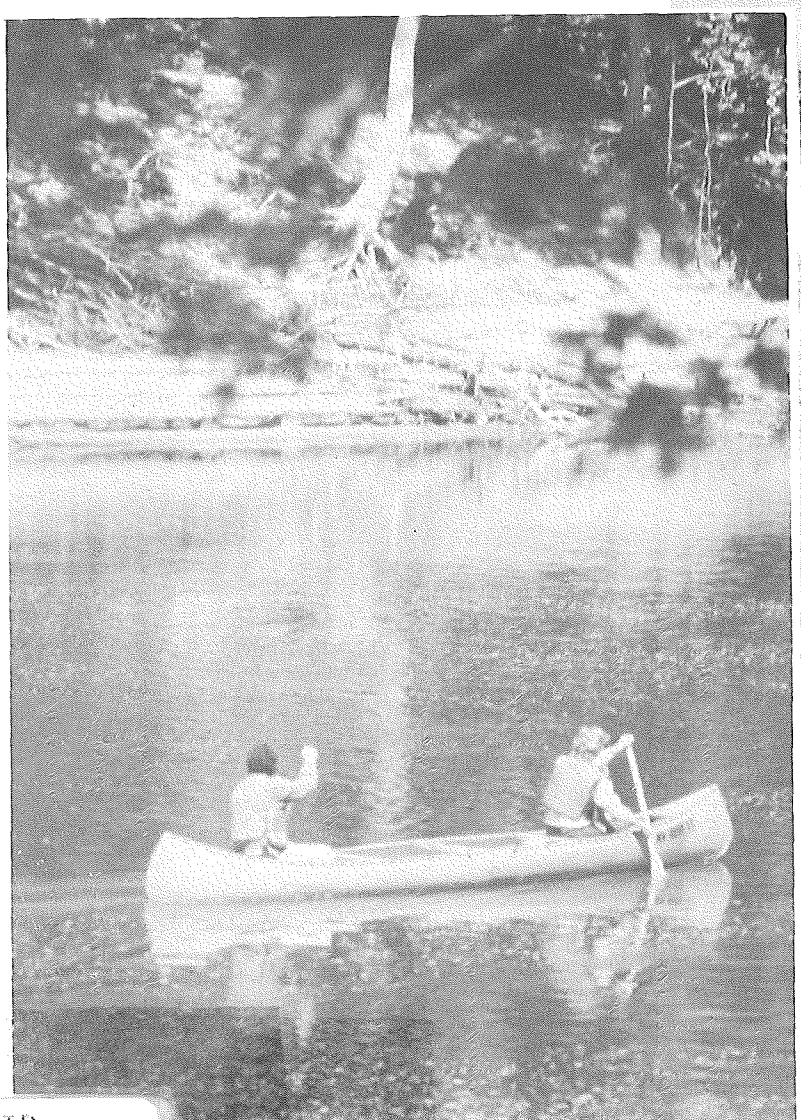
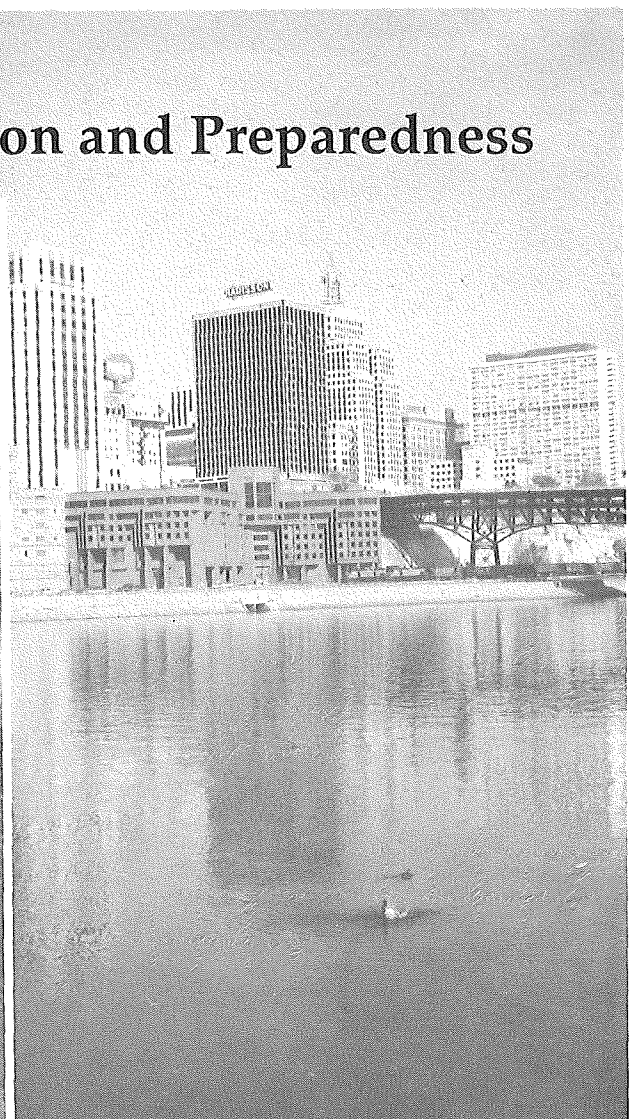
PROTECTING THE MISSISSIPPI RIVER:

A Blueprint for Spill Prevention and Preparedness





nnesota Pollution Control Agency

Pursuant to Executive Order 90-2

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Executive Summary

We've all heard of the "accident waiting to happen." What could be worse? How about hundreds of accidents waiting to happen, with very little chance of cleaning up the resultant damage to human health and the environment?

That is the situation that Minnesota finds itself in along the shores of the mighty Mississippi River.

Threats to the River

Manufacturing, transportation and storage activities along and on the Mississippi involve several million tons of petroleum products and other hazardous materials annually. At least 75 facilities — including refineries, chemical plants, and product transfer terminals — lie near enough to the river to pose a spill threat. Four main transportation activities — pipelines, railroads, barge transport and trucking — carry hazardous cargo on, near or over the river every day. Although pipelines and railroads have the greatest potential to cause a major spill into the river, even a rare barge rupture could result in a spill of several hundred thousand gallons of petroleum or other hazardous materials.

The proximity of land-based storage and barge transfer facilities to the river and the presence of hazardous liquid pipeline crossings have been identified as contributing factors in major spill incidents on rivers in the U.S. and abroad. These conditions exist along the Mississippi as it flows through Minnesota. In addition, 110 miles of in-service rail lines run along, and in some areas right across, the river channel and flood plains.

Although Minnesota has largely avoided major river crises, over the past dozen years more than 200,000 gallons of petroleum products have gone directly into the Mississippi and Minnesota rivers. This doesn't sound like much, but add to it the many land-based spills that could have entered the rivers had circumstances been different, and the gallon totals skyrocket — not to mention the quantities from countless small spills that were never reported.

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Minnesota has been lucky so far, but luck has a way of changing. Should one of these potential accidents happen, almost any hazardous materials could threaten public safety at the spill site, and most are an environmental threat as well. Aside from petroleum products, which tend to float for awhile, only a small percentage of these materials would have a chance of being recovered from water — the rest would sink, decompose, mix with, or dissolve in the river. Even those that don't mix readily with water (mainly petroleum products) would be only partially recoverable. Thirty percent is considered a very successful recovery rate for petroleum from a river spill, but weather, water levels and other unpredictable conditions make even this low recovery rate difficult to achieve.

Sensitive wildlife areas, municipal and industrial water intakes, marinas, and other sites line the river from the headwaters in Lake Itasca to the Iowa border, underscoring the major role that the Mississippi plays in Minnesota life. All are particularly vulnerable to hazardous material spills.

After the Spill

Instead of relying on continued good luck, those who handle the materials and those of us who safeguard the state's resources have an obligation to protect the Father of Waters by taking action to prevent more spills and being better prepared to handle them when they do happen.

The first hours after a spill are the most critical; unless the spill is immediately contained and kept out of the fast-moving parts of the river, cleanup will be more extensive, difficult and costly. Industry preparedness, therefore, depends on each company's ability to respond quickly with sufficient quantities of equipment and personnel. This can only be accomplished by the company anticipating needs and problems presented by a spill, and making suitable arrangements in advance to mobilize the necessary resources.

Unfortunately, the law doesn't require much in the way of river-spill prevention. Legal requirements that do exist for spill prevention and emergency planning vary from industry to industry and by type of facility or transportation activity. In general, emergency contingency planning is limited to on-site or near-site responses to spill emergencies; usually this is geared toward public safety, not environmental protection. When industry plans are prepared, they seldom include comprehensive planning for protecting downriver areas in the event of a spill, nor do they plan for long-term cleanup activities.

The state has very limited authority and no staff to review contingency plans. Federal officials also do not check plans to see if they are adequate to deal with a spill. The bottom line: Even if a company has a plan, it may be no more effective than the paper it's printed on.

Field work for this study showed that even the largest facilities and companies are ill-prepared to handle a

medium-sized or major spill. Many have access to equipment only through cooperatives and mutual-aid arrangements, and all depend heavily on for-hire response companies to handle incidents. Unfortunately, there are only two for-hire companies (with limited local resources) in the vicinity of the upper Mississippi River. Further, dependence on outside assistance results in the delay of containment efforts, thus making the cleanup more difficult and the extent of environmental damage greater.

Overall, Minnesota industry is not prepared for swift or adequate response to a major river spill.

State Response to Spills

The emergency response plans of communities and businesses along the river typically defer to the state for response to spills on the Mississippi. In doing this, however, local emergency planners are assuming that it is the state's job, not the spiller's, to do cleanup. This is incorrect.

Contrary to popular image, the state does not maintain "hands-on" spill response staff or equipment. The small amount of equipment stored at various state facilities throughout Minnesota is intended for minor pond, lake and creek spills, and would be of little value in a river incident. Rather, the real preparedness of state agencies is in planning the deployment of existing resources and coordinating the actions of various responding agencies.

Conclusions and Recommendations

The only sure way to prevent river damage from spills is to prevent the spills in the first place. Industry's and government's abilities to respond to a major spill on the Mississippi River — no matter how well-prepared or equipped — can only assure that environmental damage will be at best minimized, not avoided. It's simply a fact of nature that substances or liquids spilled into moving water are often nearly impossible to recover, regardless of what cleanup efforts are made.

Conversely, there have also been spill instances in which significant river damage could have been somewhat minimized if the responsible party or its neighbors had proper equipment and training to mobilize an immediate response.

Clearly, spill prevention and emergency planning pays in the long run; the cost to clean

up even one river spill which could have been prevented may quickly exceed the cost of effective prevention measures. Many of these costs involve damaged public resources or are otherwise borne by someone other than the spiller. Moreover, the damage to the spiller's reputation is difficult to repair, and has its own long-term costs. Therefore, the first set of recommendations covers spill prevention and planning ahead to ensure the most effective and rapid response possible.

Government agencies likewise cannot afford to be caught unprepared. Because river spills adversely affect many parties, a strong case can be made for cooperation among companies, local and regional emergency planners, state response agencies, and others dependent upon the continued health of our rivers. The second set of recommendations, then, emphasizes the need for greater private and public sector cooperation and assistance.

Last, we include several recommendations to improve the state's preparedness to handle hazardous materials emergencies, including river spills. The proposed internal changes would improve the management of the state's emergency resources, enhance communications, and make state agencies more accountable for maintaining their emergency capabilities.

Recommendations

1. **Spill Prevention and Response Planning**

- ▼ Amend existing state law to require all handlers of significant quantities of petroleum products or other hazardous materials to prevent spills and to be prepared to adequately respond to a spill. It should also authorize the MPCA to review the prevention and preparedness measures.
- ▼ Amend above-ground storage tank rules to require facility owners and operators to prepare spill contingency plans.
- ▼ Implement a voluntary spill-prevention and planning assistance program. Companies could request the state to conduct spill prevention assistance audits in order the reduce the potential for spills, and could receive assistance in developing appropriate emergency response plans.
- ▼ Enact legislation to require a business to submit to a spill prevention compliance audit and to adopt the recommendations of that audit, if the business is found by the state to have inadequate spill-prevention safeguards in place.

2. **Increase Cooperation between Industry and Government**

- The state should encourage the establishment of cooperative agreements among companies doing business along the river to provide cleanup assistance to neighboring facilities in the event of a spill. To achieve these objectives, the state should investigate various incentives to assist companies, such as tax credits and protection of "good samaritan" companies from liability for spill-related damages. The state should also identify ways to reduce existing impediments to developing useful cooperative agreements.

- Establish a River Defense Network to protect sensitive environmental, economic or aesthetic areas downriver of a major spill. In cooperation with the State of Wisconsin, preparations should include staging response equipment at a limited number of strategic locations along the river, and ensuring that trained personnel can rapidly deploy the equipment to pre-determined points where the greatest degree of protection can be achieved.

- The MPCA and the Department of Agriculture should investigate the administrative and legal barriers to assembling a network of locally-based response personnel, and make further recommendations to the Governor and the Legislature on the most feasible system of maintaining sufficient numbers of trained river response personnel.

- The MPCA and the Department of Natural Resources should train selected MPCA staff and conservation officers jointly as two-person survey teams for future river monitoring. A pool of trained river observers and boats should be readily available in the event of a river spill.

- Adopt into state law a Department of Public Safety study group's proposal to create a system of regional hazardous materials response teams. These teams will work on local, urgent public safety matters as well as ensuring that long-term environmental cleanup is completed.

3. **Enhance State Agency Preparedness**

- The state and each individual responding state agency should develop an incident command system for handling hazardous materials emergencies, based on the concepts of the national firefighting model. Industry officials and federal, state and local emergency response officials should be involved in the development, implementation, and exercise of the command system.

- The state should develop a statewide emergency communication network to link local and state responders during an emergency operation. The communication network should be fully integrated with the state's incident command system.

- The state should institute a single-call reporting system for purposes of satisfying state spill notification requirements, SARA Title III requirements, local reporting requirements, and any other requirements to notify relevant state agencies in the event of a spill or release. The one-call system should be implemented through the existing Department of Public Safety duty officer system if it becomes fully staffed and equipped, or through another existing state dispatch center, such as the State Patrol.

- The Governor should designate a state hazardous material response planning coordinator who would report directly to the Governor on all matters of state hazardous materials response preparedness. The coordinator would provide periodic reports on the status of the state's emergency response capabilities, as well as assess the performance of each state agency, in accordance with the agency roles described in Executive Order 90-2.

- Each department should designate a planning coordinator to perform similar coordinating functions for that department.

- Increase the level of follow-up for spill cleanup.

The Joint Minnesota-Wisconsin Study

The Mississippi River has played a major role in the development of the Midwestern states, beginning in the early days of exploration, trapping, and settlement of the vast interior regions of the continent. Not only is the river a primary transportation link between the Midwest and the rest of the world, it has become an important recreational, commercial, and drinking water resource as well.

Recent spills that have occurred elsewhere in the United States and other countries, however, have all too well demonstrated the potential for commercial and industrial activities to upset the delicate balance of river uses which we try to maintain. Massive spills of manufactured chemicals into Europe's Rhine River, of diesel oil into Pennsylvania's Monongahela River, and of crude oil into Missouri's Gasconade River, are all reminders that we cannot take the continued health of our own Mississippi River for granted.

Minnesota, the headwater state for the Mississippi River, has a special obligation to protect this resource. As the first users of the river, we must see that it continues to serve the myriad needs of state residents, fish and wildlife, and shoreside industries involved in manufacturing, transportation, power generation, and other enterprises that enhance the quality of life for all Minnesotans. It also means that Minnesota is the first caretaker of the river, with an obligation to states downstream to maintain the quality of the river so that each region, in turn, can derive similar benefit for its residents. Minnesota shares that obligation, by virtue of 137 miles of a common Mississippi River boundary, with the State of Wisconsin.

Recognizing this common obligation, Governor Rudy Perpich and Governor Tommy Thompson of Wisconsin met in LaCrosse, Wisconsin, in August, 1989, in part to discuss the two states' capabilities to prevent an environmental disaster from occurring on the upper Mississippi River. The governors called for a joint state effort to assess the potential

for a catastrophic release of petroleum products or other hazardous materials into the river, and to determine the readiness of each state to respond to and contain such a spill.

This report includes the Pollution Control Agency's assessment of the potential for spills on or along the upper Mississippi River, a broad review of the responsibilities of industry and government in responding to a spill, and an assessment of the existing ability to clean up a spill and prevent widespread environmental damage from occurring. Its main purpose, however, is to propose several initiatives which would:

- enhance spill prevention measures wherever possible; and,

- provide for more effective spill response actions in those cases where preventive measures prove inadequate.

Recommendations made in the report affect public agencies having a significant role in spill response, as well as private businesses that have the potential to cause spills of petroleum products and other hazardous materials or pollutants. As the recommendations are implemented, it will be necessary to assess the effectiveness of these changes and develop additional measures to better prevent spills from occurring, and to protect the environment when they do occur.

Spill Response

Cleaning up Spills in Minnesota

A spiller must report all spills occurring in the State of Minnesota to state authorities. This requirement allows state staff to monitor emergency response and cleanup actions taken by the spiller, to ensure that the environment is protected. Unfortunately, myriad state and federal laws requiring a responsible party to notify multiple local, state, and federal agencies in the event of a spill have become an unnecessary burden. We believe this burden could and should be lessened by the State's adoption of a "single-call" reporting system. A more complete discussion of current notification requirements is contained in Appendix I.

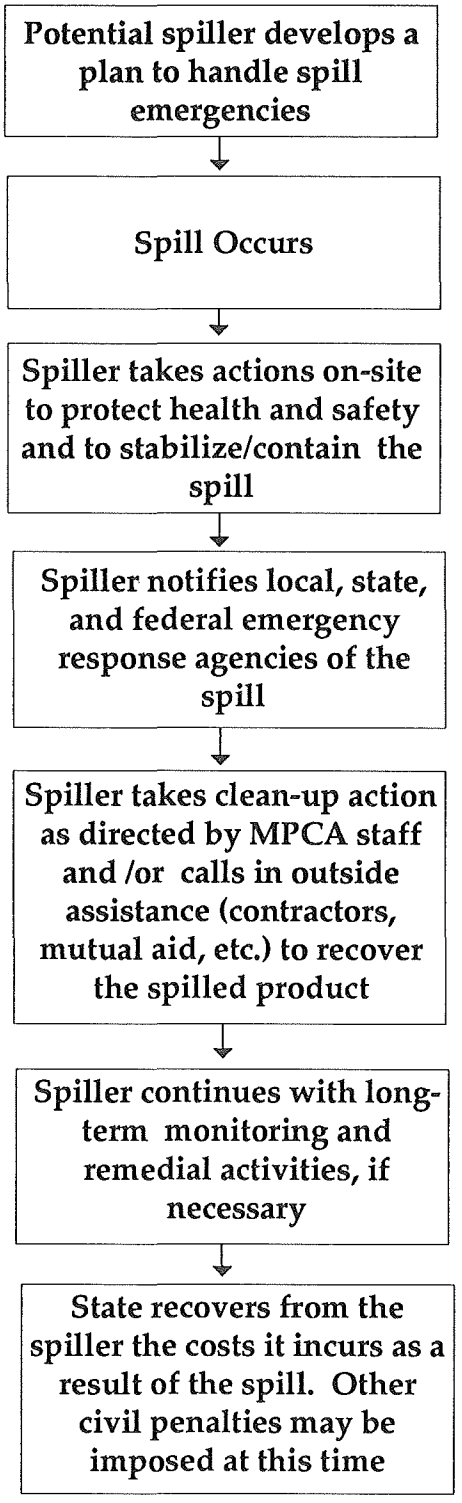
As to spill response, the primary responsibility for cleaning up a spill in Minnesota rests with the spiller. However, state and federal laws also define response roles for governmental agencies such as the MPCA, USEPA, and the Coast Guard.

Responsibility For A Spill

Under state law, the party that causes a spill is obligated to respond to the spill, recover the spilled materials, and mitigate any resultant environmental damage. Damage to be contended with includes direct toxic effects on fish and wildlife, coating animals and shoreline with the spilled material, and fish kills due to changes in dissolved oxygen levels in the water. Other public safety hazards may also accompany a spill, such as the noxious vapors and fire danger associated with a gasoline spill.

Figure 1 is a flow chart of the response to a typical spill incident. For most spills onto land, cleanup activity occurs at the site of the spill and affected areas nearby. A river spill, on the other hand, may entail an extensive and costly cleanup. Typically, a spiller should set up several containment and recovery points along the river, depending on the nature of the spilled material, the quantity of the spill, and river conditions. For a petroleum spill,

Flow Chart of Emergency Response to a Spill



these containment and recovery points would utilize various booms, vacuum trucks, oil skimmers, oil-absorbing pads, and other equipment as needed. For spills of other chemicals, only those which float on the surface and do not mix or dissolve in water can be recovered. Containment equipment similar to that used on petroleum can be used for recoverable chemicals.

The spiller must coordinate the complex logistics of operating multiple cleanup sites while overseeing the activities of in-house personnel and hired help. In contrast, the Minnesota Superfund law provides that the state limit its own response to a reported spill to the oversight and approval of response and cleanup actions taken by the responsible party. The State may, however, assume a larger role under certain circumstances.

The State Role

In the event the spiller is unwilling or unable to adequately respond, state law directs the Pollution Control Agency (or the Department of Agriculture if the spill involves pesticides or fertilizers) to take necessary response actions itself. It is important to point out, however, that neither agency dispatches staff to physically or directly contain or clean up a spill. Largely because of the personal hazard and often substantial equipment costs involved, state staff are directed not to perform any type of "hands-on" response. Rather, if the spiller fails to act, the State hires a response contractor to deploy trained personnel and proper equipment to handle the incident. State agency staff maintain the role of coordinating and overseeing the actions of the state response contractor, in much the same way state staff would oversee the actions of the spiller or his cleanup contractor.

For example, in one recent incident on the Mississippi River below Prescott, Wisconsin, the Army Corps of Engineers notified MPCA of an oil slick of unknown origin on the river. MPCA alerted the state emergency response contractor, requesting that contractor personnel and equipment be dispatched to a location downriver of the reported spill. MPCA staff also proceeded to the scene to assess the incident. Fortunately, the spill was found to be limited in extent, and recovery actions on the river were not warranted.

The Federal Role

The EPA and the Coast Guard share emergency response jurisdiction over the upper Mississippi River. In practice, the Coast Guard will respond to and investigate any spills which appear to have originated from a facility or activity under its jurisdiction: mainly barges and towboats, and waterfront transfer facilities which handle petroleum and other hazardous materials. The St. Paul Marine Safety Detachment has seven personnel available for spill response, although this is only one of many duties of the detachment.

The EPA technically has jurisdiction over all other sources of spills into the river, such as chemical plants and petroleum tank farms.

The nearest EPA spill response staff are headquartered in Chicago. Consequently, due to the short supply of local response staff, these federal agencies rely heavily on the capabilities of state response personnel for most river incidents. Unless a major incident occurs, state and local agency responders will likely be the overall governmental overseers of emergency actions.

On the other hand, a major spill which overwhelms Minnesota's response resources could result in the mobilization of the Regional Response Team, consisting of federal and state spill response officials in USEPA Region V (Chicago). The regional team functions as a coordinating group capable of bringing response resources from throughout the Great Lakes region to bear on an incident that threatens major and widespread damage, such as a catastrophic spill on the Mississippi River. The Pollution Control Agency, which is the State of Minnesota's representative to the Regional Response Team, may request additional assistance through activation of the team. It is doubtful that additional personnel or equipment could arrive on the scene during the early, most critical first hours of an incident. Therefore, the Regional Team would be mainly utilized during large events for which long-term cleanup capability is the overriding factor.

Finally, USEPA or the Coast Guard may elect to "federalize" an incident. This would occur if industry and State actions were, in the judgment of federal officials, inadequate or inappropriate to handle the emergency. Upon federalization, federal officials may send in a Coast Guard Strike Force or for-hire emergency response contractors. Spills are not usually federalized, however; federal involvement is more typically in the form of technical assistance and additional oversight personnel.

Reliance on Emergency Response Contractors

Industry depends heavily on for-hire emergency response contractors to handle anything more than small spills. It is likely, however, that a contractor would not arrive with equipment on a spill scene for between two to six hours after being alerted; response time for the Twin Cities area would be at best about 90 minutes. Meanwhile, in as little as two hours, a spill could move several miles down river and grow significantly in its extent. Even a short delay could seriously reduce the chances of recovering the spilled material from the river, and increase the extent of environmental damage.

One problem with this reliance is that there are only two full-service emergency response contractors in the upper Mississippi River region. Moreover, the local contractors available to individual companies are the same as those available to the state and federal agencies.

Once the local for-hire resources are deployed, any additional contract resources would be a half-day to several days away, regardless of whether they were requested by the spiller or by a government agency. We estimate that each local contractor individually could effectively handle a spill of about 10,000-15,000 gallons of floating product on the river under favorable conditions. Beyond this quantity, out-of-state resources would need to be procured. A spill from a single railcar, for instance, could tax an individual contractor's on-hand resources.

Emergency Planning Requirements

Overall, legal requirements for a business to develop a contingency plan for responding to a hazardous material emergency are not comprehensive, nor do they apply to all activities that could cause a significant spill. As with reporting laws, the comprehensiveness of any particular contingency planning requirement varies with the type of material and facility involved and, to the extent a lower threshold limit is exceeded, the quantities of hazardous materials present.

Oil Facilities

Most recent attention on contingency planning has resulted from major oil spills in coastal waters off Alaska, southern California, the Gulf of Mexico, and New Jersey. The federal Water Pollution Control Act requires oil facilities (other hazardous materials are not covered under existing regulations) near waterways to maintain Spill Prevention, Control, and Countermeasures (SPCC) plans, which include emergency notification and containment procedures, lists of available response equipment, phone numbers of companies qualified to undertake emergency response actions, and pertinent information about the facility.

While the Coast Guard and the Environmental Protection Agency share jurisdiction over the various types of oil facilities and transporters, there is no provision for systematic review of SPCC plans by any governmental agency. Instead, federal rules take the reactive approach of requiring a review of a company's plan only after a spill incident has shown the plan to be inadequate; that is, when a significant release of oil or refined petroleum products has already occurred. Recently enacted federal legislation requires more comprehensive contingency planning by industry and government, as well as periodic federal governmental review of the plans. Unlike the SPCC plan, which addressed only petroleum spills, the new federal law also covers hazardous materials.

Chemical-Using and Manufacturing Facilities

Perhaps the most stringent contingency planning requirements are those of Title III of the Superfund Amendments and Reauthorization Act (SARA), which came into being as a result of the 1984 Bhopal, India tragedy. SARA requires fixed facilities which routinely handle significant

quantities of "extremely hazardous materials" to file chemical inventory information with the Minnesota Emergency Response Commission. SARA also requires facility operators to work with local fire departments and other emergency management officials to develop local contingency plans to handle emergency situations which may arise at the facilities. The emphasis of this planning is on public safety: protection of the emergency response personnel at the scene of an incident, and of the surrounding community. Little consideration is given to the mainly environmental effects offsite, such as downriver water intakes or sensitive wildlife areas which may be damaged by a spill.

Another weakness of Title III planning requirements is that they do not generally apply to one major area of commercial activity: transportation. Instead, unrelated state and federal transportation regulations target operational safety for transporters of petroleum products and other hazardous materials. These do little, however, to require an adequate environmental response in the event the operational safeguards fail. Planning for transportation-related emergencies is particularly important because all modes of transportation are vulnerable to factors beyond the control of the transporter, such as a pipeline rupture caused by a negligent excavator, or a vehicle colliding with a tanker truck at an intersection or a train at a railroad crossing.

Hazardous Waste Facilities

Federal and state regulations pertaining to hazardous waste treatment, storage, and disposal facilities specify that stringent contingency planning requirements be written into the facility permits. The regulations require facility operations manuals to contain sections on emergency response procedures, and that these be on file with state and local authorities. Spill prevention measures are also required of hazardous waste facilities, and include tank integrity requirements, frequent inspection and testing, and leak detection equipment. These requirements apply only to waste activities, not production activities.

Other Facilities

The Coast Guard requires that emergency procedures be included in operations manuals for waterfront facilities which transfer hazardous materials to and from barges. Also, federal pipeline safety laws require pipeline operations manuals to include emergency response procedures. However, neither requirement includes adequate consideration of environmental impacts of a spill on downriver facilities and sensitive environmental, economic, or aesthetic areas.

The new Federal "Oil Pollution Act of 1990" requires the EPA and the Coast Guard to promulgate regulations which, if written broadly, may improve the level of environmental response planning of many transportation facilities.

Assessing the Potential for Harmful Spills

Spills occur as a result of equipment failure or human error associated with commercial, industrial, agricultural, and other day-to-day activities. While most spills occur on land, under certain conditions an uncontrolled release of a product could enter a waterway, where its chances of causing widespread environmental damage increase greatly. There are primarily two types of commercial activities with the potential to cause a river spill: the use and storage of hazardous materials at "fixed facilities," and the transportation of these hazardous products.

The fixed facilities of concern from a spills standpoint are those which use, produce, or store large quantities of hazardous materials (e.g., petroleum products, acids, solvents) or other pollutants (e.g., vegetable oil and salt, which, while generally not thought of as hazardous, may harm fish and wildlife). These facilities typically have several liquid storage tanks ranging in size from a few thousand to up to 21 million gallons. They include oil refineries, chemical manufacturing and processing plants, petroleum storage and distribution terminals, and barge loading terminals.

On the other hand, the industries involved in the transportation of hazardous materials may hold even greater potential for major spills into the Mississippi. Probably the most visible potential sources of spills are the river barges, which transport enormous quantities of gasoline, fuel oil, fertilizers, and other potentially harmful products. Less obvious are buried petroleum pipelines, which each day carry millions of gallons of toxic and ignitable products under the Mississippi and its tributaries at several crossing points. Finally, while handling smaller quantities per load than either barges or pipelines, railroad tank cars and tanker trucks also bring potential spills within reach of the river daily.

The potential for a spill from a facility or transportation activity to cause damage to the river depends on several parameters:

- the proximity of the facility or activity to the river;
- the types, quantities, and specific hazards of the materials being used, stored, or transported;
- the means by which a spill could enter the water;
- the recoverability of the spilled material once it is in the river;
- the specific hazards posed by the spilled material; and
- whether adequate safeguards are in place to prevent accidental releases from occurring, and to contain a material if a spill does occur.

In addition, the State's history of spill incidents provides useful information about the types of spills we should anticipate and prepare for in the future. It is important to note, however, that just because a certain type or magnitude of spill has not occurred in the past, this fact in no way precludes the possibility of such an incident occurring in the future.

The assessment that follows looks activity by activity at spill potential. Toward that end, fixed facilities and each of the four modes of bulk transportation are considered separate "activities." For simplicity, the spill potential of all fixed facilities, regardless of their purpose, is assumed to be directly related to the types and quantities of the materials on site. The four major modes of transportation (pipelines, railroads, barges, and trucks) are each analyzed separately.

Fixed Facilities on the River

Location and Proximity to the River: Fixed facilities vary greatly in size, from large chemical plants and petroleum tank farms, to manufacturing or distribution facilities with one or two relatively small storage tanks. On the upper Mississippi River, most of the fixed facilities of concern from a spills standpoint are located in the Twin Cities metropolitan area, upriver of Hastings, Minnesota. A few small facilities are located in downriver counties: Goodhue, Wabasha, and Winona in Minnesota; and Pepin, Buffalo, LaCrosse, and Vernon in Wisconsin. **Table 1** summarizes the number and types of facilities along the river.

In addition, there are 6 major and 10 small to medium-sized facilities located on the Minnesota, St. Croix, Chippewa, and Cannon rivers within a few miles of where each joins the Mississippi. Since spills into these tributaries could easily reach the Mississippi, commercial facilities and activities along these rivers must be considered in this assessment as well.

Many of the major facilities along the Mississippi have barge loading and unloading capabilities. The Coast Guard regulates 38 hazardous materials handling terminals on the river and its tributaries between Minneapolis and the Iowa border, although the associated storage tanks are not under Coast Guard jurisdiction. Fourteen of the terminals handle petroleum products; all but one are located between Minneapolis and Hastings. The remaining terminals handle anhydrous

ammonia and other fertilizers, caustic soda and potash, salt, and vegetable oils. **Figure 2** illustrates the concentration of facilities along a 17-mile stretch of the river between downtown St. Paul and Pine Bend, Minnesota.

Types and Quantities of Materials: Oil, gasoline, and other refined petroleum products are the most common materials stored in large quantities at fixed facilities. Two refineries located southeast of St. Paul together process several hundred thousand barrels of crude oil each day. Both facilities have extensive tank farms which include storage tanks of up to 21 million gallons capacity.

Several chemical facilities are located along the river with storage tanks in the 10,000 to 50,000 gallon range. The tanks typically hold solvents, acids, phenols, anhydrous ammonia, and other industrial chemicals. Facilities in Cottage Grove and Red Wing also handle castor oil and other vegetable oils. Many facilities have large fuel oil tanks for on-site boiler operation.

Most of the major facilities along the Mississippi also have barge loading and unloading terminals. Associated with each are above ground storage tanks (up to two million gallons each) which store the liquid products transferred to and from river barges.

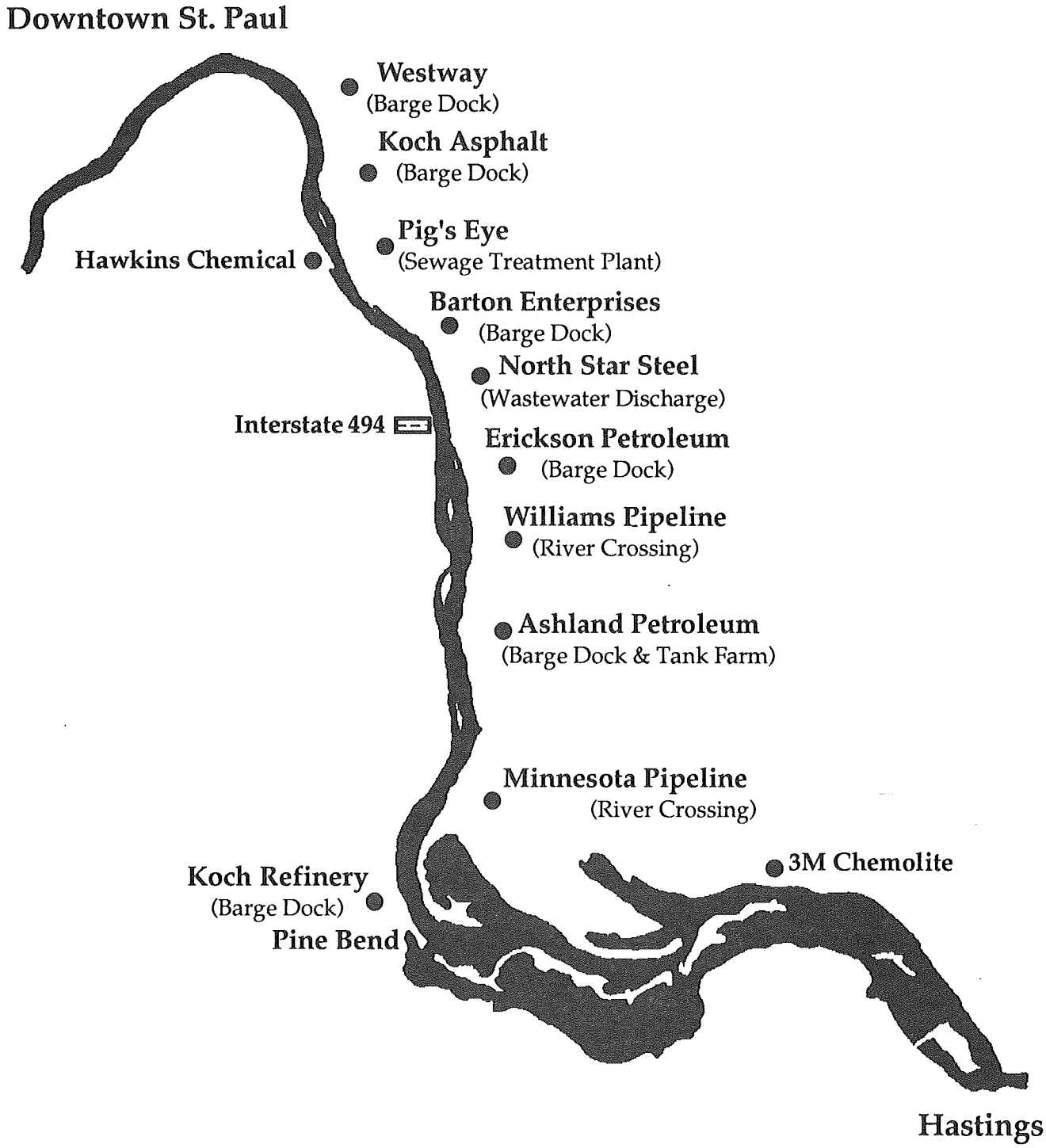
Recoverability: The petroleum products are theoretically recoverable, although river currents and weather could seriously hinder recovery efforts. With the exception of a catastrophic tank failure (as occurred in

Table 1
Number of Fixed Facilities with Spill Potential

	Facilities along Mississippi River		Facilities along Tributaries		
	Above Hastings	Below Hastings	Minnesota River	Other Rivers	Total
Petroleum and Chemical Facilities					
* with tanks >100,000 gal.	19	3	3	3	28
* smaller facilities	19	25	8	10	62
Totals	38	28	11	13	90

Facilities Along the River
South of Downtown St. Paul

Figure 2



the 1988 Ashland spill near Pittsburgh), a spill from a riverside facility may flow relatively slowly to the river, increasing the chances for containment of the spilled material. On the other hand, water soluble or decomposable chemicals such as fertilizers, acids, and many other common chemicals, are not recoverable after the material enters the water.

Hazards: Fixed facilities may pose a serious public safety hazard. Large quantities of ignitable materials which escape containment may not immediately enter the water, but could pool on-site as they flow toward the river. Once in the river, the public safety hazard tends to diminish for most materials.

Water soluble materials which are highly toxic to fish and wildlife, even in relatively small concentrations, add to the environmental risk posed by petroleum facilities.

Means of Entering the River: Most large storage tanks have dikes to contain leaks. If the dikes fail to contain the products, a leak may flow or seep from the tank site. There are several ways in which material from a fixed facility may directly or indirectly enter the river.

A direct spill to the river could occur at a barge dock, the result of a hose rupture or the failure of an operator to properly initiate or monitor product transfer. Such an incident occurred in 1989 at the Richards Asphalt terminal on the Minnesota River in Savage, Minnesota, resulting in a spill of several thousand gallons of asphalt product. Coast Guard officials state that product transfer is the riskiest aspect of any barge operation, and that a spill during transfer is the most common barge-related incident.

Indirectly, a spilled material may enter the river by way of a creek or other natural drainage, or through a nearby storm drain which discharges to the river. This assumes that the material can escape any containment structures and flow relatively unimpeded along its path. The January, 1988 Ashland diesel spill overflowed on-site containment dikes and flowed onto an adjacent facility before entering the storm drain that led to the Monongahela River.

While a tank rupture of this magnitude is considered highly unlikely, it is also possible for a large quantity of material to escape containment in other ways. In a February, 1990 incident in southern Minnesota, 10,000 gallons of gasoline leaked over the course of a weekend from a small hole in a storage tank. The gasoline soaked through porous rock under the tank, migrated along subsurface channels under the containment dike, and a relatively small but unknown amount eventually drained downhill into the nearby Cannon River.

Additionally, a potentially major spill can result from the drainage of hazardous materials mixed with large quantities of uncontrolled runoff water, as may happen while attempting to put out a fire at a facility. Unless appropriate measures are taken at the onset to contain firefighting water, or at least prevent it from reaching drainage points on the

facility site, up to several hundred thousand gallons of contaminated runoff could reach the river. This was the case in 1986 at the Sandoz chemical plant on the Rhine River in Switzerland. Failure to contain the water used on a fire at the plant resulted in over 30 tons of chemicals washing into the river, destroying fisheries and threatening drinking water supplies along the Rhine for more than one hundred miles downstream.

Safeguards in Place: In general, state regulations require all liquid storage tanks in Minnesota to have secondary containment structures, such as diked areas capable of holding more than the contents of the largest enclosed tank. At present, however, compliance with the storage tank safeguard requirements is spotty. June 1, 1990, was the deadline for tank owners to file basic information for a statewide tank inventory. Before that time, little systematic information about tank facilities existed.

Specific federal laws require petroleum facilities and hazardous waste facilities to implement containment measures and contingency planning; however, these laws do not pertain generally to all facilities which handle hazardous materials, such as manufacturing plants, railroad yards, or agricultural chemical distributors. The larger facilities appear to be aware of their spill potential, and generally have worked toward providing on-site containment and emergency planning.

Operating procedures also appear to be geared toward greater safety through spill prevention. One petroleum facility with a barge terminal, in fact, routinely deploys spill containment boom around the loading/unloading area. According to the operators, a spill of about 40,000 gallons could occur during product transfer in the worst case they could foresee. However, facility operators believe that virtually all of it could be contained within the barge mooring area, and only a small amount would likely escape to the Mississippi.

History of Fixed-Facility Spills: Minnesota spill statistics suggest that fixed facilities are less likely than transportation activities to produce a large, sudden spill. Typical facility spills are tank overfills, process upsets, and piping and storage tank leaks. Most are in the 1 to 100 gallon range, although spills of 2,000 to 10,000 gallons do occur with some frequency. Only 9 of 40 Twin Cities river spills reported to the Coast Guard in 1988 and 1989 originated from riverside facilities (including sewer outfalls), and none exceeded 100 gallons. Unlike Europe and other parts of the United States, a riverside facility in Minnesota has not been the site of a major river spill in recent memory. (This does not include large wastewater discharges, which have released several hundred thousand gallons of polluted water in low toxicity concentrations. Such discharges, for all practical purposes, cannot be contained or cleaned up once in the river.)

Firefighting runoff water was reported in 1989 as the cause of at least 43 "spill" incidents,

with as many as ten tons of material contaminating the runoff. These incidents apparently did not result in acute toxic effects, although it is likely that runoff water eventually flowed into one of the state's rivers or other bodies or water.

Potential Spill, Most Likely Spill: The potential for a fixed facility to be the origin of a river spill depends on the ease with which a material may enter the river. Catastrophic incidents like Pittsburgh's Ashland spill are considered highly improbable, and should become more so as a result of inspection and testing requirements to be included in revised state aboveground tank rules. It is more likely that a slower leak to a natural drainage or storm sewer could occur, resulting in several hundred to thousands of gallons entering the river. Nonetheless, as long as hazardous liquids continue to be stored in tanks of a million gallons or more, a spill of that size must be considered possible.

The most likely fixed facility spills would involve either a relatively small amount of pure product, or fire runoff containing large quantities of hazardous chemicals. Proper emergency planning should reduce the potential damage resulting from either possibility: an effective on-site response plan in the first instance, and the combination of facility emergency planning and firefighter training in the second instance. Should heavily-contaminated runoff water reach the river, however, environmental damage would likely be widespread and unstoppable.

Pipelines

Location and Proximity to River: Eight pipelines, ranging in diameter from 6 to 18 inches, cross under the Mississippi River at six different crossing points in the Twin Cities area. In addition, one 8-inch line carrying refined products crosses the St. Croix River, two lines cross the Minnesota River near the international airport, and one 12-inch line crosses the Minnesota in Eden Prairie. At most of the river crossings, the pipeline is laid down in a trench in the river bottom, and covered over with about two feet of rock. The 8-inch "airport line", on the other hand, runs under the Minnesota River through a tunnel bored out about twenty feet below the river bottom for additional protection from bottom erosion and dredging. One of the Mississippi River lines also runs through a bored tunnel.

Types and Quantities of Materials: Hazardous liquid pipelines transport crude oil, heating oil, gasoline, aviation fuel, and other refined petroleum products into and between facilities in the Twin Cities area. At present, only petroleum products are transported by these lines. One 16-inch and one 18-inch crude oil pipeline supply the Koch Refinery with approximately 150,000 barrels per day (6.3 million gallons, or 250,000 gallons per hour). One 12-inch line is used about 10-15 percent of the time to supply crude oil to the Ashland Refinery, and the rest of the time transports refined products. Even the smaller lines may carry 40,000 gallons per hour, or more.

to 750,000 gallons in a 1988 spill from a pipeline in the St. Croix River watershed. One 1986 incident also caused the death of two people when vapors from the spilled product ignited. To date, only the recent Minnesota River break has entered a river. All others pipeline leaks in the state have spilled to soil or low swampy areas.

Some recent pipeline spills in other parts of the country have had major impacts on inland waterways. In December 1988, a 35-foot-long seam rupture in a 22-inch diameter pipeline in Missouri allowed 840,000 gallons of crude oil to escape into a nearby creek. An 18-inch layer of oil flowed down the creek into the Gasconade River, and a small amount eventually reached the Missouri and Mississippi Rivers. Damage to river fisheries was reportedly extensive.

In April 1990, a landslide severed a 10-inch diameter pipeline along a tributary of Pennsylvania's Allegheny River, spilling 40,000 gallons of a gasoline, diesel, and kerosene mixture. After flowing about two miles to meet the Allegheny, the mixture formed a slick 20 miles long on that river. Turbulent flow over a series of dams caused the spilled material to mix to a depth of over 20 feet, where it affected deeply placed drinking water intakes for miles downstream. Absorbent boom was ineffective at recovering the spill because most of the spilled material was well beneath the river's surface.

Potential Spills, Most Likely Spill: Safeguards in place at river crossing points may reduce the relative risk of a pipeline leak or rupture in these segments. While no incidents reported in the state have involved underwater segments of pipelines, this fact in and of itself is insufficient to conclude that such a spill could not occur in the future. It is possible that a crossing segment, even though of thicker construction, could break at a weak seam in the presence of external factors, such as pressure surges, pipe corrosion, or erosion of the river bottom which leaves the line vulnerable to dredges or dragged anchors.

As occurred in the June, 1990 Minnesota River spill, a faulty valve can also be the source of a spill. Such a spill could allow 100,000 gallons or more to enter the river, depending on the pipeline flow rate, pipe diameter, the location and types of valves at each end of the crossing segment, the volume of the isolated segment, and the response time of the company. The material spilled could be either crude oil or refined petroleum products, such as gasoline, diesel oil, or aviation fuel.

Another likely scenario might be a break in a non-crossing portion of a pipeline; the history of pipeline spills in Minnesota shows that these incidents are not uncommon. The potential for such an incident to result in a river spill depends on whether the leak occurs in a location served by a form of natural or engineered drainage to the river. Since spills flow downhill, the material from a remotely-situated pipeline rupture could find its way along a creek or storm sewer rather easily. As with any other line break, limiting the

quantity of the spill depends on the ability of the pipeline operator to quickly identify and isolate the ruptured segment, and on the volume of that isolated segment (which is the upper limit of how much product could escape from the pipeline once the valves are closed). More than several hundred thousand gallons of product could be involved; depending on the circumstances, anywhere from none to nearly all of the product could enter the river.

Railroads

Location and Proximity to River: Two major rail lines are found along the Mississippi River: Burlington Northern track is predominantly along the Wisconsin bank, and Soo Line track runs mainly along the Minnesota side. Both companies also have trackage along the river in the Twin Cities metro area. In addition, there are 14 river crossings (railroad bridges) between Coon Rapids, Minnesota, and the Iowa border; 11 are in the Twin Cities metro area.

Of the nearly 140 miles of river below Prescott, Wisconsin, about 110 miles (80 percent) have railroad trackage along one or both banks. Seven separate segments of track are on levees within the river channel, and one levee segment runs alongside Wisconsin's Lake Onalaska, north of LaCrosse . Two and one-half miles of Soo Line tracks run along Weaver Bottoms (a sensitive wildlife area), and two segments adjacent to the river are immediately upstream of Wisconsin state parks.

Types and Quantities of Materials: On average, 30 to 70 trains operate daily along the river below Prescott. Approximately four percent of all railcars on Burlington Northern trains carry hazardous cargoes. Nearly 1,000 Soo Line railcars carry hazardous materials along the river each month, including 549 cars with molten sulfur (which poses a minimal spill threat). The main materials transported are:

- Molten sulfur, styrene monomer, methanol, anhydrous ammonia, ethanol, isobutane, phenol, benzene phosphorous dichloride, and chlorine (along the Minnesota bank).
- Anhydrous ammonia, LPG, chlorine, caustic soda, methanol, sulfuric acid, and phosphoric fertilizer in solution (along the Wisconsin bank).

Each carload consists of about 25,000 gallons (range typically 20,000 to 30,000). A single train may contain anywhere from no hazardous cargoes to 10 cars carrying hazardous materials, although four or five per train is more typical. On the other hand, a large shipment of hazardous materials bound for a single facility could be transported on one train; in these rare instances, most of the railcars could be carrying hazardous materials.

Recoverability: In general, the materials listed above would mix with or dissolve in water, and would therefore not be recoverable were they to spill into a river or lake. About one-third of the carloads carried by Soo Line would be partially recoverable, depending on the circumstances of the spill.

Hazards: Most of the materials listed above pose some sort of public safety hazard, ranging from flammability to inhalation hazards. In addition, the mix of different cargoes on the same train introduces the potential for chemical mixing and other circumstances which could complicate or intensify the hazards associated with each substance individually.

Means of Entering the River: A derailment along a stretch of track adjacent to (or on a levee within) the river could result in the failure of one or more cars carrying hazardous materials, with the product(s) spilling into the river. Derailed cars could end up either in the river itself, or strewn along an embankment above the river. In either case, material leaking from the cars may drain directly into the river.

A train may derail or a railcar may be leaking as the train crosses a bridge. Depending on the circumstances, leaking material may fall a long way to the river surface, where it would mix with the water column and make recovery more difficult (if possible at all for the particular substance).

Safeguards in Place: To prevent spills from occurring, federal transportation regulations cover the safe operation of trains carrying all materials. Track and equipment inspection programs, hazardous material handling rules, speed limits, track maintenance programs, and other operational requirements are designed to increase operating safety. Unfortunately, these safeguards do not prevent all train accidents.

There are no required safeguards, such as onboard spill cleanup equipment, to contain spilled materials from a derailment at the accident site. It is up to the quality and timeliness of the initial response to limit the quantities of materials which could enter the river. Unfortunately, any incident along the river may require up to several hours to reach with proper equipment, and many segments of track along the river may be virtually inaccessible to emergency responders.

History of Minnesota Rail Spills: In the past 10 years, 32 derailments involving the significant release of a hazardous material have been reported to the MPCA Spills Unit. In individual incidents, as few as one car and as many as 30 cars have spilled their contents. Hazardous products spilled have included acidic and basic chemicals, diesel fuel, potash, urea, and fuel oil. A 1988 derailment within the city of Annandale, Minnesota, resulted in the release of about 20,000 gallons of flammable methanol, and the threatened release of a carload of highly poisonous sulfur dioxide. Finally, in an April 1989 derailment near Lake Park, 18,500 gallons of lubricating oil and 9,400 gallons of gasoline additive spilled directly into Little Boyer Lake. The railroad did not commence recovery operations until six hours after the spill.

In addition, there have been over 30 cases of a locomotive spilling diesel fuel. Quantities vary between 20 gallons and 3,000 gallons, which is near the upper limit of the

locomotives' fuel capacity. Minnesota Department of Transportation statistics suggest that of the over 1 billion gallons of hazardous liquids transported by rail in the state each year, only about 10,000 gallons are spilled into the river, on average.

The railroads state that most derailments are caused by problems with the tracks, followed by mechanical malfunction and human error. They also identify collisions between trains and vehicles at highway crossings as a major cause.

Potential Spills, Most Likely Spill: A derailment could potentially result in several tens of thousands of gallons of spilled materials, depending on the number of hazardous material cars that happen to be in the train. There may also be significant public safety hazards (e.g., fire or a toxic cloud) and little chance of recovering spilled materials, depending on the particular cargoes onboard. Finally, the accident site may be somewhat inaccessible, and therefore difficult to reach in time to contain leaking materials, or even to prevent other cars from leaking later on during the incident.

Ruptured locomotive fuel tanks could result in 2,000 to 4,000 gallons of diesel fuel in the river. In one case near Winona, Minnesota two Soo Line locomotives were rammed at a highway crossing, dumping the engines with their loads of diesel fuel into the river.

In 1985, nine cars of a BN train derailed along the river in the city of Trempealeau, Wisconsin. Several railcars were carrying various chemicals, and one carrying two different chemicals caught fire. An April 1990 derailment along a creek flowing into the Allegheny River in Pennsylvania involved 12 cars carrying crude oil and caustic chemicals. Four of the tankers ruptured, spilling about 100,000 gallons of oil into the creek and eventually into the river, where municipal water supplies were affected.

While the Mississippi River has not been impacted by any major derailments in the past, it is clearly possible in the future. Small diesel spills from train engines probably would not result in significant damage to the river, but a major derailment along the riverbank involving several hazardous cargoes could very well cause serious harm.

Barge Operations

Location and Proximity to River: Barges routinely operate up and down the upper Mississippi River and into the navigable portions of the Minnesota and St. Croix rivers. Barges and their associated transfer terminals pose a direct threat of river spills by virtue of their operation on the rivers themselves.

While the actual transport of hazardous materials exposes the river to the potential for an enormous spill, the Coast Guard believes the transfer of materials to and from a barge presents the greatest chance of a spill. Army Corps of Engineers data suggest that a significant amount of product transfer occurs all along the Mississippi north of the Iowa-Minnesota border. (Thirty-eight transfer terminals on the Mississippi, Minnesota, and St. Croix rivers are regulated by the Coast Guard; these were

discussed in the section on fixed facilities.)

Types and Quantities of Materials: In 1989, according to the Army Corps of Engineers, barges transported over 1 million tons of petroleum products and over 1.2 million tons of potentially hazardous chemical products on the stretch of the Mississippi between Minneapolis and Hastings (approximately 2,000 barge loads). Barges transporting gasoline, aviation fuel, fuel oil, industrial chemicals, fertilizers, and other liquid materials, typically carry from 1,000 to 1,500 tons per barge; the largest barges operating in the region hold about 3,000 tons (over a million gallons). In addition, over 340,000 tons of salt (which could harm the freshwater environment if spilled) were brought into the Twin Cities area by barge.

Corps data show that barge transfers in the Twin Cities area more often involve petroleum products, industrial chemicals, and salt. Transfers below Hastings, Minnesota, on the other hand, primarily involve three commodities: fertilizers, coal (which poses no significant spill threat), and petroleum products. Over 2.8 million tons of fertilizers were transferred to or from barges along that stretch of the river in 1988, and over 2.6 million tons of petroleum products (or approximately 2,000 barge loads of each).

Recoverability: Under optimum river conditions, a spill of petroleum products is theoretically recoverable. However, the location of a leaking, ruptured, or grounded barge may be somewhat inaccessible, making containment and recovery operations more difficult. Fertilizers and many industrial chemicals would not be recoverable from the waterway (although the types of industrial chemicals, and, hence, their recoverability, cannot be determined from available Corps of Engineers data).

Since spills resulting from product transfers are more likely to involve relatively small quantities (up to a thousand gallons or so), a quick response by barge operators could yield a moderately successful recovery rate (as high as 30 percent of the spilled material in the case of a 1989 asphalt spill on the Minnesota River). Soluble materials like fertilizers, even in relatively small quantities, would still be unrecoverable.

Hazards: A barge carrying a hazardous cargo would pose a serious public safety hazard if it were to ignite or explode, particularly a barge broken free from a river tow or loading dock. The safety hazard could also impede efforts to bring any related release of the cargo under control, and environmental protection action would be limited to containment and cleanup of materials downstream from the barge location.

Generally, the sheer volume of material which could be spilled in a barge accident would pose a serious threat to the river, whether the material released was recoverable or not. The hazard from a product transfer incident, on the other hand, would probably be relatively small because such an incident would likely involve at most a few thousand gallons of harmful materials.

Means of Entering the River: A barge spill could originate from a small leak or a large rupture of a barge or one of its internal compartments. This would be possible in the event the barge struck an object (a bridge support or another vessel), or ran aground in shallow water (for instance, on a submerged wing dam). In all imaginable instances, the material would flow directly into the river.

Storage facilities, piping, hoses, and valves at a barge loading dock are all potential sources of a river spill. Because transfer rates are fairly slow, the quantity of product involved in such a spill would likely be relatively small. However, the proximity of transfer equipment to the water (i.e., on a pier over the river surface) would cause a spill from the equipment to directly enter the river.

Safeguards in Place: The U.S. Coast Guard regulates and regularly inspects all barges operating on the Mississippi River. Until recently, Federal rules did not require barges carrying petroleum products or other hazardous materials to be double-hulled, double-bottomed, or double-sided. However, the Minnesota Department of Transportation reports that over 90 percent of the liquid cargo barges operating along the Minnesota portion of the river are double-hulled or double-sided. In fact, single-hulled barges are no longer being manufactured; as a practical matter, as the remaining single-hulled barges are taken out of service, they will necessarily be replaced by new double-hulled barges. (The recently-enacted federal spill legislation requires a phase out of single hull barges commencing in 1995.) Finally, liquid cargo barges are divided into at least three cargo compartments, thus limiting in many cases the amount of material that could leak from a hole or rip.

Transfer activities are also closely monitored by the Coast Guard. Prior to the commencement of any transfer of product involving a barge, the Coast Guard office having jurisdiction in that area of the river must be notified. Certified or licensed personnel must be onboard the barge at all times during loading or unloading. (These personnel are certified by the Coast Guard to be familiar with the safe operation of barge transfer equipment and with emergency and spill prevention procedures.) There are also equipment inspection requirements to ensure that valves, piping, and transfer hoses are in good operating condition.

Generally, there are no safeguards to prevent a spill from a barge or a loading dock from entering the waterway. Koch Refining, however, has a barge slip constructed along one bank of the river. The mouth of the slip is routinely boomed off during all transfer operations; company officials claim this arrangement would contain even the largest spill that could occur during transfer (about 40,000 gallons), and allow only minimal leakage during the time it would take to vacuum up the spill. No other barge terminals along the river have a slip, and only one or two others are situated on the river in such a way that the entrance to the loading area could be effectively boomed off as a preventive containment measure. In

practice, most transfers occur along the bank of the river, such that any spill would be immediately swept downstream by the river current.

History of Barge-Related Spills: Over the past several years, spills from barges and towboats have accounted for only a small portion of river spills in Minnesota (fixed facilities and rail incidents each generally account for more incidents than commercial navigation). The Coast Guard reports that in 1989, there were only five reported river spills attributable to vessels (including both barges and tow boats), whereas waterfront facilities caused seven spills and four spills had unidentified causes. Only one of these five spills exceeded 100 gallons (the Minnesota River asphalt spill discussed below).

There have, however, been larger incidents. In 1978, about 100,000 gallons of aviation fuel leaked from a ruptured barge near Fountain City, Wisconsin. A 15-foot-long tear occurred in the side of the barge, which carried one million gallons of the fuel. Three other barges in the tow also carried a million gallons each of jet fuel. Because of its high volatility, most of the fuel reportedly evaporated before extensive damage to the river could occur.

In 1986, a fuel barge rammed the side of Dam No. 6 between Winona, Minnesota, and LaCrosse, Wisconsin, releasing 2,700 gallons. More recently, in 1989, a barge docked at an asphalt plant along the Minnesota River leaked about 3,000 gallons of asphalt product. A rapid response by neighboring companies and government agencies resulted in the recovery of about 30 percent of the spilled material, which is considered an excellent recovery rate for a river spill.

Barge groundings have occurred several times over the past 10 or so years, but losses of hazardous liquid cargoes have generally been minimal. Other groundings have involved barges carrying solid materials, such as coal and grain. Under less fortunate circumstances, a grounded barge could be carrying potentially harmful materials.

Potential Spills, Most Likely Spill: Coast Guard personnel warn that large river turns, "tricky" currents at river confluences, narrow channels, wide shallow sections, and windy conditions may be contributing factors in barge accidents. All of these conditions are found on the upper Mississippi River. Therefore, depending on the commodities being transported by a barge involved in an incident, there is the potential for a spill of up to several hundred thousand gallons of petroleum, fertilizers, or other chemical products. As discussed earlier, both the recoverability and the potential for river damage depend on the material spilled. Historically, large spills have occurred on U.S. rivers, but fortunately only rarely along the upper Mississippi River.

While a catastrophic barge rupture may be a rare occurrence, it is likely that spills during product transfer will continue to occur, despite current safety measures. Fortunately, these spills will be mostly small amounts (up to several thousand gallons). Diligence in monitoring transfer operations, coupled

with the preparedness of industry and government to handle these relatively small spills should limit their impact on the river. Still, it is unrealistic to expect to contain and fully clean up even this "most likely" spill, as evidenced by the 30 percent recovery rate estimated for the "very successful" response to the 1989 Minnesota River asphalt spill.

Highway Carriers

Location and Proximity to River: Two major highway routes are found along the Mississippi River, US 61 in Minnesota and US 35 in Wisconsin. Many stretches of these roads are located along or above river floodplains, and in several locations an accident on the highway could result in equipment and cargo entering the river directly. In addition, there are 26 highway crossings (bridges) between Coon Rapids, Minnesota, and the Minnesota-Iowa border, of which 20 cross the river in the Twin Cities metro area. A river spill could potentially originate from an accident on any of these bridges or the roadways adjacent to the riverbanks and floodplains.

Types and Quantities of Materials: For this study, two major carriers of hazardous materials in the river area were interviewed. The two carriers, Wayne Transports and Dahlen Transport, account for nearly 3,900 loads of hazardous materials transported along the Mississippi River each month. There are also several other major transport companies, and an unknown number of small independent carriers which handle hazardous materials. (There are no special vehicle registration requirements for trucks that haul hazardous materials.)

The data available suggest that gasoline and other fuel products are the largest single group of hazardous materials transported on Minnesota's highways. Liquid chemical transport also makes up a significant portion of the industry. Data from the two carriers we contacted showed the following materials are commonly transported:

- Gasoline, lube oil, heavy fuel, asphalt, propane, anhydrous ammonia, caustic soda, sulfuric acid, bleach, hydrochloric acid, methyl ethyl ketone, acetone, cyclohexanone, toluene, and petroleum naptha.

The monthly total for these two carriers alone was 3,870 loads, of which 2,700 (70 percent) loads were gasoline. Each load consists of between 6,000 and 8,500 gallons, depending on the weight of the material. Liquid chemical loads are typically about 7,500 gallons. The total number of truckloads of hazardous materials and other commodities transported along the river is unknown.

Hazards: Including gasoline, about 90 percent of the loads pose a public safety hazard due to the flammability, corrosivity, reactivity, or toxicity of the materials hauled. There would be no chance of recovering the spilled material from a river or lake for the 15 percent of the loads that are water soluble materials. All would pose a threat to fish, wildlife,

and the river environment in general. Excluding gasoline, 68 percent of the loads pose a public safety hazard, and only 50 percent of the loads, if spilled into a waterway, would have a chance of being recovered.

Means of Entering the River: The materials would most likely enter the river as the result of an accident on a bridge, on a stretch of highway adjacent to the river, or through a roadway drainage system (even if the roadway itself is not adjacent to the river).

Safeguards in Place: To prevent spills from occurring, there are extensive federal transportation regulations covering the operation of hazardous materials haulers. These include training for drivers, operating requirements, and equipment requirements. However, it is clear that these safeguards do not prevent all accidents.

There are no legal requirements for safeguards to contain spilled materials from a truck accident at the site of the incident. There are no requirements for operator contingency plans, nor do drivers carry even basic equipment for dealing with a highway spill (such as absorbent materials or a shovel to build a containment dike). To haul certain materials such as strong acids, however, companies equip their drivers with protective suits.

Once a tank ruptures or a valve leaks, it is up to the quality and speed of emergency responders (local police or fire, or company personnel) to limit the spread of the material. Further, it may be unrealistic to depend on the driver to take emergency response action. The driver may be incapacitated by the accident, or may have left the immediate scene for reasons of personal safety or to notify company officials and proper authorities.

History of Spills: Highway spills are common in Minnesota. Of 87 reported highway spills in 1989, 18 resulted from truck rollovers (20 percent), and 36 were diesel fuel tank leaks related to accidents (41 percent). In truck accidents, petroleum is the most commonly spilled material, varying in quantity spilled from a few gallons to about 8,000 gallons (the full load). Other commonly spilled commodities are fertilizers and milk, each of which could threaten aquatic life. Diesel fuel leaks in so-called "saddle tanks" result in relatively small spills (generally after a highway mishap), up to about 250 gallons. In rare instances, accidents have occurred on river bridges, causing small quantities of petroleum products to enter the river.

The most recent known instances of large amounts of product from a truck spill entering the river were in 1983 and 1984. In 1983, a truck rolled over on a Minneapolis surface street over a half mile from the river; about 5,000 to 6,000 gallons of diesel leaked from the tanker into a storm sewer, and was discharged to the Mississippi River near Minnehaha Creek. The 1984 spill involved an overturned truck on Highway 10, near Prescott, Wisconsin. The truck had just crossed the bridge over the St. Croix River when it tipped, emptying 1,000 to 2,000 gallons of fuel oil into the river. In both cases, some booms and absorbent pads were de-

ployed to recover the spilled products, and readily apparent damage to the rivers was minimal.

Potential Spills, Most Likely Spill: The largest potential spill would result from an accident involving a liquid hauler (or two, in rare instances) on a bridge. The most likely substance to be spilled is gasoline or related petroleum product, which typically floats on water. However, if the material fell from a high bridge, it would have a tendency to mix deeper in the water. If the product spilled adjacent to the river, and flowed down to the river via natural drainage routes or a storm sewer, it would likely remain on the surface where recovery could be possible with immediate action. On the other hand, about half of the liquid chemicals hauled by the two companies we contacted would dissolve in the water or evaporate, with no chance of recovery.

The most likely spill from a tanker truck would involve less than 10,000 gallons. However, because highway accidents do not necessarily occur in the vicinity of response personnel or equipment, the resulting spill is more likely to go uncontained longer, thereby increasing the probability it will flow to a nearby river, creek or lake if a pathway exists.

Assessment of River Spill Preparedness

There are two main barriers to river spill preparedness: the complexities of response logistics and execution, and factors associated with river spills over which we have little or no control.

1. The logistics and execution of a spill response must be planned well in advance to achieve a timely, well-equipped response. Rapid, large-scale action at the spill site is essential if a containment effort on a flowing body of water is to have any measure of success. The action taken within the first one to two hours after a material enters the river is particularly critical; once a large amount of material moves into the main channel of the river, any cleanup efforts immediately become more extensive, difficult, and costly.

2. Several factors associated with spills into moving bodies of water make them notoriously difficult to handle. To illustrate, a spill might be virtually unrecoverable because of the chemical nature of the spilled substance; for example, a material may be water soluble or for other reasons tend to mix throughout the water column. Fortunately, the most commonly spilled class of materials, petroleum products, are not water soluble and generally float on the surface, increasing the chance that a larger percentage can be recovered. However, local river conditions at the time of a spill, such as ice or strong currents, seriously hamper containment and cleanup efforts. Also, movement through a dam mixes an otherwise floating material throughout the water column. Finally, public safety considerations, such as fire or a noxious cloud, may prevent cleanup personnel from working in the area of the spill.

For purposes of this report, the spill preparedness of industry and government will be equated with their efforts to "pre-solve" the complex logistical and functional problems of a river cleanup (Item 1 above). The factors described in Item 2, on the other hand, cannot be addressed directly. However, industry and government can minimize the adverse effects of these factors by being particularly well prepared to handle the prob-

lems of logistics and execution. We discussed spill preparedness with a number of the main industrial users of the Mississippi River: chemical and petroleum manufacturing and storage facilities, petroleum pipeline operators, railroads, barge transfer facilities, and trucking companies.

Industry Preparedness

Industrial users of the Mississippi River or its surrounding areas appear prepared to handle the on-site problems presented by minor accidental releases of hazardous materials into the environment, including public safety protection and on-site spill remediation. As stated earlier in this report, industry depends heavily on outside assistance to handle anything more than minor spills. Consequently, industry preparedness may be best described as a tiered response scheme. The four tiers are: in-house resources, spill cooperatives and mutual aid networks, local response contractors, and out-of-state contractors.

In-house Resources

Although the potential exists for a spill of several hundred thousand gallons on the Mississippi River, response equipment maintained by individual companies whose operations may cause such a spill would be inadequate to contain the spilled material. The small stores of response equipment, such as absorbent booms and pads, boats, pumps, and vacuum trucks, are sufficient to handle little more than a small (a few thousand gallon) spill occurring on-site. Moreover, most equipment on hand is specifically designed for use on petroleum spills. Although certain equipment items may also be used for some non-petroleum chemical products, the state as a whole may be less able to safely and effectively handle a chemical spill into the river than a petroleum spill.

Barge loading facilities typically maintain equipment to handle an incident involving a ruptured transfer hose or a faulty valve. Even with quick reactions by the barge operator, however, several hundred gallons of liquid could spill. A large spill caused by a barge running aground or ramming a bridge support would require the mobilization of additional resources, and would certainly overwhelm the capabilities of individual barge transfer facilities operating along the Mississippi River.

Railroads are prepared to respond to the scene of a derailment within one to six hours with sufficient equipment to contain the fuel which may spill from a diesel locomotive; still, a spill occurring along a remote stretch of track may well be downriver before company-owned containment equipment could reach the scene. In any case, company responders alone would likely be unable to handle the leaking contents of several 20,000 to 25,000 gallon tank cars.

Trucking companies pose the least risk of a damaging river spill, but may be the least able to respond to an accident and resultant spill for several reasons. First, a tanker truck is often operating far from its home base and the associated response personnel and equipment. Second, the driver may be

incapacitated and therefore unable to notify proper authorities or take immediate containment action. In fact, contingency plans for tanker drivers emphasize personal and public safety; the best "response" action might be to get clear of the accident scene. Third, even if personal safety is not a factor, most individual trucks do not carry containment equipment. In practice, any initial containment effort would more likely be carried out by the first emergency responders onscene, such as police or fire personnel.

Pipeline operators rely primarily on safety features, such as thicker piping and special-function or remotely-controlled valves, to prevent spills at river crossings. Nonetheless, pipeline breaks continue to occur, and may pose a serious river pollution threat due to the various ways a spill can reach the river. Because the companies must maintain their pipelines and emergency response capabilities over large overland stretches as well as at multiple river crossings, resources are generally staged at locations more central to the entire pipeline system, rather than near specific crossing locations.

Spill Cooperatives, Mutual Aid Networks, and CAER Organizations

The second tier of industry response consists of agreements with other companies with similar response needs. There are three types currently serving Minnesota companies: spill cooperatives, mutual aid networks, and community awareness and emergency response (CAER) organizations.

The Miss-Ota-Croix spill control cooperative consists of about 15 companies engaged in the storage and distribution of petroleum products in the Twin Cities area. The cooperative maintains a semi-trailer of spill response equipment, including containment boom, pumps, a skimmer, hoses, and other related gear. The trailer is staged at a central St. Paul location near the Mississippi River, and may be deployed as needed by any of the member companies. The cooperative agreement does not, however, provide for the "loaning" of trained response personnel by member companies during an incident, due to various liability, compensation, and labor contract issues. A similar cooperative serves petroleum facilities along the river near LaCrosse, Wisconsin.

Mutual aid networks generally involve companies involved in the same industry, usually as members of a national umbrella organization for that industry. Member companies of the National Tanker Truck Association are located nationwide; should a member truck cause a spill far from its company's resources, a member company with response resources in the area may be called in. The spiller will usually be billed by the company offering response assistance for the actual costs of that assistance. Because membership in national organizations is sometimes expensive, however, industry officials we interviewed believe most small trucking companies and independent operators

do not have the protection of such a mutual aid network.

The Marine Spill Response Corporation (MSRC), an umbrella organization sponsored by major oil companies, has proposed a network of five response centers nationwide, with trained response personnel and equipment on constant standby. None of these centers, however, would be located in the Great Lakes region as currently proposed. It is the view of MSRC that sufficient resources are already available in the region but, if need be, one of the coastal centers could also respond to a Great Lakes spill.

The Association of American Railroads is also extensively involved in response to hazardous material spills involving railcars. The Association's Bureau of Explosives publishes informational material on hazardous commodities typically carried by rail. In addition, the Bureau has trained response personnel to provide advice and onscene assistance nationwide, although the response time involved could be lengthy.

Finally, CAER organizations are joint chemical industry and government planning and information entities. One such organization, Wakota CAER, covers a highly industrialized area southeast of St. Paul, including several facilities located on or near the Mississippi River. Since 1985, the organization has assisted in the integration of community and facility emergency plans, and has sponsored emergency exercises to test the effectiveness of these integrated plans. The organization serves as a regional mutual aid network for the individual companies and governmental agencies within the two-county CAER area. The Wakota group is the only CAER organization in the state.

For-Hire Response Contractors

The company spill plans we reviewed direct that for-hire response contractors be called should any spilled material leave the company's facility. However, company planners in general take for granted the capabilities of the contractors listed in their plans. As a result, the limitations of these contractors would most likely be discovered during an actual incident. Effective planning by industry should include an assessment of each contractor's capabilities and limitations beforehand to ensure that sufficient resources are being mobilized.

The reliance by industry on for-hire assistance is also problematic because the selection of river response contractors in Minnesota is severely limited. Only two "full service" contractors (Bay West and OHM Corporation, both in the Twin Cities area) are capable of responding quickly to a spill on water. Bay West is also the State's response contractor. Both have only a small number of trained personnel (each has roughly 15 with river training) and a fairly limited inventory of response equipment. However, the local OHM office is a satellite of an Ohio firm which claims the capability to import several hundred company personnel and significant quantities of equipment. In addition, Bay West has a subcontract

arrangement with Marine Pollution Control, a large Detroit firm, for additional resources. In either case, the additional resources would be a number of hours to a day or more away.

In contrast, the availability of some specific types of spill response equipment, such as vacuum trucks and power boats, appears to be good in the Twin Cities area. Tow boat services and work barges are also available, but are not always noted in industry spill plans. Finally, 3M Corporation, a major manufacturer of absorbent boom and pads, is located in St. Paul. Therefore, a large amount of equipment of this type could be made quickly available in the event of a major spill.

We estimate that resources immediately available from the warehouses of the two local response contractors would be adequate to handle a spill of 10,000 to 15,000 gallons under optimal conditions. This amounts to slightly more than the volume of a tanker truck, and quite a bit less than one full railcar. Most pipeline crossings in the Twin Cities area have the potential to release at least three to eight or more times more crude oil or refined products, and a catastrophic pipeline, storage tank, or barge rupture could release hundreds of thousands of gallons.

Finally, it should be observed that the scarcity of river cleanup resources in Minnesota is in one respect a positive condition, since it reflects the lack of a local "market" for spill control services. As the previous chapter pointed out, Minnesota and Wisconsin are fortunate in that major spills into the upper Mississippi River have been infrequent. Unless the number and severity of river spills increase over time, future planning must assume that only limited response resources will be available locally.

Out-of-State Contractors

Additional for-hire resources are available in major cities such as Detroit, Chicago, and St. Louis. Out-of-state contractors have historically responded to major spills wherever they have occurred in the country, often in situations requiring long-term cleanup efforts. For example, Marine Pollution Control from Detroit deployed specialized equipment and personnel to the 1988 Ashland spill near Pittsburgh; the company remained onscene for six weeks. Specialized response equipment not available in Minnesota includes dedicated cleanup barges and different types of containment boom which are better suited to river cleanup operations.

While the need to bring in out-of-state contractors to assist in major cleanups is widely recognized, so is the unavoidable delay of from several hours to a day or two. Therefore, company spill plans should emphasize the importance of mounting as rapid and well-equipped a response early on to contain the spill. Once initial containment efforts fail and the need for resources unavailable locally is established, a long-term cleanup commitment by the spiller becomes almost a certainty.

Local Agency Preparedness

Local emergency agencies, such as police, sheriff, and fire departments, primarily perform public safety functions where hazards exist. While personnel of these agencies are the first responders on the scene of an emergency, they generally lack much of the training specific to handling an incident involving hazardous materials. Current training for peace officers and firefighters emphasizes simple hazardous material awareness; that is, recognizing that a hazardous chemical agent is present, keeping the public a safe distance away, and waiting for specially-trained responders.

Local governments along the Mississippi River are no exception. Emergency personnel, while often eager to respond to a river spill in their communities, lack federally-required response training and the experience necessary to properly deploy river cleanup equipment. Occasional governmental or industry installations may have limited cleanup equipment in storage, but may not have a plan or the trained personnel available to utilize it. In any case, the emergency plans of communities along the river typically defer to the State for response to spills on the river. In doing this, however, local emergency planners have not recognized that state resources are not geared to providing a hands-on response to a spill on the Mississippi River.

State Agency Preparedness

Contrary to what much of the public believes, the State does not maintain "hands-on" spill response staff or equipment. The system in place (oversight and monitoring) was discussed in an earlier section. The small amount of equipment stored at various state facilities throughout Minnesota is intended for minor pond, lake, and creek spills, and would be of little value in a river incident. Rather, the real preparedness of state agencies is in planning the notification of potentially affected parties; deploying existing staff resources for cleanup oversight; and coordinating the actions of various state agencies. In addition, the State must be prepared to initiate an effective command and communications structure in the event of a significant spill. Finally, adequate staff follow-up of spills is essential to ensure that environmental damage is mitigated and that state enforcement actions have the desired deterrent effect.

Planning. Industry representatives interviewed for this study have stated that the task of developing a comprehensive plan which considers the specific downriver effects of a spill is beyond the limited planning and response capabilities of individual companies. Many, in fact, see planning for longer-term environmental response and cleanup as a role state government should fill. This stems from their belief that government agencies typically have large amounts of pertinent resource information available to them, and are thus better able to coordinate the effective use of the emergency response resources available. Indeed, an appropriate state role could be in

assisting potential spillers with the preparation of comprehensive spill contingency plans.

Coordination. As stated earlier, the Department of Public Safety's Division of Emergency Management is the planning agency for all state agency response to hazardous materials incidents. A recent product of the Division's coordination efforts is an executive order delineating the capabilities and responsibilities of all the state agencies which could be mobilized during an incident. (See Appendix II.) For the most part, the various agencies involved have enthusiastically followed through in accordance with the executive order. Still, long-term commitments by high-level agency managers must be maintained to ensure that the State as a whole is prepared to react to a spill whenever and wherever one occurs.

Command. While the spiller is responsible for the cleanup of a river spill, in practice the State becomes a "partner" in ensuring that the spiller's response actions are properly and quickly carried out. This function is best served if the State designates an onscene commander to represent its interests, and all involved state personnel understand their roles under that commander. Existing state and agency contingency plans, however, are not current with the necessary emergency procedures and command designations. Consequently, industry is unclear as to the State's role, authority, and command structure during a spill incident. The State is currently working with industry to clarify these important response issues.

Communications. Communications from point to point along the Mississippi River may be difficult, due to line-of-sight problems caused by bends and bluffs. The most popular and useful means of communication is the cellular telephone, which is limited by the same line-of-sight problems as hand-held radios. Further, the existing cellular phone network is limited to the Twin Cities metropolitan area; cellular phones could not be used for an incident on the river south of Hastings. Therefore, a simple, mobile radio system that could be used anywhere in the state is essential for effective spill response.

A river spill response would require MPCA staff to communicate with the responsible party, for-hire cleanup contractors, DNR staff, local and county officials, and other key personnel involved in the response. At present, the MPCA has no formal communication system in place for spill emergencies, although additional equipment has been purchased. Also, no coordination scheme exists to link state agencies that do have established radio frequencies; that is, one agency's personnel may talk among themselves, but would have difficulty talking with personnel from another local, state, or federal agency.

Staff Follow-up. Long term problems resulting from the continued presence of pollutants at or near a spill site may require additional staff time to resolve. In recent years, however, state oversight of cleanup activities has often been limited to the initial emergency period, during which time the

threat to the environment is mitigated. While state spill response efforts have been sufficient to alleviate immediate environmental threats, long term staff follow-up of an incident is needed to ensure that an adequate cleanup has been performed. A further benefit of highly visible state follow-up is to promote serious investigative and cleanup efforts on the part of spillers.

Federal Agency Preparedness

Federal jurisdiction for handling spills into the upper Mississippi River is divided between two agencies: EPA and the Coast Guard. No EPA spill response staff are stationed in Minnesota; in the event of a significant spill, EPA responders are deployed out of the Chicago regional office. In one recent spill, two EPA officials arrived approximately seven hours after the spill was reported to federal authorities. While these officials provided assistance to the MPCA onscene commander in that instance, the Pollution Control Agency most often acts as the informal agent for EPA for the purpose of overseeing environmental cleanups in Minnesota.

In addition, seven Coast Guard personnel staff the Marine Safety Detachment in St. Paul. These personnel perform various activities pertaining to the safety of commercial vessels operating on the Mississippi, Minnesota, and St. Croix Rivers. In addition to their primary duties of facility and vessel inspections, the marine safety personnel respond to spills caused by barges, tow boats, and waterfront barge transfer facilities. The St. Paul detachment does not perform actual cleanup work, but monitors cleanup activities or authorizes the expenditure of federal monies as necessary. Recent federal oil spill legislation, however, may provide for equipment caches located at each of the ten Coast Guard district offices; for coverage of the upper Mississippi River, the equipment would be located in St. Louis, Missouri.

The Coast Guard does, however, maintain two spill response strike teams: the Atlantic team is stationed in Alabama, the Pacific team in California. Atlantic strike team personnel are available on request to respond to spill incidents. In addition, the team could deploy any special equipment transportable by cargo aircraft. Deployment time for personnel or equipment may vary from several hours to a day or two.

Federal preparations for a major river spill consist primarily of the activities of the Regional Response Team (RRT). As discussed earlier in the report, the RRT is the mechanism by which significant federal resources could be mobilized in the event of a major hazardous material incident. Activation of the RRT would likely take several hours to several days, and would not by itself result in the deployment of equipment or cleanup personnel to the scene of an incident. Finally, the RRT maintains a regional hazardous material contingency plan, and is currently developing a computerized list of the emergency equipment available throughout the Great Lakes region.

The Upper Mississippi River Basin Association

Minnesota is one of five states making up the Upper Mississippi River Basin Association (UMRBA), which has completed work on a coordinated spill notification plan and spill response procedures. A detailed resource and information manual has been assembled by member state and UMRBA staff, covering over 850 miles of the river from the Twin Cities to Cairo, Illinois. The resource manual does not establish mutual aid agreements among states, but is simply a useful compilation of Mississippi River data. The work of the Association has been adopted by the States of Minnesota, Wisconsin, Illinois, Iowa, and Missouri. Coordinating agreements worked out by the five states will serve as the foundation for future joint actions taken by Minnesota and Wisconsin.

Overall Preparedness: Conclusions

A barge rupture, a major storage tank collapse, a pipeline break, or the derailment of several rail cars are all potential sources of a spill of a hundred thousand to over a million gallons of petroleum products or other hazardous chemicals into the Mississippi River. There is little doubt that a major river spill would pose a serious environmental threat, since at present industry's response to such a major incident would likely be slow, understaffed, and lacking in specialized equipment. Even the combined response resources of Minnesota's industries and governmental agencies would as well be insufficient to handle such a spill. This is in part because of a lack of equipment and trained response personnel available in the state, but also reflects the prior absence of statewide efforts at contingency planning and resource coordination.

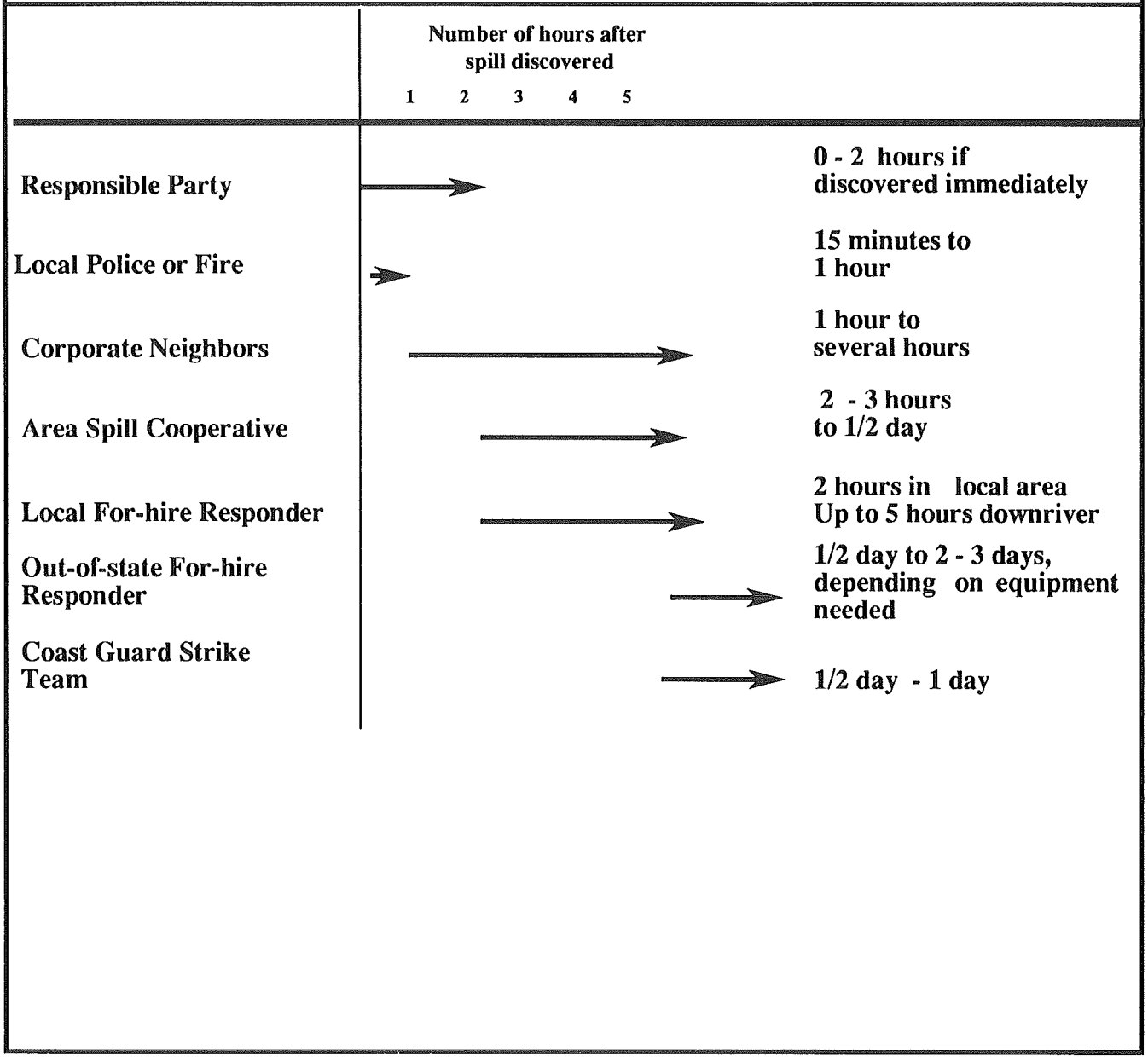
As stated earlier, the first hour or two after a spill is the most critical time for containing the spilled material and minimizing its effect on the river. **Figure 4** shows that, in general, only the spiller, local authorities, and nearby corporate neighbors are capable of responding during that critical time. If the response of these organizations is ill-prepared and delayed, a difficult and extensive cleanup may result.

More spill cleanup personnel and equipment notwithstanding, even a highly successful cleanup of a major spill on the Mississippi would still be viewed by many as woefully inadequate. However, there are several steps the State could take to limit the risk of major damage to the river. The most important are those that reduce the likelihood of a spill occurring in the first place: prevention measures. Also important are ways to improve the spill response capabilities of industry and government: contingency planning and defensive measures. The following section discusses several recommendations in the

context of the lessons learned during a recent major incident on the Minnesota River.

figure 4

Likely Response Time to A River Incident



Case History and Recommendations

The State of Minnesota has been fortunate in that only a handful of incidents over the past 20 years have significantly affected the state's rivers. Spills on the Mississippi River, with the exception of the 1978 aviation fuel spill near Fountain City, Wisconsin, have involved relatively small quantities of oil. Consequently, the State has not been called upon to respond to a major river spill. While the infrequency of such occurrences is good from an environmental perspective, it also means infrequent opportunities for industry and government spill response personnel to develop more effective ways to handle larger spills. Until recently, state emergency planners relied on the experience of other state and federal response agencies, and published accounts of past river incidents, to develop more effective spill response measures.

However, a recent major pipeline break along the Minnesota River presented industry and government with an opportunity to test preparedness to handle a river spill. The incident was extensive in terms of the length of river affected, the duration of the response effort, and its demands on the resources and in-place contingency plans of industry and government. Many important lessons were learned as a result. A brief account of this incident is presented here as a useful and realistic context for discussing several recommended changes to the current state program of spill prevention and response. The recommendations themselves are presented in the final section.

The Minnesota River Pipeline Break

The morning of Tuesday, June 12, 1990, approximately 80,000 gallons of diesel fuel leaked from a Williams Pipe Line Company valve located near the Minnesota River in Eden Prairie, Minnesota. Some of the fuel soaked into the soil as it flowed about 150 yards downhill to the riverbank. However, because the ground was saturated due to an unusually rainy spring, it is believed that most of the 80,000 gallons entered the river over a period of several hours. The cause of the fuel loss was a small, high-pressure leak in a backflow prevention valve installed by the company in 1989 to prevent a major discharge of oil from the line. Because the break did not occur in the 12-inch pipeline itself, it is unknown whether the valve could have served its intended purpose of limiting the amount of oil released into the environment.

The spill was initially observed on the river by early-morning commuters as they crossed a highway bridge about two miles downstream of the leak. The 911 emergency network received several calls from motorists during the early morning commute; the MPCA received similar calls between 7 a.m. and 8 a.m. The Scott County sheriff's office notified the Coast Guard office in St. Paul at 7:20 a.m. that oil was on the river; MPCA staff confirmed this fact with the Coast Guard at approximately 7:30 a.m. At 8 a.m., a Williams official notified the MPCA of the spill as required by state statute.

Within about one hour of the first reports of oil on the river, the city of Savage fire department deployed a string of containment boom owned by the Cargill Company at a point on the river adjacent to its barge loading facility. Unfortunately, the way the boom was placed was not optimal for the river conditions on that day (moderately high flow rates). As a result, the boom as initially deployed did not contain the diesel fuel, and in fact caused an area of turbulence behind the boom which tended to mix the fuel with the water. Several hours later, a towboat was used to redeploy the boom in a configuration which allowed the collection of oil at the Cargill barge dock, where a vacuum truck and skimmer recovered the oil collected.

The containment boom at Cargill was deployed about one hour before Williams inspected the break site and confirmed that its valve was the source of the spill. However, once the source was confirmed, a large mobilization of company and for-hire cleanup personnel and equipment took place. Containment booms were deployed and vacuum trucks equipped with oil skimmers were staged to recover the oil caught by the booms, in spite of severe thunderstorms in the area which hampered cleanup operations. By Tuesday evening, response personnel had established seven containment and recovery points (including the site of the break) along a twelve-mile stretch of the river. The point furthest downriver was still seven miles upstream of the confluence of the Minnesota River with the Mississippi. Recovery operations effectively closed the river to commercial barge traffic.

Patches of oil were observed in the Mississippi River as early as Wednesday morning, and uncontained oil continued to move downstream toward the Mississippi throughout the day. That morning, MPCA staff directed Williams to begin cleanup of oil pools and oiled shoreline and vegetation along the banks. This highly labor-intensive work was not immediately undertaken by Williams or its contractors, and few cleanup boats and crews were seen on the river until the following afternoon. MPCA and the Coast Guard insisted that, at a minimum, the pools of floating oil be removed before the river could once again be opened to barge traffic.

On Wednesday evening, the Minnesota DNR and a Williams cleanup contractor deployed an absorbent boom across the river in Fort Snelling State Park, at a bridge less than two miles from where the Minnesota River empties into the Mississippi. This was done to provide an additional measure of protection for the Mississippi, although the extremely strong currents (estimated to be about 4 miles per hour) made it unlikely that much oil could be recovered at that point.

Late Wednesday night, large trees and other debris that had washed into the Minnesota River during the previous day's heavy rains severed most of the boom lines. Fortunately, most of the recovery that could be expected from these operations had been accomplished by that time. The accompanying high water levels scoured many areas along the riverbank where oil had been pooling, transporting thin layers of oil quickly down to the Mississippi River where further dilution took place. Acute toxic affects on fish and wildlife were probably minimized by these events.

Thursday and Friday were dominated by continuing efforts to clean up pools of floating oil, some of which remained trapped in areas where several barges were moored. Repeated surveys of the river by MPCA, DNR, and Williams personnel showed satisfactory progress by cleanup crews over those two days; on Friday evening, the Coast Guard reopened the river to commercial barge traffic. Cleanup of oil-soaked shoreline and vegetation continued throughout the weekend, and by Monday, June 18, MPCA staff considered the emergency response phase complete.

Recommendations

There are two important conclusions of this study: 1) the only sure way to prevent river damage is to prevent spills from occurring, because 2) realistically, ,industry's and government's capabilities to respond to a major spill into the Mississippi River cannot guarantee that environmental damage will be minimized or avoided. Consequently, we believe that of the recommendations that follow, the most beneficial are those in the first section, pertaining to the prevention of spills and planning ahead to ensure the most effective and rapid response possible. Clearly, spill prevention and emergency preparedness pays in the long run; the cost to clean up even one river spill which could have been prevented may quickly exceed the cost of effective prevention measures. Many of these "costs" involve damaged public resources or are otherwise borne by someone other than the spiller. Moreover, the damage to the spiller's reputation is difficult to repair, and has its own long-term costs.

Government agencies likewise cannot afford to be caught unprepared. Because river spills adversely affect many but help no one, a strong case can be made for cooperation among companies, local and regional emergency planners, state response agencies, and other parties dependent upon the continued health of our rivers. Other recommendations that follow, therefore, emphasize the need for greater private and public sector cooperation and assistance.

Lastly, we include several recommendations to improve the State's preparedness to handle hazardous materials emergencies, including river spills. The internal changes proposed would improve the management of the State's emergency resources, enhance communications, and make state agencies more accountable for maintaining their emergency capabilities.

Spill Prevention and Preparedness

Preventing spills and responding effectively to those that do occur is directly related to the amount of forethought and effort a company invests in these important areas. Preventive measures are borne of a critical analysis of industrial processes, methods, and safeguards. Effective response to the spills that do occur depends on a company anticipating possible spill scenarios and knowing ahead of time what should be done on those occasions.

Consequently, we believe it is critical for the State to ensure that adequate industry effort is being directed toward spill prevention and response preparedness.

▼ Amend State Law to Require Prevention and Preparedness

Prevention is clearly the only effective way to avoid the environmental damage of a spill. For times when a spill does occur, however, existing state law requires a spiller to immediately respond to the spill and recover the spilled material as rapidly and thoroughly as possible (Minn. Stat. Section 115.061).

Experience with spill incidents has shown, however, that effective emergency response actions are usually possible only if the spiller has determined in advance what should be done in the event of a spill; that is, has prepared a spill response plan. We believe that, beyond existing law, all potential spillers should be required to prevent spills and to be adequately prepared to respond to any spill emergencies that do occur.

Therefore, we recommend that existing state law be amended to require all handlers of significant quantities of petroleum products or other hazardous materials to take measures to prevent spills and be prepared to adequately respond to a spill. In the event of a spill, or, for the largest operators, before a spill, the MPCA should have the authority to review a company's prevention measures, verify the existence of a spill plan, review the adequacy of the company's preparedness to respond, and impose penalties for failure to comply with this prevention and preparedness requirement.

▼ Require Contingency Planning in Amended Storage Tank Rules

The transportation industries shown by this study to be a potential spill threat on the Mississippi River are primarily under federal jurisdiction, except for the State's enforcement of federal safety regulations governing railroads and highway carriers. Requirements for spill preparedness among these industries must therefore be narrowly focused so as to avoid conflicts with recognized areas of federal regulation.

On the other hand, the fixed facilities which pose a potential river spill threat are within state jurisdiction, for purposes of imposing both prevention and emergency planning requirements. Currently, the MPCA is amending its rules for the safe operation of above ground tanks used for storing liquids, including those which contain petroleum and other hazardous materials. This provides an immediate opportunity for the State to require owners and operators of all above ground tanks, particularly those with close proximity to rivers and other surface water, to be prepared to handle spills from their storage facilities.

Therefore, in addition to the preventive safeguards to be required by the updated tank rules, we recommend the new rules require facility owners and operators to prepare spill contingency plans. Plans should address means by which spills could enter surface waters, and provide for specific response actions to each event.

▼ Establish a Spill Prevention and Preparedness Audit Program

At present, most of the MPCA's spill control efforts are limited to after-the-spill responses to incidents; no MPCA resources are currently directed toward implementing prevention measures prior to a company actually becoming a spiller. As a result, the years of field experience accumulated by MPCA emergency response and regional personnel are not being used to the fullest benefit of industry, the public, and the environment.

To be most effective from a prevention standpoint, response personnel should apply their knowledge of what causes spills to businesses which have not yet themselves had a spill; that is, they should conduct "spill prevention audits" of facilities through which problematic conditions, procedures, and equipment may be identified and changes suggested. This type of audit is analogous to the "energy audits" performed for homeowners by utilities to ensure the most efficient use of energy resources. As a side benefit, general field knowledge and site-specific details gained by MPCA personnel while conducting spill prevention audits would increase the effectiveness of these personnel when responding to spills at facilities similar to those audited.

MPCA staff may also provide these companies with emergency planning assistance. We found that contingency planning by the various industries we reviewed often did not consider downriver and other offsite response needs. Most company and facility plans target on-site response; even when considered in a plan, the more extensive response actions required by a river spill rely heavily on outside personnel (such as governmental agencies and for-hire contractors). The MPCA recognizes the need for industry and government to jointly work out effective spill response plans, and has devoted some of its limited resources to date to this area of planning.

We recommend that a voluntary spill prevention and planning assistance program be implemented by the MPCA. Companies could request the MPCA to conduct spill prevention assistance audits in order to reduce the potential to cause spills. In addition, businesses could receive assistance in identifying possible spill scenarios and preparing appropriate emergency response plans. Additional MPCA response staff should be hired to meet the expanded workload of this service. The program should be established to provide for regular rotation of staff between the prevention/planning function and the existing field response function.

▼ Spill Prevention Audits as Components of Enforcement

The MPCA has for several years chosen not to pursue enforcement actions subsequent to spill incidents because of limited staff resources. Not only does this lack of enforcement undermine the deterrent effect of existing statutory penalty provisions, it is a missed opportunity to work with companies with spill problems to reduce the likelihood of future spills. Even companies or facilities which would not otherwise fall under state jurisdiction, such as interstate pipelines and railroads, could be brought into compliance with state prevention requirements once a spill has occurred and state enforcement action pursued.

Wisconsin law provides that the State "may require that preventive measures be taken by any person...if [the State] finds that existing control measures are inadequate to prevent discharges." No similar provision appears in Minnesota law. Along these same lines, we believe a spill prevention compliance audit

should be required of any Minnesota business with a history of chronic or large-scale spills. The compliance audit should include emergency planning assistance if the company also has a history of poor emergency response to the spills it has caused. Each spiller should be required to make the preventive changes recommended in the compliance audit, and develop and exercise a comprehensive spill response plan with the assistance of MPCA staff.

We therefore recommend that legislation be enacted to require a business to submit to a spill prevention compliance audit and to adopt the recommendations of that audit, if the business is found by the MPCA to have inadequate spill prevention safeguards in place. Further, the legislation should give the MPCA the authority to initiate spill response drills in order to test the effectiveness of spill plans.

▼ Increase Level of Follow-up to Spill Cleanups

State staff's ability to monitor a spiller's response activities from the initial emergency through final cleanup actions is important for two reasons. First, it ensures thorough and appropriate response and cleanup actions are taken by the spiller. Second, the presence of state staff throughout a cleanup increases the deterrent effect of the cleanup; conversely, a spiller might not take seriously the State's directives to clean up a spill unless the State demonstrates through staff followup that it considers environmental cleanup important.

In recent years, lack of staffing for this important follow-up function has resulted in prolonged cleanups at best, and the suspension of cleanup activities by the spiller at worst. For example, the extent of cleanup of a number of pipeline spills which occurred in the 1960s and 1970s remains undetermined by state staff. In some cases cleanups were never undertaken, and in others the absence of routine state monitoring of cleanups makes it unclear whether sites of past major spills remain contaminated.

We therefore recommend that the state devote additional staff resources to better monitor long-term spill cleanup activities.

Increased Cooperation Among Industry and Government

The responsibility for protection of Minnesota's rivers does not belong to any one company, industry, or level of government. Only through the cooperative efforts of industry and all levels of government can the greatest degree of river protection be achieved. The spill prevention and planning program proposed above would improve the sharing of information and experience between industry and government prior to a spill incident.

The following recommendations, on the other hand, are designed to improve the sharing of resources and personnel during an actual incident.

▼ Encourage Industry Cooperatives and Mutual Aid

During the recent Minnesota River spill, the actions of private corporations with barge facilities along the river led to the setup of two of the containment and recovery points. Williams personnel set up a third containment point using containment equipment owned by the Miss-Ota-Croix Spill Control Cooperative, a consortium of companies in which Williams has actively participated.

It is evident that the willingness and ability of strategically-situated facilities to quickly initiate a river response on behalf of a spiller, even when the identity of the spiller is unknown, add to the initial effectiveness of a river response. In addition to facilitating a more rapid response, the involvement of several neighboring companies spreads the financial burden for maintaining spill equipment among a larger support base.

For these reasons, the MPCA encourages the establishment of cooperative agreements among companies doing business along the river to provide cleanup assistance to neighboring facilities in the event of a spill. We also encourage the formation of cooperatives to purchase and maintain spill response equipment, and, to the extent possible, to provide trained personnel to respond to each others' spills. To achieve these objectives, the state should investigate various incentives to assist companies, such as tax credits and protection of "Good Samaritan" companies from liability for spill-related damages. The state should also identify ways to reduce existing impediments to developing useful cooperative agreements.

▼ Establish a River Defense Network

Our assessment of industry's river response resources suggests that the limited equipment and personnel available in the Minnesota-Wisconsin region would be spread thin in the event of a major Mississippi River spill. The recent Minnesota River spill, while involving a relatively small amount of oil on a narrow and fairly manageable river, taxed industry's local resources greatly; a large number of responders, in fact, were brought in by the company and its contractor from other states. A major spill on the Mississippi River could easily overwhelm existing regional cleanup capabilities, thus decreasing the effectiveness of immediate recovery operations and increasing the chances of significant river damage. There is a clear need to develop specific measures to protect public resources downriver of a spill, including the rapid deployment of equipment and trained personnel.

It was clear from the Minnesota River pipeline spill that, in a major spill, the initial response will not occur quickly enough or be effective enough to contain the spilled material near the actual spill site. It is likely that at least the initial spill will move quickly downriver where damage to sensitive environmental, aesthetic, or economic areas (wildlife-producing backwaters, beaches, water intakes, marinas, etc.) could occur. While

each industry or facility which could cause a spill should be aware of and consider in its contingency plan the downriver potential for damage, it is doubtful that each company will actually have the capability to quickly or fully protect all of the known sensitive areas.

Therefore, the MPCA believes it is a matter of the common good, and beyond that a prudent policy, for the State to be prepared to protect such areas from a spill.

We recommend the state establish a River Defense Network to protect sensitive environmental, economic or aesthetic areas downriver of a major spill. In cooperation with the state of Wisconsin, preparations should include staging response equipment at a limited number of strategic locations along the river, and ensuring that trained personnel can rapidly deploy the equipment to predetermined points where the greatest degree of protection can be achieved. To facilitate this, the two states should undertake an assessment of the river to identify sensitive areas, determine effective protection strategies for these areas, establish equipment-staging points, and identify sources of response personnel. The two states should also develop and promote appropriate mechanisms for maintaining the equipment network, training river response personnel, and conducting on-river emergency drills.

▼ Training Local Response Personnel

A responsible party's response to a major spill on the Mississippi River could easily drain most of the pool of trained spill response personnel in the two-state area, from company workers to for-hire contractors. In fact, it is suspected that a high percentage of the response personnel deployed during the recent Minnesota River pipeline spill did not have the level of training required by federal Occupational Safety and Health regulations. The defensive network described above would consequently depend on the availability of trained workers who would not otherwise be involved in a spill response.

First response organizations, such as police, sheriff, and fire departments, are all possible sources of river defense network personnel. Minnesota National Guard personnel could also be in reserve for river defense. Personnel needs at various points along the river would depend, of course, on the locations of equipment staging points and the sensitive areas to be protected by the network. Because river response would not fall under the regular duties of these reserve personnel, issues of liability, insurance, compensation, and other legal matters must first be resolved.

Therefore, we recommend the state develop a river-spill response training program. Training should be available to local emergency response personnel, employees of potential spillers, and other individuals as appropriate.

Establish Joint MPCA-MDNR River Survey Teams

Circumstances during the Minnesota River pipeline spill necessitated the use of MPCA personnel not normally assigned to spill response to monitor several days of river cleanup activities. The monitoring, which consisted of the deployment of several two-person boat teams for frequent surveys of the affected riverbanks, was largely ad hoc; survey trips were not well-planned, and many boats carried personnel who were unfamiliar with the river and with river response practices. This hampered somewhat the efficiency and effectiveness of the State's monitoring of the cleanup.

One group of state employees with extensive experience with river environments and resource damage assessment went largely untapped: the conservation officers of the Minnesota Department of Natural Resources. DNR mobilized a number of officers and boats to provide cleanup and monitoring assistance within the boundaries of Fort Snelling State Park, approximately 15 miles downriver of the spill site. The experience of these officers, however, could have been more beneficially employed for river surveys in the upriver stretches where cleanup activities were more intensive. Additionally, MPCA personnel with special knowledge of Minnesota's rivers should be mobilized in the event of a river spill. As a result of the Minnesota River pipeline spill, MPCA and DNR have undertaken efforts to coordinate the deployment of experienced river personnel.

To continue these efforts, we recommend that MPCA and the Department of Natural Resources train selected MPCA staff and conservation officers jointly as two-person survey teams for future river monitoring. Prearrangements for sufficient numbers of survey boats should also be made. The resulting pool of trained river observers and boats should be readily available in the event of a river spill.

Create Regional Hazardous Material Response Teams

Legislation recently enacted directed the Department of Public Safety to organize a study group to develop a proposal for creating a statewide network of hazardous materials response units. These teams would be based in selected fire departments which would respond within a broader geographic region. Most of their effort would be protection of public safety at and near the scene of an incident. The availability of trained responders in every region of the state would provide much-needed protection to Minnesota's residents in the event of a release of hazardous chemicals. While training and equipment costs combined with the infrequency of hazardous materials incidents make it difficult to determine the most cost-effective approach, the MPCA supports the efforts to establish trained response units on a regional basis. Further, we see the potential for regional teams to be an important resource should a major river spill occur,

particularly a spill which threatens public health and safety.

We therefore recommend that the state adopt the Department of Public Safety Study Group's report to create a system of regional hazardous materials response teams. These regional teams and the river response teams recommended as part of the River Defense Network must act in coordination in the event of a major hazardous materials incident.

Internal Changes to Enhance State Agency Preparedness

Governor's Executive Order 90-2 designates the MPCA as lead agency for responding to spills anywhere in the state (except those involving fertilizers or pesticides). Even so, the U.S. Environmental Protection Agency and the U.S. Coast Guard, by virtue of an interagency agreement, share ultimate response authority along the Mississippi River. As noted earlier, however, federal officials are generally reluctant to take charge of an incident if the actions of state or local responders are sufficient and proper.

While EPA and Coast Guard representatives were quickly onscene and served important oversight roles during the Minnesota River incident, MPCA personnel remained the overall governmental authority throughout the cleanup. It should be noted here that a local fire chief was initially in charge of activities at the Cargill containment point downriver of the spill, but appropriately sought (in the absence of a clear public safety threat) to relinquish command to the first MPCA response staff on the scene.

The nature of a river incident renders local jurisdictional boundaries somewhat meaningless, beyond any matters of protection of local residents against threats to their immediate safety. Because a river spill does not observe city or county lines, responsibility for overseeing cleanup of the spill is logically the State's. As long as a river spill is an environmental matter rather than a public safety concern, we believe the MPCA should continue to be designated the lead state agency for river spill response. In the event a spill threatens public safety, such as a gasoline spill, a county sheriff, local fire official, the State Patrol or the State Fire Marshal would more appropriately assume command of the incident. As discussed in the following paragraphs, designation of a lead state agency is necessary to establish an effective command structure, and in no way minimizes the importance and involvement of other governmental agencies.

▼ Establish a Response Command System

The absence of a formal command structure affected the Minnesota River pipeline spill response from the onset. Williams Pipe Line Company, as the spiller, was responsible under state law to perform the necessary river cleanup, with close monitoring of all phases of the operation by MPCA personnel. Nonetheless, Williams and other industry representatives have repeatedly commented that at a

spill scene, it is often unclear who is or should be in charge. We believe a clear statement of command structure is critical; further, industry and government must develop and exercise a joint command system for responding to environmental emergencies.

Since the 1970s, firefighting organizations nationwide have operated under the so-called "Incident Command System." The System was first developed to handle the enormous management and logistical problems of forest fires. In early 1990, federal regulations requiring a similar incident command system for hazardous materials emergencies became effective. The State has not as yet implemented this requirement.

We recommend the state, as well as each individual responding state agency, develop a response command system based on the concept of the ICS Firefighting model. Industry response staff, as well as other federal, state and local emergency responders, should be intimately involved in the development, implementation, and exercise of the command system. In addition, the state could provide tailored incident command system training to both public and private sector personnel.

▼ Ensure Communications Capabilities

An integrated system of communications is probably the most critical component of an effective command structure. The Minnesota River spill response was less effective, and certainly less efficient, because of inadequate communications. For example, river monitoring personnel were often out of contact with senior company and agency officials on the scene, causing unnecessary delays in passing along information critical to timely decision-making. An insufficient number of mobile telephones was partly to blame for this breakdown.

Had the incident occurred on the Mississippi River out of reach of the Twin Cities mobile phone network, however, the situation would have been considerably worse. This is due mainly to the non-existent advance coordination of radio frequencies and usage protocols among the various response organizations. In addition, radio equipment in MPCA vehicles was scarce, and state staff involved in the incident often were not well-versed in the use of the equipment that was available. While many of these problems can be addressed by procuring the necessary equipment and training for state response personnel, the most important factor is how well communications can be integrated into the response command system.

We recommend that communications problems and needs be considered as integral components of the response command system discussed above. Like the response command system, the communications network should be developed through close cooperation with other pertinent governmental organizations and major industry responders. Further, the Department of Public Safety should develop a statewide emergency communication network to link local and state

responders during an emergency operation. One possibility is the use of the existing sheriff's "point-to-point" frequency.

▼ Establish a Single-Call Notification System

Currently, a confusing array of notification requirements faces spillers who must, by state and federal laws, report a spill that threatens groundwater or surface waters. Materials and quantities spilled, as well as where the spill occurred or what activity caused it, are all important factors in determining which federal notification requirements apply. On the other hand, the State's requirement to report spills applies uniformly to all spills within Minnesota, regardless of material spilled, the quantity, or the cause. The existing framework for spill reporting is discussed fully in Appendix I.

We believe it is an unnecessary burden on each person who must report a spill to file essentially the same report with multiple agencies. It should be an inherent function of the State's notification system to ensure that all agencies which require spill information receive it in a timely fashion.

Therefore, we recommend that the state institute a single-call reporting system for purposes of satisfying state spill notification requirements, SARA Title III requirements, local reporting requirements, and any other requirements to notify relevant state agencies in the event of a spill or release. The single-call system should be implemented through the existing Department of Public Safety Duty-Officer System, if it becomes fully staffed and equipped, or through another existing state dispatch center, such as the State Patrol.

▼ Designate a State Hazardous Material Response Planning Coordinator

Many state departments, and even divisions of departments, have widely disparate resources they can make available in the event of a river spill. Voluntary coordination efforts to date identify many of the available resources, but do not ensure that these resources would be readily available during an emergency. Additional coordinating authority at the state and department levels is necessary to ensure the highest levels of government preparedness.

In the recently updated executive order, the Minnesota Department of Public Safety identified the various state agency resources available to handle hazardous material spills in the state. Many of the agencies included in the order do not routinely handle emergency situations, and therefore may not have the level of readiness necessary to respond to a major after-hours or weekend incident. The order suggests the roles these state agencies could play in a response action; it does not, however, ensure that the roles will be effectively carried out by agency staff. One person should have the authority to ensure that agency managers seriously undertake necessary emergency preparations within their agencies. This authority

should also provide for post-incident critiques of individual agency performance during a hazardous materials incident, and binding directives to improve performance as needed.

We recommend that the Governor establish the position of State Hazardous Materials Response Planning Coordinator within the Department of Public Safety. The Planning Coordinator would report directly to the Governor on all matters of state hazardous materials response preparedness, providing periodic reports on the status of the state's emergency capabilities. The Planning Coordinator also would assess the performance of each state agency, in accordance with the agency roles described in Executive Order 90-2. Further, we recommend that each department and response agency designate a planning coordinator to perform similar coordinating functions for that department or agency.

Appendix I.

REPORTING SPILLS IN MINNESOTA

All spills of petroleum products, hazardous substances, or other pollutants within the State of Minnesota fall under the jurisdiction of the Pollution Control Agency and, in the case of fertilizers and pesticides, the Minnesota Department of Agriculture. Specifically, section 115.061 of the Minnesota Statutes states:

> It is the duty of every person to notify the agency [of jurisdiction] immediately of the discharge, accidental or otherwise, of any substance or material under its control which, if not recovered, may cause pollution of waters of the state, and the responsible person shall recover as rapidly and as thoroughly as possible such substance or material and take immediately such other action as may be reasonably possible to minimize or abate pollution of waters of the state caused thereby.

Telephones are staffed by MPCA and Department of Agriculture spill response personnel during regular business hours, and by Department of Public Safety duty officers at all other times. Reporting a spill to the State through any one of these channels fulfills Minnesota's reporting requirement. In addition, many incidents need to be reported to the State's Emergency Response Commission, Office of Pipeline Safety, Department of Transportation, and other agencies.

State law requires the reporting of all spills of potential water pollutants to the MPCA, regardless of the quantity spilled. The law covers spills at facilities as well as those that occur during transport of potentially harmful products. In 1989, over 2,500 reports of spills and storage tank leaks (mostly petroleum products) were reported; about six percent of these were spills of fertilizers or pesticides. Statistics on how many of those spills specifically affected the Mississippi River, however, have not been collected, but will be compiled in future years.

Federal Reporting Requirements

While the spiller is responsible for cleaning up a spill, notification provisions in state and federal law ensure that government agencies are aware of incidents and can monitor the cleanup. Under the existing network of reporting requirements, a person who spills even a small quantity of certain hazardous substances in Minnesota may be required to report the incident to as many as four or five separate governmental entities. This occurs because, in addition to the Minnesota law discussed above, several federal laws and regulations require spill reports be filed. Notification of federal authorities generally involves the National Response Center in Washington, D.C., operated jointly by U.S. Coast Guard and the U.S. Environmental Protection Agency. In most cases, the same incidents a spiller reports to the State must also be reported to the National Response Center.

However, with the exception of major incidents, federal officials do not take any immediate response action unless requested to by the State, other than to alert the federal agency with jurisdiction over the activity that caused the spill.

In contrast to the broad Minnesota requirement, specific federal reporting requirements vary with the substance spilled and the nature of the spill. For example, the Center receives reports of all "harmful quantities" of oil spilled on waterways. However, for any of about 360 hazardous chemicals covered by the federal Superfund law, only amounts greater than the specific "reportable quantity" for each substance must be reported. In addition, the Federal Water Pollution Control Act requires sewage treatment plants to report system bypasses, upsets, and discharges of pollutants in excess of permitted amounts. Spills that occur during the transport of a hazardous material are not covered under the same federal provisions discussed above, except for spills which are a violation of the Clean Water Act, such as barge leaks.

Reporting Transportation Spills

Reporting requirements for transportation spills vary depending on the mode of transportation, the material spilled, and other factors related to the incident's seriousness. Transportation-related spills other than oil spills into navigable waterways must be reported to the National Response Center only if an incident results in death or property damage in excess of $50,000. Pipeline spills, unless into waterways, must be reported to the Center only if they involve over 50 barrels (2,100 gallons) of hazardous liquids and $5,000 in property damage. Pipeline incidents in the state are also reportable to the Minnesota Office of Pipeline Safety, although nearly all hazardous liquid pipelines in the state are interstate lines over which the State office has no jurisdiction.

Reporting Spills Under SARA

The federal Superfund Amendments and Reauthorization Act (SARA) requires spill reports to be filed not only with the National Response Center, but also with state officials (the Department of Public Safety duty officers) and local emergency responders, such as the local sheriff or fire department. However, this law, referred to commonly as "Title III", does not apply to spills that result from transportation mishaps. For instance, train derailments and overturned trucks releasing hazardous chemicals which are otherwise covered under federal transportation and cleanup laws are not included under Title III reporting requirements. More importantly, the transport of hazardous materials is covered only peripherally by the community emergency planning requirements of Title III.

Notification of Other State and Local Agencies

The Department of Public Safety's Division of Emergency Management plans for and coordinates state agency responses to hazardous materials incidents, and is, through the duty officer system which it administers, notified of

Mississippi River spills when they occur. The current state hazardous material response plan directs the notification of various state agencies whose expertise may be needed during a spill incident. MPCA and Department of Public Safety phone lists are used to facilitate necessary and timely notification of state and local agencies.

Notification of Other States

A voluntary interstate notification mechanism was recently adopted by the five states bordering the upper Mississippi River: Minnesota, Wisconsin, Iowa, Illinois, and Missouri. Under the auspices of the Upper Mississippi River Basin Association, representatives of these states have developed a protocol for timely notification of other states in the region which may be affected by a spill originating in one of the member states. Consequently, while a spiller is required to notify various federal, state, and local authorities of a spill which enters the river, the MPCA is responsible for the notification of other states along the river.

Appendix II.

EXECUTIVE ORDER 90-2

Assigning Emergency Responsibilities to State Agencies

I, Rudy Perpich, governor of the state of Minnesota, by virtue of the authority vested in me by the Constitution and applicable statutes, do hereby issue this Executive Order:

Whereas, natural and man-made disasters in major proportions have and will occur in any part of the state; and

Whereas, hazardous materials incidents can occur in the state at any time; and

Whereas, state resources may be called upon in response to these incidents and disasters; and

Whereas, state agencies may be asked to direct these resources from state or regional Emergency Operating Centers (EOCs);

Now, therefore, I hereby order that:

1. Each department, independent division, bureau, board, commission, and independent institution of the state government, hereinafter referred to as the agencies, develop and make available to its employees emergency plans and procedures for:

a. protecting its personnel, equipment, supplies, and public records in a disaster;

b. carry on normal services in a disaster;

c. carry out emergency assignments made by this Executive Order.

2. The responsibility for emergency planning shall rest with the head of each agency. Agency heads shall designate competent agency personnel to:

a. develop emergency plans and procedures;

b. report and direct state resources from the state and/or regional Emergency Operating Centers in response to a disaster/emergency, including exercises;

c. staff Disaster Application Centers (DACs) when providing disaster relief following a presidential declaration of a major disaster, as requested by the Division of Emergency Management;

d. support emergency management activities coordinated by regional program coordinators for the Division of Emergency Management.

Agency personnel shall be available for planning, training, exercising, and participating in emergency operations. They shall be granted time off or compensation, if any, pursuant to the applicable collective bargaining unit agreement, commissioner's plan or managerial plan, for services performed outside of regular working hours.

3. The Division of Emergency Management shall have overall responsibility for coordinating the development and updating of the Minnesota Emergency Operations Plan, the Minnesota Emergency Response Plan for Nuclear Power Plants, and the Minnesota Emergency Response Plan for High-Level

Radioactive Waste Transportation Accidents/Incidents.

4. Each state agency is responsible for developing standard operating procedures and/or administrative plans to carry out its emergency responsibility assignments. Draft copies of plans and procedures shall be submitted to the Division of Emergency Management for review and coordination.

5. Each state agency that has a role in emergency management shall participate in the development of hazard mitigation strategies to reduce or eliminate the vulnerability of life and property to the effects of disasters.

6. Certain state agencies are hereby given the emergency management responsibilities specified in an appendix to this Executive Order.

Executive Order 88-22 is rescinded.

Pursuant to Minnesota Statutes 1988, Section 4.035, Subdivision 2, this Executive Order shall be effective fifteen (15) days after its publication in the State Register and filing with the Secretary of State, and shall remain in effect until it is rescinded by proper authority or expires in accordance with Minnesota Statues 1988, Section 4.035, Subdivision 3. In testimony whereof, I hereunto set my hand to this 31st day of May, 1990.

Rudy Perpich
Governor

EXCERPTS FROM EXECUTIVE ORDER 90-2

Assignments related to hazardous materials incident response

Section 205 — The Department of Agriculture shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management.

Specific duties shall include:

- providing the state lead response to pesticide/fertilizer incidents and supporting other state agencies;
- coordinating state contractor's actions at Superfund or ACRRA fund eligible sites involving pesticide/fertilizer incidents; and
- providing public information services, post incident enforcement, long-term site cleanup, laboratory services for agricultural chemical

related incidents, and evaluation of affected food and animal feed safety.

Section 302 — The Attorney General shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management.

Specific duties shall include:

- providing support on legal authorities during an incident, post incident enforcement, and training on crime identification, reporting, and preservation of evidence; and
- assisting on the preplanning and development issues, and in the recovery of state costs.

Section 1124 — The Bureau of Health Protection shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management.

Specific duties shall include:

- providing state liaison to potable water users potentially affected by an incident;
- providing drinking water sampling and analysis;
- providing evacuation and re-entry advice to state agencies;
- providing long-term health risk assessment; and
- analyzing environmental samples.

Section 1401 — The Department of Military Affairs shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management, which include: providing logistical support, evacuation and security assistance, and air support.

Section 1504 — The Department of Natural Resources shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management.

Specific duties shall include:

- providing wildlife and waterfowl rehabilitation;
- assisting in tracking plumes on waterways;
- providing chemical and pathological laboratory services;
- protecting critical habitat; and
- assisting other state and federal agencies in damage assessment.

Section 1605 — The Pollution Control Agency shall prepare procedures and support the response to hazardous materials incidents in the state as requested by the Division of Emergency Management.

Specific duties shall include:

- providing state agency lead response and support for most incidents;
- coordinating state contractor's actions at Superfund eligible sites;

- providing public information services for incidents in which the PCA was the lead agency;
- coordinating long-term site cleanup;
- assisting other state agencies in damage assessment;
- assisting lead state agency in tracking waterborne plume;
- acting as a liaison with affected waste water treatment facilities;
- providing laboratory support for airborne releases;
- assisting the Department of Health in assessing hazard and evacuation corridors; and
- providing debris assessment and hazardous debris disposal.

Section 1724 — The Division of Emergency Management shall maintain a 24-hour duty officer system for the purpose of ensuring the proper receipt and dissemination of disaster notifications to appropriate state and local government officials. This is to include, among others types of emergencies, reports of hazardous materials spills in compliance with SARA Title III, and notifications of pipeline emergency releases and reportable incidents in compliance with federal and state statutes and rules.

Section 1736 — The Division of Emergency Management shall have overall responsibility to coordinate a multi-state agency response to hazardous materials incidents in the state, including: notification of appropriate state agencies via the duty officer; providing pre-planning assistance; and, when appropriate, activating the emergency operation center and requesting federal assistance.

Section 1753 — The state Fire Marshal Division shall support the Division of Emergency Management's overall responsibility for the coordination of a multi-state agency response to a hazardous materials incident in the state, by providing lead response for explosive incidents and liaison with local fire investigators.

Section 1776 — The State Patrol Division shall support the Division of Emergency Management's overall responsibility for the coordination of a multi-state agency response to a hazardous materials incident in the state by providing traffic control, emergency communications, air support and post-incident enforcement.

Section 1780 — The Emergency Response Commission shall provide emergency response personnel with access to hazardous chemical storage information required to be provided to the Commissioner by facilities subject to regulation under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986.

Section 1790 — The Office of Pipeline Safety shall act as a liaison with pipeline companies, local units of government, federal pipeline authorities, and provide post incident enforcement and investigation.

Section 2001 — The Department of Transportation shall prepare procedures and response to hazardous materials incidents in the state as requested by the Division of Emergency Management. Specific duties shall include:

- providing information on possible evacuation routes;
- providing debris removal, transportation assistance, and special permits;
- providing roadway rehabilitation;
- providing liaison with rail industry;
- providing non-roadway transportation regulation and enforcement;
- providing air support;
- providing information management for hazardous shipments; and
- supplementing the State Patrol communication network.