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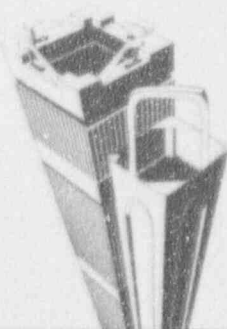
EMF-1946
Revision 0

Modular Extraction/Recovery Facility (MERF): Hazard Analysis

April 1997

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Nuclear Division



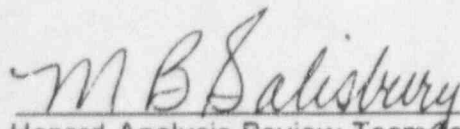
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Modular Extraction/Recovery Facility (MERF): Hazards Analysis

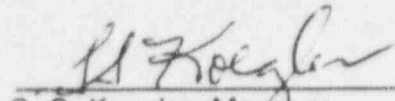
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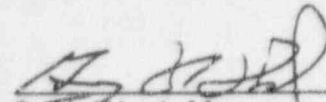
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1. Introduction

This analysis discusses hazards of the Modular Extraction/Recovery Facility (MERF) to be located north of the Lagoon Uranium Recovery/Solids Processing Facility (LUR/SPF). Each area of the process is described and includes measures that have been taken to protect the worker and the environment. The hazards of the chemicals that are used in this process are described and Material Safety Data Sheets (MSDSs) attached for reference. A "What-If Analysis" will be used to examine the major aspects of the facility's design and operation (e.g., material handling, operating procedures, work practices, waste disposal, etc.).

2. Process Description

A temporary, modular, processing facility will be constructed offsite and transported for installation at Siemens Power Corporation (SPC) to recover uranium from SPC's backlog of waste (wet wastes, prefilters alcohol-contaminated rags and HEPA filters). The uranium recovered in this process will be processed through solvent extraction. The solid waste will be incinerated at the Solid Waste Uranium Recovery (SWUR) facility or shipped to Advanced Technology Group (ATG) for supercompaction and final waste packaging for disposal at US Ecology. Liquid wastes will be discharged to Lagoon 3. At the conclusion of this campaign, the facility will be transported to other sites to process waste. It will return to SPC to process accumulated waste as needed. This facility will be located on the southeast corner of the waste pad (adjacent to LUR/SPF).

The following activities will be conducted in the MERF: sorting/shredding, leaching/extraction, precipitation/filtration, liquid and solid waste management, product and chemical storage, assay operations and offgas treatment. This discussion also includes a description of the nitric acid supply system, the caustic supply system, the hydrogen peroxide supply system and the propane fired steam boiler.

2.1 *Sorting/Shredding*

This process utilizes a sorting operation to separate waste materials for uranium recovery, direct disposal or incineration.

2.1.1 Prefilter Media

The prefilter drums contain an average of 12 filters per drum. The POG prefilters, characterized by a heavy loading of white ammonium fluoride solids and low uranium content, will be sorted out and shipped directly to Envirocare for disposal. Only the non-POG prefilters will be processed for uranium recovery. The prefilter drums are brought into the sorting glove box and their contents are removed. The prefilters are then sorted into the following waste streams: poly bags, non-POG pre-filters, POG prefilters, and miscellaneous.

2.1.2 Drummed HEPA Media

HEPA filters that have already been punched from their frames will be repackaged into shredder bins for shredding. The shredded media will then be processed through the washer/extractor for uranium recovery processing.

2.1.3 Whole HEPA Filters

Whole HEPA filters will be brought into the HEPA punch glove box where the media will be removed from the plywood frame. The HEPA filter generates the following waste streams: wire support screens, plywood frames, the media, the poly liner, and in some cases a cardboard box. The HEPA media will be shredded and processed through the washer/extractor for uranium recovery processing. The washed media will then be shipped to ATG for supercompaction and final waste packaging for burial at US Ecology. The plywood frames and cardboard boxes will be shredded and incinerated at SWUR. The poly liners will be incinerated. The wire support screens will be packaged for shipment to ATG/US Ecology.

2.1.4 Wet Wastes

The wet waste drums will likely contain free liquid due to the disposal of rags and mopheads soaked with nitric acid. In addition, liquid organic wastes such as lubricating oils, greases, tributyl phosphate and dodecane are expected to be present in some of the drums.

The bulk of the wet waste will be repackaged directly into laundry bags for uranium recovery processing. Filter cartridges (i.e., UNH and grinder filters) will be processed through a shredder in the glovebox to facilitate uranium recovery.

2.1.5 Alcohol-Contaminated Rags

Alcohol rags contain up to 50% isopropyl alcohol and are packaged in 30-gallon drums. This waste stream will be repackaged directly into laundry bags for uranium recovery processing.

2.2 Leaching/Extraction

Uranium leaching/extraction and solid waste rinsing and dewatering will take place in a 450-lb. capacity centrifugal washer/extractor. Further dewatering will occur in an 85,000 pound compactor. The actual number of bags washed during each cycle will depend upon the weight of each bag.

During the wash cycle, the uranium in the waste will be leached using 3M HNO_3 at 60-80°C for approximately 30 minutes. The leach cycle will be followed by a UNH extraction (spin) cycle to remove free liquids. The UNH solution is discharged from the washer into a strainer screen/overflow box that is designed to contain the entire liquid contents of the washer in the event of a dump valve failure. The screen in the overflow box restricts the down stream flow of solids that may escape from the washer in the unlikely event of a laundry bag failure.

After screening, the solution is pumped to the UNH Holding Tank where it will be reused directly to leach each subsequent waste load in the batch. When a given waste load has been leached and centrifugally extracted, an equivalent volume of rinse water (approx. 125 gallons) will be added to the washer/extractor for rinsing out residual UNH. The rinse cycle continues for 15 minutes while the pH is adjusted to at least 4.0 to maximize the recovery of uranium from the rinse solution. The rinse solution is transferred from the washer through the screen/overflow box to the U Precipitation Tank where any soluble uranium is precipitated.

At this point in the process, the solid waste contains very little uranium, is slightly damp, and is not considered a dangerous waste. It is further dewatered in the compactor, then assayed and packaged for either disposal at US Ecology through ATG or incinerated at SWUR.

2.3 Precipitation/Filtration

Following leaching, the UNH liquor is transferred from the UNH Holding Tank to the UNH Precip Tank. The pH is raised to at least 4.0 for effective uranium precipitation. A stoichiometric quantity of hydrogen peroxide is added to precipitate uranium peroxide ($UO_4 \cdot 2H_2O$). A reaction time of approximately 20 minutes is required to ensure adequate conversion of UNH to uranium peroxide.

The solid uranium peroxide will be separated from the liquor using a conventional horizontal belt pressure filter. The filter is completely enclosed in a containment hood with provision to remove 2.5-gallon buckets of uranium peroxide product. The filtrate from the precipitation operation is pumped to the filtrate tank and then to the wastewater holding tank to await sampling and analysis and final discharge to the lagoon system. The filtercake will be sampled and sent to the SPC Lab for total uranium, enrichment, and fluoride analysis. Each product container will be weighed and an interim NMA card will be placed on each container. These containers will be temporarily stored in a moderated storage grid area. Once laboratory analyses have been received the interim NMA card will be replaced with a permanent card showing the correct uranium content and enrichment. The product will then be transferred to solvent extraction for processing.

2.4 Liquid Waste

Waste water cannot be discharged to the lagoons that has a pH outside the range of 2-8, nor can it designate for heavy metals nor contain agents that will precipitate uranium from lagoon solution. Solutions having a U concentration greater than 1000 ppm cannot be discharged to the lagoons but will be reprocessed for an additional uranium recovery step.

All liquid wastes generated in this process will be held in the Wastewater Holding Tank (1000-gallon capacity). Samples will be taken of each batch and analyzed for U, U^{235} , pH and precipitating agents. During initial processing, samples of the liquid waste stream will be analyzed for designation purposes. Once adequate process knowledge from each waste stream has demonstrated that the solutions do not designate as a federal waste (heavy metals, pH) sampling to characterize the waste will be discontinued unless there is a significant change in the waste that is processed. However, samples of liquid waste generated from every batch will be taken for safeguards requirements and to ensure that the liquid meets the above levels for discharge to the lagoons.

2.5 Solid Waste Disposal

There will be several solid waste streams that will result from this operation.

Solid Waste Disposal

Waste Stream	Disposal Method
Wet waste poly liners	Incineration
Washed wet wastes	Incineration
Wet waste empty drums	Save for solids processing facility/LUR
Washed alcohol-contaminated rags	Incineration
Washed non-POG prefilters	ATG for supercompaction - US Ecology
POG prefilters	Envirocare
Non-POG poly liners	Incineration
Prefilter empty drums	Use only the best drums for waste packaging and shipment to ATG. Strong tight drums are to be designated for sale to ATG. Poor quality drums to be shipped to ATG for supercompaction—US Ecology
Washed HEPA filter media	ATG for supercompaction—US Ecology
HEPA filter support wire mesh	ATG for supercompaction—US Ecology
HEPA filter plywood frames	Incineration
HEPA filter poly liners	Incineration
HEPA filter cardboard boxes	Incineration
HEPA filter empty drums	Use only the best drums for waste packaging and shipment to ATG. Strong tight drums are to be designated for sale to ATG. Poor quality drums to be shipped to ATG for supercompaction—US Ecology

2.6 Assay Operations

Packaged waste containers are limited to ≤ 100 gms of U235. Also, all packaged waste containers shall be assigned a uranium value based on an approved waste assay system. All waste material leaving the MERF will be assayed to meet these requirements.

2.7 Offgas Treatment

An integrated 4,600 SCFM process off-gas (POG) system will service this facility. The system will include a preheater, a prefilter, single-stage HEPA filter and a 3,000 SCFM wet scrubbing system to insure maximum removal of airborne particulate and gaseous fumes prior to discharge through the off-gas stack. The system will include an exhaust blower that will provide adequate ventilation and containment air flow. The system is designed so that air flow in the process area travels from the lab and treated waste handling areas toward the sorting and shredding areas. This insures that the levels of contamination in the cleaner areas of the process can be minimized at all times.

The system will utilize DX-type air conditioning and electric resistance heating. The system will circulate pre-filtered fresh air only to the process area. Negative pressure in the main process area will be maintained at $-0.05''$ H₂O. The process support laboratory will be maintained at approximately -0.025 H₂O to insure that no air inleakage to the lab from the main process area occurs.

2.8 Product Storage

The uranium peroxide product will be packaged in 2.5 gallon plastic buckets limited to a maximum net weight of 18kgs. Two to three of these buckets will be generated per batch and will be stored in a 40' SeaLand container that has moderated grids built into it. The product will be stored in this area until laboratory results are available to accurately label the total uranium, the enrichment and fluoride content. The uranium peroxide will then be transported to the solvent extraction area for processing.

2.9 Chemical Storage

One drum of 50% sodium hydroxide will be stored in the HVAC module to be used to neutralize scrubber solution. All other chemicals for the process will be stored in a 25' x 25' enclosure. Nitric acid (68%) will be contained in a 350-gallon, stainless steel tote. The tote will be placed on a platform within a larger capacity containment basin. Sodium hydroxide (50%) will be stored in a 200-gallon tote and placed in a containment basin large enough to contain the contents in case of a leak or spill. The hydrogen peroxide (30%) will be delivered and stored in a 55-gallon drum. One drum at a time will be placed in the storage area. It will be placed on a pallet designed to contain the contents of the drum in case of a spill or leak.

The chemical storage area will be ventilated to ensure that any escaping chemical fumes are removed from the enclosure and that the area is safe from high and dangerous concentrations of primarily nitric acid. Also, a hand held emergency shower/eyewash station, equipped with a stay-open valve, will be located in this area.

2.10 Nitric Acid Supply System

Concentrated nitric acid for the MERF is supplied from a 350-gallon tote located in the raw material storage area. Its concentration is 68% by weight. These totes are brought into the storage area by forklift from the acid warehouse and placed on a platform in a containment basin large enough to contain the total contents of the tote if it should leak or spill. When the tote is empty, it is replaced with a full tote and the empty is sent to the chemical supplier for refilling.

The concentrated nitric acid is pumped via a metering pump to the UNH hold tank where the 3 molar nitric acid solution is made up to approximately 125 gallons. The 3 molar solution is preheated to 60°C by steam injection in this tank and then pumped to the washer extractor through stainless steel piping where it is combined with sorted waste to leach the uranium out of the waste solids. This resulting UNH solution is discharged from the washer extractor to the UNH hold tank to be used in the next wash cycle, if necessary. Additional quantity of nitric acid and water may be added to the tank to bring the volume up to the 125 gallons. Approximate usage of the concentrated nitric acid for this project is 6000 gallons.

2.11 Caustic Supply System

Concentrated sodium hydroxide is supplied from a 200-gallon tote located in the raw material storage area. Its concentration is 50% by weight. These totes are brought into the storage area by forklift from the base warehouse and placed on a platform in a containment basin large enough to contain the total contents of the tote if it should leak or spill. The sodium hydroxide is pumped by a metering pump through carbon steel piping to two locations: the washer/extractor and the precipitation tank. During the rinse cycle in the washer extractor, sodium hydroxide is added to the rinse solution to bring the pH up to at least 4 to prepare the solution for precipitation and to meet the requirements for solid waste burial. The pH of the solution is maintained by a Yokogawa pH controller and the microprocessor of the washer. Sodium hydroxide is also used to adjust the pH of the UNH solution to 3-4 prior to adding hydrogen peroxide for uranium precipitation. Again the pH is monitored/controlled by a Yokogawa pH controller. Approximate usage of sodium hydroxide for this project is 7500 gallons.

Another area where sodium hydroxide is used in this facility is in the HVAC module. Here the chemical is stored in a 55-gallon drum. It is used to adjust the pH of the scrubber solution that has removed acid fumes from various points in the process. A metering pump controls the addition of sodium hydroxide coupled with a Yokogawa pH controller. The drum will be placed on a pallet designed to contain the contents of the drum in case of a spill or leak.

2.12 Hydrogen Peroxide Supply System

Hydrogen peroxide is supplied to the MERF in 55 gallon drums. Its concentration is 30% by weight. The drum is placed on a containment pad that will hold the entire contents of the drum if there is a leak or a spill. Stoichiometric quantities of hydrogen peroxide are used to precipitate uranium from solution as a uranium peroxide ($\text{UO}_4 \cdot 2\text{H}_2\text{O}$) after the pH has been adjusted to 3-4. Only one drum at a time will be stored in this area.

2.13 Propane Fired Steam Boiler

A propane fired steam boiler is used to preheat the 3 molar nitric acid solution prior to leaching and to maintain temperature during processing in the washer extractor. The heating will be by injecting live steam into the process solution. It generates 500,000 BTU/hr at 100 psig. The boiler has an open burner that is housed in a dual wall steel casing with 3" of refractory insulation.

Propane is supplied to the boiler from tanks located approximately 75 feet south of the facility. The buried $\frac{3}{4}$ " supply line surfaces at the raw material storage area and then ties into the boiler. The steam boiler is equipped with an automatic emergency shutoff switch in the event of a fire or loss of pressure and an automatic block and bleed system.. The raw material storage area is ventilated with a forced air fan to purge any propane fumes that might escape from the unit. A gas detector is located in the most stagnant area of the storage area where gas fumes are continuously monitored. This sensor will be functionally checked every 4 months.

3. Chemical Handling And Precautions

This section describes briefly the hazards of nitric acid, sodium hydroxide and hydrogen peroxide and outlines safety precautions that must be taken. The MSDS should be referenced for a thorough description of the hazards of these chemicals. Such things as emergency action for spills or leaks, physical data, reactivity, etc. must all be understood before handling these chemicals.

3.1 Nitric Acid (68%)

Concentrated nitric acid is an oxidizer and corrodes many metals and nonmetals forming a toxic gas, nitrogen dioxide. It can cause the ignition of cellulosic materials and organic liquids. Nitric acid causes severe burns to eye and skin tissue and leaves yellow scars. If nitric acid comes in contact with the skin or clothing, it should immediately be washed thoroughly with water. Clothing soaked with nitric acid should be removed immediately to avoid burns to the skin.

3.2 Sodium Hydroxide (50%)

Sodium hydroxide is a strong base and will cause severe burns to the skin and eyes. Ingestion of sodium hydroxide can be fatal unless the base is immediately neutralized. Drink water to dilute and do not induce vomiting. Reactions of sodium hydroxide are extremely exothermic and while it is not flammable itself, the heat of reaction can trigger the ignition of numerous materials.

Protect against physically damaging the container. Do not get in eyes, on skin or on clothing. Do not allow water to get into container. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

3.3 Hydrogen Peroxide (30%)

Hydrogen peroxide is considered a strong oxidizer. Organic materials can ignite when in direct contact with hydrogen peroxide. It causes respiratory tract, skin and eye burns and severe burns to mucous membranes if inhaled. This material shall be used and stored in well ventilated areas. The vapors or mists must not be breathed. Do not get in eyes, on skin or on clothing. Keep from contact with clothing and other combustible materials. Store away from combustible materials. Keep container tightly closed. Wash thoroughly after handling. Handle with caution.

4. Safety Precautions

The MERF has been designed to ensure the safety of the operator provided standard operating procedures and safety guidelines are followed.

There are 4 hand-held emergency showers/eyewash station equipped with stay-open valves; in the raw material storage area, the leaching/extraction area, the HVAC module and the laboratory. It is the responsibility of all who work in this facility to know where they are located.

Chemical spills are contained by means of secondary containment pans. They are designed to contain 100% of the largest container within the containment pan. Containment is provided for the chemical storage totes/drums, the washer/extractor, the pressure filter, the filtrate holding tank, the UNH precipitation tank, the UNH holding tank, the miscellaneous liquid tank the waste water holding tank and the scrubber. The scrubber pan is equipped with a leak detection sensor and will alarm within the main process facility. The waste water holding tank is a double walled tank and will alarm if leaks are detected in the annular space.

When leaks are detected through audible alarms or routine visual inspections they shall be cleaned up per instruction in the MSDS's and plant guidelines. A copy of all MSDS's for each chemical that is used in the wet waste process shall be kept for reference in the facility's laboratory.

Other safety related equipment includes fire extinguishers, a first aid kit and stretcher, a criticality alarm horn and P. A. speaker, smoke detectors, fire detectors, gas detectors and heat sensors.

5. Radiation Protection

The processing of chemically contaminated wet waste, HEPA filters, prefilters and rags is performed in a limited access radiation controlled area under SPC's radiation protection program described in Chapters 3 and 12 of SPC's license application. Personnel entering the area, who require monitoring under 10 CFR 20.1502(a) are required to wear radiation monitoring devices and protective clothing/equipment appropriate for the work to be performed. Personnel are required to survey themselves prior to exiting the controlled area. Equipment leaving the controlled area must be released by Radiological Safety personnel. All personnel also receive initial and yearly refresher training on radiation protection principles and requirements.

Airborne uranium contamination is controlled by extensive use of hoods, gloveboxes, equipment which are maintained at negative pressure and ventilated to the process offgas system.

Routine surveys are performed and housekeeping practices are enforced to minimize surface and airborne contamination in the controlled areas. Air is continuously sampled and periodically analyzed to detect any airborne contamination.

Urine sample analyses and lung counts are periodically performed for personnel who work in the controlled access area. The frequencies of such testing is described in SPC's radiation protection program.

6. Personal Protective Equipment

For personal protective equipment requirements of each specific operation in the MERF, refer to the Industrial Hygiene Exposure Assessment Log. Generally, these guidelines should be followed:

1. Eye protection: Safety glasses are mandatory. Goggles and a face shield are required when changing out chemical drums/totes. Also, goggles are required when performing maintenance on chemical lines and pumps.
2. Hand Protection: Impervious gloves shall be worn when loading bags of waste into the washer, removing waste bags from the washer and changing out chemical drums/totes.
3. Body Protection: A raincoat that is impervious to these chemicals shall be worn when changing out chemical storage totes, loading bags of waste into the washer and removing bags of waste from the washer.
4. Respiratory - The primary respiratory concern is nitric acid vapors. When changing out nitric acid totes, a full-face respirator with MSA Type N canister is required.

7. Hazards Analysis: A What-If Approach

A "What-If" approach to perform the hazards analysis has been selected for the wet waste uranium recovery process located northwest of LUR/SPF. It is intended to review the process or activities conducted in this facility that are potentially safety issues. Key individuals in the plant have been asked for their input to ensure that the process has been scrutinized for potential accident scenarios as indicated by the questions that have been posed.

The following What-If questions have been supplied for the hazard analysis of the MERF.

Attachment A Hazards Analysis For Modular Extraction/Recovery Facility

What If	Consequence/Hazard	Safeguard	Action
A forklift punctures/drops a drum or tote of chemicals outside a contained area?	<ul style="list-style-type: none"> Potential chemical exposure to plant personnel and the environment. 	<ul style="list-style-type: none"> Forklift operator training. Emergency response procedures. Instructions in spill cleanup for each chemical are provided. 	<ul style="list-style-type: none"> Evacuate to a safe distance. Notify supervision and plant security and await instruction. Ensure emergency spill procedures are followed.
There is a chemical spill inside the raw material storage area?	<ul style="list-style-type: none"> Potential chemical exposure to plant personnel and the environment. 	<ul style="list-style-type: none"> Ventilated area. Containment basins for chemical storage totes/drums. Daily inspection of the containers for leaks. Safety shower in area. 	<ul style="list-style-type: none"> Evacuate to a safe distance. Notify supervision and plant security and await instruction. Ensure emergency spill procedures are followed.
Chemical piping breaks or leaks?	<ul style="list-style-type: none"> Potential chemical exposure to plant personnel. 	<ul style="list-style-type: none"> All piping pressure-checked prior to operation. Shower/eyewash stations. Regular inspection for leaks. 	<ul style="list-style-type: none"> Repair all leaks in piping and other equipment as they are discovered. Follow spill procedures for safe cleanup.
Boiler pump or water supply fails?	<ul style="list-style-type: none"> Possible boiler damage due to overpressurization (rupture). 	<ul style="list-style-type: none"> Low level switch shuts burner down. High pressure switch shuts burner down. 	<ul style="list-style-type: none"> Follow operating procedure for safe operation of the boiler.
Vacuum pump fails?	<ul style="list-style-type: none"> Loss of work station and stack air samplers. 	<ul style="list-style-type: none"> Daily sampling will detect a problem. Air Balance checks twice/day. 	<ul style="list-style-type: none"> Make sure the MERF is added to routine checklist for Air Balance.
The power goes out?	<ul style="list-style-type: none"> Loss of ventilation. 	<ul style="list-style-type: none"> No backup power. 	<ul style="list-style-type: none"> Cease operations. Notify supervision.
Washer gets out of balance?	<ul style="list-style-type: none"> Structural integrity potentially compromised. 	<ul style="list-style-type: none"> Vibration safety switch shuts off machine. Alarm for excess vibration. 	<ul style="list-style-type: none"> Observe operation of washer for excessive vibration. Distribute wash loads evenly.
The water flow to the scrubber ceases?	<ul style="list-style-type: none"> Acid vapors emitted to the atmosphere. Fan corrosion. Ammonium nitrate concentration/explosion 	<ul style="list-style-type: none"> Lo-flow alarm. Flow switch interlocked with caustic metering pump. Daily monitoring of the scrubber equipment. 	<ul style="list-style-type: none"> Functionally check flow switch/alarm every four months. Monitor the scrubber operation every startup.
There is a caustic spill in the HVAC module?	<ul style="list-style-type: none"> Liquid chemical exposure to skin and eyes. 	<ul style="list-style-type: none"> Lines are pressure checked to ensure integrity. Daily inspection for leaks. Safety shower nearby. Containment basin for caustic drum. 	<ul style="list-style-type: none"> Follow spill procedures for safe cleanup.

Attachment A Hazards Analysis For Modular Extraction/Recovery Facility (Continued)

What If	Consequence/Hazard	Safeguard	Action
The process tanks or the scrubber overflows?	<ul style="list-style-type: none"> Potential exposure to hazardous chemicals. 	<ul style="list-style-type: none"> Tanks and scrubber have secondary containment. Waste tank and scrubber equipped with leak detection/alarms. 	<ul style="list-style-type: none"> Follow spill procedures for safe cleanup.
A pressurized drum is brought into the facility for processing?	<ul style="list-style-type: none"> Potential exposure to hazardous fumes. Potential flying object. Potential ignition of organic vapors. 	<ul style="list-style-type: none"> The sorting hood is ventilated to contain hazardous gases. 	<ul style="list-style-type: none"> Follow procedures to vent drums in sorting hood.
The temp. control valve fails on steam line to the washer and UNH tank?	<ul style="list-style-type: none"> More acid vapors to be scrubbed. Higher thermal burn potential. 	<ul style="list-style-type: none"> High temperature indication. Operator will be attending the machine during operation. Routine calibration. 	<ul style="list-style-type: none"> Notify instrumentation to calibrate.
The pH control fails on the washer?	<ul style="list-style-type: none"> High quantities of caustic introduced into washer producing a dangerous waste. High heat generation. 	<ul style="list-style-type: none"> High pH alarm. Operator oversees operation. Pull sample from washer and verify with pH paper. Routine calibration. 	<ul style="list-style-type: none"> Reprocess solid waste Notify instrumentation to calibrate analyzer.
Minor washer door latch fails and comes open while operating?	<ul style="list-style-type: none"> Potential chemical and radionuclide exposure. 	<ul style="list-style-type: none"> Door interlock: an air actuated door latch prevents door from opening until machine has stopped. Liquid level is below door level. 	<ul style="list-style-type: none"> Cease operations, secure process and leave facility. Notify supervision and await instruction.
POG filter suddenly blinds?	<ul style="list-style-type: none"> Loss of containment and exhaust on hoods. Potential inhalation hazard. 	<ul style="list-style-type: none"> Daily checks on pressure drop across filters. Operator awareness when filters blind. 	<ul style="list-style-type: none"> Call Air Balance personnel. Cease operations, secure process and leave facility.
There is a chemical spill that leaks between trailers?	<ul style="list-style-type: none"> Potential chemical exposure to plant personnel and the environment. 	<ul style="list-style-type: none"> Instructions in spill cleanup are provided. Sealant between trailers to prevent leakage between trailers. Asphalt pad is resistant to materials used in MERF. 	<ul style="list-style-type: none"> Follow spill procedures for safe cleanup. Notify supervision and security. Cease operations and secure process.
Personnel comes in contact with steam lines or other heated equipment?	<ul style="list-style-type: none"> Potential burn hazard. 	<ul style="list-style-type: none"> Some heated equipment will be insulated and located to prevent casual contact. Equipment and piping will be labeled. Training for working around steam. 	<ul style="list-style-type: none"> Contact supervision and Safety for treatment of injuries pertaining to burns. Follow procedures and safeguards for working around steam.
Plant air goes down?	<ul style="list-style-type: none"> Washer door won't open. Filter won't operate. Air diaphragm pumps won't operate. Dump valve on washer won't open. 	<ul style="list-style-type: none"> Each consequence does not impact safety with plant air outage. 	<ul style="list-style-type: none"> Get plant air back in service to resume operation. Notify supervision.
Airborne particulate (radionuclide) is emitted into the facility?	<ul style="list-style-type: none"> Potential inhalation hazard. 	<ul style="list-style-type: none"> Air samplers for radioactivity are distributed throughout the facility where airborne is likely to occur. Air sampler changed each shift. Resp. protection training, mask fit. 	<ul style="list-style-type: none"> Notify supervision, Rad. Safety. Cease operations Leave facility.

Modular Extraction/Recovery Facility (MERF): Hazards Analysis

Attachment A Hazards Analysis For Modular Extraction/Recovery Facility (Continued)

What If	Consequence/Hazard	Safeguard	Action
Airborne particulate (radionuclide) is emitted out of the facility?	<ul style="list-style-type: none"> Potential inhalation hazard. 	<ul style="list-style-type: none"> Prefilters, HEPA filters, scrubber, stack sampler, and routine checks on ventilation system. 	<ul style="list-style-type: none"> Make sure the MERF is added to routine checklist for Air Balance. Follow boundary concentration action levels in Ch. 5 of License. Cease ops. At 4" H₂O.
There is a steam leak in the boiler or piping?	<ul style="list-style-type: none"> Potential burn hazard. 	<ul style="list-style-type: none"> Visual inspection will determine steam leaks and repairs needed. 	<ul style="list-style-type: none"> Follow procedures for isolating boiler and repair of leaks.
There is a leak from the waste line?	<ul style="list-style-type: none"> Potential contamination to personnel and the environment. 	<ul style="list-style-type: none"> The waste line is welded stainless steel that has been pressure tested. Daily inspection for leaks. The waste line will be blown down after every pump out. 	<ul style="list-style-type: none"> Follow operating procedures for transferring waste to Lagoon 3. Secure transfers to Lagoon 3 and repair line.
Ammonium nitrate accumulates in the facility?	<ul style="list-style-type: none"> Potential explosion hazard. 	<ul style="list-style-type: none"> Routine inspection and cleanout of equipment and ductwork. Signs posted to not weld equipment or ductwork until cleaned out. 	<ul style="list-style-type: none"> Follow cleanout procedures.
The pH control fails on the precip tank?	<ul style="list-style-type: none"> High quantity of caustic in precip tank. Excessive heat generated. Requires HNO₃ to readjust pH to proper level. 	<ul style="list-style-type: none"> Operator will be attending the precipitation operation. High pH alarm. Pull manual sample from tank to verify with pH paper. Routine calibration of pH analyzer 	<ul style="list-style-type: none"> Notify Instrumentation to calibrate analyzer. Manually adjust pH to proper level.
There is a propane leak in the raw material storage area?	<ul style="list-style-type: none"> Potential fire/explosion hazard. 	<ul style="list-style-type: none"> Ventilation fan in storage area. A gas detector/alarm interlocked to shut down propane. Block and bleed isolation. Odor detection (mercaptans). 	<ul style="list-style-type: none"> Daily checks for gas leaks. Notify supervision. 4-month PM. Secure propane supply at storage tanks
Uranium solutions drain into the raw material storage area through process piping?	<ul style="list-style-type: none"> Contamination of equipment and the environment outside of a radiation contamination zone. 	<ul style="list-style-type: none"> Check valves installed on most lines. Positive displacement chemical pumps. High pressure steam into the MERF. Vapor space and vacuum breakers. Routine surveys by Rad. Safety 	<ul style="list-style-type: none"> Notify supervision, and Radiological Safety. Cease operations, secure process, repair, decon. Follow procedures for cleanup of spills.
There is a fire in the facility? SEE FIRE HAZARDS ANALYSIS.	<ul style="list-style-type: none"> Facility damage. Personnel injury. 	<ul style="list-style-type: none"> Smoke detectors, heat sensors, HVAC interlocks, CO₂ fire suppression in glovebox. Emergence exits from the facility. 	<ul style="list-style-type: none"> Ensure that personnel are trained to respond correctly to fire alarms and that they are familiar with the fire safety equipment.
Hands or other extremities are pinched in the equipment?	<ul style="list-style-type: none"> Loss of fingers or limbs. 	<ul style="list-style-type: none"> Some equipment designed to operate with both hands away from pinch points before equipment can be actuated. 	<ul style="list-style-type: none"> Ensure that personnel are trained to run equipment and are aware of potential hazards per the SOP.
Personnel are contaminated with process solution or powder?	<ul style="list-style-type: none"> Chemical and rad exposure to personnel and the environment. Inhalation hazard (if powder). 	<ul style="list-style-type: none"> Survey instruments available. Rad. Safety assigned to the facility. Safety shower/eyewash stations. 	<ul style="list-style-type: none"> Notify supervision, Rad. Safety and Safety. Remove clothing if soaked with any hazardous liquid.

Attachment B Material Safety Data Sheet 68% Nitric Acid

CHEMICAL INTERCHANGE -- NITRIC ACID, 55-68% - NITRIC ACID, TECHNICAL
MATERIAL SAFETY DATA SHEET

FSC: 6810

NIIN: 002229655

Manufacturer's CAGE: CHEMI

Part No. Indicator: A

Part Number/Trade Name: NITRIC ACID, 55-68%

General Information

Item Name: NITRIC ACID, TECHNICAL
Company's Name: CHEMICAL INTERCHANGE
Company's Street: 2932 SOUTH BRENTWOOD
Company's City: ST. LOUIS
Company's State: MO
Company's Country: US
Company's Zip Code: 63144
Company's Emerg Ph #: 800-424-9300 (CHEMTREC)
Company's Info Ph #: 800-424-9300 (CHEMTREC)
Distributor/Vendor # 1: PRILLAMAN CHEMICAL CORP (804-539-7401)
Distributor/Vendor # 1 Cage: 0G5T1
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 017
Status: SE
Date MSDS Prepared: 20APR90
Safety Data Review Date: 09JAN95
Supply Item Manager: CX
MSDS Preparer's Name: RANDALL S. MOORE
MSDS Serial Number: BWFKL
Specification Number: O-N-350, REV.B
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: C1
Unit Of Issue: PT
Unit Of Issue Container Qty: 500 ML
Type Of Container: GLASS BOTTLE
Net Unit Weight: 1.4 LBS

Ingredients/Identity Information

Proprietary: NO
Ingredient: NITRIC ACID (SARA III)
Ingredient Sequence Number: 01
Percent: 55-68
NIOSH (RTECS) Number: Q05775000
CAS Number: 7697-37-2
OSHA PEL: 2 PPM
ACGIH TLV: 2 PPM/4 STEL; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: WATER
Ingredient Sequence Number: 02
Percent: 32-45
NIOSH (RTECS) Number: ZC0110000
CAS Number: 7732-18-5
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: LIQUID; WATER WHITE TO YELLOW (DEPENDING ON NITROUS
OXIDE CONC); SUFFOCATING ODOR
Boiling Point: 245-252F
Melting Point: -4--30F
Vapor Pressure (MM Hg/70 F): 233
Vapor Density (Air=1): 1.28
Specific Gravity: 1.36-1.41
Decomposition Temperature: UNKNOWN

Attachment B Material Safety Data Sheet 68% Nitric Acid (Continued)

Evaporation Rate And Ref: >1 (N-BUTYL ACETATE=1)

Solubility In Water: COMPLETE

Percent Volatiles By Volume: 100

pH: <1

Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: NONE

Extinguishing Media: WATER SPRAY, DRY CHEMICAL.

Special Fire Fighting Proc: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SCBA. FIGHT FIRE AS FAR A DISTANCE AS POSSIBLE. COOL FIRE EXPOSED CONTAINERS WITH WATER SPRAY.

Unusual Fire And Expl Hazards: NITRIC ACID MAY YIELD OXYGEN WHEN HEATED, WHICH WILL INCREASE THE RATE OF BURNING OF COMBUSTIBLE MATERIAL & MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLSN

Reactivity Data

Stability: YES

Cond To Avoid (Stability): EXTREME HEAT.

Materials To Avoid: COMBUSTIBLE MATERIALS, BASES, METALLIC POWDERS, HYDROGEN SULFIDE, CARBIDES, ALCOHOLS, REACTS WITH WATER TO PRODUCE HEAT.

Hazardous Decomp Products: NITROGEN OXIDES.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: TLV IS 2PPM TWA;4PPM STEL

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: **HIGHLY CORROSIVE**EYES:MAY CAUSE DAMAGE OR BLINDNESS.SKIN:MAY CAUSE CHEMICAL BURNS.INGEST:MAY CAUSE GI TRACT MAY CAUSE TEETH TO DISCOLOR.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: THERE ARE NO INGREDIENTS ABOVE 0.1% WHICH ARE IDENTIFIED AS CARCINOGENS BY NTP,IARC OR OSHA.

Signs/Symptoms Of Overexp: SKIN:YELLOW DISCOLORATION WITH BURNS, POSSIBLE DEEP ULCERATIONS.INHAL:>200PPM MAY CAUSE SEVERE LUNG DAMAGE, POSSIBLY DEATH.

Med Cond Aggravated By Exp: INDIVIDUALS WITH A HISTORY OF EYE, SKIN AND RESPIRATORY DISORDERS MAY BE AT INCREASED RISK FROM EXPOSURE.

Emergency/First Aid Proc: EYES:FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.IF IRRITATION PERSISTS,SEE DOCTOR. SKIN:WASH WITH MILD SOAP AND WATER WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. INHALATION:REMOVE VICTIM TO FRESH AIR.GIVE OXYGEN/CPR IF NEEDED.SEE DOCTOR. INGESTION:DO NOT INDUCE VOMIT.SEE DOCTOR IMMEDIATELY.IF CONSCIOUS,GIVE 1-3 GLASSES OF WATER OR MILK.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE PERSONNEL. ELIMINATE IGNITION SOURCES. VENTILATE AREA. WEAR PROTECTIVE CLOTHING AND EQUIPMENT. NEUTRALIZE VERY CAUTIOUSLY. SOAK UP WITH A NON-COMBUSTIBLE,INERT ABSORBANT;PLACE IN AN APPROPRIATE DISPOSAL CONTAINER AND COVER.

Neutralizing Agent: SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

Waste Disposal Method: CONTACT YOUR LOCAL ENVIRONMENTAL OFFICER. DISPOSE OF IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS. EPA HAZARDOUS WASTE NUMBER D002.

Precautions-Handling/Storing: STORE IN COOL, DRY, WELL VENTILATED AREA. PROTECT FROM PHYSICAL DAMAGE, HEAT, IGNITION SOURCES AND INCOMPATIBLE MATERIALS. KEEP CONTAINERS CLOSED.

Other Precautions: AVOID EXPOSING PRODUCT TO DIRECT SUNLIGHT. AVOID EYE AND SKIN CONTACT. DO NOT BREATHE VAPORS.

Attachment B Material Safety Data Sheet 68% Nitric Acid (Continued)

Control Measures

Respiratory Protection: WHERE ENVIRONMENTAL CONTROLS ARE LACKING OR IN ENCLOSED SPACES USE EITHER A SELF-CONTAINED BREATHING APPARATUS OR A NIOSH/MSHA APPROVED RESPIRATOR FOR ACID GAS, DEPENDING ON THE AIRBORN CONCENTRATION.
Ventilation: LOCAL EXHAUST VENTILATION TO KEEP EXPOSURE LEVELS BELOW PEL.
Protective Gloves: NATURAL RUBBER, NEOPRENE OR PVC GLOVES.
Eye Protection: SPLASH-PROOF GOGGLES AND FACE SHIELD.
Other Protective Equipment: PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE EXPOSURE FROM PROLONGED OR REPEATED CONTACT. EYE BATH AND SAFETY SHOWER.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING. LAUNDRY CONTAMINATED CLOTHING BEFORE REUSE.
Suppl. Safety & Health Data: NONE.

Transportation Data

Trans Data Review Date: 94009
DOT PSN Code: KFD
DOT Proper Shipping Name: NITRIC ACID
DOT Class: 8
DOT ID Number: UN2031
DOT Pack Group: II
DOT Label: CORROSIVE
IMO PSN Code: KPF
IMO Proper Shipping Name: NITRIC ACID
IMO Regulations Page Number: 8195
IMO UN Number: 2031
IMO UN Class: 8
IMO Subsidiary Risk Label: -
IATA PSN Code: HXR
IATA UN ID Number: 1760
IATA Proper Shipping Name: CORROSIVE LIQUID, N.O.S. *
IATA UN Class: 8
IATA Label: CORROSIVE
AFI PSN Code: RWF
AFI Symbols: 0
AFI Prop. Shipping Name: NITRIC ACID
AFI Class: 8
AFI ID Number: UN2031
AFI Pack Group: II
AFI Label: CORROSIVE
AFI Basic Pac Ref: 12-14
MMAC Code: NR
N.O.S. Shipping Name: NITRIC ACID 55-68%
Additional Trans Data: RQ IS 1000 LBS OR 65 GALLONS.

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 09JAN95
MFR Label Number: UNKNOWN
Label Status: F
Common Name: NITRIC ACID, 55-68%
Signal Word: DANGER
Acute Health Hazard-Severe: X
Contact Hazard-Severe: X
Fire Hazard-Slight: X
Reactivity Hazard-Slight: X
Special Hazard Precautions: **HIGHLY CORROSIVE**EYES:MAY CAUSE DAMAGE OR BLINDNESS.SKIN:MAY CAUSE CHEMICAL BURNS.INGEST:MAY CAUSE GI TRACT MAY CAUSE TEETH TO DISCOLOR. FIRST AID: EYES:FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.IF IRRITATION PERSISTS,SEE DOCTOR. SKIN:WASH WITH MILD DO NOT INDUCE VOMIT.SEE DOCTOR IMMEDIATELY.IF CONSCIOUS,GIVE 1-3 GLASSES OF WATER OR MILK.
Protect Eye: Y

Attachment B Material Safety Data Sheet 68% Nitric Acid (Continued)

Protect Skin: Y

Label Name: CHEMICAL INTERCHANGE

Label Street: 2932 SOUTH BRENTWOOD

Label City: ST. LOUIS

Label State: MO

Label Zip Code: 63144

Label Country: US

Label Emergency Number: 800-424-9300 (CHEMTREC)

URL for this msds <http://siri.org>. If you wish to change, add to, or
delete information in this archive please sent updates to dan@siri.org.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide

OHS/MDL Record Number : OHS21300

MATERIAL SAFETY DATA SHEET**SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

MDL Information Systems, Inc.
14600 Catalina Street
San Leandro, CA 94577
1-800-635-0064 (Toll Free) or
1-510-895-1313

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-815-366-2000 in USA

CAS Registry Number: 1310-73-2

RTECS Number : WB4900000

UN Number : UN 1823

SUBSTANCE: SODIUM HYDROXIDE

TRADE NAME/SYNONYM(S): CAUSTIC SODA; SODA LYE; LYE; WHITE CAUSTIC; CAUSTIC SODA, BEAD; CAUSTIC SODA, DRY; CAUSTIC SODA, FLAKE; CAUSTIC SODA, GRANULAR; CAUSTIC SODA, SOLID; SODIUM HYDRATE; SODIUM HYDROXIDE (NA(OH)); SODIUM HYDROXIDE, FLAKE; SODIUM HYDROXIDE, DRY; SODIUM HYDROXIDE, SOLID; ASCARITE; SODIUM HYDROXIDE, DRY SOLID, FLAKE, BEAD, OR GRANULAR; FOTOFOIL-ETCHANT (MILLER DIAL); UN 1823; STCC 4935235; NaOH

CHEMICAL FAMILY: Inorganic base

SUMMARY SHEET AVAILABLE: Y

CREATION DATE: 19841217 REVISED: 19960123 CHEM CHANGE DATE: 19960123

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS

1) Component Substance: SODIUM HYDROXIDE
Component Percent: 100 %
CAS Registry Number: 1310-73-2

CONTAMINANTS: NONE

SECTION 3 - HAZARDS IDENTIFICATION

NFPA Ratings (scale 0-4): Health=3 Fire=0 Reactivity=1
EMERGENCY OVERVIEW:

DESCRIPTION: Odorless, white or off-white hygroscopic solid.

STATEMENT OF HAZARDS:

Harmful if swallowed. Causes respiratory tract, skin, and eye burns and severe burns to mucous membranes.

PRECAUTIONARY STATEMENTS:

Do not breathe dust. Do not get in eyes, on skin, or on clothing. Do not allow water to get in container. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS**INHALATION:**

SHORT TERM EFFECTS: May cause irritation, possibly severe. Additional effects may include difficulty breathing, lung congestion and shock.

LONG TERM EFFECTS: May cause effects as in short term exposure. Additional effects may include diarrhea and lung effects.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause burns.

LONG TERM EFFECTS: Same effects as short term exposure.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)**EYE CONTACT:**

SHORT TERM EFFECTS: May cause burns. Additional effects may include blindness.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May be harmful if swallowed. May cause burns. Additional effects may include diarrhea, stomach pain, bloody vomit, blood in the stool, shock, coma and heart failure.

LONG TERM EFFECTS: Same effects as short term exposure.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

Date: 19881020

SECTION 4 - FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. Perform artificial respiration if necessary. Maintain airway, blood pressure and respiration. Keep warm and at rest. Treat symptomatically and supportively. Get medical attention immediately. Qualified medical personnel should consider administering oxygen.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). If burns occur, proceed with the following: Cover affected area securely with sterile, dry, loose-fitting dressing. Treat symptomatically and supportively. Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Continue irrigating with normal saline until the pH has returned to normal (30-60 minutes). Cover with sterile bandages. Get medical attention immediately.

INGESTION:

FIRST AID- Do not use gastric lavage or emesis. Dilute the alkali by giving Water or milk to drink immediately and allowing vomiting to occur. As soon as possible, have qualified medical personnel do esophagoscopy and irrigate injured areas with 1% acetic acid until the alkali is completely neutralized. (Dreisbach, Handbook of Poisoning, 11th Edition). Get medical attention immediately.

NOTE TO PHYSICIAN**ANTIDOTE:**

No specific antidote. Treat symptomatically and supportively.

SECTION 5 - FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard when exposed to heat or flame.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam (1993 Emergency Response Guidebook, RSPA P 5800.6).

For larger fires, use water spray, fog or regular foam (1993 Emergency Response Guidebook, RSPA P 5800.6).

FIRE FIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks (1993 Emergency Response Guidebook, RSPA P 5800.6, Guide Page 60).

Use agent suitable for type of fire. Use water in flooding quantities as fog.

Apply water from as far a distance as possible.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release toxic fumes of sodium oxide.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)**SECTION 6 - ACCIDENTAL RELEASE MEASURES****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.

Reportable Quantity (RQ): 1000 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

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.

SECTION 7 - HANDLING AND STORAGE

Observe all federal, state and local regulations when storing or disposing of this substance.

Store in a cool, dry, well-ventilated location. Separate from acids, water, metals. Immediately remove and properly dispose of any spilled material. (NFPA 49, Hazardous Chemicals Data, 1991)

Store away from incompatible substances.

SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION**EXPOSURE LIMITS:****SODIUM HYDROXIDE:**

2 mg/m³ OSHA TWA

2 mg/m³ OSHA ceiling (vacated by 58 FR 35338, June 30, 1993)

2 mg/m³ ACGIH ceiling

2 mg/m³ NIOSH recommended ceiling

2 mg/m³ DFG MAK TWA (total dust);

4 mg/m³ DFG MAK 5 minute peak, momentary value, 8 times/shift

Measurement method: Particulate filter; hydrochloric acid; titration;
(NIOSH Vol. III # 7401, Alkaline Dusts).

1000 pounds CERCLA Section 103 Reportable Quantity

VENTILATION:

Provide local exhaust ventilation system to meet published exposure limits.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance. Emergency wash facilities: Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent any possibility of skin contact with this substance.

GLOVES:

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z. The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

SODIUM HYDROXIDE:

10 mg/m³- Any supplied-air respirator operated in a continuous flow mode. Any air-purifying full facepiece respirator with a high efficiency particulate filter. Any powered, air-purifying respirator with a dust and mist filter. Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece. Escape- Any air-purifying, full facepiece respirator with a high efficiency particulate filter. Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Odorless, white or off-white hygroscopic solid.
MOLECULAR WEIGHT: 40.00
MOLECULAR FORMULA: NA-O-H
PHYSICAL STATE (S,L,G): S
BOILING POINT: 2534 F (1390 C)
MELTING POINT: 604 F (318 C)
SPECIFIC GRAVITY: 2.130
pH: 14 @ 5% solution
VAPOR PRESSURE: 100 mmHg @ 1111 C
WATER SOLUBILITY: soluble
SOLVENT SOLUBILITY: Soluble in alcohol, glycerol; insoluble in acetone, ether.

SECTION 10 - STABILITY AND REACTIVITY**REACTIVITY:**

Reacts exothermically with water.

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.).

INCOMPATIBILITIES:**SODIUM HYDROXIDE:**

ACETALDEHYDE: May result in violent polymerization.

ACETIC ACID: Mixing in closed container increases temperature and pressure.

ACETIC ANHYDRIDE: Mixing in a closed container increases temperature and pressure.

ACIDS: May react violently.

ACROLEIN: May result in an extremely violent polymerization.

ACRYLONITRILE: May cause violent polymerization.

ALLYL ALCOHOL + BENZENE SULFONYL CHLORIDE: Possible explosion hazard.

ALLYL CHLORIDE: Hydrolyzes.

ALUMINUM: Vigorous reaction.

ALUMINUM, ARSENIC TRIOXIDE, SODIUM ARSENATE: May generate flammable hydrogen gas.

AMMONIA + SILVER NITRATE: Precipitation of explosive silver nitride may occur.

AMMONIUM SALTS: May react violently evolving ammonia gas.

BENZENE-1,4-DIOL: Exothermic reaction.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)

N,N'-BIS(TRINITROETHYL)UREA: Formation of explosive compound.
 BROMINE: Possible explosion if not stirred continuously.
 CHLORINE TRIFLUORIDE: May cause violent reaction.
 CHLOROFORM + METHYL ALCOHOL: Exothermic reaction.
 CHLOROHYDRIN: Mixing in a closed container causes an increase in temperature and pressure.
 4-CHLORO-2-METHYLPHENOL: Possible ignition.
 CHLORONITROTOLUENES: Possible explosion.
 CHLOROPICRIN: May cause violent reaction.
 CHLOROSULFONIC ACID: Mixing in a closed container causes an increase in temperature and pressure.
 CINNAMALDEHYDE: Exothermic reaction.
 COATINGS: May be attacked.
 COPPER: Solutions may slowly corrode.
 CYANOGEN AZIDE: May form sodium 5-azidotetrazolide, which is explosive if isolated.
 2,2-DICHLORO-3,3-DIMETHYLBUTANE: Hazardous reaction.
 1,2-DICHLOROETHYLENE: May form spontaneously flammable monochloroacetylene.
 DIBORANE AND OCTANAL OXIME: Exothermic reaction.
 ETHYLENE CYANOHYDRIN: Mixing in a closed container causes an increase in temperature and pressure.
 FLAMMABLE LIQUIDS: Fire and explosion hazard.
 GLYCOLS: May cause exothermic decomposition with evolution of hydrogen gas.
 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.
 IRON: Solutions may slowly corrode.
 LEAD: May be attacked; flammable hydrogen gas may be liberated.
 LEATHER: May be attacked.
 MALEIC ANHYDRIDE: Explosive decomposition.
 METALS: Corrodes metals, reacting to form flammable hydrogen gas.
 4-METHYL-2-NITROPHENOL: Exothermic reaction.
 NITRIC ACID: Mixing in closed container increases temperature and pressure.
 NITROBENZENE: Possibly explosive reaction upon heating in presence of water.
 NITROETHANE: Forms an explosive salt.
 NITROMETHANE: Forms an explosive salt.
 NITROPARAFFINS: The nitroparaaffins, in the presence of water, form dry salts with organic bases. The dry salts are explosive.
 NITROPROPANE: Forms an explosive salt.
 O-NITROTOLUENE: Possible explosion.
 OLEUM: Mixing in a closed container causes an increase in temperature and pressure.
 ORGANIC PEROXIDES: Incompatible.
 PENTOL (3-METHYL-2-PENTENE-4-YN-1-OL): Possible explosion.
 PHOSPHORUS: May form mixed phosphines which may ignite spontaneously in air.
 PHOSPHORUS PENTOXIDE: May react violently when heated.
 PLASTICS: May be attacked.
 B-PROPIOLACTONE: Mixing in a closed container causes an increase in temperature and pressure.
 PROPYLENE OXIDE: Ignition or explosion may occur.
 RUBBER: May be attacked.
 SODIUM TETRAHYDROBORATE: Dry mixtures with sodium hydroxide containing 15-40% of tetrahydroborate liberate hydrogen explosively at 230-270 C.
 SULFURIC ACID: Mixing in a closed container causes an increase in temperature and pressure.
 1,2,4,5-TETRACHLOROBENZENE: Violent reaction.
 TETRACHLOROBENZENE + METHYL ALCOHOL: Possible explosion.
 TETRACHLOROETHYLENE: Possible explosion.
 TETRAHYDROFURAN: Serious explosions can occur.
 TIN: Evolution of hydrogen gas which may form an explosive mixture.
 1,1,1-TRICHLOROETHANOL: Explosion may occur.
 TRICHLOROETHYLENE: Formation of explosive mixtures of dichloroacetylene.
 TRICHLORONITROMETHANE + METHANOL: May cause violent reaction.
 WOOL: May be attacked.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)

ZINC (DUST): Fire and explosion hazard.

ZIRCONIUM: May cause explosive reaction upon heating.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release toxic fumes of sodium oxide.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11 - TOXICOLOGICAL INFORMATION

SODIUM HYDROXIDE:

IRRITATION DATA: 500 mg/24 hours skin-rabbit severe; 1% eye-rabbit severe;

50 ug/24 hours eye-rabbit severe; 1 mg/24 hours eye-rabbit severe; 400 ug eye-rabbit mild; 1 mg/30 seconds rinsed eye-rabbit severe; 1%/24 hours eye-monkey severe.

TOXICITY DATA: 1350 mg/kg skin-rabbit LD50 (Van Waters & Rogers Inc. MSDS);

500 mg/kg oral-rabbit LDLo; 104-340 mg/kg oral-rat LD50 (Van Waters & Rogers

Inc. MSDS); 40 mg/kg intraperitoneal-mouse LD50; mutagenic data (RTECS).

CARCINOGEN STATUS: None.

LOCAL EFFECTS: Corrosive- inhalation, skin, eye, ingestion.

ACUTE TOXICITY LEVEL: Toxic by ingestion; moderately toxic by dermal absorption.

TARGET EFFECTS: No data available.

AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing skin and eye conditions.

HEALTH EFFECTS

INHALATION:

SODIUM HYDROXIDE:

CORROSIVE. 10 mg/m3 Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- Effects due to inhalation of dusts or mist may vary from mild irritation of the nose at 2 mg/m3 to severe pneumonitis depending on the severity of exposure. Low concentrations may cause mucous membrane irritation with sore throat, coughing, and dyspnea. Intense exposures may result in destruction of mucous membranes and delayed pulmonary edema or pneumonitis. Shock may occur.

CHRONIC EXPOSURE- Prolonged exposures to high concentrations of dusts or mists may cause discomfort and ulceration of the nasal passages. Repeated exposures of 5000 mg/L were harmless to rats, but 10,000 mg/L led to nervousness, sore eyes, diarrhea and retarded growth. Rats exposed 30 minutes/day to unmeasured concentrations of sodium hydroxide aerosols suffered pulmonary damage after 2-3 months. Death occurred in 2 of 10 rats exposed to an aerosol of 40% aqueous sodium hydroxide for 30 minutes, twice a week for 3 weeks. Histopathological examination showed mostly normal lung tissue with foci of enlarged alveolar septae, emphysema, bronchial ulceration, and enlarged lymph adenoidal tissues. An epidemiologic study of 291 workers chronically exposed to caustic dusts for 30 years or more found no significant increase in mortality in relation to duration or intensity of such exposures.

SKIN CONTACT:

SODIUM HYDROXIDE:

CORROSIVE.

ACUTE EXPOSURE- Upon contact with the skin, damage including redness, cutaneous burns, skin fissures and white eschars may occur without immediate pain. Exposure to solutions as weak as 0.03 N (0.12%) for 1 hour has caused injury to healthy skin. With solutions of 0.4-4%, irritation does not occur until after several hours. Solutions of 25-50% caused no sensation of irritation within 3 minutes in human subjects. Skin biopsies from human subjects having 1 N sodium hydroxide applied to their arms for 15 to 180 minutes showed progressive changes beginning with dissolution of the cells in the horny layer and progressing through edema to total destruction of the epidermis in 60 minutes. A 5% aqueous solution caused severe necrosis to the skin of rabbits when applied for 4 hours. Alkalies penetrate the skin slowly. The extent of injury depends on the duration of contact. If sodium hydroxide is 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. Pathologic findings due to alkalies may include gelatinous, necrotic areas at the site of contact.

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)

CHRONIC EXPOSURE- Effects are dependent upon concentration and duration of exposure. Dermatitis or effects similar to those for acute exposure may occur.

EYE CONTACT:

SODIUM HYDROXIDE:

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. Blindness may occur.

CHRONIC EXPOSURE- Effects are dependent upon concentration and duration of exposure. Conjunctivitis or effects similar to those for acute exposure may occur.

INGESTION:

SODIUM HYDROXIDE:

CORROSIVE/TOXIC.

ACUTE EXPOSURE- The reported lethal dose in rats is 140-340 mg/kg. Ingestion may cause a burning sensation in the mouth, corrosion of the lips, mouth, tongue and pharynx, and severe esophageal and abdominal pain, vomiting of blood and large pieces of mucosa, and bloody diarrhea. Asphyxia can occur from swelling of the throat. Mediastinitis, alkalemia, pallor, weak, slow pulse, cardiovascular collapse, shock, coma and death may occur. Perforation of the alimentary tract and constrictive scarring may result. Esophageal stricture may occur weeks, months, or even years later to make swallowing difficult. The estimated fatal dose in man is 5 grams. Cases of squamous cell carcinoma of the esophagus have occurred with latent periods of 12 to 42 years after ingestion. These cancers were believed to be sequela of tissue destruction and possibly scar formation rather than the result of direct carcinogenic action of sodium hydroxide.

CHRONIC EXPOSURE- Depending on the concentration, repeated ingestion of alkaline substances may result in inflammatory and ulcerative effects on the oral mucous membranes and other effects as with acute ingestion.

SECTION 12 - ECOLOGICAL INFORMATION

Ecological information is not yet available for this record

SECTION 13 - DISPOSAL CONSIDERATIONS

Observe all federal, state and local regulations when storing or disposing of this substance.

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262. EPA Hazardous Waste Number D002. 100 pound CERCLA Section 103 Reportable Quantity.

SECTION 14 - TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Sodium hydroxide, solid-UN 1823

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
8 - Corrosive material

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101 AND SUBPART E:
Corrosive

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.154

Attachment C Material Safety Data Sheet 50% Sodium Hydroxide (Continued)

NON-BULK PACKAGING: 49 CFR 173.212

BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:

PASSENGER AIRCRAFT OR RAILCAR: 15 kg

CARGO AIRCRAFT ONLY: 50 kg

SECTION 15 - REGULATORY INFORMATION

TSCA Status : Y

SARA Section 302 (40 CFR 355.30) : N TPQ

SARA Section 304 (40 CFR 355.40) : N RQ

SARA Section 313 (40 CFR 372.65) : N

California Prop 65 Status : N

SARA ACUTE Hazard : Y

SARA CHRONIC Hazard : N

SARA FIRE Hazard : N

SARA REACTIVITY Hazard : Y

SARA SUDDEN RELEASE Hazard : N

SECTION 16 - OTHER INFORMATION

No other information is currently available for this record

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide

OHS/MDL Record Number : OHSIA348
MATERIAL SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MDL Information Systems, Inc. FOR EMERGENCY SOURCE INFORMATION
14600 Catalina Street CONTACT: 1-615-386-2000 in USA
San Leandro CA 94577
1-800-635-0064 (Toll Free) or
1-510-895-1313

SUBSTANCE: HYDROGEN PEROXIDE

TRADE NAME/SYNONYM(S): DIHYDROGEN DIOXIDE (SOLUTION)

CHEMICAL FAMILY: Mixture

SUMMARY SHEET AVAILABLE: Y

CREATION DATE: 19931124 REVISED: 19960619 CHEM CHANGE DATE: 19960109

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS

- 1) Component Substance: HYDROGEN PEROXIDE, SOLUTIONS
Component Percent: Range 25-35 %
CAS Registry Number: 7722-84-1
Component SARA 302 TPQ: 1000
Component SARA 304 RC: 000000001
2) Component Substance: WATER
Component Percent: Range 65-75 %

SECTION 3 - HAZARDS IDENTIFICATION

NFPA Ratings (scale 0-4): Health=2 Fire=0 Reactivity=0

EMERGENCY OVERVIEW:

DESCRIPTION: Clear, colorless liquid.

STATEMENT OF HAZARDS:

Harmful if inhaled or swallowed. Causes skin burns and severe burns to mucous membranes. Causes respiratory tract and eye irritation, possibly severe.

PRECAUTIONARY STATEMENTS:

Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Keep from contact with clothing and other combustible materials. Store away from combustible materials. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS

INHALATION:

SHORT TERM EFFECTS: May be harmful if inhaled. May cause irritation, possibly severe. Additional effects may include vomiting, diarrhea, chest pain, shortness of breath, wheezing, headache, dizziness, numbness, twitching, lung congestion, convulsions and shock.

LONG TERM EFFECTS: May cause effects as in short term exposure. Additional effects may include hearing.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation, possibly severe. Additional effects may include tingling sensation.

LONG TERM EFFECTS: May cause effects as reported in long term exposure. Same effects as short term exposure.

EYE CONTACT:

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

SHORT TERM EFFECTS: May cause irritation, possibly severe. Additional effects may include tearing and blindness.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May be harmful if swallowed. May cause burns. Additional effects may include fever, nausea, vomiting, diarrhea, stomach pain and chest pain.

LONG TERM EFFECTS: May cause effects as in short term exposure. Additional effects may include kidney damage. May also cause tumors.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4 - FIRST AID MEASURES

INHALATION:

FIRST AID- If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep the person warm and at rest. Call a physician. In the event that an individual inhales enough product to lose consciousness, person should be moved to fresh air immediately. If breathing has stopped, artificial respiration should be given immediately. In all cases, ensure adequate ventilation and provide respiratory protection before the person returns to work.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). If burns occur, proceed with the following: Cover affected area securely with sterile, dry, loose-fitting dressing. Treat symptomatically and supportively. Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Continue irrigating with normal saline until the pH has returned to normal (30-60 minutes). Cover with sterile bandages. Get medical attention immediately.

INGESTION:

FIRST AID- If the person is conscious and not convulsing, give 2-4 glasses of water to dilute the chemical. Use gastric tube to relieve the pressure caused by evolved oxygen (Dreisbach, Handbook of Poisoning, 12th Ed.). Treat symptomatically and supportively. Intubation should be performed by qualified medical personnel. Get medical attention immediately.

SECTION 5 - FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard when exposed to heat or flame.

Oxidizer: Oxidizers decompose, especially when heated, to yield oxygen or other gases which will increase the burning rate of combustible matter.

Contact with easily oxidizable, organic, or other combustible materials may result in ignition, violent combustion or explosion.

EXTINGUISHING MEDIA:

Water

Do not use dry chemical, carbon dioxide or halon.

(1993 Emergency Response Guidebook, RSPA P 5800.6).

For larger fires, flood area with water from a distance

(1993 Emergency Response Guidebook, RSPA P 5800.6).

FIRE FIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1993 Emergency Response Guidebook, RSPA P 5800.6, Guide Page 45). Flood with water.

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

Cool containers with flooding amounts of water from as far a distance as possible. Avoid breathing corrosive vapors or dusts. If fire is uncontrollable, evacuate for a radius of 2500 feet.

FLASH POINT: Not applicable

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include oxygen.

SECTION 6 - ACCIDENTAL RELEASE MEASURES**OCCUPATIONAL SPILL:**

Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch spilled material. Stop leak if you can do it without risk. Use water spray to reduce vapors. Do not get water inside 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, flush area with flooding amounts of water. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry.

Reportable Quantity (RQ): The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity established for that substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

HYDROGEN PEROXIDE (Olin Corporation has reported the following): Remove all ignition sources. Do not place spilled materials back in their original containers.

SECTION 7 - HANDLING AND STORAGE

Observe all federal, state and local regulations when storing or disposing of this substance.

Consult NFPA publication 43A, Storage of Liquid and Solid Oxidizing Materials, for Storage Requirements.

Store in a cool, dry, well ventilated area.

Do not store near heat or flame.

Protect from light.

Shelf life is 12 months.

Store below 100 F.

Store away from incompatible substances.

SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION**EXPOSURE LIMITS:****HYDROGEN PEROXIDE:**

1 ppm (1.4 mg/m³) OSHA TWA

1 ppm (1.4 mg/m³) ACGIH TWA

ACGIH A3-Animal Carcinogen (Proposed Addition 1995-96)

1 ppm (1.4 mg/m³) NIOSH recommended 10 hour TWA

1 ppm (1.4 mg/m³) DFG MAK TWA;

2 ppm (2.8 mg/m³) DFG MAK 5 minute peak, momentary value, 8 times/shift

HYDROGEN PEROXIDE (GREATER THAN 52%):

1000 pounds SARA Section 302 Threshold Planning Quantity

1 pound SARA Section 304 Reportable Quantity

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

7500 pounds OSHA Process Safety Management Threshold Quantity

VENTILATION:

Provide local exhaust ventilation system to meet published exposure limits.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles with or without a faceshield to prevent contact with this substance. Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use. CLOTHING: Employee must wear appropriate protective (impervious) 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.

RECOMMENDED MATERIAL TYPES:

Natural rubber

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z. The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

HYDROGEN PEROXIDE:

10 ppm- Any supplied-air respirator.

25 ppm- Any supplied-air respirator operated in a continuous-flow mode.

50 ppm- Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

75 ppm- Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Escape- Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against this compound. Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Clear, colorless liquid.

PHYSICAL STATE (S,L,G): L

BOILING POINT: 223 F (106 C) (30% solution)

MELTING POINT: -15 F (-26 C)

SPECIFIC GRAVITY: 1.113 (30% solution)

pH: 3.3 (30% solution)

VAPOR PRESSURE: 25 mmHg @ 30 C

VOLATILITY: 100%

WATER SOLUBILITY: Complete

SECTION 10 - STABILITY AND REACTIVITY**REACTIVITY:**

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

May ignite other combustible materials (wood, paper, oil, etc.). Reaction with fuels may be violent. Flammable poisonous gases may accumulate in tanks and hopper cars. Runoff to sewer may create fire or explosion hazard.

INCOMPATIBILITIES:

HYDROGEN PEROXIDE (Olin Corporation has reported the following):

BACOC: May generate oxygen gas and high pressure.

COMBUSTIBLE MATERIALS: Incompatible.

METALS: May generate oxygen gas and high pressure.

ORGANIC MATERIALS: Incompatible.

OXIDIZABLE MATERIALS: Incompatible.

METAL SALTS: May generate oxygen gas and high pressure.

SOLVENTS: May generate oxygen gas and high pressure.

HYDROGEN PEROXIDE:

ACETALDEHYDE: Forms explosive compound.

ACETIC ACID: Forms explosive compound.

ACETONE: Explosion.

ALCOHOLS: May form explosive compounds.

BENZENESULFONIC ANHYDRIDE: Explosive decomposition.

CARBOXYLIC ACIDS: Form explosive peroxyacids.

CHLOROSULFONIC ACID: May form explosive compound.

CHLORINE + POTASSIUM HYDROXIDE: Reacts with red luminescence.

COMBUSTIBLE MATERIALS: May accelerate the burning rate, or cause ignition or explosion on contact.

DIETHYL ETHER: Explosive mixture.

DIMETHYLPHENYLPHOSPHINE: Violent reaction on rapid mixing.

DIPHENYL DISELENIDE: May form explosive compound.

ETHANOL: Explosion.

GADOLINIUM HYDROXIDE: Forms explosive compound.

HYDROGEN SELENIDE: Rapid interaction.

KETENE: Forms explosive compound.

KETONES + NITRIC ACID: May form explosive compounds.

LITHIUM TETRAHYDROALUMINATE: Explosive mixture.

METALS (+ ALLOYS): May catalyze violent, exothermic decomposition.

METAL OXIDES: Vigorous or violent reaction.

METAL SALTS: May catalyze violent, exothermic decomposition.

NITRIC ACID + THIOUREA: Formation of explosive compound.

NITRIC ACID: Unstable mixture when more than 50% acid is present.

NITROGENOUS BASES: Explosion hazard.

ORGANIC COMPOUNDS: Under certain circumstances, may ignite or form detonable

mixtures. The presence of a catalyst may increase the risk of a reaction.

OXYGENATED COMPOUNDS + WATER: May form detonable mixtures.

PHENYLSELENOKETONES: Strong, exothermic reaction.

PHOSPHOROUS: Violent reaction if heated.

PHOSPHOROUS(V) OXIDE: Extremely violent reaction.

POTASSIUM: Violent reaction.

POTASSIUM PERMANGANATE: Violent reaction.

REDUCING AGENTS: Fire and explosion hazard.

SODIUM: Violent reaction.

TETRAHYDROTHIOPENE: May form explosive compound.

SULFURIC ACID: Explosion hazard if heated to dryness.

TIN(II) CHLORIDE: Exothermic reaction.

WOOD: Possible ignition.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include oxygen.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

SECTION 11 - TOXICOLOGICAL INFORMATION

HYDROGEN PEROXIDE (Olin Corporation has reported the following*):

CARCINOGEN STATUS: None.*

ACUTE TOXICITY LEVEL: No data available.

TARGET EFFECTS: Poisoning may affect the eyes, mucous membranes, respiratory tract, tissues, and lungs.*

AT INCREASED RISK FROM EXPOSURE: Persons with asthma and other respiratory diseases, skin or eye disorders.*

ADDITIONAL DATA: Harmful if inhaled, swallowed, and exposed to skin or eyes.*

HYDROGEN PEROXIDE:

TOXICITY DATA:

90%: 2 gm/m³/4 hours inhalation-rat LC50; 227 ppm inhalation-mouse LCLo;

500 mg/kg skin-rabbit LDLo; 4060 mg/kg skin-rat LD50; 2 gm/kg skin-pig

LDLo; 2 gm/kg oral-mouse LD50; 15 gm/kg intravenous-rabbit LD50;

>2000 ppm/8 hours inhalation-rat LC50 (Van Waters & Rogers MSDS);

mutagenic data (RTECS); tumorigenic data (RTECS).

75%: 75 mg/kg oral-rat LD50 (Van Waters & Rogers MSDS).

70%: 9200 mg/kg skin-rabbit LD50 (Van Waters & Rogers MSDS).

35%: 2000 mg/m³/4 hours inhalation-rat LC50 (CII MSDS).

30%: 1429 mg/kg oral-man LDLo; 2626 ug/kg oral-woman LDLo; 1200 mg/kg

oral-woman TDLo; >50 gm/kg intravenous-mouse LD50; mutagenic data

(RTECS); tumorigenic data (RTECS).

27-52%: 100 ppm inhalation-rat LCLo (GE MSDS).

8-20%: 1518 mg/kg oral-rat LD50; reproductive effects data (RTECS).

3%: 2000 mg/m³/4 hours inhalation-rat LC50; 2 g/kg oral-rat LD50 (Caledon MSDS).

CARCINOGEN STATUS: Animal Limited Evidence (IARC Group-3). Oral administration in mice resulted in adenomas and carcinomas of the duodenum.

Other studies indicated that hydrogen peroxide has no tumor promoting activity.

LOCAL EFFECTS: Corrosive- inhalation, skin, eyes, ingestion.

ACUTE TOXICITY LEVEL: Toxic by inhalation and ingestion; slightly toxic by dermal absorption.

TARGET EFFECTS: No data available.

AT INCREASED RISK FROM EXPOSURE: Persons with impaired pulmonary function or skin or eye disorders.

HEALTH EFFECTS

INHALATION:

HYDROGEN PEROXIDE (Olin Corporation has reported the following):

ACUTE EXPOSURE- Vapors and mist may cause irritation and inflammation of the nose, mouth, throat and respiratory tract. Pulmonary edema may develop and may cause shortness of breath, wheezing, choking, chest pain and impairment of lung function. Effects may be delayed for several hours.

CHRONIC EXPOSURE- May cause bleaching of the hair and impairment of lung function.

HYDROGEN PEROXIDE:

CORROSIVE/TOXIC.

75 ppm Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- Vapor or mist may cause severe irritation of the respiratory tract. 10% may cause sore throat, coughing, and shortness of breath; above 30% breathing may become labored. Severe systemic poisoning may result in headache, dizziness, vomiting, diarrhea, tremors, irritability, insomnia, hyper-reflexia, numbness, convulsions, unconsciousness, shock, and death.

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

Respiratory damage may range from mild bronchitis to pulmonary edema and effects may be delayed for several hours.

CHRONIC EXPOSURE- Dogs exposed to 7 ppm of 90% solution for 6 hours a day 5 days a week for 6 months showed no effects for the first 23 weeks. After week 23 they exhibited coughing, lacrimation, and bleached hair. Autopsy showed thickening of the skin with no hair follicle destruction, and irritation of the lungs. Rabbits exposed to 22 ppm for 3 months exhibited bleached hair and irritation around the nose.

SKIN CONTACT:

HYDROGEN PEROXIDE (Olin Corporation has reported the following):

ACUTE EXPOSURE- May cause severe irritation and/or burns characterized by a tingling sensation, redness, swelling, and whitening of the skin. Prolonged exposure may cause destruction of the dermis with ulceration.

CHRONIC EXPOSURE- Effects from chronic exposure would be similar to those from single exposure except for effects secondary to tissue destruction.

HYDROGEN PEROXIDE:**CORROSIVE.**

ACUTE EXPOSURE- Vapor or mist may be irritating to the skin. A 6% solution is a weak irritant. Contact with low concentrations of the liquid may cause tingling and whitening of the skin. If not removed, erythema or vesicle formation may occur. High concentrations may cause severe burns with ulceration. There are inconclusive or unverified reports of human sensitization.

CHRONIC EXPOSURE- Effects depend on the concentration and duration of exposure. Repeated or prolonged contact with corrosive substances may cause dermatitis or effects similar to acute exposure.

EYE CONTACT:

HYDROGEN PEROXIDE (Olin Corporation has reported the following): May cause severe irritation and/or burns. Direct contact may cause impairment of vision and corneal damage.

HYDROGEN PEROXIDE:**CORROSIVE.**

ACUTE EXPOSURE- Vapors may cause redness, stinging, tearing and blurred vision. The liquid may cause severe corneal or conjunctival ulceration, possibly resulting in blindness. Effects may be delayed. In rabbit eyes, 0.5% caused disturbances in the corneal epithelium which returned to normal in 24 hours; 5% caused severe corneal edema, flare in the aqueous, intense congestion of the iris and vascularization of the cornea with only partial improvement after 4-5 months; 5-30% caused corneal clouding which was persistent at concentrations >10%.

CHRONIC EXPOSURE- Effects depend on the concentration and duration of exposure. Repeated or prolonged exposure to corrosive substances may cause conjunctivitis or effects similar to acute exposure. Rabbits exposed to 7 ppm for 10 weeks exhibited no corneal damage.

INGESTION:

HYDROGEN PEROXIDE (Olin Corporation has reported the following):

ACUTE EXPOSURE- May cause irritation and/or burns to the entire gastrointestinal tract, including the stomach and intestines, characterized by nausea, vomiting, diarrhea, abdominal pain, bleeding, and/or tissue ulceration. May cause severe damage to the gastrointestinal tract with the potential to cause perforation.

CHRONIC EXPOSURE- Effects would be similar to those from a single exposure.

HYDROGEN PEROXIDE:**CORROSIVE/TOXIC/LIMITED ANIMAL CARCINOGEN.**

ACUTE EXPOSURE- May cause severe irritation and injury to the mouth and throat, distention of the esophagus and stomach, and internal bleeding. 5 humans who ingested 50 ml of a 35% solution experienced stomach and chest pains, retention of breath, foaming at the mouth, and loss of consciousness. They later developed motor and sensory disorders, fever, microhemorrhages, and moderate leucocytosis; 1 developed pneumonia. All recovered in 2-3 weeks. The lethal dose reported in rats was 75 mg/kg of a 75% solution.

CHRONIC EXPOSURE- Growth retardation, induction of dental caries, and pathological changes in the periodontium were observed in young male rats receiving 1.5% hydrogen peroxide as their drinking fluid for 8 weeks. Treatment of mice for 35 weeks with 0.15% hydrogen peroxide resulted in hydropic degeneration of hepatic and renal tubular epithelial tissues, necrosis, inflammation, irregularities of tissue structure of the stomach wall and hypertrophy of the lymphatic tissue of the small intestine wall;

Attachment D Material Safety Data Sheet 30% Hydrogen Peroxide (Continued)

concentrations in excess of 1% resulted in a pronounced loss of body weight and death within 2 weeks. Repeated administration to mice and rats produced adenomas and carcinomas of the duodenum.

SECTION 12 - ECOLOGICAL INFORMATION

Ecological information is not yet available for this record

SECTION 13 - DISPOSAL CONSIDERATIONS

Observe all federal, state and local regulations when storing or disposing of this substance. Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262. EPA Hazardous Waste Number D001. 100 pound CERCLA Section 103 Reportable Quantity.

SECTION 14 - TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Hydrogen peroxide, aqueous solutions-UN 2014

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
5.1 - Oxidizer

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Oxidizer, corrosive

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: None
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.243

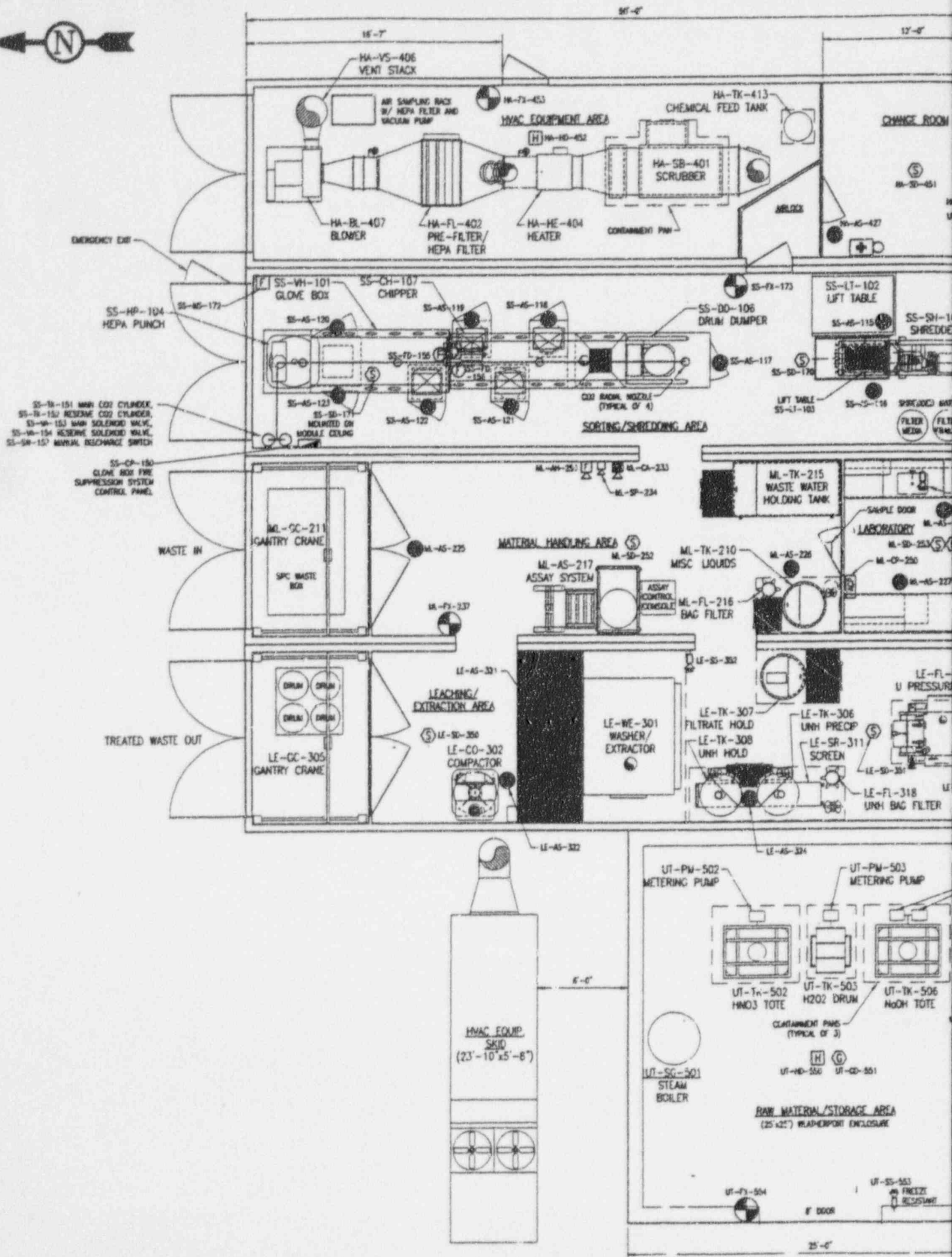
U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: Forbidden
CARGO AIRCRAFT ONLY: Forbidden

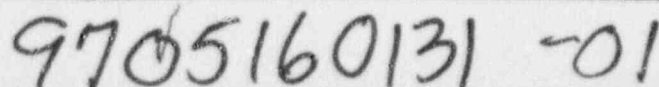
SECTION 15 - REGULATORY INFORMATION

TSCA Status : Y
SARA Section 302 (40 CFR 355.30) : Y TPQ
SARA Section 304 (40 CFR 355.40) : Y RQ
SARA Section 313 (40 CFR 372.65) : N
California Prop 65 Status : N
SARA ACUTE Hazard : Y
SARA CHRONIC Hazard : Y
SARA FIRE Hazard : Y
SARA REACTIVITY Hazard : N
SARA SUDDEN RELEASE Hazard : N

SECTION 16 - OTHER INFORMATION


No other information is currently available for this record








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
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 AIR SAMPLING STATION


 FIRE EXTINGUISHER, 10#. ABC


 HAND HELD EMERGENCY SHOWER/
EYEWASH STATION


 P.A. SPEAKER


 CRITICALITY ALARM HORN (OOGA)


 FIRST AID KIT & STRETCHER


 SMOKE DETECTOR


 HEAT DETECTOR, FIXED TEMPERATURE


 FIRE ALARM HORN


 MANUAL PULL STATION


 GAS DETECTOR

 GAS EMERGENCY SHUT OFF (BY SIEMENS)

 FIRE ALARM CONTROL PANEL

 GLOVE BOX FIRE SUPPRESSION SYSTEM CONTROL PANEL

 OPTICAL FIRE DETECTOR (MTD. IN GLOVE BOX)

 PROPANE GAS CONTROL PANEL (BY SIEMENS)

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A	1-22-87	PRELIMINARY DRAWING			
REV	DATE	DESCRIPTION	BY	CHK'D	APP'D

MERF

Modular Extraction/Recovery Facility

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JOHNSON CITY, TENNESSEE 37604
(423) 975-5568

SAFETY EQUIPMENT GENERAL ARRANGEMENT					
Scale 1/4" = 1'-0"	Drawn By M. D. WARD	Reviewed By -	Approved By J. D. BLACK		
Date 11-12-96	File No 050G0021	Job No SP02	Drawing No G002	Sheet No 1 OF 1	Rev

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