Assessing and Communicating Risk: A Partnership to Evaluate a Superfund Site on Leech Lake Tribal Lands

Executive Summary

Background

This summary highlights findings and output of from a series of panels assembled to evaluate a Superfund site on Leech Lake tribal lands. The “partnership” refers to the collaboration between the University of Minnesota Sea Grant Program (including several researchers for the Natural Resources Research Institute at the University Minnesota-Duluth) and the Leech Lake Tribal Council. The area of concern is a former wood preserving facility (the "site") owned by Champion International Paper Company (the "company") currently being remediated as a federal Superfund site. This project was funded by a grant from the U.S. EPA’s Environmental Justice Program to Minnesota Sea Grant.

The site has had a groundwater extraction/containment system since 1985, but more recently there is evidence that a remnant plume has moved off-site, potentially impacting surface and groundwater resources on Leech Lake Band of Chippewa tribal lands. Contaminants of concern include the priority pollutants PAHs, PCP, CCA (mixture of Cu, Cr and As), and PCDDs. PAHs and PCP have been measured in groundwater off-site at levels far in excess of state standards. Immediately adjacent to the site is a large lake and bay used extensively for fishing and recreation and four wells draw groundwater from the aquifer in the vicinity for use as drinking water and for a fish hatchery immediately adjacent to the site.

The primary concern of the tribe is that the site has never been adequately or sufficiently evaluated to determine whether remediation actions completed to-date protect human health or the environment. Such concern derives in part from Minnesota law that essentially permits a company that volunteers to clean up its facility the authority to design and implement sampling protocols, sample designs, limits of detection, and other quality assurance/quality control matters. Other causes of concern include changing laboratories that process samples and perform chemical analyses, changing detection limits, and an erratic sampling schedule.

A major objective of the grant was to assemble and conduct three expert panels that were asked to 1) evaluate the available groundwater contaminant information, assess potential risk of exposure, and suggest further action, 2) conduct a preliminary ecological risk assessment to evaluate available ecological information, assess potential risk of exposure, and suggest further action, and 3) to evaluate the potential tribal human health impacts based on an understanding of tribal resource use, and available groundwater and ecological information, and suggest further action, if needed.

Additional products and accomplishments from this project are detailed in a compendium of existing and new information collected for the panels (NRRI 2001), the results of a Ground Penetrating Radar survey that documents the undulating nature of the till surface in the contaminated area (Appendix 3), and a summary of outreach materials that were provided to the tribe in the course of the project.

Panel Summaries:

Groundwater Panel Recommendations

1. There needs to be a better interpretation of existing data and better use of all available data.

2. There needs to be a more complete geologic site characterization. This becomes especially important for understanding and modeling the transport of dense non-aqeuous phase liquids by gravity flow.

Options

- Possibly use Ground Penetrating Radar (GPR) or seismic investigations to improve geologic site characterization.

- Drill additional test holes for geologic characterization and additional sampling wells (particularly to the south of the treating facility) for better contaminant plume definition. If high concentrations are found in the initial wells, we suggest using an exploratory Geoprobe to determine locations for subsequent permanent wells. Because of the current poor plume definition, the simulated capture zones for the extraction wells are based on inadequate information.

- We recommend screening additional private wells in the area for contaminants.

- The source of contaminants in the DRM fish hatchery's well needs to be determined. The contaminants may be coming from the containment vault, and, if so, then the containment vault is leaking. Alternatives include: 1) the draw down of groundwater during peak pumping may be pulling contaminants in from a greater distance (this has possible implications for the city wells) or 2) the bore hole for the hatchery's well may be improperly sealed.

- Locations for any additional wells (but especially deep wells) need to be agreed upon and approved by all parties.

- There is a need for better hydraulic conductivity values (how fast water moves through the glacial deposits). Also a better understanding of the three dimensional complexity of the glacial deposits is needed in order for modeled

predictions to more accurately depict actual field conditions. Stratigraphy could be better understood by geophysical investigations.

3. Based on additional well and geologic information, the conceptual model and, subsequently the analytical model, should be re-evaluated.

- For the analytical model, at a minimum we suggest a change from specified (fixed) heads at the boundaries to a fluctuating head at the boundaries that is based on flow measurements, especially for Fox Creek. Possibly one specified head at Cass Lake or some other downstream location could be used, and then Fox Creek, Pike Bay, and the channel could be included in the model's calibration. This would allow a more realistic modeling assessment of whether the contaminants could migrate into Fox Creek and the channel, rather than just assuming they will not, and setting a specified (fixed) head at these sites.

- The complexity of this geological environment is greater than has been realized, and more realistic 3-D modeling is required.

4. The model must be calibrated to agree with existing data on well head and contaminant concentration levels.

- The model should then be tested on an independent data set, not used in calibration. Levels of contaminants in new wells could be used as a possible check on the recalibrated model.

5. Finally, all sampling and well drilling activities should follow standardized and technically acceptable protocols for contaminant investigations. All parties, including the tribe, governmental agencies, and an independent expert as determined by the tribe should approve these.

- Because there are two types of contaminant plumes (sinking dense non-aqueous phase liquids -- DNAPLs and floating light non-aqueous phase liquids -- LNAPLs), there is obvious concern about the potential for cross-contamination of wells, especially in the construction of new wells. Extreme care should be taken in drilling new wells and in sampling all wells. We recommend that dedicated sampling equipment be established for each individual well (if this is not currently occurring) to prevent sample cross-contamination.

- All parties must agree upon any changes in the well contaminant sampling scheme. (Well 118 was sampled for PAHs in 1991 and then never sampled again. Values in 1991 were 1500 ? g l-1 /45000 ? g l-1 for list 1/and list 2 PAHs. Well 118 was sampled for PCP in 1991 (60,000 ? g l-1) and again in 1996 (<50? g l-1)).

- All affected parties must agree upon any changes in analytical laboratories or detection limits.

Human Health Risk Assessment Conclusions and Recommendations

On the basis of discussions during the expert panel and evaluation of data and information provided prior to the review, the Human Health Risk Assessment Panel reached several conclusions and offers the following recommendations concerning health risks at Cass Lake.

Conclusions

The panel developed consensus on the following conclusions regarding health risks in relation to the St. Regis/Wheelers site contamination:

1. A screening-level assessment of questionable value in determining health risks has been completed (e.g., EPA 2002). This assessment does not comprehensively examine pathways of exposure that might be important in relation to tribal practices and resource utilization. The screening-level assessment does not address other COCs that might reasonably have been used during the operation of the St. Regis/Wheelers' facilities.

2. Importantly, the screening-level assessment demonstrates that, based on comparisons of reported chemical concentrations in Cass Lake area soil and groundwater samples (i.e., Barr Engineering Co. 2001, EPA 2002) with generally accepted toxicity benchmarks, the previous site remediation has not resulted in conditions that are protective of human health for residents of Cass Lake (e.g., Tables 1—4).

3. The spatial extent of sampling and data collection for soils and groundwater has emphasized the central areas of the site property. Limited sampling of off-site areas makes it difficult to determine a "safe" distance where exposures are minimal and conditions are protective of human health.

4. Current characterization and understanding of the complex geology and hydrology of the site remain incomplete. Heterogeneities and discontinuities in the till layer lead to spatially complex patterns of contaminant distribution and concentrations (e.g., LNAPLs, DNAPLs) and these patterns have been inadequately quantified. This was also the major conclusion of the previous Environmental Justice Partnership Groundwater Panel (McDonald et al. 1999).

5. The existing site characterization data are insufficient to support a technically defensible human health risk assessment. The spatial location and temporal sampling of wells used to characterize site-related contamination and assess (screen) current health risks, as reported in EPA 2002 and Annual Monitoring Reports (e.g., Barr

Engineering Co. 2001), do not appear to reflect any statistically defensible sample design.

Recommendations

Based on the above conclusions, the panel offers the following recommendations to better characterize current health risks, improve the quality of future health assessments, and reduce risks to individuals exposed to contaminants at Cass Lake:

1. The results of the screening-level human health assessment (EPA 2002) strongly indicate the potential for serious health risks to children who live adjacent to the site and who might play at the site. Steps should be taken to manage exposures and reduce risks for this sensitive age group, as well as other potentially exposed members of the community.

2. Reported concentrations of dioxins and furans in site soils indicate that the main site area should be secured and people should not be allowed on these lands. All closed wells should be identified, cased and plugged.

3. A comprehensive human health risk assessment should be performed. However, the special circumstances, unique cultural practices, and patterns of resource utilization characteristics of tribal members require modification of more conventional approaches to risk assessment (i.e., EPA 1989a, b). The overall paradigm may apply, but the methods and analyses will have to reflect a conceptual model more appropriate to tribal lifestyles. The assessment should be designed to address cumulative risks posed by simultaneous exposure to multiple COCs via multiple pathways of exposure.

4. A comprehensive conceptual model should be developed for estimating human health risks posed by historical and continuing contamination at Cass Lake. The model should include all appropriate sources of contaminants (on-site and off-site) and consider all relevant pathways, including those specific to tribal practices (e.g., sweat lodge) and utilization of local resources.

5. To the fullest possible extent, the inventories, patterns of use, and means of disposal of chemicals (e.g., LNAPLs, DNAPLs, metals, other organic contaminants) that might have been released during the course of site operations should be reconstructed. Historical releases (including uncertainties) of chemicals into air, soils, groundwater, surface waters, and sediments on-site and in the vicinity of Cass Lake should be estimated.

6. Time and resources should be directed at better collation, organization, analysis, and interpretation of data and information collected thus far for assessing human health impacts at Cass Lake. Professional database design, implementation, and management with appropriate QA/QC procedures are fundamental to meaningful and

credible assessment of health (and ecological) risks posed by contamination at Cass Lake. Cross-comparison of analyses of benchmark samples is necessary if samples are processed among different laboratories. Consistent with CERCLA protocols, the risk assessment process and supporting methods, data, and analyses should be carefully documented in support of the USEPA five-year review.

7. Careful, but serious consideration should be given to direct monitoring of human exposure to COCs. Individual body burdens of tribal members could be measured for persistent toxic chemicals, such as dioxins, furans, PCBs, biomarkers for PAHs, and volatile organic contaminants (VOC). Such measures should also include a reference or control group of individuals. The panel recognizes that there may be some cultural resistance to monitoring. However, if monitoring is thoughtfully planned and carried out, the resulting data might prove extremely useful in quantifying exposure and estimating potential health risks above and beyond the inferences that can be drawn from a baseline human health risk assessment.

8. If direct monitoring of human body burdens of chemicals proves infeasible, more accurate assessments of exposure to St. Regis/Wheelers contaminants might result from detailed mapping of patterns of current human use of the site (e.g., children's pattern of play, general utilization of the park). More samples of soils, surface waters, and sediments should be collected as appropriate from areas of intensive use.

9. A more accurate and spatially explicit quantitative description of the local geology (i.e., upper and lower aquifer, confining till layer) is needed to support a credible assessment of human health risks. As recommended by the Environmental Justice Groundwater Panel (McDonald et al. 1999), reinforced by the Human Health Risk Panel, and confirmed by an initial Ground Penetrating Radar (GPR) survey (Mooers 2002), available technologies such as GPR should be used to develop a more realistic and accurate characterization of the nature of the till layer and corresponding architecture of the upper and lower aquifers. The aquifer system may serve as a long-term source of COCs that constitute significant fractions of the DNAPLs which have apparently concentrated at the surface of the till layer.

10. The technical feasibility of removing or minimizing the functional connections (i.e., groundwater flows) between the shallow and deep aquifers should be examined as part of risk management. The results of the GPR analyses could be used to better map the depth to deep aquifer and locations of likely accumulation LNAPLs and DNAPLs.

<u>Ecological Risk Assessment Conclusions and Recommendations</u>

Based on the results of the expert panel review, the Ecological Risk Assessment Panel arrived at the following conclusions and offers several recommendations concerning ecological risks posed by the St. Regis/Wheelers Superfund site.

Conclusions

The essential issues of concern for assessing ecological risks are similar to those expressed in relation to the human health assessment (Bartell et al. 2002).

1. An incomplete screening-level assessment has been completed and the results of the screening indicate that a more comprehensive risk assessment is justified (Tables 1–4).

2. The characterization of on-site and off-site contamination is inadequate to support a meaningful examination of impacts and risks posed by site-related contamination.

3. Evaluation of the quantity and quality of existing data is difficult given current levels of data reduction, analysis, and summarization.

4. Pathways of exposure have not been comprehensively investigated for the diverse assemblages of species potentially at risk.

If the contaminated groundwater plume continues its suspected pattern of movement toward Cass Lake, risks posed by the chemicals of concern (COCs) in the plume to fish and other aquatic organisms could increase markedly in the future.

Limited efforts in ecological assessment at the Leech lake site to-date have focused on dioxin and fish. As a result of reviewing existing information and panel discussions, the panel concludes that the assessment needs to be expanded in terms of ecological endpoints and COCs. The selection of additional species as assessment/measurement endpoints should be guided by cultural practices involving plants and animals valued by the tribe, as well as by the ecological uniqueness of the region.

Recommendations

The panel recommends the following actions to facilitate the necessary ecological risk assessment for the St. Regis/Wheelers Superfund site:

1. Based on the preliminary screening-level results, a scientifically credible and technically defensible assessment of ecological risks should be performed.

2. A more comprehensive ecological assessment will require the collection of additional samples to characterize exposure and additional toxicity benchmark data.

3. The collection and processing of additional samples should be coordinated to improve the characterization of site contamination and provide data and information relevant for both the human health and ecological risk assessments.

4. An important component in improving the site characterization necessary to support an ecological risk assessment involves the derivation of bioaccumulation factors across media, COCs, and species at risk. For hydrophobic organic contaminants, measures of organic carbon in soils and sediments are unavoidable. Lipid concentrations in species of concern are also necessary to evaluate the potential for bioaccumulation of organic contaminants.

5. In contrast to the Environmental Justice Human Health Risk Assessment Report (Bartell et al. 2002), the identification of appropriate reference sites will be necessary to complete a meaningful ecological risk assessment. The reference sites should be selected to reflect ecological similarities to the conditions that existed at the St. Regis/Wheelers site prior to the onset of commercial activities.