Net Environmental Benefit (Ecological Risk) Assessment: Consensus Workshop

Environmental Tradeoffs Associated With Oil Spill Response Technologies

Upper Mississippi River, Pools 7 and 19

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A Report to USCG District 8 and US EPA Region 5

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Ecosystem Management & Associates, Inc.

Ecosystem Management & Associates, Inc.
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LIST OF ABBREVIATIONS, SYMBOLS, AND ACRONYMS

Term	Abbreviation, Symbol, or Acronym
Automated Data Inquiry for Oil Spills	ADIOS
Barrels	bbls
Compact Disc	CD
Ecological Risk Assessment	ERA
Ecosystem Management & Associates, Inc.	EM&A
Environmental Protection Agency	US EPA
Hours	hrs
In-Situ Burn	ISB
Knots	kts
Meters	m
National Oceanic and Atmospheric Administration	NOAA
Net Environmental Benefit Analysis	NEBA
Office of Research and Development	ORD
Office of Response and Restoration (NOAA)	OR&R
Oil Spill Response Organization	OSRO
On-Scene Coordinator	OSC
Parts per million	ppm
Regional Response Team	RRT
Scientific Support Coordinator	SSC
State On-Scene Coordinator	SOSC
United States Coast Guard	USCG
United States Coast Guard, Headquarters	USCG HQ
United States Coast Guard, Headquarters Office of Response	USCG HQ (G-MOR)
United States Fish and Wildlife Service	USFWS
Upper Mississippi River Basin Association	UMRBA

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Net Environmental Benefit (Ecological Risk) Assessment: Consensus Workshop

Environmental Tradeoffs Associated With Oil Spill Response Technologies

Upper Mississippi River, Pools 7 and 19

Executive Summary

In March and April 2004, the United States Coast Guard (USCG) District 8 and the US Environmental Protection Agency (US EPA) sponsored two workshops in separate locations along the upper Mississippi River to evaluate the relative risk to natural resources from various oil spill response options. The first, held in La Crosse, Wisconsin, examined a Canola oil spill from a railroad accident into Pool 7 of the Mississippi River. The second, held in Keokuk, Iowa, examined a pipeline rupture that released West Texas Intermediate crude oil into Pool 19. Both exercises were assumed to occur in the fall, and so the primary concern was for protection of migrating waterfowl. In both exercises, there were also concerns about effects on protected species of mussels. There were local differences in viable response strategies which appeared to be acceptable. For example, bird hazing using boats appeared both feasible and attractive in Pool 7, but was not considered practical in Pool 19. Conversely, there was interest in shoreline in-situ burning in Pool 19, but not in Pool 7 because of the population density in the areas where the oil would collect. In both areas the spill affected most of the pool within the first 24 hours, so many of the impacts were judged to be unavoidable. Shoreline cleaning and nearshore recovery of pooled oil was judged effective in both areas in preventing reoiling, but participants were concerned about additional damage to sensitive habitats in both workshops. In Pool 19, participants felt that an early deployment of deflection booming offered the best option to protect waterfowl. In both areas, the ecological damage to migrating populations of waterfowl could be serious if the response options were not rapidly applied and effective, since very large populations of birds, in some cases the majority of the continental population, use the pools during migration.

1.0 Objectives of the Upper Mississippi River Workshops

1.1 Background and Process

This report documents the results from two workshops, held in early 2004, designed to examine environmental issues associated with accidental releases of a vegetable oil and a refined oil into the upper Mississippi (two different locations). These workshops were sponsored, in part, by the Office of Response, Headquarters, U.S. Coast Guard (USCG HQ (G-MOR)), which has a five-year initiative to support training based on the use of a comparative risk methodology to evaluate oil spill response options. The USCG's involvement in this process began in 1998, in cooperation with several state agencies and industry. Prior to the current (2004) initiative, five other workshops have been completed under the sponsorship of G-MOR, as well as a manual on the process (*Developing Consensus Ecological Risk Assessments: Environmental Protection in Oil Spill Response Planning. A Guidebook*). The Guidebook is available from G-MOR or it can be downloaded from the contractor's web site at www.ecosystem-management.net. Citations for all of these documents are provided in Section 5.

The Guidebook and previous reports prepared for USCG HQ (G-MOR) refer to the process as a "consensus ecological risk assessment (ERA)." This report, however, refers to the process as a consensus "Net Environmental Benefit Analysis (NEBA)." In the context of these workshops there is essentially no difference in the two terms; both refer to a process of identifying and comparing environmental costs and benefits of alternative response options in oil spill response planning. When the original comparative process was developed, the term "Ecological Risk Assessment" was used to emphasize the fact that social and economic factors were not included, as is usually the case with "Net Environmental Benefits" analyses of oil spills. In this case, however, many of the workshop participants were used to using the term "ERA" to refer to a site-specific evaluation which includes (to varying degrees) field data collection and relatively more sophisticated mathematical modeling of contaminant fate and effects than is done in this approach. Therefore, at the request of one of the sponsors (EPA Region 5) the NEBA terminology is used in this report.

The process outlined in the Guidebook is designed to help planners compare ecological consequences of selected response options. The process was originally intended to support oil spill training and planning in nearshore or estuarine situations, where there are often significant controversies over alternative response options. In the freshwater situation, controversies over response options are less important than disagreements over protection and shoreline cleanup strategies, and these two workshops were intended to help extend the process into new environments, with different problems and concerns.

Regardless of location and scenario, the process is a knowledge-based conflict resolution process, in which participants work together to interpret the available information on the fate and effect of oil under various response options. The primary objectives are to achieve a consensus on the risks and benefits of response alternatives, to the extent that the participants can agree, and to identify critical issues for future discussion when they don't.

The process focuses on ecological "trade offs" or cross-resource comparisons. Through a structured analytical approach participants find "common ground" for evaluating impacts and develop a defensible logic to support their conclusions. The process is loosely based (and consistent with) the U.S. Environmental Protection Agency's ERA guidelines (US EPA, 1998), but emphasizes development of group consensus among stakeholders using currently available information, rather than additional data collection or field studies. The process uses a standard series of analytical tools specifically developed for use in a group environment. While the process is designed as a planning and educational tool, not as a real-time response tool, the knowledge gained by participants in the consensus-building process facilitates real-time decision-making.

The two workshops discussed in this report represent only the second time that this process has been used in freshwater systems. The first, conducted for Isle Royale National Park (Lake Superior), in January 2004, examined the grounding of a bulk cargo vessel near Isle Royale. The results of that workshop (Rayburn, 2004) indicated that the process could be adapted to address training scenarios in the Great Lakes. As follow-on, EPA Region 5 approached the USCG about using the process to address scenarios in the Mississippi River, where a different set of conditions would be present. The USCG agreed, and the result was the two workshops discussed in this report.

Normally, the training involves two 2 or 3-day workshops with a break of several weeks in between them to allow the participants to collect additional information and review their initial results before finalizing their conclusions. While this approach allows for the maximum consensus, it is very time consuming and does not always meet the needs of the local sponsors. As a result, a variety of schedules has been followed, including completing the entire process in one workshop, usually three days long. In this case, the sponsors felt it was more important to receive input from two separate stakeholder groups in order to demonstrate the consistency of the results, than to use a second meeting to refine the results. Therefore, two independent workshops 2.5 days long were held to analyze separate scenarios in two locations.

1.2 Sponsors and Meeting Objectives

These two workshops were sponsored by USCG District 8 (New Orleans), US EPA Region 5 (Chicago), the National Oceanic and Atmospheric Administration (NOAA), Office of Response and Restoration (OR&R) and the Upper Mississippi River Basin Association (UMRBA), all of whom provided staff support, participated in planning the meetings, and in some cases provided subject matter presentations during the workshops. Financial support for meeting facilitation and report preparation was provided by USCG HQ (G-MOR).

The overall purpose of the workshops was to provide oil spill response training and to evaluate the ecological impacts of spills of either vegetable oil or refined oil into the upper Mississippi River, and to determine if there is consensus on:

- Differences in habitat sensitivity to spilled oil, and
- Preferred clean-up or recovery options.

In addition, the sponsors wished to evaluate the process to determine if the NEBA approach was appropriate for use in flowing freshwater systems, especially large, controlled systems such as the Mississippi River. As part of that evaluation, it was hoped that specific suggestions for the modification of the process (as developed by the USCG for coastal situations) might enhance its value as an element in a standardized freshwater response planning process (see "Conceptual Model for Advanced Environmental Preparedness" by Ann Whelan, US EPA Region 5 on the workshop CD).

1.3 Participants

A total of 31 individuals attended all or part of the first workshop addressing a spill in Pool 7 (Lake Onalaska), held in La Crosse, Wisconsin. A total of 20 individuals attended all or part of the second workshop addressing a spill in Pool 19, held in Keokuk, Iowa. The names, affiliations and contact information for the attendees are provided in Appendix A.

1.4 Organization of the Report and the Associated Compact Disc

This report is one of a series of files on a Compact Disc (CD) prepared as a project deliverable product. The report summarizes the results of each of the workshops, and presents the conclusions of the participants. It is formatted to be printed as an independent, double-sided report. In addition, the CD contains copies of presentations made at the workshops by the sponsors or by subject matter experts that were not included in participant's notebooks, as well as copies of documents provided as reference material by the sponsors. These files are cited at appropriate locations in the text of the report, and their presence on the CD is indicated.

The report is divided into two sections, one for each of the two workshops. Each workshop section contains an overview, a summary of the scenario, a summary of the analytical information used, and the results specific to that meeting. Finally, a series of summary conclusions related to the sponsor's initial objectives for the two workshops are provided.

2.0 Results of the Pool 7 (Lake Onalaska) Workshop

2.1 Basic Analytical Information

2.1.1 Overview

This training exercise consisted of one accelerated, two-and-a-half day workshop held 24 to 26 March 2004. The sponsors recognized that this would limit their ability to resolve some issues during the workshop, since there would be no interim period for additional data collection. Prior to the meeting, in order to conserve meeting time, the Assessment Planning team had agreed on the spill scenario, a preliminary list of the response options for consideration, a draft table of the resources at risk, and a draft of the risk ranking matrix. Additionally NOAA HazMat (Seattle) prepared trajectory and weathering forecasts based on the spill scenario.

After opening remarks, the meeting facilitator (Dr. Don Aurand) disseminated notebooks containing a copy of the NEBA/ERA training presentation and a set of fact sheets about response options and oil impacts (all this material is included on the workshop CD). Dr. Aurand then gave an overview of the NEBA/ERA process, followed by a discussion of the habitats of concern, analytical process, and the risk ranking matrix. When this was completed, NOAA staff (Dr. Alan Mearns and Amy Merten) reviewed the scenario and basic fate and effects information developed for Canola oil if no response was initiated (the natural recovery baseline, see Pool 7 Scenario on the workshop CD). This was supplemented by a presentation by Dr. Al Venosa of the US EPA Office of Research and Development (ORD) on the fate and effect of vegetable oils in the environment (see Fate and Effect of Vegetable Oil on the workshop CD). After these discussions were completed, participants were divided into three focus groups in order to begin the analysis. The preferred number of groups is three because it allows for additional points of view to be developed, and aids later in the process in consensus development. Participants concluded day one by completing, and then discussing, the natural recovery portion of the risk matrix, in order to ensure that they understood the process. The three groups compared the results of their evaluation and discussed the differences in scoring (and resolved them to the extent possible in the available time). The risk scores associated with this option formed the basis for evaluating other response options in Pool 7.

On day 2, participants reviewed traditional mechanical recovery (see Section 2.1.5). Most of day two was spent completing the risk ranking matrix for this option. At the end of the day, an overview on the use of in-situ burning (ISB) in terrestrial and wetland situations was presented by Mr. David Fritz of BP plc. (see In-Situ Burning on the workshop CD). Finally, Ms. Ann Whelan of US EPA Region 5 provided an overview of how EPA hoped to integrate the results of the workshop into regional emergency response planning efforts (see Conceptual Model for Environmental Preparedness on the workshop CD).

On day three, the participants compared the results of the risk scoring for traditional mechanical recovery to those for natural recovery, and then spent the rest of the morning evaluating workshop results, developing a list of lessons learned, and allowing agency representatives to comment on the process. Participants felt that there was little benefit to completing the risk matrix for ISB. This was based on the consensus that it represented a viable removal tool, when properly used, but was unlikely to be different from traditional mechanical recovery in terms of its benefits and would be difficult to implement in this area because of the population density.

2.1.2 Exercise Scenario

The participants were presented with a spill scenario designed to focus on the environmental decisions that need to be made when a spill (in this case a vegetable oil) threatened the main body of Lake Onalaska and French Island. The scenario began with a train derailing while it was crossing the railroad bridge over the Black River northwest of Brice Prairie, Wisconsin. The accident occurred at 0700 local time on 14 October (October was selected in order to evaluate possible consequences on migrating water fowl) and resulted in the rupture of three tank cars carrying Canola oil and the loss of their entire contents (99,000 gallons or 2,357 barrels (bbls)). Winds for the first two days were from the N/NW at 7 to 10 knots (kts), then shifting to the N at 10 kts. The weather was mostly cloudy, but no precipitation. Daytime air temperature was in the lower 60s (°F), while nighttime temperatures were in the upper 40s.

2.1.3 Geographic Area of Concern

The geographic area of concern for the workshop was Pool 7 (emphasizing the area downstream of mile 709, especially Lake Onalaska). Lake Onalaska is approximately 12 miles long and is located just north of La Crosse, Wisconsin (see Pool 7 Maps and Indices on the workshop CD). These maps, which include information on resources and habitat areas, were extracted from the Inland Sensitivity Atlas Mississippi River, Pools 3-9 (US EPA, 2001a) and were made available to all participants for delineation of resources.

Lake Onalaska is part of the Upper Mississippi River National Wildlife & Fish Refuge, which extends 261 miles southward from Wabasha, Minnesota to just above Rock Island, Illinois. The entire refuge contains about 200,000 acres of wooded islands, forest, prairie, marsh and open water (US Fish and Wildlife Service (1998).

Resources were defined during the workshop as "Lake Onalaska," "Refuge," or "Continental" resources, depending on the population or habitat area that was considered by the participants to be the appropriate scale for the analysis. This information is useful in interpreting differences in risk rankings.

2.1.4 Resources of Concern

Prior to the workshop, members of the Steering Committee prepared a draft listing of the resources and habitats of concern in the Lake Onalaska area, based on the results of the Isle Royale National Park NEBA (US EPA, 2004). This list was reviewed by local resource managers prior to and on the first day of the workshop, and they provided suggestions as to habitat designations and example organisms. This list was then discussed by all of the workshop participants on the morning of the first day of the workshop. There was considerable discussion about the actual boundaries of and terms used to identify the various habitats; for example, wetlands are essentially part of the "backwater" habitat, and blend gradually into upland areas which are only intermittently flooded. The draft table referred to these areas as "floodway," which consisted of the broad, gently sloping area on either side of the river which could be inundated, depending on circumstances. The participants felt this included too broad an area (since it is based on elevations such as the 10, 20 or 100-year flood), and so changed the category to "riparian," to generally indicate normal inundation. Participants were not entirely satisfied with that either, and ultimately agreed to have two categories, "terrestrial" and "water's edge." The delineation was based on the normal pool elevation at mean flow. Table 2.1 is the final resources at risk listing used by the participants.

2.1.5 Conceptual Model

All of these workshops use a matrix which relates resources at risk to response options. These elements are connected by pathways, which provide a mechanism for a resource to be affected by either oil alone or oil in combination with a response option. This very basic conceptual model guides the analysis. During discussions about the analytical process, the participants agreed that this approach was adequate for their purposes, especially given the limited time available. They were presented the list of seven hazards developed initially in the San Francisco Bay workshop (Pond et al., 2000), and used in all subsequent workshops. It was agreed that these would be considered for each of the proposed response option/resource combinations during the analysis. The seven hazards are air pollution, aqueous exposure, physical trauma, oiling/smothering, thermal, waste and indirect. They agreed that the response options to be considered in the matrix would be natural recovery (no response), traditional mechanical recovery techniques, and if time was available, ISB.

2.1.6 Description of Response Options Considered

Natural recovery is when no attempt is made to remove any stranded oil in order to minimize impact to the environment or because there is no proven effective method for cleanup. Natural recovery can be used on all habitat types. Typically it is used in:

- Remote or inaccessible habitats;
- When natural removal rates are very fast;
- When the degree of oiling is light; or
- When cleanup actions will do more harm than natural removal.

This method may be inappropriate for areas where high numbers of mobile animals (birds, terrestrial mammals) or endangered species use the area. The environmental and toxicological effects from natural recovery are those of the particular spilled oil.

Traditional mechanical recovery methods include a wide range of technologies. Prior to attempting to evaluate the consequences associated with this approach, the participants spent some time identifying and discussing what was to be included in this option. They did not attempt to assign specific efficiencies to any of these options, but recognized that none were likely to be fully effective and were highly influenced by the local conditions and the level of effort expended. The response options identified were:

Table 2.1 Resources at Risk Table Used for the Pool 7, Upper Mississippi River NEBA/ERA

Broad Habitat	Component	Resource Category	Example Species
Terrestrial		Mammals	mice, mink, raccoon
		Birds	bald eagles, hawks, grackles, song birds
		Reptiles/Amphibians	garter snake, eastern racer, salamanders, tree frogs
		Macroinvertebrates	spiders, butterflies, sow bugs, centipedes, beetles
		Microinvertebrates	nematodes, soil protozoa
		Plants	river birch, willow, bur oak, silver maple
Water's Edge	Sand and Gravel	Mammals	mice, mink, raccoon
		Birds	yellow legs, gulls
		Reptiles/Amphibians	blandings turtle, painted turtle, water snake, leopard frog, softshell turtle
		Macroinvertebrates	leeches, crayfish, spiders, snails, planaria, nematodes, sow bugs, mussels
		Microinvertebrates	waterbears
		Plants	willow, cottonwood
	Mud	Mammals	muskrat, beaver, mink
		Birds	yellow legs, herons, killdeer
		Reptiles/Amphibians	water snakes, snapping turtle, wood turtle, frogs
		Macroinvertebrates	worms, crayfish
		Microinvertebrates	nematodes
		Plants	cattail, bur reed, canary grass, algae
	Cobble/Riprap	Mammals	mink, raccoon
		Birds	grackles, gulls
		Reptiles/Amphibians	water snakes, turtles
		Macroinvertebrates	snails, sow bugs
		Microinvertebrates	waterbears
		Plants	willow, cottonwood
Wetlands		Mammals	muskrat, beaver, mink, otter
		Birds	Mallards, lesser scaup, canvasback, tundra swan, great blue heron, bitterns
		Fish	carp, dog fish, northern pike
		Reptiles/Amphibians	snapping turtle, frogs, water snake
		Macroinvertebrates	may flies, midges, dragonfly, snail
		Microinvertebrates	zooplankton
		Plants	cattail, pickerel weed, lotus, wild rice, arrowhead, button bush

Table 2.1 Resources at Risk Table Used for the Pool 7, Upper Mississippi River Net Environmental Benefit Analysis (*concluded*)

Broad Habitat	Component	Resource Group	Example Species
Surface Waters	High Flow (>1kt)	Mammals	otter
		Birds	bulls, terns, osprey, eagle
		Fish	catfish, walleye, sturgeon, crappie, bass, paddlefish
		Reptiles/Amphibians	softshell turtle, map turtles, mud puppy
		Macroinvertebrates	mussels
		Microinvertebrates	
		Plants	wild celery, sago, pond weeds, bur reed
		Water Quality	
		Water Supply	
	Low Flow (<1kt)	Mammals	otter, beaver, mink, muskrat
		Birds	gulls, terns, canvasback, Canada geese, swans, coots
		Fish	Centrarcids, catfish, carp, buffalo, shiners/minnows, spotted sucker
		Reptiles/Amphibians	turtles, frogs, water snakes
		Macroinvertebrates	fingernail clams, mussels
		Microinvertebrates	
		Plants	wild celery, coontail, milfoil, lotus
		Water Quality	
		Water Supply	
	Backwaters	Mammals	mink, muskrat, beaver, otter
		Birds	heron, egrets, red-wing blackbird, coots, rails, ducks
		Fish	sunfish, minnows, largemouth bass, northern pike
		Reptiles/Amphibians	turtles, frogs, water snakes, toads, spotted salamander
		Macroinvertebrates	crayfish, mayflies
		Microinvertebrates	
		Plants	elodea, duckweed, arrowhead, willow, wild rice, button bush
		Water Quality	
		Water Supply	

- Use of oil spill boom – approximately 3,000 feet is available locally. Boom could be used to deflect floating oil from sensitive areas, or to help contain it at a location along the shoreline for collection.
- Use of sorbent materials – to remove oil from the surface, either of the water or of the soil; they are not very effective for Canola oil.
- Use of low pressure flushing.
- Shoreline collection – this can involve mechanical equipment or hand tools to collect and remove the oil. For oil still floating on the water near the shore, vacuum trucks or small skimmers may be used.
- Use of vegetation cutting and removal.

The use of shoreline cleaners was briefly discussed, and might have some utility for dams and artificial surfaces, but was considered to be of limited value. The risks and benefits of these technologies for various habitats were discussed in the fact sheets provided to the participants in their meeting notebooks.

The participants indicated that response equipment would begin to arrive on site within six hours of notification. In this scenario, the oil travels down the Black River and reaches the lake within six hours, which is the first area where boom could be deployed. After entering the lake, the oil moves through the lake to collect at the lock dam at the southern end between 24 and 36 hours post-spill. It might be possible to use boom to deflect floating oil away from areas where there are a lot of birds, but on-water recovery was not considered feasible due to currents, obstructions in the water, and limitations in equipment availability (see Pool 7 Response Considerations on the workshop CD). It might be possible to haze birds to keep them out of the area until the oil moves past (at least during the first 12 hours during daylight). It was assumed that any shoreline recovery would be done by trained individuals under proper supervision. Any bulk collection using vacuum trucks or skimmers (as opposed to removal from contaminated shoreline) will occur at the southern end of the lake. Because Canola oil is relatively clear, it will be difficult to locate and remove.

2.2 Modeling Results

The NOAA HazMat Modeling Team (Seattle, WA) produced trajectory maps using NOAA's General NOAA Oil Modeling Environment (GNOME). Input conditions were those defined in the scenario (described in Section 2.1.2). Products included maps showing the location of the oil slick on the water at approximately 6, 12 and 24 hours and maps showing the degree of shoreline oiling. Oil fate and transformation (evaporation, dispersion, water content) was forecast using the NOAA HazMat fate model, ADIOS®2.0.4b1. Very little data other than evaporation is available relative to the fate and transport of Canola oil and so this was the only variable that could be estimated using ADIOS. These models are available at the NOAA HazMat website, http://response.restoration.noaa.gov. Canola oil is relatively insoluble in water and does not tend to evaporate rapidly. The NOAA estimate was that at 24 hours after the spill 20% of the original volume would have evaporated and one percent would have dispersed, leaving 79% of the original volume in the environment. Based on discussion after the modeling presentation, it was concluded that the evaporation estimate was probably high, and that most of the product would probably still remain.

Figures 2.1 through 2.4 show the progress of the oil slick over time, while Figure 2.5 summarizes the pattern of oil accumulation along the shoreline. The slick enters the northern end of Lake Onalaska within six hours, and by 12 hours is approaching the southern end. By 24 hours the slick is starting to concentrate along the southern shore and the dams and locks, and by 36 hours has collected in a compact mass at these locations. Shoreline contamination is heaviest near the northern entrance to the lake, along a small portion of the northern shore, and on the southern shore between the control structures. In these areas relatively heavy coatings of oil form a "bathtub" ring and coat areas of vegetation. Until removed, these areas, and the accumulated oil on the water at the southern end, will "bleed" sheens of clear oil.

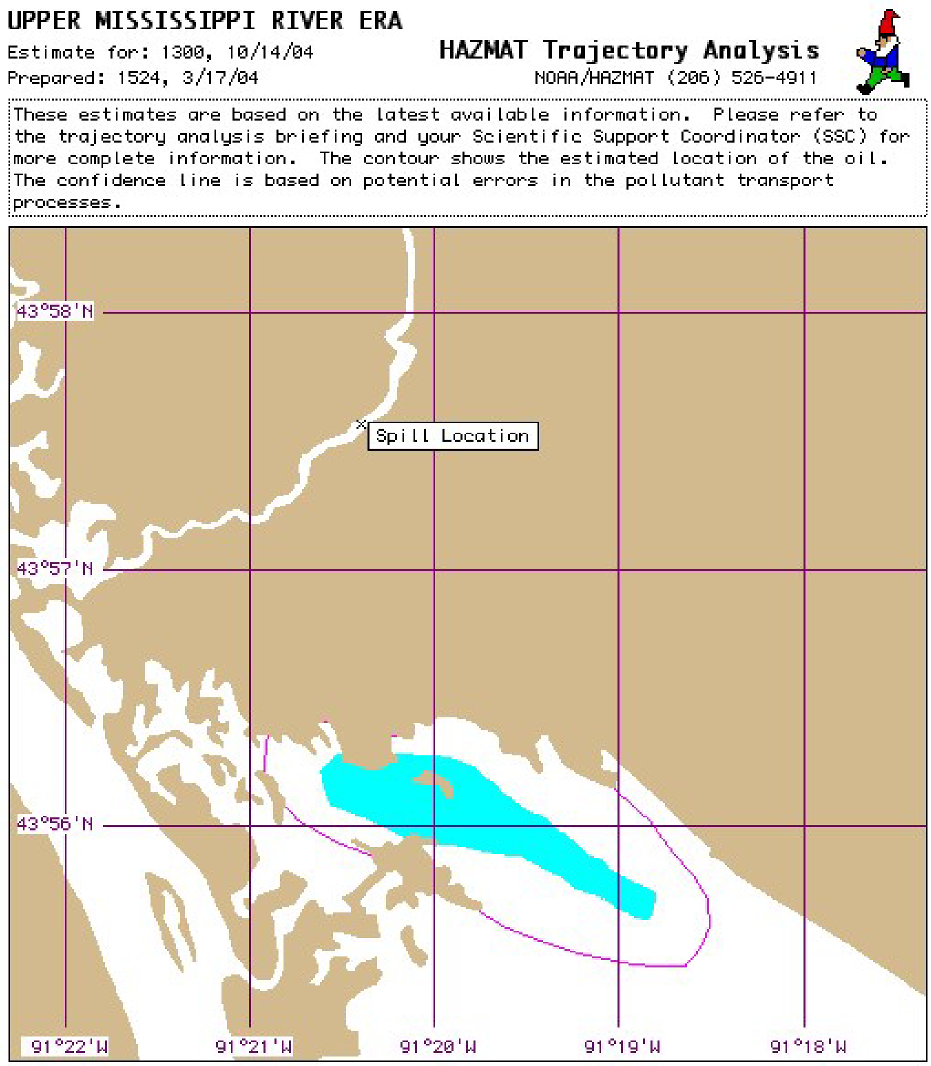


Figure 2.1 *Results from the NOAA modeling for the Pool 7 scenario showing the approximate extent of the surface slick six hours after release*

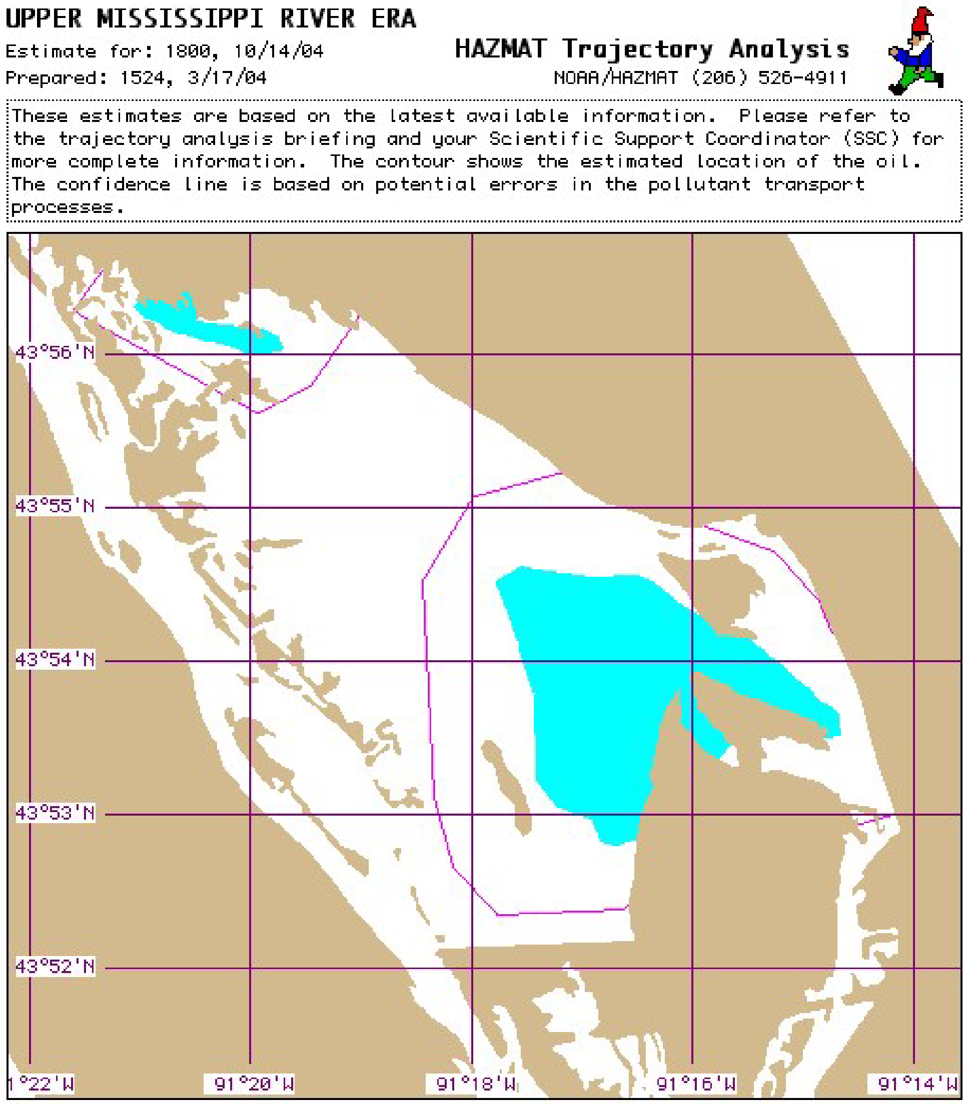


Figure 2.2 *Results from the NOAA modeling for the Pool 7 scenario showing the approximate extent of the surface slick 12 hours after release*

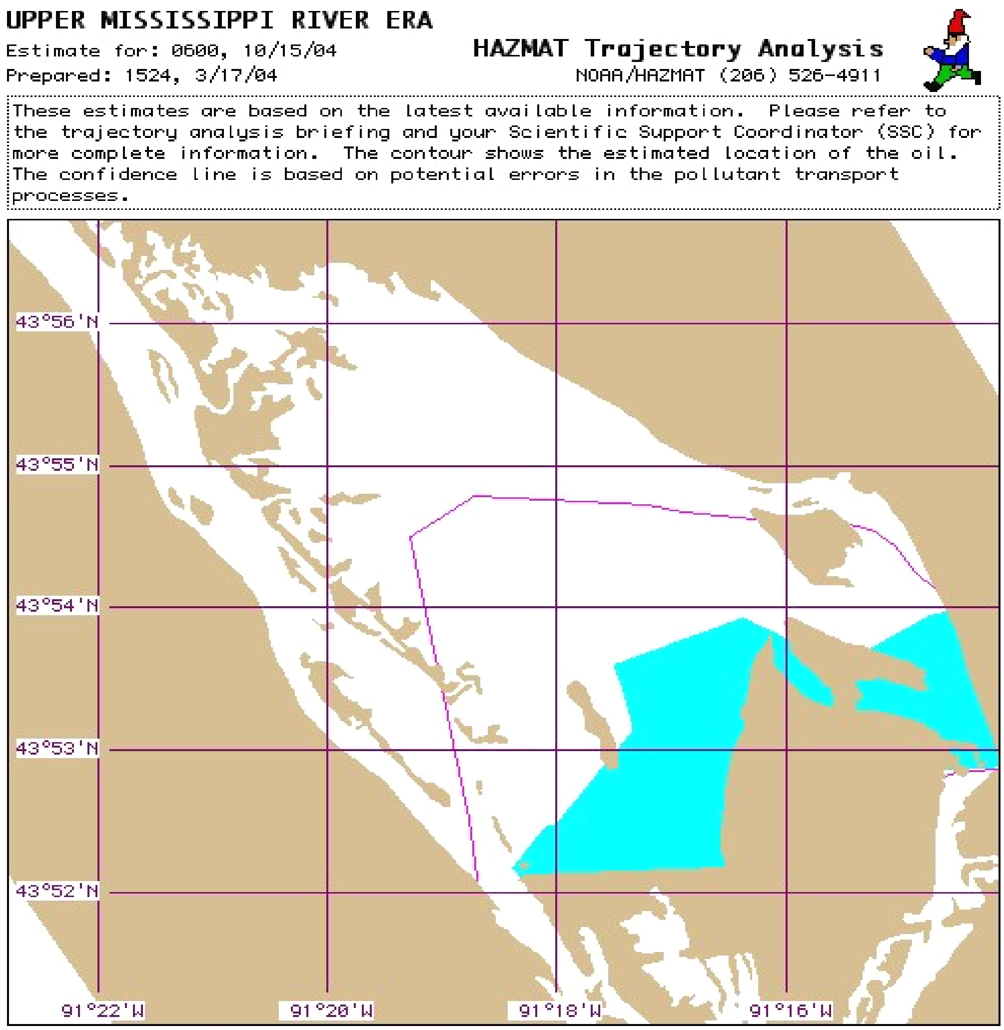


Figure 2.3 *Results from the NOAA modeling for the Pool 7 scenario showing the approximate extent of the surface slick 24 hours after release*

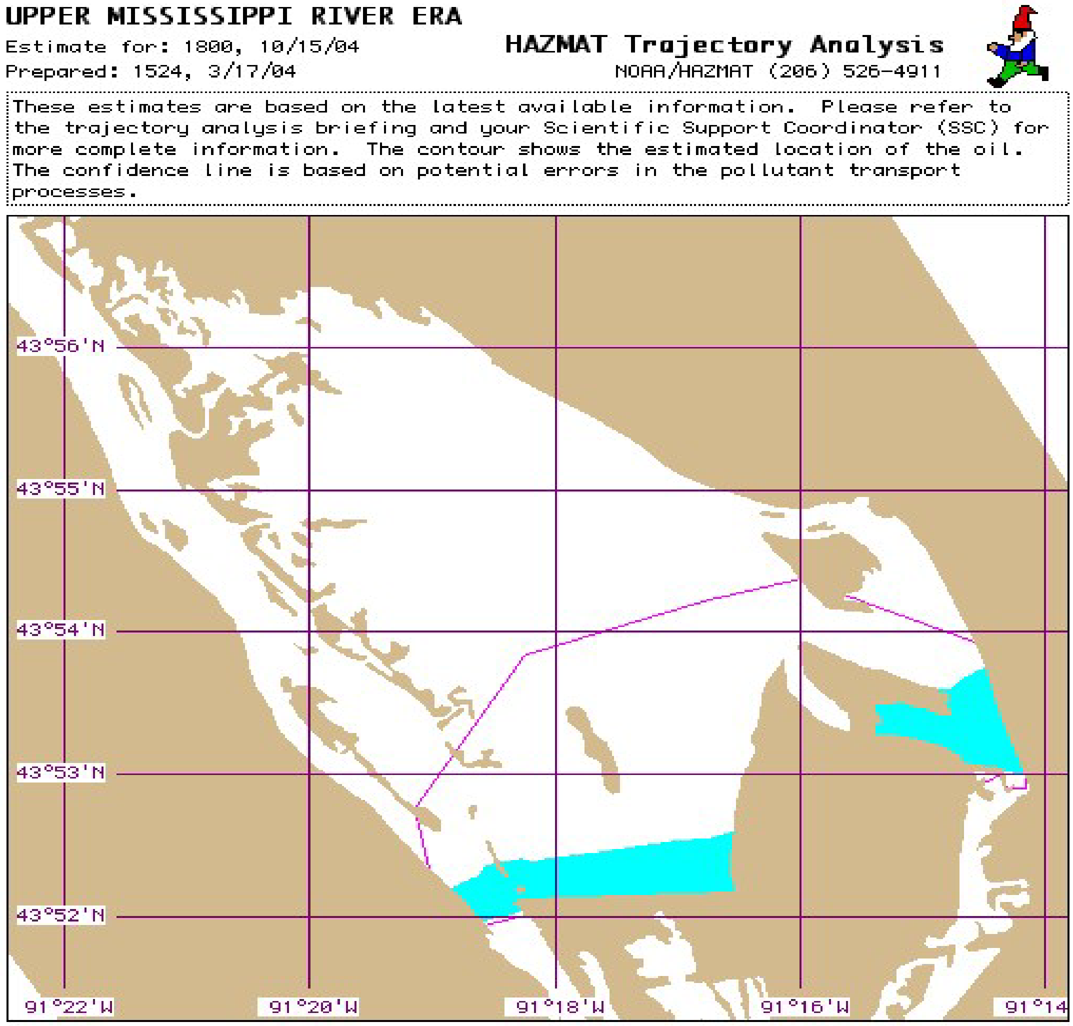


Figure 2.4 *Results from the NOAA modeling for the Pool 7 scenario showing the approximate extent of the surface slick 36 hours after release*

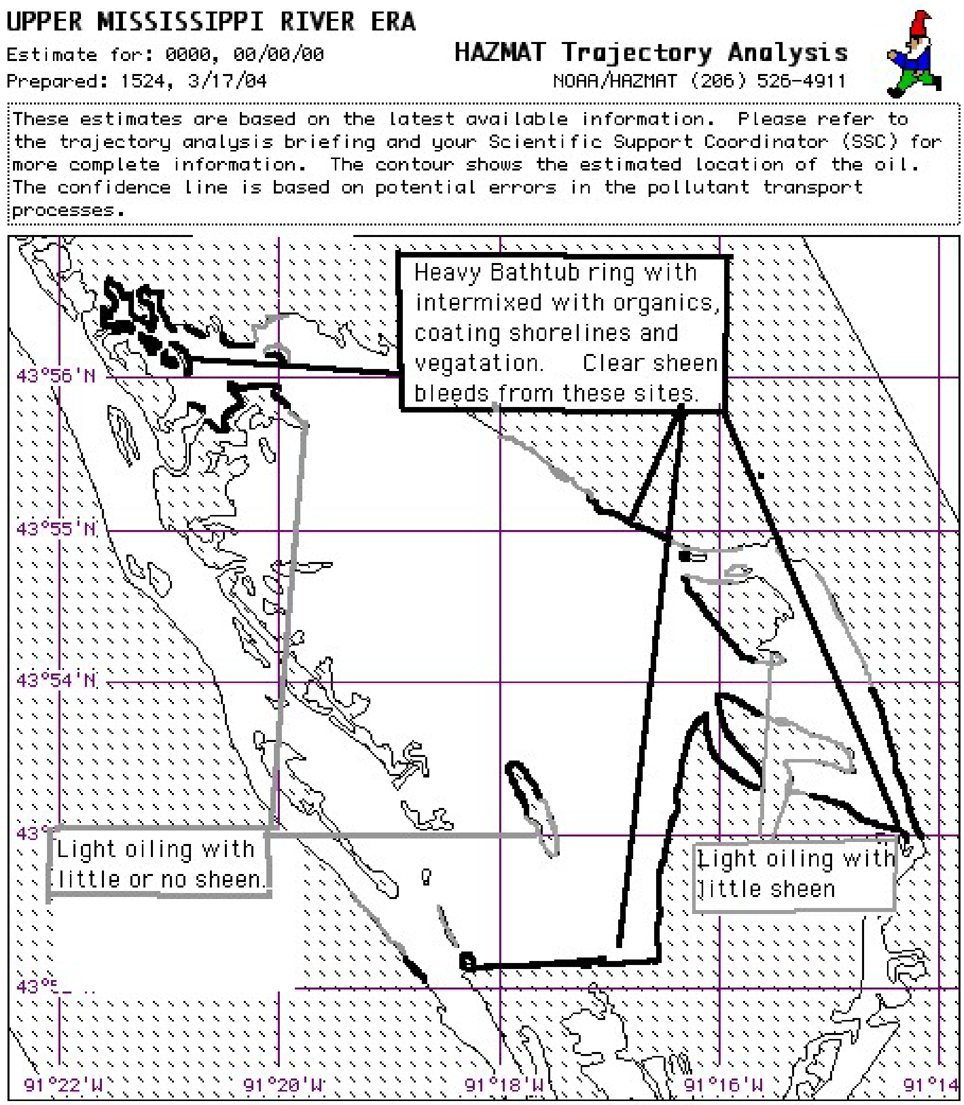


Figure 2.5 *Results from the NOAA modeling for the Pool 7 scenario showing the approximate extent and degree of shoreline oiling*

2.3 Results of the Pool 7 Risk Analysis Process

After discussion of various matrices used in previous workshops, the focus groups for the Pool 7 workshop used the risk matrix presented in Figure 2.6. Each focus group was tasked with reviewing the scenario, the modeling results, information on exposure and sensitivity to vegetable oil, and basic life history and distribution information in order to develop a group estimate of the percent of each resource affected and the recovery time. In the initial evaluation, the groups used alphanumeric codes to rate the level of concern. At the end of the workshop, color coding was used to develop summary levels of concern.

		RECOVERY			
		> 7 years (SLOW) (1)	3 to 7 years (2)	More than 1 year to 3 years (3)	1 year or less (RAPID) (4)
% of RESOURCE AFFECTED	> 50% (LARGE) (A)	1A	2A	3A	4A
	20 to 50% (B)	1B	2B	3B	4B
	5 to 20% ©	1C	2C	3C	4C
	0 to 5% (SMALL) (D)	1D	2D	3D	4D

Legend: Red cells represent a "high" level of concern, yellow cells represent a "moderate" level of concern, and green cells represent a "limited" level of concern.

Figure 2.6 *Definition of levels of concern for the Pool 7 NEBA/ERA*

Using the ranking matrix requires that the participants develop estimates of the proportion of the resource affected, and how long it will take the resource to recover. A key factor in determining whether or not a resource is affected is to apply thresholds at which impacts, either acute or chronic, would be expected to occur for the various resource groups under consideration. This is perhaps the most difficult part of the consensus process, and has been discussed in detail at all of the workshops. In this case, as in other workshops, very conservative assumptions were presented by the facilitator and accepted by the participants. For shoreline resources and habitats, damage was assumed if oil contacted the habitat.

Impacts to birds, mammals and turtles on the water surface were assumed if there was a high probability of any contact with the surface oil slick. The nature of these impacts was developed during the focus group discussions. The only thresholds which can be generally quantified are those related to aquatic toxicity. The Guidebook for the ERA process presents a series of concentration thresholds of concern, but they were developed in early workshops for petroleum products, and are not relevant for a vegetable oil spill. For the purposes of this evaluation, it was assumed that since Canola oil would not readily dissolve or disperse into the water column aquatic toxicity was a minor concern relative to the effects of physical coating.

It is important to keep in mind that the participants used the information available to them to develop levels of concern about the risk, and the risk scores do not represent a prediction of actual impacts. Instead they represent a consensus on the part of the participants that such consequences were likely to occur under the scenario under consideration.

The detailed results from the three focus groups for natural recovery are shown in Figure 2.7. The participants in this workshop decided to add an additional summary category to the risk table. This category takes the scores for the component habitats (for example, sand and gravel, mud, and cobble/riprap) and combines them into one overall score for the broad habitat type (for example, waters edge). This has not been done in previous workshops, but the participants here felt it was important to get an overall perception of the broad habitat risk, as well as the risk to component areas. Results for the various habitats are relatively consistent, with the exception of the perceived risks to wetlands and a fairly broad range of risk scores for all of the surface water component habitats. None of the groups felt that there was a significant risk of oil transport into terrestrial habitats. Scores for water's edge habitats were relatively low, and the greatest difference (mud habitat) occurred because of a difference of opinion over how much of the habitat would be affected. All of the groups felt recovery of the water's edge habitats would occur within 1 to 3 years if left untreated. The differences in the expected risk to wetlands were due primarily to the perceived risk to turtles, and to a lesser degree to birds. The groups had very different views as to whether or not over wintering turtles would be exposed, or affected by, the Canola oil. The high ranking by Group 3 was based on the assumption that they could be smothered as a result of the oil coating the sediment and the resulting oxygen demand. All of the groups believed low flow surface waters were at moderate or high risk, based on the high level of birds using the area in the fall. One group also felt that mollusks in this area might be at risk if the oil were to sink. For high flow areas, two groups rated the risk as low, while one group rated the risk as high, based on potential exposure of fish and mollusks to dissolved or sedimented oil. In follow-up discussions this risk appeared to the participants not to be particularly significant, but the groups were not asked to rescore the risk due to limited time. The remaining surface water area, backwaters, were perceived to be at low or moderate risk, primarily due to the potential impacts to mammals, turtles, fish, mollusks or plants, depending on the group. There was considerable confusion over the potential routes of exposure which were realistic, and what the impacts of such exposure might be when you are dealing with a vegetable oil. Overall, however, the participants felt concerns for open water areas were intermediate to high and were primarily due to the risk to migrating birds, without necessarily agreeing on where that risk was likely to be the most important.

The risk results for traditional mechanical recovery are shown in Figure 2.8. All of the groups felt that the traditional response option discussed would mitigate, but not eliminate, the impacts seen for natural recovery in surface water habitats. The mechanism for this improvement was primarily bird hazing and protective booming to prevent oil from moving into prime bird habitat areas. The participants felt that hazing could keep birds away from the oil as it moved through the lake, and then prevent birds from entering areas where it had collected. The participants were less sanguine about the potential to mitigate impacts in wetlands, and there was some concern that the bird hazing could force birds into these areas and increase exposure. While removal of oil from these areas was viewed as important, it was also recognized that much of the damage would have already occurred, and that there was a risk of further damage to the habitat if responders were not careful.

Habitat	Terrestrial						Water's Edge																		Wetlands						
Component							Sand and Gravel						Mud						Cobble/Riprap												
Resource	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)
Group 1	R	R	L	L	L	L	R	R	L	L	L	L	R	R	L	L	L	L	R	R	L	L	L	L	R	C	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	3D	3D	2C	4D	4D	4D	3D	3C	2C	1D	4D	3C	3D	3D	2D	4D	4D	4D	3B	3B	2C	3C	4D	4D	3C
	4D						3D						3C						4D						3B						
	4D						3C																		3B						
Group 2	L	L	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	L	L	L	L	L	L	C	L	L	L	L	L
	4D	4D	4D	NA	NA	4D	4D	3C	4D	1D	4A	4D	4D	3C	4D	2D	4A	4D	4D	4D	4D	4D	4D	4D	3B	3D	4D	4C	4D	4D	4D
	4D						3D						3D						4D						3D						
	4D						3D																		3D						
Group 3	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	3C	3C	3D	4D	4D	4D	3B	3D	3D	4C	4D	4D	3D	3D	3D	4D	4D	4D	3B	3C	1B	4C	4C	4D	4D
	4D						3C						3B						3D						1B						
	4D						3B																		1B						

Habitats	Surface Waters																										
Subhabitats	High Flow Areas (>1 Kt)									Low Flow Areas (<1 Kt)									Backwaters								
Resource	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water
Group 1	R	C	L	L	L	L	L			C	R	L	L	L	L	L			C	R	L	L	L	L	L		
	3C	4D	2D	4D	4D	4D	4D	4D	4D	1B	4D	3D	3B	4D	4D	3B	4B	4D	3D	2D	2C	2D	4D	4D	2B	4D	4D
	4D									1B									3C								
	1B																										
Group 2	L	L	L	L	L	L	L	L		L	L	L	L	L	L	L	L		L	L	L	L	L	L	L	L	
	4D	4D	4D	4D	4D	4D	4D	4D	NA	2C	4D	4D	4D	2D	4D	4D	4D	NA	3D	3B	4D	4D	3D	4D	4D	3D	NA
	4D									2C									3D								
	2C (bird driven)																										
Group 3	L	R	L	L	L	L	L	R	L	C	L	L	L	L	L	L	R	L	R	L	L	L	L	L	L	R	L
	4C	4C	4D	1B	1A	4D	4D	4D	NA	2B	3D	2D	3D	1A	4B	4D	4B	NA	4D	4D	3C	3B	3B	4D	4D	4D	NA
	1A									2B									3B								
	2B																										

Habitat Scaling: L=Local (Pool 7), R=Regional (Upper Mississippi River National Wildlife & Fish Refuge), C=Continental

Figure 2.7 *Detailed Pool 7 focus group risk analysis results for natural recovery*

Habitats	Terrestrial						Water's Edge																		Wetlands						
Component							Sand and Gravel						Mud						Cobble/Riprap												
Resource	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)
Group 1	R	R	L	L	L	L	R	R	L	L	L	L	R	R	L	L	L	L	R	R	L	L	L	L	R	C	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	3D	3D	2C	4D	4D	3C	3D	3C	2C	1D	4D	3C	3D	3D	2D	4D	4D	4D	3B	2B	2C	3C	4D	4D	3C
	4D						3D						3C						4D						2B						
	4D						3C																		2B						
Group 2	L	L	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	L	L	L	L	L	L	C	L	L	L	L	L
	4D	4D	4D	NA	NA	4D	4D	3D	4D	1D	4C	4D	4D	3D	4D	2D	4C	4D	4D	4D	4D	4D	4D	4D	3B	3D	4D	4C	4D	4D	4D
	4D						3D						3D						4D						3D						
	4D						3D																		3D						
Group 3	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	3D	4D	3D	4D	4D	4D	3C	4D	3D	4D	4D	4D	3D	4D	3D	4D	4D	4D	3B	3C	1B	4C	4C	4D	3D
	4D						3D						3C						4D						1B						
	4D						3C																		1B						

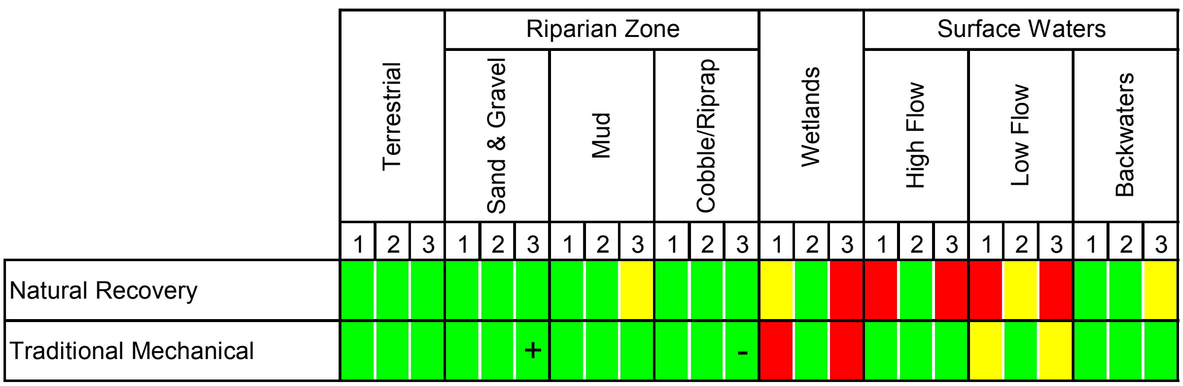
Habitats	Surface Waters																										
Subhabitats	High Flow Areas (>1 Kt)									Low Flow Areas (<1 Kt)									Backwaters								
Resource	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water
Group 1	R	C	L	L	L	L	L			C	R	L	L	L	L	L			C	R	L	L	L	L	L		
	3C	4D	2D	4D	4D	4D	4D	4D	4D	2C	4D	3D	4C	4D	4D	3B	4B	4D	3D	2D	2C	2D	4D	4D	2B	4D	4D
	4D									2C									3C								
	2C																										
Group 2	L	L	L	L	L	L	L	L		L	L	L	L	L	L	L	L		L	L	L	L	L	L	L	L	
	4D	4D	4D	4D	4D	4D	4D	4D	NA	3D	4D	4D	4C	2C	4D	4D	4D	NA	3D	3B	4D	4D	3D	4D	4D	3D	NA
	4D									3C									3D								
	3D																										
Group 3	L	R	L	L	L	L	L	R	L	C	L	L	L	L	L	L	R	L	R	L	L	L	L	L	L	R	L
	4D	4D	4D	4D	4D	4D	4D	4D	4D	4D	3D	2D	3D	1B	4B	4D	4D	NA	4D	4D	4D	4D	4D	4D	4D	4D	4D
	4D									2C									4D								
	2C																										

Habitat Scaling: L=Local (Pool 7), R=Regional (Upper Mississippi River National Wildlife & Fish Refuge), C=Continental

Figure 2.8 *Detailed Pool 7 focus group risk analysis results for traditional mechanical recovery*

2.4 Pool 7 Summary Risk Analysis Results and Lessons Learned

Figure 2.9 presents the summary results for this workshop. Traditional mechanical response was analyzed along with natural recovery. In summary, participants felt that the critical issue in this scenario was the risk to continental populations of migrating waterfowl, which would occur in the spring and fall only. There was considerable discussion about the potential risk to the benthic environment, but if the oil does not sink and is relatively insoluble, the participants agreed this risk is low. However, concern was expressed for turtles and mussels, most of which are protected, in very shallow water near shore or in areas infrequently inundated which might be contaminated, depending on conditions at the time of the spill. It was not clear how much risk these groups were exposed to, and it would be useful to define this better. In general, the participants felt that the risk to terrestrial and riparian zone resources was generally low, and that response should focus on preventing exposure of birds on the water surface, and on shoreline recovery, which would prevent continued exposure and release of oil from the shoreline. The risks to wetlands were less tractable, and could even increase with traditional response techniques.



Legend: Red cells represent a "high" level of concern, yellow cells represent a "moderate" level of concern, and green cells represent a "limited" level of concern. There are three group scores per sub-habitat type (columns). A + indicates reduced concern (i.e. "better") within the broad risk category, while a – indicates an increased concern (i.e. "worse") within the category.

Figure 2.9 *Final relative risk matrix for the Pool 7NEBA/ERA*

There does not appear to be any viable way to respond to this type of incident prior to the oil reaching the lake, and so response planning needs to focus on preventing injury in the lake as much as possible. The best way to accomplish this appears to be hazing of birds as the oil moves through the lake, followed by rapid collection of floating oil and careful cleaning of the shoreline. Given the heavy recreational and sport use of the area, balancing access and protection will be an issue in an actual event. Activities in wetland areas need to be done carefully, and response managers will need to make sure hazing on the lake does not drive birds into these areas. The issue of water level management in the lake as a way to minimize wetland contact was discussed but rejected because the lake is so large changes could not be made quickly enough to be effective.

At the conclusion of the workshop, the participants developed the following list of consensus comments for consideration in future oil spill response planning efforts for the area:

- For this scenario, in the early response, oil diversion was more effective than oil containment, because of:
  - equipment availability
  - river currents
  - access/containment
  - threatened resources.
- This may often be true along the river because of the reasons cited above.
- It is desirable for local, state and agencies to develop natural resource "priority issues" that are pool-specific, and to confirm that the issues are consistent with the available response plan.
- Chemical and physical interaction of the material with the environment will determine exposure and therefore drive the resource management decisions; this needs to be considered when developing resource priority issues.
- There is no substitute for direct, incident-specific communication between the resource agencies, response agencies and the Incident Commander to:
  - ensure appropriate response
  - prevent further damage during the response.
- Dikes will potentially act as natural collection points, and this was important in this scenario.
- It is desirable to prevent oil from passing over the spillways.
- Sponsors should examine ways to encourage participation by other individuals/groups (e.g., fire department personnel, oil spill response organizations, etc.).
- Request representation from the federal Refuge Program at UMR Hazardous Spills Coordination Group meetings.
- Aerial spotters and air boats would be a valuable tool for UMR spill response.

3.0 Results of the Pool 19 Workshop

3.1 Basic Analytical Information

3.1.1 Overview

This training exercise consisted on one accelerated, two and a half day workshop held 27 to 29 April 2004 (approximately one month after the workshop for Pool 7). The meeting opened with introductions and an overview presentation on the local response planning process by Ann Whelan (US EPA Region 5). This was followed by the standard presentation on the process and the background fact sheets provided to the participants (both provided on the CD). When the process briefing was completed, a series of presentations were made by various individuals on the topics listed below:

- Oil Characteristics – Dr. Brian Wrenn, Washington University (presentation on the workshop CD);
- Fate and Effects of West Texas Intermediate Crude Oil – Richard Wingrove (NOAA) (presentation on the workshop CD);
- Resource Overview of the Area – Ginger Molitor, US FWS (no written presentation);
- Use of Inland Sensitivity Atlas maps – Ann Whelan, US EPA (see Pool 19 Maps and Indices on the workshop CD);
- the Upper Mississippi River Hazardous Spill Response Plan and Resource Manual – Ann Whelan, US EPA; and
- Environmental Effects of Oil in Freshwater Habitats – Don Aurand, EM&A (presentation on the workshop CD).

As was done for the Pool 7 workshop, the sponsors prepared the spill scenario, the list of response options, the resources at risk table, and the risk ranking matrix in advance, in order to preserve as much time at the workshop as possible. In this case, however, the resources at risk matrix and the risk ranking matrix, which were the same as the ones developed for the Pool 7, needed to be used as presented, in order to ensure the comparability of results between the two workshops. This requirement was accepted by the participants. Day one ended with the two focus groups convening to develop the risk scores for Natural Recovery

On day 2, participants began work on evaluation of traditional mechanical recovery (see Section 3.1.5), beginning with an overview presentation on mechanical recovery techniques by Richard Wingrove, the NOAA SSC (see Pool 19 Response Considerations on the workshop CD). When this was completed, the groups moved on to consideration of ISB (see Section 3.1.5), which began with an overview prepared by Mr. David Fritz of BP plc and presented by Ann Whelan of US EPA Region 5 (see In-Situ Burning on the workshop CD).

The morning of day 3 was spent on a review of the risk analysis results, and the development of lessons learned and recommendations.

3.1.2 Exercise Scenario

The participants were presented with a spill scenario designed to focus on the environmental decisions that need to be made when a spill threatened the middle and lower portions of Pool 19. The spill was assumed to occur on the morning of 14 October 2004 (in order to involve migrating waterfowl), when a release of West Texas Intermediate crude oil occurred from a submerged pipeline crossing the Mississippi River near Fort Madison, IA (40º 37’N, 91º 20’W). Based on the capacity of the pipeline between shutoff valves, the spill volume was estimated as 80,000 gallons (1904 barrels). The release was not instantaneous, and oil continued to flow from the break for approximately 12 hours (0700 until 1900). The weather was clear to partly cloudy, with no rain predicted for 36 hours. Winds were from the N to NW at 5 to 10 knots, and were expected to continue from that direction but increase to 10 to 15 knots on the second day. Temperatures were in the range of the mid-40s (nighttime) to low 60s (daytime) (ºF).

3.1.3 Geographic Area of Concern

The geographic area of concern for the workshop was Pool 19, especially the lower and middle portions. Pool 19 is approximately 46 miles long and stretches from just south of Oquawka, Illinois to Keokuk, Iowa (see Pool 19 Maps and Indices on the workshop CD). These maps, which include information on resources and habitat areas, were extracted from the Inland Sensitivity Atlas: Mississippi River, Pools 16-26 (US EPA, 2001b) and were made available to all participants for delineation of resources.

Resources were defined during the workshop as “Local (Pool 19),” “Regional (the area of Pools 16 to 26, which is equivalent to “Refuge” in the Pool 7 workshop),” or “Continental” resources, depending on the population or habitat area that was considered by the participants to be the appropriate scale for the analysis. This information is useful in interpreting differences in risk rankings.

3.1.4 Resources of Concern

The resources of concern for the Pool 19 workshop were the same as those used for the Pool 7 workshop (see Table 2.1 in Section 2.1.4).

3.1.5 Conceptual Model

The conceptual model used for the Pool 19 work shop was the same as that used for the Pool 7 workshop (see Section 2.1.5).

3.1.6 Descriptions of Response Options Considered

The participants considered three response scenarios, natural recovery (see Section 2.1.6 for a description), traditional mechanical recovery, and on-shore ISB. The participants felt that traditional recovery techniques would focus on:

- Use of containment boom – approximately 10,000 feet would be available within 6 hours of the release. Concentrate on early deployment as far up the pool as possible. This should be feasible, since few areas have flows in excess of 1 kt.
- Low pressure flushing – beginning on the second day;
- Manual shoreline recovery using shovels and rakes (little opportunity for heavy equipment);
- Vegetation cutting and removal; and
- Use of vacuum trucks and skimmers at natural collection points.

In this scenario, there are 30 hours before the oil slick reaches the lock and dam, and equipment will become available after six hours. As a result, there is an opportunity to focus on deflection and protective booming as an initial strategy. Participants discussed the use of barges for deflection or protective booming and decided it might be feasible, but is unproven. Aerial spotters are available to assist in collection and booming. Participants estimated that between 8,000 and 20,000 gallons of product might be expected to be contained and collected. After discussion, it was concluded that bird hazing using boats was not feasible. It was assumed that contractors would be properly trained.

ISB was discussed and it was decided that it was feasible for wetlands and in some restricted shoreline areas north of Nauvoo. It is not feasible to burn on the open water. Human health issues have to be addressed prior to burning, and landowner permission is required (Union Electric is a major landowner in southern Pool 19). Additional observations were:

- An expedited burn permit process exists for Iowa and Illinois.
- Regions 5 and 7 do not require Regional Response Team (RRT) concurrence.
- Region 7 federal and state OSCs have flexibility with respect to population proximity.
- Regions 5 and 7, SOSC, and local government make the determination.
- Local fire and health officials must be consulted.
- Fire boom is not required, containment boom could be sacrificed.

Finally, the importance of public relations to a successful burn (because of the smoke plume) was noted.

3.2 Modeling Results

The NOAA HazMat Modeling Group (Seattle, WA) used the basic information in the scenario to develop an estimate of the trajectory for the crude oil slick using GNOME, based on the scenario parameters (Section 3.1.2). Basic weathering information was calculated using ADIOS®2.0.4b1, based on the properties of West Texas Intermediate crude oil. The general properties of West Texas Intermediate crude oil were presented in the NOAA overview on fate and effects (see West Texas Intermediate Crude Oil Fate and Effects presentation on the CD). The NOAA estimate was that, at 12 hours after the spill, 35% of the original volume would have evaporated and 19% would have dispersed, leaving 46% of the original volume on the water surface or shoreline (see Table 3.1). Mousse would begin to form as soon as more than 7% of the oil had evaporated, which would occur in the first few hours, with a water content of 50%. This means that the volume of the remaining oil on the surface or shoreline would approximately double. Dispersion occurs mainly in the early stages of the spill, and there is the potential for toxic components to affect shallow water resources for perhaps the first 12 hours. As can be seen in Table 3.1, there is little change in the amount evaporated or dispersed beyond 30 hours.

Table 3.1 Estimated Oil Budget (by Percent) for the Pool 19 Oil Spill Scenario

Hours into Spill	Released Gallons	Percent of Volume Released		
		Evaporated	Dispersed	Water or Shoreline
1	6.667	27	3	70
6	40,000	33	14	53
12	80,000	35	19	46
30	80,000	38	27	35
70	80,000	40	28	32
120	80,000	40	30	30

Figures 3.1 through 3.5 show the progress of the oil slick over time, while Figure 3.6 summarizes the pattern of oil accumulation along the shoreline. The slick remains to the western side of the pool as it moves downstream, until it reaches the vicinity of Nauvoo, at which point it occupies most of the water surface. The slick requires approximately 30 hours to reach Lock and Dam 19, and is elongated by the continuing release over a 12-hour period. Shoreline contamination is heaviest near the northern end of the pool, on the western shore, and is medium to light south of Nauvoo (note that the scale for degree of oiling in Figure 6 changes over time in each frame). In areas with relatively heavy coatings of oil there is a "bathtub" ring of varying thickness on shoreline surfaces and vegetation. Until removed, these areas, and the accumulated oil on the water at the southern end, will "bleed" sheens of oil.

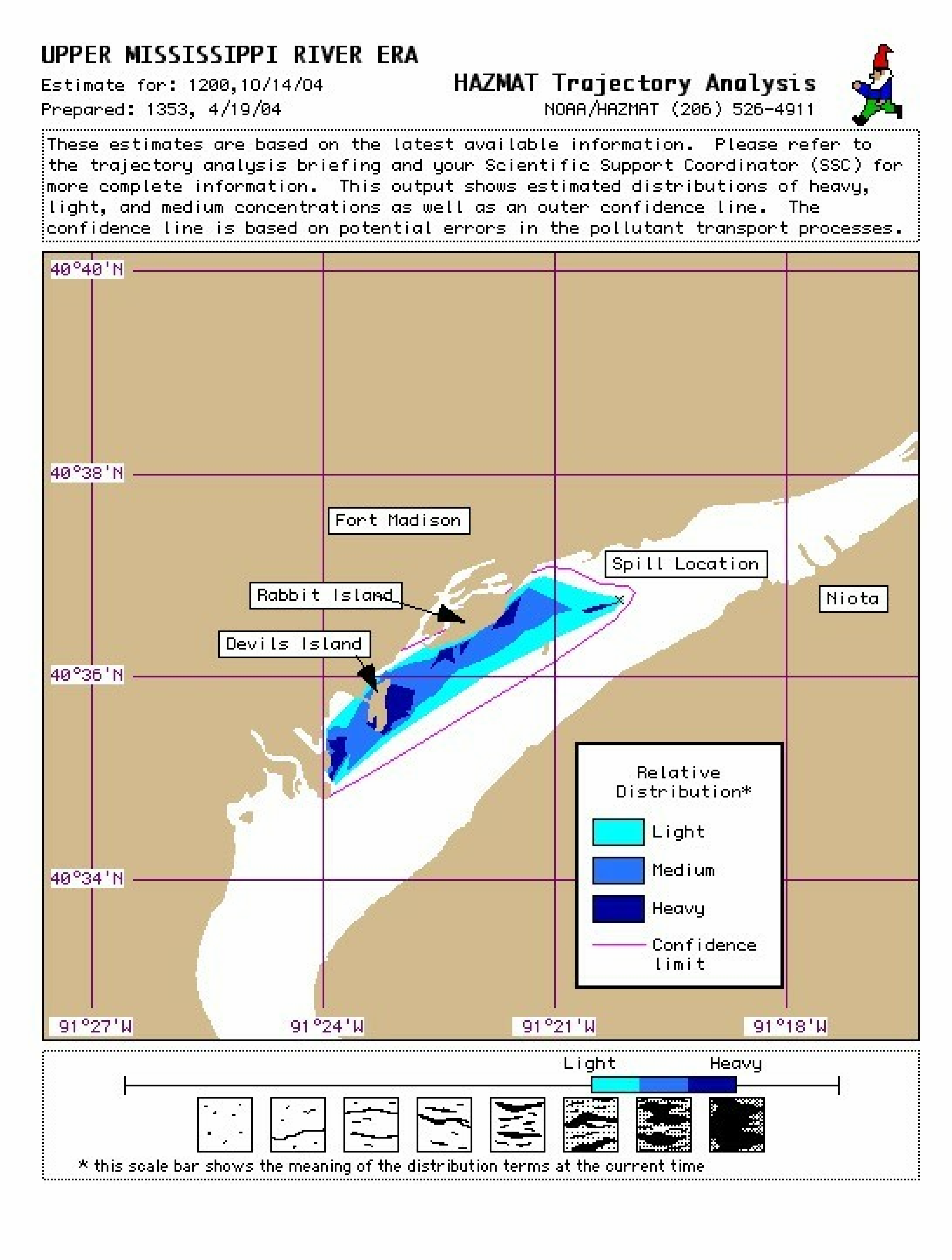


Figure 3.1 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of the surface slick five hours after release*

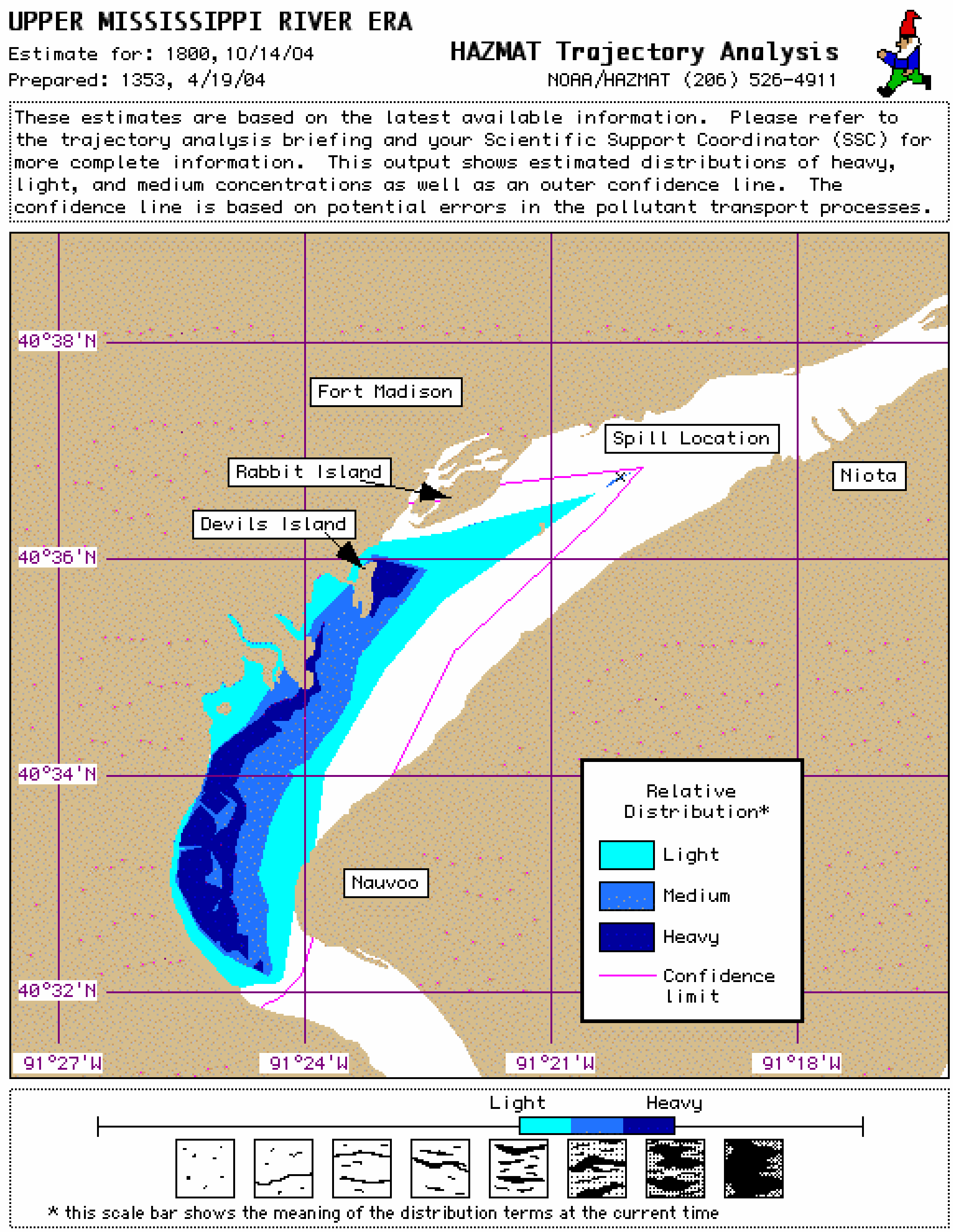


Figure 3.2 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of the surface slick 11 hours after release*

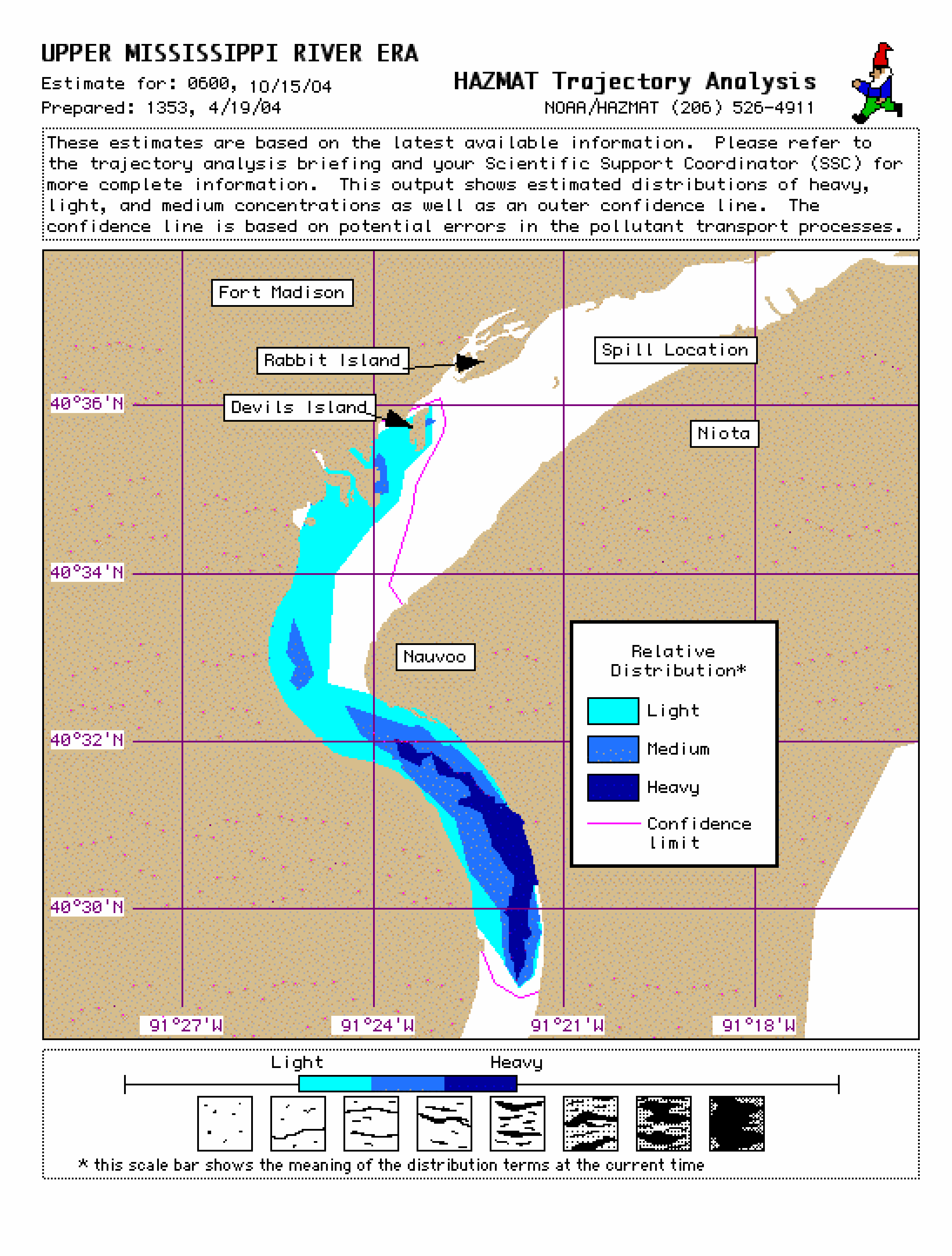


Figure 3.3 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of the surface slick 23 hours after release*

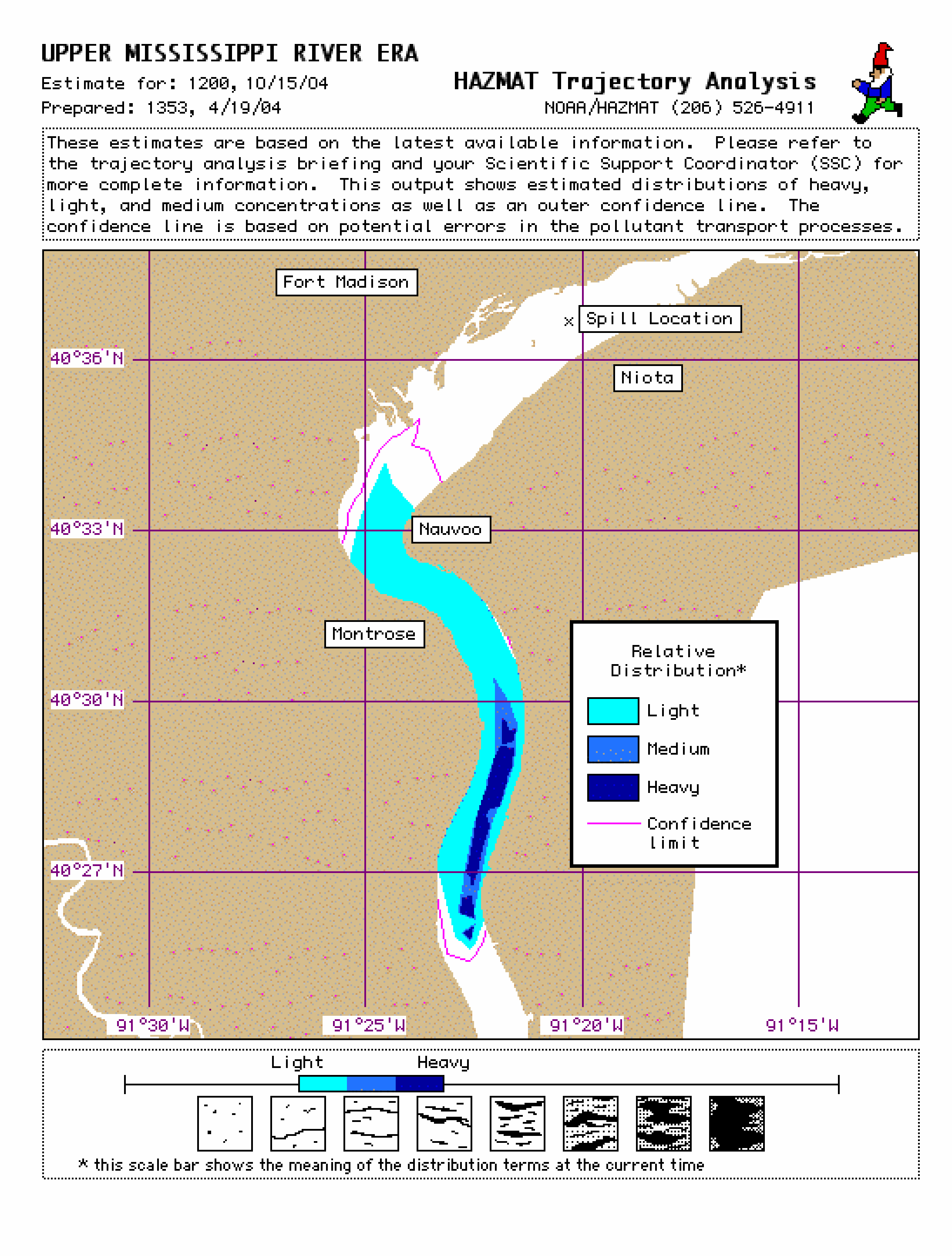


Figure 3.4 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of the surface slick 29 hours after release*

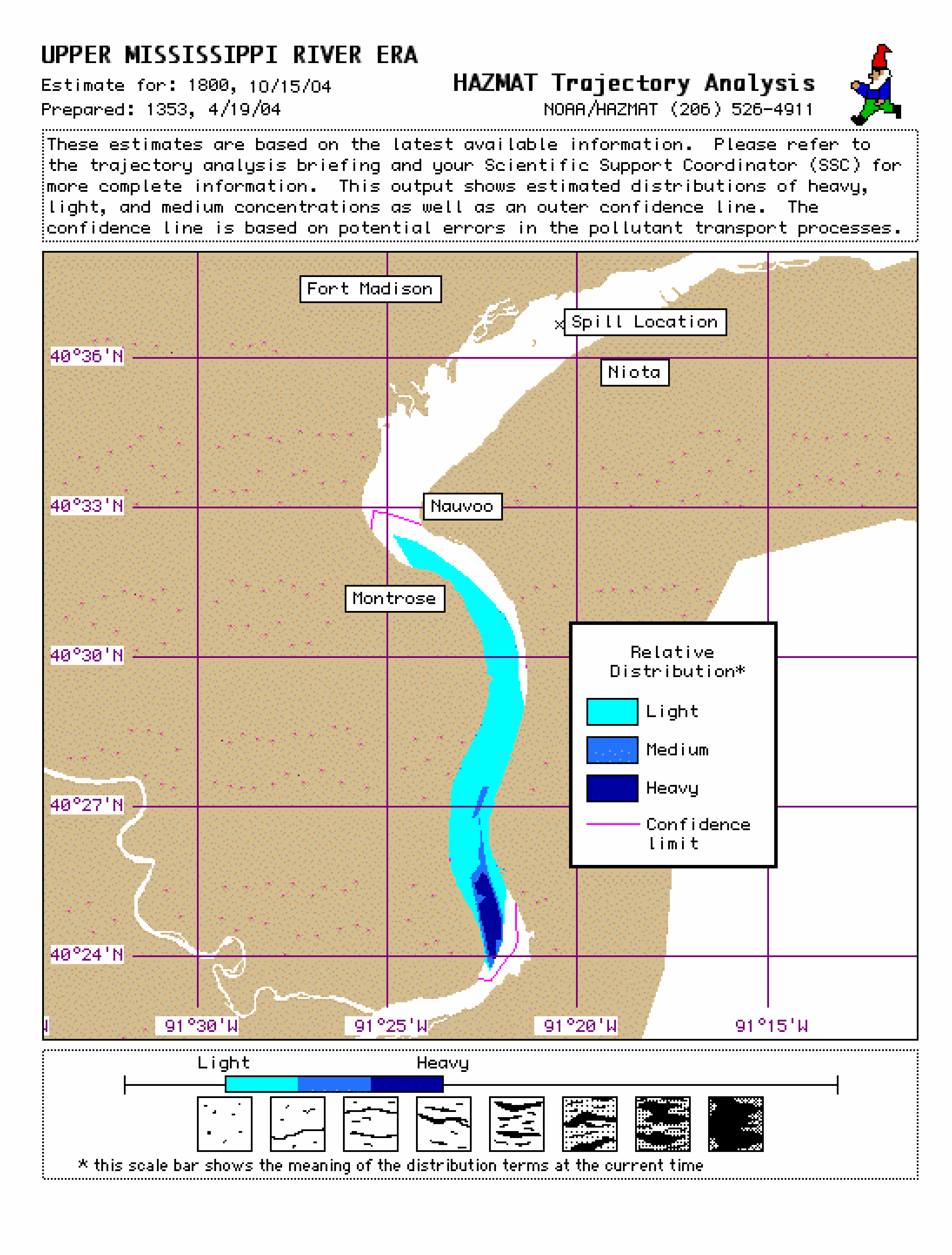


Figure 3.5 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of the surface slick 35 hours after release*

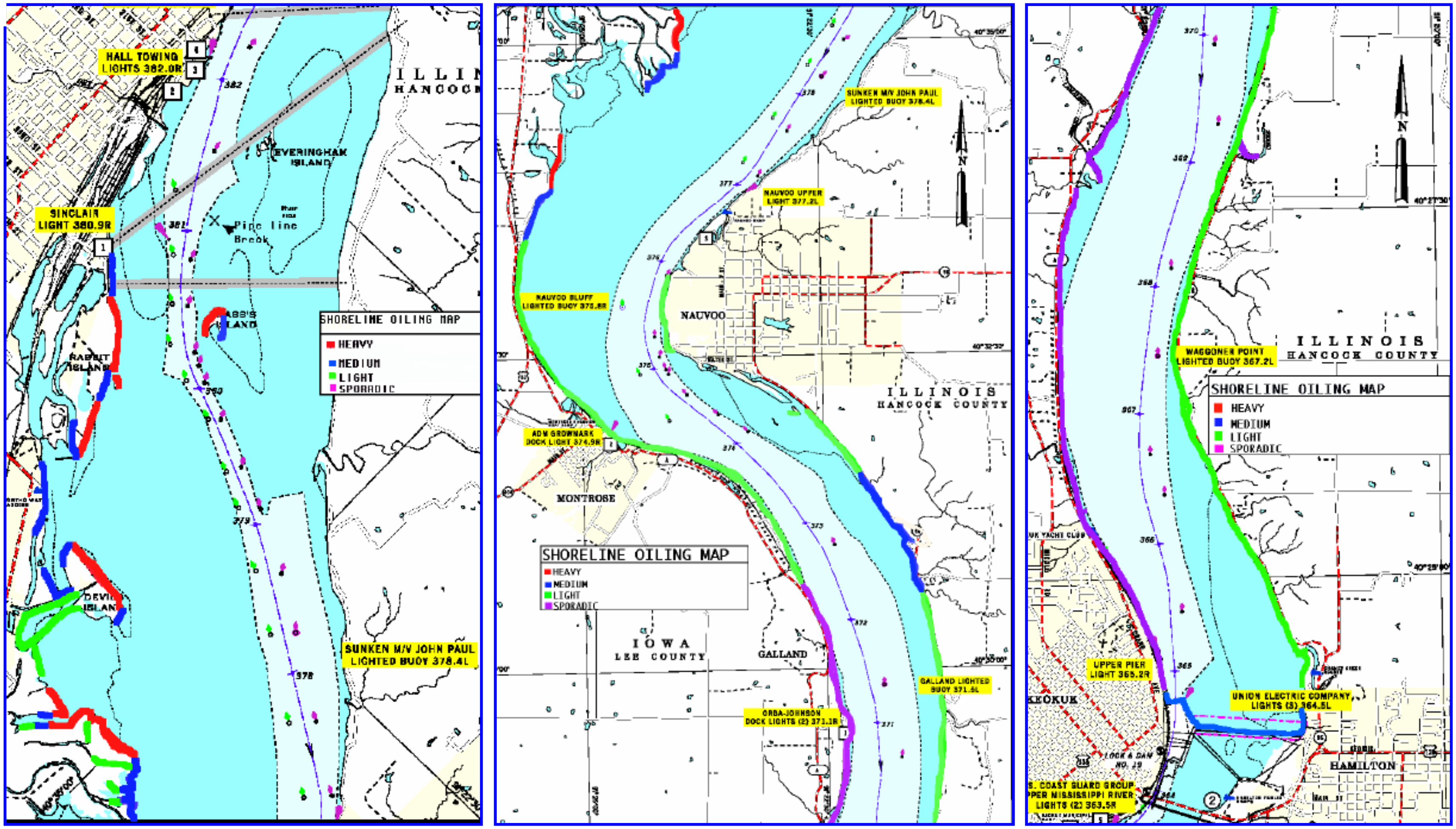


Figure 3.6 *Results from the NOAA modeling for the Pool 19 scenario showing the approximate extent of shoreline oiling. Maps read from left to right (upstream to downstream)*

3.3 Results of the Risk Analysis Process

After discussion of the reasons for using the same risk ranking matrix, the two focus groups for the Pool 19 workshop used the risk matrix presented in Figure 2.6 for their evaluation. As was the case for Pool 7, each focus group was tasked with reviewing the scenario, the modeling results, information on exposure and sensitivity to crude oil, and basic life history and distribution information in order to develop a group estimate of the percent of each resource affected and the recovery time. In the initial evaluation, the groups used alphanumeric codes to rate the level of concern. At the end of the workshop, color coding was used to develop summary levels of concern.

In their initial discussions, both groups agreed that the only one of the three open water habitats which existed in Pool 19 was "low flow" and the other two categories did not need to be considered, hence those columns are blank in all of the tables. With respect to natural recovery (Figure 3.7), the groups felt that terrestrial habitat (above the mean water level of the pool) was at low risk, and that wetlands and habitats along the waters edge were either at low or moderate risk overall. However, mammals and reptiles and amphibians were of high concern in these areas, but the groups differed in their perceptions of how severe the risk was and where it was most important. Otters were the key mammalian species mentioned by both groups. In general, invertebrates and many reptiles and amphibians were assumed to be dormant or hibernating. Fish would have probably moved to deeper water, and the birds likely to be present in the area were not heavy shoreline users, so these groups did not have high risk scores. There was concern expressed about what the situation might be like in the spring for these groups, if no cleanup was undertaken. The risk scores were quite different for open water areas. Both groups agreed that the risk there was high, and that it was driven by birds and endangered species of mussels (both state and federally listed species). The canvasback duck population was of particular concern, in that a substantial portion of the migrating population goes through Pool 19. There was some discussion of the risk to mammals that might come into contact with oil in the open water, and also for fish in shallow water areas, but these risks were viewed as much lower.

Participants felt that traditional mechanical recovery (Figure 3.8) could make conditions in muddy zones along the water's edge worse, and Group 1 also expressed concern about possible damage in sand and gravel and cobble/riprap areas. All groups felt that collecting oil in appropriate areas along the shore or near the lock and dam was appropriate, but this did not greatly influence their scores. For open water areas, both groups saw the potential for benefits in containing and collecting the oil, but differed in the degree they felt the risk could be reduced. Part of the difference related to assumptions made about where the oil could be contained. Group 2 felt that if the oil could be contained in the middle section of the pool, a significant part of the bird population could be protected. They also felt oil removal would benefit the mussel population in the long run. Group 1 saw a benefit to the mussel population, but did not believe that the oil could be contained in a way to prevent the risk to the birds.

ISB (Figure 3.9) was judged by both groups to be a viable mechanism to reduce shoreline impacts without some of the risks associated with shoreline cleaning. In addition, it was viewed as a reasonable way to prevent future releases of oil from these areas. Neither group saw any benefit to the surface water community, since burning would not limit the distribution of oil throughout the pool.

Habitats	Terrestrial						Water's Edge																		Wetlands						
Component							Sand and Gravel						Mud						Cobble/Riprap												
Resource	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)
Group 1	L	R/C	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L
	4D	4D	NA	NA	NA	4D	4D	4D	2C	3C	4C	4D	3B	3D	2B	4B	4B	4C	3C	4C	3D	4D	4D	4D	3A	3D	3B	2D	3D	3D	4D
	4D						3C						3B						3D						3C						
	4D						3B																		3C						
Group 2	L	L	L	L	L	L	L	C	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	C	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	2A	4D	4D	3D	4B	4D	2A	3D	3D	4D	4D	4D	4D	4D	4D	4D	4D	4D	2A	4D	3B	3B	3A	3A	3B
	4D						3A						3D						4D						3A						
	4D						3C																		3A						

Habitats	Surface Waters																										
Subhabitats	High Flow Areas (>1 Kt)									Low Flow Areas (<1 Kt)									Backwaters								
Resource	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial	Water Quality	Drinking Water
Group 1										C	L	L	L	C	L	L	L	L									
										1A	4C	4D	3C	2B	4D	4D	3A	3B									
										1A																	
										1A																	
Group 2										C	L	L	R	R	L	L	L	L									
										1A	3A	4D	4C	1B	4D	4D	4D	4D									
	NA									1A									NA								
										1A																	

Habitat Scaling: L=Local (Pool 19), R=Regional (Pools 16 -26), C=Continental

Figure 3.7 *Detailed Pool 19 focus group risk analysis results for natural recovery*

Habitats	Terrestrial						Water's Edge																		Wetlands						
Component							Sand and Gravel						Mud						Cobble/Riprap												
Resource	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)
Group 1	L	R/C	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L
	4C	4D	4D	4D	4D	4D	4D	4D	3C	4C	4C	4D	4C	4D	2B	4B	4B	4C	4C	4C	4D	4D	4D	4D	4B	3D	3B	2D	3D	3D	4D
	4D						3C						3B						4D						3C						
	4D						3C																		3C						
Group 2	L	L	L	L	L	L	L	C	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	C	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	3B	4D	4D	3D	4B	4D	3B	3D	3D	4D	4D	4D	4D	4D	4D	4D	4D	4D	3A	4D	3A	3A	3A	3A	2A
	4D						3B						3B						4D						2A						
	4D						3B																		2A						

Subhabitats	High Flow Areas (>1 Kt)									Low Flow Areas (<1 Kt)									Backwaters								
Resource	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water
Group 1										C	L	L	L	C	L	L	L	L									
										1A	4D	4D	4C	3B	4D	4D	3B	4B									
										1A																	
										1A																	
Group 2										C	L	L	R	R	L	L	L	L									
										2C	3C	4D	4D	2C	4D	4D	4D	4D									
										2C																	
										2C																	

Habitat Scaling: L=Local (Pool 19), R=Regional (Pools 16 -26), C=Continental

Figure 3.8 *Detailed Pool 19 focus group risk analysis results for traditional mechanical recovery*

Habitats	Terrestrial						Water's Edge																		Wetlands						
Component							Sand and Gravel						Mud						Cobble/Riprap												
Resource	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)
Group 1	L	R/C	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L	R	L	L	L	L	L
	4C	4D	4D	4D	4D	4D	4D	4D	3C	4C	4C	4D	4C	4D	3B	4B	4B	4C	3C	4C	3D	4D	4D	4D	4B	4D	3B	3D	3D	3D	4D
	4D						3C						3B						3D						3C						
							3C														3C										
Group 2	L	L	L	L	L	L	L	C	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	C	L	L	L	L	L
	4D	4D	4D	4D	4D	4D	4C	4D	4D	4D	4B	2D	3C	4D	4D	4D	4D	4D	4D	4D	4D	4D	4D	4D	3A	4D	4D	4C	4D	4D	4D
	4D						4D						4D						4D						4D						
	4D						4D																		4D						

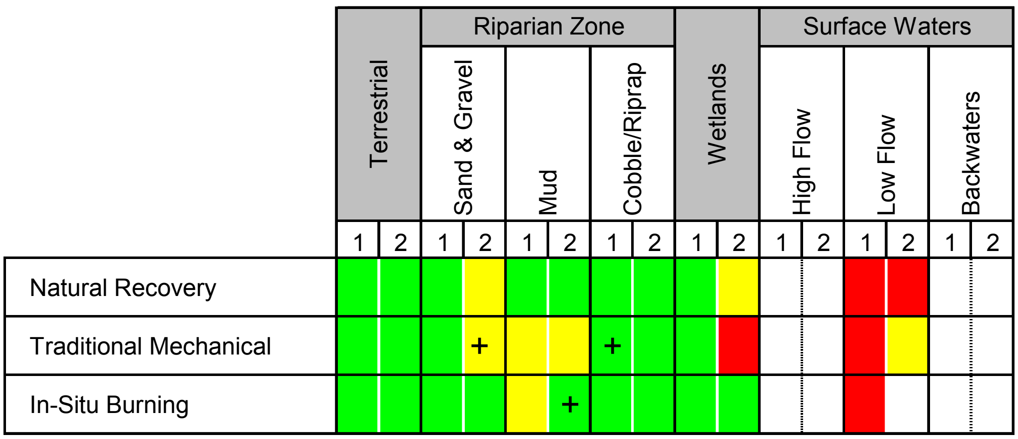
Habitats	Surface Waters																										
Subhabitats	High Flow Areas (>1 Kt)									Low Flow Areas (<1 Kt)									Backwaters								
Resource	Mammals	Birds	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water	Birds	Mammals	Reptiles and Amphibians	Fish	Macroinvertebrates	Microinvertebrates	Plants (annual & perennial)	Water Quality	Drinking Water
Group 1										C	L	L	L	C	L	L	L	L									
										1A	4D	4D	4C	3B	4D	4D	3B	4B									
										1A																	
										1A																	
Group 2										C	L	L	R	R	L	L	L	L									
										NA																	
	NA																										

Habitat Scaling: L=Local (Pool 19), R=Regional (Pools 16 -26), C=Continental

Figure 3.9 *Detailed Pool 19 focus group risk analysis results for in-situ burning*

3.4 Pool 19 Summary Risk Analysis Results and Lessons Learned

Figure 3.10 presents the summary results for this workshop. Traditional mechanical response and shoreline ISB were analyzed along with natural recovery. In summary, participants felt that the most significant risks in Pool 19 were related to exposure of migrating waterfowl and protected species of mussels. These risks were reduced, but not eliminated, by available mechanical recovery techniques. The participants expressed concern that great care was needed during shoreline cleanup, especially in mudflats and wetlands. On shore ISB was viewed as a viable option.



Legend: Red cells represent a "high" level of concern, yellow cells represent a "moderate" level of concern, and green cells represent a "limited" level of concern. There are two group scores per sub-habitat type (columns). A + indicates reduced concern (i.e. "better") within the broad risk category, while a – indicates an increased concern (i.e. "worse") within the category.

Figure 3.10 *Final relative risk matrix for the Pool 19NEBA/ERA*

Some of the differences in the natural recovery scores can be explained by assumptions the two groups made about the availability of habitat. Group 1 assumed the riparian zone consisted of less than 1 percent sand and gravel, 50 percent mud, and 50 percent cobble and riprap. Group 2 assumed the riparian zone was 10 to 15 percent sand and gravel, less than 5 percent mud, and greater than 50 percent cobble and riprap. This points out the value of detailed local habitat maps for response planning.

Both groups felt that mechanical recovery (if done carefully) and shoreline ISB would reduce long term impacts, which was an important benefit. However, protection of the birds that would be present really depended on the success of keeping oil away from any large concentrations. Further, improper shoreline recovery in areas such as wetlands or mudflats could make the situation worse.

Key species groups that influenced the risk scores included migrating waterfowl, protected species of mussels, and otters. Other groups, such as invertebrates, fish and reptiles and amphibians, were not viewed as being at as high a risk, primarily because of the time of the year. If the spill had occurred in the spring these groups would have been more important.

At the conclusion of the workshop, the participants developed the following list of consensus comments for consideration in future oil spill response planning efforts for the area:

- Local planners should discuss options with pipeline companies regarding stopping leaks at the source (repair pipe, etc.).
- Have local resource knowledge experts participating in the workshop process (presentations on natural resources, maps, etc.) with guidance and advance planning information for use during the workshop.
- This process is useful for both identifying known sensitive resources to response managers and for identifying spill response constraints to resource managers.
- Investigate benefits of sharing information available from the USGS Long Term Resource Monitoring Program Spatial Data Query and Visualization Tool. This is a project to facilitate the dissemination, display and querying of Upper Mississippi River Basin data sets, and is available at http://www.umesc.usgs.gov/data_library/tools/spatial_query.html.
- Consider developing a strategy for reallocating equipment resources or justifying new equipment needs.
- Improve initial response by local first-responders (fire departments, local HazMat teams) via local spill exercises and training.
- This process can aid in evaluating response strategies for inland spills (railroad cars, pipelines, vessel traffic).
- Evaluate options for including river biologists during the actual response.
- Involve a feedback loop from the use of various strategies at actual spills to evaluate appropriateness of that strategy.
- Need to evaluate the use of barges for booming and collecting oil in this area.

4.0 Sponsor's Summary Conclusions from the Combined Workshops

When both of the workshops were completed, the members of the workshop Steering Committee held a series of discussions concerning the results of the workshops, the workshop process, and the role these workshops might play in freshwater oil spill response planning. Their conclusions are presented below.

The freshwater NEBAs on the Upper Mississippi River, as well as one conducted for Isle Royale in Lake Superior, turned out quite differently than those done for the marine environment. This is not a function of salinity but of controversy. Due to the relative lack of controversy over response techniques in freshwater, there is no fundamental decision to make regarding technique and thus, in some sense, there is no product of the NEBA analysis. However, what we discovered was that, without the controversy, the NEBA process can be even more powerful. It allows, and may cause, deep reflection on threats, consequences and possibilities for prevention, mitigation, and planning.

Contingency planning for emergencies is well thought out for human consequences. There are many agencies with responsibilities and experience and many layers of assistance. This basic planning process has also been used successfully for environmental responses. By using the NEBA process along with some other tools, we are driven deeper into the planning process than ever before, involving a wider, more appropriate range of individuals and view points.

The outcome of the NEBA was the identification of an enormous amount of potential work in the form of specific contingency planning tasks. Some examples of these tasks are the development of a bird hazing plan; hydrologic control plan for each pool; Refuge spill response plan annexed to the Area Plan; etc. This work, in general, should be managed by Area Committees. If several Area Committees come up with the same needs, issues should be taken on by the Regional Response Team or by Regional/District offices.

To conduct future NEBAs in freshwater environments, a number of more tailored materials need to be developed because, currently, most of the documentation is either marine-specific or focuses on the dispersant controversy. Suggestions for tailored freshwater documents are:

- Overview brochure;
- Introductory PowerPoint that describes the process;
- Freshwater fact sheets
  - Each standardized environment (expanded from initial 6),
  - Key groups of species (at the level of frogs, mussels, fish, migratory waterfowl, etc.),
  - Oil types,
  - Typical scenarios (truck rollovers, train derailments, pipeline spills, vessel releases), and
  - Response techniques;
- Pathways -stressor matrix;
- Risk Ranking Matrix;

- Relative Risk Matrix (figure out how to better show and define continental, regional and local populations);
- Standard agenda w/breakout sessions;
- Standard report format;
- Timeline and standard steps for preparing for a workshop;
- Questions to ask up front; and
- Evaluation forms.

Many inland areas may be in need of specialized response considerations but may not have the level of interest by scientists and resource managers that is a prerequisite for a NEBA. For such areas, a modeling tool that helps apply general principles to basic freshwater habitat types could be tremendously useful. EPA's Regional Vulnerability Analysis (ReVA) tool is being explored as a method to help extrapolate to areas without significant research interest but that may still have high quality habitat in need of specialized protection.

Finally, our experience with NEBA was overall quite positive and we recommend it as a way to enhance current plans and planning efforts, to involve stakeholders who had previously remained outside the response community, and to bring science to the art of contingency planning.

5.0 References

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Appendix A

Participants

Participants in the Pool 7 Workshop

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3			no	Dieterman	Dan	Natural Resource Specialist	MN DNR	651-345-3365	dan.dieterman@dnr.state.mn.us
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Participants in the Pool 19 Workshop

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1				Helms	Don	Owner	Helms & Associates	563-872-4563	helmsdon@cistelecom.net
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