Transportation of reagent materials off-site risk related issues. 1984

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TRANSPORTATION OF REAGENT MATERIALS
OFF-SITE RISK RELATED ISSUES

CRANDON PROJECT

Prepared For

EXXON MINERALS COMPANY
Rhinelander, Wisconsin

By

ZORDAN ASSOCIATES, INCORPORATED
Murrysville, Pennsylvania

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1.0 INTRODUCTION

Previously, a risk assessment was performed for the Crandon Project [Ref.1]. This risk assessment examined the potential sources of risk to the environment and to public health and safety from several accident scenarios. Without exception, the risk assessment addressed Crandon Project operations and the potential for on-site and off-site effects when they could be identified. One of the areas investigated was the risk associated with spills and other unintentional releases of chemical reagents during their use or transportation on-site. Four reagents were included in the investigation: sodium cyanide, sodium dichromate, sulfur dioxide and sulfuric acid. These were chosen because of their toxicity, potential for environmental effects, diversity of physical form and properties, and quantity to be used annually. In the risk assessment, transportation of these materials to the site was not evaluated because the transport is not an on-site operation. The movement of these reagents over the site railroad tracks and access roads was included in the risk assessment, as a part of the on-site operations.

During the course of the Mine Plan review, the Wisconsin Department of Natural Resources (DNR), requested that several aspects of the transportation of chemical reagents to the Crandon site be evaluated. The DNR requested an evaluation of the probabilites and potential effects of transportation accidents involving these reagents. They were concerned primarily with transportation within Wisconsin.

This study evaluates the accident probabilities and potential effects associated with the land transport of the four reagents included in the risk assessment section of the Mine Plan [Ref.1]. Only rail and truck transport are included because there are no plans to use either air or water transport modes for these, or other, reagent commodities. The evaluation is concerned with accidental releases of the reagents during "over the road" transport. This corresponds to the movement of the commodity and vehicle from departure of the manufacturer's facility arrival at the Crandon Project boundary.

This evaluation is performed on a somewhat different basis than was the original risk assessment. That study was based on designs and proposed modes of operation that had been, and continue to be, developed by Exxon Minerals Company (Exxon). This off-site transportation study is based on available historical data and on available information which is categorized as "typical practice" for the rail and trucking industries. None of these activities are under the direct control of Exxon in the sense that other operations associated with the Crandon Project are. While the quantities of reagents to be used in the operation of the mine/mill are large, they are very small in the context of the national usage or transportation. Thus, the only element of control that Exxon can exercise is the choice of reputable manufacturers and transporters for these commodities. The choices of equipment to be used, routes to be taken and for procedures for mitigation measures following potential transportation accidents will be the responsibility of the manufacturer and transporter, rather than Exxon. Consequently, it is not possible to have the same degree of certainty concerning the details of the off-site transportation as with the on-site operations.

This evaluation has focused on accident probabilities and potential effects. Where possible, data and information explicitly related to the specific reagent commodities are used. Where this is not possible, more generic data and information are used. Numerous Federal, Wisconsin and private sources of information regarding transportation of chemical reagents have been incorporated into this study.

It is concluded that the off-site transportation of Crandon Project reagents represents a low probability source of risk to the environment and to the public. While the risk from off-site transportation should be higher than that associated with on-site operations, it is expected that the amounts of these commodities required for the Project will result in an insignificant increase in the amounts currently transported in Wisconsin.

2.0 REAGENT USE AND TRANSPORT

2.1 REAGENT USE

Several reagents will be used in the operations of the Crandon Project. The two operations which will utilize the greatest quantities of reagents are milling and water treatment. Of the four reagents included in the risk assessment and in this study, sodium cyanide, sodium dichromate and sulfur dioxide will be used in the milling operations. Sulfuric acid will be used in water treatment. Information, taken from Ref.2, related to the use of these reagents is presented in Table 2-1.

TABLE 2-1
REAGENT USE

Reagent	Estimated Monthly Consumption (pounds)	Storage Capacity (pounds)
Sodium Cyanide	13,200	36,000
Sodium Dichromate	30,100	117,000
Sulfur Dioxide	205,000	150,000
Sulfuric Acid	76,300	67,500

These reagents will be used [Ref.2] in their respective processes with equipment and procedures to avoid unintentional releases and to mitigate any releases should they occur. The monthly consumption figures are those expected for the design of the process units. The data in Table 2-1 indicate that two of the reagents have storage capacities well in excess of their monthy consumption. This leads to the expectation that delivery of these reagents may be based on the storage capacity, rather than on uniform usage. This tends to create periods where several deliveries are received in a relatively short period of time, rather than occurring regularly throughout plant operations. Two of the reagents have storage capacities smaller than the monthly consumption. This creates a situation where deliveries must be made regularly and more frequently than monthly. Alternatively, the transportation device may be left on-site to augment storage capacity during operations.

2.2 REAGENT TRANSPORTATION

Railroad and truck will be the only two modes of transportation used to deliver reagents to the site. The physical form of the four reagents requires that different devices be used for transporting these materials. A summary of reagent transportation, derived from information in Ref.2, presented in Table 2-2. Also presented is information concerning the expected number of annual shipments.

TABLE 2-2
REAGENT TRANSPORTATION

Reagent	Form	Shipment Mode	Shipment Size (pounds)	Annual Shipments (estimated)
Sodium Cyanide	Briquette	Truck	36,000	4.5
Sodium Dichromate	Liquid	Tank Truck	78,000	4.5
Sulfur Dioxide	Liquid	Tank Truck	60,000	41
		or		
		Rail Car	100,000	24
Sulfuric Acid	Liquid	Tank Truck	45,000	20

These materials require different types of cargo vessels for transport. All of these reagents are classified as "Hazardous Material" by the U.S. Department of Transportation (DOT) for purposes of transportation. Sodium cyanide is shipped in special containers, called "Flo-Bins." These devices contain 3,000 pounds, provide for containerized handling and transportation, and are used for dispensing the material during operations. Concentrated sodium dichromate solutions are strong oxidizing agents, particularly if they come in contact with aqueous acid solutions. The tanks used for transport are closed to avoid accumulation of water vapor. Sulfur dioxide is shipped as a compressed gas liquid and is classified as a corrosive liquid by DOT. Tank trucks or cars which are used for transport must meet special DOT specifications. Sulfuric acid is a corrosive material and the tank truck must also meet special DOT specifications.

2.3 TRANSPORTATION ROUTES

At the present time, neither the supplier nor the transporter of these commodities are known, except for the SooLine Railroad. As a result, it is necessary to make some simplifying assumptions. Since the supplier or manufacturer of the reagents is not known, and cannot be reasonably identified, it is assumed that they will be supplied from sources at or through major transportation centers. For the Crandon Project, there are four major transportation centers; Duluth, MN-Superior, WI; Minneapolis-St. Paul, MN; Green Bay,WI; and Milwaukee,WI-Chicago,IL. From these centers, it is assumed that the reagents can be obtained either from a manufacturer or through a supplier via trans-shipment. Rail routes were chosen from Wisconsin DOT maps. The SooLine was the carrier chosen, except where some sensitivity studies were done to see if the use of additional carrier's lines could result in a reduction of trip mileage. The information is summarized in Table 2-3. Because of uncertainties in determining the mileages and to make allowances for mileage accumulated within rail yards, the distances reported are increased by 20%. Truck shipping distances were determined from the same maps. Interstate highways were the preferred route, when possible. In all cases, the most direct route was chosen if more than one potential route seemed feasible. The truck route distances were virtually identical to the rail distances. Consequently, the trip distances reported in Table 2-3 are assumed to conservatively overestimate both the rail and truck transportation options.

TABLE 2-3
TRANSPORTATION DISTANCES

ORIGIN	DISTANCE (miles)
Duluth,MN-Superior,WI	281
Green Bay, WI	153
Minneapolis-St. Paul, MN	287
Chicago,IL-Milwaukee, WI	288

For each of the routes, only the mileage within Wisconsin is included in the tabulation. These distances will be used with accident rates, based on historical data and analysis, to evaluate probabilities of various accidents.

3.0 TRANSPORTATION ACCIDENT DATA FOR HAZARDOUS MATERIAL

3.1 INTRODUCTION

As previously discussed, sodium cyanide, sodium dichromate, sulfur dioxide and sulfuric acid are classified as "hazardous material" for the purposes of transport by the DOT. This results in a number of special regulations that govern all phases of transportation. These regulations require that accidents involving hazardous material transportation be reported. Many states, including Wisconsin, have parallel regulations covering the reporting of transportation accidents.

Accident reporting is a complex matter, since there are several agencies within DOT and in Wisconsin that are involved. A lack of uniform criteria for reporting and for severity classification makes it difficult to compare different tranportation modes. The remainder of this section includes a discussion of the accident data sources and some of the limitations of their use. It is important to recognize that the term "accident," as applied to these cases, means the accidental or unintentional release or spillage of the hazardous material cargo during some phase of transportation. As is discussed below, it is rare when the "accident" actually involves a vehicular accident or derailment. Thus, when accident rates are discussed, or probabilities of accidents are derived, these relate to unintentional releases or spillage of the cargo rather than to a vehicular accident or derailment.

3.2 NATIONAL ACCIDENT DATA

At the federal level, the most comprehensive tabulation of hazardous material accident data is prepared for the annual Transportation Safety Information Report [Ref.3], prepared by the Research and Special Programs Administration (RSPA) of DOT. This report provides a summary of all types of safety related data, including air, highway, rail, water and pipeline transport of hazardous material. While this report is necessarily a summary, the detailed records are available through a computerized data base, maintained by the Materials Transport Bureau (MTB) and Hazardous Materials Information Systems (HMIS) groups in DOT. This data base includes all hazardous material transportation accidents that are reported to the individual regulatory/reporting acencies in DOT. The MTB/HMIS data base retains accident records for specific types of hazardous material.

A comprehensive annual summary of railroad accidents is prepared by the Federal Railroad Administration [Ref.4]. This annual report tabulates much more detailed information for the railroad accidents than does the RSPA report. The detailed FRA report generally lags the RSPA summary by a full calendar year because of the increased detail. The FRA data do not include information on specific hazardous material. The FRA also maintains access to the MTB/HMIS computerized data base for railroad accidents.

CHEMTREC is a hazardous material spill response service maintained by the Chemical Manufacturers Association (CMA). Their objective is to provide rapid, emergency response information used in the mitigation of the effects of unintentional releases of hazardous material rather than to compile accident or release statistics. The CHEMTREC record of hazardous material transportation accidents is much smaller than the DOT data base because fewer accidents require CHEMTREC assistance. Thus, any accidents known to CHEMTREC will be included in the MTB/HMIS data base [Ref.5].

From the RSPA summary, there were 4,829 highway and 851 rail accidents nationwide involving hazardous material transportation in 1983. Because these data were compiled by different DOT agencies using different reporting criteria, comparisons between the two modes of transport is complex. Another factor of variability is introduced when an agency changes reporting criteria from year to year. The FRA has adjusted it's economic threshold for reporting accidents on a biennial basis.

The MTB/HMIS data base has the flexibility to permit searches for accidents involving specific commodities. From 1979 to 1983, there have been 1,754 incidents involving the four reagent commodities evaluated in this study. In these incidents, there are 1,834 records of container damage, indicating that some of the incidents involved more than one container of hazardous material. Of the 1,754 incidents, 18 involved sulfur dioxide, 32 involved cyanide materials, 4 involved sodium dichromate and the remaining 1700 involved sulfuric acid. Thirty-two of these incidents were reported from Wisconsin [Ref.6]. Summaries of accident data earlier than 1979 from the same MTB/HMIS data base yield the similar results [Ref.7].

It has been estimated [Ref.8] that less than 20% of the accidents involving transportation of hazardous material can be classified as serious. In 1980, the MTB recorded 16,115 incidents involving all modes of tranportation of hazardous material [Ref.9]. Of this number, 324 of these were classified as "Severe," resulting in death, injury or requiring evacuation. In the 1979-1983 search discussed above, there were 45 vehicular accidents or derailments and 1 evacuation encountered in the 1,754 incidents. There were no deaths and 244 injuries in the 1,754 incidents. For the 45 incidents involving vehicular accidents or derailments, 5 of the injuries occurred. There is a large difference in the monetary consequences of the two types of incidents. For those involving vehicular accidents or derailments, the average cost of the damage to the vehicle and cargo was approximately $7,150. For the remaining incidents, the average cost of the damage was approximately $235. These costs do not include the costs associated with the recording, reporting or mitigation of the incident.

While a number of federal agencies compile hazardous material transport accident records, there is no corresponding effort to report the total number of shipments or the total number of miles accumulated in hazardous material transport. The number of records (e.g., way-bills) that would have to be collected and entered into a data base have been seen as precluding the effort. However, some estimates are made from the accident reports and a sampling of way-bills. The FRA estimates the number of train-miles accumulated in all freight and hazardous material transport from a sampling of 1% of the way-bills prepared annually. The FRA also estimates that this sampling procedure results in a 20 to 30% underestimate of the annual mileage for hazardous material transport by rail [Ref.10]. A similar process is followed by the Bureau of Motor Carrier Safety of the Federal Highway Administration (FHWA) in compiling road mileage figures for hazardous material transport. For example, in 1981 it has been estimated that there were 57.5 billion vehicle miles, of which 5 to 25% were for hazardous material transport [Ref.11]. A convenient tabulation of this type of data is made in the annual Statistical Abstract of the United States [Ref.12]. As is the case with most documents of this type, the data for the year reported lag the calendar year by 1 or more years.

3.3 WISCONSIN ACCIDENT DATA

As at the federal level, several governmental agencies within Wisconsin record data on transportation accidents. However, there are some major differences. For example, the Wisconsin Railroad Bureau does not duplicate the accident reporting function of the FRA [Ref.13]. The most complete record of hazardous material transport accidents in Wisconsin is compiled by the DNR [Ref.14]. This record is not specifically directed at hazardous material transport accidents, but rather at recording unintentional releases of hazardous material. This DNR data collection activity has been ongoing since the mid-1970's, and records spills and releases at facilities in addition to those involved in hazardous material transport. The records have grown from approximately 350 events in 1978 to 700 incidents in 1983. Approximately 35 to 40% of these events involve hazardous material transportation. The remainder involve release of hazardous material at various facilities.

While the DNR data base is available, it is not convenient for use since it is a manual system. No annual summary or statistical trending of the accident data is compiled. Hence, any comparisons between the Wisconsin and various federal data bases is not directly possible. Any hazardous material transport accident that would meet the federal reporting criteria would assuredly meet the Wisconsin reporting criteria. Thus, a way to access some of the Wisconsin hazardous material transport accident data is through the use of the FRA [Ref.4] and MTB/HMIS [Refs.6&7] computerized data bases. This process may not capture some accidental releases, but would certainly capture any hazardous material transport accident that met the federal economic or public safety criteria for reporting. Such a process was used in this study.

For the search of the MTB/HMIS data base for 1979-1983, discussed in Section 3.2, there were 32 incidents involving the four reagents of interest in this evaluation. The results of the data search are presented in Appendix A. For the 32 incidents, none involved vehicular accidents or derailments. There were no deaths or injuries associated with the 32 incidents. The average cost of the damage to the cargo and vehicle was approximately $535. For the 32 incidents, 1 involved cyanide materials and 31 involved sulfuric acid. In this regard, the Wisconsin data are consistent with the national data. Sulfuric acid is the most commonly produced and transported commodity of the four reagents evaluated. Wisconsin data are also consistent with the national accident data base in that there are very few severe incidents involved in the large number that are reported.

3.4 ANALYTIC STUDIES

In addition to the various hazardous material transport accident data reporting activities discussed above, there have been a few comprehensive engineering analyses of hazardous material transport accidents and the means to estimate them in the absence of historical records. The DOT has completed a study used in selecting routes to be used in hazardous material transport [Ref.7]. This study includes the derivation of analytical expressions which can be used to estimate accident rates and probabilities for several types of highways.

Several studies have been performed to generate models to be used for the transportation of radioactive waste materials. One of the most comprehensive studies [Ref.15] includes the derivation of accident rates from generic freight transportation accident data. Accident frequencies for truck, rail and air transport modes were derived. In addition, analyses were completed for various types of damage to shipping containers.

Both of these comprehensive studies have elements of uncertainty introduced because the use of accident records and estimates of total vehicle-miles involved are not available from a consistent data base. A summary of the derived hazardous material transport accident frequencies is presented in Table 3-1.

TABLE 3-1
ACCIDENT FREQUENCY
HAZARDOUS MATERIALS TRANSPORT

MODE	FREQUENCY (accidents/vehicle-mile)	REFERENCE
Truck		
2-lane highway	1.8×10^{-6}	7*
4-lane Interstate	2.1×10^{-6}	7*
Generic	2.5×10^{-6}	15
Rail		
Generic	1.5×10^{-6} (car accidents/car mile)	15

* A range of approximately 10% is cited. Data for other road types are also presented.

In addition, several studies for transportation in urban environments have been made. One analytical study [Ref.16] indicated that the urban accident frequencies for truck transport are increased by a factor of 2 or 3 over those presented in Table 3-1. The uncertainties in the urban study are somewhat larger than those discussed above.

3.5 ACCIDENT RATE DATA

From the various sources of data discussed above, it is possible to derive accident rates for rail and truck transport. For rail transport during 1981 [Ref.12], there were 21,613,000 car loads of freight loaded. Of these, 1,333,000 were chemical and related products. If this ratio is applied to the total car-mileage estimate of 15.4 billion car-miles, it is estimated that there were 950 million car-miles of chemical commodity volume on Class I railroads. If this is assumed to be the traffic for hazardous material rail transport, and combined with the 601 accidents in 1981 [Ref.17], it is estimated that there were 0.6×10^{-7} accidents per car-mile of rail transport. This is somewhat lower than the accident frequencies discussed in Section 3.4, but is within the uncertainties in both sets of estimates.

For truck transport, the FHWA has estimated [Ref.11] that there were 57.5 billion highway miles of freight traffic during 1983, and that 5-25% of this mileage involved hazardous material transport. If these estimates are combined with the 4,829 highway accidents [Ref.3], accident rates from 1.7×10^{-6} to 3.4×10^{-7} accidents per vehicle-mile are calculated. These are comparable to the estimates discussed in Section 3.4.

4.0 PROBABILITIES OF HAZARDOUS MATERIAL TRANSPORT ACCIDENTS

4.1 ACCIDENT RATES

The accident rate data discussed in Sections 3.4 and 3.5 are judged to be comparable. As discussed in Section 4.4, the uncertainties in these accident rate data can range from factors of 1.5 to more than 5. Consequently, the accident rate data presented in Table 3-1 are adopted for use in this evaluation.

4.2 ANNUAL TRANSPORT DISTANCES

The data presented in Tables 2-2 and 2-3 can be combined to estimate the total annual mileages for transport of the four reagents chosen for this study. A shipment distance of 290 miles is chosen for both rail and truck transport. There would be 29 truck shipments and 24 rail shipments annually if sulfur dioxide is moved by rail. If truck transport is used for sulfur dioxide, there would be 70 truck shipments annually for these four reagents. The annual mileages involved would be 15,370 or 20,300 for the two options. If some other split of rail and truck transport of sulfur dioxide were chosen, the annual mileages would fall between these estimates.

4.3 ACCIDENT PROBABILITIES

The data in Sections 4.1 and 4.2 are combined with the accident rate data in Table 3-1 to estimate accident probabilities. For truck transport, an accident rate of 2×10^{-6} accidents/vehicle mile is used. For rail transport, an accident rate of 1.5×10^{-6} accidents/car-mile is used. The accident rate (acc/mi) is multiplied by the transport distance to yield the probability. The combined estimates for all 4 reagents are given in Table 4-1.

TABLE 4-1
ANNUAL ACCIDENT PROBABILITIES

MODE	NUMBER OF SHIPMENTS	MILEAGE	PROBABILITY
Truck	70	20,300	4.1×10^{-2}
	29	8,410	1.7×10^{-2}
Rail	24	6,960	1.0×10^{-2}

These estimates may be combined to yield over-all probabilities of 2.7 to 4.1×10^{-2} accidents/year for the off-site transport of these four reagents to the Crandon Project.

4.4 UNCERTAINTIES

The uncertainties associated with the accident rates, the shipment distances and the probabilities are varied and may be interactive. The accident rates are based upon combinations of records and estimates from different sources. The records were often kept for purposes much different than their use in this study. There are no known records of actual mileages accumulated in the transport of these four reagents, or for hazardous material in general. For this reason, the estimated uncertainties for other studies [Refs.7&15] may be slightly low for this study.

The uncertainties associated with shipment distances for the Crandon Project have been addressed by increasing the estimated distances for major shipment corridors by 20%. This should conservatively overestimate the distances in all but the most unusual routes through Wisconsin. In such cases, the economics of shipping will help assure that the shortest, less time consuming route is taken by the transporter.

It is difficult to estimate accurately the overall uncertainties associated with the probabilities derived in this study. Care has been taken to use estimates that tended to result in increased calculated probabilities of accidents. Consequently, it is believed that the derived probabilities are over-estimates of the likelihood of the accidents.

5.0 POTENTIAL EFFECTS

In contrast to the potential effect of spills or releases of these reagents which may occur on the Crandon Project site, the potential effects of spills or releases during transportation to the site are more difficult to assess. Because of the current lack of knowledge regarding the routes and timing of the shipments the potential effects can be discussed only in the most general terms.

For those transportation routes in rural regions, the potential effects should not be much different than those discussed in the risk assessment for on-site reagent spills. (See Section 5.3.1 of Ref.1.) The potential effects and mitigating measures would likely be similar. These reagents are not flammable. Their environmental effects are largely short-term and reversible. Clean-up and mitigation of any spills can be performed using currently available technology. Federal regulations (49CFR177) require that transporters take mitigating measures in the event an accidental release of hazardous material occurs. CHEMTREC is chartered to provide information to teams responding to these and other types of releases of chemical materials. The CMA notes [Ref.18] that it is common practice to provide both training and procedure manuals to be used in the loading, transport and unloading of chemicals. The training and manuals cover spill mitigation techniques in addition to other aspects of tranportation of these materials.

For those transportation routes in urban regions, the potential effects can be very different than those in rural regions. The higher population density makes it necessary to respond to any releases quickly to limit potential health effects. In addition to the higher population density, another factor that is different for potential urban spills or releases because of accidents is that the speed of the vehicle in urban areas is generally much lower than in rural areas. The lower speed generally results in less severe accidents, and consequently, smaller releases than from accidents which occur from high speeds [Ref.15]. This would tend to offset the higher population density in considering potential effects.

It is important to recognize that even if an accident were to occur, it is very unlikely that the entire cargo involved in the shipment would be released. In 1983, there were 4,829 highway accidents involving hazardous material transportation. These accidents resulted in 122 injuries and 8 deaths. For rail shipment of hazardous material in 1983, there were 851 accidents, with 69 injuries and no deaths. Most of these effects were related to the immediate accident effects and involved flammable materials [Ref.3]. In 1981, in rail accidents involving hazardous material, there were 601 accidents with 2,770 cars containing hazardous material. Only 773 of these cars were damaged, and 109 of these cars released hazardous material [Ref.17]. In 1982, the corresponding figures were 504 accidents, involving 2,297 cars, with 671 damaged cars and 137 cars releasing hazardous material

[Ref.4]. The MTB/HMIS tabulation [Ref.7] indicates that very few of the accidents had appreciable quantities of hazardous material releases. For the 1979-1983 incident data covering the four reagents of interest for Wisconsin presented in Appendix A, there were no reported releases over 100 gallons. Of the 34 records, 5 had releases between 10 and 100 gallons, and the remaining 29 incidents had releases less than 10 gallons. Thus, for any of the accidents, it is important to recognize that the majority are small releases.

It is not possible to be more specific about potential effects at the present time. These commodities, and other hazardous materials, are transported regularly throughout Wisconsin. There is nothing unique about these commoditites or their quantities which present an unusual set of conditions for consideration.

6.0 SUMMARY AND CONCLUSIONS

An evaluation of the probability of transportation accidents which may result in the spill or release of four chemical reagents (sodium cyanide, sodium dichromate, sulfur dioxide and sulfuric acid) used in the operation of the Crandon Project has been conducted. The evaluation has centered on the phase of transport within Wisconsin, before the shipment reaches the Project site. The effects of potential spills on the Project site were evaluated previously [Ref.1].

A number of independent data bases were used for this evaluation. These data were combined in a manner believed to conservatively over-estimate the probabilities of transport accidents. Even on this basis, the type of accidents discussed are not expected to occur over the lifetime of the Crandon Project.

The potential effects of this class of accidents could only be evaluated in the most general terms. This is because of the lack of specific information regarding the source of the reagents and the routes to be used for the actual transportation.

The effects are judged to be within the acceptable limits experienced by the daily transportation of hazardous material in commerce within Wisconsin. There is nothing unique about the reagents or their proposed quantities of use that would represent an unusual source of risk or concern to public health or to the environment.

7.0 REFERENCES CITED

1] Section 5, "Risk Assessment" of the Mine Plan for the Crandon Mine/Mill Project, 1982.

2] Environmental Impact Report, Crandon Mine/Mill Project, Revised 1984.

3] "Transportation Safety Information Report-1983 Annual Summary", Research and Special Programs Administration, U.S. Department of Transportation, April 1984.

4] "Accident/Incident Bulletin, No. 151, Calendar Year 1982", Federal Railroad Adminstration, Office of Safety, U.S. Department of Transportation, June 1983. (TD 3.103:151)

5] Personal communication, A. Howard, Chemical Manufacturers Association, CHEMTREC, 24 September 1984.

6] Personal communication with K. Coburn, Hazardous Materials Information Systems, Research and Special Programs Administration, U.S. Department of Transportation, 20 September 1984.

7] "Development of Criteria to Designate Routes for Transporting Hazardous Materials", Report FHWA/RD-80/105, Federal Highway Administration, U.S. Department of Transportation, September 1980. (TD 2.30-80/105).

8] "Hazardous Chemicals: Program aims at cutting truck spills", Chemical and Engineering News, p.6, 10 September 1984.

9] "11th Annual Report on Hazardous Materials Transportation, Calendar Year 1980", Materials Transport Bureau, Research and Special Programs Administration, September 1982.

10] Personal communication, R. Finkelstein, Systems Support Division, Federal Railway Administration, U.S. Department of Transportation, 24 September 1984.

11] Personal communication, D. Billings, Federal Highway Administration, U.S. Department of Transportation, 26 September 1984.

12] "Statistical Abstract of the United States, 1984", 104th Edition, Bureau of the Census, U.S. Department of Commerce, December 1983.

13] Personal communication, R. Montgomery, Railroad Safety Commission, Wisconsin Department of Transportation, 20 September 1984.

14] Personal communication, T. Amman, Wisconsin Department of Natural Resources, 25 September 1984

15] R. K. Clarke, et al., "Severities of Transportation Accidents, Vols. I to IV", Report No. SLA-74-0001, Sandia National Laboratories, 1976.

16] N. C. Finley, et al., "Transportation of Radionuclides in Urban Environs", NUREG/CR-0743, U.S. Nuclear Regulatory Commission, 1980.

17] "Accident/Incident Bulletin, No. 150, Calendar Year 1981", Federal Railroad Admiinstration, Office of Safety, U.S. Department of Transportation, June 1982. (TD 3.103:150)

18] "Risk Management of Existing Chemicals", Proceedings of a Seminar, Chemical Manufacturers Association, p. 29-30, June, 1984.

APPENDIX A

RAIL AND HIGHWAY TRANSPORTATION INCIDENTS
IN WISCONSIN

1979-1983

SEARCH PERFORMED 26 SEPTEMBER 1984
BY
HAZARDOUS MATERIALS INFORMATION SYSTEMS
MATERIALS TRANSPORTATION BUREAU
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION

TABLE A-1

WISCONSIN

Sep-26-1984

RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
SELECTED HAZARDOUS MATERIALS INCIDENTS

CARRIER	MODE	INCIDENT LOCATION		COMMODITY	CONT-1	CAPACITY	FAILURES	AMT RELSD	R	FAILD	DATE
SHIPPER		SHIPMENT ORIGIN		CODE & CLASS	CONT-2	INJURY DEAD	DAMAGES		EX/REG	SHIPD	REPORT #
C W TRANSPORT INC	H-H	MADISON	WI	SULFURIC ACID	BOTL PLS	1 QTS	20 00	8 QTS	5	8	03/30/79
DU PONT E I DE NEMOURS & CO		NILES	IL	09930 COR	12B	0 0	$19			60	9050991A
C W TRANSPORT INC	H-H	KAUKAUNA	WI	SULFURIC ACID	BOTL PLS	1 QTS	20 00	6 GAL	5	1	09/07/79
NATIONAL CHEMSEARCH CORP		INDIANAPOLIS	IN	09930 COR	BOX FBR	0 0	$30			36	9091421A
MURPHY MOTOR FREIGHT LINES INC	H-H	MILWAUKEE	WI	SULFURIC ACID	PAIL PLS	5 GAL	02 00	2 GAL	5	1	09/25/79
ATHEA LABORATORIES INC		MILWAUKEE	WI	09930 COR		0 0	$75			22	9100539A
GATEWAY TRANSPORTATION CO INC	H-F	JANESVILLE	WI	CYANIDE OR MIXTURES	37A	0	02 00	1 LBS	5	1	10/18/79
HOUGHTON E F & CO		DETROIT	MI	03820 POIS B		0 0	$0			1	9110340A
DAHLEN TRANSPORT INC	H-F	SCHOFIELD	WI	SULFURIC ACID	MC312	38000 GAL	11 00	10 GAL	5	1	01/23/80
NORTH STAR CHEMICALS INC		S ST PAUL	MN	09930 COR		0 0	$20			1	80020039A
UNITED PARCEL SERVICE INC	H-H	ELM GROVE	WI	SULFURIC ACID	BOTL GLS	3 GAL	01 00	1 GAL	5	1	03/27/80
CURTIN MATHESON SCIENTIFIC		WAYNE	NJ	09930 COR	BOX FBR	0 0	$250			3	80041239A
AMERICAN FREIGHT SYSTEM INC	H-F	MILWAUKEE	WI	SULFURIC ACID	JUG PLS	1 GAL	21 00	3 GAL	5	3	05/07/80
HONEYWOOD PRODUCTS INC		ALTO	MI	09930 COR	12B	0 0	$60			28	80050026A
GATEWAY TRANSPORTATION CO INC	H-F	MILWAUKEE	WI	SULFURIC ACID	LINR PLS	55 GAL	13 00	2 GAL	5	1	05/09/80
ALLIED KELITE DV RICHARDSON CH		DETROIT	MI	09930 COR	37M	0 0	$25			1	80070723A
DAHLEN TRANSPORT INC	H-H	GREEN BAY	WI	SULFURIC ACID	MC312	5000 GAL	02 00	300 GAL	5	1	05/28/80
NORTH STAR CHEMICAL		PINE BEND	MN	09930 COR		0 0	$200			1	81010161A
NEUENDORF TRANSPORTATION	H-H	WAUSAU	WI	SULFURIC ACID	BOTL PLS	1 QTS	02 00	1 PTS	5	1	06/17/80
DEVERE CHEMICAL CO		JANESVILLE	WI	09930 COR	BOX FBR	0 0	$2			18	80070856A
SCHNEIDER TANK LINES INC	H-F	GREEN BAY	WI	SULFURIC ACID	MC311	4800 GAL	17 19	1000 GAL	5	1	07/04/80
PROCTER & GAMBLE CO		GREEN BAY	WI	09930 COR		0 0	$15,000			1	80071187A
SCHNEIDER TANK LINES INC	H-H	MENASHA	WI	SULFURIC ACID	MC312	5665 GAL	18 19	10 GAL	5	1	07/30/80
ALLIED CHEMICAL CORP		CHICAGO	IL	09930 COR		0 0	$0			1	80080974A
DAHLEN TRANSPORT INC	H-F	WAUSAU	WI	SULFURIC ACID	MC312	5000 GAL	11 00	5 GAL	5	1	09/22/80
NORTH STAR CHEMICAL		PINE BEND	MN	09930 COR		0 0	$5			1	81010160A
ROGERS CARTAGE CO	H-H	MILWAUKEE	WI	SULFURIC ACID	MC312	40300 GAL	19 00	15 GAL	5	1	10/06/80
STAUFFER CHEMICAL CO		HAMMOND	IN	09930 COR		0 0	$30			1	80101543A
UNITED PARCEL SERVICE INC	H-H	MADISON	WI	SULFURIC ACID	BOTL PLS	1 QTS	14 00	2 OZS	5	1	10/10/80
CERTIFIED LABORATORIES		DALLAS	TX	09930 COR	12B	0 0	$50			1	80100802A
UNITED PARCEL SERVICE	H-F	ELM GROVE	WI	SULFURIC ACID	JUG	1 GAL	12 00	1 GAL	5	1	01/30/81
MEDIX OF WISCONSIN		GREEN BAY	WI	09930 COR		0 0	$240			1	81020588A

* (under mode abbreviation) = vehicular accident or derailment   Evac = Evacuation

TABLE A-1 (Continued)

SELECTED HAZARDOUS MATERIALS INCIDENTS

CARRIER / SHIPPER	MODE	INCIDENT LOCATION / SHIPMENT ORIGIN		COMMODITY / CODE & CLASS	CONT-1 / CONT-2	CAPACITY / INJURY DEAD	FAILURES / DAMAGES	AMT RELSD / EX/REG	R	FAILD / SHIPD	DATE / REPORT #
SCHNEIDER TANK LINES INC	H-H	MENASHA	WI	SULFURIC ACID	MC307	5665 GAL	17 00	5 GAL	5	1	02/05/81
ASHLAND CHEMICAL MENASHA		MENASHA	WI	09930 COR		0 0	$0			1	81020521A
UNITED PARCEL SERVICE	H-H	ELM GROVE	WI	SULFURIC ACID	BOTL PLS	1 QTS	11 00	6 OZS	5	1	07/16/81
PURITAN BAKERY		SANTA MONICA	CA	09930 COR	BOX FBR	0 0	$60			1	81080305A
MAISLIN TRANSPORT	H-F	MILWAUKEE	WI	SULFURIC ACID	LINR PLS	113 LBS	01 00	121 LBS	5	1	08/31/81
VWR SCIENTIFIC, INC.		BRIDGEPORT	NJ	09930 COR	BOX FBR	0 0	$116	E5456		1	81090643B
UNITED PARCEL SRVICE	H-H	ELM GROVE	WI	SULFURIC ACID	BOTL PLS	2 GAL	11 00	2 QTS	5	1	11/18/81
WORTHINGTON DIAGNOSTICS		ELK GROVE VIL	IL	09930 COR	BOX FBR	0 0	$65			1	81120037A
SCHNEIDER TANK LINES INC	H-F	APPLETON	WI	SULFURIC ACID	MC307	5500 GAL	12 00	5 GAL	5	1	01/13/82
ESTECH CHEMICAL		CALUMET CITY	IL	09930 COR		0 0	$0			1	82010447A
UNITED PARCEL SERVICE	H-F	ELM GROVE	WI	SULFURIC ACID	JUG GLS	4 GAL	01 00	1 GAL	5	1	02/15/82
AMERICAN SCIENTIIC PRODUCTS		MCGAW PARK	IL	09930 COR	CONT STY	0 0	$85			1	82030165A
UNITED PARCEL SERVICE	H-H	ELM GROVE	WI	SULFURIC ACID	BOTL PLS	12 QTS	12 17	1 GAL	5	1	02/19/82
NATIONAL CHEMSEARCH		INDIANAPOLIS	IN	09930 COR	12B	0 0	$70			1	82030166A
UNITED PARCEL SERVICE	H-F	SHEBOYGAN	WI	SULFURIC ACID	BOTL PLS	1 QTS	11 00	1 QTS	5	1	03/31/82
MOHAWK LABS		INDIANAPOLIS	IN	09930 COR	BOX FBR	0 0	$50			12	82040370A
ADANCE UNITED EXPRESSWAYS	H-F	RACINE	WI	SULFURIC ACID	BOTL GLS	3 LBS	01 00	2 LBS	5	1	04/05/82
AMERICAN SCIENTIFIC PRODUCTS		MCGAW PARK	IL	09930 COR	33A	0 0	$10			1	82040460A
UNITED PARCEL SERVICE	H-F	MADISON	WI	SULFURIC ACID	JUG PLS	6 QTS	10 11	2 QTS	5	1	05/05/82
SUN PRAIRIEIND		ST LOUIS	MO	09930 COR	BOX FBR	0 0	$300			1	82050532A
UNITED PARCEL SERVICE	H-F	ELM GROVE	WI	SULFURIC ACID	BOTL PLS	1 QTS	11 00	16 OZS	5	2	06/03/82
KEM MFG. CO.		TUCKER	GA	09930 COR	BOX FBR	0 0	$50			12	82060194A
MAISLIN TRANSPORT OF DELAWARE	H-F	MADISON	WI	SULPHURIC ACID	BOTL GLS	1 PTS	03 00	4 PTS	5	4	10/25/82
AMEND DRUG & CHEMICAL		HILLSIDE	NJ	09930 COR	12A	0 0	$0			4	82110153A
DAHLEN TRANSPORT, INC.	H-F	ALMA	WI	SULFURIC ACID	TANK TRL	0	19 00	0	5	1	12/08/82
KOCH REFINING		PINE BEND	MN	09930 COR		0 0	$5			1	82120230A
DAHLEN TRANSPORT, INC.	H-F	ALMA	WI	SULFURIC ACID	TANK STG	0	19 00	5 GAL	5	1	12/08/82
KOCH REFINING		PINE BEND	MN	09930 COR		0 0	$0			1	82120230B
ROADWAY EXPRESS, INC.	H-H	JANESVILLE	WI	SULFURIC ACID	BOTL PLS	2 QTS	20 00	3 GAL	5	8	07/29/83
CLOROBEN CHEMICAL		KEARNY	NJ	09930 COR	BOX FBR	0 0	$100			16	83080322A
LEEWAY MOTOR FREIGHT	H-F	MADISON	WI	SULFURIC ACID	DRUM	30 GAL	10 13	1 QTS	5	1	08/12/83
CAL CHEM DISTRIBUTOR			XX	09930 COR		0 0	$25			1	83090006A

* (under mode abbreviation) = vehicular accident or derailment   Evac = Evacuation

TABLE A-1 (Continued)

SELECTED HAZARDOUS MATERIALS INCIDENTS

CARRIER	MODE	INCIDENT LOCATION		COMMODITY	CONT-1	CAPACITY	FAILURES	AMT RELSD	R	FAILD	DATE
SHIPPER		SHIPMENT ORIGIN		CODE & CLASS	CONT-2	INJURY DEAD	DAMAGES	EX/REG		SHIPD	REPORT #
UNITED PARCEL SERVICE	H-F	MADISON	WI	SULFURIC ACID	JAR GLS	1 QTS	12 00	1 QTS	5	1	10/07/83
FISHER SCIENTIFIC		ITASCA	IL	09930 COR	12A	0 0	$100			4	83100347A
UNITED PARCEL SERVICE	H-H	MADISON	WI	SULFURIC ACID	JAR GLS	1 QTS	17 00	1 QTS	5	1	10/07/83
FISHER SCIENTIFIC		ITASCA	IL	09930 COR	12A	0 0	$100			4	83100490A

* (under mode abbreviation) = vehicular accident or derailment Evac = Evacuation

TABLE A-1 (Continued)

Sep-26-1984

34 RECORDS FOUND

32 INCIDENTS

TOTALS:

DEATHS = 0 *** INJURIES = 0 *** DAMAGES = $17,142

VEHICULAR ACCIDENTS/DERAILMENTS = 0

EVACUATIONS = 0

DUE TO VEHICULAR ACCIDENTS/DERAILMENTS:

TOTALS:

DEATHS = 0 *** INJURIES = 0 *** DAMAGES = $0 *** INCIDENTS = 0

PERCENTAGE DUE TO VEHICULAR ACCIDENTS/DERAILMENTS:

DEATHS = .00% INJURIES = .00% DAMAGES = .00% INCIDENTS = .00%

* (under mode abbreviation) = vehicular accident or derailment Evac = Evacuation

PROGRAM: HAZREP.FRX

TABLE A-2

CONTAINER FAILURE CODES

CODE NUMBER	ABBREVIATION	DESCRIPTION
01	DROPPED	Dropped in handling
02	EXT PUNCT	External puncture
03	OTHER FRT	Damage by other freight
04	WATER	Water damage
05	OTHER LIQ	Damage from other liquid
06	FREEZING	Freezing
07	EXT HEAT	External heat
08	INT PRESS	Internal pressure
09	CORR-RUST	Corrosion or rust
10	DEF FVC	Defective fittings, valves or closures
11	LOOSE FVC	Loose fittings, valves or closures
12	INNER REC	Failure of inner receptacles
13	BOTTOM	Bottom failure
14	BODY-SIDE	Body or side failure
15	WELD	Weld failure
16	CHIME	Chime failure
17	OTHER	Other conditions
18	HOSE BUST	Hose burst (during loading/unloading of tank trucks)
19	LOAD-UNLD	Loading/unloading spill (involving tank trucks & trailers)
20	IMP BLOCK	Improper blocking/bracing (cargo shifted, fell over, etc.)
21	IMP LOAD	Improper loading(upside down, on its side, heavy freight on top)
22	VEH ACC	Vehicular accident or derailment
23	VENTING	Venting (automatic or intentional manual venting)
24	FUMES	Release of fumes only (any type of container)
25	FRICTION	Friction (between containers or containers and vehicle)
26	STAT ELEC	Static electricity
27	METAL FTG	Metal fatigue

NOTE: Code numbers 18 through 27 were added to the incident report data base in JANUARY 1976.

Data Base	Attribute
HAZMAT.DMS	FC1C1
HAZMAT.DMS	FC2C1
CANTWO.DMS	FC1C2
CANTWO.DMS	FC2C2

TABLE A-3

RESULT CODES

CODE NUMBER	ABBREVIATION	DESCRIPTION
1	None	NONE
2	Fire	FIRE
3	Explosion	EXPLOSION
4	Fire & Explos	FIRE AND EXPLOSION
5	Spillage	SPILLAGE
6	Spill & Fire	SPILLAGE AND FIRE
7	Spill & Explos	SPILLAGE AND EXPLOSION
8	Spill-Fire-Exp	SPILLAGE, FIRE AND EXPLOSION

NOTE: The above codes were added to the incident report data base in JULY 1973.

Data Base	Attribute
HAZMAT.DMS	RSLT

APR-08-1981

TABLE A-4

TRANSPORTATION MODE CODES

CODE NUMBER	MODE ABBREVIATION	ALTERNATE ABBREVIATION	MODE OF TRANSPORTATION
1	AIR	Air	AIR
4	H-H	Hwy-H	HIGHWAY (FOR HIRE)
5	H-P	Hwy-P	HIGHWAY (PRIVATE)
6	R	Rail	RAILWAY
7	W	Water	WATER
8	F-F	FrtFwd	FREIGHT FORWARDER
9	OTH	Other	OTHER

NOTE: The above codes have been used in the incident report data base since JANUARY 1971.

Data Base	Attribute
HAZMAT.DMS	MODE
COMPNY.DMS	MODE

TABLE A-5

MULTIPLE REPORT CODES

MULTIPLE CODE	DESCRIPTION
A	A report number, appearing only once in the data base with an A code, indicates an incident involving a single shipper, commodity, container type and size, and container manufacturer.
B	A report number appearing several times with codes B thru U, indicates an incident involving more than one shipper, commodity, container type or size, or container manufacturer.
V	Limited quantities of hazardous materials for which a packaging exception is listed in section 172.101, col. 5(a).
W	Any hazardous material released from a hose during the normal course of loading or unloading of a tank vehicle after the internal valves have been closed and the hose has been disconnected.
X	Shipments of flammable liquids in packaging of 5 gallons or less capacity (does not include limited quantities).
Y	Shipments of electric storage batteries. .
Z	Any report which does not appear to meet reporting criteria as outlined in section 171.16 and which has not been returned to the reporter with a form letter.

NOTE: Codes V thru Z were added to the incident report data base in JANUARY 1977.

Data Base	Attribute
HAZMAT.DMS	MTPL