONYMS Cellulose	TRADE NAME AND SYNONYMS Solka-Floc BW-40
CHEMICAL FAMILY Carbohydrate	FORMULA $C_6H_{10}O_5$ n

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS		%	TLV (Units)	ALLOYS AND METALLIC COATINGS		%	TLV (Units)
PIGMENTS	NONE			BASE METAL	NONE		
CATALYST	NONE			ALLOYS	NONE		
VEHICLE	NONE			METALLIC COATINGS	NONE		
SOLVENTS	NONE			FILLER METAL PLUS COATING OR CORE FLUX	NONE		
ADDITIVES	NONE			OTHERS	NONE		
OTHERS	NONE						

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Do not mix with powerful oxidizing agents such as perchloric acid.		
Cellulose - CAS No. 9004-34-6		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	Chars	SPECIFIC GRAVITY (H_2O=1)	1.55
VAPOR PRESSURE (mm Hg.)	Non-Vol.	PERCENT, VOLATILE BY VOLUME (%)	5 - 7
VAPOR DENSITY (AIR=1)	Non-Vol.	EVAPORATION RATE (Water =1)	1
SOLUBILITY IN WATER	Ca. 1%		

APPEARANCE AND ODOR White fibrous powder; slight, characteristic odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) Non-volatile	FLAMMABLE LIMITS non-explosive	Lel	Uel

EXTINGUISHING MEDIA
Water, carbon dioxide

SPECIAL FIRE FIGHTING PROCEDURES
None. Burning properties similar to those of paper.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Dust explosions are possible if material and air are mixed in definite proportions and ignited.

(Continued on reverse side)

Form OSHA-20
Rev. May 72

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE TLV - 5 Mg/M^3 and pharmaceuticals. No health hazard, only white grades accepted for use in human foods as an inert, bulking agent or filteraid.

EFFECTS OF OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (*Materials to avoid*)
Powerful oxidizing agents such as perchloric acid.

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Sweep us bulk of material and vacuum the remainder.

WASTE DISPOSAL METHOD
Land-fill; materila is bio-degradable.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (*Specify type*)
Dust mask (simple) for non-hazardous substances.

VENTILATION	LOCAL EXHAUST Exhaust Fan	SPECIAL
	MECHANICAL (*General*)	OTHER

PROTECTIVE GLOVES Not required	EYE PROTECTION Normally not needed

OTHER PROTECTIVE EQUIPMENT
Not required.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Store in dry location where temperature is moderate (not over 150°F)

OTHER PRECAUTIONS
None

SULFURIC ACID
SULFURIC ACID
SULFURIC ACID

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC CHEMICAL DIVISION 1 REAGENT LANE FAIR LAWN NJ 07410 (201) 796-7100	EMERGENCY CONTACTS GASTON L. PILLORI (201) 796-7100	DATE: 12/22/85 PO NBR: N/A ACCT: 220066-01 INDEX: 15-8535-30347 CAT NO: A300C212

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 7664-93-9

SUBSTANCE: **SULFURIC ACID**

TRADE NAMES/SYNONYMS: OIL OF VITRIOL; BOV; DIPPING ACID; VITRIOL BROWN OIL; HYDROGEN SULFATE; NORDHAUSEN ACID; A-300; A-300C; A-300-SI; A-300S; A-298; SO-A-172; SO-A-174

CHEMICAL FAMILY:
INORGANIC ACID

MOLECULAR FORMULA: H2-S-O4 MOL WT: 98.07

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=2 PERSISTENCE=0

COMPONENTS AND CONTAMINANTS

PERCENT: 98 COMPONENT: SULFURIC ACID

PERCENT: 2 COMPONENT: WATER

OTHER CONTAMINANTS: NONE.

EXPOSURE LIMITS:
1 MG/M3 OSHA TWA; 1 MG/M3 ACGIH TWA;
1 MG/M3 NIOSH RECOMMENDED TWA

PHYSICAL DATA

DESCRIPTION: COLORLESS TO DARK BROWN OILY LIQUID

BOILING POINT: 536 F (280 C) MELTING POINT: 37 F (3 C)

SPECIFIC GRAVITY: 1.8 VAPOR PRESSURE: 0.001 @ 20 C

SOLUBILITY IN WATER: SOLUBLE SOLVENT SOLUBILITY: DECOMPOSES IN ALCOHOL

ODOR THRESHOLD: 1 MG/M3 VAPOR DENSITY: 3.4

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE AND EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: NON-FLAMMABLE

FIREFIGHTING MEDIA:
DRY CHEMICAL OR CARBON DIOXIDE
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, FLOOD AREA WITH WATER FROM A DISTANCE
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

EXTINGUISH USING AGENTS INDICATED; DO NOT USE WATER DIRECTLY ON MATERIAL. IF LARGE AMOUNTS OF COMBUSTIBLE MATERIALS ARE INVOLVED, USE WATER SPRAY OR FOG IN FLOODING AMOUNTS. USE WATER SPRAY TO ABSORB CORROSIVE VAPORS. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS; KEEP UPWIND (BUREAU OF EXPLOSIVES, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

135 MG/KG UNKNOWN-MAN LDLO; 2140 MG/KG ORAL-RAT LD50; 18 MG/M3/8 HOURS INHALATION-GUINEA PIG LC50; CARCINOGEN STATUS: NONE.
SULFURIC ACID IS A SEVERE EYE, PULMONARY, AND SKIN IRRITANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:
CORROSIVE/TOXIC. 80 MG/M3 IS IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.
ACUTE EXPOSURE- EXPOSURE TO CONCENTRATIONS CONTAINING 5 MG/M3 MAY CAUSE NOSE AND THROAT IRRITATION, HEADACHE, COUGH, AN INCREASE IN RESPIRATORY RATE OR IMPAIRMENT OF VENTILATORY CAPACITY. DELAYED SYMPTOMS MAY INCLUDE INCLUDE PULMONARY EDEMA, TIGHTNESS IN THE CHEST, CYANOSIS, HYPOTENSION, BRONCHITIS, OR EMPHYSEMA.

CHRONIC EXPOSURE- REPEATED EXPOSURE TO THE MIST CAUSES CHRONIC TRACHEO-BRONCHITIS, EROSION AND DISCOLORATION OF THE TEETH, BRONCHIAL PNEUMONIA, OR GASTROINTESTINAL DISTURBANCES.

SKIN CONTACT:
CORROSIVE.
ACUTE EXPOSURE- CONTACT MAY CAUSE SEVERE IRRITATION AND PAIN, BURNS, AND VESICULATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO THE LIQUID OR MIST MAY CAUSE IRRITATION AND DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS, (APPROXIMATELY 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER THE AREAS WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION.

EYE CONTACT:
CORROSIVE.
ACUTE EXPOSURE- DIRECT CONTACT WITH THE CONCENTRATED ACID SOLUTION MAY CAUSE SEVERE DAMAGE, OFTEN LEADING TO BLINDNESS. DILUTE SOLUTIONS PRODUCE MORE TRANSIENT EFFECTS FROM WHICH RECOVERY MAY BE COMPLETE. EXPOSURE TO THE MIST CAUSES EYE IRRITATION AND LACRIMATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS, AND LACRIMATION.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IN CASE OF BURNS, APPLY STERILE BANDAGES LOOSELY WITHOUT MEDICATION. GET MEDICAL ATTENTION.

INGESTION:
CORROSIVE.
ACUTE EXPOSURE- SEVERE BURNING PAIN IN THE MOUTH, THROAT, AND ABDOMEN FOLLOWED BY VOMITING AND DIARRHEA OF DARK, PRECIPITAED BLOOD. ASPHYXIA MAY OCCUR FROM SWELLING OF THE THROAT. PERFORATION OF THE ESOPHAGUS AND STOMACH MAY OCCUR.

FIRST AID- IF VICTIM IS CONSCIOUS, GIVE LARGE QUANTITIES OF WATER IMMEDIATELY TO DILUTE THE ACID. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
VIOLENT EXOTHERMIC REACTION WITH WATER AND ORGANIC MATERIALS. MAY IGNITE FINELY DIVIDED COMBUSTIBLE MATERIALS ON CONTACT.

INCOMPATIBILITIES:
ACETIC ANHYDRIDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ACETONE CYANHYDRIN: POSSIBLE EXPLOSION.
ACETONE AND NITRIC ACID: ACETONE WILL DECOMPOSE VIOLENTLY WHEN BROUGHT IN CONTACT WITH MIXED SULFURIC-NITRIC ACIDS.
ACETONE AND POTASSIUM DICHROMATE: IGNITION.
ACETONITRILE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ACROLEIN: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ACRYLONITRILE: VIGOROUS EXOTHERMIC REACTION.
ALCOHOLS AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
ALLYL ALCOHOL: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.

ALLYL CHLORIDE: ALLYL CHLORIDE MAY VIOLENTLY POLYMERIZE.
2-AMINOETHANOL: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
AMMONIUM HYDROXIDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
AMMONIUM TRIPERCHROMATE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ANILINE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
BROMATES AND METALS: POSSIBLE IGNITION AND FIRE.
BROMINE PENTAFLUORIDE: VIOLENT REACTION.
N-BUTYRALDEHYDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
CARBIDES: CONCENTRATED SULFURIC ACID IS EXTREMELY HAZARDOUS IN CONTACT WITH CARBIDES.
CESIUM ACETYLENE CARBIDE: IGNITION.
CHLORATES: ALL CHLORATES, WHEN BROUGHT IN CONTACT WITH SULFURIC ACID MAY GIVE OFF EXPLOSIVE CHLORINE DIOXIDE GAS. A VIOLENT EXPLOSION IS USUAL.
CHLORATES AND METALS: IGNITION LIKELY.
CHLORINE TRIFLUORIDE: VIOLENT EXPLOSION.
CHLOROSULFONIC ACID: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
CUPROUS NITRIDE: VIOLENT REACTION.
DIISOBUTYLENE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
DIMETHYLBENZYLCARBINOL AND HYDROGEN PEROXIDE: EXPLOSION.
EPICHLOROHYDRIN: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ETHANOL AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
ETHYLENE CYANOHYDRIN: VIOLENT REACTION.
ETHYLENE DIAMINE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ETHYLENE GLYCOL: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ETHYLENIMINE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
FULMINATES: SULFURIC ACID IS EXTREMELY HAZARDOUS IN CONTACT WITH FULMINATES.
HYDROCHLORIC ACID: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
HYDROFLUORIC ACID: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
IODINE HEPTAFLUORIDE: THE ACID BECOMES EFFERVESCENT.
INDANE AND NITRIC ACID: POSSIBLE EXPLOSION.
IRON: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
ISOPRENE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMP. & PRESSURE.
LITHIUM SILICIDE: INCANDESCENT REACTION.
MERCURIC NITRIDE: EXPLOSION.
MESITYL OXIDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
METALS (POWDERED): CONTACT WITH SULFURIC ACID IS EXTREMELY HAZARDOUS.
NITRIC ACID AND GLYCERIDES: EXPLOSION.
P-NITROTOLUENE: EXPLOSION.
PENTASILVER TRIHYDROXYDIAMINOPHOSPHATE: EXPLOSION.
PERCHLORATES: POSSIBLE EXPLOSION.
PERCHLORIC ACID: FORMATION OF DANGEROUS ANHYDROUS PERCHLORIC ACID.
PERMANGANATES AND BENZENE: POSSIBLE EXPLOSION.
1-PHENYL-2-METHYL-PROPYL ALCOHOL AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
PHOSPHORUS: YELLOW PHOSPHORUS IGNITES WHEN PLACED IN BOILING CONCENTRATED

SULFURIC ACID.
PHOSPHORUS ISOCYANATE: VIOLENT REACTION.
PICRATES: CONTACT WITH CONCENTRATED SULFURIC ACID IS EXTREMELY HAZARDOUS.
POTASSIUM TERT-BUTOXIDE: IGNITION.
POTASSIUM CHLORATE: POSSIBLE FIRE AND EXPLOSION.
POTASSIUM PERMANGANATE: POSSIBLE EXPLOSION IN THE PRESENCE OF MOISTURE.
POTASSIUM PERMANGANATE AND POTASSIUM CHLORIDE: VIOLENT EXPLOSION.
BETA-PROPIOLACTONE: MIXTURES IN CLOSED CONTAINERS CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
PROPYLENE OXIDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
PYRIDINE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
RUBIDIUM ACETYLENE CARBIDE: BURNS WITH SULFURIC ACID.
SILVER PERMANGANATE: EXPLOSION.
SODIUM: REACTS WITH EXPLOSIVE VIOLENCE.
SODIUM CARBONATE: VIOLENT REACTION.
SODIUM CHLORATE: POSSIBLE FIRE OR EXPLOSION.
SODIUM HYDROXIDE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
STEEL: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
STYRENE MONOMER: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
TOLUENE AND NITRIC ACID: VIOLENT REACTION.
VINYL ACETATE: MIXING IN A CLOSED CONTAINER CAUSED AN INCREASE IN TEMPERATURE AND PRESSURE.
ZINC CHLORATE: LIKELY TO CAUSE FIRES AND EXPLOSIONS.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS INCLUDE HIGHLY TOXIC FUMES OF SULFUR OXIDES.

POLYMERIZATION:
NOT KNOWN TO OCCUR.

****

CONDITIONS TO AVOID

MAY IGNITE OTHER COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.). VIOLENT REACTION WITH WATER. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN CONFINED SPACES. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

****

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.

NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

AIR SPILL:
KNOCK DOWN VAPORS WITH WATER SPRAY. KEEP UPWIND.

WATER SPILL:
NEUTRALIZE WITH AGRICULTURAL LIME, SLAKED LIME, CRUSHED LIMESTONE, OR SODIUM BICARBONATE.

ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

OCCUPATIONAL SPILL:
KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL. DO NOT TOUCH SPILLED MATERIAL. DO NOT GET WATER INSIDE CONTAINER. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DO NOT PUT WATER ON LEAK OR SPILL AREA. CLEAN UP ONLY UNDER THE SUPERVISION OF AN EXPERT. DIKE SPILL FOR LATER DISPOSAL. DO NOT APPLY WATER UNLESS DIRECTED TO DO SO. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:

50 MG/M3- GAS MASK WITH A CHIN-STYLE, FRONT, OR BACK-MOUNTED ACID GAS CANISTER AND A HIGH-EFFICIENCY PARTICULATE FILTER.
HIGH-EFFICIENCY PARTICULATE RESPIRATOR WITH A FULL FACEPIECE.
SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

100 MG/M3- TYPE C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET, OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

ESCAPE- GAS MASK WITH A CHIN-STYLE, FRONT, OR BACK-MOUNTED ACID GAS CANISTER AND A HIGH-EFFICIENCY PARTICULATE FILTER.
SELF-CONTAINED BREATHING APPARATUS.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
WEAR APPROPRIATE PROTECTIVE CLOTHING TO AVOID ANY POSSIBILITY OF SKIN CONTACT WITH LIQUIDS CONTAINING MORE THAN 1% SULFURIC ACID. AVOID REPEATED OR PROLONGED SKIN CONTACT WITH LIQUIDS CONTAINING 1% OR LESS SULFURIC ACID.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC

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TIN
TIN
TIN

MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 7440-31-5

SUBSTANCE: **TIN**

TRADE NAMES/SYNONYMS: TIN, METALLIC; SILVER MATT POWDER; TIN FLAKE; TIN POWDER; WANG; METALLIC TIN; STANNUM; C.I. 77860; PIGMENT METAL 5; T-121; T-122; T-123; T-124; T-127; T-128; T-129; T-131

CHEMICAL FAMILY:
INORGANIC METAL

MOLECULAR FORMULA: SN MOL WT 118.69

CERCLA RATINGS (SCALE 0-3): HEALTH=1 FIRE=1 REACTIVITY=0 PERSISTENCE=3

COMPONENTS AND CONTAMINANTS

PERCENT: >99 COMPONENT: TIN

OTHER CONTAMINANTS: SILICATES

EXPOSURE LIMITS:
2 MG/M3 OSHA TWA; 2 MG/M3 ACGIH TWA

PHYSICAL DATA

DESCRIPTION: ODORLESS, ALMOST SILVER-WHITE, LUSTROUS, SOFT METAL

BOILING POINT: 4100 F (2260 C) MELTING POINT: 449 F (232 C)

SPECIFIC GRAVITY: 7.3 VAPOR PRESSURE: 1 MMHG @ 1610 C

SOLUBILITY IN WATER: INSOLUBLE

SOLVENT SOLUBILITY: HCL, SULFURIC ACID, AQUA REGIA, ALKALI

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
SLIGHT FIRE, NEGLIGIBLE EXPLOSION HAZARD, IN THE FORM OF DUST, WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: COMBUSTIBLE   AUTOIGNITION TEMP.: 806 F (430 C)

FIREFIGHTING MEDIA:
SPECIAL POWDER, DRY SAND, NO HYDROUS EXTINGUISHING AGENTS.

FIREFIGHTING:
USE EXTINGUISHING AGENT AS INDICATED.

TOXICITY

CARGINOGEN STATUS: NONE.
METALLIC TIN IS RELATIVELY NON-TOXIC. INORGANIC TIN COMPOUNDS ARE EYE, MUCOUS MEMBRANE, RESPIRATORY TRACT, AND SKIN IRRITANTS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
400 MG(SN)/M3 IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.
ACUTE EXPOSURE- TIN COMPOUNDS MAY CAUSE RESPIRATORY IRRITATION.
CHRONIC EXPOSURE- THE DUST OR FUME MAY CAUSE BENIGN PNEUMOCONIOSIS WITHOUT
CHRONIC EXPOSURE- THE DUST OF FUME MAY CAUSE BENIGN PNEUMOCONIOSIS WITHOUT FIBROSIS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BRATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. KEEP AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
ACUTE EXPOSURE- NO REPORTED EFFECTS IN HUMANS FROM TIN DUST. INORGANIC TIN COMPOUNDS MAY CAUSE IRRITATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT WITH INORGANIC TIN COMPOUNDS MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

EYE CONTACT:
ACUTE EXPOSURE- NO REPORTED EFFECTS IN HUMANS FROM TIN DUST. DIRECT CONTACT WITH INORGANIC TIN COMPOUNDS MAY CAUSE IRRITATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO INORGANIC TIN COMPOUNDS MAY CAUSE CONJUCTIVITIS.

FIRST AID- WASH EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROX-

IMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

INGESTION:

ACUTE EXPOSURE- RELATIVELY NON-TOXIC BEACUSE OF POOR ABSORPTION. AT VERY HIGH LEVELS, ABDOMINAL PAIN, NAUSEA, VOMITING, GASTRIC IRRITATION, AND DIARRHEA MAY OCCUR.

FIRST AID- DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
VIOLENT REACTION MAY OCCUR WITH BROMINE TRIFLUORIDE, CARBON DIOXIDE AND BICARBONATE POWDER, OR AMMONIUM NITRATE. VILOENT REACTION MAY OCCUR WITH BROMINE EXCEPT IN HALOCARBON SOLUTION. VIOLENT REACTION WITH CHLORINE TRIFLUORIDE IN PRESENCE OF CARBON. PRODUCES INCANDESCENT AND EXOTHERMIC REACTION WHEN HEATED WITH IODINE HEPTAFLUORIDE OR TELLIRIUM OR IN CHLORINE. FLAMES AND SPARKING MAY OCCUR WHEN CUPRIC NITRATE IS IN PROLONGED, CLOSE CONTACT WITH TIN FOIL WITH WATER. IGNITION MAY OCCUR WITH FLUORINE AT 100 C. VIGOROUS, INCANDESCENT REACTION MAY OCCUR WITH POWDERED SULFUR. OXIDATION WITH INCANDESCENCE MAY OCCUR WITH POTASSIUM OXIDE OR PEROXIDE, OR SODIUM PEROXIDE.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY GIVE OFF STANNIC OXIDE.

POLYMERIZATION:
NONE KNOWN.

****
CONDITIONS TO AVOID

****
SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
NO SPECIFIC PRECAUTIONS OR PROCEDURES NECESSARY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION OR GENERAL DILUTION VENTILATION TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:

200 MG/M3- HIGH-EFFICIENCY PARTICULATE RESPIRATOR.

400 MG/M3- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:
PROTECTIVE CLOTHING NOT REQUIRED. AVOID REPEATED OR PROLONGED CONTACT WITH THIS SUBSTANCE.

GLOVES:
PROTECTIVE GLOVES ARE NOT REQUIRED BUT RECOMMENDED.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 02/08/85   REVISION DATE: 04/23/85

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MATERIAL SAFETY DATA SHEET

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MATERIALS INFORMATION SERVICES

NO 311
INHIBITED
1,1,1-TRICHLOROETHANE
REVISION D
DATE August 1983

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: **INHIBITED 1,1,1-TRICHLOROETHANE**
OTHER DESIGNATIONS: Methyl Chloroform, MC, CCl_3CH_3, GE Material D5B79, CAS# 000 071 556, α-Trichloroethane
TRADENAMES & MANUFACTURER: BLACO-THANE (Baron-Blakeslee), CHLOROTHENE NU & VG (Dow), INHIBISOL (Penetone Corp.), TRI-ETHANE (PPG Ind. Inc), TRITHENE (SRS, Inc.)

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
1,1,1-Trichloroethane	>95	8-hr TWA 350 ppm**
Inhibitor, typical*	< 5	Unknown
*Inhibitors used are proprietary. Commercial materials contain up to about 5% inhibitor and are designed for cold cleaning or vapor degreasing use or both.		Human, Inhalation LCLo 27 gm/m³/10 min
**Current OSHA PEL and ACGIH (1983) TLV. ACGIH STEL 450 ppm.		TCLo 920 ppm/70 min (CNS effects)
NIOSH (1976) proposed a 10-hr TWA of 200 ppm with a 350 ppm ceiling (15 minute sample) and has recommended caution in use		Human, Oral TDLo 670 mg/kg (GI effects)

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg F ----- ca 165*
Vapor pressure, 20 C, mm Hg ----- 100
Vapor density (Air=1) ----------- 4.55
Water solubility, g/100ml H_2O @20C - 0.09
Specific gravity, 25/25C --- 1.3-1.336*
Volatiles, % --------------- ca 100
Melting point, deg C ------- -32
Evaporation rate (CCl_4=1) -- 1
Molecular weight ----------- 133.41

Appearance & Odor: Colorless liquid with a mild, sweetish, pleasant, ether-like odor which may be just perceptible (unfatigued) at about 100 ppm in air.
*Properties depend on the inhibitor and inhibitor level.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp	Flammability Limits in Air	Lower	Upper
None	537 C (998 F)	(High energy ignition source at 25C), Vol. %	8.0%	10.5%

This material is nearly nonflammable. High energy, such as electric arc, is needed for ignition, and the flame tends to go out when the ignition source is removed. Material involved in a fire can emit toxic and irritating fumes. Water fog, carbon dioxide, dry chemical, or foam may be used to fight fires.
Use self-contained or air-supplied breathing apparatus for protection against suffocating vapors and toxic and corrosive decomposition products.

SECTION V. REACTIVITY DATA

This material can be hydrolyzed by water to form hydrochloric acid and acetic acid. It will react with strong caustic, such as caustic soda or caustic potash to form flammable or explosive material. Attacks natural rubber.
It requires inhibitor content to prevent corrosion of metals; and when inhibitor is depleted, it can decompose rapidly by reaction with finely divided white metals, such as aluminum, magnesium, zinc, etc. Do not use these metals for storage containers or in pressurized spraying equipment where MC is involved.
It will decompose at high temperature upon contact with hot metal, or under ultra-violet radiation to produce toxic and corrosive gases (hydrogen chloride, dichloroacetylene, chlorine and some phosgene).

NO. 311

SECTION VI. HEALTH HAZARD INFORMATION

TLV 350 ppm or 1900 mg/m3

Brief exposure at 900-1000 ppm causes mild eye irritation and loss of coordination due to the early effects of MC on the CNS. Excessive exposure gives headache, drowsiness, impaired judgement, unconsciousness. Defats skin on contact, can produce irritation and dermatitis; can be absorbed through the skin. Eye contact gives pain and irritation. Considered low in toxicity among the chlorinated hydrocarbons.

FIRST AID:

Eye contact: Flush eyes well with plenty of running water for 15 min, including under eyelids.

Skin contact: Remove solvent-wet clothing promptly. Wash contact area with warm water and soap. Get medical attention for irritation.

Inhalation: Remove to fresh air. Restore and/or support breathing as needed. Get medical assistance. (Note: Advise physician not to use adrenalin.)

Ingestion: Contact physician. Aspiration a hazard! Possible spontaneous vomiting. (If medical help not readily available and amount swallowed was appreciable, give milk or water to drink and induce vomiting. Repeat. Estimated lethal dose for 150 lb man is 0.5 to 1 pint.)

PHYSICIAN: Avoid using sympathomimetic amines in treatment.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

For small spills in ventilated area, mop, wipe or soak up with absorbent material avoiding inhalation and contact. Evaporate outdoors or in an exhaust hood.

For large spills, inform safety personnel and evacuate area. Use protective equipment during clean-up (see Sect. VIII). Ventilate area. Contain liquid, pick up and place in closed metal containers. Do not allow to enter drains and water ways.

DISPOSAL: Dispose of via a licensed waste solvent disposal company, or reclaim by filtration and distillation procedures. Follow Federal, State and Local regulations.

Aquatic toxicity TLm 96: 100-10 ppm.

EPA hazardous waste number under RCRA is U226 (40CFR261).

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Air-supplied or self-contained respirator should be available for non-routine or emergency use. A chemical cartridge-type respirator can be used for a limited time below 1000 ppm. A full facepiece is needed above 500 ppm.

Chemical goggles or a face shield should be worn if splashing is possible. Gloves and apron (of neoprene, polyethylene or polyvinyl alcohol) should be worn when needed to avoid skin contact. Remove solvent-wet clothing promptly. A safety shower and eyewash station should be available to use area if splashing is probable.

Preplacement and periodic medical examinations should consider cardiovascular, liver, CNS functions, and skin.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, well-ventilated area. Keep water-free. Monitor inhibitor level for vapor degreasing use. Use caution in cleaning operations involving white metal fines (see Sect. V). Trichloroethylene contamination may cause decomposition when aluminum is degreased.

Provide medical monitoring of those regularly exposed to MC in the workplace. Preclude those with CNS, liver, or heart disease from exposure. Personnel using this solvent should avoid drinking alcoholic beverages shortly before, during, or soon after exposure.

NIOSH (1976 Crit. Doc.) expressed concern because of possible birth defects from high level pregnant rat exposures. Since 1976, directed studies have been negative. At occupational physicians' seminar on "Reproductive Hazards in the Workplace," Washington, DC (4/25/83), no physician was aware of data to substantiate the NIOSH concern.

DOT Classification: ORM-A I.D. No. UN2831

DATA SOURCE(S) CODE: 1-12,14,20,23,25,26,30,31,34,37,38,45-49,53

APPROVALS: MIS/CRD J. M. Nuber

INDUST. HYGIENE/SAFETY DW 7-21-83

MEDICAL REVIEW: 1 August 1983

GENERAL ELECTRIC

CHEM REPORT
05/23/1986

CHEM ID	CHEM NAME
***	
* 007440-61-1	URANIUM

ENTRY INFORMATION
05/23/1986

PREPARER	REVIEWER	ENTRY DATE	REVISED
***			
* D. AVERILL	J. BROWER	02/13/1985	05/16/1986

DOE CHEMICAL HAZARDS EMERGENCY MANAGEMENT SYSTEM
05/23/1986

HEALTH AND SAFETY INFORMATION — AUTHORITY

CHEMICAL NAME OR SYNONYM
***
* URANIUM
* URANIUM METAL
* U238
* URANIUM METAL PYROPHORIC — DOT
* 7440-61-1

DISPOSAL

RECOVERY FOR REPROCESSING IS THE PREFERRED METHOD FOR HANDLING WASTE URANIUM. SHIP TO LISCENCED RECOVERY FACILITY. SCRAP URANIUM SHOULD BE COVERED WITH OIL.

DECOMPOSITION PRODUCTS

THERMAL DECOMPOSITION - URANIUM OXIDES.

ENVIRONMENTAL EFFECTS

NO CRITERIA SET, BUT EPA HAS SUGGESTED A PERMISSIBLE CONCENTRATION IN WATER OF 3 UG/L BASED ON HEALTH EFFECTS.

EMERGENCY PROCEDURES

PERSONS NOT WEARING PROTECTIVE EQUIPMENT AND CLOTHING SHOULD BE RESTRICTED FROM AREAS OF SPILLS UNTIL CLEANUP HAS BEEN COMPLETED. IF URANIUM MATERIALS ARE SPILLED, 1. VENTILATE AREA OF SPILL. 2. COLLECT SPILLED MATERIAL IN MOST CONVENIENT AND SAFE MANNER AND DEPOSIT IN SEALED CONTAINERS FOR RECLAMATION. LIQUID CONTAINING URANIUM OR INSOLUBLE COMPOUNDS SHOULD BE ABSORBED IN VERMICULITE, DRY SAND, EARTH, OR A SIMILAR MATERIAL. URANIUM CHIPS OR TURNINGS WHICH ARE SPILLED SHOULD BE COVERED WITH OIL.

FIRST AID

WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL. SKIN EXPOSURE - PROMPTLY WASH CONTAMINATED SKIN USING SOAP OR MILD DETERGENT AND WATER. IF IRRITATION IS PRESENT AFTER WASHING, GET MEDICAL ATTENTION. INHALATION - IF A PERSON BREATHES IN LARGE AMOUNTS OF URANIUM MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY . SWALLOWING - GIVE THE PERSON LARGE QUANTITIES OF WATER IMMEDIATELY. AFTER THE WATER HAS BEEN SWALLOWED, TRY TO GET THE PERSON TO VOMIT BY TOUCHING THE BACK OF THE THROAT WITH A FINGER. DO NOT MAKE AN UNCONSCIOUS PERSON VOMIT. GET MEDICAL ATTENTION IMMEDIATELY.

FIRE HAZARD

URANIUM IS A DANGEROUS FIRE HAZARD IN THE FORM OF A SOLID OR DUST WHEN EXPOSED TO HEAT OR FLAME. IT IS A MODERATE EXPLOSION HAZARD IN THE FORM OF DUST WITH A MINIMUN EXPLOSIVE CONCENTRATION OF 60 GRAMS/CU.M. EXTINGUISH WITH DRY POWDER, DRY SAND, OR GRAPHITE. DONOT USE

CARBON DIOXIDE.

HEALTH HAZARD

HIGHLY TOXIC AND RADIOACTIVE.
URANIUM AND/OR IT INSOLUBLE COMPOUNDS ARE TOXIC IF THEY ARE INHALED, SWALLOWED, OR IF THEY COME IN CONTACT WITH THE EYES OR SKIN. URANIUM METAL AND ITS INSOLUBLE COMPOUNDS ARE LESS TOXIC THAN THE SOLUBLE COMPOUNDS. IT IS WEAKLY RADIOACTIVE AND IS PRINCIPALLY AND ALPHA PARTICLE EMITER. IT IS NOT A SIGNIFICANT EXTERNAL RADIATION HAZARD. IT POSES AN INTERNAL RADIATION AND CHEMICAL HAZARD. EXPOSURE MAY CAUSE AN INCREASE IN CANCER OF THE LYMPHATIC AND BLOOD-FORMING TISSUES IN MAN. PROLONGED CONTACT WITH THE SKIN MIGHT CAUSE RADIATION DAMAGE TO THE SKIN AND/OR SKIN RASH (DERMATITIS). PROLONGED INHALATION HAS CAUSED DAMAGE TO THE LUNGS OF ANIMALS. URANIUM IS HIGHLY TOXIC TO THE KIDNEYS AND LIVER.

CHEMICAL INCOMPATIBILITIES

CONTACT WITH CO2 MAY CAUSE FIRE.
URANIUM METAL IS INCOMPATIBLE WITH HALOGENS. U POWDER IGNITES IN FLORINE AT ROOM TEMPERATURE, IN CHLORINE AT 150-180 DEGREES C, AND IN IODINE VAPOR AT 260 DEGREE C. MAY EXPLODE OR IGNITE IN BRF3 AND CCL4. URANIUM REACTS EXPLOSIVELY WITH NITRIC ACID, AND DINITROGEN TETRAOXIDE. U METAL GLOWS AND PRODUCES HEAT IN AMMONIA, SULFUR VAPOR, AND IN CONTACT WITH SELENIUM.

MEDICAL RECCOMMENDATIONS

SPECIAL ATTENTION SHOULD BE GIVEN TO THE BLOOD, LUNGS, KIDNEY, AND LIVER IN PREEMPLOYMENT MEDICAL EXAMS. PERIODIC MEDICAL EXAM SHOULD INCLUDE A CHEST X-RAY, URINALYSIS, COMPLETE BLOOD COUNT AND CHEMISTRY.

PHYSICAL DESCRIPTION

A HARD, SILVERY WHITE RADIOACTIVE METAL

PROTECTION MEASURES

GOOD ENGINEERING CONTROLS SHOULD BE USED TO REDUCE ENVIRONMENTAL CONCENTRATIONS TO THE PERMISSIBLE EXPOSURE LEVEL (PEL). ABOVE THE PEL RESPIRATORY PROTECTION MUST BE WORN. AT A CONCENTRATION OF 2.5 MG/M3 OR LESS WEAR FUME RESPIRATOR OR HIGH EFFICENCY PARTICULATE RESPIRATOR APPROVED FOR RADIONUCLIDES, A SUPPLIED-AIR RESPIRATOR, OR A SCBA. EMPLOYEES SHOULD WEAR IMPERVIOUS CLOTHING, GLOVES, AND GOGGLES TO PREVENT SKIN CONTACT WITH URANIUM. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE SOLIDS OR LIQUIDS CONTAINING URANIUM OR INSOLUBLE COMPOUNDS ARE HANDLED, PROCESSED, OR STORED. EMPLOYEES WHO HANDLE URANIUM SHOULD WASH THEIR HANDS THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER BEFORE EATING, SMOKING OR USING TOILET FACILITIES.

SAMPLING METHODS

NO STANDARD MEASUREMENT METHODS FOR URANIUM OR INSOLUBLE COMPOUNDS HAVE BEEN PUBLISHED BY NIOSH. MAY BE SAMPLED AND USING A CELLULOSE ESTER FILTER AND ANALYZED BY ATOMIC ABSORPTION.

SHIPPING INFORMATION

SHIP AS URANIUM METAL, PYROPHORIC. LABEL AS RADIOACTIVE AND FLAMMABLE SOLID.

STORAGE RECOMMENDATIONS

STORE AS RADIOACTIVE MATERIAL. KEEP FROM EXPOSURE TO AIR, MOISTURE, CO2, HALOGENS, ACIDS, AMMONIA, SULFUR. SCRAP URANIUM SHOULD BE COVERED WITH OI

USE

URANIUM METAL HAS LIMITED USES IN ALLOYS AND PHOTOELECTRIC TUBES. URANIU COMPOUNDS ARE USED AS FUEL IN NUCLEAR REACTORS, IN PLUTONIUM PRODUCTION, IN THE ARE PRODUCTION OF OTHER RADIOACTIVE ISOTOPES, AND AS FEEDS FOR GASEOUS DIFFUSION PLANTS.

CHEMICAL CATEGORIES
05/23/1986

CATEGORY	CLASS NAME	CLASS CODE

***		
* CARCINOGEN	HUMAN	
* CHEMICAL	ACTINIDE METAL	U
* HAZARD CODE	REACTIVITY	2
* HAZARD CODE	HEALTH	3
* HAZARD CODE	FIRE	3
* HEALTH HAZARD	KIDNEY TOXIN	
* PHYSICAL HAZARD	PYROPHORIC	
* PHYSICAL HAZARD	RADIOACTIVE	
* TRANSPORTATION	RADIOACTIVE AND FLAMMABLE SOLID	UN2979

CHEM NAME* URANIUM

CHEMICAL ATTRIBUTES
05/23/1986

ATTRIBUTE	VALUE	UNITS	QUALITY	COMMENTS
***				
* IGNITION TEMP	150.000	TO 175C		SOLID
* CHEM FORMULA			U	
* MOL WEIGHT	238.030	G/MOL		
* PHYSICAL STATE			SOLID	AT 20 - 25 C
* HALF LIFE	4.500	10E9 YEARS		
* IGNITION TEMP	20.000	C	MINIMUM	DUST CLOUD
* MELTING POINT	1133.000	C		
* BOILING POINT	3818.000	C		
* SPECIFIC GRAVITY	19.050		WATER=1	AT 25 C
* SOLUBILITY			INSOLUBLE	IN WATER
* EXPOSURE LIMIT	0.250	MG/CU.M	PEL	AS U
* EXPOSURE LIMIT	0.200	MG/CU.M	TLV	AS U

SELECTED MATERIALS THAT ARE RELATED TO OR CONTAIN THE SUBSTANCE
05/23/1986

CHEM NAME* URANIUM

***
* URANIUM COMPOUNDS
* URANIUM DICARBIDE
* URANIUM DIOXIDE
* URANIUM HEXAFLUORIDE
* URANIUM HYDRIDE
* URANIUM OCTAOXIDE
* URANIUM OXYFLUORIDE
* URANIUM TETRAFLUORIDE
* URANYL FLUORIDE
* URANYL NITRATE

A.2 Auxiliary Process Chemicals*

Charcoal, Activated
CINDOL[R]
Doubleteam[R]
Filterbestos[R]
Filterbest (C-95)
Hydrogen Peroxide
Isopropyl Alcohol
Monolec Industrial Lubricant
W & B Coolant

* Chemicals used in low volumes, i.e., approximate volumes consumed are less than 100 gallons/year.

Thiokol/Ventron Division
Alfa Products

304394

MATERIAL SAFETY DATA SHEET

C

'RODUCT NAME: Charcoal, activated CAS# 1333-86-4

CHEMICAL NATURE: Nonmetallic element

% ACTIVITY: 97+%

I. PHYSICAL DATA

BOILING POINT, 760 mm. Hg	4000°C	Melting POINT	3500°C
SPECIFIC GRAVITY	3.51	VAPOR PRESSURE AT 20°C.	No Data
VAPOR DENSITY	<1	SOLUBILITY IN H_2O	Insoluble
PER CENT VOLATILES BY WEIGHT	Not applicable	IONIC NATURE	NO
APPEARANCE AND ODOR	Black amorphous mass.		

II. HAZARDOUS INGREDIENTS

MATERIAL	%	TLV (Units)
Charcoal, activated	97+%	3.5 mg/m^3
(ACGIH-1980)		

III. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (test method)	No Data	AUTOIGNITION TEMPERATURE		No Data	
FLAMMABLE LIMITS IN AIR, % by volume	No Data	LOWER		UPPER	

EXTINGUISHING MEDIA	Flammable solid Use water, carbon dioxide dry chemical extinguishing agents, dry extinguishing agents, dry sand, or dry ground dolomite.
SPECIAL FIRE FIGHTING PROCEDURES	No special firefighting procedures needed, use normal procedures which include wearing NIOSH/MSHA approved self-contained breathin[g] apparatus, flame and chemical resistant clothing; hats, boots and gloves. If without risk, remove material from fire area. Cool containers with water from maximum distance.
'NUSUAL FIRE AND XPLOSION HAZARDS	Slight explosion hazard when exposed to flame/

304394

THE BURDEN OF SAFE USE OF OUR MATERIALS MUST REST ENTIRELY WITH THE USER. WE CANNOT ASSUME RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF ANY INFORMATION SUPPLIED BY US CONCERNING THE HAZARDS OR RECOMMENDED USE OF THE CHEMICALS.

IV. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	3.5 mg/m^3 (ACGIH-1980)
EFFECTS OF OVEREXPOSURE	Associated with small amounts of irritation and possible toxic impurities.
EMERGENCY AND FIRST AID PROCEDURES	Remove from exposure. Eyes: Flush with copious amounts of water for at least 15 minutes. Skin: Remove any contaminated clothing. Flood skin with large volumes of water for 15 minutes. Ingestion/Inhalation: Seek prompt, competent medical attention.

V. REACTIVITY DATA

STABILITY			
UNSTABLE	STABLE	CONDITIONS TO AVOID	Heat, sparks, open flame or other sources of ignition.
	X		
INCOMPATIBILITY (materials to avoid)			Halogen containing compounds, sodium compounds, potassium compounds.
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION			
May Occur	Will not Occur	CONDITIONS TO AVOID	
	X		

VI. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	Wearing full protective clothing and respiratory protection (See Sect. VII), eliminate all sources of ignition. Cover spill with dry sand or dry vermiculite, mix well and carefully transfer to a well-marked container. Close container tightly. Submit or retain for disposal.
WASTE DISPOSAL METHOD	Consult state, local, and federal regulations for proper disposal of Charcoal, activated.

VII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)		NIOSH/MSHA approved high efficiency particulate respirator or self-contained breathing apparatus for emergency use.		
VENTILATION	LOCAL EXHAUST	Fume Hood	SPECIAL	
	MECHANICAL	Not acceptable	OTHER	
PROTECTIVE GLOVES		Rubber	EYE PROTECTION	OSHA approved safety goggles
OTHER PROTECTIVE EQUIPMENT		Lab coat and apron, flame & chemical resistant coveralls, eyewash capable of sustained flushing, safety drench shower and hygienic fac		

VIII. SPECIAL PRECAUTIONS

PRECAUTIONARY LABELING	Warning. Flammable solid. Liberates toxic fumes upon decomposition.
OTHER HANDLING AND STORAGE CONDITIONS	Keep container tightly closed. Store in a cool, dry, well-ventilated area. Wash thoroughly after use. Keep away from incompatible materials and flammable materials.

E.F. HOUGHTON & CO.
P.O. BOX 930 VALLEY FORGE, PA. 19482 * (215) 666-4105

MATERIAL SAFETY DATA SHEET

REV DATE: 081283

423202 CINDOL 3202

SECTION I-PRODUCT IDENTIFICATION

PRODUCT NAME: CINDOL 3202
PROPER SHIPPING NAME: METAL CUTTING DRAWING COMPOUND

HAZARD CLASS: NON-HAZARDOUS
HAZARD ID NO: N/A

COMPLETED BY: DAVID H EADLINE
PHONE NUMBER: 215-666-4105
MFG. DUNS # : 00-226-1535

SECTION II-COMPONENTS

**** CONFIDENTIAL ****

MATERIAL	CAS NO	PERCENT	HAZARD
MINERAL OIL	8012-95-1	44	TLV:5 MG/CU.M. AS OIL MIST
SODIUM PETROLEUM SULFONATE	68608-26-4	10-30	
FATTY ACID-AMINE CONDENSATE	61790-66-7	10-30	
FATTY ACID ESTER	68989-57-1	1-10	
C15-C20 ALPHA OLEFINS	64743-02-8	10-30	
TRIDECYL ALCOHOL	112-70-9	1-10	
BUTYL CARBITOL	112-34-5	1-10	
PRESERVATIVE	3811-73-2	1-10	
FORMALDEHYDE	50-00-0	0.6	TLV:C-2 PPM
DYE	2321-07-5	<1	
PERFUME	68917-09-9	<1	

(PRODUCT USE DILUTION; 5%)

SECTION III-PHYSICAL DATA

BOIL. PT.(DEG F): ABOVE 300
VAPOR PRESSURE (MM HG) NEGLIGIBLE
VAPOR DENSITY (AIR = 1) 10+
PERCENT VOLATILE: NIL
PH NEAT: N/A PH AT 5 %:9.5

SPECIFIC GRAVITY: 0.934
EVAP RATE: NEGLIGIBLE
SOL IN WATER: EMULSIFIES

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT, DEG. F (METHOD USED): 305 C.O.C. LEL: N/D UEL: N/D
NFPA CLASSIFICATION HEALTH: 0 FIRE: 1 REACTIVITY: 0
EXTINGUISHING MEDIA:
CARBON DIOXIDE, FOAM, DRY CHEMICAL

CONTINUED ON PAGE 2

****

SPECIAL FIRE FIGHTING INSTRUCTIONS:
NOT REQUIRED
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NONE

SECTION V - HEALTH HAZARD INFORMATION

ROUTES OF EXPOSURE AND EFFECTS

INHALATION:
N/A
SKIN:
MILD IRRITANT; MAY HAVE DEFATTING ACTION
EYE:
MILD IRRITANT
INGESTION:
NO SIGNIFICANT EFFECTS EXPECTED

*********** FIRST AID **********

INHALATION:
N/A
SKIN:
WASH WITH SOAP AND WATER
EYE:
FLUSH WITH WATER 15 MINUTES. CONSULT PHYSICIAN IF IRRITATION PERSISTS
INGESTION:
IF INGESTED, DO NOT INDUCE VOMITING, CONSULT PHYSICIAN. PRODUCT CONTAINS MINERAL OIL, PETROL, SULFONATE, ALPHA OLEFIN

SECTION VI - REACTIVITY DATA

STABILITY: STABLE: [X] UNSTABLE: [ ]
INCOMPATABILITY (MATERIALS TO AVOID):
STRONG OXIDIZERS
HAZARDOUS DECOMPOSITION PRODUCTS:
THERMAL; OXIDES OF CARBON AND NITROGEN
HAZARDOUS POLYMERIZATION: MAY OCCUR: [ ] WILL NOT OCCUR: [X]

SECTION VII - SPILL OR LEAK PROCEDURES

POTENTIAL AS A POLLUTANT:
PRODUCT NOT EXTREMELY BIODEGRADABLE AS SUCH. KEEP SPILLS AWAY FROM SEWERS AND SLOW MOVING STREAMS. MATERIAL NOT CONSIDERED A POLLUTANT IF EFFECTIVE WASTE DISPOSAL IS UTILIZED.
BIOCHEMICAL OXYGEN DEMAND (BOD-5): N/D
SPILL, LEAK OR RELEASE:

CONTINUED ON PAGE 3

****
FLUSH AREA WITH COPIOUS AMOUNTS OF WATER AND MOP UP

WASTE DISPOSAL:
TREAT NEAT MATERIAL ACCORDING TO REGULATIONS FOR DISPOSAL OF WASTE PETROLEUM OIL. FOR EMULSIONS, USE DEEMULSIFICATION PROCESS TO SPLIT PRODUCT. TREAT OILY LAYER AS WASTE OIL. NEUTRALIZE AQUEOUS LAYER AND RELEASE TO TREATMENT PLANT IN ACCORDANCE WITH PERTINENT REGULATIONS.

==
SECTION VIII - SPECIAL PROTECTION INFORMATION
==

RESPIRATORY PROTECTION:
NOT NORMALLY REQUIRED
VENTILATION:
LOCAL EXHAUST REQUIRED
PROTECTIVE GLOVES:
RUBBER IF SKIN IS SENSITIVE
EYE PROTECTION:
SAFETY GOGGLES IF SPLASHING
OTHER PROTECTIVE EQUIPMENT:
NOT REQUIRED

==
SECTION IX - SPECIAL PRECAUTIONS
==

STORAGE AND HANDLING CONDITIONS:
AVOID CONTACT WITH STRONG OXIDIZERS

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DATE OF ISSUE	SUPERSEDES
06/13/86	09/23/85

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED ACCURATE IN LIGHT OF CURRENT FORMULATION. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THIS DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

SECTION I - GENERAL INFORMATION

CHEMICAL NAME & SYNONYMS
N/A

TRADE NAME & SYNONYMS
DOUBLETEAM

CHEMICAL FAMILY
SYNTHETIC COOLANT

FORMULA
X<--MIXTURE

MANUFACTURERS NAME:
MANTEK, DIVISION OF NCH CORP.

ADDRESS (NUMBER, STREET, CITY, STATE & ZIP CODE)
BOX 152170
IRVING, TEXAS 75015

PREPARED BY:	PRODUCT CODE NUMBER	EMERGENCY TELEPHONE NUMBER
RICHARD STOLLEY/T.S.CHEM	0002	214-438-4144 EXT. 013

SECTION II- HAZARDOUS INGREDIENTS

CHEMICAL NAME (INGREDIENTS)	HZD D TYPE	TLV*	PEL*	CAS#
NO HAZADOUS INGREDIENTS				
PER 29 CFR 1910.1200(D)				

SECTION III - PHYSICAL DATA

BOILING PT.(FAHRENHEIT)	210	SPEC GRAVITY (H2O=1)	:1.090
VAPOR PRESSURE (MM HG).	18	COLOR	LIGHT YELLOW

(CONTINUED) SECTION III - PHYSICAL DATA

VAPOR DENSITY (AIR=1)	0.6	ODOR	OCOTEA CYMBARIUM
PH @ 100%	9.6	CLARITY	TRANSPARENT
PERCENT. VOLATILE BY VOLUME (%)	65	EVAPORATION RATE (BU AC = 1)	0.10
SOLUBILITY IN WATER	COMPLETE		
VISCOSITY	NON-VISCOUS		

SECTION IV - FIRE AND EXPLOSION HAZARD

FLASH POINT (METHOD USED)	FLAMMABLE LIMITS	LEL	UEL
NON-FLAM	N/A	N/A	N/A

EXTINGUISHING MEDIA <--FOAM *ALCOHOL* <--FOAM <--CO2 DRY <--CHEMICAL WATER <--SPRAY <--OTHER

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE & EXPLOSION HAZARDS

N/A

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE :

NOT ESTABLISHED FOR MIXTURE. SEE SECTION II.

EFFECTS OF OVEREXPOSURE

- ACUTE - (SHORT TERM EXPOSURE)

DIRECT CONTACT WITH THE EYES MAY CAUSE IRRITATION.
UNDILUTED SKIN CONTACT MAY CAUSE REDDENING OF SKIN IRRITATION AND POSSIBLE DISCOMFORT TO SENSITIVE SKIN.

- CHRONIC - (LONG TERM EXPOSURE)

DIRECT CONTACT WITH EYES FOR A PROLONGED PERIOD OF TIME CAN CAUSE CORNEAL DAMAGE. PROLONGED UNDILUTED SKIN CONTACT AMY CAUSE REDDENING OF SKIN, IRRITATION LEADING POTENTIALLY TO DERMATITIS.
***NOTE - THIS COOLANT DILUTED AS RECOMMENDED SHOULD NOT CAUSE SKIN IRRITATION.

PRIMARY ROUTE OF ENTRY: X<-- INHALATION <-- INGESTION X<-- ABSORPTION

EMERGENCY & FIRST AID PROCEDURES

INHALATION :
REMOVE TO FRESH AIR. SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.

EYE CONTACT:
FLUSH WITH PLENTY OF WATER FOR 15 MINUTES HOLDING EYELIDS APART TO ENSURE FLUSHING OF ENTIRE SURFACE AREA. SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.

SKIN CONTACT:
BARRIER CREAM ADVISABLE: WASH WITH SOAP AND WATER.

INGESTION :
GIVE TWO GLASSES OF WATER TO DILUTE CONTENTS OF STOMACH. SEE A PHYSICIAN IF DISCOMFORT OCCURS.

NOTES TO PHYSICIAN :
N/A

SECTION VI - TOXICITY INFORMATION

N/A

SECTION VII - REACTIVITY DATA

STABILITY	X<--STABLE	<--UNSTABL	CONDIOTIONS TO AVOID
	N/A		

INCOMPATIBILITY (MATERIALS TO AVOID)
DO NOT ADD ANY ADDITIONAL MATERIALS SUCH AS SODIUM NITRITE OR POTASSIUM NITRITE. CANCER CAUSING MATERIAL CAN BE FORMED.

HAZARDOUS DECOMPOSITION PRODUCTS
N/A

HAZARDOUS	X <--WILL NOT OCCUR	<--MAY OCCUR	CONDITIONS TO AVOID
POLYMERIZATION	N/A		

SECTION VIII - SPILL OR LEAK PROCEDURES

STEPS TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
SMALL SPILL - FLUSH SURFACE WITH LARGE VOLUME OF WATER AND FLUSH DOWN DRAIN. LARGE SPILL - STOP LEAK. CONTAIN SPILL. REMOVE BY WET VACUUM OR ABSORBANT. REUSE SPILLED MATERIAL IF POSSIBLE. OTHERWISE, PLACE IN CLOSED LABELED CONTAINER AND STORE IN SAFE PLACE.

WASTE DISPOSAL METHOD
THE INGREDIENTS IN THIS PRODUCT ARE NOT REGULATED AS HAZARDOUS MATERIALS BY THE EPA. THIS PRODUCT MAY BE FLUSHED INTO A SANITARY SEWER. HOWEVER, AFTER USE IT WILL BE NECESSARY TO SKIM TRAMP OIL AND ELIMINATE SOLIDS BEFORE FLUSHING. CHECK WITH STATE AND LOCAL AUTHORITIES PRIOR TO DISPOSAL OF TRAMP OIL. SOLIDS OR DISCHARGE INTO SANITARY SEWER.

NEUTRALIZING AGENT
FLUSH WITH LARGE AMOUNTS OF WATER.

SECTION IX - SPECIAL PROTECTION INFORMATION

REQUIRED VENTILATION
GOOD INDUSTRIAL HYGIENE PRACTICE DICTATES THAT THE WORK AREAS SHOULD PROVIDE ADEQUATE VENTILATION OR CONTROLS TO MAINTAIN AND MEET OSHA REQUIREMENTS.

RESPIRATORY PROTECTION
GENERAL EXHAUST IS ADEQUATE UNDER NORMAL CIRCUMSTANCES.

PROTECTIVE GLOVES
GLOVES SHOULD BE WORN DEPENDING UPON SEVERITY OF CONTACT.

EYE PROTECTION
CHEMICAL GOGGLES DEPENDING UPON SEVERITY OF CONTACT.

OTHER PROTECTION
N/A

SECTION X - STORAGE AND HANDLING INFORMATION

STORAGE TEMPERATURE	INDOOR	HEATED	REFRIGERATED	OUTDOOR
120 F.<--MAX 32 F.<--MIN	X			

PRECAUTIONS TO BE TAKEN IN HANDLING & STORING
STORE IN MODERATE TEMPERATURES.

OTHER PRECAUTIONS
KEEP OUT OF REACH OF CHILDREN.
READ ENTIRE LABEL BEFORE USING.

SECTION XI - TRANSPORTATION - (FOR FUTURE USE)

APPLICABLE REGULATIONS
<--49 CFR <--IMCO <--TARIFF 6 D <--IATA <--MILITARY AIR (AFR 71-4)

SHIPPING NAME

HAZARD CLASS | ID NUMBER | REPORT QTY

LABELS | LIMITED QTY

UNIT CONTAINER

DOT SPS CONTAINER | NET EXPLOSIVE WT.

AEROSOL PROPELLANT(S)

SECTION XII - REFERENCES

1. THRESHOLD LIMIT VALUE FOR CHEMICAL SUBSTANCES IN THE WORK ENVIRONMENT, 2ND EDITION, ACGIH, 1985.
2. NIOSH REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES. 1982.

8

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: INDUSTRIAL FILTER & PUMP MFG. CO.	EMERGENCY TELEPHONE NO.: (312) 656-7800
ADDRESS (Number, Street, City, State, and ZIP Code): 5900 West Ogden Ave, Cicero, Illinois 60650	
CHEMICAL NAME AND SYNONYMS: NONE	TRADE NAME AND SYNONYMS: FILTERBESTOS
CHEMICAL FAMILY: NONE	FORMULA: PROPRIETARY

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
No asbestos 4-28-78 RLS		
NOT AVAILABLE		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)		SPECIFIC GRAVITY (H_2O=1)	
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (______ =1)	
SOLUBILITY IN WATER	NOT AVAILABLE		
APPEARANCE AND ODOR			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
NOT AVAILABLE			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

EFFECTS OF OVEREXPOSURE

NOT REGUIATED

EMERGENCY AND FIRST AID PROCEDURES

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE		

INCOMPATABILITY *(Materials to avoid)* NOT AVAILABLE

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR		

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

NOT AVAILABLE

WASTE DISPOSAL METHOD

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* DUST RESPIRATOR

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES | EYE PROTECTION

OTHER PROTECTIVE EQUIPMENT

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

NONE

OTHER PRECAUTIONS

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
INDUSTRIAL FILTER & PUMP MFG. CO.	312-656-7800
ADDRESS (Number, Street, City, State, and ZIP Code) 5900 W. Ogden Avenue, Cicero, Illinois 60650	
CHEMICAL NAME AND SYNONYMS CELLULOSE	TRADE NAME AND SYNONYMS C-95 FILTERBEST
CHEMICAL FAMILY WOOD	FORMULA GROUND WOOD PULP

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS	NONE		BASE METAL	NONE	
CATALYST	"		ALLOYS	"	
VEHICLE	"		METALLIC COATINGS	"	
SOLVENTS	"		FILLER METAL PLUS COATING OR CORE FLUX	"	
ADDITIVES	"		OTHERS	"	
OTHERS	"				

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
NONE		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	NONE	SPECIFIC GRAVITY (H_2O=1)	1.58
VAPOR PRESSURE (mm Hg.)	"	PERCENT, VOLATILE BY VOLUME (%)	NONE
VAPOR DENSITY (AIR=1)	"	EVAPORATION RATE (________ =1)	NONE
SOLUBILITY IN WATER	"		
APPEARANCE AND ODOR	FIBROUS SOLID FLOC - PRACTICALLY ODORLESS		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) NONE	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA WATER			
SPECIAL FIRE FIGHTING PROCEDURES NONE			
UNUSUAL FIRE AND EXPLOSION HAZARDS DUST EXPLOSIBILITY INDEX 2.8 MIN. EXPLOSION CONC. 0.055 OZ/FT^3			

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	NONE
EFFECTS OF OVEREXPOSURE	NO EFFECTS
EMERGENCY AND FIRST AID PROCEDURES	NONE

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	NONE
INCOMPATABILITY *(Materials to avoid)*	STRONG OXIDANTS		
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	NONE

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

SWEEP UP

WASTE DISPOSAL METHOD DUMP - NO SPECIAL METHOD NECESSARY

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* DUST MASK		
VENTILATION	LOCAL EXHAUST	SPECIAL
NORMAL	MECHANICAL *(General)* FORCE VENTILATION RECOMMENDED	OTHER
PROTECTIVE GLOVES UNNECESSARY	EYE PROTECTION DUST GOGGLES	
OTHER PROTECTIVE EQUIPMENT		

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING NONE

OTHER PRECAUTIONS NONE

GPO 934-110

Form OSHA-20
Rev. May 72

MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT

SCHENECTADY, N. Y. 12305

MATERIALS INFORMATION SERVICES

NO. 44A
9, 5, 19

HYDROGEN PEROXIDE
(>60%)

Date December 1978

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: [redacted] (>60%)
OTHER DESIGNATIONS: H_2O_2 Concentrated Solution, CAS# 007 722 841
MANUFACTURER: Material is available from several suppliers, including FMC Corporation and Pennwalt Corporation.

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Hydrogen Peroxide (H_2O_2)	> 60	8-hr TWA 1 ppm*
Water	< 40	--
Proprietary Stabilizer (such as acetanilide, sodium stannate or other)	Small amount	
*Current OSHA and ACGIH (1978) TLV. Material increases in hazards as H_2O_2 concentration increases. Obtain detailed supplier recommendations, especially for 90% H_2O_2 grade and higher concentrations.		Rat, inhalation LCLo 100 ppm (pulmonary edema)

SECTION III. PHYSICAL DATA

	70%	90%	98%	100%
Boiling point at 1 atm, deg C	126	141	148	152.2
Vapor pressure at 30 C, mm Hg	10.1	4.7	3.1	ca 3
Partial pressure of H_2O_2 at 30 C, mm Hg	1.17	2.25	2.67	--
Specific gravity (20/4 C)	1.29	1.39	1.44	1.45
Approx. freezing point, deg C	-40	-11	-2	-0.4
Volumes oxygen produced/1 volume H_2O_2 soln.	300	418	470	--
Water solubility	MISCIBLE			

Appearance & Odor: A clear, colorless to light blue, water-like liquid without odor (or with a characteristic slightly acidic odor).

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
None	None	None		

Extinguishing Media: Use water in large amounts to fight fire in which this material is involved; other extinguishing agents are expected to be ineffective. Hydrogen peroxide is non-flammable, but it provides oxygen to facilitate or initiate burning of surrounding combustibles. It is a dangerous fire and explosion hazard in a fire situation. When highly concentrated material is heated, shocked by impact, or contaminated it can rupture containers, start fires (with combustibles), or explode. Use large amounts of water to dilute spilled material and flush it away from combustibles. Firefighters must use self-contained breathing equipment and have eye protection.

SECTION V. REACTIVITY DATA

When handled properly and kept cool and pure, this material is stable. It does not polymerize but can decompose releasing heat and oxygen. Above 65% H_2O_2 more heat is released by decomposition than can be absorbed by evaporation of the water present. Unchecked, the decomposition temperature of 70% H_2O_2 can reach to about 500 F, and 90% to 1364 F. Combustibles in contact with this material can be expected to undergo spontaneous ignition, often delayed. A homogeneous mixture with organic materials such as alcohols or glycerine is a sensitive and powerful explosive. Pure H_2O_2 at 90% in water not readily detonated at room temperature, but higher concentrations and/or heat can facilatate detonation. Contamination with certain materials such as iron, chromium, brass bronze, lead, silver, manganese or their salts or with alkalis or ordinary dirt or rust can give violent decomposition.

SECTION VI. HEALTH HAZARD INFORMATION

TLV 1 ppm (See Sect. II)

The health hazard associated with normal usage is acute local damage by oxidation effects on tissue in contact with liquid or vapor, especially of the eyes, skin, and upper respiratory systems. Concentrations in air above 75 ppm are too irritating to be tolerated. Short exposure to very high airborne concentration can be lethal from damage to the respiratory system. The effects of contact with tissues can range from irritation or blistering to necrosis, depending on conditions. Do not ingest! FIRST AID:

Eye contact: Immediately flush with plenty of running water for 15 minutes, including under eyelids; then get prompt medical attention.

Skin contact: Remove contaminated clothing under a safety shower. Wash affected skin area thoroughly with water. Contact a physician if redness or skin burn is apparent. (Immerse contaminated clothing in water; launder before allowing to dry out.)

Inhalation: Remove to fresh air. Contact a physician immediately.

Ingestion: Immediately give much water to drink to dilute; encourage vomiting. Give lukewarm water freely and encourage belching if there is evidence of distention. Contact physician.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Prepare in advance for emergency situations! A source plenty of water for dilution and flushing of spills must be readily available as well as drainage and a holding area free from incompatible chemicals.

Safety personnel should be given prompt notification of significant spills.

Immediately flush spills with copious amounts of water, flush away from combustible materials. Provide maximum ventilation; eliminate sources of ignition. evacuate area except for clean-up personnel, who must use full protective equipment (see Sect. VIII). Flush to holding area for dilution with more water and/or the decomposition of H_2O_2.

DISPOSAL: Follow Federal, State and local regulations for disposal. Small spills can be highly diluted with water and flushed to the drain.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general ventilation and local exhaust ventilation to meet TLV requirements. Local exhaust ventilation and/or hoods should be used where mist or vapors may be generated. Self-contained breathing apparatus must be available for emergency use.

Prevent contact with the skin by the use (as required) of boots, protective clothing, and gloves which are impermeable to, and insoluble in H_2O_2 (polyesters which are antistatic treated, chloroprene, PVC or polyethylene have been recommended).

Chemical safety goggles and/or face shield must be used for eye protection. An eyewash station and safety shower must be readily available near use or storage area.

Provide special training to employees working with H_2O_2 on body protection, emergency procedures and first aid.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in original containers (or in an approved container of compatible material) in a cool, clean, fire resistant area away from combustible materials, catalytic metals and compounds, direct sunlight, and sources of heat. A source of ample water must be available for handling spills. Protect containers from physical damage and from contamination. Do not return material to storage container after removal! Ventilation must be good. Containers must be covered and vented. Workers handling H_2O_2 must be specially trained for the assignment. Procedures must maintain the high purity of stored material. Prevent contact with combustible materials. All equipment used to handle hydrogen peroxide must be of approved composition and properly cleaned and passivated before use.

DOT Classification - OXIDIZER (yellow label)

DATA SOURCE(S) CODE: 1,2,4-9, 12,16,20

APPROVALS: MIS, CRD	J. M. Nielson
Industrial Hygiene and Safety	[signature]
Corporate Medical Staff	George F. Martelton MD

MATERIAL SAFETY DATA SHEET

UNION CARBIDE

EFFECTIVE DATE: MAY 1, 1985

Union Carbide Corporation urges the customer receiving this Material Safety Data Sheet to study it carefully to become aware of hazards, if any, of the product involved. In the interest of safety you should (1) notify your employees, agents, and contractors of the information on this sheet, (2) furnish a copy to each of your customers for the product, and (3) request your customers to inform their employees and customers as well.

I - IDENTIFICATION

PRODUCT NAME:	ISOPROPANOL, ANHYDROUS		
CHEMICAL NAME:	Isopropyl Alcohol	CHEMICAL FAMILY:	Alcohols
FORMULA:	$(CH_3)_2CHOH$	MOLECULAR WEIGHT:	60.10
SYNONYMS:	Isopropyl alcohol; 2-propanol; dimethyl carbinol		
DEPARTMENT OF TRANSPORTATION	Hazard Classification Shipping Name	Flammable Liquid Isopropanol	
CAS # 67-63-0	CAS NAME	2-Propanol	

II - PHYSICAL DATA

BOILING POINT, 760 mm Hg	82.26°C (180.07°F)	FREEZING POINT	-88.5°C (-127.3°F)
SPECIFIC GRAVITY (H_2O = 1)	0.7864 at 20/20°C	VAPOR PRESSURE at 20°C	33 mm Hg
VAPOR DENSITY (air = 1)	2.07	SOLUBILITY IN WATER, % by wt.	Complete at 20°C
PERCENT VOLATILES BY VOLUME	100	EVAPORATION RATE (Butyl Acetate = 1)	2.88
APPEARANCE AND ODOR	Colorless liquid; characteristic odor		

III - INGREDIENTS

MATERIAL	%	TLV	HAZARD
Isopropanol	~100	400 ppm	Eye irritant; Flammable

IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT	53°C, Tag Closed Cup, ASTM D 56; 63°F, Tag Open Cup, ASTM D 1310			
FLAMMABLE LIMITS IN AIR, % by volume	LOWER	2.0	UPPER	12.7 at 200°F
EXTINGUISHING MEDIA	Use water spray, carbon dioxide, dry chemical, alcohol-type, or universal-type foams applied by manufacturers' recommended techniques.			
SPECIAL FIRE FIGHTING PROCEDURES	Use self-contained breathing apparatus and protective clothing.			
UNUSUAL FIRE AND EXPLOSION HAZARDS	Vapors form from this product and may travel or be moved by air currents and ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equip., static discharges, or other ignition sources at locations distant from handling point.			

EMERGENCY PHONE NUMBER • 304/744-3487 • This number is available days, nights, weekends, and holidays.

V. HEALTH HAZARD DATA

TLV AND SOURCE:

400 ppm, ACGIH 1984-5; OSHA 29 CFR, para. 1910.1000, Table Z-1

EFFECTS OF ACUTE OVEREXPOSURE

SWALLOWING	Slightly toxic. Ingestion of a large quantity may cause drowsiness and loss of consciousness. Stomach cramps, pain, nausea, vomiting, and diarrhea may also occur.
SKIN ABSORPTION	No evidence of adverse effects from available information.
INHALATION	Low concentrations may cause mild irritation of eyes, nose, and throat. Concentrations above the TLV may result in headache and drowsiness.
SKIN CONTACT	Prolonged contact may cause drying and cracking of skin.
EYE CONTACT	Causes slight to moderate irritation, with possible corneal injury.

EFFECTS OF REPEATED OVEREXPOSURE

No evidence of adverse effects from available information.

OTHER HEALTH HAZARDS

None currently known.

EMERGENCY AND FIRST AID PROCEDURES

SWALLOWING	Give two glasses of water and induce vomiting. If a significant quantity has been swallowed, get medical attention promptly.
SKIN	Remove contaminated clothing and flush skin with water.
INHALATION	Remove to fresh air. If breathing stops, give artificial respiration and get medical attention as soon as possible.
EYES	Flush eyes immediately with large quantities of water. Get medical attention.

NOTES TO PHYSICIAN

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition.

VI - REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID	
UNSTABLE	STABLE		Heat; sparks; flame
	X		

INCOMPATIBILITY (materials to avoid)	Avoid concentrated nitric and sulfuric acids, strong oxidizers, aldehydes, halogens, and halogen compounds.
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS	Burning may produce carbon monoxide and/or carbon dioxide.

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID	
May Occur	Will Not Occur		None
	X		

VII - SPILL OR LEAK PROCEDURE

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	Extinguish and do not turn on any ignition source until area is determined to be free from explosion or fire hazards. Collect large spills for disposal. Flush small spills with water.
WASTE DISPOSAL METHOD	Incinerate in a furnace where permitted under appropriate Federal, State, and local regulations. See Section IX.

VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION	Self-contained breathing apparatus in high concentrations.		
VENTILATION	This product should be confined within closed equipment, in which case general (mechanical) room ventilation should be satisfactory. Special, local ventilation is needed at points where vapors can be expected to escape to the workplace air.		
PROTECTIVE GLOVES	Butyl	EYE PROTECTION	Monogoggles
OTHER PROTECTIVE EQUIPMENT	Eye bath; safety shower		

IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Keep away from heat, sparks, and flame. Avoid contact with eyes. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

FOR INDUSTRY USE ONLY

OTHER PRECAUTIONS

At very low concentrations in water (~10 ppm), isopropanol is readily biodegradable in a wastewater treatment plant.

LUBRICATION ENGINEERS, INC.
PO BOX 7128 FORT WORTH, TX 76111

MATERIAL SAFETY DATA SHEET

****************************** SECTION I ******************************
PRODUCT IDENTIFICATION

Supplier:
Lubrication Engineers, Inc.
3851 Airport Freeway
Fort Worth, TX 76111

Emergency Telephone No.:
(817) 834-6321

Chemical Name and Synonyms:
Not Applicable

Trade Name and Synonyms:
4701 Monolec Industrial Lubricant

Chemical Family:
Petroleum Hydrocarbon

Formula:
Not Applicable

**************************** SECTION II ****************************
TYPICAL CHEMICAL AND PHYSICAL PROPERTIES

Appearance:
Red/orange lubricant

Viscosity: At 210 F, SUS
Not applicable

At 100 C, CS
Not applicable

Odor:
Lube oil odor

Viscosity: At 100 F, SUS
Not applicable

At 40 C, CS
Not applicable

Relative Density: (Air=1)
>1

Solubility in Water:
Negligible

PH: 6-8

Melting Point:
450 F

Pour Point:
Not applicable

Boiling Point: F
>500

Flash Point: F (Method)
475 F C.O.C.

Vapor Pressure: (MM HG 60F)
<5

Specific Gravity: (H20=1)
Approx. .85

****

SECTION III
INGREDIENTS

	Wt PCT (Approx)	TLV	Oral LD50	Dermal LD50
Hazardous Ingredients:				
Barium compounds	<1.0	Unknown	Unknown	Unknown
Antimony compounds	4.0-7.0	Unknown	Unknown	Unknown
Barium dinonlynaphthalene sulfonate (rust inhibitor)	<1.0	Unknown	3.5ml/kg Rat	2ml/kg Rabbit
Antimony dialkyldithiocarbamate (multi-functional additive)	4.0-7.0	0.5 mg/m3 as Sb	>16,000 mg/kg Rat	16000mg/kg Rabbit
Oil Mist (Mineral)	>80.0	5mg/m3 TWA	Unknown	Unknown
Non-Hazardous Ingredients:				
Additives and/or Other Ingreds.				

The precise ingredients, their C.A.S. Numbers, and percent of composition are proprietary to Lubrication Engineers, Inc. This material is an automotive/industrial lubricant with a low order of toxicity and irritancy.

SECTION IV
FIRE AND EXPLOSION HAZARD DATA

Flash Point: F (Method Used)
475 F (C.O.C.)

Flammable Limits: LEL UEL
Unknown

Extinguishing Media:
Foam, dry chemical, water fog, or carbon dioxide.

Special Fire Fighting Procedures:
Do not direct a solid stream of water into fire. Treat as a petroleum oil fire. Respiratory protection required for fire fighting personnel.

Unusual Fire and Explosion Hazards:
None

SECTION V
HEALTH HAZARD DATA

Threshold Limit Value: (If Established)
Not established. Oil mist = 5 mg/m3.

Effects of Overexposure:
May cause mild dermatitis upon prolonged contact. Expected to be an eye and lung irritant. No components are listed on OSHA, I.A.R.C., or N.T.P. lists for carcinogens.

SECTION VI
EMERGENCY AND FIRST AID PROCEDURES

Eye Contact:
Flush immediately with water until irritation subsides.

Skin Contact:
Wash affected skin area with mild soap and water.

Ingestion:
Do not induce vomiting. Contact a physician.

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. Contact a physician.

SECTION VII
REACTIVITY DATA

Stability: (Thermal, Light, Etc.)
Stable

Conditions to Avoid:
Contact with nuclear radiation and strong oxidizing materials.

compatibility: (Materials to Avoid)
Strong oxidizing materials.

Hazardous Decomposition Products:
Dense smoke; oxides of C, S, N, Sb; Ba compounds; hydrogen sulfide.

Hazardous Polymerization:
Will not occur.

SECTION VIII
SPILL OR LEAK PROCEDURES

Steps To Be Taken In Case Material Is Released Or Spilled:
Remove all sources of ignition. Treat as a petroleum oil spill.

Waste Disposal Method:
Incinerate where permitted under Federal, State and local laws. Used petroleum products may be recycled through re-refining processes.

SECTION IX
SPECIAL PROTECTION INFORMATION

Eye Protection:
Sufficient to avoid direct contact.

'n Protection:
Protective neoprene or plastic gloves may be desired.

Respiratory Protection:
Usually not needed.

Ventilation:
Usually not needed in open, unconfined areas.

Other:
Not needed.

SECTION X
SPECIAL PRECAUTIONS

Close containers when not in use. Keep away from heat, open flames and strong oxidants. Avoid eye contact and prolonged skin contact. Avoid breathing oil mists. Wash thoroughly after handling.

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Form Approved
Budget Bureau No. 44-R1387
Approval Expires

Form No. LSB-005-4
May 1969

U.S. DEPARTMENT OF LABOR

WAGE AND LABOR STANDARDS ADMINISTRATION
Bureau of Labor Standards

MATERIAL SAFETY DATA SHEET

SECTION I

MANUFACTURER'S NAME White & Bagley of Michigan, Inc.	EMERGENCY TELEPHONE NO. 617-791-3201
ADDRESS (Number, Street, City, State, and ZIP Code) 7131 Westfield, Detroit, Michigan 48204	617-987-2217 E.F.Ahern (nights)
CHEMICAL NAME AND SYNONYMS NA (Not Applicable)	TRADE NAME AND SYNONYMS W&B Grinding Concentrate 1500
CHEMICAL FAMILY NA	FORMULA NA

SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
None		

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	equiv. to water	SPECIFIC GRAVITY (H_2O=1)	1.3
VAPOR PRESSURE (mm Hg.)	equiv. to water	PERCENT VOLATILE BY VOLUME (%)	57
VAPOR DENSITY (AIR=1)	approx. 2	EVAPORATION RATE (water =1)	1
SOLUBILITY IN WATER			

APPEARANCE AND ODOR concentrate: yellow-orange liquid - odor cinnamon
diluted: green colored solution. No characteristic odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) NA	FLAMMABLE LIMITS NA	Lel	Uel

EXTINGUISHING MEDIA NA

SPECIAL FIRE FIGHTING PROCEDURES NA

UNUSUAL FIRE AND EXPLOSION HAZARDS Residue-laden cloths should be discarded in proper manner. Residues increase combustibility.

THRESHOLD LIMIT VALUE (diluted form) Not listed by ACGIH*. Suggest using 5 mg/cu. meter set by ACGIH for mineral oil mists -- which is a visible concentration

EFFECTS OF OVEREXPOSURE

None known

EMERGENCY AND FIRST AID PROCEDURES

Skin: Wash off with soap and water

Eye: Flush with water for 15 minutes

*American Conference of Governmental Industrial Hygienists

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)* Oil; Mineral Acids

HAZARDOUS DECOMPOSITION PRODUCTS Oxides of nitrogen if mineral acids are added

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Flush with water and absorb

WASTE DISPOSAL METHOD Dilute with large amounts of water and dispose in accordance with local, state and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* None

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)* Yes	OTHER

PROTECTIVE GLOVES No	EYE PROTECTION Goggles when dispensing concentrate
OTHER PROTECTIVE EQUIPMENT No	

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Store away from area where mineral acids are stored

OTHER PRECAUTIONS None

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U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: The White & Bagley Company	EMERGENCY TELEPHONE NO.: 617-791-3201
ADDRESS (Number, Street, City, State, and ZIP Code): 150 Worcester Center Blvd., Worcester, MA 01608	617-987-2217 E. F. Ahern (nights)
CHEMICAL NAME AND SYNONYMS: NA (Not Applicable)	TRADE NAME AND SYNONYMS: W&B Grinding Concentrate 1500-3226
CHEMICAL FAMILY: NA	FORMULA: NA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
none		
Contains No Nitrites		
Contains Triethanolamine soaps of fatty acids Triethanolamine Borate		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	equiv. to water	SPECIFIC GRAVITY ($H_2O=1$)	1.09
VAPOR PRESSURE (mm Hg.)	equiv. to water	PERCENT, VOLATILE BY VOLUME (%)	58
VAPOR DENSITY (AIR=1)	approx. 2	EVAPORATION RATE (Water =1)	1
SOLUBILITY IN WATER	complete		
APPEARANCE AND ODOR	Concentrate: yellow orange liquid - sweet odor Diluted: green colored solution - no characteric odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): NA	FLAMMABLE LIMITS: NA	Lel	Uel
EXTINGUISHING MEDIA: NA			
SPECIAL FIRE FIGHTING PROCEDURES: NA			
UNUSUAL FIRE AND EXPLOSION HAZARDS: None			

SECTION V - HEALTH HAZARD DATA

..D LIMIT VALUE (diluted form) Not listed by ACGIH* Suggest using 5 mg/cu. meter set by ACGH for mineral oil mists--which is a visible concentration.

..S OF OVEREXPOSURE

None known

EMERGENCY AND FIRST AID PROCEDURES

Skin: Wash off with soap and water

Eye: Flush with water for 15 minutes

*American Conference of Governmental Industrial Hygienists

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	-

INCOMPATABILITY (Materials to avoid)

Oil, mineral acids

HAZARDOUS DECOMPOSITION PRODUCTS

CO_2 if combustion takes place

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

..EPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Flush with water and absorb

WASTE DISPOSAL METHOD

Dilute with large amounts of water and dispose of in accordance with local, state and federal regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

None

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General) Yes	OTHER

PROTECTIVE GLOVES No	EYE PROTECTION goggles when dispensing concentrate

OTHER PROTECTIVE EQUIPMENT No

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Store away from area where mineral acids are stored

..THER PRECAUTIONS

None

GPO 934-110

APPENDIX B

M-AREA SUPPORTING DATA

B.1 M-Area Ground Water Monitoring Data

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 1A
North SRP Coordinate: 101,833.7
South SRP Coordinate: 48,468.5
Casing Elevation (ft): 352.5

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	6/23/86	7/17/86	10/29/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	238.5	237.0	236.9	236.1
Temperature	°C	19.2	19.3	19.6	19.2
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		3.9	4.31	4.43	4.32
Specific Conductance	µmhos/cm	43.0	42.5	46.0	42.4
Total Organic Carbon	mg/L	2.0	1.0	<1.0	<1.3
Total Organic Halogen	mg/L	0.497	0.23	0.22	0.18
WATER QUALITY PARAMETERS					
Chloride	mg/L	2.3	-	-	3.4
Iron	mg/L	0.155	-	-	0.019
Manganese	mg/L	0.019	-	-	0.006
Phenols	mg/L	<0.002	-	-	<0.002
Sodium	mg/L	3.84	3.62	-	2.98
Sulfate	mg/L	10	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.009	-	0.008
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	<0.1	-	-	<0 12
Lead	mg/L	0.037	0.074	0.035	0.02
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	3.6	1.83	2.7	2.7
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	<0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	4.0	-	4.0	3.9
Gross Beta	pCi/L	4.0	-	4.1	2.8
Radium	pCi/L	6.0	-	5.2	4.7
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	198	228	163
Tetrachloroethylene	µg/L	-	81.6	90	47
1,1,1-Trichloroethane	µg/L	-	-	45.1	<5.0
Trans-1,2-Dichloroethylene	µg/L	-	-	-	31
1,1-Dichloroethylene	µg/L	-	-	-	<5.0
Nickel	mg/L	0.013	<0.004	<0.004	<0.004
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.039
Zinc	mg/L	-	-	-	0.033
Total Phosphate	mg/L	-	-	-	0.032
Aluminum	mg/L	-	-	-	0.138

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 1A
North SRP Coordinate: 101,824.2
East SRP Coordinate: 48,486.1
Casing Elevation (ft): 353.4

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/13/87	4/16/87	7/9/87	11/1/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	235.1	234.71	235.0	235.2
Temperature	°C	18.2	18.7	19.4	19.8
Total Dissolved Solids	mg/L	22	30	<5	<5.0
INDICATOR PARAMETERS					
pH		4.16(4)	4.45(4)	4.4	4.28(7)
Specific Conductance	µmhos/cm	42(4)	45.9(4)	45	45.4(7)
WATER QUALITY PARAMETERS					
Chloride	mg/L	2.7	2.7	3.2	3.7
Iron	mg/L	0.028(2)	0.077	0.028	0.061
Manganese	mg/L	0.005	0.008	0.007	0.011
Phenols	mg/L	<0.002	<0.002	<0.005	<0.005
Sodium	mg/L	3.03(2)	3.17	3	3.06
Sulfate	mg/L	<3	<3	10.8	<5.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.008(2)	0.01	0.009	<0.004
Cadmium	mg/L	<0.002	<0.002	<0.002	0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	<0.1	0.11	<0.10	0.25
Lead	mg/L	0.026	0.013	0.01	0.011
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	2.6	2.95	4.64	5.27
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	<0.002
Endrin	µg/L	<0.10	-	<0.10	<0.10
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.50	-	-	-
Toxaphene	µg/L	<1.0	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2		-	-
Gross Alpha	pCi/L	3.2	2.7	2.5	8.8
Gross Beta	pCi/L	5.3	<2	2.4	5.9
Radium	pCi/L	4.8	3.3	3.8	5.2
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	165	140	84.4	60
Tetrachloroethylene	µg/L	36.2	30.1	20.2	9.5
1,1,1-Trichloroethane	µg/L	<1	<1	<5	<1
Trans-1,2-Dichloroethylene	µg/L	-	19	<5	8.7
1,1-Dichloroethylene	µg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	<0.1	<1.00	<0.10	<1.0
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	0.052	0.041	0.033	0.039
Zinc	mg/L	0.036	0.044	0.018	0.228
Total Phosphate	mg/L	<0.020	0.03	0.08	0.03
Aluminum	mg/L	0.175(2)	0.234	0.23	0.196
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	0.37	-	-	-
Beryllium	mg/L	<0.001	-	-	-
Calcium	mg/L	0.684	-	-	-
Magnesium	mg/L	0.398	0.008	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.44	-	-	-
Carbon Tetrachloride	µg/L	<1.0	<5.00	<1.00	<1
Chloroform	µg/L	<1	<1	<1	<5
Chlorobenzene	µg/L	-	<5	<5	<5
1,1-Dichloroethane	µg/L	-	<5	<5	<5
1,2-Dichloroethane	µg/L	-	<1	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	<10
Vinyl Chloride	µg/L	-	<10	<10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 2A
North SRP Coordinate: 102,028.3
South SRP Coordinate: 48,746.0
Casing Elevation (ft): 351.7

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/17/86	10/30/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	236.5	238.1	237.3	236.4
Temperature	°C	18.8	19.2	19.6	17.9
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		3.7	4.15	4.19	4.06
Specific Conductance	µmhos/cm	48	81.7	81.1	75
Total Organic Carbon	mg/L	<1.0	1.0	<1.0	<1.0
Total Organic Halogen	mg/L	0.154	0.152	0.419	631
WATER QUALITY PARAMETERS					
Chloride	mg/L	2.9	-	-	3.9
Iron	mg/L	0.055	-	-	0.011
Manganese	mg/L	0.01	-	-	0.013
Phenols	mg/L	<0.002	-	-	<0.002
Sodium	mg/L	2.4	2.31	-	2.63
Sulfate	mg/L	<5	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.02	-	0.016
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	<0.1	-	-	<0.1
Lead	mg/L	0.021	0.052	0.083	0.03
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	3.99	6.22	5.2	5.2
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	<0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	15	-	30.4	
Gross Beta	pCi/L	8	-	14.6	
Radium	pCi/L	4	-	22.1	
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	158.3	336	290
Tetrachloroethylene	µg/L	-	42.7	192	277
1,1,1-Trichloroethane	µg/L	-	-	39.2	<25
Trans-1,2-Dichloroethylene	µg/L	-	-	-	19
1,1-Dichloroethylene	µg/L	-	-	-	<25
Nickel	mg/L	0.005	0.028	<0.004	0.005
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.022
Zinc	mg/L	-	-	-	0.028
Total Phosphate	mg/L	-	-	-	0.102
Aluminum	mg/L	-	-	-	0.753

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well:	MSB 2A
North SRP Coordinate:	102,028.3
East SRP Coordinate:	48,746.0
Casing Elevation (ft):	351.7

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/16/87	7/9/87	10/11/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	236.5	236.5	335.6	235.0
Temperature	°C	17.8	17.9	18.6	17.3
Total Dissolved Solids	mg/L	50	32	<5	30
INDICATOR PARAMETERS					
pH		4.04(4)	4.33(4)	4.3	4.00(4)
Specific Conductance	µmhos/cm	66(4)	56.5(5)	56	52.5(4)
WATER QUALITY PARAMETERS					
Chloride	mg/L	3.5	3.7	4	3.3
Iron	mg/L	0.017	0.035	0.01	0.704
Manganese	mg/L	0.012	0.008	0.006	0.006
Phenols	mg/L	<0.002	<0.002	<0.005	<0.005
Sodium	mg/L	2.94	2.69	2.21	2.29
Sulfate	mg/L	7.5	<0.003	11.4	<5.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.015	0.012	0.011	0.01
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	0.005	<0.004	<0.004
Fluoride	mg/L	<0.1	0.11	<0.1	0.2
Lead	mg/L	0.032	0.026	0.019	0.014
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	4.43	3.73	5.21	4.92
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	<0.002
Endrin	µg/L	<0.1	-	<0.1	<0.1
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.5	-	-	-
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	10.8	10.5	6.5	5.9
Gross Beta	pCi/L	9.6	6.0	6.7	5.0
Radium	pCi/L	13.2	4.9	7.6	9.0
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	425	600	488	212
Tetrachloroethylene	µg/L	355	632	2137	501
1,1,1-Trichloroethane	µg/L	1	14	34	20
Trans-1,2-Dichloroethylene	µg/L	-	<5	12	<5
1,1-Dichloroethylene	µg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	<0.1	<0.1	<1.0	<1.0
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	0.059	0.072	0.083	0.084
Zinc	mg/L	0.03	0.025	0.024	0.052
Total Phosphate	mg/L	0.070	0.07	0.08	0.1
Aluminum	mg/L	0.736	0.703	0.737	0.61
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	0.279	-	-	-
Beryllium	mg/L	<0.001	-	-	-
Calcium	mg/L	2.11	-	-	-
Magnesium	mg/L	0.66	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.64	-	-	-
Carbon Tetrachloride	µg/L	7.41	<1.00	<1.00	<5
Chloroform	µg/L	13	<1	<1	<5
Chlorobenzene	µg/L	-	<5	<5	<5
1,1-Dichloroethane	µg/L	-	<5	<5	<5
1,2-Dichloroethane	µg/L	-	26	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	<10
Vinyl Chloride	µg/L	-	<10	<10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 3A
North SRP Coordinate: 102,189.9
South SRP Coordinate: 48,553.7
Casing Elevation (ft): 359

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/17/86	10/29/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	237.0	238.2	237.1	-
Temperature	°C	20.4	20.8	21.6	20.5
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		4.0	6.22	4.26	4.38
Specific Conductance	µmhos/cm	341	599.5	278.2	126
Total Organic Carbon	mg/L	2.0	5.0	30.0	5.1
Total Organic Halogen	mg/L	79.8	176.1	225.8	211.4
WATER QUALITY PARAMETERS					
Chloride	mg/L	4.6	-	-	6.7
Iron	mg/L	0.142	-	-	0.101
Manganese	mg/L	0.385	-	-	0.155
Phenols	mg/L	0.004	-	-	0.004
Sodium	mg/L	28.2	103	-	11.1
Sulfate	mg/L	<5	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.076	-	0.08
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	0.34	-	-	0.64
Lead	mg/L	0.025	<0.005	0.006	0.024
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	37.5	55	20.5	19
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	0.22	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	92	-	70.6	-
Gross Beta	pCi/L	44	-	23.8	-
Radium	pCi/L	92	-	49.9	-
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	57,075	65,400	89,200
Tetrachloroethylene	µg/L	-	220,615	251,100	211,200
1,1,1-Trichloroethane	µg/L	-	-	<5,000	<5,000
Trans-1,2-Dichloroethylene	µg/L	-	-	-	<5,000
1,1-Dichloroethylene	µg/L	-	-	-	<5,000
Nickel	mg/L	0.059	0.024	0.026	0.032
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	0.006	-	-	<0.005
Copper	mg/L	-	-	-	0.02
Zinc	mg/L	-	-	-	0.12
Total Phosphate	mg/L	-	-	-	0.232
Aluminum	mg/L	-	-	-	4.37

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 3A
North SRP Coordinate: 102,189.9
East SRP Coordinate: 48,553.7
Casing Elevation (ft): 359

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/20/87	8/4/87	10/22/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	-	-	-	-
Temperature	°C	21.2	21.4	21.7	23.8
Total Dissolved Solids	mg/L	166	858	1058	1364
INDICATOR PARAMETERS					
pH		4.24(4)	6.74(4)	5.6	6.61(5)
Specific Conductance	µmhos/cm	225(4)	1217(4)	1800	1990(5)
WATER QUALITY PARAMETERS					
Chloride	mg/L	6.8	19.9	26.5	16.3
Iron	mg/L	0.193	0.042	0.082	0.23
Manganese	mg/L	0.157	0.267	0.623	4.26
Phenols	mg/L	<0.002	0.009	<0.005	0.006
Sodium	mg/L	14.3	260	274	4060
Sulfate	mg/L	5	85.8	120	124
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	0.002	<0.002
Barium	mg/L	0.074	0.026	0.072	0.063
Cadmium	mg/L	<0.002	<0.002	<0.002	0.002
Chromium	mg/L	0.007	<0.004	<0.004	0.007
Fluoride	mg/L	<0.1	0.43	0.6	0.54
Lead	mg/L	0.013	<0.006	<0.006	<0.006
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	21.8	116	47.8	151
Selenium	mg/L	<0.002	-	0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	0.02
Endrin	µg/L	<0.1	-	<0.1	<5.0
Lindane	µg/L	<0.10	-	-	<3.0
Methoxychlor	µg/L	<0.5	-	-	<25
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	30.4	<3.0	97.2	58.4
Gross Beta	pCi/L	19.3	79	130	119
Radium	pCi/L	29.2	4.1	15.7	15.4
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	10684	84800	91780	124600
Tetrachloroethylene	µg/L	127863	250000	99530	271670
1,1,1-Trichloroethane	µg/L	11	14	589	<5
Trans-1,2-Dichloroethylene	µg/L	-	<5	36	15
1,1-Dichloroethylene	µg/L	-	<5	2300	1360
Nickel	mg/L	0.048	0.04	0.051	0.234
Uranium	mg/L	<0.1	<0.1	<1.0	<1.0
Cyanide	mg/L	<0.005	0.032	0.019	0.037
Copper	mg/L	0.013	0.004	0.009	0.034
Zinc	mg/L	0.116	0.013	0.033	0.268
Total Phosphate	mg/L	0.030	0.04	<0.020	<0.020
Aluminum	mg/L	2.95	0.016	0.073	0.22
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	0.518	-	-	-
Beryllium	mg/L	<0.001	-	-	-
Calcium	mg/L	11.1	-	-	-
Magnesium	mg/L	3.06	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	7.26	-	-	-
Carbon Tetrachloride	µg/L	4.9	<1.00	11.6	<5
Chloroform	µg/L	<1	<1	43	<5
Chlorobenzene	µg/L	-	<5	26	<5
1,1-Dichloroethane	µg/L	-	<5	24	17
1,2-Dichloroethane	µg/L	-	<1	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	56625	85
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	1.2
Vinyl Chloride	µg/L	-	<10	83	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 4A
North SRP Coordinate: 101,993.4
South SRP Coordinate: 48,312.6
Casing Elevation (ft): 354.1

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/17/86	10/30/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	238.5	237.4	236.2	234.0
Temperature	°C	20.3	21.3	21.1	20.1
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		4.9	5.25	5.41	5.5
Specific Conductance	µmhos/cm	2500	3490	3304.8	3310
Total Organic Carbon	mg/L	2.0	2.0	2.0	2.4
Total Organic Halogen	mg/L	5.28	3.31	6.42	4.67
WATER QUALITY PARAMETERS					
Chloride	mg/L	14.2	-	-	12.5
Iron	mg/L	0.046	-	-	0.174
Manganese	mg/L	0.006	-	-	0.027
Phenols	mg/L	0.002	-	-	0.006
Sodium	mg/L	551	734	-	704
Sulfate	mg/L	266	-	466	504
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.02	-	0.015
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	0.2	-	-	0.12
Lead	mg/L	0.028	0.03	0.015	0.01
Mercury	mg/L	0.0002	-	-	0.0002
Nitrate (as N)	mg/L	260	330	320	294
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	0.003
Endrin	µg/L	0.22	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	16	-	85.3	88.3
Gross Beta	pCi/L	49	-	297	271
Radium	pCi/L	19	-	47.4	26.4
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	3,322	5,470	5,200
Tetrachloroethylene	µg/L	-	4,990	6,350	5,100
1,1,1-Trichloroethane	µg/L	-	-	<1,000	<5,000
Trans-1,2-Dichloroethylene	µg/L	-	-	-	<5,000
1,1-Dichloroethylene	µg/L	-	-	-	<5,000
Nickel	mg/L	<0.004	0.006	0.006	<0.004
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	-	-	-	<0.005
Copper	mg/L	-	-	-	0.008
Zinc	mg/L	-	-	-	<0.002
Total Phosphate	mg/L	-	-	-	0.107
Aluminum	mg/L	-	-	-	0.034

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 4A
North SRP Coordinate: 101,993.4
East SRP Coordinate: 48,312.6
Casing Elevation (ft): 354.1

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		2/4/87	4/16/87	8/4/87	10/11/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	234	234.1	234.4	233.9
Temperature	°C	19.5	21.2	21.9	19.7
Total Dissolved Solids	mg/L	2182	32	1690	1440
INDICATOR PARAMETERS					
pH		5.65(5)	5.96(4)	6.4	6.70(5)
Specific Conductance	µmhos/cm	2800(4)	2400(4)	1750	1920(5)
WATER QUALITY PARAMETERS					
Chloride	mg/L	4.7	2.9	9.5	7
Iron	mg/L	0.056	0.075	0.045	0.245
Manganese	mg/L	0.026	0.01	0.011	0.002
Phenols	mg/L	0.030	<0.002	<0.005	0.003
Sodium	mg/L	254	514	461	437
Sulfate	mg/L	11450	<3.0	228	135
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.014	0.007	0.005	<0.004
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	0.27	0.16	0.31	0.35
Lead	mg/L	0.007	<0.006	<0.006	0.007
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	238	120	74.6	160
Selenium	mg/L	0.006	-	0.006	0.003
Silver	mg/L	0.002	<0.002	0.002	<0.002
Endrin	µg/L	<0.1	-	0.5	<0.10
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.5	-	-	-
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	18.6	<3.0	72.4	18.6
Gross Beta	pCi/L	30.7	132	115	54.6
Radium	pCi/L	18.9	<1.0	4.8	3.8
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	4991	7040	2850	3122
Tetrachloroethylene	µg/L	4600	8520	2823	2394
1,1,1-Trichloroethane	µg/L	<1(142)	58	47	54
Trans-1,2-Dichloroethylene	µg/L	<5	<38	37	<5
1,1-Dichloroethylene	µg/L	553	550	620	138
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	<0.1	<1.0	<1.0	<1.0
Cyanide	mg/L	<0.005	<0.005	0.006	0.014
Copper	mg/L	0.118	0.157	0.067	0.022
Zinc	mg/L	0.042	0.022	0.016	0.037
Total Phosphate	mg/L	0.052	0.11	0.11	0.16
Aluminum	mg/L	<0.020	0.021	0.047	<0.020
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	1.45	-	-	-
Beryllium	mg/L	<0.005	-	-	-
Calcium	mg/L	4.31	-	-	-
Magnesium	mg/L	1.61	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	6.0	-	-	-
Carbon Tetrachloride	µg/L	72.5(<5)	<1.00	<1.00	<5
Chloroform	µg/L	300(<5)	200(<5)	<1	<5
Chlorobenzene	µg/L	52	<43	<5	<5
1,1-Dichloroethane	µg/L	<5	<14	11	<5
1,2-Dichloroethane	µg/L	<5	<1	<1	<1
1,1,2-Trichloroethane	µg/L	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	<5	<10	40	<10
Vinyl Chloride	µg/L	<5	<10	10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 5A
North SRP Coordinate: 101,971.5
East SRP Coordinate: 46,998.8
Casing Elevation (ft): 344.6

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/22/86	11/2/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	236.5	235.4	234.7	232.7
Temperature	°C	18.4	18.6	18.7	18.4
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		5.48	5.12	5.21	4.84
Specific Conductance	µmhos/cm	99.5	105.4	161.6	192
Total Organic Carbon	mg/L	1.0	1.0	<1.0	2.23
Total Organic Halogen	mg/L	0.044	0.06	0.08	0.076
WATER QUALITY PARAMETERS					
Chloride	mg/L	4	-	-	8.0
Iron	mg/L	0.015	-	-	0.031
Manganese	mg/L	0.005	-	-	0.011
Phenols	mg/L	<0.002	-	-	0.002
Sodium	mg/L	13.1	31.3	-	30.3
Sulfate	mg/L	<5	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.005	-	0.007
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	<0.1	-	-	0.13
Lead	mg/L	<0.005	0.012	<0.006	0.011
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	8.3	10	8.25	18.5
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	<0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	<2.0	-	<3.0	10.3
Gross Beta	pCi/L	4	-	16.6	33
Radium	pCi/L	3	-	2.5	1.9
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	11.2	14.3	16.0
Tetrachloroethylene	µg/L	-	39.7	45.7	57.0
1,1,1-Trichloroethane	µg/L	-	-	22.4	27
Trans-1,2-Dichloroethylene	µg/L	-	-	-	<5.0
1,1-Dichloroethylene	µg/L	-	-	-	9
Nickel	mg/L	<0.004	0.004	0.005	0.005
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.01
Zinc	mg/L	-	-	-	0.033
Total Phosphate	mg/L	-	-	-	0.042
Aluminum	mg/L	-	-	-	<0.02

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 8A
North SRP Coordinate: 101,971.5
East SRP Coordinate: 46,998.8
Casing Elevation (ft): 344.6

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/20/87	7/27/87	10/17/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	231.7	229.2	231.7	231.1
Temperature	°C	17.9	18.9	19.0	19.5
Total Dissolved Solids	mg/L	178	166	180	74
INDICATOR PARAMETERS					
pH		4.98(4)	5.32(4)	5.13(3)	5.18(4)
Specific Conductance	µmhos/cm	212(5)	226(4)	198(3)	180(4)
WATER QUALITY PARAMETERS					
Chloride	mg/L	5.6	5.6	5.8	4.27
Iron	mg/L	0.021	0.153	0.042	0.081
Manganese	mg/L	0.013	0.016	0.016	0.04
Phenols	mg/L	<0.002	<0.005	<0.005	<0.005
Sodium	mg/L	33.8	33.3	40.7	34.6
Sulfate	mg/L	<3	<3.0	<5.0	<5.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.01	0.01	0.01	0.011
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	<0.1	0.11	0.16	0.2
Lead	mg/L	0.006	0.007	0.007	0.009
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	21.9	23.9	23.4	19
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	<0.002
Endrin	µg/L	<0.1	-	<0.10	<0.10
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.5	-	-	-
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	12.5	<3.0	3.6	<3.0
Gross Beta	pCi/L	58.8	85	70.4	<2
Radium	pCi/L	2.7	2.6	3.4	<1
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	9.97	18.8	16	12
Tetrachloroethylene	µg/L	41.2	62.3	32	32
1,1,1-Trichloroethane	µg/L	20	30	23	14
Trans-1,2-Dichloroethylene	µg/L	-	<5	<5	9.7
1,1-Dichloroethylene	µg/L	-	<5	<1	<5
Nickel	mg/L	0.004	0.005	<0.004	<0.004
Uranium	mg/L	<0.1	<0.1	<0.1	<1.0
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	0.005	0.008	0.006	0.006
Zinc	mg/L	0.022	0.025	0.017	0.06
Total Phosphate	mg/L	0.030	0.05	0.11	0.03
Aluminum	mg/L	0.022	<0.020	0.033	0.034
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	0.45	-	-	-
Beryllium	mg/L	<0.001	-	-	-
Calcium	mg/L	3.14	-	-	-
Magnesium	mg/L	0.639	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.85	-	-	-
Carbon Tetrachloride	µg/L	<1	<1.00	<1.0	<5
Chloroform	µg/L	<1	<1	<1	<5
Chlorobenzene	µg/L	-	<5	<1	<5
1,1-Dichloroethane	µg/L	-	8	9(<1)	<5
1,2-Dichloroethane	µg/L	-	<1	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	<10
Vinyl Chloride	µg/L		<10	<10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 6A
North SRP Coordinate: 101,133.8
East SRP Coordinate: 46,319.9
Casing Elevation (ft): 343.9

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/21/86	11/1/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	235.3	234.5	233.1	231.1
Temperature	°C	19.2	18.9	18.9	18.3
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		4.6	5.05	5.25	4.94
Specific Conductance	µmhos/cm	35.4	33.1	33.2	36.6
Total Organic Carbon	mg/L	<1.0	3	<1.0	5.4
Total Organic Halogen	mg/L	<0.0065	<0.005	<0.005	<0.005
WATER QUALITY PARAMETERS					
Chloride	mg/L	5.2	-	-	6.8
Iron	mg/L	0.031	-	-	0.04
Manganese	mg/L	0.005	-	-	0.005
Phenols	mg/L	<0.002	-	-	<0.002
Sodium	mg/L	5.18	4.39	-	5.92
Sulfate	mg/L	<5	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.005	-	<0.004
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	0.1	-	-	<0.1
Lead	mg/L	0.01	0.014	<0.006	0.009
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	<0.5	<0.5	<0.5	0.23
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	<2.0	-	2.0	1.2
Gross Beta	pCi/L	<3.0	-	<2.0	2
Radium	pCi/L	2	-	1.2	<1.0
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	<1.0	<1.0	<5.0
Tetrachloroethylene	µg/L	-	2.6	<1.0	<5.0
1,1,1-Trichloroethane	µg/L	-	-	<1.0	<5.0
Trans-1,2-Dichloroethylene	µg/L	-	-	-	-
1,1-Dichloroethylene	µg/L	-	-	-	<5.0
Nickel	mg/L	<0.004	<0.004	<0.004	<0.006
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.006
Zinc	mg/L	-	-	-	0.003
Total Phosphate	mg/L	-	-	-	0.047
Aluminum	mg/L	-	-	-	<0.02

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 6A
North SRP Coordinate: 101,133.6
East SRP Coordinate: 46,319.9
Casing Elevation (ft): 343.9

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/20/87	7/9/87	10/17/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	230.4	223.3	230.8	231.1
Temperature	°C	18.1	19.4	18.6	19.4
Total Dissolved Solids	mg/L	6	18	8	<5
INDICATOR PARAMETERS					
pH		4.76(4)	5.24(5)	5.1	5.22(5)
Specific Conductance	µmhos/cm	35.7(4)	34.2(5)	37	40(5)
WATER QUALITY PARAMETERS					
Chloride	mg/L	5.1	4.5	6	5.36
Iron	*mg/L*	0.038	0.062	0.046	0.382
Manganese	mg/L	0.005	0.006	0.004	0.008
Phenols	mg/L	0.004	<0.005	<0.005	<0.005
Sodium	mg/L	6.06	5.4	5.23	5.29
Sulfate	mg/L	<3	<3.0	<5.0	11.31
DRINKING WATER PARAMETERS					
Arsenic	*mg/L*	<0.002	-	<0.002	<0.002
Barium	mg/L	0.005	0.006	0.005	0.006
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	<0.1	0.1	<0.1	0.24
Lead	mg/L	0.007	0.012	0.008	0.009
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	*mg/L*	0.27	0.18	0.8	0.71
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	<0.002
Endrin	µg/L	<0.1	-	<0.10	<0.10
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.5	-	-	-
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	1.2	<3	1.9	<3
Gross Beta	pCi/L	1.7	2	1.9	3.1
Radium	pCi/L	<1.0	<1	0.7	<1
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	<1.00	<1.00	1.7	<1
Tetrachloroethylene	µg/L	1.07	<1.00	<5	<1
1,1,1-Trichloroethane	µg/L	<1	<1	<1	<1
Trans-1,2-Dichloroethylene	µg/L	-	<5	<5	<5
1,1-Dichloroethylene	µg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	<0.1	<0.1	<0.1	<1.0
Cyanide	*mg/L*	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	<0.004	0.006	<0.004	0.005
Zinc	mg/L	0.012	0.012	0.006	0.013
Total Phosphate	mg/L	0.040	0.06	0.11	0.07
Aluminum	mg/L	0.014	0.026	<0.020	0.026
MISCELLANEOUS CONSTITUENTS					
Potassium	*mg/L*	0.115	-	-	-
Beryllium	mg/L	<0.001	-	-	-
Calcium	mg/L	0.569	-	-	-
Magnesium	mg/L	0.177	-	-	-
Antimony	mg/L	<0.003	<0.003	16.5	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.12	-	-	-
Carbon Tetrachloride	µg/L	<1.00	<1.00	<1.00	<5
Chloroform	µg/L	<1	<1	<1	<5
Chlorobenzene	µg/L	-	<5	<5	<5
1,1-Dichloroethane	µg/L	-	<5	<5	<5
1,2-Dichloroethane	µg/L	-	<1	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	<10
Vinyl Chloride	µg/L		<10	<10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 7A
North SRP Coordinate: 100,585.7
East SRP Coordinate: 46,726.1
Casing Elevation (ft): 344.5

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/16/86	10/30/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	236	234.8	234.1	232.3
Temperature	°C	18.2	18.6	18.9	20.5
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		4.5	4.95	5.09	4.96
Specific Conductance	µmhos/cm	53	64.6	64.9	61.1
Total Organic Carbon	mg/L	<1.0	<1.0	<1.0	<1.6
Total Organic Halogen	mg/L	0.047	0.063	0.065	0.154
WATER QUALITY PARAMETERS					
Chloride	mg/L	5.2	-	-	4.42
Iron	mg/L	0.06	-	-	0.034
Manganese	mg/L	0.018	-	-	0.023
Phenols	mg/L	<0.002	-	-	<0.002
Sodium	mg/L	7.13	8.19	-	10.9
Sulfate	mg/L	<5	-	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.01	-	0.01
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	<0.1	-	-	<0.1
Lead	mg/L	0.005	0.01	0.006	<0.005
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	9.04	4.8	4.5	4.5
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	<0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	9.0	-	3.3	3.8
Gross Beta	pCi/L	<3.0	-	3.0	10
Radium	pCi/L	6.0	-	3.8	3.5
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	15.3	23.8	50
Tetrachloroethylene	µg/L	-	41.1	59.7	131
1,1,1-Trichloroethane	µg/L	-	-	9.1	<50
Trans-1,2-Dichloroethylene	µg/L	-	-	-	<50
1,1-Dichloroethylene	µg/L	-	-	-	<50
Nickel	mg/L	*<0.004*	*<0.004*	*<0.004*	*0.006*
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.009
Zinc	mg/L	-	-	-	<0.002
Total Phosphate	mg/L	-	-	-	0.052
Aluminum	mg/L	-	-	-	0.022

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 7A
North SRP Coordinate: 100,585.7
East SRP Coordinate: 46,726.1
Casing Elevation (ft): 344.5

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/20/87	7/9/87	10/17/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	231.4	224.5	231.2	230.9
Temperature	°C	17.5	18.7	18.4	18.2
Total Dissolved Solids	mg/L	63	50	18	72
INDICATOR PARAMETERS					
pH		4.80(5)	5.17(4)	5.1	5.05(4)
Specific Conductance	µmhos/cm	60.75(4)	64.8(4)	82	85.2(4)
WATER QUALITY PARAMETERS					
Chloride	mg/L	4.1	3.5	3.6	3.12
Iron	mg/L	0.029	0.051	0.065	0.14
Manganese	mg/L	0.025	0.025	0.024	0.026
Phenols	mg/L	<0.002	<0.005	<0.005	<0.005
Sodium	mg/L	9.5	9.57	11.5	14.8
Sulfate	mg/L	5	<3.0	22.1	5.85
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.012	0.013	0.014	0.015
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	<0.1	0.11	<0.10	0.25
Lead	mg/L	0.007	0.01	<0.060	<0.006
Mercury	µg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	4.77	5.27	8.08	12.8
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	0.002	<0.002	<0.002	<0.002
Endrin	µg/L	<0.1	-	<0.10	<0.10
Lindane	µg/L	<0.05	-	-	-
Methoxychlor	µg/L	<0.5	-	-	-
Toxaphene	µg/L	<1	-	-	-
2,4-D	µg/L	<20	-	-	-
2,4,5-TP (Silvex)	µg/L	<2	-	-	-
Gross Alpha	pCi/L	<3.0	2.5	1.7	7.8
Gross Beta	pCi/L	2.8	2.3	2.4	5.5
Radium	pCi/L	2.2	2.2	2.3	2.6
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	46	72.6	30	51
Tetrachloroethylene	µg/L	172	192	141	106
1,1,1-Trichloroethane	µg/L	2	2	3	<1
Trans-1,2-Dichloroethylene	µg/L	-	<5	<5	<5
1,1-Dichloroethylene	µg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	0.006	0.006	<0.004
Uranium	mg/L	<1.0	<1.0	<1.0	<1.0
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	<0.004	0.021	0.004	<0.004
Zinc	mg/L	0.011	0.021	0.01	0.026
Total Phosphate	mg/L	0.050	0.03	0.09	0.09
Aluminum	mg/L	<0.020	0.023	0.02	0.02
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	0.441	-	-	-
Beryllium	mg/L	<0.005	-	-	-
Calcium	mg/L	1.25	-	-	-
Magnesium	mg/L	0.605	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	<0.003
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.64	-	-	-
Carbon Tetrachloride	µg/L	<1.00	<1.00	<1.00	<5
Chloroform	µg/L	<1	<1	<1	<5
Chlorobenzene	µg/L	-	<5	<5	<5
1,1-Dichloroethane	µg/L	-	<5	<5	<5
1,2-Dichloroethane	µg/L	-	<1	<1	<1
1,1,2-Trichloroethane	µg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	-	<10	<10	<10
Vinyl Chloride	µg/L	-	<10	<10	<10

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 8A
North SRP Coordinate: 100,815.1
East SRP Coordinate: 47,293.2
Casing Elevation (ft): 344.2

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		2/3/86	5/27/86	7/17/86	10/30/86
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	237.0	236.1	235.3	233.8
Temperature	°C	18	18.3	18.8	18.9
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH		4.5	4.92	4.88	4.88
Specific Conductance	µmhos/cm	215	340	386.5	437
Total Organic Carbon	mg/L	<1.0	<1.0	<1.0	<1.0
Total Organic Halogen	mg/L	0.12	0.13	0.121	0.065
WATER QUALITY PARAMETERS					
Chloride	mg/L	4.6	-	-	5.8
Iron	mg/L	0.047	-	-	0.022
Manganese	mg/L	0.022	-	-	0.038
Phenols	mg/L	<0.002	-	-	<0.002
Sodium	mg/L	36.9	52.1	-	79.3
Sulfate	mg/L	<5	-	<5.0	3
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	-	-	-
Barium	mg/L	-	0.013	-	0.016
Cadmium	mg/L	-	-	-	<0.002
Chromium	mg/L	-	<0.004	-	<0.004
Fluoride	mg/L	<0.1	-	-	0.11
Lead	mg/L	0.01	0.013	0.011	0.01
Mercury	mg/L	<0.0002	-	-	<0.0002
Nitrate (as N)	mg/L	25.3	36.3	42.5	48.3
Selenium	mg/L	-	-	-	-
Silver	mg/L	-	-	-	<0.002
Endrin	µg/L	<0.04	-	<0.04	-
Lindane	µg/L	-	-	-	-
Methoxychlor	µg/L	-	-	-	-
Toxaphene	µg/L	-	-	-	-
2,4-D	µg/L	-	-	-	-
2,4,5-TP (Silvex)	µg/L	-	-	-	-
Gross Alpha	pCi/L	9.0	-	24.3	63.6
Gross Beta	pCi/L	76.0	-	123.8	214.5
Radium	pCi/L	10.0	-	12.8	12.1
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	38.8	55.5	19
Tetrachloroethylene	µg/L	-	155.2	147	86
1,1,1-Trichloroethane	µg/L	-	-	<10.0	<50
Trans-1,2-Dichloroethylene	µg/L	-	-	-	<50
1,1-Dichloroethylene	µg/L	-	-	-	<50
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	-	-	-	-
Cyanide	mg/L	<0.005	-	-	<0.005
Copper	mg/L	-	-	-	0.006
Zinc	mg/L	-	-	-	<0.002
Total Phosphate	mg/L	-	-	-	0.042
Aluminum	mg/L	-	-	-	0.037

Table E-2 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 8A
North SRP Coordinate: 100,815.1
East SRP Coordinate: 47,293.2
Casing Elevation (ft): 344.2

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/31/87	4/20/87	8/4/87	10/17/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	232.9	232.3	232.2	231.7
Temperature	°C	18.0	19.2	19.6	18.2
Total Dissolved Solids	mg/L	348	330	270	196
INDICATOR PARAMETERS					
pH		4.58(5)	5.12(5)	4.9	4.87(4)
Specific Conductance	μmhos/cm	461(5)	440(5)	340	278(4)
WATER QUALITY PARAMETERS					
Chloride	mg/L	5.6	4.7	4.3	5.38
Iron	mg/L	0.027	0.034	0.04	0.096
Manganese	mg/L	0.041	0.042	0.036	0.037
Phenols	mg/L	<0.002	<0.005	<0.005	<0.005
Sodium	mg/L	10.1	81.6	58.7	51.7
Sulfate	mg/L	<3	<3.0	<5.0	<5.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	-	<0.002	<0.002
Barium	mg/L	0.018	0.018	0.017	0.013
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	<0.1	0.11	<0.10	0.26
Lead	mg/L	0.013	0.013	0.006	0.007
Mercury	μg/L	<0.20	<0.20	<0.20	<0.20
Nitrate (as N)	mg/L	51.2	55.6	38.8	31.4
Selenium	mg/L	<0.002	-	<0.002	<0.002
Silver	mg/L	<0.002	<0.002	<0.002	<0.002
Endrin	μg/L	<0.1	-	-	<0.10
Lindane	μg/L	<0.05	-	-	-
Methoxychlor	μg/L	<0.5	-	-	-
Toxaphene	μg/L	<1	-	-	-
2,4-D	μg/L	<20	-	-	-
2,4,5-TP (Silvex)	μg/L	<2	-	-	-
Gross Alpha	pCi/L	57.2	6.2	10.9	20.9
Gross Beta	pCi/L	137	157		
Radium	pCi/L	14.4	10.2	8.6	6.5
SITE SPECIFIC PARAMETERS					
Trichloroethylene	μg/L	10	27	60	49
Tetrachloroethylene	μg/L	25.4	47	127	26
1,1,1-Trichloroethane	μg/L	<1	4	4	<1
Trans-1,2-Dichloroethylene	μg/L	-	<5	<5	<5
1,1-Dichloroethylene	μg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	<0.004	<0.004	<0.004
Uranium	mg/L	<1.0	<1.0	<1.0	<1.0
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005
Copper	mg/L	<0.004	0.006	0.006	<0.004
Zinc	mg/L	0.104	0.013	0.011	0.037
Total Phosphate	mg/L	0.040	0.04	0.04	0.06
Aluminum	mg/L	0.04	0.046	0.051	0.05
MISCELLANEOUS CONSTITUENTS					
Potassium	mg/L	1.35	-	-	-
Beryllium	mg/L	<0.005	-	-	-
Calcium	mg/L	4.73	-	-	-
Magnesium	mg/L	1.81	-	-	-
Antimony	mg/L	<0.003	<0.003	<0.003	0.004
Tin	mg/L	-	-	-	<0.120
Silica	mg/L	3.43	-	-	-
Carbon Tetrachloride	μg/L	<1.00	<1.00	<1.00	<5
Chloroform	μg/L	<1	<1	<1	<5
Chlorobenzene	μg/L	-	<5	<5	<5
1,1-Dichloroethane	μg/L	-	<5	<5	<5
1,2-Dichloroethane	μg/L	-	<1	<1	<1
1,1,2-Trichloroethane	μg/L	-	<5	<5	<5
1,1,2,2-Tetrachloroethane	μg/L	-	<10	10	<10
Vinyl Chloride	μg/L	-	<10	<10	<10

Table E-4 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 29D
North SRP Coordinate: 107,323.0
East SRP Coordinate: 51,226.9
Casing Elevation (ft): 365.1

PARAMETER		UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986	
Sample Date			N/A	6/18/86	7/23/86	11/3/86	
Casing Material			-	PVC	PVC	PVC	
Sampling Technique			-	Pumped	Pumped	Pumped	
Filtered			-	Yes	Yes	Yes	
Water Elevation		feet	-	237.4	237.7	236.9	
Temperature		°C	-	19.4	19.4	19.1	
Total Dissolved Solids		mg/L	-	-	-	-	
INDICATOR PARAMETERS							
pH	*		-	4.48	4.78	3.72	†
Specific Conductance	*	µmhos/cm	-	35.0	35.1	84.8	†
Total Organic Carbon	*	mg/L	-	<1.0	<1.0	<1.1	
Total Organic Halogen	*	mg/L	-	<0.005	<0.005	<0.005	
WATER QUALITY PARAMETERS							
Chloride		mg/L	-	4.5	2.27	2.8	
Iron		mg/L	-	0.045	0.036	0.033	
Manganese		mg/L	-	0.005	0.005	0.004	
Phenols		mg/L	-	<0.002	<0.002	<0.002	
Sodium		mg/L	-	3.58	4.33	3.91	
Sulfate		mg/L	-	<5.0	<5.0	<3.0	
DRINKING WATER PARAMETERS							
Arsenic		mg/L	-	<0.002	-	-	
Barium		mg/L	-	<0.004	0.007	0.007	
Cadmium		mg/L	-	<0.001	<0.001	<0.002	
Chromium		mg/L	-	<0.004	<0.004	<0.004	
Fluoride		mg/L	-	0.18	<0.1	<0.1	
Lead		mg/L	-	0.03	0.028	0.017	
Mercury		mg/L	-	<0.0002	<0.0002	<0.0002	
Nitrate (as N)		mg/L	-	2.2	2.1	2.14	
Selenium		mg/L	-	<0.002	-	-	
Silver		mg/L	-	<0.002	<0.002	<0.002	
Endrin		µg/L	-	<0.04	-	-	
Lindane		µg/L	-	<1.0	-	-	
Methoxychlor		µg/L	-	<20.0	-	-	
Toxaphene		µg/L	-	<1.0	-	-	
2,4-D		µg/L	-	<20.0	-	-	
2,4,5-TP (Silvex)		µg/L	-	<2.0	-	-	
Gross Alpha		pCi/L	-	10.1	6.9	7.1	
Gross Beta		pCi/L	-	7.0	4.3	5.45	
Radium		pCi/L	-	8.5	8.8	7.8	
Coliform B		#/100 mL	-	<1.0	-	-	
Turbidity		NTU	-	1	-	-	
SITE SPECIFIC PARAMETERS							
Trichloroethylene		µg/L	-	<5.0	<5.0	<5.0	
Tetrachloroethylene		µg/L	-	<5.0	<5.0	<5.0	
1,1,1-Trichloroethane		µg/L	-	<5.0	<5.0	<5.0	
Trans-1,2-Dichloroethylene		µg/L	-	<5.0	<5.0	<5.0	
1,1-Dichloroethylene		µg/L	-	<5.0	<5.0	<5.0	
Nickel		mg/L	-	<0.004	<0.004	<0.004	
Uranium		mg/L	-	<0.1	<0.05	-	
Cyanide		mg/L	-	<0.005	<0.005	<0.005	
Copper		mg/L	-	0.008	<0.004	0.012	
Zinc		mg/L	-	0.011	0.002	0.014	
Total Phosphate		mg/L	-	0.014	0.042	0.037	
Aluminum		mg/L	-	0.03	0.045	0.032	
Potassium			-	-	-	-	
Beryllium			-	-	-	-	
Silica			-	-	-	-	
Calcium			-	-	-	-	
Magnesium			-	-	-	-	
Antimony			-	-	-	-	
Tin			-	-	-	-	
Carbon Tetrachloride			-	-	-	-	
Chloroform			-	-	-	-	

* - Mean of 4 replicate measurements except where indicated (†)

Table E-4 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well:	MSB 29D
North SRP Coordinate:	107,323.0
East SRP Coordinate:	51,226.9
Casing Elevation (ft):	365.1

PARAMETER	UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date		1/26/87	4/6/87	8/4/87	12/17/87
Casing Material		PVC	PVC	PVC	PVC
Sampling Technique		Pumped	Pumped	Pumped	Pumped
Filtered		Yes	Yes	Yes	Yes
Water Elevation	feet	235.8	235.1	236.4	235.6
Temperature	°C	16.7	18.7	19.8	17.7
Total Dissolved Solids	mg/L	22	33*	72	9
INDICATOR PARAMETERS					
pH *		4.44*	4.82*	4.6	4.60*
Specific Conductance *	µmhos/cm	36.6*	34.5*	36	35.1*
Total Organic Carbon *	mg/L	<1.0	-	-	-
Total Organic Halogen *	mg/L	<0.005	-	-	-
WATER QUALITY PARAMETERS					
Chloride	mg/L	2.5	-	2.9	-
Iron	mg/L	0.019	-	0.121	0.033
Manganese	mg/L	0.004	-	0.004	0.014
Phenols	mg/L	<0.002	-	<0.005	<0.005
Sodium	mg/L	4.59	3.93	3.44	3.46
Sulfate	mg/L	3	-	<5.0	<5.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	<0.002	<0.002	<0.002	<0.002
Barium	mg/L	0.007	-	0.008	0.014
Cadmium	mg/L	<0.002	-	-	-
Chromium	mg/L	<0.004	-	<0.004	0.006
Fluoride	mg/L	<0.1	-	-	-
Lead	mg/L	0.011	0.01	0.011	0.008
Mercury	mg/L	<0.0002	-	-	-
Nitrate (as N)	mg/L	2.18	2.18	2.04	3.04
Selenium	mg/L	<0.002	<0.002	<0.002	<0.002
Silver	mg/L	<0.002	-	-	-
Endrin	µg/L	<0.1	<0.10	<0.10	<0.10
Lindane	µg/L	<0.05	<0.05	≤0.05	<0.05
Methoxychlor	µg/L	<0.5	<0.5	<0.5	<0.5
Toxaphene	µg/L	<1.0	<1.0	<1.0	<1.0
2,4-D	µg/L	<20.0	<0.30	<0.30	<0.30
2,4,5-TP (Silvex)	µg/L	<2.0	<0.09	<0.09	<0.09
Gross Alpha	pCi/L	6.6	9	5.7	21.7
Gross Beta	pCi/L	5.4	7.1	4.6	13.7
Radium	pCi/L	6.9	8.1	5.9	6.3
Coliform B	#/100 mL	-	-	-	-
Turbidity	NTU	-	-	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	<1.0	<1.0	<1.0	<1.0
Tetrachloroethylene	µg/L	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/L	<1.0	<1.0	<1.0	<1.0
Trans-1,2-Dichloroethylene	µg/L	-	<5	<5.0	<5.0
1,1-Dichloroethylene	µg/L	-	<5	<5	<5
Nickel	mg/L	<0.004	<0.004	<0.004	0.012
Uranium	mg/L	<0.1	<0.10	<1.0	<1.0
Cyanide	mg/L	<0.005	-	<0.005	<0.005
Copper	mg/L	0.007	-	0.009	0.015
Zinc	mg/L	<0.012	-	0.007	0.054
Total Phosphate	mg/L	0.03	<0.020	0.02	0.07
Aluminum	mg/L	0.047	0.042	0.056	0.074
Potassium		0.37	-	-	-
Beryllium		0.001	-	-	-
Silica		3.32	-	-	-
Calcium		0.29	-	-	-
Magnesium		0.442	-	-	-
Antimony		<0.003	-	-	-
Tin		-	-	-	<0.120
Carbon Tetrachloride		<1.0	<1.0	<1.0	<1.0
Chloroform		<1.0	<1.0	<1.0	<1.0

* - Mean of 4 replicate measurements except where indicated (†)

Table E-4 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 43D
North SRP Coordinate: 107,274.2
East SRP Coordinate: 49,322.0
Casing Elevation (ft): 357.5

PARAMETER	UNITS	1ST QUARTER 1986	2ND QUARTER 1986	3RD QUARTER 1986	4TH QUARTER 1986
Sample Date		N/A	6/18/86	7/22/86	11/2/86
Casing Material		-	PVC	PVC	PVC
Sampling Technique		-	Pumped	Pumped	Pumped
Filtered		-	Yes	Yes	Yes
Water Elevation	feet	-	236.6	236.6	236.4
Temperature	°C	-	20.1	20.1	19.5
Total Dissolved Solids	mg/L	-	-	-	-
INDICATOR PARAMETERS					
pH *		-	5.04	5.12	4.69 †
Specific Conductance *	µmhos/cm	-	23.5	23.83	26.7 †
Total Organic Carbon *	mg/L	-	<1.0	<1.0	<2.1
Total Organic Halogen *	mg/L	-	<0.005	<0.005	<0.005
WATER QUALITY PARAMETERS					
Chloride	mg/L	-	4.0	2.27	3.4
Iron	mg/L	-	0.017	0.032	0.033
Manganese	mg/L	-	0.023	0.025	0.021
Phenols	mg/L	-	<0.002	<0.002	<0.002
Sodium	mg/L	-	1.63	1.94	1.68
Sulfate	mg/L	-	<5.0	<5.0	<3.0
DRINKING WATER PARAMETERS					
Arsenic	mg/L	-	<0.002	-	-
Barium	mg/L	-	<0.004	0.004	<0.004
Cadmium	mg/L	-	<0.001	<0.001	<0.002
Chromium	mg/L	-	<0.004	<0.004	<0.004
Fluoride	mg/L	-	0.15	<0.1	<0.1
Lead	mg/L	-	0.014	0.023	0.015
Mercury	mg/L	-	<0.0002	<0.0002	<0.0002
Nitrate (as N)	mg/L	-	0.95	1.19	1.17
Selenium	mg/L	-	<0.002	-	-
Silver	mg/L	-	<0.002	<0.002	<0.002
Endrin	µg/L	-	<0.04	-	-
Lindane	µg/L	-	<1.0	-	-
Methoxychlor	µg/L	-	<20.0	-	-
Toxaphene	µg/L	-	<1.0	-	-
2,4-D	µg/L	-	<20.0	-	-
2,4,5-TP (Silvex)	µg/L	-	<2.0	-	-
Gross Alpha	pCi/L	-	<3.0	<3.0	<3.0
Gross Beta	pCi/L	-	<2.0	<2.0	<2.0
Radium	pCi/L	-	0.4	0.9	<1.0
Coliform B	#/100 mL	-	<1.0	-	-
Turbidity	NTU	-	0	-	-
SITE SPECIFIC PARAMETERS					
Trichloroethylene	µg/L	-	<5.0	<5.0	<5.0
Tetrachloroethylene	µg/L	-	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	µg/L	-	<5.0	<5.0	<5.0
Trans-1,2-Dichloroethylene	µg/L	-	<5.0	<5.0	<5.0
1,1-Dichloroethylene	µg/L	-	<5.0	<5.0	<5.0
Nickel	mg/L	-	<0.004	<0.004	<0.004
Uranium	mg/L	-	<0.1	<0.1	-
Cyanide	mg/L	-	<0.005	<0.005	<0.005
Copper	mg/L	-	<0.004	0.006	0.005
Zinc	mg/L	-	0.008	0.016	0.008
Total Phosphate	mg/L	-	<0.01	0.039	0.04
Aluminum	mg/L	-	0.142	0.038	0.03
Potassium		-	-	-	-
Beryllium		-	-	-	-
Silica		-	-	-	-
Calcium		-	-	-	-
Magnesium		-	-	-	-
Antimony		-	-	-	-
Tin		-	-	-	-
Carbon Tetrachloride		-	-	-	-
Chloroform		-	-	-	-

* - Mean of 4 replicate measurements except where indicated (†)

Table E-4 (cont'd)
M-Area HWMF Interim Status Ground-Water Monitoring Data

Well: MSB 43D
North SRP Coordinate: 107,274.2
East SRP Coordinate: 49,322.0
Casing Elevation (ft): 357.5

PARAMETER		UNITS	1ST QUARTER 1987	2ND QUARTER 1987	3RD QUARTER 1987	4TH QUARTER 1987
Sample Date			1/29/87	4/6/87	8/4/87	12/19/87
Casing Material			PVC	PVC	PVC	PVC
Sampling Technique			Pumped	Pumped	Pumped	Pumped
Filtered			Yes	Yes	Yes	Yes
Water Elevation		feet	234.9	234.2	234.39	234.8
Temperature		°C	18.5	18.5	19.7	19.1
Total Dissolved Solids		mg/L	32	20	-	52
INDICATOR PARAMETERS						
pH	*		4.54*	5.12*	5.4	4.72*
Specific Conductance	*	µmhos/cm	23.8*	23.6*	26	25.0*
Total Organic Carbon	*	mg/L	<1.0	-	-	-
Total Organic Halogen	*	mg/L	<0.005	-	-	-
WATER QUALITY PARAMETERS						
Chloride		mg/L	2.9	-	3	2.4
Iron		mg/L	0.031	-	0.032	0.04
Manganese		mg/L	0.02	-	0.018	0.015
Phenols		mg/L	<0.002	-	<0.005	<0.005
Sodium		mg/L	2.02	1.75	1.8	1.66
Sulfate		mg/L	<3.0	-	<5.0	<5.0
DRINKING WATER PARAMETERS						
Arsenic		mg/L	<0.002	<0.002	<0.002	<0.002
Barium		mg/L	0.004	-	0.005	0.005
Cadmium		mg/L	<0.002	-	-	-
Chromium		mg/L	<0.004	-	<0.004	<0.004
Fluoride		mg/L	<0.1	-	-	-
Lead		mg/L	0.008	0.012	0.008	0.009
Mercury		mg/L	<0.0002	-	-	-
Nitrate (as N)		mg/L	1.2	1.16	1.31	1.37
Selenium		mg/L	<0.002	<0.002	<0.002	<0.002
Silver		mg/L	<0.002	-	-	-
Endrin		µg/L	<0.1	<0.1	<0.1	<0.10
Lindane		µg/L	<0.05	<0.05	<0.05	<0.05
Methoxychlor		µg/L	<0.5	<0.50	<0.50	<0.50
Toxaphene		µg/L	<1.0	<1.0	<1.0	<1
2,4-D		µg/L	<20	<0.30	<0.30	<0.30
2,4,5-TP (Silvex)		µg/L	<2.0	<0.09	<0.09	<0.09
Gross Alpha		pCi/L	1.2	<3.0	<3.0	1.3
Gross Beta		pCi/L	<2.0	1.8	<2.0	3.2
Radium		pCi/L	<1.0	<1.0	0.5	0.4
Coliform B		#/100 mL	-	-	-	-
Turbidity		NTU	-	-	-	-
SITE SPECIFIC PARAMETERS						
Trichloroethylene		µg/L	<1.0	<1.0	<1.0	<1.0
Tetrachloroethylene		µg/L	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane		µg/L	<1.0	<1.0	<1.0	<1.0
Trans-1,2-Dichloroethylene		µg/L	-	<5.0	<5.0	<5.0
1,1-Dichloroethylene		µg/L	-	<5.0	<5.0	<5.0
Nickel		mg/L	<0.004	<0.004	<0.004	<0.004
Uranium		mg/L	<0.1	<0.10	<1.0	<1.0
Cyanide		mg/L	<0.005	-	<0.005	<0.005
Copper		mg/L	<0.004	-	0.008	0.005
Zinc		mg/L	0.010	-	0.086	0.017
Total Phosphate		mg/L	0.04	<0.020	<0.020	0.100
Aluminum		mg/L	0.034	0.043	0.066	0.079
Potassium			0.134	-	-	-
Beryllium			<0.001	-	-	-
Silica			3.52	-	-	-
Calcium			0.895	-	-	-
Magnesium			0.489	-	-	-
Antimony			<0.003	-	-	-
Tin			-	-	-	<0.120
Carbon Tetrachloride			<1.0	<1.0	<1.0	<1.0
Chloroform			<1.0	<1.0	<1.0	<1.0

* - Mean of 4 replicate measurements except where indicated (†)

B.2 M-Area Process Waste Interim Storage/Treatment Facility Tank Supernatant Analytical Data

M-AREA PROCESS WASTE INTERIM STORAGE/TREATMENT TANK ANALYSES

ANALYSIS OF SUPERNATANT BY ENWRIGHT LABORATORIES

PARAMETERS	UNITS	TANK No. 1	2	3	4	5	5 (DUP.)	6	8 *
ALUMINUM	mg/L	1800	6300	110	25	4400	4500	1900	2100
NICKEL	mg/L	0.91	1.3	0.32	1.1	1.1	0.71	0.93	1.2
COPPER	mg/L	0.51	0.87	<0.01	0.24	1.6	1.7	0.54	0.4
LEAD	mg/L	0.65	1.2	<0.50	<0.50	1.0	1.0	0.55	0.9
CADMIUM	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CHROMIUM	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05
ZINC	mg/L	<0.10	0.38	<0.10	<0.10	1.0	1.0	<0.10	<0.01
URANIUM	mg/L	8	42	63	180	23	23.0	12	12
SELENIUM	mg/L	<0.01	<0.1	<0.01	<0.01	<0.1	-	<0.01	<0.025
ARSENIC (hydride method)	mg/L	0.076	0.063	-	-	0.099	-	-	-
ARSENIC (AA method)	mg/L	-	-	0.15	0.041	-	-	1.3	<0.050
1,1,1-TRICHLOROETHANE**	µg/L	<5	<5	<5	<5	<5	<5	<5	<5
SODIUM	mg/L	24000	34000	10000	20000	24000	22000	18000	30000
NITRATE (as N)	mg/L	12000	18500	6000	21000	13000	13000	13000	18000
PHOSPHATE (as P)	mg/L	2300	1700	100	42	2100	2500	2100	2600
pH		12.3	12.9	10.5	9.6	12.8	12.9	12.4	12
VISCOSITY	cSt	1.2	1.5	1.1	1.1	1.2	1.2	1.1	1.05
SPECIFIC GRAVITY		1.06	1.12	1.02	1.07	1.08	1.08	1.06	1.09
TOTAL SOLIDS	mg/L	97000	162000	42000	119000	118000	115000	101000	120000
Lab. ID No.		37576	37577	37578	37579	37580	37582	37581	44710

Tanks 1 through 6 sampled in Nov. 1986. Al, Ni, Cu, Pb, Cd, Cr, Zn, PO4, & solids completed by 3/9/87. As and Se requested later, and results completed 5/28/87. Nitrate and uranium completed 9/30/87. Viscosity and sp. gr. completed 10/29/87.
Tank 8 sampled in Jan. 1987. Samples stored until Nov. 1987 and then shipped to Enwright. Analyses completed 1/22/88.
*Tank 8 sampled at port No. 16.

**All 1,1,1-trichloroethane analyses conducted within 30 days of sample collection.

APPENDIX C

RESUMES AND LABORATORY QUALIFICATIONS

C.1 Resumes of SRL Personnel

RESUME

WILLIE W. HARLEY
TECHNICIAN
SAVANNAH RIVER LABORATORY
INTERIM WASTE TECHNOLOGY DIVISION
WESTINGHOUSE SAVANNAH RIVER COMPANY

EDUCATION

High School Diploma, Batesburg-Leesville High School

EXPERIENCE

W.W. Harley has 35 years of experience working with various aspects of radiochemistry and waste treatments as a laboratory technician. Responsibilities include:

Waste Treatment:

- Stabilization and solidification of low-level waste using cement-based waste technology
- W.W. Harley's most recent work includes the preparation of saltstone for leaching, calorimeter and rheology studies.

Environmental-Radionuclide Migration Studies:

- Well water sampling
- Well drilling and coring
- Soil classification
- Soil and plant sampling including analysis for vegetative uptake of radionuclides

Radiochemistry Research:

- Separation of radionuclides by ion exchange and precipitation methods
- Separation of elements by organic extraction methods
- Separation of elements by gas diffusion techniques

Analytical Support:

- Operation of alpha, beta, gamma counters
- Chemical analysis by titration
- Analytical support including review, documentation and performance of laboratory procedures

RESUME

Errol G. Orebaugh
Staff Chemist, Interim Waste Technology Division

EDUCATION
B.S.CH., 1959 University of Florida, Gainesville, Fla.
Ph.D. Inorganic Chemistry, 1972, Florida State University, Tallahassee, Fla.

EXPERIENCE

Dr. Orebaugh's current responsibilities in the Low Level Waste Group, and the Interim Waste Technology Division of the Savannah River Laboratory are to advise and develop appropriate tactics, methods and solutions to a wide variety of waste reduction, handling, storage, and disposal problems encountered in the operations of D.O.E.'s Savannah River Facility.

Dr. Orebaugh's previous experience in the Laboratories Analytical (7 years) and Separations Development Divisions (12 years) provide expertise with which he is able to view current and past waste handling situations.

In addition, he provides expertise in the modeling of chemical systems to predict thermodynamic equilibria of aqueous electrolyte solutions.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Fellow, American Institute of Chemists
Alpha Chi Sigma Chemical Fraternity

RESUME

JOHN P. HARLEY, JR.
RESEARCH ENGINEER
INTERIM WASTE DIVISION
SAVANNAH RIVER LABORATORY
WESTINGHOUSE SAVANNAH RIVER COMPANY

EXPERIENCE

- Engineer in PSDF Liason Group - Assisted in preparation of basic data and conceptual design review for $100 MM Plutonium Storage and Distribution Facility 6/78 - 3/79

- Supervisor in JB-Line - Provided process support including: procedure preparation, shift relief, clerical supervision, QA Coordinator, personnel training, coordination of shipping, receiving, and processing of off-site recoverable Pu^{239} materials. Also, assigned as production shift supervisor responsible for approximately 20 people and coordination of support groups (Maintenance, Health Protection, etc.) 3/79 - 8/81

- Supervisor in HB-Line - Provided process support including: QA/QC of shipping containers, coordinated off-site shipping and receiving of Pu^{238}, procedure preparation, shift relief. Also, assigned as shift supervisor responsible for Pu^{238} Scrap Recovery Operations 8/81 - 5/83

- Engineer in Personnel Department, Exempt Development Division - Responsible for logistics, scheduling, material/course selection, record keeping, planning and publicizing training activities for the >2000 salary roll employees at Savannah River Plant 5/83 - 2/85

- Supervisor in TNX Operations - Supervised 7 foremen and 40 operators and coordinated support activities responsible for the operations of a large semi-works testing facility 2/85 - 2/87

- Engineer in Interim Waste Technology Group - Provides technical support to plant operations in areas concerning low-level radioactive waste disposal 2/87 - present

RESUME

CHRISTINE A. LANGTON
STAFF MATERIALS SCIENTIST
INTERIM WASTE TECHNOLOGY DIVISION
SAVANNAH RIVER LABORATORY
WESTINGHOUSE SAVANNAH RIVER COMPANY

EDUCATION

BS, Geochemistry, 1972, Pennsylvania State University, State College, PA

MS, Geochemistry, 1976, Pennsylvania State University, State College, PA

Ph.D., Materials Science and Engineering, Pennsylvania State University, State College, PA

EXPERIENCE

Responsibilities include support of waste solidification and stabilization programs at the Savannah River Site. Work involves development and testing of waste treatments and hydrated ceramic wasteforms (cement-based). In addition, responsibilities include characterization of building materials used at SRS. Work includes corrosion evaluation of metals and concrete.

C.A. Langton conducted Ph.D. research in phase equilibria and reaction kinetics for low temperature hydrated systems which included patenting a geothermal well cement.

Previous experience includes employment with Gulf Mineral Resource Company, Denver, CO, Exploration Geochemist, 1974 - 1976, and with the Pennsylvania State University, State College, PA, assistant research professor, 1980 - 1982.

PROFESSIONAL AFFILIATIONS

American Ceramic Society
    1988 Chairman Cements Division

American Concrete Institute
    Committee 227 Radioactive Waste Management

Materials Research Society

C.2 General and Personnel Qualifications for Enwright Laboratories

Enwright Laboratories, Inc.
General Statement of Qualification
Analyses of M-Area Wastes
In
Support of Westinghouse Savannah River Company
Savannah River Site
(Formerly E.I. Du Pont de Nemours & Co., Inc.
Savannah River Plant)

Enwright Laboratories, Inc. is a full service environmental testing and research laboratory located in Greenville, South Carolina. The lab's professional staff includes organic and inorganic chemists, biologists, toxicologists and chemical and environmental engineers. The firm's primary focus is that of providing our clients with scientific and environmental engineering, problem identification and solution development services. Our staff is supported with an approximate 6,000 square foot state-of-the-art chemical/biological laboratory equipped to service a broad spectrum of the environmental market's needs, including mixed waste analysis and treatment.

Following is a break-down of Enwright's three main service areas and a listing of key services provided within each area. Also provided is a partial listing of related projects completed by Enwright.

Enwright Laboratories, Inc. maintains a strict Quality Assurance Program in accordance with South Carolina Department of Health and Environmental Control regulations, and of 10 CFR 50 Quality Assurance Criteria for "Nuclear Power Plants". Attached is a copy of Enwright's state certification (number 87050) and license to handle low-level radioactive wastes. In addition, our facilities, procedures and staff were recently audited by an independent consulting firm according to EPA's Contract Laboratory Program (CLP).

Enwright's Quality Assurance Program includes:

A. A Minimum of 10% Duplicate Analysis

B. Standard Additions

C. Surrogate Spikes

D. Field Blanks, Lab Blanks, and Reagent Blanks

E. Analysis of Multiple Standards

F. Blind Ampules (EPA and Internal)

G. Participation in numerous QA Audits and Certification Programs

H. Strict Documentation

ENWRIGHT
ENVIRONMENTAL CONSULTING LABORATORIES

A team of environmental scientists and engineers providing analytical, toxicology and applications services to industry, government and consulting engineers.

Analytical Chemistry

- Groundwater Monitoring
- Hazardous Waste Characterization
- Mixed Waste Analysis
- Water & Wastewater Monitoring

Applications Technologies

- Treatability & Process Evaluations
- Hazardous Waste Stabilization
- Remediation Support Services
- Toxicity Reduction Evaluations

Aquatic Toxicity

- Biological Assessments
- Toxicity Testing

EXPERIENCE

ANALYTICAL PROJECTS ENWRIGHT LABORATORIES, INC

MONITOR APPENDIX VIII CONSTITUENTS
Blackman Uhler Corporation
Spartanburg, South Carolina

Continuous monitoring of select Appendix VIII constituents for sixteen monitoring wells.

GROUNDWATER MONITORING
Duke Power Company
Charlotte, North Carolina

Analyzed and evaluated infiltration of ash pond discharge water into groundwater supply. Monitored 17 wells for metals and other general water quality parameters.

GROUNDWATER MONITORING
Amoco Chemical Company
Charleston, South Carolina

Continuous monitoring of groundwater well network for metals content and indicator parameters.

CHARACTERIZE ORGANIC CONTAMINATION
Sperry Univac, Incorporated
Bristol, Tennessee

Characterized type, quality and extent of volatile organic contamination in soil and groundwater.

VOLATILE ORGANIC COMPOUND ANALYSIS
Sandoz Incorporated
Charlotte, North Carolina

Performed numerous analyses on volatile organic compounds in groundwater to support a petition for alternate concentration limits.

PRIORITY POLLUTANT SURVEY
Century West Engineering Company
Portland, Oregon

Provided analytical support for a confidential client at a superfund site. Analytical program included a complete Appendix VIII and priority pollutant survey on fifteen wells.

EXPERIENCE

ANALYTICAL PROJECTS | ENWRIGHT LABORATORIES, INC

PRIORITY POLLUTANT SURVEY
E. I. Dupont de Nemours and Company
Spruance Plant
Richmond, Virginia

Performed priority pollutant survey of all discharges. Also, conducted bioassays to determine potential toxity of effluent.

HAZARDOUS WASTE DELISTING
Michelin Tire Corporation
Greenville, South Carolina

A comprehensive analysis of solid waste to support a hazardous waste delisting petition. Our involvement in the project included development of supplemental Appendix VIII methodology and coordination and negotiation with the EPA Division of Solid & Hazardous Waste in Washington, D.C.

SOLID WASTE & GROUNDWATER MONITORING
American Hoechst Corp.
Spartanburg, South Carolina

Continuous monitoring of groundwater, wastewater and solid waste. In-stream monitoring of receiving stream, bio-assay testing, and priority pollutant survey.

PRIORITY POLLUTANT SURVEY
Confidential Client
Various Locations

Conducted a priority pollutant survey at eight discharge and three river stations. Work was part of an environmental audit.

GROUNDWATER TESTING
Geraghty & Miller, Inc.
Aiken, South Carolina

Regularly scheduled, on-going testing of groundwater samples at various sites in the southeast for a variety of parameters.

EXPERIENCE

ANALYTICAL PROJECTS ENWRIGHT LABORATORIES, INC

WASTEWATER ANALYSIS
E. I. Dupont de Nemours and Company
Camden, South Carolina

Performed continuous analysis of volatile organic compounds in wastewater discharge.

SUPERFUND SITE REMEDIATION STUDY
Camp Dresser & McKee
Arlington, Virginia

Performed analysis of chromium, arsenic, and pentachlorophenol at a superfund site in conjunction with remedial action feasibility study.

HAZARDOUS WASTE TCLP TESTING
GSX Corporation
Columbia, South Carolina

Subjected 25 hazardous waste samples generated at industries throughout the Southeast to the Toxicity Characteristic Leaching Procedure (TCLP) to determine impact of proposed methodology.

TEAM

DR. STEVEN L. HOEFFNER Geo Chemist

As a Geo Chemist, Dr. Hoeffner is responsible for tracking and managing the larger projects handled by Enwright Laboratories. He interacts continually with clients to ensure that quality results are delivered on schedule and within budget. Dr. Hoeffner also serves as a consultant on groundwater assessment and remedial action studies. In addition, he is involved in the developmnt of Appendix VIII, Appendix IX and SW-846 Methodology using GC, GC/MS, and HPLC techniques. He is Director of Enwright's mixed waste program (hazardous and radioactive waste) which is currently expanding. Finally, as Deputy Quality Assurance Officer, he ensures that quality is maintained in the laboratory.

EXPERIENCE 5 Years professional experience

EDUCATION University of Missouri - Columbia, Ph.D. in Chemistry, Environmental Sciences Program
Colorado School of Mines, B.S. in Chemistry

MEMBERSHIPS American Chemical Society

PUBLICATIONS

- Hoeffner, Steve L., Radionuclide Sorption on Savannah River Plant Burial Ground Soil: A Summary and Intrepretation of Laboratory Data. USDOE Report DP-1702, E. I. Dupont de Nemours & Co., Savannah River Laboratory, Aiken, SC 1985.
- Hoeffner, Steve L., Cobalt Sorption Onto Savannah River Plant Soils. USDOE Report DP-1694, E.I. Dupont de Nemours & Co., Savannah River Laboratory, Aiken, SC 1984.
- Oblath, S.B. and S.L. Hoeffner, "Evaluation and Performance of the Special Wasteform Lysimeters at a Humid Site", Proceedings: Seventh Annual Participants" Information Meeting, DOE Low-Level Waste Management Program, 1985.
- Stone, J.A., S.B. Oblath, R.H. Hawkins, M.W. Grant, S.L. Hoeffner, and C.M. King, "Waste Migration Studies at the Savannah River Burial Ground", Proceedings: Seventh Annual Participants; Information meeting, DOE Low-Level Waste Management Program, 1985.
- Stone, J.A., S.B. Oblath, R.H. Emslie, S.L. Hoeffner, and C.M. King, "Radionuclide Migration Studies at the Savannah River Plant Humid Shallow

Land Burial Site for Low-Level Waste", Proceedings: Sixth Annual Participants' Information Meeting, DOE Low-Level Waste Management Program, 1984.

- Hoeffner, Steve L. Laboratory Simulation of Radionuclide Migration Through Basalt, Ph.D. Dissertation, Department of Chemistry, University of Missouri-Columbia, 1983.

RELATED EXPERIENCE

- COLORADO SCHOOL OF MINES - Assistance was provided to Thomas Wideman, CSM professor, in several areas; 1) Characterization of the seasonal variations of acid mine waters, 2) Mass balance on process streams of a pilot-scale oil shale retort, 3) Comparison of methods of sample preservation as applied to retort by-products, and 4) Purification ability of oil shale and oil shale by-products on liquid waste streams from the retort.

- UNIVERSITY OF MISSOURRI, HEAVY METALS REMOVAL- The ability of coal and coal gasification by-products (coal char and coal ash), in conjunction with coal humic acids, to remove heavy metals from solution was investigated. Excellent removal was obtained by controlling the pH.

- BATELLE LABORATORIES, RADIOACTIVE WASTE SAMPLES Through a 1981 NORCUS appointment (Northwest College and University Association for Science) one and one-half years at the Battelle Laboratories (near the Hanford Site in Washington State) were devoted to laboratory studies of actinide migration through basalt. This work has application to the proposed high-level waste disposal respository for the Hanford site. The results are presented in Dr. Hoeffner's Ph.D. dissertation, "Laboratory Simulation of Radionuclide Migration Through Basalt".

- SAVANNAH RIVER LABORATORY, AIKEN, SC - A Postdoctoral appointment at the Savannah River Laboratory in South Carolina. During the two year appointment, an in-depth laboratory study and summary on radionuclide migration from the on-site low-level waste burial ground was completed. The pH and radionuclide concentration were two controlling variables. Organics present in the burial ground monitoring wells were identified. The effect of these organics on radionuclide mobility remains to be defined.

CHARLES H. REECE, Ph.D **Laboratory Manager**

Dr. Reece, as an experienced toxicologist is responsible for and has been involved in hazardous waste determinations, toxicity reduction evaluations, limnological studies, bioassays, and project management. He is proficient in operating and interpreting results from a variety of analytical instruments including: capillary column/gas chromatograph/mass spectrometer, fluorometer, HPLC, and atomic absorption spectrophotometer. Design and development of special environmental projects are among Dr. Reece's primary interests.

EXPERIENCE 7 Years professional experience

EDUCATION Oklahoma State University, Ph.D Aquatic Toxicology
Stephen F. Austin State University, M.S. Biology and Statistics
Stephen D. Austin State University, B.S. Select Student

MEMBERSHIPS Water Pollution Control Federation
Society of Environmental Toxicology and Chemistry
Pollution Control Association of South Carolina
Sigma Xi, Research Society

PUBLICATION Reece, C.H. and S.L. Burkes, "Isolation and Chemical Characterization of Petroleum Refinery Wastewater Fractions Acutely Lethal to Daphnia Magna, "Aquatic Toxicology and Hazardous Assessment: Seventh Symposium, ASTM STP 854, R.D. Cardwell, R. Prudy, and R.C. Bahner, Eds., American Society for Testing and Materials, 1984.

RELATED EXPERIENCE

- ORGANIC ANALYSIS, E.I. DUPONT, SAVANNAH RIVER PLANT, AIKEN, SC - Conducted organic analysis of non-radioactive hazardous waste.

- GAS CHROMATOGRAPHIC ANALYSES - Performed extensive GC/MS analyses to determine concentrations of organic priority pollutants and groundwater at a chemical plant. Appendix VIII compounds in water, wastewater and hazardous wastes from numerous industrial facilities.

- BIOASSAYS, MORE THAN 30 PROJECTS, VARIOUS LOCATIONS - Conducted on-site flow through, static, and static renewal bioassays using vertebrate and invertebrate, marine and freshwater organisms in several states for textile manufacturers, chemical plants, power plants, hazardous waste treatment facilities, petroleum refineries and an electrical hardware manufacturer.

- TOXICITY REDUCTION EVALUATION, OKLAHOMA - Performed toxicity reduction evaluation on petroleum refinery wastewater in Oklahoma. Isolated and chemically characterized the fractions acutely toxic to Daphnia magna using GC/MS and various physical and chemical fractionation techniques.

- ORGANIC ANALYSES, VARIOUS PROJECTS - Routinely analyzed groundwater, wastewater, drinking water and hazardous wastes for volatile and non-volatile organics.

- PRIORITY POLLUTANT ANALYSIS - Analyzed process wastewater streams at four petroleum refineries and determined the major source of priority pollutants. Conducted an on-site comparison of activated carbon and activated sludge to determine the more efficient remover of priority pollutants.

CHRISTINE G. TEAL **Organic Analytical Chemist**

As Chief Organic Analysis Chemist, Ms. Teal is responsible for the operation and supervision of samples requiring analysis by gas chromatography and gas chromatography mass spectrometry. She directs the organic preparation/extraction laboratory and schedules all organic analyses. Ms. Teal interprets mass spectral data and assures that the proper quality controls are carried out with all organic analyses. Her responsibilities also include methods development and performance of research projects.

EXPERIENCE 13 Years professional experience

EDUCATION University of North Carolina, B.S., Chemistry

RELATED EXPERIENCE

- RESEARCH TRIANGLE INSTITUTE, RESEARCH TRIANGLE PARK, NC - Analytical Chemist responsible for identify confirmation, purity determination and dosage analysis of chemicals and formulations used in the National Toxicology Program. Duties included analysis by IR, GC, HPLC, UV/VIS, wet chemistry, and interpretation of Mass Spectral and NMR data. Responsibilities included writing and compilation of final reports, Standard Operating Procedures, and protocols for the bioassayers' laboratories.

- MICHELIN TIRE CORPORATION - Laboratory Supervisor/ Water Specialist for tire manufacturing firm. Supervised the chemical quality control laboratory responsible for the testing of raw materials, in-process and finished products. Later responsible for the treatment of all water systems in all Michelin plants in the United States as well as special projects relating to product contamination.

- TEXASGULF, INC. - Duties included methods development relating to laboratory analytical procedures, for phosphate mining operation, which also included conversion to liquid and dry fertilizer. Later, supervised the quality control laboratory for process control and shipment analysis.

JAMES WESTMORELAND Special Project Chemist

Mr. Westmoreland is employed as a Special Project Chemist to serve Clients with priority needs or non-routine analysis. His responsibilities require that he be cross-trained in many techniques using a variety of instrumentation. Mr. Westmoreland is experienced in operating a Gross Alpha/Beta counter, Liquid Scintillation Counters, Gas chromatograph, and atomic adsorption spectrophotometer. He primarily serves Enwright's "mixed wastes" Clients under the direction of Dr. Hoeffner.

EXPERIENCE 3 Years professional experience

EDUCATION Bob Jones University, B.S., Chemistry

RELATED EXPERIENCE

- E.I. DUPONT, SAVANNAH RIVER PLANT, AIKEN, SC- Provided analytical support on a hazardous waste characterization study at the TNX Boneyard site. Analysis included physical, organic, and metallic characterizations.
- E.I. DUPONT, SAVANNAH RIVER PLANT, AIKEN, SC- Performed toxic extraction procedure and toxicity characteristic leaching procedure on hazardous wastes samples to support a de-listing petition. Samples contained low-levels of radioactive uranium.
- BROOKHAVEN NATIONAL LAB, GLEN FALLS, NY - Analyzed cement stabilized radioactive wastes for hazardous waste characteristics.
- MARTIN MARIETTA, PIKETON, OH - Analyzed low-level radio active soil and water samples for herbicides, gross alpha and beta activity, and metal concentrations.
- CHEM NUCLEAR, BARNWELL, SC - Analyzed groundwater samples for gross alpha and beta activity, metal concentrations and tritium by liquid scintillation.

TEAM Enwright Laboratories, Inc.

TAMMY J. CLEVELAND Organics Preparation Technician

As Organics Preparation Technician, Ms. Cleveland is responsible for the extraction and concentration of samples for organic analysis by gas chromatography/mass spectrometry. Ms. Cleveland prepares samples for semivolatile, herbicide, pesticide, and PCB analyses. She also performs the biochemical oxygen test for numerous compliance studies.

EXPERIENCE 4 Years professional experience

EDUCATION Rutledge College, Nursing Assistant Certificate

RELATED EXPERIENCE

- COMMONWEALTH LABORATORIES, GREENVILLE, SC - Laboratory technician responsible for a variety of environmental compliance testing.

TEAM Enwright Environmental Consulting Laboratories, Inc.

LETITIA S. HOLCOMBE Inorganics Supervisor

Ms. Holcombe supervises all wet chemistry testing. She coordinates scheduling, training, and problem-solving. Ms. Holcombe performed cyanide analyses for this project.

EXPERIENCE 4 Years professional experience

EDUCATION Carson-Newman College, B.A., Biology

RELATED EXPERIENCE

- PALMETTO HIGH SCHOOL, WILLIAMSTON, SC - Taught biology and physical science.

JULIANA G. LUCERO

Education

BS Degree - General Science, College of Santa Fe, Santa Fe, New Mexico

Experience

Controls for Environmental Pollution, Inc., Santa Fe, New Mexico

Laboratory Technician. Water Quality Laboratory. Perform the following procedures within inorganic chemistry, microbiology, and instrumental analysis on water, soil, and oil samples. Prepare all types of standards, reagents, and medias. Handle and use: pH meter, autoclave, LaChat, Ion-chromatography, analytical balance, and personal microcomputer. Use all types of pipets, glassware, reagents, and hazardous liquids and materials. Follow and recognize all laboratory safety procedures. Calibrate pipets and machines in proper fashion.

TEAM Natural Resources Laboratory, Inc.

RON KEIL Lab Director

Mr. Keil is the lab director and head chemist. He supervises or performs all analyses. Most analyses performed by the lab are for trace elements, particularly radioisotopes. Mr. Keil performed or supervised all uranium analyses for this project.

EXPERIENCE 18 Years professional experience

EDUCATION Colorado School of Mines, B.S., Chemistry

RELATED EXPERIENCE

- LOS ALAMOS SCIENTIFIC LABORATORY - Analyzed for plutonium.

ELVIN J. CHAVEZ
LABORATORY TECHNICIAN

TEAM:

Enwright Laboratories, Inc.

EDUCATION:

AAS Degree Water and Waste Water Chemistry, New Mexico State University, Las Cruces, New Mexico

EXPERIENCE:

Controls for Environmental Pollution, Inc. Santa Fe, New Mexico

Technical Services. Provide technical assistance to clients which includes: advising on required tests to be performed, pricing information, correct sampling and preservation, reviewing data with clients and advising of problems concerning analysis. Reviewing and signing reports, submitting reruns when necessary, run cation/anion balances using ion data base program and also for computing analytical data and storage.

In charge of special projects which includes: distribution ratios, cation exchange capacity, centrifuge moisture, atterburg limits, plasticity and plastic/liquid limits. Advise clients of proper EPA protocol as well as RCRA hazardous waste identification, preparation (EP Tox and TCLP) and also of maximum contaminant levels (MCL) set forth by IBWA, SDWA and State Regulatory Agencies.

Group Leader. Supervised technicians in the laboratory area and assigned duties. Assisted in solving analytical problems and choosing proper methodology for analyses performed. Assisted technical services in updating and improving ongoing methods and also selecting and reviewing new methods. Prepared EPA spikes for metals, wet chemistry, bacteriology and organic chemistry analysis. Worked closely with other supervisors in solving methods, equipment failure and other mechanical and analytical problems. Provided training to laboratory personnel in chemical analysis, laboratory safety and hazardous sample collection, handling, storage and disposal. Reviewed and approved wet chemistry data of work performed by technicians to check for curve accuracy, internal lab spike accuracy and duplication of samples. Prepared annual and quarterly job evaluations on subordinates.

Technician. Water Quality Laboratory. Performed the following tests on soil, vegetation, oil and water samples: pH, total suspended solids, total dissolved solids, turbidity, chemical oxygen demand, carbonates, bicarbonates, alkalinity, fluoride and cyanide distillation, which also included making standards, setting up a curve and analyzing fluoride and cyanide, potentiometrically, specific conductivity, preparing dilutions and standards to make curve for the fluoride test and analyzing sulfates, gravimetrically. Other duties included determining hardness, residual chlorine, ignitability, hexavalent chromium and phenols using spectrophotometer, iodine, sulfide, sulfite, acidity, oil and grease, color odor and surfactants. Operated Ion Chromatograph, prepared acids and reagents for total dissolved solids, total suspended solids and slow sulfate tests using metler balance, calibrations of micro liter pipets, logging data, and making computations. Determined nitrate, nitrite, total Kjeldahl nitrogen, ammonia, sulfate, and chloride using the Lachat Quick-chem machine. Performed field sampling for environmental parameters and collected data for air and water quality testing; assisted Receiving Department in sample preservation; performed sample extractions for organic chemistry using sonic dismembrator and extractions for PCB parameter; determine total coliform for Bacti Lab. Determined dry weight, % solids, % moisture and specific gravity in soil and oil, bromide in H_2O, orthophosphate and acetate in H_2O using Ion Chromatograph. Attained certificate of training for hazardous chemicals handling and mining operation from United States Department of Labor.

Santa Rosa Water Department, Santa Rosa, New Mexico

Assistant Operator. Duties performed included operation of waste water treatment facility which consisted of primary clarifier, trickling filter plant, settling basin, contact chamber, and chlorine injection rooms. Performed daily scrub downs, visual inspection of equipment and servicing. Sample collection, preservation. Running residual chlorine and settleable solids and deliver to laboratories for further analysis.

ATTACHMENT

Enwright Laboratories Certifications and Radioactivity License

South Carolina Department of Health and Environmental Control

Parameter Certification

The ENWRIGHT LABORATORIES laboratory has been evaluated and has demonstrated proficiency in the detection of the following parameters:

CLEAN WATER ACT

METHOD 624 PURGEABLES GC/MS
METHOD 625 BASE/NEUTRALS AND ACIDS GC/MS

LAB I.D. No. 23127

Certificate No. 87050

Issued: January 5, 1988

Expires April 14, 1990

Wayne Davis
Manager
Laboratory Certification Section

South Carolina Department of Health and Environmental Control

Parameter Certification

The ENWRIGHT LABORATORIES laboratory has been evaluated and has demonstrated proficiency in the detection of the following parameters:

SAFE DRINKING WATER ACT

HYDROGEN-ION CONCENTRATION (pH)
STANDARD PLATE COUNT
TOTAL COLIFORM BACTERIA (MF)
FLUORIDE
ARSENIC
BARIUM
CADMIUM
CHROMIUM
LEAD
MERCURY
SELENIUM
SILVER

CLEAN WATER ACT

NITRATE - BRUCINE METHOD
COLOR - 110.2 COLORIMETRIC METHOD
PHENOL - 420.1 SPECTROPHOTOMETRIC METHOD
CHLORIDE - MERCURIC NITRATE METHOD
SULFATE - TURBIDIMETRIC METHOD
SULFIDE - IODOMETRIC METHOD
SULFITE - IODOMETRIC METHOD
CYANIDE - SPECTROPHOTOMETRIC METHOD
TOTAL ALKALINITY - TITRIMETRIC METHOD
TOTAL PHOSPHORUS - COLORIMETRIC METHOD
ORTHOPHOSPHATE - COLORIMETRIC METHOD
SPECIFIC CONDUCTANCE
DISSOLVED OXYGEN
AMMONIA-NITROGEN - ELECTRODE METHOD
TOTAL KJELDAHL NITROGEN - TITRATION METHOD
TOTAL DISSOLVED SOLIDS - METHOD 209.B
TOTAL SUSPENDED SOLIDS - METHOD 209-C
TOTAL ORGANIC CARBON - METHOD 415.1
BIOCHEMICAL OXYGEN DEMAND
FECAL COLIFORM BACTERIA (MF)

TRACE METALS ANALYSIS

ALUMINUM	COPPER	SILVER
ANTIMONY	IRON	ZINC
ARSENIC	LEAD	CALCIUM
BERYLLIUM	MANGANESE	MAGNESIUM
CHROMIUM	MERCURY	POTASSIUM
CADMIUM	NICKEL	SODIUM
COBALT	SELENIUM	

LAB I.D. No. 23127

Certificate No. 87050

Issued: JULY 30, 1987

Expires APRIL 14, 1990

Wayne Davis
Manager
Laboratory Certification Section

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

RADIOACTIVE MATERIAL LICENSE

Pursuant to the Atomic Energy and Radiation Control Act, Section 13-7-40 et. seq. of S.C. Code of Laws of 1976, as amended, and Supplements thereto, and the South Carolina Department of Health and Environmental Control Regulation 61-63, Radioactive Material (Title A), and in reliance on statements and representations heretofore made by the applicant, a license is hereby issued authorizing the licensee to receive, acquire, possess and transfer radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules and regulations of the South Carolina Department of Health and Environmental Control now or hereafter in effect and to any conditions specified below.

LICENSEE	
1. Name Enwright Laboratories, Inc.	3. License Number 388
2. Address 104 Tower Drive P.O. Box 5287 Greenville, S.C. 29607	4. Expiration Date February 28, 1991

5. Radioactive Material (Element and Mass Number)	6. Chemical and/or Physical Form	7. Maximum Radioactivity and/or quantity of material which licensee may possess at any one time.
A. Any radioactive material with Atomic Nos. 1 through 83	A. See Item 8.A. below	A. See Item 8.A. below.
B. Nickel 63	B. Sealed source (Varian Vista Model 600000.00)	B. 8 millicuries.

8. Authorized Use:

A. As contaminants incidental to water and sludge analysis, not to exceed one millicurie total.

B. To be used in a Varian Vista 6000 gas chromatograph.

Conditions

- Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Material License
Supplementary Sheet

License Number 388

Amendment No.

Conditions continued

10. The licensee shall comply with the provisions of Title A, State of South Carolina Rules and Regulations for Radiation Control; Part I - General Provisions; Part III - Standards for Protection Against Radiation; and Part VI - Notices, Instructions, and Reports to Workers; Inspections.

11. Radioactive material shall be used by, or under the supervision of: William E. Tabor or Steve L. Hoeffer.

12. Unless otherwise specified by specific conditions of this license, the licensee shall not use radioactive material in or on human beings, experimental animals, products distributed to the public, or in field applications where activity is released to the environment.

13. A. Each sealed source containing radioactive material other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed three years. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

B. The test shall be capable of detecting the presence of 0.005 microcuries of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Department.

C. If the test reveals the presence of 0.005 microcuries or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Department regulations. A report shall be filed within five (5) days of the test with the Chief, Bureau of Radiological Health, S.C. Department of Health and Environmental Control, 2600 Bull Street, Columbia, S.C. 29201, describing the equipment involved, the test results, and the corrective action taken.

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Material License
Supplementary Sheet

License Number 388

Amendment No.

Conditions continued

14. Tests for leakage and/or contamination shall be performed by persons specifically authorized by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such service.

15. In lieu of using the conventional radiation caution colors (magenta or purple on yellow background) as provided in RHA 3.8.1 of Part III, the licensee is hereby authorized to label detector cells and cell baths, containing radioactive material and used in gas chromatography devices, with conspicuously etched or stamped radiation caution symbols without a color requirement.

16. The licensee shall perform surveys of all incoming samples. Records of these surveys shall be maintained for review by the Department.

7. The licensee shall maintain a current inventory log of all samples received. This log shall be maintained for review by the Department.

18. The licensee shall dispose of all radioactive material and contaminated items by return to the sample generator.

19. The licensee shall maintain itemized disposal records for review by the Department.

20. Except as specifically provided otherwise, the licensee shall possess and use radioactive material described in Items 5, 6, and 7 of this license in accordance with statements, representations, and procedures contained in application dated November 25, 1985; and letters dated January 13 and 21, 1986, all signed by William E. Tabor.

: of Issuance February 25, 1986

For the South Carolina Department
of Health and Environmental Control

By: Heyward G. Shealy (VRA)
Heyward G. Shealy, Chief
Bureau of Radiological Health

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Material License
Supplementary Sheet

License Number 388

Amendment No. 01

Enwright Laboratories
104 Tower Drive
Greenville, South Carolina 29607

In accordance with letter dated February 21, 1986, signed by William E. Tabor, S.C. Radioactive Material License No. 388 is hereby AMENDED:

TO CHANGE:

5. Radioactive Material (Element & Mass Number)	6. Chemical and/or Physical Form	7. Maximum Radioactivity and/or quantity of material which licensee may possess at any one time.
A. Any radioactive material with Atomic Nos. 1 thru 98	A. Any	A. See Item 8.A. below

TO CHANGE: 8.A. Authorized Use:

A. As contaminants incidental to water, sludge, and chemical analysis not to exceed 1 millicurie total.

TO ADD: Condition 21.

21. Except for plutonium contained in a medical device designed for individual human application, no plutonium, regardless of form, shall be delivered to a carrier for shipment by air transport or transported in a aircraft by the licensee except in packages the design of which the U.S. Nuclear Regulatory Commission has specifically approved for transport of plutonium by air.

March 28, 1986
Date of Issuance

For the South Carolina Department of Health and Environmental Control

By: Heyward G. Shealy
Heyward G. Shealy, Chief
Bureau of Radiological Health

DHEC 812 (11-83)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Material License
Supplementary Sheet

License Number 388

Amendment No. 04

Enwright Laboratories, Inc.
Greengate Office Building #5
25 Woods Lake Road
P.O. Box 5287
Greenville, South Carolina 29607

In accordance with letter dated January 21, 1988, signed by Steve L. Hoeffner, Ph.D., S.C. Radioactive Material License No. 388 is hereby AMENDED:

TO CHANGE:

8. Authorized Use:

A. As contaminants incidental to water and sludge analysis not to exceed 10 millicuries total.

Date of Issuance ~~January 28, 1988~~

For the South Carolina Department of Health and Environmental Control

By: Heyward G. Shealy

Heyward G. Shealy, Chief
Bureau of Radiological Health

APPENDIX D

Sampling Procedures and

Chain of Custody Forms

D.1 300-M Sludge Sampling Procedure

Special Procedure IWT-88-4-1
300-M SLUDGE SAMPLING PROCEDURE

SAFETY

- Wear the following protective clothing as a minimum: brown coveralls (regulated clothing required for Uranium process work), rubber gloves and safety glasses.
- Use extreme caution when climbing or descending ladder.
- Use rope to raise and/or lower equipment and supplies to tank tops. Do not carry materials when climbing or descending ladders.

EQUIPMENT

- "Sludge Judge" sampler
- Stainless steel bucket
- Stainless steel funnel
- 40 1-gallon polypropylene jugs
- Tamper-proof seals
- Permanent marking pin
- Plastic bags and wipes

PROCEDURE

NOTE: All sampling to be conducted under guidance of C. A. Langton or J. P. Harley.

1. Transport equipment to location to be sampled.
2. Place bucket on plastic bag so as to catch potential spills.
3. Assemble "Sludge Judge" sampler. (Note: Five sections are needed for tanks 7 and 8; three sections are needed for tanks 1-6.)
4. Slowly lower the "Sludge Judge" to the bottom of the tank. Tug firmly on the rope as you begin to raise the unit to seat the check valve.
5. Place the bottom end (discharge) of the "Sludge Judge" in the bucket and drain the sludge from the unit by bumping the pin extending from the bottom section against the bottom of the bucket.
6. Discharge supernatant from "Sludge Judge" back into the tank being sampled by bumping the discharge pin against the inside of the tank.

7. Using a funnel, carefully pour the sample from the bucket into a 1-gal. polypropylene jug. Note: Bucket is to be emptied as needed to facilitate sampling.

8. Repeat steps 4 - 7 until one gallon of sample is obtained.

9. Label jug with tank number and sample location and place tamper-proof seal on jug top.

10. Repeat steps 4 - 9 until 2 gallons of sample are obtained from each sample location for tanks 7 and 8 and at least 1 gallon of sample is obtained from each sample location for tanks 1 - 6.

11. Store samples in locked cabinet until transport to SRL using Chain of Custody records can be made.

D.2 Savannah River Laboratory Notebook Record of 300-M F006 Sludge Stabilization

Savannah River Laboratory
Notebook Record

The 300-M F006 sludge collected during April 1988 was first allowed to settle in 4 liter collection bottles after they were transferred to SRL. During sampling, a small amount of supernate wastewater was also collected. After resettling, the supernate was decanted from the original sample containers and poured into one liter polypropylene bottles, sealed and labeled with the same number as on the tamper proof seal for the original collection bottle.

The F006 sludge in the 4 liter containers was homogenized by stirring with a spatula and 1000 grams was then removed from each of the 32 bottles (one from each of the four sample locations in the 8 waste tanks). The pH of the 1000 gram F006 sample was adjusted with 50 grams of 50 weight percent Na(OH) solution in order to achieve a more fluid (pumpable material). The higher alkalinity of the pH adjusted sludge was also found to accelerate the hydration reactions of the cementitious solids used to solidify the sludge.

The sludge was then stabilized with a mixture of cementitious solids consisting of portland cement, Newcem (cementitious slag) and Class F fly ash. Supernate removed from each of the original bottles of waste was added to the sludge-cementitious solids mixture to achieve a processable waste form. The amount of supernate added to each 300-M saltstone sample depended on the viscosity of the F006 sludge-cementitious solids mixture. The supernate added varied between 5 and 20 percent of the total weight of the mixture. Only the amount of supernate needed to wet the cementitious solids and provide for intimate mixing of the waste sludge and dry solids was added.

300-M saltstone samples were cast into polypropylene bottles for EP and TCLP testing. The bottles were sealed and labeled with the chain of custody number from the original waste sample used to make the saltstone. Samples for total chemical analysis and archive specimens were also prepared in the same manner. Rheological properties (plastic viscosity and yield point) were measured for one of the waste forms from each tank sampled.

The 300-M saltstone samples were allowed to set at room temperature in sealed containers. All samples set within 5 days. The samples were then cured in the same sealed containers for 28 days prior to being packaged for shipment to Enwright Laboratories for total analysis, and EP and TCLP extractions.

The chain of custody for these samples was transferred to Enwright Laboratory personnel on 7-25-88.

TITLE M-AREA Sludge Saltstone DATE 6-24 Page No. 91

PURPOSE Adjust Sludge pH Book No. E 43345

TANK 7 SE port $\boxed{pH = 12}$ >11 , <12.3

pH determined by Microessentials pH paper

mix
100 g sludge (~~shaken~~ to mix)
5 g 50% Na(OH)

Centrifuge to separate liquid for pH determination

pH of adjusted sludge to 5% 50% Caustic

TANK 7

ID		pH	pH after adjustment with 5g 50% caustic/100g waste
1523	SE	12	~13.5
	SW	12	13.5
	NE	12	13.5
	NW	12	13.5
1763	NW 4		

Prepare pH adjusted waste - Tank 7

ID		tare(g)	g waste	g 50% NaOH	g total
1523	SE	177.7	1000 g	50 g	1050
1535	SW		1000	50	1050
1536	NE		1000 g	50 g	1050
1751	NW		1000	50 g	1050

Tank 4

Seal (ID)	~~[illegible]~~	supernate pH	Adj pH +5% 50% NaOH	g waste	g 50% NaOH	g total
1763	4-NW	10.3	13.2	1000	50	1050
1766	4 SE	10.3	13.2	1000	50	1050
* 1765	4 SW	10.3	13.2	1000	50	1050
1764	4 NE	10.3	13.2	1000	50	1050

* Sample used for settling test p. 93 of notebook

EXPERIMENTER Christine A Langton DATE 4-24-88

WITNESSED BY DATE

92 Page No. TITLE M-Area Saltstone DATE 6/24/26

E 43345 Book No. PURPOSE Adjust Sludge pH

TANK 6

	TANK ID	pH	adjusted pH	(g waste	50% (g NaOH) adjusted	(g) total
1771	6NW	12.1	13.5	1000	50	1050
1772	6NE	12.1		1000	50	1050
1773	6SW	12.1		1000	50	1050
1774	6SE	12.1		1000	50	1050

TANK 2

		pH	adjusted pH	g waste	g 50% NaOH soln	(g) total
1757	2SW	12.1	13.5	1000	50	1050
1758	2NW	12.1	13.5	1000	50	1050
-	2NE	12.1	13.5	1000	50	1050
-	2SE	12.1	13.5	1000	50	1050

TANK 5

	TANK ID	pH	adjusted pH	(g) waste	(g) NaOH adjusted	(g) total
1768	5NE	12.1	13.2	1000	50	1050
* 1767	5NW	12.1	13.2	1000	50	↓
1769	5SW	12.1	13.2	1000	50	
1770	5SE	12.1	13.2	1000	50	

TANK 1

		pH	adjusted pH	g waste	g NaOH adjusted	g total
1753	1NW	12.1	13.5	1000	50	1050
1756	1SE	12.1	13.5	1000	50	1050
1755	1SW	12.1	13.5	1000	50	1050
1754	1NE	12.1	13.5	1000	50	1050

	TANK 3	pH	adjusted pH	g waste	g (NaOH) adjusted	g total
1761	3SW	10.5	13.5	1000	50	1050
1762	3SE	10.2	13.5	1000	50	1050
1760	3NE	10.5	13.5	↓	↓	↓
1759	3NW	10.5	13.5			

TANK 8

1527	8NW	12.2	13.5	1000	50	1050
1530	8NE	12.2	13.5	1000	50	1050
1532	8SE	12.2	13.5	1000	50	1050
	SW					

EXPERIMENTER Christine Aharfor DATE 6-26-88

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE M-Area Saltstone DATE 6-24 Page No. 93

PURPOSE Test Setting Properties of pH adjusted sludge Book No. E 43345

Test	Set as of	pH adj' Sludge	Blend Slag	Supernate
1-1	set by 6-27	54 g	54 g	— 20 g
1-2	6-27	50 g of 1-1	—	5 g
2-1	6-27	54	54	20
2-2	6-27	50 g 2-1		5 g
4-1	not set 6-27	54	54	10 g
4-2	not set 6-27	50 g 4-1		5 g
5-1	not set 6-27	54	54	15 g
5-2	not set 6-27	50 g 5-1		5 g
6-1	6-27	54	54	15
6-2	6-27	50 g 6-1		5 g
7-1	6-27	54		15
7-2	6-27	50 g 7-1		5 g
3-1		54	54	5 g
3-2		50 g 3-1		5 g
5-1 Rework	10% caustic	54	54	5 g
5-2 Rework	"	50 g 5-1 rework		5 g
4-1 Rework	"	54	54	10 g
4-2 Rework	"	50 g 4-1 rework		5 g
8-1	6-28	54 g	54 g	20 g
8-2	6-28	55.3 g of 8-1		5.5 g
3-1 Rework with 10% caust		54	54	5 g
3-2 Rework with 10% caust		50 g ~~3-1~~ Rework		5 g

EXPERIMENTER

WITNESSED BY [illegible] DATE [illegible]

E. I. DU PONT DE NEMOURS & CO. (INC.)

94 Page No. TITLE M-Area Saltstone DATE 6-27-88

E 43345 Book No. PURPOSE Extra pH adjustment of Tanks 4 + 5

Seal ID	Added $Na(OH)_2$	pH adjusted slurry	~~total~~ g	
1765	50	1140	1190	TANK 4
1763	50g	1127	1177	Adjusted ~~with~~
1766	50	1140	1190	10 wt% $Na(OH)_2$ 50%
1765	50	1082	1132	
1767	50	1089	1139	TANK 5
1768	50	1141	1191	Adjusted with
1769	50	1138	1188	10 wt% $Na(OH)_2$ 50%
1770	50	1140	1190	
1759	50	1138	1188	TANK 3
1760	50	1137	1187	Adjusment with
1761	50	1125	1175	extra caustic
1762	50	1073	1123	to 10 wt% $Na(OH)_2$ 50% soln

EXPERIMENTER Christin A. Langton DATE 6-28

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE M-Area Saltstone DATE 6-27-88 Page No. 95

PURPOSE Prepare Composite Chain of Custody Samples for Analysis No. E 43345

TANK 5

sludge Composite 5

Seal ID		Running total (g) Sludge	(original - no pH adjust.)
1767	NW	103.7 g	22.7 g
1768	NE	63.8 g	38 g
1769	SW	~~25.8~~	25.8 g
1770	SE	81.0	17.2 g

supernate 5 Seal ID 1769 (SW)

supernate filtered through 0.45 μm Nalgene Disposable filter before sending to analytical

---

TANK 4

sludge composite 4

Seal ID	Location	Composite wt Running total g	Individual Sludges - no pH adjust. g
1764	NE	25.4	25.4
1765	SW	49.9	24.5
1763	NW	75.7	25.8
1766	SE	101.0	25.3

supernate 4 Seal ID 1766 (SE)

supernate filtered through 0.45 μm Nalgene Disposable filter before sending to analytical

---

TANK 6

sludge composite 6

Seal ID	Location	Composite wt Running total g	Individual sludge no pH adjust (g)
1772	NE	24.9	24.9
1771	NW	49.7	24.8
1773	SW	75.9	26.2
1774	SE	102.2	26.3

Supernate 6 seal ID (SE) 1774

supernate filtered through 0.45 μm Nalgene Disposable filter before sending to Analytical

EXPERIMENTER C Abrams DATE 6-27

WITNESSED BY DATE

96 Page No. TITLE M-Area Settling DATE 6-28-85

E 43345 Book No. PURPOSE Make composite Sludge for Analytical Chain of Custody

TANK 2

sludge composite 2

Seal ID	Location	Composite wt Running total	Individual sludge wt g
1757	SW	25.7	25.7
? -1775	SE	51.2	25.5
? 1776	NE	75.2	24.0
1758	NW	100.6	25.4

Supernate 2 seal ID 1757 (SW)

TANK 1

sludge composite 1

Seal ID	Location	Composite wt Running total	Individual Sludge wt g
1754	NE	25.8	25.8
1753	NW	52.8	27.0
1756	SE	78.2	51.2
1755	SW	104.5	26.3

Supernate 1 seal ID 1755 (SW)

TANK 3

sludge composite 3

Seal ID	Location	Composite wt Running total	Individual Sludge wt g
1759	NW	24.8	24.8
1762	SE	50.0	25.2
1760	NE	75.4	25.4
1761	SW	100.0	24.6

Supernate 3 seal ID 1761 (SW)

EXPERIMENTER Christine A Langston DATE 6-27-88

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE M-Area Saltstone DATE 6-28-88 Page No. 97

PURPOSE ~~Test Saltstone Settling + Adjust off~~ Book No. E 43345
Make Composite Sludges for Analytical Chain of Custody

TANK 7

sludge composite 7

Seal ID #	Location	Composite wt Running total	Individual sludge wt (g)
1523	SE	25.0	25.0
1525	SW	50.3	25.3
1536	NE	75.3	25.0
1751	NW	100.2	24.9

supernate 7 1536 (NE)

TANK 8

sludge composite 8

Seal ID	Location	Composite wt Running total	Individual sludge wt (g)
1527	NW	25.1	25.1
1530	NE	50.4	25.3
1532	SE	75.1	24.8
1534	SW		

EXPERIMENTER C A Langton DATE 6-28-88

WITNESSED BY DATE

98 Page No. TITLE M-Area Settlers DATE 6-29

E 43345 Book No. PURPOSE Grout Rheology

TANK 1 NW Grout

3	31
6	41
100	69
200	86
300	102
600	142

pv = 40 (cp) yield point = 102 (lbs/100 ft²)

10 min gel strength 35 (lbs/100 ft²)

Tank 2 NW Grout

3	34
6	46
100	62
200	78
300	94
600	134

pv = 40 (cp) yield point = 54 (lbs/100 ft²)

10 min gel strength 68 (lbs/100 ft²)

TANK 3 NE 1760 seal ID

3	13
6	17
100	22
200	26
300	30
600	42

pv = 12 (cp) yield point = 18 (lbs/100 ft²)

10 min gel strength start 10:27 19 (lbs/100 ft²)

EXPERIMENTER [signature] DATE 6-29-88

WITNESSED BY DATE

TITLE M-Area Saltstone DATE 6-29 Page No. 99

PURPOSE Make Leaching Samples Book No. E 43345

TANK 1 Saltstone

TANK 2 Saltstone

	g
Slag	235
F Ash	235 (American)
II Cement	30
Sludge	500
Supernate	200

TANK 1 Saltstone Waste

tank/port	SEAL ID	Samples EP	MEP	TCLP	ANS16.1
T 1 NW	1753	2	2	2	2
T 1 NE	1754	2	2	2	2
T 1 SW	1755	2	2	2	2
T 1 SE	1756	2	2	2	2

TANK 2 Saltstone

Slag	235
F-Ash	235 (American)
II Cement	30
Sludge	500
Supernate	200

TANK/port	Waste Seal ID	Samples EP	MEP	TCLP	ANS16.1
T2 NE	1776	2	2	2	2
T2 SE	1775	2	2	2	2
T2 SW	1757	2	2	2	2
T2 NW	1758	2	2	2	2

TANK3

	g
slag	235
F ash	235
Cement	30
sludge	500
supernate	~~100~~ 50

tank/port	Seal ID	EP	MEP	TCLP	ANS16.1
T3 NW	1759	2	2	2	2
T3 NE	1760	2	2	2	2
T3 SW	1761	2	2	2	2
T3 SE	1762	2	2	2	2

EXPERIMENTER Christine Langton DATE 6-30-88

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

100 Page No. TITLE H Area Saltstone DATE 6-30-88

E 43345 Book No. PURPOSE Grout Rheology

TANK 4 Saltstone Grout Rheology

3	26
6	28
100	35
200	40
300	45
600	60

PV = 24 (cp) yield pt. = 21 (lbs/100ft²)

not good measurement
too thick getting slippage on film of ledge

10 min gel strength 11:22
52 (lbs/100ft²)

TANK 5 Saltstone Grout

~~T5-NE~~ T5-NW

3	30
6	37
100	46
200	68
300	88
600	147

PV = 59 (cp) yield pt. 29 (lbs/100ft²)

10 min gel strength start 12:54 300 + (#10?) (lbs/100ft²)

TANK 6 Saltstone Grout

T6-NE

3	23
6	30
100	43
200	48
300	54
600	80

PV = 26 (cp) yield point - 28 (lbs/100ft²)

10 min gel strength ~~start~~ 01:46
175 (lbs/100ft²)

EXPERIMENTER Christine A. Langton DATE 6-30-88

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE M-Area Saltstone DATE 6-30-88 Page No. 101

PURPOSE Prep of Saltstone Samples for Required Leaching Book No. E 43345

Tank 4 Receipe

* Slag	235
~~*~~ F Fly Ash	235
~~*~~ Cement	30
~~*~~ Sludge	500
Supernate	100

				EP	MEP	TCLP	ANS16.1
*	*	T4 NW	1763	2	2	2	2
≠	*	T4 NE	1764	2	2	2	2
≠	≠	T4 SW	1765	2	2	2	2
≠	≠	T4 SE	1766	2	2	2	2

≠

Slag	235	g
F Fly Ash	235	g
Cement	30	g
Sludge	500	g
supernate	150	g

Still thick thixotropic

Tank 5 Receipe

Slag	235 g
F flyash	235 g
Cement	30
sludge	500
supernate	50

	Seal ID	EP	MEP	TCLP	ANS16.1
T5 NW	1767	2	2	2	~~2~~
T5 NE	1768	2	2	2	2
T5 SW	1769	2	2	2	2
T5 SE	1770	2	2	2	2

TANK 6

Slag	235 g
F Flyash	235
Cement	30
Sludge	500
Supernate	250 ~~200~~

	Seal ID	EP	MEP	TCLP	ANS16.1
T6 NW	1771	2	2	2	2
~~T6~~ T6 NE	1772	2	2	2	2
T6 SW	1773	2	2	2	2
T6 SE	1774	2	2	2	2

EXPERIMENTER DATE

WITNESSED BY [illegible signature] DATE 6-30-88

E. I. DU PONT DE NEMOURS & CO. (INC.)

102 Page No. TITLE M-Area Saltstone DATE 6-30-88

E 43345 Book No. PURPOSE Grout Rheology

Tank 7 Grout Rheology

Tank 7 NE ~~332~~ 2H 1523

3	26
6	35
100	46
200	59
300	72
600	109

pV = 37cp
ypoint = 35 (lbs/100ft²)

10 min gel strength 3:05
82 (lbs/100ft²)

TANK 8 GROUT RHEOLOGY

TANK 8 SE 1532

3	21
6	29
100	37
200	44
300	51
600	75

pv = 24 (cp)
yieldpt = 27 (lbs/100ft²)

10 min gel strength - 3:44 50 (lbs/100ft²)

EXPERIMENTER Christen Alanzo DATE 6-30-88

WITNESSED BY DATE

TITLE ~~M~~ Area Saltstone DATE 6-30-88 Page No. 103

PURPOSE Prep Saltstone for Required Leaching Book No. E 43345

TANK ~~8~~ Saltstone

Slag	235
FA Ash	235
Cement	30
Sludge	500
Supernate	100

Tank 7	Seal ID	EP	MEP	TCLP	ANS 16.1
T7 SE	1523	2	2	2	2
T7 SW	1525	2	2	2	2
T7 NE	1536	2	2	2	2
* T7 NW	1751	2	2	2	2

* T7 NW recipe

slag	235
F Flyash	235
Cement	30
sludge	500
supernate	200

sludge thicker than other T7 samples

Tank 8 Saltstone

slag	235
F flyash	235
cement	30
sludge	500
supernate	200

Tank 8	Seal ID	EP	MEP	TCLP	ANS 16.1
T8 NW	1527	2	2	2	2
* T8 NE	1530	2	2	2	2
* T8 SE	1532	2	2	2	2
T8 SW	1534	2	2	2	2

slag	235
F flyash	235
cement	30
sludge	500g
supernate	250g

EXPERIMENTER Christine Langton DATE 6-30-88

WITNESSED BY DATE

104 Page No. TITLE M-Area Saltstone Study DATE 7-5-88

E 43345 Book No. PURPOSE SET Time

Tank	2	NW	Port	SET	See page 98
Tank	2	SW	"	SET	See page 99
Tank	2	NE	"	SET	
Tank	8	SE	"	SET	
Tank	2	SE	"	SET	
Tank	8	NE	"	SET	
Tank	8	NW	"	SET	

7/6/88

Tank 7	SE	Port	SET	
	SW	"	SET	
	NE	"	SET	
	NW	"	SET	
Tank 3	SE	Port	SET	~ 2 % Free H_2O
	SW	"	SET	~ 2 % Free H_2O
	NE	"	SET	~ 2 % Free H_2O
	NW	"	SET	~ 2-3 % Free H_2O
Tank 4	SE	Port	SET	~ 0.1 % Free H_2O
	SW	"	SET	~ 1 % Free H_2O
	NE	"	SET	no free H_2O
	NW	"	SET	no free H_2O
Tank 1	SE	Port	SET	no free H_2O
	SW	"	SET	no free H_2O
	NE	"	SET	no free H_2O
	NW	"	SET	no free H_2O

reabsorbed after 7 days by 7-7-88

EXPERIMENTER WW Haley DATE 7/5/88

WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE M-Area Saltstone Study DATE 7-6-88 Page No. 105

PURPOSE Set time Book No. E 43345

• Tank 5	SE Port	SET	no free H_2O
	SW "	SET	no free H_2O
	NE "	SET	no free H_2O
	NW "	SET	no free H_2O
• Tank 6	SE Port	SET	no free H_2O
	SW "	"	"
	NE "	"	"
	NW "	"	"

Date: 7/7/88

• Sampled Leach Soln.

(1) 4-5-8A
(2) 4-5-8B

• Sampled 1 thru 13 3K-88 Leach Solns.

• Dumped Samples from Enwright Lab. - Depleted Uranium.

• Rec'd. 5 Boxes of 50 ml vials to be used for EP TOX. PR # 2709663 AX 0849596

Date: 7/8/88

CALORIMETER STUDY See page 107

Purpose: Evaluate Slag made by Standard Slag Co. for Z Area Production Facility.

Method: Prepared Saltstone in std. order.

46% of Sim 296 DWPF Salt Soln
25% of Slag By Standard Slag Co.
25% of "F" Flyash by American Flyash Co.
4% of Type II Cement by Blue Circle

EXPERIMENTER WW Hanley DATE 7/8/88

WITNESSED BY DATE

108 Page No. TITLE M-Area Saltstone DATE 7/21/88

E 43345 Book No. PURPOSE Prepare EP Tox Samples for leach

Samples from M-Area (4 ea. EP Tox, prepared 6/28 & 6/29/88) are packaged and cured at 40°C.

Sample are Tank #1 SE Port, SW Port, NE Port, + NW Port

Sample	are	Tank	#1	SE Port	SW Port	NE Port	NW Port
"	"	"	#2	"	"	"	"
"	"	"	3	"	"	"	"
"	"	"	4	"	"	"	"
"	"	"	5	"	"	"	"
"	"	"	6	"	"	"	"
"	"	"	7	"	"	"	"
"	"	"	8	"	#	"	"

All samples are EP Tox which weighs 80 gr. (greater)
Sampled cured over weekend.

7/22/88

A Sample was prepared from Tank 8 SW Port by C. Langton.
Cured in oven at 40°C over weekend.

7/25/88

Salt-stone samples from above were removed from 40°C oven and packaged for Enwright Lab.

The samples are prepared for Enwright Lab. Greenville, S.C. attn. Dr. Steve Hoffner.

7/28/88

M-Area saltstone samples were given to EnWright Lab. people.

EXPERIMENTER [signature] DATE 7/28/88

WITNESSED BY DATE

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: M-Area Saltstone [1] DATE: 7/25/88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: C. A. Langton and W. W. Harley

DATE	TIME	Saltstone Composite SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	wt. gr. VOLUME	ANALYSIS REQUIRED	COMMENT
7/25/88		TANK #7	WB 18028	B106 773A	75	Analyze per Purchase Requisition # W 74839	See Instructions
		8	WB 18029				
		1	WB 18030				
		2	WB 18031				
		3	WB 18032				
		4	WB 18033				
		5	WB 18034				
		6	WB 18035				

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
W W Harley	7/25/88	2:00 PM	Robert A. Mabry				

1. RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2. RECORD SEAL No. IF SEAL IS USED.
3. Each Sampler Seal (contained) 16 Saltstone samples

8/3/88

A sample from Z Area Vault Cells had water (Rain) held up in them. In order to dump a pH measurement had to be made.

Vault #1	pH
Cell #1	10.9 ✓
Cell #2	10.8 ✓
Cell #3	10.8 ✓

EXPERIMENTER W W Harley DATE 8/3/88

WITNESSED BY DATE

D.3 Chain of Custody Record for Collection of 300-M Sludge Waste (F006) for Waste Stabilization and for Off-Site Waste Form Evaluation

Chain of Custody Documentation

The chain of custody documentation contained in this Appendix covers collection of the waste samples by IWT/SRL personnel and analyses of stabilized waste by personnel from Enwright Laboratories, Inc. Preparation of the waste form was conducted by Christine A. Langton and Willie Harley in Room B106 Building 773A, and chain of custody was maintained throughout the preparation process and curing period by those individuals. Chain of custody control for samples submitted to Enwright Laboratories, Inc. is provided in other documentation.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 AREA SLUDGE SALTSTONE[1] DATE: 4-20-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: J.P. HARLEY, C.A. LANGTON, W. HARLEY, E.G. OREBAUGH

DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	VOLUME	ANALYSIS REQUIRED	COMMENT
4-20	1:06PM	100-7SE1	1523	SE Port T7	≈1Gal	Saltstone EP toxicity test	~2'6" Sludge
4-20	1:30PM	100-7SE2	1524	SE Port T7	≈1Gal		—
4-20	2:05	100-7SW1	1525	SW Port T7	≈1Gal		~2'7" Sludge
4-20	2:25	100-7SW2	1526	SW Port T7	~1Gal		—
4-21	12:35PM	100-8NW1	1527	NW Port T8	~1GAL		~3'6" Sludge (bottom 1' of Sludge = thick, top 2½' of Sludge = v. thin - watery)
4-21	12:50	100-8NW2	1528	NW Port T8	~1GAL		
4-21	1:15	100-8NE1	1529	NE Port T8	~1GAL		~2'11" Sludge
4-21	1:30	100-8NE2	1530	NE Port T8	~1GAL		—
4-21	1:55	100-8SE1	1531	SE Port T8	~1Gal		~4' Sludge (top 3' of which is relatively thin compared to bottom 1' which is thick settled sludge)
4-21	2:10	100-8-SE2	1532	SE Port T8	~1GAL		—

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christine A Langton	4-21-88	3:05PM	samples carried to 773-A Room B 10 and locked in cabinet 4				Christine A Langton, W W Harley
Christine A Langton	5-6-88	—	samples transferred to 55 gal drums in 773-A Rm BC6				Christine A Langton, W W Harley

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

page 2/4

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 AREA SLUDGE SALTSTONE [1] DATE: 4-21-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: J.P. Harley, C.A. Langton, W Harley, E.G. Orebaugh

DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	VOLUME	ANALYSIS REQUIRED	COMMENT
4-21	2:30PM	100-8SW1	1533	SW Port T8	~1GAL	Saltstone	3'6" total sludge (<1' heavy settled sludge ~2'6" watery sludge)
4-21	2:50	1008SW2	1534	SW Port T8	~1GAL	EP toxicity testing	—
4-26	1:25PM	100-7NE1	1535	NE Port T7	≅1GAL		~3' Sludge
4-26	1:50	100-7NE2	1536 cal	NE Port T7	~1Gal		—
4-26	2:15	100-7NW1	~~1751~~ 1751	NW Port T7	≅1Gal		4' 7" Sludge
4-26	2:37	100-7NW2	1752	NW Port T7	≅1Gal		—
4-27	12:17PM	100-1NW1	1753	NW Sideport T1	~1gal		<1 inch sludge
4-27	12:40PM	100-1NE1	1754	NE sideport T1	~1gal		in tank 1
4-27	1:05	100-1SW1	1755	SW sideport T1	~1gal		
4-27	1:25	100-1SE1	1756	SE sideport T1	~1gal		

RELINQUISHED BY	DATE	TIME	RECEIVED BY / RELINQUISHED BY / DATE / TIME	RECEIVED BY
Christine Alaxton	4-26-88	3:45PM	samples carried to 773-A Room B106 and locked in Cabinet	W H Harley
Christine Alaxton	4-27	4:30PM	samples taken to 300-M-425-100 and locked in cabinet	W H Harley
Christine Alaxton	5-6-88		samples transferred to 773-A Rm B106 and all samples placed in 55 gal drum for storage in B106, 773-A	W H Harley

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK

2 RECORD SEAL ID, IF SEAL IS USED.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 Area SLUDGE SALTSTONE [1] DATE: 4-27-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: J.P. Harley C.A. Langton W. Harley E.G. Orebaugh

DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	VOLUME	ANALYSIS REQUIRED	COMMENT
4-27	1:47PM	100-2 SW	1757	SW Sideport T2	~1GAL	Saltstone EP toxicity tests	1'5" Sludge in tank 2
4-27	2:05PM	100-2 NW	1758	NW Sideport T2	≈1GAL		1'7" Sludge
4-27	2:30PM	100-3 NW	1759	NW Sideport T3	≈1GAL		2 Feet Sludge
4-27	3:25PM	100-3 NE	1760	NE Sideport T3	≈1GAL		2' Sludge
4-27	3:50PM	100-3 SW	1761	SW Sideport T3	~1GAL		2'3" Sludge
4-27	4:05PM	100-3 SE	1762	SE Sideport T3	~1GAL		2' Sludge
4-28	10:25AM	100-4 NW	1763	NW Sideport T4	~1GAL		2' Sludge
4-28	10:38AM	100-4 NE	1764	NE Sideport T4	~1GAL		2' Sludge
4-28	10:50	100-4 SW	1765	SW Sideport T4	~1GAL		2' Sludge
4-28	11:15	100-4 SE	1766	SE Sideport T4	~1GAL		1'11" Sludge

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christine A. Langton	4-27-88	4:30PM	sample taken to 300-M-425	700 and locked in metal cabinet			W. Harley
Christine A. Langton	5-6-88		samples transferred to 773-A Room B106 and placed on 55 gal drums with lids for storage and care				W. Harley

[1] RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK

[2] RECORD SEAL ID, IF SEAL IS USED.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 AREA SLUDGE SALTSTONE [1] **DATE:** 4-28-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: J.P. HARLEY C.A. LANGTON W. HARLEY, E.G. OREBAUGH

DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	VOLUME	ANALYSIS REQUIRED	COMMENT
4-28	11:37AM	100-5 NW	1767	NW sidedport T5	≈1GAL	SALTSTONE EP TOXICITY TESTS	2' 1" Sludge
4-28	11:55	100-5 NE	1768	NE sidedport T5	≈1GAL		2' Sludge
4-28	12:15PM	100-5 SW	1769	SW sidedport T5	≈1GAL		2' 1" Sludge
4-28	12:30	100-5 SE	1770	SE sidedport T5	≈1GAL		2' 1" Sludge
4-28	12:55	100-6 NW	1771	NW sidedport T6	≈1GAL		1' 5" Sludge
4-28	1:22	100-6 NE	1772	NE sidedport T6	≈1GAL		1' 3" Sludge
4-28	1:35	100-6 SW	1773	SW sidedport T6	≈1GAL		1' 6" Sludge
4-28	1:48	100-6 SE	1774	SE sidedport T6	≈1GAL		1' 5" Sludge
4-28	2:15	100-2 SE	1775	SE sidedport T2	≈1GAL		1' 5" Sludge
4-28	2:36	100-2NE	1776	NE sidedport T2	≈1GAL		1' 5" Sludge

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christen A Langton	4-28-88	3:05	samples taken to cabinet in 300-M-425-100 and lock in cabinet				W W Harley
Christen A Langton	5-6-88		samples transferred to 773-A in B106 for storage in special drum and cabinet.				W W Harley

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 - AREA SALTSTONE [1] DATE: 7-7-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: CHRISTINE A. LANGTON, WILLIE HARLEY

Preparation DATE	TIME	SALTSTONE SAMPLE NO.	TAMPER SEAL[2]	SAMPLE SOURCE LOCATION	# Samples ~~VOLUME~~	ANALYSIS REQUIRED	COMMENT
6-29		1753	WB18030	T1 NW	4	EP organic TCLP total MEP	
		1754		T1 NE	4	EP	1 Composite
		1755		T1 SW	4	EP	
		1756		T1 SE	4	EP	
		1776	WB18031	T2 NE	4	EP	1 Composite
		1775		T2 SE	4	EP	
		1757		T2 SW	4	EP	
		1758		T2 NW	4	EP	
		1759	WB18032	T3 NW	4	EP	
		1760		T3 NE	4	EP	

Prepared for Shipment by and

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christine A. Langton	7-7-88	10:35 AM	W.W. Harley				

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
W.W. Harley							

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

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CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300-AREA SALTSTONE [1] DATE: 7-21-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: CHRIS I

Preparation DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	# Samples Drum(s) VOLUME	ANALYSIS REQUIRED	COMMENT
		1761	WB18032	T3 SW	4	EP organic TCLP, total MEP	
		1762	↓	T3 SE	4	EP	composite
6-30-88		1763	WB18033	T4 NW	4	EP	
		1764		T4 NE	4	EP	1 Composite
		1765		T4 SW	4	EP	
		1766	↓	T4 SE	4	EP	
		1767	WB18034	T5 NW	4	EP	
		1768		T5 NE	4	EP	1 composite
		1769		T5 SW	4	EP	
		1770	↓	T5 SE	4	EP	

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christy Nacita	7-7-88	10:35	Will Harley				
Will Harley							

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300 AREA SALTSTONE [1] DATE: 7-~~2~~-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: CHRISTINE A LAWGTON
WILLIE HARLEY

Preparation DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	~~VOLUME~~ # samples 50ml Samples	ANALYSIS REQUIRED	COMMENT
6-29		1771	WB18035	T6 NW	4	EP, organic TCLP, total MEP	
		1772		T6 NE	4	EP	1 composite
		1773		T6 SW	4	EP	
		1774		T6 SE	4	EP	
6-30-88		1523	WB18028	T7 SE	4	EP	1 composite
		1525		T7 SW	4	EP	
		1536		T7 NE	4	EP	
		1751		T7 NW	4	EP	
		1527	WB18029	T8 NW	4	EP	1 composite
		1530		T8 NE	4	EP	

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Christine A Lawgton	7-7-88	10:35	Will Harley				
Will Harley							

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

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CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: 300-Area Saltstone[1] DATE: 7-21-88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: Christine A Lawton, Willie Harley

Preparation DATE	TIME	SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	# Sample VOLUME	ANALYSIS REQUIRED	COMMENT
6-30-88		1532	WB18029	T8 SE	4	EP, TCLP, total MEP	1 composite
		1534	↓	T8 SW	4	EP ↓ ↓	

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
Krista Norton	7-7-88	10:35	Willie Harley				
W Harley							

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK
2 RECORD SEAL ID, IF SEAL IS USED.

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: M-AREA SALTSTONE[1] DATE: 7/25/88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: C. A. Langton (initials) / W. W. Hawley

DATE	TIME	SAMPLE NO. (SALTSTONE COMPOSITE)	TAMPER SEAL[2]	SAMPLE LOCATION	VOLUME (ml. gal.)	ANALYSIS REQUIRED	COMMENT
7/25/88		TANK #7	WB 18028	BLDG 773A	75	Analyze per	SEE INSTRUCTIONS
		8	WB 18029			Purchase	
		1	WB 18030			Requisition #	
		2	WB 18031			W 74839	
		3	WB 18032				
		4	WB 18033				
		5	WB 18034				
		6	WB 18035				

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
WW Hawley	7/28/88	2:07PM	Roberta Maloney / ROBERT A. MABRY				
Roberta Maloney	7-28-88	4:55pm	Theresa Colley				

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK

2 RECORD SEAL ID, IF SEAL IS USED.

3. EACH TAMPER SEAL CONTAINED 16 SALTSTONE SAMPLES

CHAIN OF CUSTODY RECORD - IWTD SAMPLES

PROJECT: M-AREA SALTSTONE [1] DATE: 7/25/88

NAMES OF PERSONNEL RESPONSIBLE FOR SAMPLING: C.A. Langton cwwl / W. W. Hawley

DATE	TIME	SALTSTONE COMPOSITE SAMPLE NO.	TAMPER SEAL[2]	SAMPLE LOCATION	wt. gm. ~~VOLUME~~	ANALYSIS REQUIRED	COMMENT
7/25/88		TANK #7	WB 18028	BLDG 773A	75	ANALYZE PER	SEE INSTRUCTIONS
		8	WB 18029			PURCHASE	
		1	WB 18030			REQUISITION #	
		2	WB 18031			W 74839	
		3	WB 18032				
		4	WB 18033				
		5	WB 18034				
		6	WB 18035				

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
W W Hawley	7/28/88	2:07PM	Robert A. Mabry (ROBERT A. MABRY)				
Robert A. Mabry	7-28-88	4:55pm	Therese Colley				

1 RETURN COMPLETED FORM TO PROJECT LEADER FOR INCLUSION IN LAB NOTEBOOK

2 RECORD SEAL ID, IF SEAL IS USED.

3. EACH TAMPER SEAL CONTAINED 16 SALTSTONE SAMPLES

APPENDIX E

SALTSTONE DEVELOPMENT FORMULATIONS

Appendix E
300-M Saltstone Development

The overall goals in designing the 300-M saltstone material include: 1) meet all federal and state requirements for delisting F006 sludge and for non-hazardous, low-level radioactive waste disposal (see Appendix G for the DOE Record of Decision concerning low-level waste disposal at the Savannah River Site); 2) protect the quality of the groundwater at the disposal site boundary. More specifically, the objective for developing the 300-M saltstone formulations discussed in this delisting petition were to produce a cement-based waste form which can be processed as a grout/slurry and which, upon curing, results in a low-leaching solid.

Mixtures of portland cement, cementitious blast furnace slag (Newcem), and flyash and mixtures of portland cement and flyash were tested for stabilizing F006 sludge currently stored in the 300-M waste tanks. Both types of mixtures produce a low-leaching solid waste form provided that the hydration reactions are accelerated by adjusting the pH of the sludge to greater than 12. Each sample of sludge from Tanks 2, 6, 7, 8 was adjusted with 50 wt% Na(OH) in a 20:1 ratio by weight. Sludge from Tanks 3, 4 and 5 were adjusted in a ratio of 20:2 wt %. The portland cement-Newcem-flyash system was selected because it provides the additional feature of in situ chemical reduction from the thiosulfate and ferric iron in the Newcem. This same dry solids blend is currently used for Defense Waste Solidification at the Savannah River Site. This facility is permitted by SCDHEC as a waste water treatment facility.[1]

The dry cementitious solids were proportional and preblended prior to mixing with the 300-M sludge. Supernate from each tank was added to this mixture to assure wetting of the dry solids and to provide water for hydration reactions responsible for stabilization. The minimum amount of supernate necessary to achieve a homogenous grout was added. The proportions for the 300-M saltstone prepared for EP toxicity and TCLP testing are shown in Table E1. Preliminary experiments resulted in the proportions of sludge to supernate. Equal amounts of sludge and cementitious solids were added to the mixtures. This proportioning was selected on the basis of leaching and heat of hydration measurements.

After casting in polypropylene containers and sealing these containers, the samples were checked for free standing water and set after 5 and 7 days. All samples set within 5 days, and free water (only observed in saltstone made tanks 3 and 4) was completely used in hydration reactions within 7 days. After setting, all samples were cured at 40°C which approximates curing in 55 gallon drums or in the saltstone vaults. After 28 days curing, EP and TCLP testing was initiated.

TABLE E1

PROPORTIONS OF 300-M SALTSTONE
INGREDIENTS USED IN FORMULATIONS TESTED FOR DELISTING

300-M SALTSTONE INGREDIENTS (wt %)	300-M Tank No.*							
	1	2	3	4	5	6	7	8
300-M F006 Sludge	42	42	47.5	45.5	47.5	40	45.5	42
300-M Supernate	16	16	5	9	5	20	9	16
Cementitious Solids Blend**	42	42	47.5	45.5	47.5	40	45.5	42

* The same proportions were used for the four different sludge samples collected from each tank.

** The cementitious solids blend contained 47 wt % reactive Newcem, 47 wt % flyash and 6 wt % portland cement.

APPENDIX F

ANALYTICAL DATA

F.1 Total, EP Toxicity, and TCLP Data

ENWRIGHT
LABORATORIES

CERTIFICATE OF ANALYSIS

CLIENT: E.I. DuPont De Nemours
Savannah River Plant
PROJECT: Saltstone

LAB CERTIFICATION NO: 23127

DATE SAMPLED: 07/25/88
DATE RECEIVED: 07/28/88
DATE REPORTED: 09/23/88

LAB NO.:	88-A441-01	88-A441-02	88-A441-03	88-A441-04
SAMPLE ID:	1-SE	1-SW	1-NE	1-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	70	70	68	80
Barium (mg/kg)	180	180	150	200
Chromium (mg/kg)	33	32	33	35
Nickel (mg/kg)	1,100	1,100	1,000	1,500
Zinc (mg/kg)	100	85	83	95
Uranium (wt%)	1.4	1.4	1.6	1.5
Nitrate Nitrogen (mg/kg)	4,000	3,600	4,300	4,000
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	<10	----	----
Ignitability				
Flash Point (°C)	----	----	>90	----

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LAB NO.: SAMPLE ID:	88-A441-01 1-SE	88-A441-02 1-SW	88-A441-03 1-NE	88-A441-04 1-NW
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.2	0.2	0.2	0.2
Barium (mg/l)	1.3	1.0	1.7	1.4
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	1.2	1.1	1.1	1.3
Zinc (mg/l)	0.40	0.27	0.25	0.36
Uranium (mg/l)	93	120	110	120
Nitrate Nitrogen (mg/l)	130	100	140	106

LAB NO.: SAMPLE ID:	88-A441-01 1-SE	88-A441-02 1-SW	88-A441-03 1-NE	88-A441-04 1-NW
Toxic Characteristic Leaching Procedure: (ug/l)				
Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.:	88-A441-05	88-A441-06	88-A441-07	88-A441-08
SAMPLE ID:	2-SE	2-SW	2-NE	2-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	67	57	65	60
Barium (mg/kg)	210	180	190	200
Chromium (mg/kg)	41	34	39	39
Nickel (mg/kg)	1,400	1,900	1,700	1,600
Zinc (mg/kg)	84	62	74	75
Uranium (wt%)	2.9	2.7	3.1	3.0
Nitrate Nitrogen (mg/kg)	5,200	5,300	5,300	5,400
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	----	<10	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.3	0.3	0.3
Barium (mg/l)	1.9	1.7	1.6	1.1
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	0.62	0.57	0.58	0.30
Zinc (mg/l)	0.17	0.22	0.20	0.16
Uranium (mg/l)	280	250	270	110
Nitrate Nitrogen (mg/l)	170	150	130	194

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LAB NO.:	88-A441-05	88-A441-06	88-A441-07	88-A441-08
SAMPLE ID:	2-SE	2-SW	2-NE	2-NW

Toxic Characteristic Leaching Procedure: (ug/l)

Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.:	88-A441-09	88-A441-10	88-A441-11	88-A441-12
SAMPLE ID:	3-SE	3-SW	3-NE	3-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	40	45	45	43
Barium (mg/kg)	190	230	250	230
Chromium (mg/kg)	31	34	33	28
Nickel (mg/kg)	290	240	240	230
Zinc (mg/kg)	63	64	62	74
Uranium (wt%)	0.32	0.35	0.30	0.30
Nitrate Nitrogen (mg/kg)	2,500	2,300	2,000	2,300
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	<10	----	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.2	0.3	0.3
Barium (mg/l)	2.6	2.7	1.5	2.0
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	0.95	1.0	0.81	0.77
Zinc (mg/l)	0.29	0.27	0.33	0.11
Uranium (mg/l)	59	17	12	3.8
Nitrate Nitrogen (mg/l)	70	70	73	81

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LAB NO.:	88-A441-09	88-A441-10	88-A441-11	88-A441-12
SAMPLE ID:	3-SE	3-SW	3-NE	3-NW

Toxic Characteristic Leaching Procedure: (ug/l)

Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.: SAMPLE ID:	88-A441-13 4-SE	88-A441-14 4-SW	88-A441-15 4-NE	88-A441-16 4-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	55	50	47	50
Barium (mg/kg)	210	260	210	230
Chromium (mg/kg)	36	37	29	32
Nickel (mg/kg)	790		750	790
Zinc (mg/kg)	43	38	57	57
Uranium (wt%)	1.2	1.1	1.3	1.3
Nitrate Nitrogen (mg/kg)	7,300	7,100	6,300	5,100
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	<10	----	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.3	0.3	0.3
Barium (mg/l)	1.6	1.7	1.8	1.5
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	2.5	2.3	1.8	1.6
Zinc (mg/l)	0.11	0.13	0.17	0.25
Uranium (mg/l)	44	43	36	51
Nitrate Nitrogen (mg/l)	198	208	203	155

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LAB NO.:	88-A441-13	88-A441-14	88-A441-15	88-A441-16
SAMPLE ID:	4-SE	4-SW	4-NE	4-NW
Toxic Characteristic Leaching Procedure: (ug/l)				
Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.: SAMPLE ID:	88-A441-17 5-SE	88-A441-18 5-SW	88-A441-19 5-NE	88-A441-20 5-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	3
Lead (mg/kg)	62	60	55	62
Barium (mg/kg)	270	260	270	300
Chromium (mg/kg)	46	45	46	42
Nickel (mg/kg)	1,300	1,200	1,400	1,400
Zinc (mg/kg)	71	78	73	85
Uranium (wt%)	1.2	1.1	1.0	1.1
Nitrate Nitrogen (mg/kg)	3,300	3,000	3,900	2,900
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	----	<10	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.2	0.2	0.2	0.2
Barium (mg/l)	1.1	0.9	0.8	1.3
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	0.72	0.72	0.74	0.70
Zinc (mg/l)	0.23	0.25	0.27	0.31
Uranium (mg/l)	82	76	75	77
Nitrate Nitrogen (mg/l)	71	56	71	56

LAB NO.:	88-A441-17	88-A441-18	88-A441-19	88-A441-20
SAMPLE ID:	5-SE	5-SW	5-NE	5-NW
Toxic Characteristic Leaching Procedure: (ug/l)				
Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.: SAMPLE ID:	88-A441-21 6-SE	88-A441-22 6-SW	88-A441-23 6-NE	88-A441-24 6-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	3	3	<3	<3
Lead (mg/kg)	55	55	55	55
Barium (mg/kg)	150	180	200	210
Chromium (mg/kg)	35	30	30	37
Nickel (mg/kg)	1,300	1,200	1,200	1,300
Zinc (mg/kg)	63	54	55	74
Uranium (wt%)	1.5	1.5	1.5	1.3
Nitrate Nitrogen (mg/kg)	4,000	3,700	3,700	4,100
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<5	<5
Sulfide (mg/kg)	----	<10	----	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.3	0.3	0.3
Barium (mg/l)	1.5	1.5	1.4	1.3
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	1.2	1.2	1.4	1.3
Zinc (mg/l)	0.20	0.20	0.17	0.17
Uranium (mg/l)	110	110	110	90
Nitrate Nitrogen (mg/l)	155	128	128	155

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LAB NO.:	88-A441-21	88-A441-22	88-A441-23	88-A441-24
SAMPLE ID:	6-SE	6-SW	6-NE	6-NW

Toxic Characteristic Leaching Procedure: (ug/l)

Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.: SAMPLE ID:	88-A441-25 7-SE	88-A441-26 7-SW	88-A441-27 7-NE	88-A441-28 7-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	50	40	40	50
Barium (mg/kg)	230	170	211	230
Chromium (mg/kg)	38	34	36	37
Nickel (mg/kg)	1,900	1,300	2,100	2,100
Zinc (mg/kg)	51	57	53	52
Uranium (wt%)	0.46	0.42	0.66	0.57
Nitrate Nitrogen (mg/kg)	5,300	6,700	6,300	5,600
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<10 *	<10 *	<5	<5
Sulfide (mg/kg)	----	----	<10	----
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.3	0.3	0.3
Barium (mg/l)	1.2	1.3	1.2	1.0
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	2.0	1.5	1.7	1.9
Zinc (mg/l)	0.10	0.16	0.14	0.15
Uranium (mg/l)	33	26	42	33
Nitrate Nitrogen (mg/l)	181	165	165	159

* Matrix interference on these samples.

LAB NO.: SAMPLE ID:	88-A441-25 7-SE	88-A441-26 7-SW	88-A441-27 7-NE	88-A441-28 7-NW
Toxic Characteristic Leaching Procedure: (ug/1)				
Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

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LAB NO.: SAMPLE ID:	88-A441-29 8-SE	88-A441-30 8-SW	88-A441-31 8-NE	88-A441-32 8-NW
Total Analysis:				
Arsenic (mg/kg)	<50	<50	<50	<50
Selenium (ug/kg)	<250	<250	<250	<250
Mercury (ug/kg)	<30	<30	<30	<30
Cadmium (mg/kg)	<0.5	<0.5	<0.5	<0.5
Silver (mg/kg)	<3	<3	<3	<3
Lead (mg/kg)	40	35	40	40
Barium (mg/kg)	210	180	190	170
Chromium (mg/kg)	35	29	35	40
Nickel (mg/kg)	900	940	1,300	930
Zinc (mg/kg)	54	48	64	56
Uranium (wt%)	1.4	1.3	1.4	1.3
Nitrate Nitrogen (mg/kg)				
Oil & Grease (wt%)	<0.1	<0.1	<0.1	<0.1
Reactivity				
Cyanide (mg/kg)	<5	<5	<10 *	<5
Sulfide (mg/kg)	----	----	----	<10
Ignitability				
Flash Point (°C)	----	>90	----	----
Toxic Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.05	<0.05	<0.05	<0.05
Lead (mg/l)	0.3	0.3	0.2	0.2
Barium (mg/l)	1.1	2.4	1.3	1.9
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	1.7	1.8	2.0	1.2
Zinc (mg/l)	0.20	0.14	0.13	0.16
Uranium (mg/l)	56	57	55	63
Nitrate Nitrogen (mg/l)	170	180	180	160

* Matrix interference on this sample.

LAB NO.:	88-A441-29	88-A441-30	88-A441-31	88-A441-32
SAMPLE ID:	8-SE	8-SW	8-NE	8-NW

Toxic Characteristic Leaching Procedure: (ug/l)

Acrylonitrile	<50	<50	<50	<50
Benzene	<50	<50	<50	<50
2-Butanol (Isobutanol)	<2,000	<2,000	<2,000	<2,000
Carbon Disulfide	<100	<100	<100	<100
Carbon Tetrachloride	<50	<50	<50	<50
Chlorobenzene	<50	<50	<50	<50
Chloroform	<50	<50	<50	<50
1,2-Dichlorobenzene	<50	<50	<50	<50
1,4-Dichlorobenzene	<50	<50	<50	<50
1,2-Dichloroethane	<50	<50	<50	<50
1,1-Dichloroethylene	<50	<50	<50	<50
Methylene Chloride	<50	<50	<50	<50
Methyl Ethyl Ketone	<2,500	<2,500	<2,500	<2,500
Pyridine	<2,000	<2,000	<2,000	<2,000
1,1,1,2-Tetrachloroethane	<100	<100	<100	<100
1,1,2,2-Tetrachloroethane	<50	<50	<50	<50
Tetrachloroethylene	<50	<50	<50	<50
Toluene	<50	<50	<50	<50
1,1,1-Trichloroethane	<50	<50	<50	<50
1,1,2-Trichloroethane	<50	<50	<50	<50
Trichloroethylene	<50	<50	<50	<50
Vinyl Chloride	<50	<50	<50	<50

ENWRIGHT
LABORATORIES

CERTIFICATE OF ANALYSIS

CLIENT: E.I. DuPont de Nemours
PROJECT: Saltstone
LAB CERTIFICATION NO: 23127

DATE RECEIVED: 07/29/88
DATE REPORTED: 03/30/89
DATE AUTHORIZED: 01/30/89

LAB NO.:	88-A441-01	88-A441-02	88-A441-03	88-A441-04
SAMPLE ID:	1-SE	1-SW	1-NE	1-NW
Parameters:				
Total Lithium	0.4	0.4	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-05	88-A441-06	88-A441-07	88-A441-08
SAMPLE ID:	2-SE	2-SW	S-NE	2-NW
Parameters:				
Total Lithium	0.4	0.4	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-09	88-A441-10	88-A441-11	88-A441-12
SAMPLE ID:	3-SE	3-SW	3-NE	3-NW
Parameters:				
Total Lithium	0.4	0.5	0.5	0.5
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-13	88-A441-14	88-A441-15	88-A441-16
SAMPLE ID:	4-SE	4-SW	4-NE	4-NW
Parameters:				
Total Lithium	0.4	0.5	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-17	88-A441-18	88-A441-19	88-A441-20
SAMPLE ID:	5-SE	5-SW	5-NE	5-NW
Parameters:				
Total Lithium	0.6	0.6	0.6	0.6
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-21	88-A441-22	88-A441-23	88-A441-24
SAMPLE ID:	6-SE	6-SW	6-NE	6-NW
Parameters:				
Total Lithium	0.4	0.4	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-25	88-A441-26	88-A441-27	88-A441-28
SAMPLE ID:	7-SE	7-SW	7-NE	7-NW
Parameters:				
Total Lithium	0.5	0.4	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

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LAB NO.:	88-A441-29	88-A441-30	88-A441-31	88-A441-32
SAMPLE ID:	8-SE	8-SW	8-NE	8-NW
Parameters:				
Total Lithium	0.4	0.4	0.4	0.4
Total Characteristic Leaching Procedure:				
Freon (ug/1)	<50	<50	<50	<50

LAB NO.:	88-A441-01	88-A441-02	88-A441-03	88-A441-04
SAMPLE ID: *	TC-1	TC-2	TC-3	TC-4
Total Characteristic Leaching Procedure:				
Arsenic (ug/1)	110	76	91	82
Selenium (ug/1)	<50	<50	<50	<50
Mercury (ug/1)	<0.5	<0.5	<0.5	<0.5
Lead	<0.1	<0.1	<0.1	<0.1
Silver	0.04	0.02	<0.01	0.02
Chromium	<0.05	<0.05	<0.05	<0.05
Barium	0.2	0.1	0.3	0.2
Cadmium	<0.01	<0.01	<0.01	<0.01
Nickel	0.13	0.06	0.03	0.27
Zinc	<0.01	<0.01	<0.01	<0.01
Uranium	51	220	5.3	23

LAB NO.:	88-A441-05	88-A441-06	88-A441-07	88-A441-08
SAMPLE ID: *	TC-5	TC-6	TC-7	TC-8
Total Characteristic Leaching Procedure:				
Arsenic (ug/1)	66	97	80	81
Selenium (ug/1)	<50	<50	<50	<50
Mercury (ug/1)	<0.5	<0.5	<0.5	<0.5
Lead	<0.1	<0.1	<0.1	<0.1
Silver	0.02	0.03	<0.01	<0.01
Chromium	<0.05	<0.05	<0.05	<0.05
Barium	0.3	0.4	0.5	0.3
Cadmium	<0.01	<0.01	<0.01	<0.01
Nickel	0.09	0.33	0.78	0.81
Zinc	<0.01	<0.01	<0.01	<0.01
Uranium	18	43	10	11

* TC = Tank Composite
** From scan of stored data.

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The above results are reported in milligrams per liter unless otherwise noted.

Analytical methods are those approved by the U.S. Environmental Protection Agency.

Respectfully submitted,

ENWRIGHT LABORATORIES, INC.

Charles H. Reece

Charles H. Reece, Ph.D.
Laboratory Manager

kgb

ENWRIGHT
LABORATORIES

CERTIFICATE OF ANALYSIS
QUALITY CONTROL DATA

CLIENT: E.I. DuPont De Nemours
Savannah River Plant
PROJECT: Saltstone Quality Control

LAB CERTIFICATION NO: 23127

DATE SAMPLED: 07/25/88
DATE RECEIVED: 07/28/88
DATE REPORTED: 10/27/88

PARAMETER - ARSENIC

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-10	<50	<50	104
88-A441-16	<50	<50	113
88-A441-19	<50	<50	96
88-A441-21	<50	<50	104
88-A441-22	<50	<50	105
88-A441-24	<50	<50	100
Toxic Extraction Procedure (ug/l)			
88-A441-13	<50	<50	110
88-A441-18	<50	<50	112
88-A441-31	<50	<50	88
88-A441-02	<50	<50	86
88-A441-05	<50	<50	92
88-A441-09	<50	<50	87
88-A441-14	<50	<50	86
88-A441-17	<50	<50	101
Multiple Extraction Procedure (ug/l)			
88-A441-32 - #2	<50	<50	100

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PARAMETER - BARIUM

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-29	210	160	82
88-A441-30	180	180	107
88-A441-31	190	190	106
Toxic Extraction Procedure (mg/l)			
88-A441-21	1.5	1.5	98
88-A441-22	1.5	1.4	102
88-A441-23	1.4	1.3	109
88-A441-24	1.3	1.3	120
Multiple Extraction Procedure (mg/l)			
88-A441-08 - #1	<0.1	<0.1	104
88-A441-01 - #2	<0.1	<0.1	115
88-A441-01 - #3	<0.1	<0.1	106
88-A441-01 - #4	<0.1	<0.1	115
88-A441-20 - #6	<0.1	<0.1	99
88-A441-20 - #8	<0.1	<0.1	98
88-A441-11 - #9	<0.1	<0.1	101
88-A441-32 - #9	<0.1	<0.1	106

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PARAMETER - CADMIUM

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-02	<0.5	<0.5	97
88-A441-05	<0.5	<0.5	99
88-A441-14	<0.5	<0.5	99
Toxic Extraction Procedure (mg/l)			
88-A441-10	<0.01	<0.01	95
88-A441-20	<0.01	<0.01	87
88-A441-30	<0.01	<0.01	107
Multiple Extraction Procedure (mg/l)			
88-A441-24 - #1	<0.01	<0.01	112
88-A441-08 - #2	<0.01	<0.01	115
88-A441-08 - #4	<0.01	<0.01	111
88-A441-11 - #4	<0.01	<0.01	110
88-A441-20 - #5	<0.01	<0.01	101
88-A441-08 - #6	<0.01	<0.01	103
88-A441-01 - #8	<0.01	<0.01	109
88-A441-28 - #8	<0.01	<0.01	112
88-A441-32 - #9	<0.01	<0.01	110

PARAMETER - CHROMIUM

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-01	33	33	117
88-A441-11	33	32	119
88-A441-15	29	29	117
88-A441-17	46	48	116
88-A441-23	30	30	119
88-A441-32	40	38	120
Multiple Extraction Procedure (mg/l)			
88-A441-32 - #1	<0.05	<0.05	116
88-A441-28 - #2	<0.05	<0.05	116
88-A441-24 - #3	<0.05	<0.05	115
88-A441-08 - #4	<0.05	<0.05	118
88-A441-11 - #5	<0.05	<0.05	117
88-A441-16 - #6	<0.05	<0.05	116
88-A441-01 - #7	<0.05	<0.05	117
88-A441-24 - #8	<0.05	<0.05	118
88-A441-01 - #9	<0.05	<0.05	116

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PARAMETER - LEAD

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-06	57	57	100
88-A441-10	45	45	100
88-A441-13	55	55	106
88-A441-20	62	62	104
88-A441-26	40	40	105
88-A441-30	35	35	103
Toxic Extraction Procedure (mg/l)			
88-A441-07	0.3	0.3	102
88-A441-12	0.3	0.3	100
88-A441-21	0.3	0.3	101
88-A441-26	0.3	0.2	101
Multiple Extraction Procedure (mg/l)			
88-A441-28 - #1	<0.1	<0.1	106
88-A441-01 - #5	<0.1	<0.1	104
88-A441-08 - #6	<0.1	<0.1	105
88-A441-11 - #7	<0.1	<0.1	106
88-A441-16 - #8	<0.1	<0.1	108

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PARAMETER - MERCURY

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (ug/kg)			
88-A441-04	<200	<200	95
88-A441-06	<200	<200	118
88-A441-10	<200	<200	117
Toxic Extraction Procedure (ug/l)			
88-A441-01	<0.5	<0.5	126
88-A441-11	<0.5	<0.5	124
88-A441-31	<0.5	<0.5	112
88-A441-21	<0.5	<0.5	112
Multiple Extraction Procedure (ug/l)			
88-A441-28 - #7	<0.5	<0.5	110
88-A441-28 - #4	<0.5	<0.5	119
88-A441-20 - #6	<0.5	<0.5	80
88-A441-16 - #4	<0.5	<0.5	110
88-A441-28 - #8	<0.5	<0.5	110
88-A441-11 - #4	<0.5	<0.5	110

PARAMETER - NICKEL

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-09	290	220	108
88-A441-14	880	880	96
88-A441-17	1,300	1,400	107
88-A441-29	900	890	105
Toxic Extraction Procedure (mg/l)			
88-A441-01	1.2	1.2	93
88-A441-05	0.59	0.62	90
88-A441-09	0.95	0.99	96
88-A441-13	2.5	2.3	97
88-A441-17	0.72	0.89	102
88-A441-21	1.2	1.2	95
88-A441-25	2.0	1.9	110
88-A441-29	1.7	1.6	94
88-A441-32	1.2	1.4	104
Multiple Extraction Procedure (ug/l)			
88-A441-08 - #2	<0.05	<0.05	86
88-A441-11 - #3	<0.05	<0.05	94

PARAMETER - SELENIUM

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (ug/kg)			
88-A441-02	<250	<250	82
88-A441-12	<250	<250	92
88-A441-22	<250	<250	88
88-A441-31	<250	<250	91
Toxic Extraction Procedure (ug/l)			
88-A441-03	<50	<50	103
88-A441-13	<50	<50	90
88-A441-23	<50	<50	89
88-A441-29	<50	<50	96
Multiple Extraction Procedure (ug/l)			
88-A441-01 - #1	<50	<50	94
88-A441-16 - #2	<50	<50	82
88-A441-20 - #3	<50	<50	96
88-A441-24 - #8	<50	<50	96
88-A441-28 - #7	<50	<50	92
88-A441-11 - #6	<50	<50	90
88-A441-32 - #7	<50	<50	89

PARAMETER - SILVER

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-04	<3	<3	99
88-A441-08	<3	<3	94
88-A441-12	<3	<3	96
88-A441-16	<3	<3	102
88-A441-19	<3	<3	101
88-A441-24	<3	<3	105
88-A441-27	<3	<3	103
Toxic Extraction Procedure (mg/l)			
88-A441-04	<0.05	<0.05	98
88-A441-09	<0.05	<0.05	97
88-A441-17	<0.05	<0.05	99
Multiple Extraction Procedure (mg/l)			
88-A441-32 - #1	<0.01	<0.01	101
88-A441-28 - #2	<0.01	<0.01	95
88-A441-08 - #3	<0.01	<0.01	99
88-A441-01 - #4	<0.01	<0.01	96
88-A441-11 - #6	<0.01	<0.01	93

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PARAMETER - ZINC

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-29	54	54	111
88-A441-30	48	45	115
88-A441-32	56	56	120
Toxic Extraction Procedure (mg/l)			
88-A441-10	0.27	0.28	113
88-A441-20	0.31	0.27	93
88-A441-30	0.14	0.16	101
Multiple Extraction Procedure (mg/l)			
88-A441-24 - #1	<0.01	<0.01	116
88-A441-08 - #2	<0.01	<0.01	114
88-A441-08 - #3	<0.01	<0.01	105
88-A441-11 - #4	<0.01	<0.01	111
88-A441-20 - #5	<0.01	<0.01	101
88-A441-08 - #6	<0.01	<0.01	105
88-A441-01 - #8	<0.01	<0.01	101
88-A441-28 - #8	<0.01	<0.01	102
88-A441-32 - #9	<0.01	<0.01	115

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PARAMETER - CYANIDE

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-10	<5	<5	63
88-A441-18	<5	<5	63
88-A441-32	<5	<5	135

PARAMETER - OIL & GREASE

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-32	<100	<100	----

PARAMETER - SULFUR

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-32	3.1	3.1	----

PARAMETER - URANIUM

LAB NO.:	Initial Result	Duplicate	% Recovery
Toxic Extraction Procedure (mg/l)			
88-A441-01	93	77	----
88-A441-05	280	272	----
88-A441-13	44	46	----
88-A441-23	110	110	----
88-A441-27	42	38	----
88-A441-30	57	64	----

PARAMETER - NITRATE NITROGEN

LAB NO.:	Initial Result	Duplicate	% Recovery
Total Analysis (mg/kg)			
88-A441-01	4,000	4,000	----
88-A441-10	2,300	2,400	----
88-A441-20	2,900	2,900	----
88-A441-30	5,800	5,800	----
Toxic Extraction Procedure (mg/l)			
88-A441-10	70	70	105
88-A441-20	55	56	110
88-A441-30	176	182	110
Multiple Extraction Procedure (mg/l)			
88-A441-08 - #2	30	30	110
88-A441-16 - #3	71	71	110
88-A441-20 - #4	20	20	110
88-A441-28 - #5	56	59	110
88-A441-32 - #6	24	23	----
88-A441-01 - #8	33	36	110
88-A441-11 - #9	20	20	110

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LAB NO.: 88-A441-04

Parameter	Initial Result	Duplicate	% Recovery
Toxic Characteristic Leaching Procedure			
Acrylonitrile	<50	<50	----
Benzene	<50	<50	101
2-Butanol (Isobutanol)	<2,000	<2,000	----
Carbon Disulfide	<100	<100	----
Carbon Tetrachloride	<50	<50	86
Chlorobenzene	<50	<50	90
Chloroform	<50	<50	90
1,2-Dichlorobenzene	<50	<50	86
1,4-Dichlorobenzene	<50	<50	86
1,2-Dichloroethane	<50	<50	86
1,1-Dichloroethylene	<50	<50	145
Methylene Chloride	<50	<50	149
Methyl Ethyl Ketone	<2,500	<2,500	----
Pyridine	<2,000	<2,000	----
1,1,1,2-Tetrachloroethane	<100	<100	----
1,1,2,2-Tetrachloroethane	<50	<50	82
Tetrachloroethylene	<50	<50	88
Toluene	<50	<50	137
1,1,1,-Trichloroethane	<50	<50	86
1,1,2-Trichloroethylene	<50	<50	92
Trichloroethylene	<50	<50	97
Vinyl Chloride	<50	<50	----

Analytical methods are those approved by the U.S. Environmental Protection Agency.

Please call Steve Hoeffner, your service representative, if you have questions concerning this report.

Respectfully submitted,

ENWRIGHT LABORATORIES, INC.

Steve Hoeffner for CHR

Charles H. Reece, Ph.D.
Laboratory Manager

kgb

F.2 MEP Data

LAB NO.:	88-A441-01	88-A441-01	88-A441-01	88-A441-01	88-A441-01
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<100	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.10	0.05	0.02	0.02	0.01
Nitrate Nitrogen (mg/l)	71	50	40	30	30

LAB NO.:	88-A441-01	88-A441-01	88-A441-01	88-A441-01
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.009	0.007	0.004	0.007
Nitrate Nitrogen (mg/l)	36	36	36	36

LAB NO.:	88-A441-08	88-A441-08	88-A441-08	88-A441-08	88-A441-08
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<100	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.07	0.10	0.08	0.09	0.09
Nitrate Nitrogen (mg/l)	50	30	30	40	0

LAB NO.:	88-A441-08	88-A441-08	88-A441-08	88-A441-08
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.077	0.059	0.029	0.024
Nitrate Nitrogen (mg/l)	41	43	36	13

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LAB NO.:	88-A441-11	88-A441-11	88-A441-11	88-A441-11	88-A441-11
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5

Multiple Extraction Procedure:

Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.01	0.01	0.01	0.01	0.01
Nitrate Nitrogen (mg/l)	30	30	35	20	41

LAB NO.:	88-A441-11	88-A441-11	88-A441-11	88-A441-11
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9

Multiple Extraction Procedure:

Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.005	0.004	0.004	0.008
Nitrate Nitrogen (mg/l)	18	18	25	20

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LAB NO.:	88-A441-16	88-A441-16	88-A441-16	88-A441-16	88-A441-16
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.04	0.02	0.02	0.02	0.02
Nitrate Nitrogen (mg/l)	71	<15	71	61	46

LAB NO.:	88-A441-16	88-A441-16	88-A441-16	88-A441-16
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.017	0.010	0.008	0.012
Nitrate Nitrogen (mg/l)	96	41	41	25

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LAB NO.:	88-A441-20	88-A441-20	88-A441-20	88-A441-20	88-A441-20
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.06	0.03	0.01	<0.01	0.02
Nitrate Nitrogen (mg/l)	30	30	50	20	25

LAB NO.:	88-A441-20	88-A441-20	88-A441-20	88-A441-20
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.004	0.002	0.003	0.002
Nitrate Nitrogen (mg/l)	31	17	18	15

LAB NO.:	88-A441-24	88-A441-24	88-A441-24	88-A441-24	88-A441-24
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.03	0.02	0.01	0.01	0.01
Nitrate Nitrogen (mg/l)	35	40	30	20	20

LAB NO.:	88-A441-24	88-A441-24	88-A441-24	88-A441-24
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.007	0.004	0.004	0.004
Nitrate Nitrogen (mg/l)	23	25	20	36

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LAB NO.:	88-A441-28	88-A441-28	88-A441-28	88-A441-28	88-A441-28
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.01	0.01	0.02	<0.01	0.03
Nitrate Nitrogen (mg/l)	40	40	40	35	59

LAB NO.:	88-A441-28	88-A441-28	88-A441-28	88-A441-28
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.004	0.003	0.003	0.006
Nitrate Nitrogen (mg/l)	36	25	36	36

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LAB NO.:	88-A441-32	88-A441-32	88-A441-32	88-A441-32	88-A441-32
SAMPLE ID:	MEP 1	MEP 2	MEP 3	MEP 4	MEP 5
Multiple Extraction Procedure:					
Arsenic (ug/l)	<100	<100	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.02	0.02	0.01	0.01	0.02
Nitrate Nitrogen (mg/l)	41	61	50	25	20

LAB NO.:	88-A441-32	88-A441-32	88-A441-32	88-A441-32
SAMPLE ID:	MEP 6	MEP 7	MEP 8	MEP 9
Multiple Extraction Procedure:				
Arsenic (ug/l)	<50	<50	<50	<50
Selenium (ug/l)	<10	<10	<10	<10
Mercury (ug/l)	<0.5	<0.5	<0.5	<0.5
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01
Silver (mg/l)	<0.01	<0.01	<0.01	<0.01
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01
Barium (mg/l)	<0.1	<0.1	<0.1	<0.1
Chromium (mg/l)	<0.05	<0.01	<0.01	<0.01
Nickel (mg/l)	<0.05	<0.05	<0.05	<0.05
Zinc (mg/l)	<0.01	<0.01	<0.01	<0.01
Uranium (mg/l)	0.008	0.006	0.004	0.008
Nitrate Nitrogen (mg/l)	24	20	20	20

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Analytical methods are those approved by the U.S. Environmental Protection Agency.

Please call Steve Hoeffner, your service representative, if you have questions concerning this report.

Respectfully submitted,

ENWRIGHT LABORATORIES, INC.

Charles H. Reece

Charles H. Reece, Ph.D.
Laboratory Manager

kgb

Enclosure: Chain-of-Custody

F.3 Analysis Dates for Saltstone Samples

ANALYSIS DATES FOR SALTSTONE SAMPLES

Parameters	Date(s) Analyzed	Analyst(s) Involved
Arsenic	9/13 - 9/17/88	These metals were analyzed by: Steve Hoeffner & James Westmoreland
Selenium	9/18 - 10/21/88	
Mercury	8/31/88	
Cadmium	9/1/88	
Silver	8/25/88	
Lead	8/30/88	
Barium	9/2/88	
Chromium	8/25/88	
Nickel	8/30/88	
Zinc	9/1/88	
Uranium	9/2/88	Ron Keil
Nitrate Nitrogen	9/9/88	Elvin Chaves
Oil & Grease	8/15 - 9/9/88	Tammy Cleveland
Cyanide	8/17 - 9/7/88	Letitia Holcombe
Flash Point	8/29/88	Julianna Lucere
Volatile Organic Analysis		Chris Teal
88-A441-01-08	8/2/88	
88-B441-09-16	8/4/88	
88-A441-17-20	8/5/88	
88-A441-21-23	8/10/88	
88-A441-24-32	8/13/88	

Subcontract Laboratories	Location	Certification No.
Natural Resources Lab.	Lakewood, CO	N/A
Controls for Environmental Pollution	Santa Fe, New Mexico	See Attached

Appendix G

Disposal Option Selection and Documentation

G.1 Summary of 300-M Saltstone Disposal

G.1 Summary of 300-M Saltstone Disposal

Solidified waste from M Area will be disposed of in engineered vaults. This disposal method is consistent with the Final Environmental Impact Statement issued on groundwater protection and waste management activities at the Savannah River Plant.[1] The Record of Decision for the EIS[2] states that new Low-Level Radioactive Waste Disposal Facilities to be built at SRS will consist of engineered vaults. Solidified waste from M Area has been shown to be non-hazardous, and will thus be considered to be low-level radioactive waste because of its uranium content.

DOE Order 5820.2A[3], which was issued in final form in September of 1988, requires that each DOE site will perform a site-specific analysis of waste streams and disposal technologies to demonstrate that waste management practices used will protect human health and the environment. The performance criteria to be met is consistent with the limits proposed by the U.S. Environmental Protection Agency[4] of 4 mrem/year for drinking water. This is to be met immediately at the disposal facility boundary. Work to complete the Performance Assessments for a number of new disposal facilities at SRS is just beginning, but a simplified bounding calculation can be done using a combination of "worst case" assumptions to show that M Area waste will meet the performance criteria.

REFERENCES

1. U.S. Department of Energy, Final Environmental Impact Statement: Waste Management Activities for Groundwater Protection Savannah River Plant Aiken, South Carolina, U.S. Department of Energy (December 1987).

2. U.S. Department of Energy, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, SC; Record of Decision, Federal Register, V. 53, No. 48, page 7557, Wednesday, March 9, 1988.

3. U.S. Department of Energy, Radioactive Waste management, DOE Order 5820.2A, U.S. Department of Energy (September 1988).

4. U.S. Environmental Protection Agency, EPA Advance Notice of Proposed Rulemaking Dealing with Radionuclides Under Safe Drinking Waste Act, 51 FR 34836 (September 1986).

5. Wilhite, E.L., Saltstone Disposal Vault Performance: Effect of Formulation Variation, Savannah River Laboratory, Aiken, SC (February 1988).

6. McIntyre, P.F., Personal Communication, 1988. Data recorded in DPSTN-4434.

G.2 Record of Decision DOE/EIS-0120

Development of Area B (48 acres) would include demolition of existing facilities and construction of new container facilities and an intermodal rail facility. Container facilities would include container transfer and storage areas. The intermodal rail facility would also include tracks and a container staging area. Area B could also include a U.S. Customs Service office, gatehouse, and administration, operation, and maintenance facilities.

The project would also include demolition and construction of Navy facilities to be displaced by the lease agreement. This construction will include recreational, administration and storage facilities. These facilities will be sited at various locations on the NSCO outside of the proposed lease area.

The alternatives to be evaluated will include:

1. The proposed project as discussed above.
2. Alternative configurations, land usage, and amount of property to be leased.
3. The No Action alternative.

We wish to learn the views of affected agencies and individuals regarding the scope and content of the environmental documentation to be prepared for the proposed action. Please respond with written comment within 30 days of the published date of this notice to Ms. Loretta Meyer, Environmental Division, Port of Oakland, 77 Jack London Square, Oakland, California 94607. Questions or comments to be directed to the Navy should be mailed to Mr. Thorn Johnston, Head, Planning Implementation Branch, Western Division Naval Facilities Engineering Command, P.O. Box 727, San Bruno, California, 94066.

Date: March 3, 1988.

William R. Bablington, Jr.,
Commander, JAGC, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 88-5070 Filed 3-8-88; 8:45 am]
BILLING CODE 3810-AE-M

DEPARTMENT OF EDUCATION

[CFDA No. 84.031G]

Invitation for Applications for New Awards Under the Endowment Challenge Grant Program for Fiscal Year 1988

Purpose: Provide grants to eligible institutions of higher education so that they can establish or increase their endowment funds.

Eligibility: Potential applicants, including current grantees under any of the Institutional Aid Programs authorized by Title III of the Higher Education Act, are advised that a notice was published in the Federal Register on December 14, 1987, 52 FR 47446–47447, informing interested parties how to be designated as eligible to receive Endowment Challenge Grant funds.

Deadline for Transmittal of Applications: June 9, 1988.

Applications Available: April 11, 1988.

Available Funds: $19.148 million.

Estimated Range of Awards:

Regular grants: $50,000–$500,000.

Large grants: Over $1,000,000.

Estimated Average Size of Awards: $500,000.

Estimated Number of Awards: 30 to 50.

Project Period: 240 months.

Applicable Regulations: The Endowment Challenge Grant Program Regulations, 34 CFR Part 628.

For Applications or Information Contact: Ms. Anne Price-Collins, Chief, Challenge Grant and Endowment Branch, U.S. Department of Education, 400 Maryland Avenue SW., Room 3042, ROB-3, Washington, DC 20202, Telephone: (202) 732-3335. Applications will be sent to those institutions designated as eligible under the Title III Programs.

Program Authority: 20 U.S.C. 1065a.

Dated: March 1, 1988.

C. Ronald Kimberling,
Assistant Secretary for Postsecondary Education.

[FR Doc. 88-5180 Filed 3-8-88; 8:45 am]
BILLING CODE 4000-01-M

DEPARTMENT OF ENERGY

[DOE/EIS-0120]

Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, SC; Record of Decision

The Department of Energy (DOE) prepared this Record of Decision pursuant to Regulations of the Council on Environmental Quality (40 CFR Part 1505) and Implementing Procedures of the Department of Energy (52 FR 47662, December 15, 1987). This Record of Decision is based on DOE's *Draft and Final Environmental Impact Statements, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina* (DOE/EIS-0120), the public scoping meetings and review hearings on the Draft EIS, and the distribution of approximately 850 copies to Congress, state and Federal agencies, and concerned groups and individuals. DOE considered all public and regulatory comments received on the EIS in the preparation of this Record of Decision.

Decision

DOE has decided to modify hazardous, low-level radioactive, and mixed waste management activities at the Savannah River Plant (SRP) by implementing the Combination strategy discussed in DOE/EIS-0120. Specific project-level actions to be implemented are discussed in the EIS and include:

1. The closure of six inactive low-level radioactive waste sites in the SRP R-Area and one "mixed" waste site in the F-Area where waste constituent concentrations demonstrate a need for removal (even though total waste removal is impossible under any strategy)

These sites were selected for waste removal as a part of the Combination strategy because waste removal now would significantly reduce the extent of or eliminate the need for groundwater remedial actions after site closure. Additional sites may be selected in the future, based on further site-specific investigations and regulatory interactions.

2. The construction of a new "vault-design" low-level radioactive waste disposal facility adjacent to the existing low-level waste burial ground near the center of SRP at site "C"

Currently, the Department of Energy also plans to construct and operate new storage/disposal facilities for hazardous and/or mixed waste in accordance with the Resource Conservation and Recovery Act (RCRA), the Hazardous and Solid Waste Amendments of 1984 (HSWA), and/or the South Carolina Hazardous Waste Management Act (SCHWMA), as amended. The prime candidate sites for the disposal facilities (either a RCRA landfill, an aboveground or below ground vault, or a cement/flyash matrix vault) are at sites "L" and "B" as discussed in the EIS. Storage facilities will be sited, designed, and constructed in these or other areas based on operating considerations and in compliance with regulatory requirements. The site-specific, project-specific actions will be addressed in future planning and in response to regulatory permitting and decisionmaking processes.

3. Reactor disassembly-basin purge water discharges to active seepage and containment basins in the C-, K-, and P-Areas at SRP will continue

DOE will continue to evaluate the general applicability of tritiated-water discharge mitigation measures at SRP.

DOE's decision is based on the assessments and analyses in the EIS. Based on these assessments and analyses, DOE has concluded that implementation of the Combination waste management strategy at SRP will provide adequate environmental and human health protection in accordance with existing requirements.

Background

The Savannah River Plant is a major DOE installation that produces nuclear materials for national defense and research purposes and its operations generate hazardous, radioactive, and mixed (radioactive and hazardous) wastes. Previous acceptable waste disposal practices have included the use of seepage basins for liquids, disposal pits and waste piles for solids, and a burial ground for solid low-level radioactive wastes.

Groundwater contamination of water-table aquifers has occurred at some sites as a result of waste management practices at SRP. Detected contaminants include volatile organic compounds (degreasing solvents), heavy metals (lead, chromium, mercury, and cadmium), radionuclides (tritium, uranium, fission producers, and plutonium), and other chemicals (e.g., nitrates); measured levels of waste constituents have exceeded maximum contaminant levels (MCLs) and other regulatory standards or guideline concentrations.

As a result of legislative actions (Pub. L. 98–181; RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and SCHWMA), their implementing regulations, and DOE Administrative Orders, as well as concerns to protect the environment, many remedial or corrective actions have been started at SRP. These actions include the removal and storage of buried wastes and contaminated soils; the design, construction, and operation of liquid effluent treatment facilities; the use of recovery wells and an air stripper to remove volatile organic compounds from groundwater; the design of a two-stage, rotary kiln incinerator to detoxify hazardous wastes; and waste disposal demonstration programs (e.g., the greater confinement disposal demonstration).

In addition, there are ongoing demonstration programs that affect waste management activities including a "beta-gamma" incinerator, and a box/drum compactor. DOE expects these and other programs to result in improved methods for treatment and disposal of mixed and low-level radioactive wastes or reduction in waste volumes to meet applicable regulations.

The terms "hazardous," "low-level radioactive," and "mixed" (i.e., hazardous and low-level radioactive) are used throughout the EIS as common use terms without specific regard to technical or regulatory definitions unless indicated. DOE does *not* intend this Record of Decision to be a permit application for existing SRP facilities or a vehicle to resolve the applicability of the requirements of RCRA, HSWA, CERCLA, the Superfund Amendments and Reauthorization Act (SARA), and counterpart State of South Carolina regulations to existing SRP facilities or waste sites. Ongoing regulatory interactions and the expanded SRP groundwater monitoring and characterization program will provide the bases for the application of specific regulations and/or permit requirements to existing facilities and waste sites following the publication of this Record of Decision.

Additional documentation in compliance with 40 CFR 1502.20 may be prepared if necessary to implement the project-specific actions discussed in and related to the modification of SRP waste management activities assessed in DOE/EIS-0120.

Description of Alternatives

DOE's proposed action is to modify waste management activities for hazardous, low-level radioactive, and mixed wastes at SRP to protect groundwater, human health, and the environment by implementation of a waste management strategy.

DOE considered Combination, Dedication, Elimination, and No Action waste management strategies for existing waste sites, new disposal facilities, and the discharge of disassembly-basin purge water. Table 1 illustrates the project-level actions which were combined to develop the overall strategies for analysis in the EIS.

As shown in Table 1, each strategy results in different combinations of project-specific actions. The number of waste sites from which waste is removed varies with each strategy. Waste removal subsequently determines the acreage which must be devoted to waste management purposes, affects monitoring costs, security concerns, etc. Similarly, selection of one of the alternative strategies will determine whether new disposal and/or storage facilities are constructed, whether discharges of disassembly-basin purge water to reactor area seepage basins will continue, and the costs and effects associated with the implementation of each strategy. The Combination strategy selected by DOE combines features of the Dedication and Elimination strategies in terms of project-specific actions.

No Action Strategy

No major onsite environmental benefits are expected from the No Action strategy; however, the offsite environment would be protected as a result of continuing waste management practices such as groundwater cleanup in the A/M-Areas. This strategy would result in the following:

Onsite groundwater impacts.

TABLE 1.—ALTERNATIVE WASTE MANAGEMENT STRATEGIES ANALYZED IN THE FEIS (DOE/EIS-0120)

Alternative strategy	Facility category		
	Existing waste sites	New disposal facilities	Disassembly-basin purge water discharge
No action; continue to ensure protection of offsite environment.	No waste removal and no remedial or closure actions.	No new disposal facilities	Continued discharge to seepage basins.
Compliance through Dedication of existing and new disposal areas.	No waste removal; remedial and closure actions as required.	Aboveground or belowground disposal	Continued discharge to seepage basins.
Compliance through Elimination of existing waste sites and storage of wastes.	Remove waste at all sites; remedial and closure actions as required.	Retrievable storage	Direct discharge to onsite streams or evaporation.

TABLE 1.—ALTERNATIVE WASTE MANAGEMENT STRATEGIES ANALYZED IN THE FEIS (DOE/EIS-0120)—Continued

Alternative strategy	Facility category		
	Existing waste sites	New disposal facilities	Disassembly-basin purge water discharge
Compliance through a Combination of dedication and elimination of waste sites, and both storage and disposal of wastes.	Remove waste at selected sites; remedial and closure actions as required.	Aboveground or belowground disposal and retrievable storage.	Continued discharge to seepage basins and study of other mitigation measures.

Elevated concentrations of tritium, strontium-90, and nitrate in Four Mile Creek
Potential terrestrial impacts from open pits and basins
Accidental releases from stored wastes with possible impacts on aquatic and terrestrial ecology and socioeconomics
Continued minor habitat and wetlands impacts
Occupational exposures and risks of fires, spills, and leaks due to waste transportation and accidents
Dedication of 300 acres
Potential future exposures to persons occupying the Savannah River Plant

The estimated total capital cost to continue current practices is about $17 million. Total 20-year operating costs for the No Action strategy are estimated at about $86 million. Estimated lifetime maintenance and monitoring costs are about $51 million.

Dedication Strategy

The major environmental benefits predicted to occur from the implementation of the Dedication strategy include improvement of onsite groundwater quality from remedial and closure actions at existing waste sites; improvement of onsite surface water quality; reduction of potential public health effects; and reduction in atmospheric releases. A disadvantage would be the removal of some sites from public use through their dedication for waste management purposes; as much as 700 acres would be affected. Environmental impacts under this strategy could include the following:

Local and transitory onsite groundwater drawdown effects
Minor short-term terrestrial impacts due to the use of borrow pits for backfill
Impacts to wildlife habitat due to land clearing and development
The dedication of about 400 acres of land to new above and belowground disposal facilities
The dedication of about 300 acres at existing waste sites
Accidental and occupational risks

The total capital cost for implementation of this strategy ranges from about $281 million to $788 million. Total 20-year operating costs range from about $51 to $258 million. Estimated costs for closure range from about $19 to $31 million. Estimated post-closure maintenance and monitoring costs range from about $65 million to $119 million. The cost ranges are based on the types of facilities that would be selected.

Elimination Strategy

The environmental benefits expected from the implementation of the Elimination strategy include improvement to onsite groundwater and surface water quality from the removal and closure of all existing waste sites and remedial actions, as required; reduction of potential public health effects and atmospheric releases (except increased tritium air releases under the evaporation option); and no requirement for dedication of sites at the SRP. Disadvantages include higher occupational risks than with other strategies and the absence of assurance of the future availability of disposal sites in other areas. Environmental impacts that could occur under this strategy include:

Onsite groundwater drawdown effects (local and transitory)
Added tritium releases to surface streams from direct discharge or increased atmospheric (evaporation) releases
The highest occupational risks of all the strategies during waste removal, closure, and remedial actions
Terrestrial impacts at borrow pits that were greater than those for other strategies
Some loss of habitat (up to 400 acres) due to land clearing and development during the construction of the retrievable storage facilities
The greatest risk of spills, leaks, and fires, and the greatest worker exposures due to waste removal, transportation, treatment, and disposal.

The total capital cost for implementation of this strategy during the 20-year operational period would range between $2.0 billion and $4.8 billion. Total 20-year operating costs would range from about $370 million to $2.4 billion. Estimated post-closure maintenance and monitoring costs are about $37 million. The costs for the eventual treatment and disposal of stored waste are not included in these monitoring and maintenance estimates.

Combination Strategy

Major environmental benefits to be derived from implementation of the Combination strategy include secure, retrievable storage and disposal of wastes; improvement to onsite surface water and groundwater from removal of wastes at selected sites, closure of selected waste sites, and remedial actions, as required; reduction of potential public health effects; and reduction of atmospheric releases. The dedication of some sites for waste management purposes would be required. This strategy could cause the following impacts:

Local and transitory groundwater drawdown effects
Some habitat disruption on up to 400 acres of land required by new disposal facilities
Dedication of up to 400 acres of land for new storage/disposal facility(s)

The estimated total capital cost of implementation of the Combination strategy ranges from about $459 to $957 million. Total 20-year operating costs range from about $73 to $273 million. Closure costs range from about $37 to $48 million. Estimated post-closure maintenace and monitoring costs range from $90 to $105 million.

Environmentally Preferable Alternative

The Elimination strategy is the "environmentally preferable alternative" when long-term impacts are considered. In the short-term, however, implementation of the Elimination strategy results in increased occupational exposures. The Elimination strategy results in the removal of hazardous, low-level radioactive, and mixed wastes at existing waste sites; retrievable storage for wastes resulting from remedial actions and ongoing operations; and ultimately will result in the elimination of discharges of disassembly-basin purge water to reactor seepage and containment basins. Actual reductions in health effects associated with reduced environmental concentrations of waste constituents are, however, extremely limited. In some cases, health effects associated with the elimination strategy are actually higher than for other strategies, including the Combination strategy, because of occupational exposures resulting from waste removal actions and the re-suspension of waste particles during waste removal actions.

Basis for Decision

In compliance with the National Environmental Policy Act and its implementing regulations, DOE has analyzed the environmental impacts of the alternatives described in the EIS through extensive impact assessment, modeling, and human health and environmental risk assessment. Comments were received by DOE through the scoping process and as a result of distribution of the Draft EIS. DOE considered and responded to these comments as part of the preparation of the Final EIS. DOE's preferred alternative for modifying waste management activities at SRP is the Combination strategy. The Combination strategy was selected by DOE as the preferred alternative over the environmentally preferable alternative because it provides adequate human health and environmental protection, has lower occupational risk, the cost associated with closure actions and the construction of new retrievable storage facilities is significantly lower, and terrestrial ecological impacts are lower.

Considerations in the Implementation of the Decision

Implementation of the preferred waste management strategy will involve separate but related activities for regulatory compliance, Congressional funding authorization, and designs for new storage and disposal facilities.

Conclusion

DOE has considered all environmental factors, benefits and costs, institutional and programmatic needs, and schedules, and has concluded that it will implement the Combination strategy discussed in DOE/EIS-0120. DOE will continue its interactions with regulatory agencies to ensure that actions implemented in accordance with this Record of Decision comply with applicable regulatory requirements. DOE will proceed with implementation of this waste management strategy subject to the authorization and appropriation of funds by Congress.

Dated: March 2, 1988.

Troy E. Wade II,

Acting Assistant Secretary for Defense Programs.

[FR Doc. 88-5197 Filed 3-8-88; 8:45 am]

BILLING CODE 6450-01-M

Economic Regulatory Administration

[ERA Docket No. 87-43-NG]

Entrade Energy Corp.; Order Granting Blanket Authorization To Import Natural Gas

AGENCY: Economic Regulatory Administration, Department of Energy.

ACTION: Notice of order granting blanket authorization to import natural gas.

SUMMARY: The Economic Regulatory Administration (ERA) of the Department of Energy (DOE) gives notice that it has issued an order granting EnTrade Corporation (EnTrade) blanket authorization to import Canadian natural gas for sale in the domestic spot market. The order issued in ERA Docket No. 87-43-NG authorizes EnTrade to import up to 175 Bcf of gas over a two-year period beginning on the date of first delivery.

A copy of this order is available for inspection and copying in the Natural Gas Division Docket Room, GA-076, Forrestal Building, 1000 Independence Avenue SW., Washington, DC 20585, (202) 586-9478. The docket room is open between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday, except Federal holidays.

Issued in Washington, DC, March 3, 1988.

Constance L. Buckley,

Director, Natural Gas Division Office of Fuels Programs, Economic Regulatory Administration.

[FR Doc. 88-5196 Filed 3-8-88; 8:45 am]

BILLING CODE 6450-01-M

Office of Energy Research

Basic Energy Sciences Advisory Committee; Open Meeting

Pursuant to the provision of the Federal Advisory Committee Act (Pub. L. 92-463, 86 Stat. 770), notice is hereby given of the following meeting:

Name: Basic Energy Sciences Advisory Committee (BESAC), Energy.

Date and Time: April 6, 1988, 9:00 a.m.–5:00 p.m.; April 7, 1988, 9:00 a.m.–4:00 p.m.

Place: U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585, Room 5E-069.

Contact: Louis C. Ianniello, Department of Energy, Office of Basic Energy Sciences (ER-11), Office of Energy Research, Washington, DC 20545, Telephone: 301-353-3081.

Purpose of the Committee: To provide advice on a continuing basis to the Secretary of the Department of Energy (DOE), through the Director of Energy Research, on the many complex scientific and technical issues that arise in the development and implementation of the Basic Energy Sciences (BES) program.

Tentative agenda: Briefings and discussions of:

April 6, 1988

- BES FY 1988/FY 1989 Budget
- Status of BES Programs
- Review of BESAC Reports
- Public Comment (10 Minute Rule)

April 7, 1988

- Committee Agenda for 1988
- Committee Structure
- Geosciences, Engineering, Energy Biosciences
- Public Comment (10 Minute Rule)

Public Participation: The meeting is open to the public. Written statements may be filed with the Committee either before or after the meeting. Members of the public who wish to make oral statements pertaining to agenda items should contact: Louis C. Ianniello at the address or telephone number listed above. Requests must be received 5 days prior to the meeting and reasonable provision will be made to include the presentation on the agenda. The Chairperson of the Committee is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business.

Transcripts: The transcript of the meeting will be available for public review and copying at the Freedom of Information Public Reading Room, 1E-190, Forrestal Building, 1000 Independence Avenue SW., Washington, DC between 9:00 a.m., and 4:00 p.m., Monday through Friday, except Federal holidays.

Issued at Washington, DC on March 4, 1988.

J. Robert Franklin,

Deputy Advisory Committee Management Officer.

[FR Doc. 88-5198 Filed 3-8-88; 8:45 am]

BILLING CODE 6450-01-M

Office of Hearings and Appeals

Issuance of Proposed Decision and Order; Period of December 21, 1987 Through January 29, 1988

During the period of December 21, 1987 through January 29, 1988, the proposed decision and order summarized below was issued by the Office of Hearings and Appeals of the Department of Energy with regard to an application for exception.

Under the procedural regulations that apply to exception proceedings (10 CFR Part 205, Subpart D), any person who will be aggrieved by the issuance of a proposed decision and order in final form may file a written notice of

G.3 DOE Order 5820.2A

U.S. Department of Energy
Washington, D.C.

ORDER

DOE 5820.2A

9-26-88

SUBJECT: RADIOACTIVE WASTE MANAGEMENT

1. PURPOSE. To establish policies, guidelines, and minimum requirements by which the Department of Energy (DOE) manages its radioactive and mixed waste and contaminated facilities.

2. CANCELLATION. DOE 5820.2, RADIOACTIVE WASTE MANAGEMENT OF 2-6-84.

3. SCOPE. The provisions of this Order apply to all DOE elements and, as required by law and/or contract and as implemented by the appropriate contracting officer, all DOE contractors and subcontractors performing work that involves management of waste containing radioactivity and/or radioactively contaminated facilities for DOE under the Atomic Energy Act of 1954, as amended (Public Law 83-703).

4. EXCLUSION. This Order does not apply to the management by the Department of commercially generated spent nuclear fuel or high-level radioactive waste, nor to the geologic disposal of high-level waste produced by the Department's activities and operations. Such materials are managed by the Office of Civilian Radioactive Waste Management under the requirements of the Nuclear Waste Policy Act of 1982, as amended (Public Law 97-425).

5. POLICY. Radioactive and mixed wastes shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees, and the environment. The generation, treatment, storage, transportation, and/or disposal of radioactive wastes, and the other pollutants or hazardous substances they contain, shall be accomplished in a manner that minimizes the generation of such wastes across program office functions and complies with all applicable Federal, State, and local environmental, safety, and health laws and regulations and DOE requirements.

6. REFERENCES. (See Attachment 1.)

7. DEFINITIONS. (See Attachment 2.)

8. RESPONSIBILITIES.

   a. Assistant Secretary for Defense Programs (DP-1) has authority for establishing policy for the management of DOE waste and assuring that DOE waste generated by operations and activities under DP-1 cognizance, or any other waste within the purview of DP-1, is managed according to the requirements of this Order. DP-1 also has general responsibility for assuring that

DISTRIBUTION:

All Departmental Elements

INITIATED BY:

Office of Defense Waste and Transportation Management

DP-1 programmatic decisions include waste management considerations when appropriate. Specific responsibilities include:

(1) Assuring the safe storage and disposal of all DOE waste other than that managed by NE-1 and RW-1;

(2) Implementing new and alternative technologies and processes to improve management of DP waste;

(3) Developing and operating the Waste Isolation Pilot Plant, a facility near Carlsbad, New Mexico, for conducting research and development to demonstrate the safe disposal of radioactive waste from defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission;

(4) Conducting research and development for DOE waste transportation systems and providing for safe, efficient, and economic transport of materials, pursuant to DOE 1540.1;

(5) Managing DP contaminated facilities, including those that are surplus to program needs;

(6) Assuring that the environmental, safety, health, transportation, quality assurance, unusual occurrence, construction project management, real estate management, and facility design requirements set forth in DOE Orders are implemented for DP-1 waste management programs; and

(7) Supporting the information needs of the Integrated Data Base program on defense program activities and jointly managing and funding the program in cooperation with NE-1 and RW-1 (see Attachment 1, page 3, paragraph 23).

b. Director of Defense Waste and Transportation Management (DP-12) is charged with carrying out DP-1 waste management responsibilities for oversight of the waste management complex, for interpreting waste management policy, and for implementing the requirements of this Order for waste management facilities and operations funded by DP-12. Specific responsibilities include:

(1) Management of storage, treatment, and disposal operations for defense waste;

(2) Managing defense contaminated facilities that are excess to programmatic needs;

(3) Reviewing and approving new or alternative waste management practices;

(4) Conducting research and development for DOE waste transportation systems and providing for safe, efficient, and economic transport of materials, pursuant to DOE 1540.1;

(5) Conducting independent health, safety, and quality assurance audits of field waste management organizations, in cooperation with EH-1, to assess compliance with the requirements of this Order;

(6) Issuing, in consultation with EH-1, approval of exemptions from the requirements of this Order (paragraph 9) that are proposed by other Headquarters or field organizations;

(7) Issuing in consultation with EH-1 and Headquarters program organizations updated waste management guidance; and

(8) Approving documents, reports, and plans, as required by this Order, for DP programs and activities.

c. Director of Civilian Radioactive Waste Management (RW-1) is responsible for selected research and development, siting, construction, operation, and management activities assigned to the Secretary of Energy by the Nuclear Waste Policy Act of 1982 (Public Law 97-425) for the interim storage and disposal of high-level waste and spent nuclear fuel. Specific responsibilities include the following:

(1) The long-term care, in cooperation with NE-1, of closed commercial low-level waste sites transferred to DOE;

(2) Lead responsibility, in cooperation with NE-1 and DP-1, for the Integrated Data Base program (see Attachment 1, page 3, paragraph 23);

(3) Assurance that the requirements of DOE Orders are met for all waste management activities under RW-1 purview; and

(4) Independent health, safety, and quality assurance audits of field waste management organizations in cooperation with EH-1, to assess compliance with the requirements of this Order.

d. Assistant Secretary for Nuclear Energy (NE-1) is responsible for assuring that waste generated by operations funded by NE-1 is managed according to the requirements of this Order and that NE-1 program decisions include waste management considerations, as appropriate. Specific responsibilities include:

(1) Managing DOE wastes from NE-1 operations and activities, including the breeder reactor, space nuclear, naval reactor, and remedial action programs, as well as the Three Mile Island and West Valley projects;

(2) Managing waste generated by DOE enrichment operations and disposed at sites located at the Oak Ridge, Portsmouth, and Paducah gaseous diffusion plants;

(3) Managing any greater than Class C low-level waste, as defined in Section 3(b)(1)(D) of Public Law 99-240, which may be accepted by the Department for disposal in cooperation with DP-1;

(4) Developing and implementing alternative technologies and processes to support storage and disposal of waste or spent fuel generated by NE-1 operations;

(5) Managing NE-1 contaminated facilities, including those that are surplus to program needs, and waste storage/disposal sites;

(6) Developing and implementing commercial applications for waste byproducts;

(7) Assuring that environmental, safety, health, transportation, quality assurance, unusual occurrence, construction project management, real estate management, and facility design requirements set forth in DOE Orders, are implemented for NE-1 waste management programs;

(8) Conducting independent health, safety, and quality assurance audits of field waste management operations in cooperation with EH-1 to assess compliance with the requirements of this Order; and

(9) Supporting the information needs of the Integrated Data Base program on civilian nuclear program activities in cooperation with DP-1 and RW-1 (see Attachment 1, page 3, paragraph 23).

e. Assistant Secretary for Environment, Safety and Health (EH-1) is responsible for providing an independent overview of DOE radioactive waste management and decommissioning programs to determine compliance with DOE environment, safety, and health requirements and applicable Environmental Protection Agency (EPA) and state regulations. Specific responsibilities include:

(1) Advising the Secretary of the status of Departmental compliance with the requirements of this Order and applicable provisions of DOE 5480.1B, and EH Orders.

(2) Conducting independent appraisals and audits of DOE waste management and decommissioning programs consistent with the requirements of DOE 5482.1B.

(3) Reviewing site Waste Management Plans and Decommissioning Project Plans with regard to compliance with DOE environment, safety, and health requirements.

f. Director, Naval Nuclear Propulsion Program: Executive Order 12344, statutorily prescribed by PL 98-525 (42 USC 7158 note), establishes the responsibilities and authority of the Director, Naval Nuclear Propulsion Program (who is also the Deputy Assistant Secretary for Naval Reactors within the Department) over all facilities and activities which comprise the Program, a joint Navy-DOE organization. The policy principle promoted by these executive and legislative actions is cited in the Executive Order as "...preserving the basic structure, policies and practices developed for this Program in the past...". Accordingly, The Naval Propulsion Program is exempt from the provisions of this Order. The Director shall maintain an environmental protection program to assure compliance with applicable environmental statutes and regulations. The Director and EH-1 shall exchange information and cooperate as appropriate to facilitate exercise of their respective responsibility.

g. Directors of other Headquarters Program Organizations are responsible for implementing the requirements of this Order for all DOE waste generated by their programs until it is transferred to a DOE or licensed storage/disposal site. For all contaminated facilities under their jurisdiction, they are responsible for assuring that their programmatic decisions include waste management considerations, as appropriate, and for implementing the requirements of other applicable DOE Orders for their waste management programs.

h. Office of General Counsel (GC-1) provides legal advice to program organizations regarding DOE waste management and decommissioning activities involving DOE-owned and privately owned sites; renders legal opinion on DOE authority to undertake remedial action and other waste management activities; and renders legal opinions on, and concurs in, program actions to comply with the National Environmental Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, and other legal authorities in conjunction with proposed waste management and decommissioning activities.

i. Assistant Secretary, Management and Administration (MA-1) is responsible for providing contractual and business advice to program organizations regarding DOE waste management activities, including use of DOE management and operating contractors in such activities.

j. Heads of Field Organizations are responsible for all activities that affect the treatment, storage, or disposal of waste in facilities under their jurisdiction regardless of where the waste is generated. Heads of field organizations with treatment, storage or disposal facilities responsibility have the authority for establishing waste management requirements at that facility (e.g., setting waste acceptance criteria, waste certification, verification of contents of waste shipped or to be shipped, concurring in waste reduction plans). In addition, they are responsible for assuring that the day-to-day waste management and surplus facility operations at their sites are conducted in compliance with the requirements of this Order and comply with all applicable Federal, State, and local statutes. Specific responsibilities include the following:

(1) Preparing annual updates of the Waste Management Plans for all operations under their purview according to the format in the Waste Management Plan Outline, Chapter VI. These Plans shall be submitted in December of each year and be distributed to DP-12, EH-1, and other appropriate Headquarters organizations for review and comment.

(2) Preparing supplements to this Order that identify specific detailed requirements for waste management practices and procedures conducted at their sites.

(3) Overseeing fiscal responsibility for transporting waste and establishing of fees to recover the incremental costs for storage and disposal of DOE waste at their sites.

(4) Establishing waste acceptance criteria and reviewing waste minimization plans of other field organization's facilities that generate radioactive, hazardous, or mixed waste that will be treated, stored or disposed of at facilities under their purview.

(5) Auditing any waste generating organization that ships waste to their sites for treatment, storage, or disposal to assure compliance with established waste acceptance criteria.

(6) Maintaining environmental, safety, and health programs for all DOE waste management operations under their purview.

(7) Managing contaminated facilities under their purview according to the requirements of this Order and guidance provided by Headquarters program offices, providing program secretarial officers with the necessary characterizational and engineering data for contaminated facilities, and developing site-specific priorities, schedules, and costs for remedial actions.

(8) Assuring that the requirements of the Order, applicable to contractors and subcontractors whose contracts fall within the scope of the Order, are properly reflected in the contract document.

(9) Defining and assuring that required quality assurance activities are established and implemented for all waste management activities under their purview, pursuant to the requirements of DOE 5700.6B and reporting unusual occurrences pursuant to the requirements of DOE 5000.3.

(10) Providing information, as requested, to the Integrated Data Base Program, Oak Ridge National Laboratory, for all types of waste under

their purview, including: high-level waste; transuranic waste; low-level waste; naturally occurring and accelerator produced radioactive material; mixed waste; and wastes from decommissioning activities (see Attachment 1, page 3, paragraph 23).

k. Manager of Albuquerque Operations Office is responsible, in addition to the responsibilities identified in paragraph 8j, for use of certified packaging, standard containers, transportation, waste acceptance criteria, and all other aspects related to transuranic waste emplacement at the Waste Isolation Pilot Plant. Within the Albuquerque Operations Office, a standing committee, the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee, is responsible for review, audit, and approval of generator transuranic waste certification programs and activities. The Manager of the Albuquerque Operations Office, as Head of the Waste Isolation Pilot Plant project office, also has responsibility for the design, construction, technology development, and operational activities leading to permanent isolation of transuranic waste from the biosphere.

9. EXEMPTIONS. Exemptions from the requirements of this Order may be granted only with the approval of DP-12 in consultation with EH-1. New or alternate waste management practices that are based on appropriate documented safety, health protection, and economic analyses may be proposed by field organizations and adopted with the approval of DP-12 and EH-1.

10. IMPLEMENTING PROCEDURES AND REQUIREMENTS. Within 6 months of the date of issuance of this Order, Heads of Field Elements shall prepare and submit to appropriate Headquarters program organizations an implementation plan describing schedules, costs, and quality assurance activities for compliance with the requirements of this Order with copies to EH-1 for review and comment. Specific guidance for the plan will be issued by DP-12 under separate cover. Thereafter, the status of compliance with the requirements of this Order shall be reported to the appropriate Headquarters program organization in the annual update of the Waste Management Plans.

11. CLEARANCE UNDER THE PAPERWORK REDUCTION ACT OF 1980. This directive has been determined to contain information collections under the provisions of 5 CFR 1320, "Controlling Paperwork Burdens on the Public." The Office of Management and Budget (OMB) has issued a clearance to the Department (OMB No. 1910-0900) for these information collections.

BY ORDER OF THE SECRETARY OF ENERGY:

LAWRENCE F. DAVENPORT
Assistant Secretary
Management and Administration

REFERENCES

1. DOE 1332.1A, UNIFORM REPORTING SYSTEM, of 10-15-85, establishes the content and format of plans and reports to be obtained from the Department's contractors and stipulated as a contract requirement.

2. DOE 1430.1A, MANAGEMENT OF THE DEPARTMENT'S SCIENTIFIC AND TECHNICAL INFORMATION, of 9-10-86, which establishes the policy that scientific and technical information developed during work supported by DOE shall be promptly and fully reported to the Technical Information Center (MA-28), located in Oak Ridge, Tennessee, for inclusion in the Department's information data base.

3. DOE 1540.1, MATERIALS TRANSPORTATION AND TRAFFIC MANAGEMENT of 5-3-82, establishes the Department's policies for management of materials transportation activities.

4. DOE 1540.2, HAZARDOUS MATERIAL PACKAGING FOR TRANSPORTATION ADMINISTRATIVE PROCEDURES of 9-30-86, establishes administrative procedures for the certification and use of radioactive and other hazardous materials packaging by the Department of Energy.

5. DOE 2110.1, PRICING OF DEPARTMENTAL MATERIALS AND SERVICES of 2-16-84, which establishes the Department's policy for establishing prices and charges for materials and services provided to outside persons and organizations.

6. DOE 4300.1B, REAL PROPERTY AND SITE DEVELOPMENT PLANNING of 7-1-87, establishes Department policies and procedures for planning the development and utilization of sites and their facilities and for the acquisition, use, inventory, and disposal of real property or interests therein.

7. DOE 4700.1, PROJECT MANAGEMENT SYSTEM, of 3-6-87, establishes the DOE Project Management System (PMS), provides implementing instructions, formats and procedures and sets forth requirements which govern the development, approval and execution of DOE's outlay program acquisition as embodied in the PMS.

8. DOE 5000.3, UNUSUAL OCCURRENCE REPORTING SYSTEM of 11-7-84, establishes the Department's policy and provides instructions for reporting, analyzing, and disseminating information on programmatically significant events.

9. DOE 5400.2, ENVIRONMENTAL COMPLIANCE ISSUE COORDINATION, of 8-13-87, establishes DOE requirements for coordination of significant environmental compliance issues.

10. DOE 5440.1C, NATIONAL ENVIRONMENTAL POLICY ACT of 4-9-85, establishes the Department's policy for implementation of the National Environmental Policy Act of 1969 (Public Law 91-190).

11. DOE 5480.1B, ENVIRONMENTAL SAFETY, AND HEALTH PROGRAM FOR DEPARTMENT OF ENERGY OPERATIONS of 9-23-86, establishes an overall framework of program requirements for safety, environmental, and health protection, including criteria for radiation exposure and radioactive effluent releases for operating facilities and sites.

12. DOE 5480.3, SAFETY REQUIREMENTS FOR THE PACKAGING AND TRANSPORTATION OF HAZARDOUS MATERIALS, HAZARDOUS SUBSTANCES AND HAZARDOUS WASTES, of 7-9-85, establishes requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes.

13. DOE 5481.1B, SAFETY ANALYSIS AND REVIEW SYSTEM of 9-23-86, establishes uniform requirements for the preparation and review of safety analyses of DOE operations.

14. DOE 5482.1B, ENVIRONMENT, SAFETY AND HEALTH APPRAISAL PROGRAM of 9-23-86, establishes an environment safety and health appraisal program for DOE.

15. DOE 5484.1, ENVIRONMENTAL, SAFETY, AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS of 2-24-81, establishes requirements and practices for reporting environmental, health, and safety information for DOE operations.

16. DOE 5700.6B, QUALITY ASSURANCE of 9-23-86, sets forth principles and assigns responsibilities for establishing, implementing, and maintaining programs of plans and actions to assure quality achievement in the Department's programs.

17. DOE 6430.1, GENERAL DESIGN CRITERIA of 12-12-83, establishes general design criteria for use in acquisition of the Department's facilities and to establish responsibilities and authorities for the development and maintenance of those criteria.

18. WIPP-DOE-069, rev. 2, of 9-85, "Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant" of 9-81, as updated, specifies basic requirements for disposal of contact-handled and remote-handled transuranic waste at the Waste Isolation Pilot Plant. Copies of this and other DOE Waste Isolation Pilot Plant reports may be obtained from the Albuquerque Operations Office.

19. WIPP-DOE-120, rev. 1, of 1-83, "Quality Assurance" establishes the Quality Assurance requirements to ensure that each site's transuranic waste certification program will perform satisfactorily.

20. WIPP-DOE-157 rev. 1, of 9-85, "Data Package Format for Certified Transuaranic Waste for the Waste Isolation Pilot Plant" specifies the arrangement of data which are required to be reported to the Waste Isolation Pilot Plant for transuranic waste to be received.

21. DOE/LLW-63T of 9-87, "Guidance for Conduct of Waste Management Systems Performance Assessment" provides information on meeting the systems performance requirement of Chapter III 3b(2) of DOE 5820.2A.

22. DOE-JIO-025 of 9-87, "Comprehensive Implementation Plan for the DOE Defense Buried Transuranic-Contaminated Waste Program," describes long term management alternatives for all DOE sites with buried transuranic waste.

23. DOE/RW-0006, rev. 3, "Integrated Data Base for 1987: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics" of 9-87, with annual updates, summarizes data in the Integrated Data Base program on all domestic spent fuel and radioactive waste. Copies may be obtained from the Office of Nuclear Energy, Germantown, or the Technical Information Center, Oak Ridge.

24. DOE/DP/0020/1 "An Evaluation of Commercial Respository Capacity for the Disposal of Defense High Level Waste," of 6-85, evaluates the use of civilian repository capacity for the disposal of high level waste resulting from Defense activities, and provided to the President as one analytical input for his evaluation as required under the Nuclear Waste Policy Act.

25. Nuclear Waste Policy Act of 1982, as amended, (Public Law 97-425) provides for the development of repositories for the disposal of high-level waste and spent nuclear fuel.

26. Uranium Mill Tailings Radiation Control Act of 1978 (Pubic Law 95-604) establishes national policy for control of uranium mill tailings.

27. Energy Reorganization Act of 1974 (Public Law 93-438), in Section 202, assigns licensing and related regulatory authority to the Nuclear Regulatory Commission for facilities authorized for the express purpose of long-term storage of defense high-level waste.

28. Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Public Law 96-164), Section 213(a) authorizes the Waste Isolation Pilot Plant.

29. Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240) makes the Federal Government responsible for disposal of commercially generated greater than class C waste as defined in Section 3(b)(1)(D) of the Act.

30. Resource Conservation and Recovery Act of 1976, as amended, (Public Law 94-580) establishes safe and environmentally acceptable management practices for solid wastes.

31. Comprehensive Environment Response, Compensation, and Liability Act of 1980, as amended, (Public Law 96-510) to provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment, and the cleanup of inactive hazardous waste disposal sites.

32. The Superfund Amendments and Reauthorization Act of 1986 (Public Law 99-270) provides for a fund (Superfund) which may be utilized by the Environmental Protection Agency, State, and local governments to clean up hazardous waste sites listed on the National Priorities List.

33. National Environmental Policy Act of 1969 (Public Law 91-190) requires the preparation of a statement which considers environmental impacts, alternatives, and resource commitments for any major Federal action that significantly affects the quality of the human environment.

34. Title 5 CFR 1320, Controlling Paperwork Burdens on the Public serves as the implementing regulation for Public Law 96-511, Paperwork Reduction Act of 1980 and directs the identification and clearance of information collections levied on the public, including contractors, State and local government units, and persons who perform services for the Department on an individual basis.

35. Title 10 CFR Part 60, of 2-25-81, Disposal of High-Level Wastes in Geologic Repositories, prescribes rules governing the licensing of the Department of Energy to receive and possess source, special nuclear, and byproduct material at a geologic repository operations area.

36. Title 10 CFR Part 61, of 12-27-82, Licensing Requirements for Land Disposal of Radioactive Waste, establishes technical requirements for the land disposal of commercial low-level waste including site selection, site design, and facility operation and closure.

37. Title 10 CFR Part 71, of 8-5-83, Packaging and Transportation of Radioactive Material, establishes (1) requirements for packaging, preparation for shipment, and transportation of licensed material and (2) procedures and standards for NRC approval of packaging and shipping procedures for fissile material and for a quantity of other licensed material in excess of a Type A quantity.

38. Title 10 CFR Part 962, of 5-1-87, Radioactive Waste; Byproduct Material establishes the policy that all DOE radioactive waste which is hazardous under the Resource Conservation and Recovery Act will be subject to regulation under both the Resource Conservation and Recovery Act and Atomic Energy Act.

39. Title 40 CFR Part 61, of 7-1-87 National Emission Standards for Hazardous Air Pollutants, establishes standards for atmospheric emissions of hazardous air pollutants and radionuclides.

40. Title 40 CFR Part 191, of 9-19-85, Environmental Radioactive Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and transuranic Radioactive Waste, establishes radiation protection standards governing the management and storage of spent nuclear fuel or high-level or transuranic wastes at any disposal facility operated by DOE.

41. Title 40 CFR Part 192, of 1-5-83, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, concerns the control of residual radioactive material at designated processing or disposal sites.

42. Title 40 CFR Part 261, of 5-19-80, Identification and Listing of Hazardous Waste identifies those solid wastes that are subject to regulation as hazardous waste.

43. Title 40 CFR 262, of 5-19-80, Standards Applicable to Generators of Hazardous Waste, establishes manufacturing, packaging, labeling, record keeping, and reporting requirements for generators of hazardous waste.

44. Title 40 CFR Part 263, of 5-19-80, Standards Applicable to Transporters of Hazardous Waste, establishes manufacturing, record keeping, spill reporting and cleanup requirements for transporters of hazardous waste.

45. Title 40 CFR Part 264, of 5-19-80, Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, establishes minimum national standards defining the acceptable management of hazardous waste.

46. Title 40 CFR Part 265, of 5-19-80, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure.

47. Title 49 CFR Parts 100-178, of 10-1-86, Other Regulations Relating to Transportation: Chapter I-Research and Special Programs Administration, Department of Transportation, prescribes the requirements of the DOT governing the transportation of hazardous material and the manufacture and testing of packaging and containers.

48. ANSI/ASME NQA-1 "American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1," sets forth requirements for the establishment and execution of quality assurance programs for the design, construction, operation, and decommissioning of nuclear facilities.

49. Atomic Energy Act of 1954, as amended 42 U.S.C. § § 2011-2292 (1982) which authorizes and directs the Atomic Energy Commission to produce special nuclear material in its own facilities to produce atomic weapons or atomic weapons parts and to research and develop military applications of atomic energy.

50. Nuclear Waste Policy Amendments Act of 1987 (part of the Budget Reconciliation Act for FY 1988 Public Law 100-203), of December 22, 1987, streamlines and focuses the high level waste management program established by the Nuclear Waste Policy Act.

DEFINITIONS

1. Below Regulatory Concern. A definable amount of low-level waste that can be deregulated with minimal risk to the public.

2. Buffer Zone. The smallest region beyond the disposal unit that is required as controlled space for monitoring and for taking mitigative measures, as may be required.

3. Byproduct Material. (Attachment 1, pages 4 and 5, paragraphs 38 and 49.)

   a. Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident or to the process of producing or utilizing special nuclear material. For purposes of determining the applicability of the Resource Conservation and Recovery Act to any radioactive waste, the term "any radioactive material" refers only to the actual radionuclides dispersed or suspended in the waste substance. The nonradioactive hazardous waste component of the waste substance will be subject to regulation under the Resource Conservation and Recovery Act.

   b. The tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Ore bodies depleted by uranium solution extraction operations and which remain underground do not constitute "byproduct material."

4. Certified Waste. Waste that has been confirmed to comply with disposal site waste acceptance criteria (e.g., the Waste Isolation Pilot Plant-Waste Acceptance Criteria for transuranic waste) under an approved certification program.

5. Closure.

   a. Operational Closure. Those actions that are taken upon completion of operations to prepare the disposal site or disposal unit for custodial care, (e.g., addition of cover, grading, drainage, erosion control).

   b. Final Site Closure: Those actions that are taken as part of a formal decommissioning or remedial action plan, the purpose of which is to achieve long-term stability of the disposal site and to eliminate to the extent practical the need for active maintenance so that only surveillance, monitoring, and minor custodial care are required.

6. Contact-Handled Transuranic Waste. Packaged transuranic waste whose external surface dose rate does not exceed 200 mrem per hour.

7. Decommissioning. Actions taken to reduce the potential health and safety impacts of DOE contaminated facilities, including activities to stabilize, reduce, or remove radioactive materials or to demolish the facilities.

8. Decontamination. The removal of radioactive contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

9. Department of Energy Waste. Radioactive waste generated by activities of the Department (or its predecessors), waste for which the Department is responsible under law or contract, or other waste for which the Department is responsible. Such waste may be referred to as DOE waste.

10. Disposal. Emplacement of waste in a manner that assures isolation from the biosphere for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste.

11. Disposal Facility. The land, structures, and equipment used for the disposal of waste.

12. Disposal Site. That portion of a disposal facility which is used to dispose of waste. For low-level waste, it consists of disposal units and a buffer zone.

13. Disposal Unit. A discrete portion (e.g., a pit, trench, tumulus, vault, or bunker) of the disposal site into which waste is placed for disposal.

14. DOE Reservation. A location consisting of a DOE-controlled land area including DOE-owned facilities (e.g., the Oak Ridge Reservation) in some cases referred to as a Site, such as the Nevada Test Site, the Hanford Site; or as a Laboratory, such as the Idaho National Engineering Laboratory; or as a Plant, such as Rocky Flats Plant; or as a Center, such as the Feed Materials Production Center.

15. Free Liquids. Liquids which readily separate from the solid portion of a waste under ambient temperature and pressure.

16. Engineered Barrier. A man-made structure or device that is intended to improve the performance of a disposal facility.

17. Hazardous Wastes. Those wastes that are designated hazardous by EPA regulations (40 CFR 261).

18. High-Level Waste. The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

19. Institutional Control. A period of time, assumed to be about 100 years, during which human institutions continue to control waste management facilities.

20. Low-Level Waste. Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or 11e(2) byproduct material as defined by this Order. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g.

21. Monitoring. The making of observations and measurements to provide data to evaluate the performance of a waste management operation.

22. Mixed Waste. Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively.

23. Natural Barrier. The physical, chemical, and hydrological characteristics of the geological environment at the disposal site that, individually and collectively, act to retard or preclude waste migration.

24. Naturally Occurring and Accelerator Produced Radioactive Material. Any radioactive material that can be considered naturally occurring and is not source, special nuclear, or byproduct material or that is produced in a charged particle accelerator.

25. Near Surface Disposal. Disposal in the upper 30 meters of the earth's surface, (e.g. shallow land burial).

26. Performance Assessment. A systematic analysis of the potential risks posed by waste management systems to the public and environment, and a comparison of those risks to established performance objectives.

27. Pyrophoric Material. A material which under normal conditions is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious transportation, handling or disposal hazard.

28. Quality Assurance. All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily and safely in service. Quality assurance includes quality control, which comprises all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.

29. Radioactive Waste. Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended and of negligible economic value considering costs of recovery.

30. Remedial Action. Activities conducted at DOE facilities to reduce potential risks to people and/or harm to the environment from radioactive and/or hazardous substance contamination.

31. Remote-Handled Transuranic Waste. Packaged transuranic waste whose external surface dose rate exceeds 200 mrem per hour. Test specimens of fissionable material irradiated for research and development purposes only and not for the production of power or plutonium may be classified as remote-handled transuranic waste.

32. Repository. A facility for the permanent deep geologic disposal of High Level or Transuranic Waste.

33. Spent Nuclear Fuel. Fuel that has been withdrawn from a nuclear reactor following irradiation, but that has not been reprocessed to remove its constituent elements.

34. Storage. Retrievable retention of waste pending disposal.

35. Storage Facility. Land area, structures, and equipment used for the storage of waste.

36. Storage Unit. A discrete part of the storage facility in which waste is stored.

37. Surplus Facility. Any facility or site (including equipment) that has no identified or planned programmatic use and is contaminated with radioactivity to levels that require controlled access.

38. Transuranium Radionuclide. Any radionuclide having an atomic number greater than 92.

39. Transuranic Waste. Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Heads of Field Elements can determine that other alpha contaminated wastes, peculiar to a specific site, must be managed as transuranic waste.

40. Treatment. Any method, technique, or process designed to change the physical or chemical character of waste to render it less hazardous, safer to transport, store or dispose of, or reduced in volume.

41. Treatment Facility. The specific area of land, structures, and equipment dedicated to waste treatment and related activities.

42. Waste Container. A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal.

43. Waste Management. The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

44. <u>Waste Package</u>. The waste, waste container, and any absorbent that are intended for disposal as a unit. In the case of surface contaminated, damaged, leaking, or breached waste packages, any overpack shall be considered the waste container, and the original container shall be considered part of the waste.

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CHAPTER I

HIGH-LEVEL WASTE

1. PURPOSE. To establish policies and guidelines for managing the Department of Energy's (DOE) high-level waste and any other materials which, because of their highly radioactive nature (level of health risk, longevity of health risk and thermal activity), require similar handling. (Unless demonstrated to the contrary, all high-level waste shall be considered to be radioactive mixed waste and subject to the requirements of the Atomic Energy Act, as amended, and the Resource Conservation and Recovery Act.)

2. POLICY. All high-level waste generated by DOE operations shall be safely stored, treated, and disposed of according to requirements set forth in this Order. Storage operations shall comply with applicable EPA standards and EPA/State regulations. Geologic disposal shall comply with both Nuclear Regulatory Commission regulations and EPA standards.

3. REQUIREMENTS.

   a. Design.

      (1) Requirements for New Facilities.

         (a) Design objectives for new facilities will assure protection of the public and operating personnel from hazards associated with normal high-level waste operations, accident conditions, and the effects of natural phenomena. Other objectives are compliance with DOE policies regarding nuclear safety, quality assurance, fire protection, pollution control, and safeguards and security protection for high-level waste and protection of essential operations from the effects of potential accidents.

         (b) Designs for new storage and treatment facilities shall meet the requirements of DOE 6430.1, applicable EH Orders and 40 CFR 264.

         (c) Designs for new storage facilities shall incorporate features to facilitate retrieval capability.

      (2) Design Review for Existing Facilities. Uniform requirements for the preparation of safety analysis reports for high-level waste operations, detailed in DOE 5481.1B, include the review of existing operational facilities based on current technical criteria. When hazards are identified that should be eliminated, controlled, or mitigated, appropriate upgrading, actions in accordance with paragraph 3a(1) above, shall be identified and implemented according to the requirements of DOE 5481.1B.

b. Storage Operations - Doubly Contained Systems.

(1) Waste Characterization.

(a) Liquid and solidified high-level waste shall be characterized consistent with radiation protection requirements to determine its hazardous components, per 40 CFR 261 and 40 CFR 264. Characterization shall satisfy requirements of paragraph 3b(1)(b) and may reflect knowledge of waste generating processes, laboratory testing results, and/or the results of periodic sampling and analysis. Examples of required information are chemical composition, physical properties, radionuclide concentrations, and pH.

(b) Waste characteristics and compatibility information shall be documented in a safety analysis report (see DOE 5481.1B) and be used as a basis for designing new facilities.

(2) Storage and Transfer Operations.

(a) All new high-level waste handling, transfer, and storage facilities (e.g., tanks, bins, pipelines, and capsules) shall be doubly contained.

(b) Singly contained pipelines may be used routinely for liquid waste that has a total radioactivity concentration of less than 0.05Ci/gal ($4.9 \times 10^{11} Bq/m^3$). They may be used on a temporary basis for higher activity waste, if appropriate design and administrative controls are in place to mitigate adverse effects from a pipeline failure.

(c) Leaking waste storage systems shall not be used to receive waste unless secondary containment is maintained (e.g., liquid level maintained below leak point) and it can be shown with the support of formal documentation (e.g., Safety Analysis Reports, Operational Safety Requirements, Operating Standards) that temporary operation can be performed without releasing radioactive liquid to the environment.

(d) Secondary containment systems shall be capable of containing liquids that leak into them from the primary system and shall be equipped with transfer capability to retrieve the leaked liquid. Secondary containment systems for solidified high-level waste shall provide for physical isolation of the waste from the environment.

(e) To the extent practical, waste shall be segregated by type (sludge, salt, high activity, and low activity) to make accessibility for future processing easier.

(f) Where required, ventilation and filtration systems shall be provided to maintain radionuclide releases within the guidelines specified in DOE 5481.1B and applicable EH Orders. Ventilation systems shall be provided where the possibility exists for generating flammable and explosive mixtures of gases (e.g., hydrogen/air or organics/air).

(g) Facilities using cathodic corrosion protection systems shall include engineered features that protect against abnormal conditions such as stray currents or system failure. The cathodic protection systems shall be calibrated annually, and all sources of impressed current shall be inspected and/or tested at least every other month.

(h) Engineering controls shall be incorporated to provide liquid volume inventory data and to prevent spills, leaks, and overflows from tanks or containment systems. Examples are level-sensing devices, liquid level alarms, and maintenance of sufficient freeboard. The high-level waste shall be stored at pressures lower than those of ancillary systems (e.g., cooling water).

(i) Nuclear criticality safety considerations and controls shall be evaluated for normal operations and, before any significant operational changes are made, to protect against an uncontrolled nuclear criticality incident (e.g., dissolution of sludges for removal from tank).

(j) Each facility shall utilize remote maintenance features and other appropriate techniques to minimize personnel radiation exposure in accordance with DOE 5481.1B.

(k) Upon loss and subsequent recovery of normal electrical power, high-level waste transfer equipment shall not have the capability to restart without active operator action.

(3) Monitoring, Surveillance, and Leak Detection.

(a) Monitoring and leak detection capability shall be incorporated in the engineering systems (e.g., liquid level sensing devices and alarms for high-level waste liquid systems) to provide rapid identification of failed containment, and measurement of abnormal temperatures. The following, at a minimum, shall be monitored: temperature; pressure; radioactivity in ventilation exhaust; and liquid effluent streams associated with high-level waste facilities. Where the possibility exists for the generation of flammable and explosive mixtures of gases, monitoring shall be conducted. For facilities storing liquid high-level waste, the following should also be monitored: liquid levels; sludge volume; tank chemistry; condensate and cooling water.

(b) Leak detection systems (e.g., conductivity probes) shall be designed and operated so that they will detect the failure of the primary containment boundary, the occurrence of waste release, or accumulated liquid in the secondary containment system.

(c) A method for periodically assessing waste storage system integrity (e.g., coupons for corrosion testing, photographic and periscopic inspections, leak detectors, liquid level devices) shall be established, documented, and reported as required in the Waste Management Plan.

(d) Electrical monitoring and leak detection devices essential to safe operations shall be provided with backup power, as appropriate, to ensure operability under emergency conditions.

(e) Surface water systems associated with the high-level waste storage area shall be monitored according to applicable National Pollution Discharge Elimination System permits and EH Order requirements.

(f) A system of ground water or vadose zone monitoring wells meeting the Resource Conservation and Recovery Act requirements per 40 CFR 264 shall be installed, as a minimum, around clusters of liquid waste storage tanks.

(4) Contingency Actions.

(a) A tank or secondary containment system from which there has been a leak or a spill to the surrounding soil, or which is otherwise unfit for use, shall be removed from service until conditions can be evaluated fully.

(b) Upon detection of released radioactive materials, steps shall be taken to prevent further migration of the release to soil or surface water. Major contamination in the soil shall be removed or stabilized unless compliance with this requirement would cause greater harm to human health or the environment.

(c) If a release results from a spill and the integrity of the system is not damaged, the system may be returned to service as soon as action to correct the condition is completed.

(d) For emergency situations involving liquid high-level waste, spare capacity with adequate heat dissipation capability shall be maintained to receive the largest volume of liquid contained in any one tank. Adequate transfer pipelines also shall be maintained in operational condition. Interconnected tank farms with adequate transfer capabilities and spare capacity may be considered as a single tank farm for purposes of this requirement.

(e) A schedule and procedure shall be developed for monitoring, surveillance, and calibration checks. The frequency of these activities shall be based on the potential rate of equipment deterioration and the possibility of an environmental or human health incident, assuming that a malfunction from equipment failure or human error is not detected between checks. Schedules, procedures, and performance requirements shall be documented in the operating and maintenance documentation.

(f) Each high-level waste facility shall have response procedures for credible emergencies, as identified in the Safety Analysis Reports.

(5) Training.

(a) Operator training and qualification standards shall be developed and an up-to-date record of training status shall be maintained.

(b) Worker safety training must comply with the requirements of DOE 5480.1B and applicable EH Orders.

(6) Quality Assurance. Consistent with DOE Order 5700.6B, high-level waste operations shall be conducted in accordance with applicable requirements of the American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 and other appropriate national consensus standards. (See Attachment 1, page 5, paragraph 48).

(7) Waste Treatment and Minimization.

(a) For the purpose of economy and enhancing the safety of high-level waste storage, processing programs shall be developed and implemented at the generating site to reduce the quantity of waste being sent to storage, and techniques (e.g., evaporation) shall be implemented to reduce further the waste volume in storage.

(b) Programs should be developed and implemented to treat high-level waste in storage to prepare it for eventual conversion to suitable disposal forms, as such forms are developed. This may include separation of high-level waste into other waste categories, such as transuranic waste or low-level waste.

(c) The chemistry of liquid high-level waste shall be adjusted to control corrosion within design limits for the storage system.

(d) Treatment reagents shall not be placed in a tank system without proven effective mitigative action if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, or otherwise fail.

(e) Waste generation and waste management systems that significantly change the chemical and physical forms of the waste shall be technically assessed to assure compatibility and retrievability.

c. Storage Operations - Singly Contained Tank Systems.

(1) Waste Characterization. The contents of singly contained tank systems shall be characterized consistent with radiation protection requirements and the needs associated with safe storage to determine its hazardous components consistent with 40 CFR 261, 40 CFR 264, and State requirements. Characterization may reflect knowledge of waste generating processes, laboratory testing results, and/or the results of periodic sampling and analysis.

(2) Storage and Transfer Operations.

(a) Singly contained tank systems shall not be used to store fresh high-level waste from fuel reprocessing operations except under emergency conditions as determined by the Operations Office Manager.

(b) Storage and transfer operations shall be conducted within the limits defined in the Safety Analysis Reports according to DOE 5481.1B.

(c) Engineered systems shall be incorporated to provide waste volume inventory data, consistent with the nature of the specific waste stored in singly contained tanks. Examples are surface level sensing devices and interstitial liquid level sensing devices.

(d) Singly contained pipelines: (see paragraph 3b(2)(b)).

(e) Where active ventilation is required, systems shall be provided to maintain radionuclide releases at the point of discharge within the guidelines specified in applicable EH Orders for offsite concentrations and DOE 5480.1B for onsite dose commitment considerations.

(f) Nuclear criticality safety (see paragraph 3b(2)(i)).

(g) Each facility shall use remote maintenance features and other appropriate techniques to maintain personnel radiation exposure as low as reasonably achievable.

(h) Electrical power loss (see paragraph 3b(2)(k)).

(3) Monitoring, Surveillance, and Leak Detection.

(a) Monitoring and surveillance capability shall exist to provide liquid volume, waste inventory data, and identification of failed containment.

(b) A method for periodically assessing waste storage tank integrity (e.g., coupons, photographic inspections, leak detectors, liquid level devices) shall be established and documented.

(c) Emergency power (see paragraph 3b(3)(d)).

(d) Monitoring wells (see paragraph 3b(3)(f)).

(4) Contingency Action.

(a) A contingency action plan shall be maintained to respond to spills or leaks and other credible emergencies as identified in the Safety Analysis Reports.

(b) Leak mitigation (see paragraph 3b(4)(b)).

(c) For emergency situations involving pumpable liquid in singly contained tanks, appropriate equipment (e.g., pumps) shall be maintained to provide removal of liquid.

(5) Training. (see paragraphs 3b(5)(a) and (b)).

(6) Quality Assurance. (see paragraphs 3b(6)(a)).

d. Disposal. New and readily retrievable waste shall be processed and the high-level waste fraction disposed of in a geologic repository according to the requirements of the Nuclear Waste Policy Act of 1982 (Public Law 97-425) as amended. Options for permanent disposal of other waste, such as single shell tank waste, shall be evaluated and include such methods as in-place stabilization as well as retrieval and processing, as required for new and readily retrievable waste. Analytic predictions of disposal system performance shall be prepared and incorporated in the National Environmental Policy Act process.

(1) New and Readily Retrievable. New and readily retrievable existing high-level waste shall be processed to a final immobilized form in facilities such as the Defense Waste Processing Facility and the Hanford Waste Vitrification Plant preparatory to permanent disposal in a deep geologic repository.

(a) Waste acceptance specifications and criteria based upon the requirements outlined in 10 CFR 60.113, 10 CFR 60.131(b)(7), 10 CFR 60.135, 10 CFR 71.87, and 40 CFR 191 shall be developed for high-level waste forms prior to startup of facilities that generate the disposal waste form. Specifications and criteria shall be approved by RW-20 and DP-12 for Defense Programs high-level waste forms and by RW-20 and NE-20 for West Valley Demonstration Project product. As examples, specifications and criteria for the Defense Waste Processing Facility vitrified high-level waste form are documented in DOE/RW-0125; those for the West Valley Demonstration Project high-level waste form are documented in DOE/RW-0136.

(b) Interim storage for solidified high-level waste awaiting transport to the designated geologic repository shall comply with applicable requirements in paragraph 3b.

(2) Other Waste. High-level waste that is not readily retrievable shall be monitored periodically in situ. Field offices shall reevaluate the safety of such waste to determine the need for corrective measures as necessary. Options for permanent disposal of singly contained tank waste shall be evaluated and include such methods as in-place stabilization as well as retrieval and processing, as required for new and readily retrievable waste in paragraph 3d(1).

CHAPTER II

MANAGEMENT OF TRANSURANIC WASTE

1. PURPOSE. To establish policies and guidelines for managing DOE transuranic waste starting with its generation, continuing through closure of the Waste Isolation Pilot Plant, and finally the management of buried transuranic waste as defined in Attachment 1, page 3, paragraph 22. Transuranic wastes that are also mixed wastes are subject to the requirements of the Atomic Energy Act and the Resource Conservation and Recovery Act. Additionally, buried transuranic wastes are subject to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act.

2. POLICY. Transuranic waste shall be managed to protect the public and worker health and safety, as well as the environment, and performed in compliance with applicable radiation protection standards and environmental regulations. Practical and cost effective methods shall be used to reduce the volume and toxicity of transuranic waste.

   a. Transuranic waste shall be certified in compliance with the Waste Isolation Pilot Plant-Waste Acceptance Criteria, placed in interim storage (if required), and sent to the Waste Isolation Pilot Plant.

   b. Transuranic waste that the Department of Energy has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation provided by a geologic repository or, transuranic waste that cannot be certified or otherwise approved for acceptance at the Waste Isolation Pilot Plant, shall be disposed of by alternative methods. Alternative disposal methods shall be approved by DOE Headquarters (DP-12 and EH-1) and shall comply with the National Environmental Policy Act requirements and EPA/State regulations.

3. REQUIREMENTS.

   a. Waste Classification.

      (1) Any material that is known to be, or suspected of being contaminated with transuranium radionuclides shall be evaluated as soon as possible in the generating process, and determined to be either recoverable material, transuranic waste, low-level waste, mixed waste, or non-radioactive trash in order to avoid commingling the various material streams.

      (2) The lower concentration limit for transuranic waste (>100 nCi/g of waste) shall apply to the contents of any single waste package at the time of assay. The mass of the waste container including shielding shall not be used in calculating the specific activity of the waste.

(3) Radioactive wastes with quantities of transuranic radionuclides in concentrations of 100 nCi/g of waste or less shall be considered to be low-level waste, and shall be managed according to the requirements of Chapter III of this Order.

(4) Mixed transuranic waste:

(a) Mixed transuranic waste meeting the requirements of the Waste Isolation Pilot Plant-Waste Acceptance Criteria shall be sent to the Waste Isolation Pilot Plant.

(b) The Data Package prepared by the generators for the Waste Isolation Pilot Plant shall include information on the kinds and quantities of hazardous components contained in a waste package in accordance with applicable Resource Conservation and Recovery Act regulations.

(c) The determination whether the transuranic waste exhibits any hazardous characteristics or contains listed hazardous components may be based on knowledge of the waste generating process when the performance of a chemical analysis would significantly increase the radiation hazard to personnel.

b. <u>Transuranic Waste Generation and Treatment</u>.

(1) Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Transuranic waste reduction efforts shall be based on the implementation of techniques such as process modification, process optimization, materials substitution, decontamination, assay of suspect waste, and new technology development. Volume reduction techniques, such as incineration, compaction, extraction, and shredding, shall be implemented wherever cost effective and practical. Treatment facilities shall be permitted by the appropriate regulatory authority.

(2) Transuranic waste shall be assayed or otherwise evaluated to determine the kinds and quantities of transuranic radionuclides present prior to storage. Additionally, hazardous waste components shall be estimated or analyzed, whichever is appropriate.

(3) Mixed transuranic waste shall be treated, where feasible and practical, to destroy the hazardous waste component.

(4) Transuranic waste that is classified for security reasons shall be treated to remove or destroy the classified characteristic(s) prior to certification. Declassification should be performed by the generator.

c. Transuranic Waste Certification.

(1) Transuranic waste shall be certified, pursuant to the Waste Isolation Pilot Plant-Waste Acceptance Criteria, placed in interim storage, and sent to the Waste Isolation Pilot Plant when it becomes operational.

(2) Uncertified transuranic waste shall not be sent to the Waste Isolation Pilot Plant except by special permission granted in response to a formal, documented request to the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee and the Waste Isolation Pilot Plant Waste Operations.

(3) All transuranic waste certification sites shall prepare a certification plan which describes how the waste meets each waste acceptance criterion described in the WIPP-DOE-069 (see Attachment 1, page 3, paragraph 18).

(4) Each certification plan shall define controls and other measures to ensure that each element of the certification plan is performed adequately as described. Requirements for these quality assurance activities are described in the WIPP-DOE-120 (see Attachment 1, page 2, paragraph 19).

(5) Certification plans, including associated quality assurance plans, shall be submitted for review, comment, and approval by the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee.

(6) The Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee shall submit certification and associated quality assurance plans to the state of New Mexico's Environmental Evaluation Group for review and comment prior to granting formal approval of such plans.

(7) The Environmental Evaluation Groups's comments on certification and associated quality assurance plans shall be resolved between the affected site and the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee prior to granting formal approval of the plans.

(8) Approved certification and associated quality assurance plans shall be implemented by the generating sites using specific, written operational procedures.

(9) Certification activities conducted under approved plans and procedures shall be audited periodically, in accordance with a written audit program plan on a continuing basis by the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee. An Environmental Evaluation Group representative may accompany the Waste Isolation

Pilot Plant-Waste Acceptance Criteria Certification Committee audit team as an observer during site audits. The Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee may grant certifying authority to the site following successful completion of an audit.

(10) The Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee shall issue a formal audit report to the responsible field organization following the completion of an audit. The audit report shall describe the activities of the Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee audit team and include a record of any findings, observations, and recommendations. Corrective actions taken as a result of a finding shall be verified on subsequent audits. The Waste Isolation Pilot Plant-Waste Acceptance Criteria Certification Committee shall institute a tracking system to ensure timely resolution of findings, observations, recommendations, and the resultant corrective actions.

(11) Failure to resolve and close out previous audit findings and recommendations or sending noncomplying waste to the Waste Isolation Pilot Plant when judged by the Waste Acceptance Criteria Certification Committee to be a serious violation, shall result in suspension of certifying authority, pending satisfactory resolution.

d. Transuranic Waste Packaging.

(1) Newly generated transuranic waste shall be placed in noncombustible packaging that meets DOT requirements.

(2) All Type A transuranic waste containers shall be equipped with a method to prevent pressure buildup. Acceptable pressure-relief devices include permeable gaskets, vent clips, and filtered vents.

(3) The waste packages shall be marked, labeled, and sealed in accordance with the Waste Isolation Pilot Plant-Waste Acceptance Criteria, EPA, and DOT requirements, as defined in the WIPP-DOE-069, 40 CFR 262, Subpart C, and 49 CFR 172, Subparts D, E, and 49 CFR 173, Subpart I, where applicable, prior to shipping.

e. Temporary Storage at Generating Sites. The following activities shall be performed to assure the safe storage of transuranic wastes consistent with the requirements of applicable Resource Conservation and Recovery Act regulations:

(1) Transuranic waste shall be segregated or otherwise clearly identified to avoid the commingling of transuranic waste streams with high-level waste or low-level waste.

(2) Certified transuranic waste shall not be commingled with noncertified transuranic waste and shall be stored in a manner unlikely to alter its certification status.

(3) Transuranic waste in storage areas shall be protected from unauthorized access.

(4) Transuranic wastes in storage shall be monitored periodically to ensure that the wastes are not releasing their radioactive and/or hazardous constituents.

(5) Transuranic waste storage facilities shall be designed, constructed, maintained, and operated to minimize the possibility of fire, explosion, or accidental release of radioactive and/or hazardous components of the waste to the environment.

(6) Facilities which store transuranic waste shall have a contingency plan designed to minimize the adverse impacts of fire, explosion, or accidental release of hazardous components of the waste to the environment.

(7) Transuranic waste shall be stored in such a way so as to maintain radiation exposures as low as reasonably achievable.

f. Transportation/Shipping to the Waste Isolation Pilot Plant.

(1) Transuranic waste shipments shall comply with the provisions of DOE and DOT regulations, pursuant to DOE 1540.1.

(2) Transuranic waste shipments by truck shall be by a DOE-controlled carrier system. All transuranic waste shall be transported in certified Type B packaging.

(3) Shipping papers shall provide the information required by DOT (49 CFR 172, Subpart C), the Waste Isolation Pilot Plant Data Package (WIPP-DOE-157), and, as necessary, the manifest required by EPA (40 CFR 261, and 262).

(4) Distribution of the shipping papers shall be as follows:

(a) Shipper - one copy (or more);

(b) Carrier - one copy; and

(c) Waste Isolation Pilot Plant - two copies.

A copy of the papers will be returned by the Waste Isolation Pilot Plant to the shipper after emplacement of the waste at the Waste Isolation Pilot Plant.

(5) Appropriate EPA and State authorizations/permits shall be obtained for the transport system, as applicable.

(6) Placarding of shipments shall be carried out, as required by the regulations of DOT (contained in 49 CFR 172, Subpart F).

(7) All shipments of transuranic waste shall be in or on "exclusive use" vehicles, as defined in 49 CFR 173. Shipments shall be made as expeditiously as possible and shall be tracked from origin to destination using a real-time tracking communications system. Deviations from "preferred routes," delays and other irregularities detected by the system shall be investigated by the responsible traffic manager and a report sent to the Waste Isolation Pilot Plant within 90 days.

(8) The Albuquerque Operations Office shall develop a transuranic waste transportation management and operations plan which addresses, but is not limited to, the following considerations:

(a) Communication between transport vehicle and traffic management;

(b) Shipment tracking in transit;

(c) Security;

(d) Emergency notification/response;

(e) Shipment routing;

(f) Shipment notification as appropriate;

(g) Driver training and qualifications;

(h) Vehicle maintenance and inspection;

(i) State surveillance and inspection; and

(j) Inspection and recertification of transport packagings.

g. Interim Storage.

(1) Interim storage sites have been designated for storage of:

(a) Waste certified by off site generators;

(b) Waste certified by on site generators;

(c) Waste certified by interim storage personnel; and

(d) Uncertified waste received from on site and/or off site generators that is awaiting processing and certification.

(2) New interim storage facilities shall be sited, designed, constructed, and operated consistent with the requirements of applicable Resource Conservation and Recovery Act regulations and in a manner which satisfactorily addresses the following considerations at a minimum:

(a) Proximity to ground water and areas of seismic activity or flood plains shall be identified, and potential impacts shall be evaluated.

(b) The facility shall be designed and operated to minimize the run on and run off of precipitation. The run off control system shall provide for collecting and sampling run off, which may come in contact with the waste packages, prior to releasing the water for discharge.

(c) An environmental monitoring system shall be provided to detect any release and migration of major radioactive and hazardous components. Background levels of primary radioactive and hazardous waste components shall be determined.

(d) The storage facility design shall minimize the possibility for the unauthorized entry of persons.

(e) Incompatible wastes types shall be placed in separate packages and stored in segregated areas to prevent accidental ignition or chemical reaction.

(f) Waste storage facilities shall be designed and operated to minimize the exposure of personnel to radiation and chemicals.

(g) The storage facility operator shall inspect or verify routinely the condition of waste packages at the storage site for deterioration that may threaten human health or cause release of hazardous or radioactive components to the environment.

(h) The storage facility operator shall prepare plans that identify and describe how the site will be closed at the end of its active life. These plans shall address sampling, testing, and monitoring for major radioactive and hazardous waste components in soil and groundwater.

(i) Sites that use underground storage tanks for the storage of transuranic waste shall comply with the requirements of the Resource Conservation and Recovery Act, as applicable.

(j) Permits shall be acquired, as necessary, from appropriate regulatory entities for all the interim storage facility activities listed above.

(3) Existing interim storage sites shall be reviewed for consistency with the items in paragraph 3g(2). Any necessary corrective actions shall be performed based on a compliance schedule approved by appropriate regulatory authorities.

(4) Certified waste shall be stored in a manner unlikely to alter the certification of the waste package.

(5) Operators of interim storage facilities shall receive data package information (see Attachment 1, page 2, paragraphs 18 and 20) for each waste package from the generator. The operator shall store the waste generator's data and shall use the data to prepare a new Data Package at the time of shipment to the Waste Isolation Pilot Plant.

(6) Certified waste from off site generators does not require additional waste analysis or interim inspection, either upon receipt at the storage site or at the time of shipment to the Waste Isolation Pilot Plant. The generator of the certified waste is responsible for describing the waste form and waste package content.

(7) Waste that has been certified by a generator and shipped to an interim storage site shall be reshipped to the Waste Isolation Pilot Plant by the interim storage site in the following manner:

(a) The generator/certifier shall be identified as the generator/certifier and shipping originator.

(b) The interim storage site shall be identified as the reshipper.

(c) The shipping originator is responsible for certifiability of the waste form, waste package content, waste container procurement documentation, related Data Package information, and proper marking, labeling and placarding of the shipment. The shipping originator is responsible for any problems or discrepancies relating to the above-mentioned items that may occur during shipment to or emplacement at the Waste Isolation Pilot Plant.

(d) The reshipper is responsible for complete data package assembly, transmittal, proper marking, labeling, placarding, verifying the adequacy of the exterior condition of the container (e.g., no significant deterioration, bulging) and for proper shipment loading. The reshipper shall perform radiation dose rate and contamination surveys on each package. The reshipper is responsible for any problems or discrepancies involving the items mentioned above.

(8) The interim storage site is the shipping originator for stored waste certified at that site. Agreements may need to be developed between offsite waste generators and interim storage site operators/certifiers to define clearly their respective responsibilities.

h. Waste Isolation Pilot Plant.

(1) The Waste Isolation Pilot Plant is a defense activity of the DOE for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from defense activities.

(2) After the successful demonstration of the safe disposal of defense transuranic wastes, the Waste Isolation Pilot Plant will be the planned destination for all certified contact-handled and remote-handled transuranic waste, including mixed transuranic waste.

(3) Prior to shipment of waste, the Waste Isolation Pilot Plant shall validate the data package for that waste shipment.

(4) Upon receipt of waste, Waste Isolation Pilot Plant activities shall include, but not be limited to, the following:

(a) Verification of the package or assembly identification numbers against the Data Package;

(b) Measurement of the external radiation dose rate of the package and shipping container;

(c) Verification that contamination levels on the package and shipping container surfaces are within acceptable limits; and

(d) Review and proper processing of all shipping papers and manifests.

(5) During a period of up to 5 years from the first emplacement of waste in the Waste Isolation Pilot Plant, the waste shall be stored retrievably. This phase is called the Operations Demonstration Period.

(6) The decision for or against permanent disposal will be made at the end of the Operations Demonstration Period. If the decision is against using the Waste Isolation Pilot Plant as the repository, the stored waste shall be retrieved, repackaged, if necessary, and handled as directed by DOE. At that time, the Waste Isolation Pilot Plant shall be decontaminated, decommissioned, and closed, per agreement with the State of New Mexico.

(7) If the Waste Isolation Pilot Plant is designated a repository, the underground portion of the Waste Isolation Pilot Plant shall be sealed upon completion of all planned transuranic waste disposal activities. Surface facilities shall be decontaminated and decommissioned, and the Waste Isolation Pilot Plant will be closed, per agreement with the state of New Mexico.

(8) Following closure, the salt tailings will be disposed of in an environmentally acceptable manner and the site shall be returned to its natural state. Waste burial record shall be stored securely, and permanent markers shall be installed to minimize the possibility of future human intrusion.

i. Buried Transuranic-Contaminated Waste.

(1) Alternatives for the long term management of buried transuranic-contaminated waste at inactive DOE waste sites are addressed in Attachment 1, page 3, paragraph 22. The inactive waste sites are located at Idaho National Engineering Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Savannah River Plant, and the Hanford Site. The program will lead to the closure of each waste site, in compliance with the National Environmental Policy Act requirements, the Comprehensive Environmental Response, Compensation, and Liability Act, the *Superfund Amendments and Reauthorization Act*, and other applicable DOE, EPA, and State requirements.

(2) Each waste site shall be characterized to include information on types and quantities of radioactive and hazardous chemicals. This information shall be verified by appropriate sampling/analysis/monitoring techniques. The characterization and verification activities will also include determination of waste migration from the burial sites and potential environmental and health impacts.

(3) Each DOE site will develop a closure strategy for the waste site(s), utilizing the waste characterization data. Basic site-closure strategies which could be a combination of (a), (b), and (c) depending on site-specific and regulatory requirements, are as follows:

(a) Leave waste in place with enhanced monitoring.

(b) Leave waste in place, use enhanced confinement or in-situ immobilization techniques, and provide enhanced monitoring.

(c) Retrieve, process, and dispose of the transuranic waste at the Waste Isolation Pilot Plant.

(4) Each DOE site will develop a site closure plan, which will include, as a minimum, the following:

(a) National Environmental Policy Act requirements;

(b) Applicable Federal, State and local regulations (e.g., DOE, EPA, State);

(c) Permits required;

(d) Selected closure strategy and justification;

(e) A waste retrieval strategy:

1 Methodology for segregating transuranic and low-level waste,

2 Identification of mixed waste components,

3 Certification of transuranic waste for disposal at the Waste Isolation Pilot Plant,

4 Management of low-level waste and mixed waste, and

5 Plans for maintaining exposures as low as reasonably achievable;

(f) Budget requirements by fiscal year;

(g) Schedule for closure strategy completion; and

(h) Post-closure monitoring and controls.

j. Quality Assurance. Consistent with DOE Order 5700.6B, transuranic waste operations shall be conducted in accordance with applicable requirements of the American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 (see Attachment 1, page 5, paragraph 48) and other appropriate national consensus standards.

CHAPTER III

MANAGEMENT OF LOW-LEVEL WASTE

1. PURPOSE. To establish policies, requirements and guidelines, for managing the Department's solid low-level waste.

2. POLICY.

   a. DOE-low-level waste operations shall be managed to protect the health and safety of the public, preserve the environment of the waste management facilities, and ensure that no legacy requiring remedial action remains after operations have been terminated.

   b. DOE-low-level waste shall be managed on a systematic basis using the most appropriate combination of waste generation reduction, segregation, treatment, and disposal practices so that the radioactive components are contained and the overall system cost effectiveness is maximized.

   c. DOE-low-level waste shall be disposed of on the site at which it is generated, if practical, or if on-site disposal capability is not available, at another DOE disposal facility.

   d. DOE-low-level waste that contains non-radioactive hazardous waste components (mixed waste) shall conform to the requirements of this order, applicable EH Orders, and shall also be regulated by the appropriate regional authorities under the Resource Conservation and Recovery Act.

3. REQUIREMENTS.

   a. Performance Objectives. DOE-low-level waste that has not been disposed of prior to issuance of this Order shall be managed on the schedule developed in the Implementation Plan (See page 7, paragraph 10) to accomplish the following:

      (1) Protect public health and safety in accordance with standards specified in applicable EH Orders and other DOE Orders.

      (2) Assure that external exposure to the waste and concentrations of radioactive material which may be released into surface water, ground water, soil, plants and animals results in an effective dose equivalent that does not exceed 25 mrem/yr to any member of the public. Releases to the atmosphere shall meet the requirements of 40 CFR 61. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.

(3) Assure that the committed effective dose equivalents received by individuals who inadvertently may intrude into the facility after the loss of active institutional control (100 years) will not exceed 100 mrem/yr for continuous exposure or 500 mrem for a single acute exposure.

(4) Protect ground water resources, consistent with Federal, State and local requirements.

b. Performance Assessment.

(1) Field organizations with disposal sites shall prepare and maintain a site specific radiological performance assessment for the disposal of waste for the purpose of demonstrating compliance with the performance objectives stated in paragraph 3a.

(2) Each field organization shall, for each DOE reservation within its cognizance, prepare and maintain an overall waste management systems performance assessment supporting the combination of waste management practices used in generation reduction, segregation, treatment, packaging, storage, and disposal. Background and guidance on waste management systems performance assessment is provided in Attachment 1, page 3, paragraph 21.

(3) Where practical, monitoring measurements to evaluate actual and prospective performance should be made at locations as required, within and outside each facility and disposal site. Monitoring should also be used to validate or modify the models used in performance assessments.

c. Waste Generation.

(1) Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution and decontamination.

(2) Waste Generation Reduction. All DOE-low-level waste generators shall establish auditable programs (goals, incentives, procedures, and reports) to assure that the amount of low-level waste generated and/or shipped for disposal is minimized.

(3) Waste Segregation. Each DOE-low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost effective treatment and disposal.

(4) Waste Minimization. Each DOE-low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste.

d. Waste Characterization.

(1) Low-level waste shall be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. This characterization shall ensure that, upon generation and after processing, the actual physical and chemical characteristics and major radionuclide content are recorded and known during all stages of the waste management process.

(2) Waste characterization data shall be recorded on a waste manifest, as required by paragraph 3m, and shall include:

(a) The physical and chemical characteristics of the waste.

(b) Volume of the waste (total of waste and any solidification or absorbent media).

(c) Weight of the waste (total of waste and any solidification or absorbent media).

(d) Major radionuclides and their concentrations.

(e) Packaging date, package weight, and external volume.

(3) The concentration of a radionuclide may be determined by direct methods or by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements.

e. Waste Acceptance Criteria.

(1) Waste shipped from one field organization to another for treatment, storage or disposal shall be done in accordance with the requirements established by the operations office having responsibility for operations of the receiving facility.

(2) Waste acceptance criteria shall be established for each low-level waste treatment, storage, and disposal facility, and submitted to the cognizant field organization.

(3) Generators of waste shall implement a low-level waste certification program to provide assurance that the waste acceptance criteria for

any low-level waste treatment, storage, or disposal facility used by the generator are met. Generators and facilities receiving the waste are jointly responsible for assuring compliance with waste acceptance criteria. Generators are financially responsible for actions required due to nonconformance.

(4) Generator low-level waste certification programs shall be subject to a periodic audit by operators of facilities to which the waste is sent by the generator.

(5) The waste acceptance criteria for storage, treatment, or disposal facilities shall address the following issues:

(a) Allowable quantities/concentrations of specific radioisotopes to be handled, processed, stored or disposed of;

(b) Criticality safety requirements (waste forms and geometries);

(c) Restrictions regarding low-level waste classified for security reasons;

(d) External radiation and internal heat generation;

(e) Restrictions on the generation of harmful gases, vapors, or liquids in waste;

(f) Chemical and structural stability of waste packages, radiation effects, microbial activity, chemical reactions, and moisture;

(g) Restrictions for chelating and complexing agents having the potential for mobilizing radionuclides; and

(h) Quantity of free liquids.

f. Waste Treatment.

(1) Waste shall be treated by appropriate methods so that the disposal site can meet the performance objectives stated in paragraph 3a.

(2) Waste treatment techniques such as incineration, shredding, and compaction to reduce volume and provide more stable waste forms shall be implemented as necessary to meet performance requirements. Use of waste treatment techniques to increase the life of the disposal facility and improve long-term facility performance, by improved site stability and reduction of infiltrating water, is required to the extent it is cost effective.

(3) The development of large scale waste treatment facilities shall be supported by appropriate the National Environmental Policy Act documentation in addition to the following:

(a) A document shall be prepared that analyzes waste streams needing treatment, treatment options considered and a rationale for selection of proposed treatment processes;

(b) A construction design report including projected waste throughputs and treatment methods, construction and operating cost estimates; and

(c) A Safety Analysis Report.

(4) Operation of waste treatment facilities shall be supported by adequate documentation including the following:

(a) Operation and maintenance procedures;

(b) Personnel training and qualification procedures;

(c) Monitoring and emergency response plans; and

(d) Records shall be maintained for each package of low-level waste that enters and leaves the treatment facility.

g. Shipment.

(1) The volume of waste and number of shipments of low-level waste shall be minimized and the shipments will be conducted based on plans developed by field organizations. Off site shipment of low-level waste shall be in compliance with DOE 1540.1.

(2) Generators shall provide an annual forecast in the third quarter of the fiscal year to the field organizations managing the off-site disposal facility to which the waste is to be shipped.

(3) Generators must receive advance approval from the receiving facility and shall certify prior to shipment that waste meets the receiving facility waste acceptance criteria. The certification program shall be auditable and able to withstand independent review.

(4) Each package of waste must comply with the labeling requirements of DOE 1540.1.

h. Long-Term Storage.

(1) Low-level waste shall be stored by appropriate methods, to achieve the performance objectives stated in paragraph 3a.

(2) Records shall be maintained for all low-level waste that enters and leaves the storage facility, (see paragraph 3m).

(3) The development and operation of a waste storage facility shall be supported by the following documentation (two or more of these may be combined for convenience):

(a) An analysis which identifies the need for the storage facility;

(b) A Construction Design Report, including projected waste planned for storage; construction and operating cost estimates;

(c) A Safety Analysis Report and appropriate National Environmental Policy Act documentation; and

(d) Operational procedures and plans.

(4) Storage of waste to allow for nuclides to decay or storage of wastes until they can be disposed of by approved methods are acceptable.

i. Disposal.

(1) Low-level waste shall be disposed of by methods appropriate to achieve the performance objectives stated in paragraph 3a, consistent with the disposal site radiological performance assessment in paragraph 3b.

(2) Engineered modifications (stabilization, packaging, burial depth, barriers) for specific waste types and for specific waste compositions (fission products, induced radioactivity, uranium, thorium, radium) for each disposal site shall be developed through the performance assessment model (see paragraph 3b(1)). In the course of this process, site specific waste classification limits may be developed if operationally useful in determining how specific wastes should be stabilized and packaged for disposal.

(3) An Oversight and Peer Review Panel of DOE, contractor, and other specialists in performance assessments will be selected by DP-12, with participation by EH-1 and operations office representatives. Through consultation and review, this panel shall ensure consistency and technical quality around the DOE complex in the development and application of performance assessment models that include site specific geohydrology and waste composition.

(4) Disposition of waste designated as greater-than-class C, as defined in 10 CFR 61.55, must be handled as special cases. Disposal systems for such waste must be justified by a specific performance assessment through the National Environmental Policy Act process and with the concurrence of DP-12 for all DP-1 disposal facilities and of NE-20 for those disposal facilities under the cognizance of NE-1.

(5) The following are additional disposal requirements intended either to improve stability of the disposal site or to facilitate handling and provide protection of the health and safety of personnel at the disposal site:

(a) Waste must not be packaged for disposal in cardboard or fiberboard boxes, unless such boxes meet DOT requirements and contain stabilized waste with a minimum of void space. For all types of containers, void spaces within the waste and between the waste and its packaging shall be reduced as much as practical.

(b) Liquid wastes, or wastes containing free liquid, must be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable, but, in no case, shall the liquid exceed 1 percent of the volume of the waste when the waste is in a disposal container, or 0.5 percent of the volume of the waste processed to a stable form.

(c) Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

(d) Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged as identified in paragraph 3i(5)(e).

(e) Waste in a gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C.

(f) Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.

(6) Waste containing amounts of radionuclides below regulatory concern, as defined by Federal regulations, may be disposed without regard to radioactivity content.

(7) Disposal Site Selection.

(a) Disposal site selection criteria (based on planned waste confinement technology) shall be developed for establishing new low-level waste disposal sites.

(b) Disposal site selection shall be based on an evaluation of the prospective site in conjunction with planned waste confinement technology, and in accordance with the the National Environmental Policy Act process.

(c) The disposal site shall have hydrogeologic characteristics which, in conjunction with the planned waste confinement technology, will protect the groundwater resource.

(d) The potential for natural hazards such as floods, erosion, tornadoes, earthquakes, and volcanoes shall be considered in site selection.

(e) Site selection criteria shall address the impact on current and projected populations, land use resource development plans and nearby public facilities, accessibility to transportation routes and utilities, and the location of waste generation.

(8) Disposal Facility and Disposal Site Design.

(a) Design criteria shall be established prior to selection of new disposal facilities, new disposal sites, or both. These design criteria shall be based on analyses of physiographic, environmental, and hydrogeological data to assure that the policy and requirements of this Order can be met. The criteria shall be also based on assessments of projected waste volumes, waste characteristics, and facility and disposal site performance.

(b) Disposal units shall be designed consistent with disposal site hydrology, geology, and waste characteristics and in accordance with the National Environmental Policy Act process.

(9) Disposal Facility Operations.

(a) Field organizations shall develop and implement operating procedures for low-level waste disposal facilities that protect the environment, health and safety of the public, and facility personnel; ensure the security of the facility; minimize the need for long-term control; and meet the requirements of the closure/post-closure plan.

(b) Permanent identification markers for disposal excavations and monitoring wells shall be emplaced.

(c) Operating procedures shall include training for disposal facility operating personnel, emergency response plans, and a system of reporting unusual occurrences according to DOE 5000.3.

(d) Waste placement into disposal units should minimize voids between containers.

(e) Operations are to be conducted so that active waste disposal operations will not have an adverse effect on filled disposal units.

j. Disposal Site Closure/Post Closure.

(1) Field organizations shall develop site-specific comprehensive closure plans for new and existing operating low level waste disposal sites. The plan shall address closure of disposal sites within a 5-year period after each is filled and shall conform to the requirements of the National Environmental Policy Act process. Performance objectives for existing disposal sites shall be developed on a case-by-case basis as part of the National Environmental Policy Act process.

(2) During closure and post closure, residual radioactivity levels for surface soils shall comply with existing DOE decommissioning guidelines.

(3) Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives of this Order.

(4) Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act, or, if mixed waste is involved, may be included in permit applications for operation of contiguous disposal facilities.

(5) Closure plans for new and existing operating low-level waste disposal facilities shall be reviewed and approved by the appropriate field organization.

(6) Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.

k. Environmental Monitoring.

(1) Each operational or non-operational low-level waste treatment, storage, and disposal facility shall be monitored by an environmental monitoring program that conforms with DOE 5484.1 and, at a minimum, meet the requirements of paragraph 3K(2) through 3K(4).

(2) The environmental monitoring program shall be designed to measure: (a) operational effluent releases; (b) migration of radionuclides; (c) disposal unit subsidence; and (d) changes in disposal facility and disposal site parameters which may affect long-term site performance.

(3) Based on the characteristics of the facility being monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring surface soil, air, surface water, and, in the subsurface, soil and water, both in the saturated and the unsaturated zones.

(4) The monitoring program shall be capable of detecting changing trends in performance sufficiently in advance to allow application of any necessary corrective action prior to exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment, storage, or disposal facility or disposal site meet the requirements of applicable EH Orders.

l. Quality Assurance. Consistent with DOE 5700.6B, the low-level waste operational and disposal practices shall be conducted in accordance with applicable requirements of American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 (See Attachment 1, page 5, paragraph 48) and other appropriate national consensus standards.

m. Records and Reports.

(1) Each field organization shall develop and maintain a record keeping system that records the following: a historical record of waste generated, treated, stored, shipped, disposed of, or both, at the facilities under its cognizance. The data maintained shall include all data necessary to show that the waste was properly classified, treated, stored, shipped, and/or disposed of. The data maintained in the system shall be based on the data recorded on waste manifests.

(2) Waste Manifest. Records shall be kept and accompany each waste package from generator through final disposal. The manifest shall contain data necessary to document the proper classification, and assist in determining proper treatment, storage, and disposal of the waste. Waste manifests will be kept as permanent records. At a minimum, the following data will be included:

(a) Waste physical and chemical characteristics,

(b) Quantity of each major radionuclide present,

(c) Weight of the waste (total of waste and any solidification or absorbent media),

(d) Volume of the waste (total of waste and any solidification or absorbent media), and

(e) Other data necessary to demonstrate compliance with waste acceptance criteria.

CHAPTER IV

MANAGEMENT OF WASTE CONTAINING AEA 11e(2) BYPRODUCT MATERIAL AND NATURALLY OCCURRING AND ACCELERATOR PRODUCED RADIOACTIVE MATERIAL

1. PURPOSE. To establish policies and guidelines for managing DOE waste containing byproduct material, as defined by section 11e(2) of the Atomic Energy Act of 1954, as amended, and Naturally Occurring and Accelerator Produced Radioactive Material.

2. POLICY. DOE waste containing naturally occurring and accelerator produced radioactive material or byproduct material as defined by section 11e(2) of the Atomic Energy Act, as amended, or similarly contaminated residues derived from DOE remedial actions, shall be stored, stabilized in-place, and/or disposed of consistent with the requirements of the residual radioactive material guidelines contained in 40 CFR 192. Small volumes of DOE waste containing 11e(2) byproduct material or naturally occurring and accelerator produced radioactive material may be managed as low-level waste in accordance with the requirements of Chapter III of this Order. If the waste is classified as mixed waste, management also must be in compliance with the requirements of the Resource Conservation and Recovery Act.

3. REQUIREMENTS.

   a. Waste Management.

      (1) Waste covered under this chapter in quantities too large for acceptance at DOE low-level waste disposal sites shall be managed according to the requirements of 40 CFR 192, and disposed of at specially designated DOE sites or tailing disposal sites established under the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604). These disposal sites should be identified and developed as needed in support of DOE remedial actions, and will normally be located in the State in which the wastes are generated.

      (2) With the approval of the appropriate field organization, small volumes of 11(e) byproduct material and naturally occurring and accelerator produced radioactive material waste may be disposed of at DOE low-level waste sites in accordance with the requirements of Chapter III of this Order.

      (3) All DOE waste containing:

         (a) Naturally occurring and accelerator produced radioactive material mixed with the Resource Conservation and Recovery Act hazardous chemicals shall be managed as hazardous waste under the Resource Conservation and Recovery Act.

(b) Byproduct 11e(2) (or a combination of 11e(2) byproduct and naturally occurring and accelerator produced radioactive material) mixed with the Resource Conservation and Recovery Act hazardous chemicals, shall be managed consistent with both the Resource Conservation and Recovery Act and 40 CFR Part 192.

b. Quality Assurance. Consistent with DOE 5700.6B, waste management practices shall be conducted in accordance with applicable requirements of American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 (reference 48) and other appropriate national consensus standards.

CHAPTER V

DECOMMISSIONING OF RADIOACTIVELY CONTAMINATED FACILITIES

1. PURPOSE. To establish policies and guidelines for the management, decontamination, and decommissioning of radioactively contaminated facilities under DOE ownership or control.

2. POLICY. Radioactively contaminated facilities for which DOE is responsible shall be managed in a safe, cost-effective manner to assure that release of, and exposure to, radioactivity and other hazardous materials comply with Federal and State standards. Facilities, equipment, and valuable materials shall be recovered and reused when practical.

3. REQUIREMENTS. DOE organizations shall develop and document their programs to provide for the surveillance, maintenance, and decommissioning of contaminated facilities. The decommissioning programs shall be implemented as follows:

   a. General.

      (1) Each field organization shall prepare and maintain a complete list of contaminated facilities both operational and excess under its jurisdiction. A continuous record of jurisdictional program responsibility for all contaminated facilities shall be maintained by the cognizant field organization for use in assigning decommissioning responsibility.

      (2) Operational records (e.g., facility design drawings and modifications, characterization data on contamination levels, prior decontamination activities, and incident reports required by DOE Orders) for all contaminated facilities shall be maintained by the cognizant field organization for use in preparing decommissioning plans.

      (3) Planning for facility decommissioning shall be initiated during the design phase for new facilities and prior to termination of operations for existing operational facilities. Such plans shall consider the 2-year budget cycle to assure adequate funding availability.

      (4) Program offices shall be responsible for placing the facility in a safe storage condition, providing surveillance and maintenance, and decommissioning the facilities under their jurisdiction when they become excess to programmatic needs, or for finding another programmatic sponsor for them. For multiple user facilities, the program office shall determine decommissioning liability for user program offices based on each program's overall contribution to the contamination or some other mutually acceptable basis. This cost sharing formula may be applied when the facility is placed in safe storage or during surveillance and maintenance, when appropriate.

(5) Responsibility for contaminated facilities may be transferred from one program organization to another by mutual agreement of the programs involved. The program organization to which a facility is transferred shall accept full responsibility for surveillance, maintenance, and decommissioning of the facility according to the requirements of this Order. Agreements to transfer facilities for functional purposes shall be in writing and shall identify explicitly the concurrent transfer of responsibility for surveillance, maintenance, and decommissioning.

(6) The DP and NE decommissioning programs exist for the primary purpose of managing and decommissioning the contaminated facilities currently assigned to them. Other contaminated facilities that have no programmatic sponsor, or that are excess to program needs and have a current sponsor, shall be assigned to the DP and NE programs for management and decommissioning with the approval of the program secretarial officers involved or their designees.

(7) Decommissioning expertise gained by DOE and its contractors is available at most major DOE facilities, and should be utilized by DOE programs. A computerized Decommissioning Technology data base is maintained at the Richland Operations Office. Published reports on nuclear facility decommissioning may be obtained from the Remedial Action Program Information Center at Oak Ridge National Laboratory.

b. Facility Design. Facilities in which radioactive or other hazardous materials are utilized shall be designed to simplify decontamination and decommissioning and/or increase the potential for reuse. Features and procedures that simplify and facilitate decommissioning shall be identified during the planning and design phase based upon a proposed decommissioning method or conversion to other use. Examples of features to be incorporated are identified in DOE 6430.1.

c. Post-Operational Activities.

(1) DOE Program organizations shall identify contaminated facilities under their jurisdiction, document the potential for reuse and recovery of materials and equipment, and develop schedules for decommissioning them. Projects consisting of one or more facilities shall be identified as appropriate, and priorities shall be developed based on:

(a) Maintaining employee and public health and safety,

(b) Protection of the environment,

(c) Compliance with the National Environmental Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, and other contractual or legal requirements,

(d) Cost effective program management (e.g., maintaining manpower pools, selecting economical decommissioning alternatives), and

(e) Future site plans.

(2) Program organizations shall assure that, prior to initiation of decommissioning activities, adequate surveillance and maintenance is performed for their surplus facilities to meet applicable radiation protection (DOE 5480.1B), hazardous chemical and safety standards, to maintain physical safety and security, and to reduce potential public and environmental hazards. All high-level waste and stored hazardous materials should be removed by the operator as part of the last operational activities prior to entering into the decommissioning phase.

d. Decommissioning Project Activities.

(1) Characterization. Baseline data for each project shall be collected to support a thorough physical, chemical, and radiological characterization to fulfill the requirements of the National Environmental Policy Act reviews, the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act preliminary assessment/site investigations, and detailed engineering. The baseline data shall include:

(a) Drawings, photographs, and other records reflecting the as-built and as-modified condition of the facility and grounds;

(b) The condition of all structures, existing protective barriers, and systems installed to ensure public, occupational, and environmental safety;

(c) The type, form, quantity, and location of hazardous chemical and radioactive material from past operations at the site; and

(d) Information on factors that could influence the selection of decommissioning alternatives (safe storage, entombment, dismantlement) such as potential future use, long-range site plans required by DOE 4300.1B, facility condition, and potential health, safety, and environmental hazards.

(2) Environmental Review Process. The Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act and/or the Resource Conservation and Recovery

Act status of each project shall be identified and a remedial investigation/feasibility study performed if required. Based on the results of the remedial investigation/feasibility study and any additional data deemed necessary by the responsible field organization, an appropriate environmental review shall be performed according to the requirements of the National Environmental Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act. Candidate decommissioning alternatives shall be identified, assessed, and evaluated, and a preferred decommissioning alternative selected based on the results of the environmental review.

(3) Engineering. Technical engineering planning for each project shall be conducted during the environmental review process to assure that alternative actions and associated environmental issues are identified and assessed, and to support preparation of environmental documentation. Detailed engineering will be initiated after a preferred alternative is selected. A Decommissioning Project Plan shall be prepared for approval by the appropriate program office in compliance with DOE 4700.1. The Plan shall include the following:

(a) Physical, chemical, and radiological characterizational data or references to such data;

(b) A summary evaluation of decommissioning alternatives for the facility including the preferred alternative;

(c) Plans for meeting requirements from the environmental review process (National Environmental Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act) and all necessary permits;

(d) Radiological criteria to be used (modifications, if any, to guidance presented in applicable EH Orders must be approved by the Headquarters program organization and EH-1);

(e) Projections of occupational exposure;

(f) Estimated quantities of radioactive waste to be generated; and

(g) Detailed administrative, cost, schedule, and management information.

(4) Decommissioning Operations.

(a) The decommissioning project shall be conducted in accordance with guidance from Headquarters program offices and the Decommissioning Project Plan. Significant deviations shall be approved by the responsible field organization in consultation with the appropriate program office.

(b) Approval of MA-22 (Office of Project and Facilities Management) shall be obtained before initiating activities to demolish a DOE-owned facility, per the requirements of DOE 4300.1B.

(c) Status reports on project activities shall be prepared in accordance with the requirements of DOE 1332.1A or 4700.1, as appropriate.

(d) Information on waste generation shall be provided to the Integrated Data Base Program, as required.

(e) Decommissioning operations shall be considered a waste generator and shall meet generator requirements contained in the previous chapters of this Order.

(5) Post Decommissioning Activities.

(a) After decommissioning operations have been completed, a final radiological and chemical survey report (or an independent verification survey report, at remote sites) and a project final report shall be prepared. The final report shall include a description of the project, the final status of the property, and the lessons learned from the project.

(b) The responsible field organization shall compile a Project Data Package consisting of, as a minimum: the Record of Completion; the final radiological and chemical survey report; the Project Final Report; and for remote sites, an independent verification survey report, Certification Docket, and appropriate public notices. The Project Data Package shall be retained permanently in the field organization archives.

(c) The responsible program organization shall assure that any necessary long-term maintenance and surveillance or other safety controls are provided for the decommissioned property.

(d) The decommissioned property may be released from DOE ownership according to the requirements of DOE 4300.1B, if the responsible program organization, in consultation with the Office of the Assistant Secretary EH-1, certifies that the property meets applicable release criteria for residual radioactivity and hazardous chemicals, and the property is identified properly by notation in the legal land records of the local government entity.

(e) The decommissioned property may be reused for other program activities that may or may not involve radioactivity or hazardous chemicals. If appropriate release criteria are not met, the property may be reused for other program activities that may or may not involve radioactivity or hazardous chemicals provided that adequate safety controls are maintained.

e. Quality Assurance. Consistent with DOE 5700.6B, waste management practices shall be conducted in accordance with applicable requirements of American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 (Attachment 1, page 5, paragraph 48) and other appropriate national consensus standards.

CHAPTER VI

WASTE MANAGEMENT PLAN OUTLINE

1. PURPOSE. To provide guidance on the development and maintenance of a waste management plan for each site that generates, treats, stores, or disposes of DOE waste.

2. DISCUSSION. The Order for radioactive waste management emphasizes accountable operational requirements set forth in a prescriptive style. Each site that generates, treats, stores, or disposes of DOE radioactive waste, or decommissions contaminated facilities, is responsible for complying with these requirements in terms of how operations are conducted and how these activities are documented. The documentation serves as the written word that the actual operations are being conducted within the framework of the Order.

   The primary purpose of the Waste Management Plan is to compile and consolidate an annual report on how waste management operations are conducted, what facilities are being used to manage wastes, what forces are acting to change current waste management systems, and what plans are in store for the coming fiscal year. The scope of the plan includes the management of both radioactive and hazardous constituents in the Department's waste, whether these are separated or mixed. The body of the Waste Management Plan should not include descriptions of Environmental Restoration activities, as this information is provided under a separate program. However, several documents prepared with Environmental Restoration funding may be cited in Attachment VI-1 to the Waste Management Plan; this preserves consistency in accounting for documentation. Also, the Waste Management Plan includes the management of the DOE's liquid low-level waste which is not governed specifically by this Order.

   The waste management plan provides a vehicle to report current waste management practices and plans for the coming year. It serves as the core document in the site's waste management operations and should reference supporting documentation as appropriate. The attachment to the Waste Management plan allows sites to account for major documentation as required by the Order.

3. FORMAT FOR WASTE MANAGEMENT PLANS.

   a. Executive Summary. An Executive Summary is mandatory for each Waste Management Plan.

      (1) As a rule of thumb, limit the length of the executive summary to 10 percent or less of the length of the Waste Management Plan. Summarize the past year in waste management including the principal regulatory/environmental issues and the degree to which planned activities were accomplished.

(2) Provide a forecast of the coming year and discuss project startups, facility modifications, regulatory issues, and the waste management budget.

b. General Site Information.

(1) Organization and Administration. Indicate the DOE field organization(s) and contractor(s) responsible for managing waste treatment, storage and disposal operations; discuss approval authorities, and clarify DOE/contractor interfaces. Include relationships between contractor's operations if multiple contractors are involved.

(a) Use charts to enhance text descriptions of organizational structure. Describe lead responsibilities of functional groups including the organization responsible for preparing this plan.

(b) Show the relationships, in a separate section, between documents that guide and support the waste management program at the site. Identify the organization responsible for maintaining up-to-date copies of all reference documents at the field organization level.

(2) Site Description. Include a brief description of site location, demography size, geographic features, climate, geologic and hydrogeologic conditions, and primary mission where waste management operations are conducted.

c. Radioactive and Mixed Waste Management. This section of the plan describes radioactive and mixed waste management operations at the site and includes descriptions of the waste management systems and facilities, the characteristics of wastes managed, and discussion of the problems, recommendations, and the future direction of the site operations. The top-level divisions of this section should be by waste type; i.e., high-level, transuranic, and low-level. These categories should be subdivided further by waste phase, liquid, solid, or gaseous (where appropriate).

(1) System and Facility Descriptions.

(a) Overview. For each of the categories of waste provide an overview of the systems that treat, store, and dispose of these wastes. Use flowcharts to indicate waste sources, intermediate processing steps, and ultimate disposition of waste streams. Identify which waste streams are classified as mixed waste.

(b) Facility Descriptions. Identify the facilities that comprise the waste management systems according to waste type and waste phase and describe the facilities in the following order: Treatment Facilities; Storage Facilities; and Disposal Facilities. Detailed descriptions of facility operations are not required, but enough explanation should be given to support the discussion of planned activities. Examples of appropriate information include location maps, radiological and chemical characteristics of waste treated/stored/disposed, facility operating parameters, unique or special equipment used, and status of permitting activities. Include facility layout drawings and flow sheets where appropriate.

(2) Current and Future Plans. This section is used to document the planning efforts at the site and indicate the direction of radioactive and mixed waste management activities. It should be organized to reflect site-specific situations. In general, it should: define problems with, and/or new requirements for, waste management systems; cite specific recommendations and strategy for making improvements; identify actions to achieve compliance with regulations; and discuss plans to modify current waste management systems such as construction of new facilities, plant upgrades, facility decommissioning/closure. Remedial actions should indicate how the findings of system performance assessments were factored into recommendations and plans. They should clearly indicate the driving forces behind their stated plans, such as: to achieve disposal of waste currently in storage; to enhance systems performance; to meet regulatory requirements; and to increase worker protection/safety.

(3) Implementation Requirements. This section is used to document the implementation status by updating the "Implementation Summary Table" from the Implementation Plan. It should present these data in similar tabular format. It should also report progress realized during the past year, remaining actions to complete, remaining costs, and estimated completion dates. In addition it should indicate any variances from original cost and schedule projections in the Implementation Plan, and discuss reasons for variances.

d. Hazardous Waste Management (DP Facilities).

(1) System and Facility Descriptions.

(a) Overview. Provide an overview of the system used to treat, store, and dispose of hazardous wastes at the site. Use flow sheets and location maps where appropriate.

(b) Facility Description. Organize according to treatment facilities, storage facilities, and disposal. Describe the combination of facilities used to manage hazardous wastes at the site and include a discussion of current methods of disposal. Indicate the kinds of hazardous wastes generated and their sources. (Facility drawings and location maps should be included as appropriate.) Indicate status of permitting activities and other actions to achieve compliance with the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act.

(2) Current and Future Plans. Indicate recent and planned changes in waste management practice as well as actions to minimize hazardous waste generation; e.g., materials substitution and treatment to render waste nonhazardous. Identify plans for new facility construction, modifications, upgrades, or closures.

e. Schedule and Cost Summary. Show current FY costs and operational schedule for the waste management program. In a separate set of tables, show a 5-year (FY + 4) cost and schedule projection and indicate major milestones to be accomplished during that period.

f. Environmental Monitoring Programs. Describe the status of environmental monitoring that supports waste management operations, with discussion of monitoring installations, media sampled, and constituents analyzed. (This section of the plan should focus on the environmental monitoring systems installed to meet regulatory compliance at the individual waste management facilities. It is not necessary to describe the site-wide monitoring program that reports directly to EH.) Provide descriptions of planned system upgrades and modifications and key these to applicable discussions in paragraphs 3c and d. Include facility maps where appropriate.

g. Related Subjects. Use this section to report on related topics of significant interest to waste management planning efforts at the site. Examples include preparation/review of major National Environmental Policy Act documentation; personnel training; quality assurance; technology demonstrations; and decommissioning projects.

WASTE MANAGEMENT DOCUMENTATION REQUIREMENTS

DISCUSSION. To identify principal documentation requirements as identified, sites are required to list and describe (where appropriate) the waste management documentation indicated below. Each of the following paragraphs refer to specific sections of this Order that require the preparation of waste management documentation. Reporting is limited to documents issued in the previous FY, unless the most recent revision of an existing document was issued earlier. Where possible, this Attachment should retain a standard bibliographical format.

(1) Chapter I - High-Level Waste.

(a) Paragraph 3a. List titles and dates of issue of Safety Analysis Reports. Forecast schedule for preparation and issue date of planned Safety Analysis Reports.

(b) Paragraph 3b(3)(c). List titles and dates of documents supporting the periodic assessment of waste storage tank integrity.

(c) Paragraph 3b(4). Cite documentation of contingency actions of the past year. List schedule for completion of corrective actions.

(2) Chapter II - Transuranic Waste.

(a) Paragraph 3c(3). Cite the Transuranic Waste Certification Plan and date of issue. If not issued, give schedule for preparation.

(b) Paragraph 3g(2)(h). Cite the closure plan for interim storage facilities. If not issued, give schedule for preparation.

(c) Paragraph 3(1). Index major documentation developed under the Buried Transuranic - Contaminated Waste Program. Show schedule for preparation of documents in the current fiscal year.

(3) Chapter III - Low-Level Waste.

(a) Paragraph 3b(1). Cite documentation on radiological performance assessment of disposal facilities. If not issued, provide schedule for preparation in paragraph 3 of the Waste Management Plan.

(b) Paragraph 3e(1). Cite Waste Acceptance Criteria for each low-level waste treatment storage and disposal facility. List anticipated additions to this list for the current fiscal year.

(c) Paragraph 3e(3). Report the status of audits of certification activities by operators of disposal facilities. Report status of follow-up reports.

(d) Paragraph 3g(2). List document(s) forecasting waste to be shipped by generators to off-site disposal facilities.

(e) Paragraph 3i(4)(d). List reports justifying on-site disposal of waste exceeding Class C limits. Such disposal cases anticipated for the next year should be forecast.

(f) Paragraph 3i(8). Cite major National Environmental Policy Act documentation (e.g., Environmental Impact Statement, Environmental Assessment) supporting selection of any new disposal sites. Give schedule of preparation for appropriate documentation for the next year.

(g) Paragraph 3j(1). Cite closure plans for low-level waste disposal sites and dates of issue. Give schedule of preparation for anticipated reports.

(4) Decommissioning of Radioactively Contaminated Facilities.

(a) Paragraphs 3a(1). Cite field organization documentation where the complete listing and the jurisdictional program responsibility for all contaminated facilities is recorded.

(b) Paragraph 3c(1). Cite the post-operational documentation that records the potential for reuse and recovery of materials and equipment and the schedule for decommissioning contaminated facilities.

(c) Paragraph 3d(3). List Decommissioning Project Plans and dates of issue. Show a schedule for preparation of Plans in the current fiscal year.

(d) Paragraph 3d(5). List final radiological and chemical survey reports and project final reports, and show dates of issue. Show anticipated additions to this list for the coming year.