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ENVIRONMENTAL ASSESSMENT

FOR THE

SALE OF EXCESS LITHIUM HYDROXIDE

STORED AT THE OAK RIDGE K-25 SITE

AND THE

PORTSMOUTH GASEOUS DIFFUSION PLANT

APRIL 1993

**U.S. Department of Energy Oak Ridge Operations Office
Oak Ridge, Tennessee**

Office of Defense Programs

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**SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
OAK RIDGE, TENNESSEE**

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

Al	aluminum
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cu	copper
DOC	Department of Commerce
DOE	Department of Energy
DOJ	Department of Justice
DOT	Department of Transportation
Energy Systems	Martin Marietta Energy Systems, Inc.
EPA	Environmental Protection Agency
Fe	Iron
GSA	General Services Administration
lb	pound
⁶ Li	lithium-6 isotope
⁷ Li	lithium-7 isotope
LiCl	lithium chloride
LiOH	lithium hydroxide
LiOH•H ₂ O	lithium hydroxide monohydrate
M	million
NEPA	National Environmental Policy Act
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORR	Oak Ridge Reservation
PCB	polychlorinated biphenyl
PORTS	Portsmouth Gaseous Diffusion Plant
ppm	parts per million (milligrams per liter)
RCRA	Resource Conservation and Recovery Act
Si	silicon
TCLP	toxicity characteristics leaching procedure
TSCA	Toxic Substances Control Act
U.S.	United States

EXECUTIVE SUMMARY

This Environmental Assessment evaluates the Department of Energy's (DOE's) proposed sale of 80 million (M) lbs of government surplus lithium hydroxide monohydrate ($\text{LiOH} \cdot \text{H}_2\text{O}$, referred to in this summary as LiOH) and three alternatives to the proposed action. The LiOH is proposed to be sold by competitive bid in various size lots in several sales over a 1- to 3-year time period. The proposed sale is to be restricted to United States purchasers. DOE, the Department of Justice, and the Department of Commerce have approved the proposed sale format. The LiOH is comprised of unprocessed (virgin) and processed (depleted) LiOH. The virgin LiOH and depleted LiOH are stored at DOE's K-25 Site in Oak Ridge, Tennessee, and Portsmouth Gaseous Diffusion Plant near Piketon, Ohio, respectively. Depleted LiOH contains approximately 2 to 15 parts per million (ppm) of mercury, compared to approximately 0.100 ppm in the virgin LiOH. During storage, both the depleted and virgin LiOH have undergone chemical and physical transformations. The material has absorbed carbon dioxide and, due to the hygroscopic nature of LiOH, it has absorbed moisture from the air which has converted the once free-flowing powder into a solid monolithic block. Even under the best of sealing conditions, the LiOH will become severely lumped. Therefore, it is not expected that any of the LiOH storage drums will contain free-flowing LiOH. As a result of these changes in the LiOH characteristics, LiOH will require some form of processing to produce a commercial grade of clean free-flowing LiOH. An analysis of the potential uses for the DOE surplus LiOH concluded that the most effective use of the LiOH would be to convert it to a commercial grade of clean, free-flowing LiOH. The surplus LiOH may be used to produce commercial grade LiOH in the normal course of lithium production.

The Ohio Environmental Protection Agency (OEPA) issued a notice of violation to DOE Portsmouth stating that DOE had not evaluated the surplus lithium hydroxide for hazardous waste characteristics because of mercury content. In follow-up discussions between DOE and OEPA, both parties agreed to the benefits of returning the depleted LiOH to the commercial sector. OEPA maintained that the depleted LiOH was a solid waste and a potentially hazardous waste due to mercury content. Conversely, DOE did not concede that the depleted LiOH was subject to regulation as a solid waste. However, to resolve the impasse, DOE submitted to OEPA (October 8, 1992) at OEPA's suggestion, a variance request from classification as waste for the depleted LiOH in accordance with the provisions of the Ohio Administrative Code. OEPA responded that, if a buyer exists with plans to purchase the LiOH for use as a raw material in a production process, OEPA would not consider the material to be a waste. OEPA directed that DOE does not have to wait for a disposition on the variance request in order to proceed with sales of this material. Companies have expressed interest in purchasing the material for use as a raw material in their processes.

Transportation risk was analyzed because of the quantity and potentially hazardous nature of the LiOH requiring transportation. The LiOH is currently packed in polyethylene-lined Department of Transportation (DOT)-approved drums for storage and future transportation. Approximately 2,369 total truck

shipments are required to transport the surplus LiOH to the buyer's locations. The accident risk analysis predicts between 3.5 and 17.6 accidents during transportation of the entire 80M lbs of LiOH. The calculated probability for hazardous material spills to result from the predicted accidents ranges from 0.7 to 3.5. No data are available addressing the severity or quantity of the potential spill events. Most states and many local governments have hazardous material spill emergency response teams that would be capable of containing and cleaning up these releases. Compared to spills of other hazardous materials, LiOH spills do not present any unique cleanup problems. Additionally, due to the solidified nature of the LiOH, dispersion of the LiOH during a spill event would be limited. Similar calculations performed for rail travel predict 17.7 accidents with 3.6 accidents resulting in spills. It should be noted that conservative models were used for the accident and spill predictions (i.e., the assumptions and data used in the accident prediction model will err on the high side).

The alternatives to the proposed action are:

1. *Hold separate sales for the depleted and virgin LiOH.* The virgin LiOH is a more valuable and marketable commodity since it does not contain elevated levels of mercury, requiring processing equipment that some potential buyers may not possess to remove the mercury. Segregation and sale of the virgin LiOH has the potential to attract additional buyers. This could possibly result in a higher purchase price and expedited removal of virgin LiOH, compared to a combined sale of virgin and depleted LiOH.
2. *Extend the sales period over several years.* This would smooth out the potential marketplace impacts of introducing upwards of 80M lb of LiOH in a one- to three-year period. However, DOE would be incurring storage costs of approximately \$1M/year, and critically needed space at the K-25 Site would remain unavailable. The OEPA variance would be required to be renewed on an annual basis until the depleted stock is sold.
3. *Continue to store the LiOH at the two sites and sell the material in small lots over an extended period of time (no action alternative).* Significant maintenance and storage costs would be incurred with this alternative. DOE would continue to be exposed to potential environmental liabilities from the storage of large quantities of surplus LiOH and would be required to renew the OEPA variance for the depleted LiOH on an annual basis. In effect, DOE would remain the custodian of the LiOH for at least 50 years, based on the past history of restricted sales.

1. INTRODUCTION

1.1 PURPOSE AND NEED

The Department of Energy (DOE) has in storage approximately 80 million (M) pounds (lbs) of surplus lithium hydroxide monohydrate ($\text{LiOH} \cdot \text{H}_2\text{O}$, referred to in this document as LiOH). This material is no longer required for Federal activities but is worth tens of millions of dollars in the commercial market. To limit potential environmental liabilities associated with the storage of large quantities of LiOH (primarily as a result of spills), to free critically needed storage space, to reduce storage and maintenance costs currently estimated at \$1M a year (Spence 1992), and to generate revenue for the Federal government, DOE proposes to sell the surplus LiOH on the United States open market.

1.2 BACKGROUND

In the early 1950s, the U. S. Atomic Energy Commission (DOE's predecessor) purchased lithium hydroxide monohydrate, a granular, free-flowing, and strongly caustic powder (Stecher 1968), for a process that removes the lithium-6 (^6Li) isotope for use in a weapons production program at the Y-12 Plant in Oak Ridge, Tennessee. The production program was in effect from 1955 to 1963 and involved a chemical exchange process in which an LiOH solution contacted mercury in a stagewise separation process. One of the isotopes preferentially forms an amalgam with the mercury, resulting in one stream enriched in ^6Li and another enriched in lithium-7 (^7Li). The amalgam is then electrolytically separated to again produce LiOH. The ^6Li was used by DOE for defense purposes, and the depleted LiOH was stockpiled (DOE 1992c) along with the unprocessed (virgin) LiOH. The LiOH used in the lithium isotope separation process contains less than 2.5 percent of ^6Li isotope compared to the unprocessed LiOH, which is comprised of approximately 7 percent ^6Li and 93 percent ^7Li isotopes. During the lithium isotope separation process, not all the mercury was extracted from the recovered (depleted) LiOH. The depleted LiOH contains approximately 2 to 15 parts per million (ppm), compared to less than 0.100 ppm for the virgin LiOH (Y-12 Plant Laboratory 1986). Additionally, the depleted LiOH contains higher levels of aluminum (Al), copper (Cu), iron (Fe), and silicon (Si) compared to the virgin LiOH (Y-12 Plant Laboratory 1986). Upon termination of the program, the virgin LiOH, as well as the depleted LiOH material, was stored. The virgin LiOH was stored at DOE's Oak Ridge Reservation (ORR) K-25 Site, formerly known as the Oak Ridge Gaseous Diffusion Plant (Figs. 1.1 and 1.2). Due to lack of space at ORR, the depleted LiOH was transported and stored at DOE's Portsmouth Gaseous Diffusion Plant (PORTS) (Figs. 1.3 and 1.4).

Fig. 1.1. Map showing location of Oak Ridge and the ORR in relationship to geographic region.

Fig. 1.2. Location of the K-25 Site in relation to Oak Ridge.

Fig. 1.3. Location of the Ohio DOE site.

Fig. 1.4. Location of the PORTS in relation to the geographic region.

In fiscal years 1965 and 1974, approximately 13M lb and 80M lb, respectively, of the LiOH stockpile were declared excess by the Atomic Energy Commission and transferred to the General Services Administration (GSA). The GSA subsequently declared the LiOH surplus to government needs and offered it for sale. The GSA negotiated a sale with the two dominant U. S. commercial lithium producers in 1974. However, the Department of Justice (DOJ) did not approve the contracts because of antitrust and marketing strategy concerns. Between 1965 and 1987, GSA was able to sell only 13M lb of the PORTS surplus LiOH (Wynn 1992a) because of the Department of Commerce (DOC)-mandated sales limitations, the presence of mercury in the depleted LiOH (Lynch 1986), and a limited market. Desiring to diminish environmental vulnerability (Cochran 1984), free up badly needed storage space, and reduce storage costs, DOE petitioned GSA to delegate to DOE the authority to sell the surplus LiOH. DOE succeeded in its petition and since 1988 has worked with DOJ and DOC to develop an expedited sale plan. DOE, DOJ and DOC agreed to the sale format (12/88).

Both the virgin and depleted LiOH were stored in their original packaging of polyethylene-lined fiber drums. Due to the extended storage time, the drums deteriorated because of age, the corrosive nature of the LiOH, and damage during movement between storage sites. Therefore, in 1985 DOE initiated an effort to re-drum the material. At K-25, each fiber drum of virgin LiOH was placed into a new DOT-approved 80-gal polyethylene-lined overpack steel drum. K-25 personnel repacked 55,470 drums weighing between 425 and 440 lb with an approximate combined weight of 23,594,520 lb (Milligan 1986). PORTS repacked the depleted LiOH in two sizes of new DOT-approved, polyethylene-lined overpack steel drums, 78 and 90 gal, respectively. Approximately 134,000 drums of depleted LiOH, with a combined weight of 57M lb, are proposed for sale from the PORTS inventory. The repacking effort was completed on September 30, 1988, at an approximate cost of \$16M to the Federal government. Included in the cost was the refurbishment of four existing storage facilities as well as construction of three new storage buildings at PORTS.

During storage, both the depleted and virgin LiOH has undergone chemical and physical transformations. The material has absorbed carbon dioxide and contains approximately 0.5 percent by weight, which exceeds current specifications for the commercial LiOH product, compared to a typical weight specification of 0.22 percent as originally procured (Brown 1992). Due to the hygroscopic nature of LiOH, it has absorbed moisture from the air which has converted the once free-flowing powder into a partially solid to solid monolithic block (DOE 1992c). Even under the best of sealing conditions, the LiOH would still become severely lumped (Brown 1992). Therefore, it is not expected that any of the LiOH storage drums would contain free-flowing LiOH. As a result of these changes in the LiOH characteristics and the mercury contained in the depleted LiOH, both the depleted and virgin LiOH would require processing prior to further use. An analysis of the potential uses for the DOE surplus LiOH concluded that the most effective use of the LiOH would be to convert it to a commercial grade of clean, free-flowing LiOH (Brown 1992). The surplus LiOH may be used to produce commercial grade LiOH in the normal course of lithium production (Brown 1992).

2. PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to offer for sale by competitive bid restricted to United States purchasers (Wynn 1992b) approximately 80M lb of government surplus lithium hydroxide monohydrate. The proposed sale and interest response request would be published in the Commerce Business Daily. Responding firms would be invited to a question-and-answer conference. Prior to the proposed sale, LiOH samples would be available and provided to those potential buyers requesting samples. Twenty-three million pounds of surplus virgin LiOH is stored at DOE's Oak Ridge K-25 Site, Oak Ridge, Tennessee (Figs. 1.1 and 1.2) and 57M lb of surplus depleted LiOH is stored at PORTS near Piketon, Ohio (Figs. 1.3 and 1.4). Both facilities are operated by Martin Marietta Energy Systems, Inc. (Energy Systems) under contract to DOE. The proposed sale is to occur over several different time periods within a one- to three-year period (Wynn 1992b). The first proposed sale would be comprised of approximately 30M lb of depleted LiOH in assorted-size allotments ranging from 10,000 to 10,000,000 lb (DOE 1989a). LiOH would be sold "where is-as is" and awarded to the highest bidder for each lot. Prior to the proposed sale, the LiOH would be screened for radioactive contamination. This procedure is standard practice to ensure that radionuclide-contaminated materials are not inadvertently released to the public (Eaker 1992b). To limit potential liabilities, DOE would verify that all potential buyers are capable of extracting and handling the mercury in a legally prescribed manner, and would be required to assume liability for the proper treatment and disposition of the LiOH-derived mercury (see p. 17). Energy Systems, DOE's agent for the sale, would load the LiOH into buyer-provided transportation vehicles for delivery. LiOH buyers would be required to remove their LiOH on a schedule determined by the quantity purchased. The conditions for the proposed sale were discussed and mutually agreed to by DOE, DOJ, and DOC (DOE 1989a). The lot sizes and conditions for the proposed sale are expected to be similar to the originally proposed sales lot sizes and those data are presented in Table 2.1. The remaining 50M lb would be sold under the same conditions as proposed for the first sale.

Table 2.1. Specified lot sizes agreed to by the Departments of Energy, Justice, and Commerce

Lot Number	Pounds	Lot Number	Pounds
1	10,000 to 50,000	9	500,000
2	10,000 to 50,000	10	500,000
3	10,000 to 50,000	11	1,000,000
4	10,000 to 50,000	12	1,000,000
5	100,000	13	1,000,000
6	100,000	14	5,000,000
7	100,000	15	10,000,000
8	500,000	16	10,000,000

These quantities would be offered under the sale, and each award would be accepted based on the highest price for any individual lot. Lots 1-4 would allow bids on any quantity from 10,000 to 50,000 lb. For lots 5-16, bids would be accepted only on full lot quantities.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

2.2.1 Separate Sales for the Virgin LiOH and Depleted LiOH

The virgin LiOH and depleted LiOH could be sold as separate actions. The virgin LiOH is a more valuable and marketable commodity since it does not contain the level of mercury as the depleted LiOH. Additionally, if the virgin LiOH is sold first, it would allow K-25 to free badly needed storage space, whereas space at PORTS would not be required for several years (Eaker 1992a). Realistically, the United States LiOH primary producers, Cyprus Foote Mineral Company and FMC Corporation, Lithium Division, may be the only bidders for either material due to the processing requirements. For example, lithium grease manufacturers who in the past purchased some of the virgin LiOH were unable to use it due to lithium carbonate contamination and eventually sold the LiOH to a lithium producer for conversion to regular commercial grade LiOH (Brown 1992).

2.2.2 Extended Sales Period

The number of proposed sales could be increased in number and extended over a period of years. This would smooth out the potential effects on the marketplace of introducing upwards of 80M lb of LiOH in a 1- to 3-year period. Marketplace consumption of lithium materials in 1986 was approximately 80.2M lb, which included approximately 16.8M lb of LiOH. A 1995 projection of the market demand for lithium materials indicates an estimated total consumption of 100M lb, including 21.7M lb of LiOH. Therefore, the 80M lb of LiOH DOE proposes to sell over a three-year period represents approximately four years of market consumption (SRI 1987a).

2.2.3 No Action Alternative

The no action alternative is considered in accordance with NEPA regulations (40 CFR 1500-1508) and provides a baseline for comparison with the proposed action and alternatives. The no action alternative is to continue to store the LiOH at the K-25 Site and PORTS and to sell the material in small lots over an extended period of time. Based on previous sales history, DOE would continue to store surplus LiOH for a minimum of 50 years.

2.3 ALTERNATIVES CONSIDERED AND REJECTED

2.3.1 Alternative Storage Sites

Both onsite and offsite alternative LiOH storage sites were considered. Alternative storage sites could solve the immediate problem of freeing storage space at both the K-25 Site and PORTS but would not address the problems of reducing potential environmental liabilities, reducing storage and maintenance costs, and generating revenue for the Federal government from the sale of surplus material. Relocating the LiOH would involve substantial costs and needlessly increase the risk of spillage. Additionally, potentially significant environmental impacts may be associated with constructing, modifying, or using facilities at other locations.

2.3.2 LiOH Donation

While LiOH donation may expedite the LiOH removal, it is unrealistic. The LiOH is a valuable, marketable commodity that has the potential to generate tens of millions of dollars for the Federal government. Sale of the material may recover all or a substantial amount of the cost of the LiOH storage and repacking effort.

2.3.3 Disposal

Various disposal options were explored and addressed in a study requested by DOE, *Investigation of Lithium Hydroxide Disposal with Cost Estimates* (Munday 1987). The disposal options reviewed were above-ground storage, sanitary burial, hazardous burial, conversion to lithium chloride (LiCl) followed by hazardous burial, concrete fixation of LiOH, conversion to LiCl and concrete fixation of LiCl, dissolution, ocean disposal, conversion to an insoluble compound or alloy, fixation in glass, and neutralization followed by flushing into a stream. These alternatives were reviewed during preparation of this environmental assessment; all except the above-ground storage option were rejected as unreasonable because of two or more of the following: extremely high costs, legality of action, potentially severe environmental impacts, potential liability, and lack of any recovery of the value of the LiOH. The above-ground storage option is, in effect, the no action alternative.

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3. THE AFFECTED ENVIRONMENT

3.1 OAK RIDGE RESERVATION

The ORR contains three major operating facilities: Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, and Oak Ridge K-25 Site. The ORR is located within the corporate limits of the city of Oak Ridge in eastern Tennessee. The ORR consists of about 35,300 acres (14,300 hectares) of Federally-owned lands. The K-25 Site, the storage location for the virgin LiOH, is adjacent to the confluence of Poplar Creek with the Clinch River, approximately 10 miles (16.1 kilometers) west of downtown Oak Ridge, Tennessee, on a 1500-acre (607-hectare) tract. The surrounding area has a low population density and is approximately 35 percent farmland and 65 percent woodland. A wide variety of wildlife exists in the area surrounding the K-25 Site (Energy Systems 1989c, 1991). No Federally listed threatened or endangered plant or animal species are known to inhabit the ORR. However, there are several species listed by the State of Tennessee that inhabit the ORR (Kroodsma 1991; Parr 1991); these would not be affected by the proposed action or alternatives.

The original mission of the K-25 Site, production of enriched uranium hexafluoride, ceased in 1985. The K-25 Site now has a multipurpose function that includes housing many contractor central staff functions, operating waste treatment facilities, and serving as a center for applied technology. Waste management activities at the K-25 Site are increasing. Low-level radioactive wastes from other ORR operations are now being placed in the Building K-25 vaults until the final disposition strategy is identified. Also, polychlorinated biphenyl (PCB) wastes contaminated with uranium are incinerated in the K-1435 Toxic Substances Control Act (TSCA) incinerator (Energy Systems 1989c, 1991).

The virgin LiOH is stockpiled in the storage vaults building at the K-25 Site. This building is near the center of the K-25 Site. The storage vaults are easily accessible by truck, and normal loading can be accomplished.

3.2 PORTS

PORTS is located in sparsely populated rural southern Ohio on approximately 3800 acres (1538 hectares). The facility is approximately 1 mile (1.61 kilometers) east of the Scioto River Valley at an elevation approximately 120 ft. (36.6 meters) above the Scioto River floodplain, with the nearest community, Piketon, 3 miles (4.83 kilometers) northwest of the plant. Except for the Scioto River floodplain, which is farmed extensively for grain crops, marginal farmland and densely forested hills surround PORTS. Local fauna in the PORTS area are typical of southern Ohio (Energy Systems 1989b). No Federally listed threatened or endangered species have been observed on PORTS. An Ohio-protected species, the sharp-shinned hawk (*Accipiter striatus*), has been sighted occasionally (Kornegay 1991). This species would not be affected by the proposed action or alternatives.

PORTS' principal function is the separation of uranium isotopes through gaseous diffusion. Support operations include the feed and withdrawal of material from the primary process, treatment of water for both potability and cooling purposes, steam generation for heating purposes, decontamination of equipment removed from the plant for maintenance or replacement, recovery of uranium from various waste materials, and treatment of industrial wastes.

The depleted LiOH is stored in Buildings X744K, X744S, X744T, and X744U and in three pole barns specifically constructed to house the overflow from the LiOH repacking. These storage facilities are located in the southern and eastern portions of the complex. Each of the storage buildings is accessible by tractor-trailer, and normal loading can be accomplished.

4. ENVIRONMENTAL IMPACTS

The proposed action and each of the alternatives entail the sale of LiOH and subsequent loading of the LiOH drums onto buyer-provided transportation vehicles for delivery to the final destination. The building(s) where the LiOH is stored at each site are located in an industrial area where loading, off-loading, and transportation of hazardous cargo are common.

4.1 PHYSICAL ENVIRONMENT

4.1.1 Air Quality

4.1.1.1 Proposed action

No impacts to air quality have been identified. Transportation of 80M lb of LiOH would require approximately 694 and 1,675 truck shipments from K-25 and Portsmouth, respectively. Traffic congestion and subsequent vehicle exhaust emissions are unlikely to present a problem at the K-25 Site but may be noticeable at the PORTS facility. Effects of vehicle exhaust on air quality at PORTS would be minimized by dispatching trucks carrying LiOH during off-peak hours. Additionally, these trips would take place over a period of time, which should also reduce potential exhaust emission impacts on air quality.

4.1.1.2 Separate sales for the virgin and depleted LiOH

No impacts to air quality have been identified. Depending on the quantity of LiOH sold and transported at any one time, the effects on air quality are potentially the same as those discussed for the proposed action.

4.1.1.3 Extended sales period

No impacts to air quality have been identified. Depending on the quantity of LiOH sold and transported at any one time, the effects on air quality are potentially the same as those discussed for the proposed action.

4.1.1.4 No action alternative

No impacts to air quality have been identified. Due to the small number of LiOH sales under this alternative, it is highly unlikely that traffic congestion and associated transportation vehicle exhaust would be a problem at either site.

4.1.2 Geology, Topography, and Soils

4.1.2.1 Proposed action

There are no identified impacts to the geology, topography, or soils associated with the proposed action. The proposed action does not require any construction, modification, demolition of structures, or alteration of

terrain. The loading of LiOH onto transportation vehicles, LiOH delivery, and continued storage of LiOH would use existing paved roadways and storage facilities.

4.1.2.2 Separate sales for the virgin and depleted LiOH

There are no identified impacts to the geology, topography, or soils associated with this alternative (see Sect. 4.1.2.1).

4.1.2.3 Extended sales period

There are no identified impacts to the geology, topography, or soils associated with this alternative (see Sect. 4.1.2.1).

4.1.2.4 No action alternative

There are no identified impacts to the geology, topography, or soils associated with this alternative (see Sect. 4.1.2.1).

4.1.3 Hydrology and Water Quality

4.1.3.1 Proposed action

No identified impacts to hydrology and water quality are associated with the proposed action during normal loading operations. Due to the solidified nature of the LiOH, the consequence of a spill event occurring during loading operations at either facility would be highly localized in the industrial areas and relatively easy to contain and cleanup, and both sites have trained spill response personnel to minimize spill impacts. Both facilities have Spill Prevention Control and Countermeasure Plans in effect for LiOH storage and loading operations. The probability of transportation spill events, with potential impacts to water resources, is addressed in Sect. 4.3.7.

4.1.3.2 Separate sales for the virgin and depleted LiOH

There are no identified impacts to hydrology and water quality associated with this alternative (see Sect. 4.1.3.1).

4.1.3.3 Extended sales period

There are no identified impacts to hydrology and water quality associated with this alternative (see Sect. 4.1.3.1).

4.1.3.4 No action alternative

There are no identified impacts to hydrology and water quality associated with this alternative (see Sect. 4.1.3.1).

4.1.4 Noise

4.1.4.1 Proposed action

Potential noise impacts would be generated primarily from transportation vehicles on public highways (assuming truck transport) and should be minimal. Transportation vehicles are assumed to meet legal requirements for exhaust noise suppression. LiOH loading operations would take place within industrial settings at both the K-25 Site and PORTS and would not affect the environs at either facility.

4.1.4.2 Separate sales for the virgin and depleted LiOH

There are no identified noise impacts associated with this alternative (see Sect. 4.1.4.1).

4.1.4.3 Extended sales period

There are no identified noise impacts associated with this alternative (see Sect. 4.1.4.1).

4.1.4.4 No action alternative

There are no identified noise impacts associated with this alternative (see Sect. 4.1.4.1).

4.2 NATURAL ENVIRONMENT

4.2.1 Proposed Action

During normal operations, no impacts associated with the proposed action have been identified that would affect the ecology or threatened or endangered species at either the K-25 Site or the PORTS facility. Spills within the K-25 Site and the PORTS facility would be highly localized, confining any effects to within the industrial areas. Both sites have trained spill response personnel. Thus, spill impacts on natural resources would be avoided or minimized. Spill event probabilities during transport of the LiOH are addressed in Sect. 4.3.7.

4.2.2 Separate Sales for the Virgin LiOH and Depleted LiOH

Potential impacts are identical to the proposed action (see Sect. 4.2.1).

4.2.3 Extended Sales Period

Potential impacts are identical to the proposed action (see Sect. 4.2.1).

4.2.4 No Action Alternative

There are no identified impacts from this alternative.

4.3 MANMADE ENVIRONMENT

4.3.1 Archaeological and Historical Resources

4.3.1.1 Proposed action

The proposed action is within two industrial complexes and would not involve any road construction, excavation, building, or demolition activities. Therefore, no effects to archaeological or historical resources have been identified or are anticipated.

4.3.1.2 Separate sales for the virgin and depleted LiOH

There are no identified impacts from this alternative.

4.3.1.3 Extended sales period

There are no identified impacts from this alternative.

4.3.1.4 No action alternative

There are no identified impacts from this alternative.

4.3.2 Human Health and Safety

4.3.2.1 Proposed action

The 55,470 drums of LiOH stored at the K-25 Site and the estimated 134,000 surplus LiOH drums stored at PORTS are stacked three to four drums high on pallets. The LiOH is stored in DOT-approved polyethylene-level metal drums. Forklifts can be used at each site to load the pallets directly onto the transportation vehicles. The potential for an accident involving spillage of the material is a concern during loading, shipment, and off-loading. LiOH is a caustic solid and may cause chemical burns to the skin upon contact and to mucus membranes if inhaled. All drums at both sites are DOT-approved and were purchased new between 1985 and 1988. The drums have been in storage facilities protected from the elements and are in good condition. Accidents during loading or unloading would most likely involve puncturing a drum with

forklift tines or dropping a drum. Drum puncture would most likely result in minor spillage that could be readily cleaned up by trained personnel. Because both the virgin and depleted LiOH are partially to fully solidified (see Sect. 1.2), health hazards due to airborne emissions from a spill event would be less than from LiOH in powder state. The metal drums are in good condition and should be burst-resistant. Personnel loading the drums would be properly attired, trained, and knowledgeable about working with hazardous materials. Standard operating procedures for loading hazardous materials would be followed. Off-loading personnel are assumed to be similarly trained and familiar with the hazards of working with LiOH. Additionally, standard safety procedures must be followed on DOE sites. Prior to transport, drivers would be briefed on safety precautions to be followed during LiOH transport. It should be noted that in the thousands of work-hours associated with the repackaging task, an effort that involved considerably more potential contact with exposed LiOH at PORTS, there was not one lost-time accident (Energy Systems 1989a, 1989d).

4.3.2.2 Separate sales for the virgin and depleted LiOH

Human health and safety effects are similar to those described for the proposed action (see Section 4.3.2.1).

4.3.2.3 Extended sales period

Human health and safety effects are similar to those described for the proposed action (see Section 4.3.2.1). Should the LiOH storage period extend past 1995, some of the overpack drums may require replacement. The life expectancy of the overpack drums used to store LiOH at both sites is estimated to be between 10 and 15 years (DOE 1989b). The repackaging would again require considerable effort and would subject personnel to potential LiOH exposure.

4.3.2.4 No action alternative

The no action alternative analysis is similar to the extended sales period alternative. However, because of their extremely slow sales potential, it is certain that a majority of the overpack drums would require replacement.

4.3.3 Land Use

4.3.3.1 Proposed action

The proposed action would not alter land use patterns or involve new construction or demolition activities. Sale of the virgin LiOH at the Oak Ridge K-25 Site would free much-needed storage space. Existing programs already using Building K-25 for storage would use the freed space. Facilities at the Portsmouth location are not required for immediate use; however, future use storage requirements have been identified (Eaker 1992a).

4.3.3.2 Separate sales for the virgin and depleted LiOH

There are no impacts to land use patterns associated with this alternative (see Sect. 4.3.3.1).

4.3.3.3 Extended sales period

There are no impacts to land use patterns associated with this alternative (see Sect. 4.3.3.1).

4.3.3.4 No action alternative

There are no impacts to land use patterns associated with this alternative (see Sect. 4.3.3.1).

4.3.4 Regulatory Compliance

4.3.4.1 Proposed action

The proposed open market sale of the depleted LiOH containing 2 to 15 ppm of mercury initially raised serious regulatory compliance questions. On September 17 through September 20, 1991, OEPA conducted a Resource Conservation and Recovery Act (RCRA) compliance evaluation inspection at the Portsmouth facility. The inspection was conducted to determine compliance with state and Federal hazardous waste requirements. Based on this inspection, OEPA determined that Portsmouth was in violation of the OAC because it considered the processed LiOH to be a solid waste and a hazardous waste determination had not been made (OEPA 1991). In a January 29, 1992, follow-up letter, OEPA stated that the DOE Portsmouth facility remains in violation and requested that DOE "conduct an evaluation of the waste lithium hydroxide" (OEPA 1992).

In follow-up discussions between DOE and OEPA, OEPA took the position that the depleted LiOH was a solid waste, per OAC 3745 requirements regarding speculative accumulation, because DOE failed to market sufficient amounts of depleted LiOH over the years. Additionally, OEPA felt the material had the potential to be a hazardous material due to the trace amounts of process mercury contamination. On the other hand, DOE held that the LiOH was a valuable commodity and not a solid waste. DOE based this position on the past sales of 13M lb of LiOH, the current interest shown by the commercial lithium

sector, and the past selling failures being due to various government special interest concerns and not LiOH acceptability (DOE 1992b). To resolve the impasse, without conceding the depleted LiOH was subject to regulation as a solid waste and, at OEPA's suggestion (Wynn 1992a), DOE submitted a variance request from classification as waste to OEPA (on October 8, 1992) for the depleted LiOH in accordance with the provisions of OAC 3745 (DOE 1992b). OEPA has not yet issued a variance, but has replied that, "[i]f DOE Portsmouth is able to find a buyer for the lithium hydroxide the OEPA would not consider the material to be a waste once it is sent off-site for use as a raw material in a production process." The response continues by stating, "Shipping of the material would not require a manifest, the transporter would not have to be a licensed hazardous waste transporter and the destination facility would not have to have a permit to accept hazardous waste." The response concludes by affirming that "DOE does not have to wait for a disposition on the variance request in order to proceed with sales of this material" (OEPA 1993). A copy of this letter is included in Appendix C for information and reference and does not represent agreement with the position that has been taken by the OEPA regarding the classification of this material as waste.

In addition to mercury, sample data were analyzed and obtained by spectrographic techniques and are available for all the RCRA toxicity characteristic contaminant elements (arsenic, barium, cadmium, chromium, lead, and silver) except selenium. Barium, cadmium, and chromium are clearly below the RCRA regulatory level. The sample analyses detection limits were not low enough to make a determination concerning arsenic or lead content. Data for silver is available only for the virgin LiOH, and it was under the RCRA regulatory limit. It must be emphasized that the sample data for the RCRA toxicity characteristic contaminant elements can only be used as a potential indicator of a hazardous waste classification because the sample data were not obtained by Toxicity Characteristic Leaching Procedure (TCLP) analysis. Other elements are found in elevated levels in the depleted LiOH (Al 60-400 ppm, Cu 8 to 52 ppm, Fe 10 to 290 ppm, and Si 60 to 510 ppm) when compared to the virgin LiOH (Al <10 ppm, Cu <10 ppm, Fe <20-30 ppm, and Si <20 ppm), but these elements are not listed as contaminants of concern under the RCRA toxicity characteristic criteria, and there is no evidence that the potential purchasers would find them objectionable.

To limit potential Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) liabilities that govern the response to and cleanup requirements for hazardous substances releases, DOE would verify that all potential buyers are capable of extracting and handling the mercury in a legally prescribed manner and that the best management practices for storing and processing the depleted LiOH are in place at their facilities. DOE also will request that potential buyers agree to indemnify DOE from any liability.

4.3.4.2 Separate sales for the virgin and depleted LiOH

The regulatory discussion for the proposed action is applicable for holding separate sales for the virgin and depleted LiOH.

4.3.4.3 Extended sales period

The regulatory discussion for the proposed action is applicable for an extended sales period.

4.3.4.4 No action alternative

The regulatory discussion for the proposed action is applicable for the no-active alternative.

4.3.5 Relationship with Applicable Federal, State, Regional, and Local Land Use Plans

4.3.5.1 Proposed action

The K-25 Site is located within the boundaries of Roane County, Tennessee, but is outside Roane County land use plans because it is located entirely within the Oak Ridge city limits (Human 1992). By Ordinance 9-913 of the City of Oak Ridge, the city has elected not to issue permits or perform inspections on any of the Federally-held property within its borders. There are no relevant Federal, state, or regional planning authorities. The proposed action would be compatible with surrounding land uses and would not create any change of use or character (DOE 1992a).

The PORTS facility is located within the rural boundaries of Pike County where there are no zoning requirements or land use plans (Powell 1992). Sections 303.02 and 519.02 of the Ohio Revised Code delegate zoning authority to unincorporated portions of counties and townships, respectively. Local governments have the option of enacting zoning resolutions. Pike County has not elected to do so. There are no relevant Federal, state, or regional planning requirements. The proposed action would be compatible with surrounding land uses and would not create any change of use or character.

4.3.5.2 Separate sales for the virgin and depleted LiOH

There is no impact to land use plans associated with this alternative.

4.3.5.3 Extended sales period

There is no impact to land use plans associated with this alternative.

4.3.5.4 No action alternative

There is no impact to land use plans associated with this alternative.

4.3.6 Socioeconomics

The proposed action and alternatives are not expected to employ any new personnel for the loading, transportation, and unloading of the LiOH.

4.3.6.1 Proposed action

The proposed sale format of the entire stock of surplus LiOH was agreed to in concert by the Departments of Energy, Justice, and Commerce on December 2, 1988, in a meeting held by DOE in Washington, D.C. The design of the proposed sale addresses the concern of DOJ, which, in 1974, objected to the sale of lithium hydroxide to the lithium manufacturers due to antitrust and marketing strategy concerns. A successful sale of all surplus LiOH would reduce maintenance and storage cost to the Federal government by approximately \$1M a year (Spence 1992). DOJ stated the following in a letter to DOE dated March 13, 1989:

"The plan for disposition of surplus lithium, which is the product of discussion and cooperation between our respective staffs, resolves our concern that the disposal process be designed in a way that likely would not reinforce any market power possessed by the small number of primary producers of lithium. The present plan would rely on competitive bidding to dispose of the surplus lithium in a fair and allocatively efficient manner. Moreover, the auction would be structured to provide to a broad range of prospective purchasers, including the primary lithium producers, an opportunity to acquire portions of the surplus stock" (DOJ 1989).

A market study completed in 1986 and updated in 1987 (SRI 1986; 1987a) concluded that if DOE achieved 100 percent market penetration, i.e., sold all 80M lb of LiOH in one year, the existing LiOH producers would have no market for their product for approximately four years. The market study suggested that the two primary U.S. LiOH producers could be severely damaged as a result. These statements were echoed in letters sent to DOE (Cyprus Foote Mineral Company 1989; LITHCO 1989) by the two primary U.S. lithium producers, objecting to the DOE-proposed LiOH sale announced in July 1989. This argument may be fallacious as the two primary producers of LiOH are potentially the only ones interested in and capable of processing the depleted and virgin LiOH in a cost effective manner.

The proposed sale would allow competitive bidding and ensure that DOE receives fair market value for the LiOH product. Because the sale is open to all interested buyers in the U.S., the two primary U.S. lithium producers would have fair and equal opportunity to purchase the surplus LiOH. Due to the quantity of LiOH proposed for sale over a relatively short time, it is doubtful that any one purchaser could obtain the entire stock of surplus LiOH. The concern that foreign buyers could purchase enough of the stock to cut into the market of the primary U.S. producers has been addressed by excluding any but U.S. firms from the proposed sale. The surplus LiOH would require

processing prior to commercial use and therefore is not desirable to the middle and end users of LiOH. This issue is discussed in Sect. 4.3.4. No evidence suggests that the elevated levels of Al, Cu, Fe, and Si in the depleted LiOH, compared to the levels in the virgin LiOH, would inhibit or be objectionable to the potential buyers of the depleted LiOH.

Generally, under NEPA, a purely economic effect that has no impact on the physical environment would be insufficient to trigger NEPA requirements for preparation of an Environmental Impact Statement. Although the regulations of the Council on Environmental Quality include in the definition of "human environment" the relationships of people to the natural and physical environment, the language has been interpreted to mean that there must be some physical effect as well. A purely economic or purely social effect has not been sufficient, even, for example, where the closing of a military base had far-reaching effects on the local economy (Leydorf 1992).

4.3.6.2 Separate sales for the virgin and depleted LiOH

Impacts associated with this alternative are similar to the proposed action.

4.3.6.3 Extended sales period

Impacts associated with this alternative are similar to the proposed action. However, extending the sales period would result in further expenditures by DOE for storage and maintenance costs, estimated at \$1M/year (Spence 1992), and lost revenue to the Federal government. A major concern is that an extended sales period may force the repacking of the LiOH at considerable expense (the repacking costs from 1985 to 1988 were \$16M). The SRI market study estimated that the LiOH could have been sold in 1975 for \$35.3M, and adding that amount of Federal revenue lost by not selling the LiOH to the costs of storage and maintenance pushes the total costs as high as \$49.2M at the end of 1990 (SRI 1987b). An extended sales period may decrease potential market impacts to the primary producers of LiOH.

4.3.6.4 No action alternative

The no action alternative impacts are similar to the extended sales period alternative. However, fiscal impacts to the Federal government would be greatly increased, since DOE would in effect become a storage custodian for at least 50 years, based on previous sales history.

4.3.7 Transportation Risk

4.3.7.1 Proposed action

The large quantity and potentially hazardous nature of the material that may be shipped under the proposed action and alternatives require that the potential transportation impacts be assessed. The principle underlying the

transportation risk analysis was to make conservative assumptions for the underlying data wherever professional judgment was used to select among several reasonable choices. That is, if two or more items of data existed, all of which were thought to be reasonably derived, the data that would lead to the greatest impact were selected for the analysis. Loading and off-loading of LiOH is addressed in Sect. 4.3.2.

To calculate the number of highway shipments needed from each site, it was first assumed that all the Portsmouth LiOH was in the smaller (78-gal) drums; this maximizes the number of shipments. It was also assumed that 80 drums of each type could be loaded into a 45-ft van semi-trailer. The 80-drum payload takes into account the interior dimensions of the trailer and the size of the drums, and assumes that each drum weighs 500 lb. This leads to a total payload of 48,000 lb, which, when added to the weight of the tractor and semi-trailer, would still comprise a legal weight shipment. These assumptions lead to 694 truck shipments from the Oak Ridge Site and 1675 truck shipments from the Portsmouth Site, for a total of 2369 truck shipments. Truck shipments of LiOH would be by enclosed trailer rather than by flatbeds. This DOE requirement is levied to minimize potential spills resulting from an accident.

Since it is not known where the LiOH would be shipped, five cities around the country were selected as potential destinations. Located on the outer edge of the U.S., thus maximizing shipment distance, the five destinations are Houston, Texas; Detroit, Michigan; Boston, Massachusetts; Minneapolis, Minnesota; and Seattle, Washington (Fig. 4.1). It was assumed that 20 percent of the shipments from each DOE site would be shipped to each of these destinations.

A simplified approach was used to select routes between the DOE sites and the destinations. The *Rand McNally Road Atlas* (1992) was used as the basis for route selection, in accordance with the following principles:

- The shortest route to an interstate highway in the general direction of the shipment was selected from each DOE site.
- Each shipment stayed on the Interstate system to reach the destination.
- Mileage class of highway was tabulated segment by segment from the atlas
- At each destination, an additional 25 miles was added to account for local access to purchasers of the LiOH.

The standard measure of relative safety used in transportation safety analysis is the rate of accidents expressed as the number of accidents per unit of travel for the vehicles under study. For this study, the accident rates of large trucks was used to provide the best estimate of accident potential. When the data and necessary assumption were applied (for a thorough discussion

of the underlying assumption see Appendix A of this Environmental Assessment), the total accident rate for all destinations ranged between 3.5 and 17.6 accidents during the transportation of the entire 80M lb of LiOH. The calculated probabilities (assuming a 20.4 percent release rate for trucks carrying hazardous materials and involved in an accident) for a hazardous waste spill as a result of these accidents ranges from 0.7 to 3.5; i.e., in 4 (3.5) of the calculated 18 (17.6) accidents, a spill of LiOH would occur. No data are available addressing the severity or quantity of the spill event. The predicted spill could be less than the contents of one drum or could release the contents of all 80 drums. Section 4.3.2.1 addresses human health and safety concerns associated with a spill event.

Fig. 4.1. Location of proposed destinations of the LiOH in relation to current locations at Oak Ridge and Portsmouth.

Railroad transportation risk was reviewed, but due to the lack of information, an analysis of rail impacts is more cursory. Rail car payload capacity was assumed to be 160 drums of LiOH. This cuts the number of required shipments in half, or 347 from Oak Ridge and 838 from Portsmouth. Also, unlike trucks, several rail cars could be used in a single shipment; this would reduce the amount of train miles traveled, thus reducing the expected number of accidents. However, for this study, only single car rail shipments were assumed to predict the most conservative accident rate. The same destinations for rail shipments were selected as those analyzed for truck shipments. The single source of accident rates was the Federal Railroad Administration (DOT 1975-1982). Railroad accident rates for the years 1975 to 1982 were averaged, resulting in 11.88 accidents per million train miles. Rail accident probability calculations indicate that a total of 17.7 rail accidents may be expected. Since hazardous material release rates are not available for rail, the same percent rate used for trucks was used. Accordingly, an accident spill potential of 3.6 was calculated, i.e., of the 18 (17.7) predicted accidents, 4 (3.6) of the accidents would result in a spill event. No data are available addressing the severity or quantity of the spill event. The predicted spill could be less than the contents of one drum or could release the contents of all 160 drums. Section 4.3.2.1 contains additional information concerning human health and safety associated with a spill event.

Most states and many local governments have hazardous material spill emergency response teams that would be capable of containing and cleaning up these releases. Compared to other hazardous material spills, cleanup of LiOH spills does not present any unique problems. Personnel involved in spill cleanup would be required to wear protective clothing and respirators.

Should a LiOH spill reach a water body, mortality of aquatic organisms could occur. Mortality and area affected would depend on the quantity of LiOH released and the time period over which it was released. As a highly conservative estimate, 2 percent (Margiotta 1992) of the entire transportation route crosses over or is in close proximity to a surface water body that may be impacted by a transportation accident involving a LiOH spill. Thus, based on probability statistics, there is less than a 0.5 percent chance that the four accidents with associated LiOH spills predicted from the transportation risk study would potentially impact a body of surface water.

Accidents involving LiOH spills could be expected to release airborne LiOH particulates. Again, the quantity of release depends on the severity of the accident, the number of drums breached, and the climatic conditions at the accident scene. High wind conditions would potentially increase and spread LiOH airborne contamination. However, the LiOH is in a partially to fully solidified form (see Sect. 1.2), which would tend to limit airborne dispersion.

4.3.7.2 Separate sales for the virgin LiOH or depleted LiOH

Transportation risk would be the same as addressed in the proposed action (Sect. 4.3.7.1).

4.3.7.3 Extended sales period

Transportation risk would be similar to the proposed action (Sect. 4.3.7.1); however, it would occur over an extended period of time.

4.3.7.4 No action alternative

Transportation risk would be substantially decreased over the potential risk associated with the proposed action. Most of the LiOH would remain in storage at the two sites for at least 50 years.

4.4 CUMULATIVE OR LONG-TERM ENVIRONMENTAL IMPACTS

4.4.1 Proposed Action

No cumulative or long-term environmental impacts associated with this action have been identified. It is assumed that the depleted LiOH would be sold to purchasers capable of handling the mercury found in the depleted LiOH in a responsible and legally prescribed manner.

4.4.2 Separate Sales for the Virgin LiOH and Depleted LiOH

No cumulative or long-term environmental impacts are associated with this action. It is assumed that the depleted LiOH would be sold to purchasers capable of handling the mercury found in the depleted LiOH in a responsible and legally prescribed manner. If the LiOH is not sold in a timely fashion, the K-25 Site and PORTS workforce may be exposed to LiOH and to industrial accidents associated with a LiOH repacking effort.

4.4.3 Extended Sales Period

The Extended Sales Period would most likely require the K-25 and PORTS workforce to redrum some or all the LiOH. This task would result in potential LiOH and associated industrial accident exposure during the repacking effort. Additionally, if storage facilities are still occupied by the LiOH and additional storage requirements are identified for new or existing programs, new construction or facility modifications may be necessary. It is assumed that the depleted LiOH would be sold to purchasers capable of handling the mercury found in the depleted LiOH in a responsible and legally prescribed manner.

4.4.4 No Action Alternative

The K-25 Site and PORTS workforce would be potentially exposed to LiOH and industrial accidents during the LiOH redrum effort. Long-term LiOH storage at both sites would continue to occupy storage space at the K-25 Site and PORTS. As a result, modifications to existing facilities or new construction may be required to provide space for existing or future new program requirements. It is assumed that the depleted LiOH would be sold to purchasers capable of handling the mercury found in the depleted LiOH in a responsible and legally prescribed manner.

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AGENCIES AND PERSONS CONSULTED

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Nuclear Materials Management Office
Oak Ridge, TN

DOE
Office of the Chief Counsel
Oak Ridge Reservation Field Office
Oak Ridge, TN

DOE
Office of the General Counsel
Washington D. C.

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APPENDIX A

IMPACTS OF TRANSPORTING LITHIUM HYDROXIDE FROM THE DEPARTMENT OF ENERGY'S OAK RIDGE AND PORTSMOUTH SITES

PREPARED BY:

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APRIL 1992

Science Applications International Corporation
An Employee-Owned Company

MEMORANDUM

To: Chuck Pergler

From: Rich Margiotta *RM*
Senior Transportation Analyst

Date: April 13, 1992

Subject: Transportation impacts of transporting lithium hydroxide from DOE's Oak Ridge and Portsmouth sites

Enclosed please find my analysis of the transportation impacts that would follow the sale and subsequent transport of lithium hydroxide from the referenced DOE sites. The analysis is based on the most appropriate data that is now available to the best of my knowledge. In performing this analysis I have endeavored to make conservative assumptions, that is, to err on the side of overestimating the potential impacts.

Please contact me if you require clarification on any of the technical points.

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1. TECHNICAL ANALYSIS

1.1 BACKGROUND

The Department of Energy (DOE) has proposed the sale of lithium hydroxide from its Oak Ridge and Portsmouth reservations. The large quantity and hazardous nature of the material that would be shipped require that the transportation impacts be assessed. This study evaluates those impacts. The principle driving the analysis presented here is to make conservative assumptions for the underlying data wherever professional judgment was used to select among several reasonable choices. That is, if two or more items of data existed, all of which were thought to be reasonably derived, the data that would lead to the greatest impact were selected for the analysis.

1.2 HIGHWAY RELATED IMPACTS

Number of Shipments. The lithium hydroxide at both sites was originally stored in containers that had deteriorated to such a degree that it was overpacked into steel drums to prevent spillage. At the Oak Ridge site, 80-gal drums were used, while at the Portsmouth site, 78-gal and 90-gal drums were used. Approximately 55,470 drums are present at the Oak Ridge site and 134,000 drums at the Portsmouth site, although it is not known how many drums of each size are present at the Portsmouth site.

To calculate the number of highway shipments needed from each site, it was first assumed that all the Portsmouth material was in the smaller (78-gal) drums; this maximizes the number of shipments. It was also assumed that 80 drums of each type could be loaded into a 45-foot van semi-trailer. The 80-drum payload takes into account the interior dimensions of the trailer and the size of the drums and assumes that each drum weighs 500 pounds. This leads to a total payload of 48,000 pounds, which, when added to the weight of the tractor and semi-trailer, would still comprise a legal weight shipment. These assumptions lead to:

- 694 truck shipments from the Oak Ridge Site and
- 1,675 truck shipments from the Portsmouth site.

Destinations. Since it is not known where the lithium hydroxide would be shipped, five cities scattered around the country were selected as potential destinations. The five sites are located on the outer edge of the U.S., thus maximizing shipment distance (in accordance with the principle stated in Section 1.1). The five destinations are:

- Houston, Texas;
- Detroit, Michigan;
- Boston, Massachusetts;

- Minneapolis, Minnesota; and
- Seattle, Washington.

It was assumed that 20 percent of the shipments from each DOE site would be shipped to each of these destinations.

Highway Routes and Distances. A simplified approach was used to select routes between the DOE sites and the destinations. The *1992 Rand McNally Road Atlas* was used as the basis for route selection, with professional judgment being exercised in accordance with the following principles:

- The shortest route to an Interstate Highway in the general direction of the shipment was selected from each DOE site.
- Each shipment stayed on the Interstate System to reach the destination.
- Mileages class of highway were tabulated segment by segment from the Atlas.
- At each destination, an additional 25 miles was added to account for local access to purchasers of the lithium hydroxide.

Accident Rates. The standard measure of relative safety used in transportation safety analysis is the rate of accidents expressed as the number of accidents per unit of travel for the vehicles under study. The unit of travel is typically vehicle miles and is referred to as "exposure," i.e., the amount of time that vehicles are "exposed" to potential accident conditions.

For this study, the accident rates of large trucks are needed to provide the best estimate of accident potential. A review of the literature reveals that large truck accident rates have been developed by many studies over the years. (The type of large truck considered was the so-called "single-trailer combination," the typical tractor-trailer. Accidents rates are computed as accidents per million vehicle-miles or MVM.) A compilation of these studies is presented in Table 1. In performing the accident calculations, three sets of rates were used from Table 1. First, the total vehicle involvement rates for rural/urban Interstate/nonfreeway combinations were used to estimate *total* accidents. Second, the casualty (fatalities plus injuries) involvement rates by highway class were used to estimate casualty accidents. (Casualty accidents were used as an indicator since the forces involved in an accident resulting in a personal injury or death are higher, and therefore more likely to produce a rupture of hazardous material containers.) Third, the total accident rate for petroleum trucks was used, since it leads to a conservative (high) estimate of accidents and is the rate previously used by DOE in several studies.

Release Rates. Ideally, how material overpacked in steel drums responds to accident conditions should be known in order to estimate hazardous material release rates. Unfortunately, no such information was uncovered by this study. Instead, an estimate of release rate was made by analyzing data from the Federal Highway Administration's (FHWA) Office of Motor Carrier (OMC) Form 50-T data base. This data base contains information on large truck accidents in which the truck was involved in interstate commerce and the severity of the accident was at least \$4,400 in property damage or an injury or fatality occurred. Data from 1983 through 1987 were aggregated and analyzed. The results appear in Table 2.

Table 1. Large Truck Accident Rates (per MVM) From Previous Studies

TOTAL ACCIDENT RATES				
<u>All Combinations</u>				
All Land Use Types	2.82 ^{1,2}	2.50 ³		
All Urban	7.60 ⁴			
All Suburban	1.30 ⁴			
All Rural	0.60 ⁴			
TOTAL VEHICLE INVOLVEMENT RATES				
<u>Single-Trailer Combinations</u>	<u>Intercity</u>	<u>Local</u>	<u>All Travel</u>	<u>Petroleum Only</u>
Van	0.76 ²	1.68 ²	1.01 ²	--
Tank	0.78 ²	1.42 ²	1.97 ⁵	5.94 ³
Platform	1.07 ²	0.70 ²	1.00 ⁵	--
Rural Interstate	0.77 ⁶			
Urban interstate	2.79 ⁶			
Rural Nonfreeway	0.97 ⁶			
Urban Nonfreeway	2.94 ⁶			
CASUALTY ACCIDENT VEHICLE INVOLVEMENT RATES				
<u>Highway Class</u>	<u>Single Trailer Combinations²</u>		<u>All Vehicles⁷</u>	
Rural Interstate	0.27		0.26	
Rural Principal Arterial	0.35		0.72	
Rural Minor Arterial	0.48		N/A	
Rural Minor Collector	0.64		1.00	
Urban Interstate	0.55		0.47	
Urban Principal Arterial	1.13		1.09	

Notes: (1) Vehicle involvement rates account for multiple vehicles of the same type. For instance, if two single trailer combinations collide, they count as two single trailer vehicle involvements but only one accident. Based on past experience, vehicle involvement rates for combinations are 1 to 2 percent higher than corresponding accident rates.

(2) Casualty accidents include both fatal and injury accidents

Sources are keyed to the references in the back of the report.

Table 2. Release Rates From FHWA Form 50-T Data

Accident Result	<u>Number of Accidents (collective percentage)</u>	
	Hazardous Cargo	Nonhazardous Cargo
Not Applicable (no spill, fire, or explosion)	6,497 (79.6%)	145,552 (93.2%)
HazMat* Spill	1,331 (16.3%)	238 (0.2%)
NonHazMat Spill	146 (1.8%)	8,816 (5.6%)
Fire	172 (2.1%)	1,507 (1.0%)
Explosion	15 (0.2%)	71 (0.05%)
TOTAL	8,161	156,184

*Hazardous Material

Over 16 percent of trucks carrying hazardous cargo involved in an accident experienced a hazardous cargo release. Again, to be conservative, we assume that if a fire, explosion, or nonhazardous cargo was released (e.g., mixed shipments), then it is likely that hazardous cargo would also be released. (This may in fact be the case, but only the nonhazardous items were reported in the data.) Making this assumption leads to a hazardous material release rate for trucks involved in OMC-reported accidents of 20.4 percent. When this number is applied to the total number of expected accidents, the result is made additionally conservative because of the property damage-only threshold; if *all* accidents were included in the OMC data, the true release rate would be lower, since those accidents involving very little property damage would not generate sufficient forces to rupture packages with the same frequency. (Appendix A supports the notion that as accident severity increases, so does release rate.)

Calculation of Expected Accidents and Releases. Table 3 shows the results of applying the methodology to get expected accidents. Specifically, it shows the routes taken from each DOE site to the destinations, the mileage of the routes traveled (by highway class), the vehicle-miles traveled (mileages times number of shipments), applicable accident rates, and the expected number of accidents. Three different expected accidents were calculated: total accidents based on the urban/rural Interstate/nonfreeway rates; total accidents based on the single rate borrowed from petroleum trucks; and casualty accidents based on the highway class rates of Table 1.

The end result of applying this methodology is that the total number of accidents expected ranges between 3.5 and 17.6, depending on the rate used. Applying the release rate of 20.4 percent yields the expected number of releases to range between 0.7 and 3.5. Most states and many local governments have hazardous material spill emergency response teams that would be capable of containing and cleaning up these releases.

1.3 RAIL-RELATED IMPACTS

In contrast to data available on highway transportation, far fewer data are available on rail safety and transportation because of the nearly exclusive private sector control of rail operations. (However, the Federal Rail Administration does collect accident statistics on rail in the same manner as the Federal Highway Administration does for trucks.) Therefore, the analysis of rail impacts is more cursory.

Rail car payload capacity is greater than that of trucks. For this study it is estimated that a rail car can carry twice as many drums of lithium hydroxide as a truck (160 versus 80). This cuts the number of required shipments in half, or 347 from the Oak Ridge site and 838 from the Portsmouth site. Also, it should be noted that, unlike trucks, several rail cars could be used in a single shipment; this would reduce the amount of train miles

traveled, thus reducing the expected number of accidents. However, for this study and to be conservative, only single car rail shipments were assumed.

Table 3

Accident Rate Calculations

ROUTE	TOTAL MILES	HIGHWAY CLASS	RURAL MILES	URBAN MILES	TOTAL RATE (RURAL)	TOTAL RATE (URBAN)	CAS/LTY RATE (RURAL)	CAS/LTY RATE (URBAN)	TOTAL RATE (PETROL)	RURAL VEH-MI	URBAN VEH-MI	TOTAL ACCIDENTS	CASUALTY ACCIDENTS	TOTAL ACCIDENTS
<u>ORGDG/HOUSTON</u>														
SR 58	5	Rur 2 lane	5	0	0.97	2.94	0.48		5.94	695	0	0.000674	0.000334	0.004128
I-40	8	Rur Int	8	0	0.77	2.79	0.27	0.55	5.94	1112	0	0.000856	0.000300	0.006605
I-75	94	Rur Int	69	25	0.77	2.79	0.27	0.55	5.94	9591	3475	0.017080	0.004501	0.077612
I-59	463	Rur Int	378	85	0.77	2.79	0.27	0.55	5.94	52542	11815	0.073421	0.020685	0.382281
I-12	76	Rur Int	46	30	0.77	2.79	0.27	0.55	5.94	6394	4170	0.016558	0.004020	0.062750
I-10	272	Rur Int	202	70	0.77	2.79	0.27	0.55	5.94	28078	9730	0.048767	0.012933	0.224580
Urb Hwy	25	Urb Multi		25	0.97	2.94	0.35	1.13	5.94	0	3475	0.010217	0.003927	0.020642
TOTAL	943			708	235					93412	32665	0.167573	0.046698	0.778597
<u>PORTS/HOUSTON</u>														
US 23	60	Rur Multi	60	0	0.97	2.94	0.35	1.13	5.94	20100	0	0.019497	0.007035	0.119394
I-64	127	Rur Int	97	30	0.77	2.79	0.27	0.55	5.94	32495	10050	0.053061	0.014301	0.252717
US 60	15	Urb Multi		15	0.97	2.94	0.35	1.13	5.94	0	5025	0.014774	0.005678	0.029849
BG PKWAY	72	Rur Int	72	0	0.77	2.79	0.27	0.55	5.94	24120	0	0.018572	0.006512	0.143273
I-65	315	Rur Int	240	75	0.77	2.79	0.27	0.55	5.94	80400	25125	0.132007	0.035527	0.626819
I-59	325	Rur Int	280	45	0.77	2.79	0.27	0.55	5.94	93800	15075	0.114285	0.033617	0.646718
I-12	76	Rur Int	46	30	0.77	2.79	0.27	0.55	5.94	15410	10050	0.039905	0.009688	0.151232
I-10	272	Rur Int	202	70	0.77	2.79	0.27	0.55	5.94	67670	23450	0.117531	0.031168	0.541253
Urb Hwy	25	Urb Multi		25	0.97	2.94	0.35	1.13	5.94	0	8375	0.024623	0.009464	0.049748
TOTAL	1287		997	290						333995	97150	0.534255	0.152991	2.561001
<u>ORGDG/DETROIT</u>														
SR 58	5	Rur 2 lane	5	0	0.97	2.94	0.48		5.94	695	0	0.000674	0.000334	0.004128
I-40	25	Urb Int		25	0.77	2.79	0.27	0.55	5.94	0	3475	0.009695	0.001911	0.020642
I-75	527	Rur Int	367	160	0.77	2.79	0.27	0.55	5.94	51013	22240	0.101330	0.026006	0.435123
Urb Hwy	25	Urb Multi		25	0.97	2.94	0.35	1.13	5.94	0	3475	0.010217	0.003927	0.020642
TOTAL	582		372	210						51708	29190	0.121916	0.032177	0.480534

Table 3 (continued)

Accident Rate Calculations

ROUTE	TOTAL MILES	HIGHWAY CLASS	RURAL MILES	URBAN MILES	TOTAL RATE (RURAL)	TOTAL RATE (URBAN)	CAS/LTY RATE (RURAL)	CAS/LTY RATE (URBAN)	TOTAL RATE (PETROL)	RURAL VEH-MI	URBAN VEH-MI	TOTAL ACCIDENTS	CASUALTY ACCIDENTS	TOTAL ACCIDENTS
<u>PORTS/DETROIT</u>														
US 23	5	Rur Multi	5	0	0.97	2.94	0.35	1.13	5.94	1675	0	0.001625	0.000586	0.009950
SR 32	95	Rur Multi	95	0	0.97	2.94	0.35	1.13	5.94	31825	0	0.030870	0.011139	0.189041
I-75	272	Rur Int	152	120	0.77	2.79	0.27	0.55	5.94	50920	40200	0.151366	0.035858	0.541253
Urb Hwy	25	Urb Multi	252	25	0.97	2.94	0.35	1.13	5.94	0	8375	0.024623	0.009464	0.049748
TOTAL	397			145						84420	48575	0.208484	0.057047	0.789990
<u>ORGD/BOSTON</u>														
SR 58	5	Rur 2 Lane	5	0	0.97	2.94	0.48		5.94	695	0	0.000674	0.000334	0.004128
I-40	61	Rur Int	36	25	0.77	2.79	0.27	0.55	5.94	5004	3475	0.013548	0.003262	0.050365
I-81	495	Rur Int	445	50	0.77	2.79	0.27	0.55	5.94	61855	6950	0.067019	0.020523	0.408702
I-76	15	Urb Int		15	0.77	2.79	0.27	0.55	5.94	0	2085	0.005817	0.001147	0.012385
I-78	181	Rur Int	106	75	0.77	2.79	0.27	0.55	5.94	14734	10425	0.040431	0.009712	0.149444
I-95	232	Rur Int	137	95	0.77	2.79	0.27	0.55	5.94	19043	13205	0.051505	0.012404	0.191553
Urb Hwy	25	Urb Multi	729	25	0.97	2.94	0.35	1.13	5.94	0	3475	0.010217	0.003927	0.020642
TOTAL	1014			285						101331	39615	0.189211	0.051309	0.837219
<u>PORTS/BOSTON</u>														
US 23	60	Rur Multi	60	0	0.97	2.94	0.35	1.13	5.94	20100	0	0.019497	0.007035	0.119394
I-64	64	Urb Int	34	30	0.77	2.79	0.27	0.55	5.94	11390	10050	0.036310	0.008603	0.127354
I-79	148	Rur Int	138	10	0.77	2.79	0.27	0.55	5.94	46230	3350	0.044944	0.014325	0.294505
I-68	112	Rur Int	112	0	0.77	2.79	0.27	0.55	5.94	37520	0	0.028890	0.010130	0.222869
I-70	28	Rur Int	28	0	0.77	2.79	0.27	0.55	5.94	9380	0	0.007223	0.002533	0.055717
I-81	30	Rur Int	10	20	0.77	2.79	0.27	0.55	5.94	3350	6700	0.021273	0.004590	0.059697
I-76	15	Urb Int		15	0.77	2.79	0.27	0.55	5.94	0	5025	0.014020	0.002764	0.029849
I-78	181	Rur Int	106	75	0.77	2.79	0.27	0.55	5.94	35510	25125	0.097441	0.023406	0.360172
I-95	232	Rur Int	137	95	0.77	2.79	0.27	0.55	5.94	45895	31825	0.124131	0.029895	0.461657
Urb Hwy	25	Urb Multi	625	25	0.97	2.94	0.35	1.13	5.94	0	8375	0.024623	0.009464	0.049748
TOTAL	895			270						209375	90450	0.418851	0.112744	1.780961

Table 3 (continued)

Accident Rate Calculations

ROUTE	TOTAL MILES	HIGHWAY CLASS	RURAL MILES	URBAN MILES	TOTAL RATE (RURAL)	CAS/LTY RATE (RURAL)	CAS/LTY RATE (URBAN)	TOTAL RATE (PETROL)	RURAL VEH-MI	URBAN VEH-MI	TOTAL ACCIDENTS	CASUALTY ACCIDENTS	TOTAL ACCIDENTS
<u>ORGD/ MINNEAPOLIS</u>													
SR 58	5	Rur 2 Lane	5	0	0.97	2.94	0.48	5.94	695	0	0.000674	0.000334	0.004128
I-40	25	Urb Int	0	25	0.77	2.79	0.27	5.94	0	3475	0.009695	0.001911	0.020642
I-75	255	Rur Int	205	50	0.77	2.79	0.27	5.94	28495	6950	0.041332	0.011516	0.210543
I-74	419	Rur Int	329	90	0.77	2.79	0.27	5.94	45731	12510	0.070116	0.019228	0.345952
I-80	168	Rur Int	153	15	0.77	2.79	0.27	5.94	21267	2085	0.022193	0.006889	0.138711
I-35	246	Rur Int	206	40	0.77	2.79	0.27	5.94	28634	5560	0.037561	0.010789	0.203112
Urb Hwy	25	Urb Multi	0	25	0.97	2.94	0.35	5.94	0	3475	0.010217	0.003927	0.020642
TOTAL	1143		898	245					124822	34055	0.191787	0.054594	0.943729
<u>PORTS/ MINNEAPOLIS</u>													
US 23	5	Rur Multi	5	0	0.97	2.94	0.35	5.94	1675	0	0.001625	0.000536	0.009950
SR 32	95	Rur Multi	95	0	0.97	2.94	0.35	5.94	31825	0	0.030870	0.011139	0.189041
I-74	419	Rur Int	299	120	0.77	2.79	0.27	5.94	100165	40200	0.189285	0.049155	0.833768
I-80	168	Rur Int	153	15	0.77	2.79	0.27	5.94	51255	5025	0.053486	0.016603	0.334303
I-35	246	Rur Int	206	40	0.77	2.79	0.27	5.94	69010	13400	0.090524	0.026003	0.489515
Urb Hwy	25	Urb Multi	0	25	0.97	2.94	0.35	5.94	0	8375	0.024623	0.009464	0.049748
TOTAL	958		758	200					253930	67000	0.390412	0.112949	1.906324
<u>ORGD/ SEATTLE</u>													
SR 58	5	Rur 2 Lane	5	0	0.97	2.94	0.48	5.94	695	0	0.000674	0.000334	0.004128
I-40	150	Rur Int	115	35	0.77	2.79	0.27	5.94	15985	4865	0.025882	0.006992	0.123849
I-24	175	Rur Int	175	0	0.77	2.79	0.27	5.94	24325	0	0.018730	0.006568	0.144491
I-57	50	Rur Int	50	0	0.77	2.79	0.27	5.94	6950	0	0.005352	0.001877	0.041283
I-64	75	Rur Int	35	40	0.77	2.79	0.27	5.94	4865	5560	0.019258	0.004372	0.061925
I-70	256	Rur Int	216	40	0.77	2.79	0.27	5.94	30024	5560	0.038631	0.011164	0.211369
I-29	372	Rur Int	317	55	0.77	2.79	0.27	5.94	44063	7645	0.055258	0.016102	0.307146
I-90	1543	Rur Int	1423	120	0.77	2.79	0.27	5.94	197797	16680	0.198841	0.062579	1.273993
Urb Hwy	25	Urb Multi	0	25	0.97	2.94	0.35	5.94	0	3475	0.010217	0.003927	0.020642
TOTAL	2651		2336	315					324704	43785	0.372842	0.113913	2.188825

Table 3 (continued)

Accident Rate Calculations

ROUTE	TOTAL MILES	HIGHWAY CLASS	RURAL MILES	URBAN MILES	TOTAL RATE (RURAL)	TOTAL RATE (URBAN)	CAS/LTY RATE (RURAL)	CAS/LTY RATE (URBAN)	TOTAL RATE (PETROL)	RURAL VEH-MI	URBAN VEH-MI	TOTAL ACCIDENTS	CASUALTY ACCIDENTS	TOTAL ACCIDENTS
<u>PORTS/SEATTLE</u>														
US 23	60	Rur Multi	60	0	0.97		0.35		5.94	20100	0	0.019497	0.007035	0.119394
I-64	463	Rur Int	358	105	0.77	2.79	0.27	0.55	5.94	119930	35175	0.190484	0.051727	0.921324
I-70	256	Rur Int	216	40	0.77	2.79	0.27	0.55	5.94	72360	13400	0.093103	0.026907	0.509414
I-29	372	Rur Int	317	55	0.77	2.79	0.27	0.55	5.94	106195	18425	0.133176	0.038806	0.740243
I-90	1543	Rur Int	1423	120	0.77	2.79	0.27	0.55	5.94	476705	40200	0.479221	0.150820	3.070416
Urb Hwy	25	Urb Multi	2374	25	0.97	2.94	0.35	1.13	5.94	795290	8375	0.024623	0.009464	0.049748
TOTAL	2719			345			GRAND TOTALS			2,377,987	598,060	0.940104	0.284760	5.410538
												3.535434	1.019183	17.677719

The destinations for rail shipments were the same ones used for truck shipments. In the absence of data on rail mileages, highway mileages between the storage sites and the destinations were used as surrogates. The single source of accident rates was the Federal Railroad Administration⁸. Railroad accident rates for the years 1975 to 1982 were averaged, resulting in 11.88 accidents per million train-miles.

Table 4 shows the results of the rail accident calculations. A total of 17.7 rail accidents can be expected. Since hazardous material release rates are not available for rail, the same 20.4 percent rate used for trucks was used to arrive at a total of 3.6 expected releases of lithium hydroxide if it were to be shipped by rail.

Table 4
Calculation of Rail Accidents

ORIGIN/DEST	TOTAL MILES	TOTAL RATE	TOTAL ACCIDENTS
ORGDP/HOUSTON TOTAL	943	11.88	0.777477
PORTS/HOUSTON TOTAL	1287	11.88	2.562530
ORGDP/DETROIT TOTAL	582	11.88	0.479843
PORTS/DETROIT TOTAL	397	11.88	0.790462
ORGDP/BOSTON TOTAL	1014	11.88	0.836015
PORTS/BOSTON TOTAL	895	11.88	1.782024
ORGDP/MINNEAPOLIS TOTAL	1143	11.88	0.942371
PORTS/MINNEAPOLIS TOTAL	958	11.88	1.907462
ORGDP/SEATTLE TOTAL	2651	11.88	2.185675
PORTS/SEATTLE TOTAL	2719	11.88	5.413768
		TOTAL	17.6776277

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**LARGE TRUCK RELEASE RATES BY ACCIDENT SEVERITY
FROM 1983-1987 OMC ACCIDENT DATA**

CONTROLLING FOR SEVERITY=FATAL

Accident Result		Cargo Type	
Frequency Col Pct	HAZMAT	NONHAZ	Total
N/A	466 71.91	9184 88.25	9650
HAZMAT SPILL	111 17.13	12 0.12	123
FIRE	60 9.26	487 4.68	547
NONHAZMAT SPILL	8 1.23	694 6.67	702
EXPLOSION	3 0.46	30 0.29	33
Total	648	10407	11055

CONTROLLING FOR SEVERITY=INJURY

Accident Result	Cargo Type		
Frequency Col Pct	HAZMAT	NONHAZ	Total
N/A	3264 8.44	75006 93.23	78270
HAZMAT SPILL	726 17.45	135 0.17	861
FIRE	69 1.66	581 0.72	650
NONHAZMAT SPILL	96 2.31	4705 5.85	4801
EXPLOSION	6 0.14	22 0.03	28
Total	4161	80449	84610

CONTROLLING FOR SEVERITY=PDO

Accident Result	Cargo Type		
Frequency Col Pct	HAZMAT	NONHAZ	Total
N/A	2767 82.55	61362 93.93	64129
HAZMAT SPILL	494 14.74	91 0.14	585
FIRE	43 1.28	439 0.67	482
NONHAZMAT SPILL	42 1.25	3417 5.23	3459
EXPLOSION	6 0.18	19 0.03	25
Total	3352	65328	68680

APPENDIX B

**VARIANCE REQUEST FOR LITHIUM HYDROXIDE
MONOHYDRATE IN STORAGE AT THE U.S. DEPARTMENT
OF ENERGY PORTSMOUTH GASEOUS DIFFUSION PLANT**

Department of Energy

Oak Ridge Field Office
P.O. Box 2001
Oak Ridge, Tennessee 37831--

October 8, 1992

Mr. Donald Schregardus, Director
Ohio Environmental Protection Agency
Post Office Box 1049
1800 WaterMark Drive
Columbus, Ohio 43266-0149

Dear Mr. Schregardus:

VARIANCE REQUEST FOR LITHIUM HYDROXIDE MONOHYDRATE IN STORAGE AT THE U.S. DEPARTMENT OF ENERGY PORTSMOUTH GASEOUS DIFFUSION PLANT

Enclosed for your review and approval is a request that the 57 million pounds of lithium hydroxide monohydrate (LiOH) presently in storage at the U.S. Department of Energy (DOE) Portsmouth Gaseous Diffusion Plant (PORTS) not be classified as waste. This request is being made in accordance with the provisions of Ohio Administrative Code 3745-50-311 and 3745-50-312.

The Ohio Environmental Protection Agency (OEPA) and DOE have been discussing the regulatory status of the LiOH for the past several years. Recently, members of our respective staffs met to discuss the history of the LiOH (both how it was produced and past efforts to sell it), as well as the potential for marketing the material in the future. While both parties agree to the benefits of returning this material to the commercial sector, no agreements were reached as to its regulatory status while it remains in storage at PORTS.

OEPA has taken the position that the LiOH is a solid waste per the requirements of OAC 3745 regarding speculative accumulation because DOE has failed to market sufficient amounts over the years, and the material has the potential to be a hazardous waste because of the trace amounts of mercury contamination which resulted from its processing. DOE's position is that the LiOH is a valuable commodity, that it does not fit into any of the categories noted in the hazardous waste regulations which would classify it as a solid waste, and that it should, therefore, not be subject to regulation as a waste. DOE's position is also based on the past sales of 13 million pounds of LiOH, the current interest shown by the commercial lithium sector, and past failures to sell the material being related to various government special interest concerns and not the acceptability of the LiOH.

Mr. Donald Schregardus

-2-

October 8, 1

Based on the prior sales of this material, the estimated value of the 57 million pounds stored at PORTS is approximately \$60 million. The 1990 market price for LiOH was \$2.32 per pound. This makes the total potential value of this material after it is processed to be approximately \$132 million.

Two U.S. commercial lithium producers have expressed an interest in purchasing this material. They would use the LiOH in their normal production processes to make commercial grade LiOH. This would allow the LiOH to be handled in an environmentally sound manner because any trace mercury contamination would be removed during the normal purification steps of the processes.

While DOE does not concede that the LiOH is subject to regulation as a solid waste, we are enclosing the variance request as the most expeditious approach to resume marketing the material. The enclosed document provides information to support this request. Your prompt approval of this request will help DOE expedite the sale of this material. Your cooperation is greatly appreciated.

Sincerely,

Eugene W. Gillespie
Site Manager
Portsmouth Site Office

FM-723:Wynn

Enclosures:

1. Variance Request from Classification as Waste for LiOH Stored at PORTS
2. Letters from Commercial Lithium Producers

VARIANCE REQUEST FROM CLASSIFICATION AS WASTE
FOR LITHIUM HYDROXIDE MONOHYDRATE STORED
AT THE DOE PORTSMOUTH GASEOUS DIFFUSION PLANT

The U.S. Department of Energy (DOE) is requesting a variance from classification as solid waste for the lithium hydroxide monohydrate (LiOH) stored at the DOE Portsmouth Gaseous Diffusion Plant (PORTS). This request is being made consistent with the criteria from OAC 3745-50-312(A): "The director may grant requests for a variance from classifying as a solid waste those materials that are accumulated speculatively without sufficient amounts being recycled if the applicant demonstrates that sufficient amounts of the material will be recycled or transferred for recycling in the following year. If a variance is granted, it is valid only for the following year, but can be renewed, on an annual basis, by filing a new application. The director's decision will be based on the following standards and criteria":

CRITERIA 1: The manner in which the material is expected to be recycled, when the material is expected to be recycled, and whether this expected disposition is likely to occur (for example, because of past practice, market factors, the nature of the material, or contractual arrangements for recycling).

The LiOH was originally processed by DOE to separate the isotope of lithium-6 from that of lithium-7. This process was accomplished by contacting a solution of lithium hydroxide with mercury in a stagewise separation process. One of the isotopes preferentially forms an amalgam with the mercury resulting in one stream enriched in lithium-6 and another enriched in lithium-7. The lithium/mercury amalgam was then electrolytically separated to again produce LiOH. The lithium-6 was utilized by DOE for defense purposes, and the lithium enriched in lithium-7 (but still containing recoverable lithium-6) was stockpiled (in the form of LiOH) by DOE in case of future needs. The material as stored by DOE was suitable for all commercial uses of LiOH, and prior to 1970, approximately 13 million pounds of the material was sold.

DOE has received expressions of interest by commercial vendors to purchase the stored material for use within their industrial processes. The LiOH being stored at PORTS will be sold to commercial vendors for processing. At the production facilities, the material would be processed through their normal operation. During the process, the trace amounts of mercury will be stripped out in similar fashion as are naturally occurring contaminants without major modification to the process or equipment. The material would be processed back to commercial grade LiOH by adding it into the normal production processes of the commercial lithium producers. The material is analogous to the raw material in that it provides a source of lithium for the process, as well as a caustic value. The lithium sources for the commercial processes are obtained through leaching of either brine or pegmatite rock. It is then treated with lime to remove contaminants and to change it to the proper chemical form for further processing. The PORTS LiOH would be added to the processes at this stage. The PORTS LiOH would provide a source of lithium to the process, as well as replace a portion of the lime. This would allow the lithium in the PORTS material to continue through the process and eventually emerge as commercial grade LiOH.

The time frame in which the accumulated LiOH can be processed is dependent upon completion of the sale of the material to commercial vendors. Once the sale is completed, transfer of the stored material will commence as soon as possible and will continue until all material is sold. It is anticipated that approximately two to three million pounds of material would be moved during the first year. Firm takedown schedules are currently being developed, but it is expected that the removal of the material will take 6 to 8 years from the time in which the sale is commenced because of the massive inventory level.

CRITERIA 2: The reason that the applicant has accumulated the material for one or more years without recycling 75 percent of the volume accumulated at the beginning of the year.

The LiOH in storage at PORTS was originally purchased in the early 1950's. The LiOH was produced through a unique process that separated the enriched lithium-6 isotope from the lithium-7 isotope. In the course of this process, the enriched lithium-7 isotope material became contaminated with trace amounts of mercury. A large portion of this material was retained by DOE on an as-needed basis for additional support of the nuclear weapons program. DOE first made this material available to the commercial lithium market in 1966. The U.S. General Services Administration (GSA) determined 80 million pounds of LiOH to be surplus and negotiated agreements to sell 48 million pounds to two U.S. firms in 1971. The entire stock, constituting 4.5 times the world's demand, was planned to be sold to commercial lithium vendors. However, concerns raised by the Departments of Justice (DOJ) and Commerce (DOC) regarding antitrust and marketing strategies halted further progress until 1988, at which time the DOJ and DOC approved DOE's scaled-down marketing strategy. In addition, the GSA Inspector General raised concerns about the low bid prices offered for the material. In 1984, the GSA delegated the authority to DOE to sell the material. The DOJ/DOC restricted DOE to selling no more than 1 to 2 million pounds per year of the LiOH until their concerns were adequately resolved. These concerns have been addressed, and DOE has an acceptable sales plan approved by DOJ/DOC. Currently, DOE has halted any additional sales until the solid waste issue can be resolved with OEPA.

CRITERIA 3: The quantity of material already accumulated and the quantity expected to be generated and accumulated before the material is recycled.

DOE currently has approximately 57 million pounds of LiOH in storage at PORTS. The entire volume of this material is intended to be sold to commercial lithium vendors for use within their industrial processes. The DOE is not currently generating additional LiOH nor is future generation of this material expected.

CRITERIA 4: The extent to which the material is handled to minimize loss.

In order to prevent the release of the LiOH to the environment, DOE repackaged all the LiOH at PORTS into new steel containers, refurbished the old warehouses, and constructed new ones at a cost of approximately \$12 million. The original fiber board containers were placed inside plastic lined steel drums. Because of its hygroscopic nature during the time period

CRITERIA 4: (continued)

that the LiOH has been in storage at PORTS, it has turned from a pourable powder into a monolithic block. The fact that this material has absorbed moisture from the air and is in the form of a solid ingot, the risk of a release or environmental problem is significantly reduced. As in the past (DOE repackaged this material in 1987), DOE will continue to take precautions to ensure proper management including continued, periodic documented inspection of the buildings in which the material is stored.

CRITERIA 5: Other relevant factors.

The LiOH in storage at PORTS was originally purchased and processed in the 1950's. Until 1966 the material was maintained by DOE as a stockpile to support the nuclear weapons program. This material, upon successful sales, will be transported by truck to commercial vendors. LITHCO is located in North Carolina, and Foote Mineral is located in Nevada. Both LITHCO and Foote Mineral have indicated that if this material is classified as a waste, their interest will be diminished due to the stigma of receiving waste at their facilities (see Enclosure 2). DOE has based its request on what is considered an environmentally acceptable, cost effective option for this material. If this variance request is not accepted, DOE could be subjected to a significant financial burden in order to dispose of this material. Acceptance of this request will allow DOE to expedite the sale process and initiate removals of the material from the PORTS site.

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APPENDIX C

OEPA'S RESPONSE TO VARIANCE REQUEST

State of Ohio Environmental Protection Agency

O. Box 1049, 1800 WaterMark Dr
Columbus, Ohio 43266-0149
(614) 644-3020
Fax (614) 644-2329

George V. Voinovich
Governor

Donald A. Schregardus
Director

January 12, 1993

Dane Bartlett
CC10
P.O. Box 2001
Oak Ridge, Tennessee 37831-8510

RE: Sale of Lithium Hydroxide Waste

Dear Mr. Bartlett:

In an October 8, 1992 letter to Director Donald Schregardus Eugene Gillespie requested a variance from the classification as a waste for the lithium hydroxide residues being stored at the Portsmouth facility. That request raised several issues regarding the storage and status of that material. First, please be advised that we will be addressing our concern with the storage of the lithium in a future letter. This letter is intended to address the Ohio EPA's position regarding the sale of the lithium.

At this time the lithium hydroxide in storage at the Portsmouth facility has been in storage for a number of years. For various reasons this material, although determined to be surplus material, has not been disposed of or sold as a product. Given the circumstances surrounding the generation and storage of the lithium hydroxide the Ohio EPA (OEPA) considers the material to be a waste. Given the mercury contamination of the material we also feel that it is subject to the waste analysis provisions of Ohio Administrative Code (OAC) 3745-52-11 and all other applicable hazardous waste rules.

DOE has expressed concern about OEPA's position regarding the status of the lithium hydroxide. Your concern centers around the perception that potential buyers may be opposed to accepting the material if it is considered a waste. OEPA's position regarding the lithium hydroxide is based upon the fact that this material has been accumulated speculatively per OAC 3745-51-02(C)(4). OEPA's position in this matter applies to this material while it is stored at the Portsmouth facility.

Dane Bartlett
Page Two

If DOE Portsmouth is able to find a buyer for the lithium hydroxide the OEPA would not consider the material to be a waste once it is sent off-site for use as a raw material in a production process. Shipping of the material would not require a manifest, the transporter would not have to be a licensed hazardous waste transporter and the destination facility would not have to have a permit to accept hazardous waste. However, I would point out that the lithium hydroxide must be going to a legitimate end use, not being disposed of, and DOE would be required to maintain records documenting the disposition of the lithium hydroxide.

The OEPA encourages reuse and recycling of hazardous waste whenever possible and in no way wishes to impede DOE's plans to sell this material. DOE does not have to wait for a disposition on the variance request in order to proceed with sales of this material.

I hope that this has helped answer your questions. If you have any further questions please feel free to contact me at (614) 644-2956.

Sincerely,

Edward A. Kitchen
Manager RCRA Technical Assistance Section
Division of Hazardous Waste Management

EAK/pas

cc: Michael Savage, Assistant Chief, DHWM
Pam Allen, Manager, CMES, DHWM
Jennifer Hille, DHWM
Donna Goodman/Jeff Smith, SEDO
Eugene Gillespie, Department of Energy

APPENDIX D

LETTERS OF INTEREST FROM POTENTIAL PURCHASERS

FMC Corporation

Lithium Division
449 North Cox Road
Box 3925
Gastonia, North Carolina 28053
704 868 5300 Fax 704 868 5370

FMC

September 14, 1992

Mr. Randy Riggs
Department of Energy
Oak Ridge Field Office
P. O. Box 2001
Oak Ridge, TN 37831-8759

Dear Mr. Riggs:

As discussed today on the telephone, we are interested in the purchase of lithium material from your inventory. So that we can reconfirm our reprocessing technology and further develop our methods to handle the material we would like to receive one drum of the depleted lithium hydroxide monohydrate.

This material should be shipped freight collect to the attention of George Matthews via Roadway. Roadway's Chillicothe terminal phone number is 614/773-0441. The material should be shipped to:

FMC Corporation
Lithium Division
Highway 161
Bessemer City, NC 28016

If there are any transportation issues, please call them to the attention of Jim Waters (704/868-5325), Lithium Traffic Manager.

I look forward to future discussions.

Best regards.

R. S. Wedinger
Manager, Venture Development

:kg

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007255khg(2)

FMC Corporation

Lithium Division
449 North Cox Road
Box 3925
Gastonia North Carolina 28054-0020
704 868 5300 Fax 704 868 5370

September 15, 1992

**Mr. Paul Wasilko
Martin Marietta Energy Systems, Inc.
Y 12 Plant
P. O. Box 2009
Oak Ridge, TN 37831**

Dear Mr. Wasilko:

FMC Lithium Division continues to be interested in the purchase of lithium material from your stockpile. We would entertain an effort to develop a takedown scenario for depleted and virgin material held in Ohio and Tennessee. Obviously, we will need to develop more information on quantity, composition and pricing.

FMC Corporation would not be interested in purchasing the material if it were classified as a "waste."

Sincerely,

A handwritten signature in dark ink, appearing to read "Paul L. Schroeder", written over a horizontal line.

**Paul L. Schroeder
Lithium Division Manager**

PLS:rhd

**cc: Patrick M. Brown, Ph.D.
211 Allen Drive
Exton, PA 19341**

**Jeffrey J. Raynor, FMC
Robert S. Wedinger, FMC**

FMC Corporation

Lithium Division
149 North Cor Road
P.O. 3925
Gastonia, North Carolina 28054-0025
704 868 5300 Fax 704 868 5370

August 21, 1992

FMC

Mr. Paul Wasilko
Martin Marietta Energy Systems, Inc.
Y 12 Plant
P. O. Box 2009
Oak Ridge, TN 37831

Dear Mr. Wasilko:

FMC Lithium Division continues to be interested in the purchase of lithium material from your stockpile. We would entertain an effort to develop a takedown scenario for depleted and virgin material held in Ohio and Tennessee. Obviously, we will need to develop more information on quantity, composition and pricing.

Sincerely,

Paul L. Schroeder
Lithium Division Manager

PLS:rhd

cc: Patrick M. Brown, Ph.D.
211 Allen Drive
Exton, PA 19341

Cyprus Foote Mineral Company
Suite 301
301 Lindenwood Drive
Malvern, Pennsylvania 19355-1740
(215) 889-9605
Telex 173176, FAX (215) 889-9612

August 21, 1992

Dr. Patrick M. Brown
211 Allen Drive
Exton, PA 19341

Dear Pat:

You have suggested to us that we consider purchasing lithium hydroxide monohydrate, which the U. S. Government has stockpiled in Piketon, Ohio.

Cyprus Foote Mineral Company would be willing to pursue with the Department of Energy a program whereby we would purchase in the order of 1,000,000 pounds per year of virgin and/or depleted lithium hydroxide monohydrate for a period of 20 years. Our willingness to proceed with discussions with the Department of Energy is contingent on our obtaining representative samples of the stockpiled material. We require samples of the material for laboratory testing to ensure that we can remove the mercury contamination successfully.

Please keep us informed regarding your discussions with the Department of Energy regarding this matter.

Sincerely,

A handwritten signature in cursive script, reading 'Richard N. Jacobson'.

Richard N. Jacobson, Ph.D.
Vice President - Research and Engineering

RNJ:nb

D-4

Cyprus Foote Mineral Company
Suite 301
301 Lindenwood Drive
Malvern, Pennsylvania 19355-1740
(215) 889-9605
Telex 173176, FAX (215) 889-9612

VIA TELEFAX

September 14, 1992

Mr. Paul R. Wasilko
Martin Marietta Energy Systems, Inc.
Y-12 Plant
P. O. Box 2009
Oak Ridge, TN 37831

Dear Mr. Wasilko:

Cyprus Foote Mineral Company is interested in obtaining one drum, approximately 400 lbs., of lithium hydroxide monohydrate for test purposes.

Our interest in requesting this material is to investigate methods to use the material in our processes. This material could supplement our brine sources for lithium. We would not be interested in the material if it were classified as a waste.

I appreciate your cooperation in obtaining us a sample of this material.

Sincerely,

A handwritten signature in cursive script, reading 'Richard N. Jacobson'.

Richard N. Jacobson, Ph.D.
Vice President, Research and Engineering

RNJ:nb

D-5

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FINDING OF NO SIGNIFICANT IMPACT

**FINDING OF NO SIGNIFICANT IMPACT
FOR THE
PROPOSED SALE OF EXCESS LITHIUM HYDROXIDE STORED
AT THE OAK RIDGE K-25 SITE AND THE
PORTSMOUTH GASEOUS DIFFUSION PLANT**

AGENCY: Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA) (DOE/EA-0855) for a competitive bid market sale of 80 million pounds of government surplus lithium hydroxide monohydrate (LiOH). The LiOH is no longer required for federal activities but is worth tens of millions of dollars in the commercial market. The purpose of the sale is to limit potential environmental liabilities associated with the storage of large quantities of LiOH, free critically needed storage space, reduce storage and maintenance costs currently estimated at \$1M/year, and generate revenue for the Federal government. Based on the analysis in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the definition of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required and DOE is issuing this Finding of No Significant Impact (FONSI).

COPIES OF THE EA AND FONSI ARE AVAILABLE FROM:

Ms. Susan Morris
U.S. Department of Energy
DOE Site Office
Building 9704-2, MS 8009
Y-12 Plant
Oak Ridge, Tennessee 37831
(615) 576-3545

FOR FURTHER INFORMATION ON THE NEPA PROCESS CONTACT:

Carol Borgstrom, Director
Office of NEPA Oversight
U.S. Department of Energy
1000 Independence Avenue, S. W.
Washington, D. C. 20585
(202) 586-4600 or (800) 472-2756

PROPOSED ACTION: The proposed action is the sale of government surplus LiOH currently stored at the DOE Oak Ridge Reservation K-25 Site, Oak Ridge, Tennessee, and the Portsmouth Gaseous Diffusion Plant near Piketon, Ohio. The LiOH would be sold by competitive bid in several sales periods within a one- to three-year time frame. The first sale would be comprised of 30 million pounds of both processed and unprocessed LiOH in assorted-size allotments ranging from 10,000 to 10,000,000 pounds. The processed LiOH was used for a weapons production program and depleted in the lithium-6 isotope. LiOH would be sold "where is-as is" and awarded to the highest bidder for each lot. Martin Marietta Energy Systems, Inc., DOE's agent for the sale, would load the LiOH into buyer-provided transportation vehicles for delivery. LiOH buyers would be required to remove their LiOH on a schedule determined by the quantity purchased. The conditions for the proposed sale were mutually agreed to by DOE, the Department of Justice (DOJ), and the Department of Commerce (DOC). The remaining 50 million pounds would be sold under the same conditions as the initial sale.

ENVIRONMENTAL IMPACTS: The potential adverse environmental impacts of the proposed action are insignificant. The sales program does not entail any construction or demolition activities and, therefore, would not affect floodplains, wetlands, historic properties listed on or potentially eligible for listing on the National Register of Historic Places, or any species proposed for listing or listed as threatened or endangered under the Endangered Species Act. The

Most states and many local governments have hazardous material spill emergency response teams that would be capable of containing and cleaning up these releases. Compared to other hazardous material spills, cleanup of LiOH spills does not present any unique problems. Personnel involved in spill cleanup would be required to wear protective clothing and respirators to avoid chemical burns to skin and mucus membranes if inhaled.

Should a LiOH spill reach a water body, mortality of aquatic organisms could occur. However, based on probability statistics, there is less than a 0.5 percent chance that the four accidents with associated LiOH spills predicted from the transportation risk study would potentially impact a body of surface water.

The proposed sale has been approved by DOE, DOJ, and DOC and designed to buffer the potential impacts of introducing approximately a four-years' supply of LiOH into the market place. Sale of the LiOH would eliminate the potential environmental liabilities associated with the storage of large quantities of LiOH, free critically needed storage space for other DOE programs (which otherwise may have to build new storage facilities), reduce storage and maintenance costs, and generate revenue for the Federal government.

ALTERNATIVES CONSIDERED: The no-action alternative was considered in accordance with NEPA regulations and provided a baseline for comparison with the proposed action and alternatives. The no-action alternative would continue storage of the LiOH with very limited sales. This action would not decrease the potential threat to the environment and human health and safety. Long-term LiOH storage may force the construction of new facilities to provide space for existing or future program requirements, and the Federal government would continue to incur

processed LiOH contains approximately 2-15 parts per million of mercury as a result of processing. DOE would limit the purchase of this material to those buyers with a demonstrated ability to extract and handle the mercury in a legally prescribed manner. An analysis of potential uses for the DOE surplus LiOH concluded that the most effective use of the LiOH would be to convert it to a commercial grade of clean, free-flowing LiOH. The surplus LiOH may be used to produce commercial grade LiOH in the normal course of lithium production. The Ohio Environmental Protection Agency (OEPA) determined that the processed LiOH was a solid waste and was a potentially hazardous waste due to mercury content. Consequently, DOE submitted to OEPA a variance request from classification as waste for the processed LiOH in accordance with the provisions of the Ohio Administrative Code. OEPA responded that it would not consider the material to be a waste once it is sent off-site for use as a raw material in a production process. OEPA directed that DOE does not have to wait for a disposition on the variance request in order to proceed with sales of this material.

Purchasers of the LiOH would be required to provide enclosed trailers for transportation to their facilities. Approximately 2,369 truck shipments or 1,185 rail cars would be required to transport the 80 million pounds of LiOH to buyer facilities. Four accidents could occur, based on conservative calculated probabilities for the risk of vehicle accidents which may result in a LiOH spill. There is no data available addressing the severity or quantity of a spill event. Compared to other hazardous material spills, cleanup of LiOH does not present any unique problems. Additionally, due to moisture absorption, the LiOH would no longer be a free-flowing powder but would be partially to totally solidified, which would tend to limit its dispersion in a spill event.

significant maintenance and storage costs. Therefore, this alternative was not selected.

A second alternative, not chosen, was to hold separate sales for the processed and unprocessed LiOH. Holding separate sales would probably stimulate interest in the unprocessed LiOH, to the detriment of the processed material.

The third and last alternative reviewed was to increase the number of sales and extend them over a period of years. This alternative was not selected due to the fiscal concern over the continuing maintenance and storage costs. A major consideration is that an extended sales period may force the repackaging of the LiOH, due to storage drum deterioration, at significant expense.

DETERMINATION: The proposed sale of 80 million pounds of surplus LiOH does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. This finding is based on analyses in the EA. Therefore, an environmental impact statement for the proposed action is not required.

Issued at Washington, D.C., this 7th day of May, 1993.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

9/20/93

END