

# Health Consultation

---

**FINAL EDITION**

**ST. REGIS PAPER COMPANY SITE  
COMMUNITY HEALTH CONCERNS AND HEALTH OUTCOME DATA REVIEW**

**CASS LAKE, CASS COUNTY, MINNESOTA**

**EPA FACILITY ID: MND057597940**

**SEPTEMBER 25, 2007**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
Division of Health Assessment and Consultation  
Atlanta, Georgia 30333**

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR Toll Free at  
1-800-CDC-INFO

or

Visit our Home Page at: <http://www.atsdr.cdc.gov>

HEALTH CONSULTATION

FINAL EDITION

ST. REGIS PAPER COMPANY SITE  
COMMUNITY HEALTH CONCERNS AND HEALTH OUTCOME DATA REVIEW

CASS LAKE, CASS COUNTY, MINNESOTA

EPA FACILITY ID: MND057597940

Prepared by:

Minnesota Department of Health  
Under Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry

## Foreword

This document summarizes health concerns associated with the St. Regis Superfund site in Cass Lake, Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH) in collaboration with the Agency for Toxic Substances and Disease Registry (ATSDR) and the Leech Lake Band of Ojibwe (LLBO). A number of steps are necessary to do such an evaluation:

- *Evaluating exposure:* MDH scientists begin a site evaluation by reviewing available information about environmental contamination at the site, or emitted from the site. The first task is to find out how much contamination is present, where it is found, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. Instead, MDH relies on information provided by the U.S. Environmental Protection Agency (EPA), the Agency for Toxic Substances and Disease Registry (ATSDR) and the Leech Lake Band of Ojibwe (LLBO), other government agencies, businesses, and the general public.
- *Evaluating health effects:* If there is evidence that people are being exposed—or could be exposed—to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. The report focuses on public health i.e., the health impact on the community as a whole and is based on existing scientific information.
- *Developing recommendations:* In the evaluation report, MDH, ATSDR, and LLBO outline their conclusions regarding any potential health threat posed by a site and offer recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with individual sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies—including EPA, LLBO, or local government. However, if an immediate health threat exists, MDH will issue a public health advisory warning of the danger and will work to resolve the problem.
- *Soliciting community input:* The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the organizations responsible for cleaning up the site, and the community surrounding the site. Any conclusions about the site are shared with these groups and organizations that provided the information. Once an evaluation report has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, you are encouraged to contact MDH.*

*Please write to:*           Community Relations Coordinator  
                                  Site Assessment and Consultation Unit  
                                  Minnesota Department of Health  
                                  625 Robert Street North  
                                  Box 64975  
                                  St. Paul, MN 55164-0975

*Or call:*                   (651) 201-4897 or 1-800-657-3908  
                                  (toll free, then press the number 4 on your touch tone phone)

*Website:*                [www.health.state.mn.us](http://www.health.state.mn.us)

## Table of Contents

I. Introduction .....	4
II. Background .....	4
Site Description and History of Operations .....	4
History of Response Actions: Site Remediation and Evaluation.....	5
Agency for Toxic Substances and Disease Registry (ATSDR) and Minnesota Department of Health (MDH) Involvement.....	7
Current Conditions: Demographics, Land Use, and Natural Resources.....	7
General Regional Issues.....	9
Site Visits .....	9
Children’s Health Considerations .....	11
III. Community Exposure and Health Concerns.....	11
Methods for Identifying Community Concerns.....	11
Past Occupational Exposures:.....	12
Past Residential Exposure (1957-1986):.....	13
Past Residential Exposure in Drinking Water: .....	14
Potential for Ongoing Exposure From Contaminated Surface Soil on the Site:.....	15
Potential for Ongoing Exposure From Surface Water and Lake Sediment .....	16
Potential for Ongoing Exposure from Consumption of Fish and Game On or Near the Site: 16	
Potential for Ongoing Exposure from Uses of Garden and Native Plants:.....	17
Perceived Excess of Health Problems Among Residents Living On or Near the Site .....	17
Health of Children and Future Generations .....	21
Medical Tests .....	22
Health Study.....	22
Need for More Information to Area Residents .....	23
Economic Concerns and Future Land Use.....	23
Future Site Remediation .....	24
IV. Health Outcome Data Review .....	25
Minnesota Cancer Surveillance .....	25
Minnesota Cancer Mortality Data.....	27
Minnesota Birth Records .....	27

Future Health Studies.....	28
V. Conclusions.....	29
VI. Recommendations.....	31
VII. Health Action Plan .....	32
References.....	35

Figures

- Figure 1. Site Map
- Figure 2. Historical Aerial Photograph of Site and Neighborhood
- Figure 3. Historical Photograph of Child Canoeing on “Rainbow Pond” (Site Runoff)
- Figure 4. Area of “Rainbow Pond” Following Excavation of Contaminated Soils, 2004.
- Figure 5. Map to Residents Showing Area of Contamination

Appendices

- A. Letter to Residents and “Reduce Soil Contact” Fact Sheet
- B. ATSDR Public Health Statements for Creosote, Pentachlorophenol, and Dioxin.
- C. Health Information Resources
- D. MDH Publication: Cancer and The Environment
- E. MDH Publication: Cancer in Minnesota: Racial and Ethnic Disparities
- F. MDH Publication: Diabetes in Minnesota
- G. Health Outcome Data Review: Methods and Limitations
- H. Public Comments Received and Responses

## **I. Introduction**

This health consultation (HC) is a collaborative effort between the US Agency for Toxic Substances and Disease Registry (ATSDR) Region V, the Leech Lake Band of Ojibwe (LLBO), and the Minnesota Department of Health (MDH). This HC is part of a series of consultations that focus on health impacts associated with environmental exposures to contamination from the St. Regis Superfund site in Cass Lake, Minnesota. Each HC addresses a specific environmental medium (soil, sediment, water, and fish) or community health concerns. This HC addresses community health concerns.

The purpose of this report is to provide a brief site history, document the health concerns of current and former residents and summarize available health outcome data. This includes an assessment of the unique health concerns and health outcomes of Leech Lake Band of Ojibwe tribal members practicing traditional cultural and spiritual activities on and around the site.

In the process of preparing this report, the authors reviewed United States Environmental Protection Agency (USEPA), ATSDR and MDH project files and documents, toxicological and epidemiological literature and case reports, and data from the Minnesota Cancer Surveillance System and Minnesota Center for Health Statistics. In addition to these documents, interviews with community members and former workers, meetings with city and tribal government officials, meetings with local health care providers, several site visits, and community meetings form the basis for this HC. The Human Health and Ecological Risk Assessment prepared by the responsible party for this site was not a source for this document. An initial draft in 2005 (Integral, 2005) was not accepted by the USEPA. A new draft is expected to be released for review in late 2007.

## **II. Background**

### Site Description and History of Operations

The following summary is based on information contained in the following documents:

- ATSDR public health assessment, St. Regis Paper Company National Priorities List (NPL) Site, April 1989;
- ATSDR/MDH Site Review and Update, July 1993;
- ATSDR/MDH Site Review and Update, April 1995;
- USEPA NPL Fact Sheet, St. Regis Paper Co., February 1998;
- Minnesota Pollution Control Agency (First) Five-Year Review Report, March 1995;
- USEPA Second Five-Year Review Report, September 2000;
- USEPA Fact Sheet, July 2001;
- USEPA Fact Sheet, October 2002;
- USEPA Field Sampling Plan for Removal Site Evaluation, March 2003;
- MDH/ATSDR/LLBO health consultation on Soils, August 2004; and
- Barr Engineering Final Report, January 2004.

The St. Regis Paper Company Superfund site was the location of a former wood preserving facility that operated from 1957 through 1985 in the city of Cass Lake, MN. In 1957, the Wheeler Division of St. Regis Corporation started a wood-treatment operation on land leased from a railroad and eventually expanded the site to its current boundaries by purchasing land south of the leased facility (see Figure 1).

In 1957, creosote was the first wood preservative material used at the facility to pressure treat lumber. It continued to be used in the wood treating plant located in the north central portion of the site until the facility closed in 1985. The “North Storage Area” located on the northwestern corner of the site was used for the storage of treated and untreated lumber. In 1960, use of pentachlorophenol (PCP) as a pressure treatment chemical for wood products began. It was generally combined with a carrier solvent, usually No. 2 fuel oil.

Large amounts of wastewater were generated in the treatment process. Through the years this wastewater was discharged into various on site ponds; at times sludge from the storage tanks was taken to the city dump and burned.

In 1974, improvements were made to the wastewater treatment system. Wastewater was routed to a primary separation tank, aerated, and nutrients were added. Wastewater was also sprayed on the ground or hauled and dumped in various areas of the property. Beginning in 1980 until the facility closed in 1985, water was evaporated from the waste and the residue placed in barrels and transported to a hazardous waste disposal facility out-of-state in accordance with new federal hazardous waste regulations.

Timber waste, metal scraps, chemical containers, and demolition wastes were deposited in the landfill area on the east end of the site property. Large open-air burners were also used to burn bags from the treatment chemicals.

#### History of Response Actions: Site Remediation and Evaluation

In 1982, a groundwater investigation concluded that polynuclear aromatic hydrocarbon (PAH) compounds and PCP were present in the upper aquifer east of the wood treatment operations. Arsenic, chromium, and copper were also found at low levels in the groundwater.

On September 21, 1984, the site was placed on the National Priorities List (NPL; Superfund), and considered to be a high priority Superfund site (MND057597940). The wood preserving operation ceased in September 1985. Sampling has confirmed that groundwater, surface water, sediment, and soil on and in the vicinity of the site were contaminated as a result of the wood preserving process and waste disposal activities.

From 1985 through 1988, there were a number of actions to deal with contamination of soil and groundwater. Municipal water was extended to nearby residents. Visibly contaminated soils and sludge were excavated from the site and city dump pit. Excavations, including the disposal ponds, were backfilled with soil from other areas of the site, and the site was graded. A soil



containment vault was built on the southwest corner of the site and filled with the contaminated soils and sludge. Groundwater extraction and treatment systems were installed at the former

treatment plant site and at the city dump. These systems have operated continuously since that time. Champion (who acquired the St. Regis Company in January 1985) donated portions of the property to the City of Cass Lake for future development.

In March 1995, the Minnesota Pollution Control Agency (MPCA) completed a 5-year review that recommended additional sampling of soil, sediment, groundwater, and surface water. USEPA began the second 5-year review process in 2000 and in October 2001 began to implement the previously recommended sampling of soil, surface water, groundwater, sediment and fish. All October 2001 soil samples from the former north storage area show higher dioxin levels when compared to the reference samples. The North Storage Area soil dioxin concentrations ranged from 6 to 5,639 ppt TEQ (toxicity equivalency quotient). A total of 17 samples had dioxin TEQ values greater than 200 ppt. The pond locations and the former spray irrigation and landfill area were not sampled for PCDD/PCDF (dioxins).

Of the 20 residential properties that were sampled, 8 had dioxin TEQ values greater than 50 ppt, the Health Based Screening Value recommended by MDH and LLBO (MDH/LLBO/ATSDR, 2004). This value is based on the ATSDR Minimal Risk level for dioxin (ATSDR, 1998). Dioxin TEQ concentrations on residential properties ranged from 10 to 485 ppt.

Fifteen residential properties had values greater than 20 ppt dioxin, the residential/recreational Soil Reference Value (SRV) developed by the MPCA (MPCA, 2006). The industrial criterion of 35 ppt, developed at the same time, was used in the investigation and cleanup of the Joslyn NPL site in Minnesota (MPCA, 2006). Soil Reference Values are levels derived by MPCA that are considered to be safe levels of chemicals in soil.

Additional soil sampling was conducted in 2003 (Barr, 2004). Composite samples were taken from former processing area, pond areas and the North Storage Area. Dioxin TEQs from these areas ranged from 9 parts per trillion (ppt) to 5,700 ppt. Additional sampling was done to determine if wind deposition could have carried dioxins immediately north and south of the former wood treatment operation area. Dioxin TEQs in these samples, which included composites of multiple residential properties, ranged from 8 ppt to 51 ppt. Samples were also collected at the Cass Lake-Bena Elementary School (6 ppt) and the Fox Creek Townhomes (2 ppt). Finally, composite soil samples were collected and analyzed from seven additional residences in the neighborhood south of the site that were not sampled in EPA's 2001 investigation. Dioxin TEQs in these residential samples ranged from 18 ppt to 290 ppt. The soil data collected from the site to date is reviewed in more detail in the health consultation on soils.

In June 2004, EPA began a time-critical removal action to remove surface soils with dioxin concentrations greater than 1,000 ppt from portions of the site owned by the City of Cass Lake and from private residential property. As of September 2004, excavations ranging from 4 inches to several feet in depth have been temporarily covered with an impermeable cloth and the area enclosed with temporary fencing to limit access until a vegetative cover could be seeded. The

temporary cloth cover and fencing were later removed. In 2004, EPA also collected additional samples of area soils, sediments and biota to conduct a human health and ecological risk assessment in order to determine the need for future remedial action. Data collected for the risk assessment and as part of the time-critical removal action will be described in future MDH documents.

#### Agency for Toxic Substances and Disease Registry (ATSDR) and Minnesota Department of Health (MDH) Involvement

ATSDR is mandated by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA 1986) to conduct a public health assessment at each site proposed for or listed on the National Priorities List. In 1989, ATSDR completed a public health assessment for the site based on available site data at that time (ATSDR, 1989). In cooperation with ATSDR, the Minnesota Department of Health completed two Site Review and Update documents in 1993 and in 1995 to review site status and recommendations (MDH 1993, 1995).

ATSDR was provided a copy of the Final Data Evaluation Report for the St. Regis Paper Company site (October 2001 Sampling Data) and was asked to provide an evaluation to USEPA, based on a review and analysis of the new environmental data. After an initial review of the data, ATSDR, MDH and LLBO determined that soils on the site and on neighboring residential properties were contaminated with dioxins in concentrations that present a health concern to area residents and the LLBO. MDH and ATSDR have determined that a complete exposure pathway via soil exists for site contamination.

Based on the October 2001 sample data, in February 2003 EPA mailed sample results to all the current owners and residents whose properties were sampled. ATSDR, LLBO, and MDH jointly authored a letter sent in February 2003 to residents living south and north of the site advising them to avoid contact with dioxin contaminated soils (see Appendix A). A map outlining the area of contamination was also mailed with the letter to residents (Figure 5).

In August 2003, MDH issued a health consultation report which provides more extensive description and assessment of soil contamination and potential exposures, along with health recommendations. This was released for public comment and subsequently published as a final edition in December 2005.

#### Current Conditions: Demographics, Land Use, and Natural Resources

The St. Regis Superfund site consists of 125 acres located centrally in the City of Cass Lake, which lies within the Leech Lake Band of Ojibwe (LLBO) Indian Reservation. The approximate site boundaries are the BNSF Railroad tracks on the north, state Highway 371 on the west, Pike Bay and the channel between the Bay and Cass Lake on the east, and to the south, Fox Creek, which empties into Pike Bay (See Figure 1).

Currently, portions of the site owned by International Paper have been fenced, though most of the site has unrestricted access. Areas of the site excavated by EPA are seeded with a vegetative cover.

The city of Cass Lake, located in Cass County, Minnesota, is the largest community within the LLBO reservation and has a population of 860, of whom 64% are American Indian, 30% are white, and 5% are two or more races, according to the 2000 U.S. Census. The median age of the Cass Lake population is 28.4 years, 10% of the population is under the age of 5 years, and 36% of the population is under age 18. The median household income is \$20,583, and 25% of families lived below the poverty level in 1999. The largest employers in Cass County are tribal, state and local government services, wood product industries, retail trades, and tourism.

According to the 2000 census, the 56633 zip code area, in which the city of Cass Lake is located, has a total population of 4,323, of whom 58% are American Indian, 38% are white, and 3% are two or more races. The median age of the 56633 zip code area's population is 31.4 years, 9% are under age 5, and 34% are under age 18. The median household income is \$27,909, and 20% of families lived below the poverty level in 1999. These demographics are very similar to the City of Cass Lake, though there is a slightly higher percentage of American Indians and families living in poverty in the city.

The Leech Lake Band of Ojibwe Indian Reservation encompasses 864,000 acres including non-Indian owned fee land, and shares its boundaries with the U.S. Forest Service, Beltrami, Cass, Hubbard and Itasca counties. The boundaries also include portions of three major watersheds. There are 208 miles of stream and rivers, over 270 fishable lakes and 168,000 acres of wetlands. The National Chippewa Forest makes up the largest portion of the reservation land and supports a variety of forest and aquatic ecological types. Plant communities are extensively used in many ways, including a large timber and wood products industry.

The LLBO reservation is the permanent homeland for all LLBO members, and there are presently about 4,560 Tribal members living there, according to the Minnesota Indian Affairs Council. Traditional uses of plants for food, medicine, and crafts remain critical to maintaining the cultural integrity of the Band's heritage. The Leech Lake Ojibwe Reservation has the largest natural wild rice production of any of the state's reservations. Wild Rice (Manoomin) has cultural and spiritual significance for the Leech Lake Band of Ojibwe and is vital to their cultural, spiritual and economic health.

Located on the site and just south of the site (3 city blocks) are approximately 40-50 homes (including a home child care business), small businesses, and unoccupied properties owned by both Tribal members and non-tribal individuals. International Paper owns portions of the site, including the soil containment vault located on the southwest corner of the site. A concrete building at 3<sup>rd</sup> St. and Elm is used for storage by a boat and marina business. Cass Forest Products, located on the west side of state Highway 371, maintains two drying kilns on the site and stock piles newly kiln dried wood on the northwest corner of the site.

Immediately north of the site is the Burlington Northern (BN) Railway and a small office facility owned by BN. North of the railway (two to six blocks north of the site) is the city commercial center, including city hall, small businesses, an American Legion Hall, a medical clinic, a tribal

college, an elementary school, a Boys and Girls Club, and many residences. Within one mile north of the site are the Indian Health Service Hospital and Clinic, Tribal government offices, a Tribal housing area (known as "Tract 33"), a community recreation center, Headstart childcare, the Eagleview homeless shelter, the Leech Lake Detoxification residence, and 2 elder care facilities (Heritage Manor and Elder's Place).

In close proximity to the east side of the site is Pike Bay and a city park area known as the "Box Factory," a popular recreation area for local residents. A railroad bridge just east of the site crosses the channel between Pike Bay and Cass Lake. Local residents and tourists use these lakes and the channels for recreation, primarily fishing. Resort owners in Cass Lake depend on fishing and other recreational uses of the area's lakes and forests to attract tourists. Wetland areas in the channel and Pike Bay have been used traditionally for harvesting wild rice, as well as gathering other plants and clay materials for cultural purposes.

Land south of the site and the immediate neighborhood includes a portion of the Chippewa National Forest and Fox Creek. The city owns the solid waste dump, municipal wastewater treatment facility and an animal control facility on the north side of Fox Creek. The LLBO and the Minnesota Chippewa Tribe offices, Foxcreek Townhomes, an Indian housing neighborhood, and the high school are also located south of the site within 1-2 miles.

Located west of the site are private residences, the U.S. Forest Service Office, and land owned by Burlington Northern Railroad.

#### General Regional Issues

The LLBO is governed by an elected 5 member Reservation Tribal Council (RTC). The Band is a signatory to the Treaty of February 22, 1855, 10 Stat. 1165, which established reservations for the Pillager and Winnibigoshish Bands on Cass Lake, Leech Lake and Lake Winnibigoshish. The three reservations were augmented, connected and enlarged by a subsequent treaty in 1864, and were further enlarged by Executive Orders in 1873 and 1874. Under the authority of these treaties and executive orders, the Band retains its inherent sovereign authority over its members and the Reservation. The Band has maintained its regulatory authority over waters within the Reservation and retains inherent rights to ensure the viability of the Reservation as the permanent homeland of the Band and its members, and to preserve Reservation resources so as to promote the Band's religious and historic values. The Leech Lake Band of Ojibwe adopted a Hazardous Substance Control Act (Resolution No. 01-29) on August 25, 2002. This Act establishes clean-up standards for a number of hazardous substances in various media, including 10 ppt for soil.

#### Site Visits

Region 5 ATSDR and LLBO representatives attended a public meeting in July 2002 held by EPA to present information on EPA's ongoing activities at the St. Regis site and to solicit community input. Residents expressed concerns and asked questions about how the site may be affecting their health.

Region 5 ATSDR (two representatives), Leech Lake Band of Ojibwe (LLBO) (three representatives) and MDH (6 representatives) met in November 2002 at the LLBO offices near the St. Regis site to discuss and prioritize a series of media specific health consultations, to

determine recommendations for any immediate action needed to protect public health, and toured the site. It was determined that site residents should be informed in writing of their EPA 2001 soil sampling results and be advised to avoid contact with dioxin contaminated soils (see Appendix A and Figure 5). MDH representatives also met with one family of long-time site residents at that visit to gather site history and health concerns. Representatives from each agency met again in Cass Lake in January 2003 to discuss their progress.

In February 2003, MDH, ATSDR, and LLBO participated in a public meeting held by EPA to inform residents of the dioxin soil contamination levels from the sampling conducted in 2001 and to answer questions. During that visit, MDH, ATSDR, and LLBO participated in meetings with EPA and individual site residents regarding specific property sampling results.

In July 2003 MDH staff met with LLBO Tribal members, local residents and members of the community group, Heal Our Mother Earth (HOME) in Cass Lake to listen to their health concerns and descriptions of the ways in which people living near the site may have been exposed to site chemicals, including pathways unique to LLBO Tribal members. MDH also interviewed former workers during the EPA Public Availability Session to obtain information on workplace exposures and chemical handling.

In August 2003, MDH staff, including epidemiologist, John Soler, from the Minnesota Cancer Surveillance System (MCSS) and University of Minnesota School of Public Health (UM-SPH) scientist, Dr. Patricia McGovern, conducted a community meeting in Cass Lake to present information from the MCSS and to discuss community involvement in an EPA Environmental Justice grant opportunity. The grant would support additional health risk communication activities or health research related to the St. Regis site. In a separate meeting with local health care providers, Tribal Health officials and Indian Health Service providers, health professionals indicated their willingness to support UM-SPH in developing the proposal. This grant was subsequently not funded.

In October 2003, MDH, LLBO and ATSDR representatives conducted a community meeting in Cass Lake with city officials and residents to present and take comment on the first health consultation, Public Comment Draft dated August 28, 2003. This presented a review of the soil contamination data available to date and made public health recommendations.

In February 2004, MDH staff attended an EPA public meeting held in Cass Lake. EPA presented the results of additional soil sampling conducted in 2003, as well as future plans under the Superfund program for a time-critical soil removal action for city property in 2004, and ongoing activities under the remedial action program. MDH representatives also toured the site to observe recent changes (added site fencing of International Paper property) and met with LLBO officials to discuss progress.

In July 2004, MDH staff toured the site following recent excavation activities. Staff also assisted the LLBO staff in providing health education materials at a Leech Lake Reservation Pow Wow.

### Children's Health Considerations

Over one-third of the Cass Lake population are under the age of 18 and 10% are children under age five. MDH, ATSDR, and LLBO recognize that infants and children might be more vulnerable to exposures than adults in communities faced with environmental contamination.

Children are more vulnerable because:

- During play, children are likely to disturb contaminated soils.
- Young children ingest more soil due to frequent hand-to-mouth behavior.
- Young children inhale more respiratory toxins due to their higher breathing rate.
- Children's metabolism and rapid growth may enhance hormone-mediated effects.

Because children depend on adults to protect them from environmental risks, MDH, ATSDR, and LLBO are committed to evaluating their special interests at the site. In addition, the LLBO culture places a special value on the health and well-being of future generations.

## **III. Community Exposure and Health Concerns**

### Methods for Identifying Community Concerns

Community concerns about the health effects of exposure to chemicals from the St. Regis Superfund site have been identified through various sources.

1. Individual and group discussions with residents and former employees were conducted during the course of several community meetings and site visits held from July, 2002, through February, 2004. Residents described the ways in which they came in contact with chemicals from the St. Regis site in the past and currently, and their health concerns.
2. A residential survey of current and former residents conducted by the LLBO in 2002 described traditional, cultural and spiritual uses of natural resources in the area and identified ways that tribal people might have been exposed to site contaminants during the years the plant was operating.
3. MDH and ATSDR staff visited 2 health clinics in Cass Lake, the Indian Health Service clinic and the Merit Care clinic. MDH met with physicians and staff to discuss any concerns they may have heard from patients or observed in their practice.
4. A 2002 report by scientists at the University of Minnesota Sea Grant and Natural Resources Research Institute, "Assessing and Communicating Risk: A Partnership to Evaluate a Superfund Site on Leech Lake Tribal Lands" was reviewed.
5. MDH has received several telephone calls from current and former residents expressing health concerns related to the site.

From these discussion and documents, community concerns about exposure and health were identified in several areas described below.

### Past Occupational Exposures:

*Former employees and family members have described past occupational exposure to wood treating chemicals, and asked whether their work exposure could have caused health problems.*

Former employees of the St. Regis facility spoke with MDH and EPA staff during community meetings held in February and July, 2003 and agreed to be interviewed by MDH about past exposure and chemical handling practices on the site. One employee who worked in the treating plant from 1962 to 1985 said that the treating plant operated 24 hours per day, 7 days per week, typically with 2 employees working 12-hour shifts each day. Job duties in the treating plant included mixing 40 lb. bags of crystal pentachlorophenol in a tank with #2 fuel oil. Workers reported that dust from the process burned the skin. Creosote in liquid form was unloaded from rail cars. Cloth gloves and coveralls were usually worn by treatment plant workers when handling the creosote and PCP. Workers did not report any use of copper chromated arsenate (CCA) for wood treatment but did report use of “Chemonite”, the registered trade name for ammoniacal copper zinc arsenate (ACZA).

Workers also reported crawling inside the 120’ long treatment cylinders once per year to clean the tanks. This job involved shoveling out residual chemicals and sludges, and mixing with Floor-Dri for disposal. Workers also entered the hot treatment cylinders as needed when wood being treated (called “charges”) became stuck inside and had to be manually pulled out of the cylinder.

Typically 20-30 employees worked in the yard outside the treatment plant as laborers. Laborer duties included piling treated and untreated wood, operating a tractor and forklift, “pulling charges” from the cylinders, operating the “pole peelers”, and grading, cutting and drying the poles.

Workers reported that sludge from the treatment process was typically dumped and burned at the city dump pit prior to 1980. Wastewater was stored in ponds on the site, then pumped and disposed of off-site, including disposal directly into a sewer near the city wastewater treatment plant. Two large open burners (known as “teepee burners”) located on the site were used to burn bark, wood shavings, waste oil and the empty PCP sacks. Other wood and metal scrap material was piled in the landfill area on the east side of the site. Spills of creosote along the railroad tracks were also reported. One worker reported that he “took a bath” in creosote during an accidental release while unloading a rail car and was taken to a hospital for treatment of burns to the skin. Waste disposal practices changed in the 1980’s, and sludges were drummed for shipment off-site.

According to one employee, workers received medical exams during the last few years of operations (during the 1980s). They report that they did not receive copies of their exam results. They report that most of the former workers do not live in Cass Lake today, and some have died. Anecdotal reports of health problems among former workers include burns and peeling skin from skin contact, cancers, lupus, and blindness due to a rare eye condition.

Several studies have been published describing the occupational hazard and clinical effects of creosote and PCP exposures to workers at lumber mills and wood treatment facilities. Creosote is

a mixture of dozens of components including naphthalene, phenol, cresols, and polycyclic aromatic hydrocarbons (PAH) (Heikkila et al. 1987). High exposure to creosote has caused skin rash or irritation, burns on the surfaces of the eyes, convulsions, mental confusion, kidney or liver problems, and respiratory irritation. PCP poisoning incidents in wood treatment facilities have resulted in severe illness to workers, characterized clinically by fever, profuse sweating, difficulty breathing, weight loss, weakness, flu-like symptoms, confusion and delirium (Williams, 1982; Walls et al., 1998; Cline, 1989; Jorens and Schepens, 1993; Gorman et al., 2001; Gilbert et al, 1990). In some cases, excess exposures have resulted in severe industrial poisoning, organ failure and deaths (Wood et al. 1983). See Appendix B: ATSDR Public Health Statements for more information on the health effects of creosote and PCP.

The Occupational Safety and Health Administration (OSHA) regulates occupational exposure to PCP and Creosote. OSHA has set a Permissible Exposure Limit (PEL) for PCP of 0.5 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) of air as an 8-hour time-weighted average. OSHA also gives PCP a “skin” designation indicating the potential for absorption through skin contact. Creosote has a PEL of  $0.2 \text{ mg}/\text{m}^3$  in workplace air. Both PCP and Creosote are classified by the International Agency for Research on Cancer (IARC) as probable human carcinogens.

Past Residential Exposure (1957-1986):

*Community members in Cass Lake reported exposure to chemical odors, smoke and direct contact with chemical wastes from living near the plant while the facility was operating.*

In March 2000, MPCA notified MDH of the health concerns of a resident living near the site and MDH contacted the resident. The resident described a history of exposure to contaminants at the site starting in 1957 when wood-treating operations began. Past routes of exposure from the site included childhood exposure through skin contact from swimming in wastewater ponds and runoff areas, and from playing with treated scrap wood in the landfill area. Strong odors were reported from freshly treated wood that was stacked around the home. The resident was concerned about exposure and health effects to other family members living on the property and reported numerous health problems in the family. This report led to a review of available environmental sampling data for the property. The resident was provided with information about the chemicals on the site and advised to consult a physician trained in occupational and environmental medicine.

MPCA files documented the presence of strong chemical odors in the residential neighborhood near the plant. In a July 22, 1976 memo, an MPCA Regional Specialist inspecting the facility reported that “numerous odor complaints have been recorded. Most of the complaints are due to the fact that the newly treated wood products are stored very close to homes. One home we observed...had freshly treated wood material stacked on three sides – right next to the property line...the odor was almost unbearable.” Published analyses of airborne substances at a treating plant and utility pole storage site have confirmed that the characteristic odor of PCP treated wood is made up of a mixture of petroleum hydrocarbons (Fortin et al. 2002). Creosote also has a sharp, smokey odor. Historical aerial photographs also document the stacking of wood products near area homes (Figure 2).



During a public meeting with MDH staff in July 2003, community members informed MDH that many more houses were present on the site in the 1950s and 1960s than are found there today. At one time as many as 80 families may have lived within 2 blocks south of the site. Many of the Indian families who were living on or next to the site moved to new Indian housing areas (Tract 33) built in the 1960s in a northern section of the city. As families moved away, the St. Regis Company acquired their properties and expanded their operations into the neighborhood south of the site. Other families refused to sell their property to the company and stayed on the site. A few of these families still live there today.

Community members reported that many children lived in the area and played regularly on the site. Children's activities included:

- swimming or wading in wastewater ponds and runoff areas
- playing on treated logs stacked around the homes
- gathering wood scraps from the site for building forts, or for use as firewood
- making and tasting "mudpies"

Ponds of water runoff from the site, described as "pools of smelly, oily water", occurred around homes, particularly in the spring. One of these runoff ponds, known as "Rainbow Pond", filled an area located between 2<sup>nd</sup> and 3<sup>rd</sup> St. S., west of Norway Ave., and was used by neighborhood children for swimming and canoeing (Figure 3). People walked to school or town on footpaths and on a "boardwalk" that was built through the site. Some residents reported frequent spills and fires on the property and along the railroad tracks. The two large "teepee burners" on the site burned "all night and all day" for days at a time according to one resident, blowing smoke into nearby houses.

From these reports and the limited data available, residents living near the site from 1957-1986 may have been exposed for many years to site chemicals, both product and waste materials, primarily from inhalation of dusts and smoke, and direct skin contact with wastewater, sludges and handling of treated wood. Residents were probably exposed to solvents and fuel oils, creosote, PAH, and pentachlorophenol vapors during the years that the wood treatment plant was operating and before the gross contamination (sludges, soils and wastewater) was removed.

Children living near the St. Regis site may have experienced greater exposures compared with adults due to their higher rate of respiration and more frequent direct skin contact with treated wood and wastewater. Although there are no direct measurements of the residential exposures at this site, studies of exposures to residents of PCP-treated log homes offer some estimate of the potential for biological absorption of PCP among residents living in close proximity to PCP-treated wood, particularly for children. Blood serum levels of PCP measured in residents of log homes averaged 420 ppb, compared to a control group mean serum PCP of 40 ppb. (Cline et al. 1989). Serum levels in children in these homes were significantly higher than those for parents, averaging 1.8 times greater.

#### Past Residential Exposure in Drinking Water:

*Residents are concerned about past use of private well water at several homes near the site and about possible contamination. Indian residents also asked if use of well water in traditional Ojibwe sweat lodges would be a source of exposure.*

Residents reported a chemical taste and odor from drinking water wells to MPCA. Review of MPCA files revealed that, in 1985, chemical contaminants (PAHs and PCP) were present at low levels in several private drinking water wells and in 2 Cass Lake city wells. Concentrations found in these wells did not exceed State drinking water criteria. All residents were subsequently connected to city water in 1985, except for one resident who refused access to the property and was provided with bottled water.

Use of well water in a traditional Ojibwe sweat lodge would be expected to cause inhalation exposure to any volatile organic compounds present in the water. Since well water contamination levels from private wells near the site were below levels of health concern for drinking water, exposure levels from inhalation of volatiles in a sweat lodge would be expected to be low. However, a “sweat” (time spent using the sweat lodge) can be very long, from several hours to days, increasing the potential exposure time.

MDH/ATSDR/LLBO are preparing a separate public health assessment that addresses groundwater contamination, surface water contamination, sediment contamination and potential public health impacts. It addresses in detail questions concerning past exposures and potential for current exposures. Several wells currently exist on the site, although they are no longer in use.

Potential for Ongoing Exposure From Contaminated Surface Soil on the Site:

*Residents are concerned about contaminated soils around and near their homes. They ask if they are being exposed from wind-blown dust and tracking of dirt in homes, children playing in soils, and digging and construction activities.*

Concerns about possible residual contamination of soils following the initial clean up of the site conducted in 1986 were confirmed when the results of soil sampling conducted in the fall of 2001 were released in 2002. MDH scientists reviewed these sampling data and provided health recommendations in the previous MDH health consultation document: St. Regis Paper Company, August 2004.

MDH has determined, based on the available sampling data, that soils in some locations on the site and on 8 neighboring residential properties are contaminated with dioxins in concentrations that exceed the MDH level of health concern (50 ppt TEQ) for chronic (long term) exposure (ATSDR/MDH/LLBO, 2004). Even more properties exceed the MPCA the industrial criterion of 35 ppt, the residential/recreational SRV of 20 ppt(MPCA, 2006), and the LLBO Hazardous Substance Control Act criterion for dioxins in soil of 10 ppt. The MPCA industrial criterion of 35 ppt was used at the Joslyn NPL site (MPCA, 2005). Before the removal, dioxin concentrations in several areas on the site and adjacent to homes exceeded 1,000 ppt TEQ of dioxin, the EPA action level for time-critical removal.

Based on these results, ATSDR, LLBO, and MDH co-authored a letter sent February 2003 to 40 residents south of the site advising them to avoid all contact with dioxin contaminated soils >50 ppt TEQ. Residents were also provided with their property sample results, a map (Figure 5), and a factsheet (Appendix A) with specific guidance for avoiding contact with soils, minimizing the tracking of contaminated dirt into homes, and the blowing of dusts into homes.

Although there is no immediate health risk from these exposures, MDH is concerned about long-term (lifetime) risks, particularly for children playing in dioxin-contaminated soils. Children have greater exposure to contaminants in soils due to their hand-to-mouth play behaviors, and greater skin surface area-to-weight ratios. Children playing in contaminated soils may ingest small amounts of dioxin that can accumulate in the body over time, and add to lifetime cancer risk. MDH advised residents to provide safe play areas, with clean soils or sand, for young children. All residents were advised to stay off the St. Regis site until a final remedy for the site, which protects the health of current and future generations living in Cass Lake, has been found.

#### Potential for Ongoing Exposure From Surface Water and Lake Sediment

*Other potential exposure pathways of concern to community members include swimming/wading in Pike Bay near the former “Box Factory,” in Fox Creek and in the channel area by the train bridge. Resort owners expressed concern about the safety of visitors who use the lakes for swimming and other water sports.*

MDH, LLBO and ATSDR’s assessment of contaminant levels in area surface water and sediment due to the potential for contaminated groundwater to enter the Pike Bay channel and Fox Creek waters is available in a separate public health assessment. The PHA recommends that access to Fox Creek and the Channel Area be restricted and signs be posted warning residents and visitors to avoid contact with sediments and bottom-dwelling organisms in this area, until additional assessment of the human health risks is completed. If dioxin were present, it would most likely be found in the sediment near places where contaminated water is released into the lake or stream. Swimming in surface waters would not be a health concern unless contaminated sediment is disturbed and swallowed.

Tourists visiting lake resorts in the area should not be concerned about swimming/boating activities in area lakes. Sediment sampling in Fox Creek has confirmed the presence of contamination, and wading and swimming in Fox Creek east of Highway 371 should be restricted. However, additional sediment samples collected in 2004 at the area of the “Box Factory” park that now serves as a public access to Pike Bay and the channel area between Pike Bay and Cass Lake are still being analyzed.

#### Potential for Ongoing Exposure from Consumption of Fish and Game On or Near the Site:

*Residents are concerned about exposure to site contaminants from catching and eating fish from Pike Bay, Cass Lake, and the channel; hunting and eating deer, rabbits, frogs, squirrels, grouse and ducks. Fishing and hunting are common activities for residents and visitors to the area.*

Fish tissue levels of dioxin are a potential health concern for people who consume fish regularly or as part of a traditional, subsistence diet. MDH, ATSDR and LLBO are evaluating the most recent data from fish samples collected in Pike Bay and the channel area. Currently residents are advised to follow the existing fish consumption guidelines provided by both MDH and LLBO. Concern for dioxin exposure in fish should be weighed against the potential health benefits of fish in the diet. Most foods that contain animal fat, including meat, dairy, and eggs, also contain low levels of dioxin and represent the primary source of exposure for the general population.

A separate health consultation document will address fish consumption concerns because this represents a potentially significant pathway for ongoing exposure.

EPA has conducted additional sampling to measure tissue levels of dioxin in other game species, and a determination of health risk will be made. MDH, ATSDR, and LLBO will advise Cass Lake residents if any excess risk from consumption of these animals is found. EPA will evaluate a subsistence lifestyle using these species as a primary food source for human health risk.

Potential for Ongoing Exposure from Uses of Garden and Native Plants:

*Residents are concerned about exposure from harvesting, eating or handling wild rice, hazelnuts, berries, cedar roots and other native plant species. They also asked if it was safe to grow and eat garden vegetables from home gardens on or near the site; and to practice traditional use of native plants for medicines and crafts.*

Site contaminants such as PAHs and dioxins are “lipophilic,” which means that in biological tissues they are stored mainly in oils and fats. These compounds will also readily bind to soils and sediments. There is also some evidence that these chemicals may be taken up from the soils by plants and incorporated into plant tissues (Hulster et al., 1994, EPA 2000, ATSDR 2001). This may be particularly true for plants with high oil content, such as corn, green beans, and soybeans. Contaminated dust from the site could have blown into nearby gardens and wooded areas and settled on the plants. During the years that the plant was operating, residents who consumed vegetables from gardens near the plant without washing them thoroughly may have ingested small amounts of contaminated soils. Similarly, other traditional uses of plants which require handling or consumption of plant material may have been a source of exposure if plants were collected on the site or very close to the site where wind-blown dust from the site had settled.

This exposure pathway remains a concern today if plants grown in or near to contaminated soils are consumed or handled. MDH, ATSDR, and LLBO have advised residents near the site to avoid gardening in or collecting plants from contaminated areas. Residents who wished to garden were advised to garden in a raised bed with clean soil, and to practice thorough washing of any plants grown near the site prior to consumption or use.

Perceived Excess of Health Problems Among Residents Living On or Near the Site

*Many former and current residents who live or lived near the site want to know if they will become sick from exposure to site-related contamination. Some residents perceive that there has been an excess of death and disease, particularly cancer, among their friends, neighbors and relatives. They want to know whether the health problems they have experienced might have been caused by exposure to the site contaminants.*

MDH, ATSDR, and LLBO met with many residents to discuss their concerns about health. Health problems reported in these conversations and meetings include both cancer and non-

cancer health concerns. Some of the people expressed their own health problems or history of illnesses, while others described the health problems of neighbors, relatives or friends.

#### *Non-Cancer Health Concerns*

Some of the non-cancer health concerns reported by current and former residents, or their relatives and neighbors, are:

- Skin problems, rashes
- Allergies
- Respiratory problems
- Birth defects
- Growth and developmental delays in children
- Pre-mature births and miscarriages
- Learning disabilities among children
- Neurological disorders
- Anxiety and other psychological disorders
- Thyroid disorders
- Lupus
- Kidney, liver and bladder problems
- Aneurisms
- Strokes
- Hypertension
- Bone/vertebrae deterioration
- Headaches

It is not certain whether exposure to site chemicals has caused or contributed to any of these reported illnesses. These illnesses have many possible causes, and are known to occur in all communities. Community members are strongly encouraged to discuss their health concerns with their health care provider, so that appropriate health information, diagnosis and medical care can be provided. A physician who knows their patient's complete medical history is in the best position to determine what may be causing or contributing to an illness. Appendix C provides a list of additional resources that will help to answer questions about some of these specific health concerns and questions.

Some residents suspect that these illnesses have occurred at rates that are unusual when compared to other similar communities and that, therefore, the site must be causing this unusual excess of disease. However, MDH and ATSDR do not have surveillance data that would be needed to identify unusual patterns or trends of these chronic, non-cancer effects in Minnesota communities. While the state maintains extensive surveillance systems for monitoring trends in infectious diseases, chronic diseases (except cancer) are not routinely tracked. MDH has recently begun working on a statewide Birth Defects Information System. A statewide system would track trends in birth defects, target needed support services to families, and be useful for research investigations necessary for understanding the causes of birth defects.

Although it is not possible to know with certainty whether site chemicals have caused or contributed to health problems in the community, some of the health complaints of residents who lived near the site prior to 1986 (such as headaches, respiratory problems, skin rashes, neuropsychiatric problems, thyroid and kidney problems) are consistent with literature reports of chronic PCP poisonings and/or solvent toxicity. The PCP solution was mixed with petroleum solvents and contaminated with dioxins, both of which would have contributed to its toxicity. Chronic PCP poisoning, as a result of exposures over a long period of time, has caused clinical effects on the skin, metabolism, immune function, blood formation, the respiratory system, the nervous system, the kidney, and the gastro-intestinal tract (Proudfoot, 2003, Jorens and Schepens, 1993). Painful irritation of the eyes and upper respiratory tract can occur from exposure to PCP dusts and sprays, and can lead to chronic problems such as conjunctivitis, bronchitis, and sinusitis (Baader and Bauerer, 1951, Klemmer, 1980).

In addition to causing a local irritation from skin contact, several skin diseases (dermatitis) have been reported in the literature with chronic PCP exposure, including urticaria and pemphigus vulgaris (Lambert et al. 1986), and chloracne (O'Malley et al. 1990). Chloracne is the most prominent clinical effect observed from dioxin exposure, and so observed cases with PCP exposure may be due to the dioxin contaminants in PCP.

Endocrine and metabolic effects of PCP reported in the literature have included menstrual disorders and infertility among women (Gerhard et al. 1999). It has been suggested that PCP may disrupt endocrine control and cause disturbances of thyroid function. Elevated blood levels of PCP have been associated with suppression of the immune system in exposed patients suffering from respiratory infections and fatigue (Daniel et al., 2001).

Although it has not been well investigated, PCP is potentially toxic to the central nervous system. In a study of timber workers exposed to PCP, chronic neuropsychiatric complaints including depression, anxiety, confusion, insomnia, fatigue and behavioral problems were reported (Gorman, 2001). It is thought that PCP's affinity for a thyroxine-binding protein, causing thyroid dysfunction may cause an indirect effect on the brain. PCP has been measured in cerebrospinal fluid of 16 neurological patients indicating the ubiquitous nature of this pesticide (Jorens et al. 1991). Long term exposure to solvents (which are mixed with PCP) has similar effects on personality and mood changes, learning, memory functions, and psychomotor functioning (Cramner and Goldberg, 1986).

In the kidney, PCP was found to reduce glomerular filtration rate and tubular function in 16 of 18 workers studied, but these effects were reversed when the exposure was removed (Begley et al., 1977). There are a few reports of effects on blood cells following PCP exposure, including premature lysis or agenesis of red blood cells, aplastic anemia, and several types of leukaemia. In the liver, isolated changes in liver enzymes have been observed (Jorens and Schepens, 1993).

Dioxin is the contaminant of greatest health concern for people living near the site today since the remediation in 1986-87 removed most of the PCP and creosote contamination. There are many difficulties and uncertainties in our understanding of dioxin's health effects in humans. Dioxin is usually found as a complex mixture with other potentially toxic compounds, such as pesticides. Studies of workers exposed to these chemical mixtures contaminated with dioxin at

high levels have been shown increased occurrence of chloracne, a skin disease, and increased levels of certain liver enzymes, indicating mild liver toxicity.

Scientists believe that much of the toxicity of dioxin is due to its effects on the common Ah (aryl hydrocarbon) receptor, a gene protein that controls many cellular processes (cf. ATSDR, 1998). Studies in laboratory animals show that dioxins can interfere with the normal growth and function of many systems in the body. In animal studies, the severity of these effects vary widely depending on dose, age, gender, body composition, and species.

A critical target of dioxin is the endocrine system, affecting several hormone systems. These critical effects observed in animals include decreased sperm counts in offspring (rats), immune suppression (rats), ovarian dysfunction (multiple species), endometriosis (monkeys), and neurobehavioral effects in offspring (monkeys). Low doses also cause changes in levels of thyroid hormones and enzyme activity.

In human studies, effects on reproductive hormones and thyroid function have been reported, though the data is limited. There have also been inconsistent reports of dioxin's effects on cardiovascular disease, neurological and psychological measures, respiratory function, diabetes and the immune system. More research is needed to understand these effects in humans.

Lupus was mentioned as a health concern of several residents and former workers. Systemic lupus erythematosus (SLE) is one of many autoimmune diseases, resulting from a dysfunction of the immune system in which the body attacks its own organs, tissues, and cells. Very limited data exists to estimate the prevalence or incidence of autoimmune diseases but they are estimated to afflict 5-8% of the population nationally. The causes of lupus are not well understood but it is known to affect women more than men, especially African American women. The National Institute of Environmental Sciences and the National Center on Minority Health and Health Disparities have joined together to learn more about the range of possible hormonal, occupational and environmental risk factors for this disease. Environmental exposures being studied include silica dust, solvents, heavy metals, and pesticides. Presently, not enough information is known about the relationship between lupus and chemical exposures to adequately address this concern.

#### *Cancer Concerns*

Several residents have reported a perceived excess of cancers among people who lived in the neighborhood or worked at the treatment plant. Several different types of cancer, including brain cancer, breast cancer and leukemia have been reported.

MDH, EPA and the International Agency for Research on Cancer consider 2,3,7,8 dibenzo-p-dioxin to be a known human carcinogen, and other dioxin/furan congeners to be likely carcinogens (MDH, 2003a). Several studies have shown low excess risks for developing cancer among occupational groups exposed to dioxins in industrial settings. However, no specific type of cancer has been identified, and the risk to the general population remains uncertain. PCP and creosote are both known to cause cancer in animals and are classified as likely human carcinogens by EPA and IARC (ATSDR, 1996; 1994).

In response to these concerns, MDH has conducted a review of cancer data for the Cass Lake area in the Minnesota Cancer Surveillance System. The results and discussion of this health outcomes data review are presented in the next section of this document.

MDH has written an informational booklet, entitled Cancer and the Environment (Appendix D) to answer some of the most commonly asked questions about cancer. This booklet describes what is known about the causes of cancer and provides resources for residents to get answers to questions about specific cancers.

#### Health of Children and Future Generations

*Residents have expressed considerable concern for the health of children and future generations. They want to know if these chemicals or their effects can be passed from an exposed parent to a child. They want to know if these chemicals cause chromosomal damage. They asked if it is safe to breastfeed their babies. Residents living on the site today asked if they should move to protect their families. As one resident wrote: "What long term effect can the exposure have on self, children, grandchildren, etc.? How can I get myself and my family away from this site?"*

The protection of children and future generations is a fundamental value in Ojibwe culture; the protection of children and developing fetuses is a primary goal in the practice of public health. The main concern for children living near the site today is the potential for an increase in long term (lifetime) cancer risk from continued exposure to dioxin through ingestion of contaminated soils and dusts. Exposures to area plants and animals, sediments, groundwater and surface water, if found to be contaminated, may contribute to their risk as well.

There may be impacts on the growth and development of children from prenatal and postnatal exposures to dioxins. In the general population, dioxin has been measured in the blood of pregnant women and in breast milk, and small amounts can be passed from mother to infant. Infant exposure to breast milk with dioxin TEQ level ranging from 28-93 picograms/g resulted in increased thyroid-stimulating hormone levels (Koopman-Esseboom et al., 1994), decreased blood platelets (Pluim et al. 1994b) and increased T-cell counts (Weisglas-Kuperus et al. 1995).

MDH and LLBO believe that conservative clean up actions which remove soil contamination from residential property to levels below 50 ppt dioxin will not only reduce long term cancer risk, but will also provide protection from the uncertain risk to future generations (MDH/LLBO/ATSDR, 2004).

In order to avoid any excess cancer risk to children from the site, residents were advised in a letter and information sheet (Appendix A) to avoid contact with contaminated soil that exceeds 50 ppt until a final remedial action has been completed. The recommended options for reducing contact with contaminated soils include keeping hands clean, keeping dust out of the house, reducing outdoor activities that stir up dust, taking special care when gardening, providing a safe play area and taking precautions when preparing home grown vegetables. The letter also included a map of the site and neighborhood that outlined areas to avoid (Figure 5). Although relocating was not specifically recommended, moving from the area is an option some families



may choose to take if avoidance of the exposure to young children is not possible or practical until a permanent remedy for the contamination is complete.

### Medical Tests

*Some community members and local physicians want to know whether there is a medical test that can measure the site chemicals or their effects in the body.*

It is possible to measure PCP and dioxin in the blood or urine of exposed people. Studies of adults have shown that with chronic exposure, PCP has an elimination half-life of 17-20 days and is mostly excreted in the urine (ATSDR, 1994; 1998). This means that if the exposure is stopped, concentrations in the blood and urine will decrease by one half over 17-20 days. Though some tissue storage in the body may occur with chronic exposure, it is unlikely that past PCP exposure from the St. Regis site would be measurable in the blood or urine of exposed residents today.

The general population is exposed to dioxins primarily through foods as a result of the accumulation of these substances in the food chain. Therefore, most people have small amounts of dioxin in their blood and in body fat. Levels of dioxin in the body will be influenced by both past and recent exposures, and this “body burden” will increase with age. Differences in body tissue levels in a population can also be due to differences in absorption, distribution, metabolism and elimination. Half-lives for all the dioxins and furans in the body vary from 3-19 years; the half-life of TCDD is estimated to be approximately 7 years (ATSDR, 1998). Because dioxins are stored in fat tissue, they will stay in the body longer in people with higher amounts of body fat (Tepper et al. 1997)

Recently, the U.S. Centers for Disease Control and Prevention conducted a national study to determine how much dioxin can be measured in blood and the range of variability in the general population (CDC, 2003). TCDD was below the level of detection (< 4.5 picograms/gram of lipid) in over 95% of the samples. The levels found in the general population were far below those found with occupational or accidental exposures that produce health effects.

Although blood tests are useful in scientific research studies, MDH/ATSDR/LLBO does not recommend that residents be tested for dioxin levels in blood as part of routine medical care. Knowing the dioxin concentration in the body would not be helpful to a physician in predicting whether an individual patient is likely to experience health effects. Also, there is no medical treatment to remove these chemicals from the body if they are found.

### Health Study

*Residents want to know whether MDH or other scientists are or will be conducting a health study of people who were exposed to chemicals from the site.*

A scientific health study, or epidemiological investigation, is one of the possible actions that can be recommended in the public health assessment of the St. Regis site. An epidemiological study collects data about a particular health outcome in a specific population at risk and measures exposure or other risk factors that may be associated with the outcome. Such an investigation may be recommended by MDH if the scientific study could provide a public health benefit to the

community (and does not harm the community), is scientifically feasible (has a reasonable probability of answering the scientific question), and the necessary resources are available.

A broad scientific study designed to measure a causal connection between past exposure to contaminants at the site and a range of health problems experienced by people living in the Cass Lake community has not been recommended. In small communities, epidemiological methods are generally not statistically powerful enough to be successful. Limited historical measures of exposure and population data profoundly limit the scientific feasibility of such a study. In addition, a prolonged health study may hamper community efforts to plan for the future restoration of the site, and restore economic vitality.

MDH and LLBO have been working with scientists at the University of Minnesota School of Public Health to identify specific research and educational programs which may provide a benefit to the Cass Lake community, and to the scientific community. If these efforts are successful, the work will bring added benefits to the community in the form of health education, risk communication, and support for area health professionals, with a goal of improving the health of area residents.

#### Need for More Information to Area Residents

*Some residents, particularly those new to the area, expressed their dismay at the lack of public information about the site. The site was not marked and new residents living blocks from the site were unaware that a Superfund site existed in Cass Lake. They expressed a need to be educated about the health effects, particularly for their children. Some health care providers also expressed a lack of prior knowledge about the site history, contaminants or health concerns.*

MDH, ATSDR, and LLBO recognize that greater education and understanding among community members and physicians of the important health issues related to this site will lead to positive actions to reduce health risks, and are working to bring increased health education opportunities to community members and health care providers. Health care providers who are better informed can play an important role in communicating health risk information to their patients. MDH/ATSDR/LLBO are working to bring educational programs that will strengthen community involvement in decisions related to future clean-up and use of site land. Some of these educational opportunities and specific recommendations are described in the next section.

#### Economic Concerns and Future Land Use

*Some residents and business owners are concerned about the effect that publicity about the site will have on property values and tourism.*

MDH, ATSDR, and LLBO recognize that people in Cass Lake may have suffered economic losses from property devaluation around the site. Completion of site evaluation and remediation as soon as possible will minimize economic impact and restore property values. It is not clear if tourism in the area has been affected.

*City officials and tribal officials have expressed a need for more housing in the area. City officials do not want to lose use of a property so central to the city, and the vital family housing that the area currently provides.*

The future use and zoning of the site property is an important factor for choosing site clean-up levels. Given the site's central location in the city, city planning and visioning efforts and strong community involvement will help obtain the best possible outcome.

*Tribal members are concerned that their treaty rights to hunt, fish and gather resources will be limited by site-related contamination if it is not remediated. They are concerned that some of their traditional ways of life are being threatened by degradation of natural resources. They want to know if exercising their treaty rights in and around the site jeopardizes their health.*

EPA will be conducting future risk assessments using an exposure scenario of a traditional, subsistence lifestyle. MDH, ATSDR and LLBO are actively involved in reviewing EPA's plans to ensure that the Tribe's treaty rights and traditional way of life are protected in all decisions to be made. Tribal members are especially encouraged to be informed and active participants in all negotiations regarding the future use and remediation of this site.

#### Future Site Remediation

*Many residents are concerned about the health and economic effects of more site remediation and want to know whether people are safe living there during clean-up actions. They want to know where the dioxin contaminated soils will go if they are removed and what remedial actions have taken place at other similar sites. One resident asked, "Are we being treated the same (as people at other sites)?"*

A "time-critical" removal of soils contaminated above 1,000 ppt dioxin TEQ on land owned by the City of Cass Lake was conducted in 2004. During such site remediation efforts, the protection of residents from dust or vapor exposure is required. EPA is expected to notify residents in advance when they will be working on a neighboring property. Contractors, under EPA supervision, are required to conduct air sampling at the perimeter of an excavation area and use stringent dust control methods to ensure that contaminated dust particles do not reach neighboring homes.

Information about the final remedial action plan is not yet available. EPA is currently working with International Paper Company and various stakeholders, including LLBO, MDH, ATSDR, and the City of Cass Lake, to conduct a Human Health Risk Assessment and an Ecological Risk Assessment. These risk assessments, which are prescribed under the Federal Superfund program, will then be used to determine the clean-up criteria for the final remediation. Community members are encouraged to attend community meetings and stay involved in the process with EPA to negotiate a remedial action plan that meets the needs of the community and is protective of public health and the environment.

In Minnesota, there are currently 2 other former wood treatment facilities with dioxin contamination that are under investigation or have been remediated (Ritari and Joslyn NPL sites), and many others exist around the country. Community members interested in remedial actions that have taken place in other communities with similar facilities and/or dioxin contamination should contact MPCA Superfund Division or MDH Site Assessment and

Consultation staff. They may also access information available on EPA and ATSDR websites. Links to these sites and contact information are provided in Appendix C.

Recently (MPCA, 2004) the MPCA determined that risk assessment at the Joslyn site would be based on the upper bound cancer slope factor from EPA's re-evaluation of animal data (liver cancer in female rats) as recommended by MDH (2003a). The slope factor is  $1.4 \times 10^6 [\text{mg/kg/d}]^{-1}$ . Given exposure factors that MPCA employs to develop SRVs, or safe concentrations in soil, the dioxin level for cleanup of residential/recreational property is 20 ppt (MPCA, 2006).

#### **IV. Health Outcome Data Review**

Cancer incidence and mortality provide two important measures of the impact and trends of cancer in Minnesota. The Minnesota Department of Health collects and analyzes data on both incidence and mortality of cancer. Incidence data are compiled by the Minnesota Cancer Surveillance System (MCSS) and mortality data are compiled by the Minnesota Center for Health Statistics (MCHS).

Minnesota population estimates are developed from the United States Census Bureau's 1990 and 2000 censuses. Population statistics are necessary for estimating the size of the population at risk and for calculating disease and death rates. All incidence and mortality rates presented below are age-adjusted to the 1970 US standard population. Expected cancer values in the 56633 population were calculated using Indirect Standardization Methods whereby the age-specific rates in the standard population (Minnesota state-wide rates) are applied to the age distribution of the population of interest (in this case, zip code 56633). Age-adjustment minimizes the effect of differences in age distributions when comparing rates among different populations.

##### Minnesota Cancer Surveillance

In response to the concern that an excess of cancer has occurred or is occurring in the Cass Lake community, MDH has examined available data in the Minnesota Cancer Surveillance System (MCSS). The MCSS systematically collects demographic and diagnostic information on all Minnesota residents with newly diagnosed cancers. The primary objectives of the Minnesota Cancer Surveillance System are to:

- Monitor the occurrence of cancer in Minnesota and describe the risks of developing cancer;
- Inform health professionals and educate citizens regarding specific cancer risks;
- Answer the public's questions and concerns about cancer;
- Promote cancer research; and
- Guide decisions about how to target cancer control resources.

From MCSS we know that about ½ of all Minnesotans will be diagnosed with a cancer at some time in their lives and about ¼ will die from cancer. Cancer is the second most common cause of death after heart disease.

MCSS collects demographic information for all newly-diagnosed (incident) cancers, including the address of the resident at the date of diagnosis. Knowing the address at time of diagnosis makes it possible for health officials to examine cancer rates within defined geographic boundaries, but it is important to note that cancers in people who moved from the area and were diagnosed somewhere else are not included.

To address the concerns of Cass Lake residents, all new cancers diagnosed from 1993-2002 in the zip code 56633 in MCSS were counted and are shown in the table below as observed cases. These observed cancers are then compared to the number of cancers that would be expected in that population if cancer rates in the 56633 area were identical to the statewide cancer rates.

To determine the expected number of these cancers in the area for that time period requires an accurate count of the population over the same time period. The size of the population in the area is estimated from the 1990 and 2000 census data. The table below shows the observed and expected counts for some of the most common types of cancer and the total of all cancers.

Table 1. Observed and Expected Incident Cancers in zip code 56633, 1993-2002

<b>Cancer Site</b>	<b>Observed</b>	<b>Expected*</b>
lung	35**	21
colorectal	20	19
kidney	10**	4
lymphoma/leukemia	13	14
bladder	4	8
oral cavity	12**	4
cervical (females)	4**	1
breast (females)	31	26
prostate (males)	32	31
All cancers	197**	168

\* Expected values are based on statewide Minnesota cancer rates.

\*\* The observed excess of this cancer is statistically significant. The probability of finding an excess this large or larger due to chance alone is less than .05 or 5%.

From 1993-2002 there were 197 newly diagnosed cancers in the 56633 zip code area, which is more than the expected number of 171 cancers based on statewide rates (Table 1). This excess appears to be largely due to an observed excess of cancers of the lung, kidney, and oral cavity. In females, the MCSS data show an excess of cervical cancer and a slight excess in breast cancer.

Identifying race and ethnic differences in cancer risks is an important function of the MCSS. However, prior to 1995, race was “unknown” in 9.7% of reported cases. Starting in 1995, MCSS began conducting active follow-up to collect missing information on race and from 1995 through 1999 the percent with unknown race was lowered to 3.3%. Understanding racial and ethnic differences in cancer rates are further limited by the fact that populations of color in Minnesota are still relatively small, and population estimates used to calculate rates may represent undercounts during the national census. Despite these limitations, MCSS has recently aggregated

data from 1988-2002 to examine cancer risks by race and ethnicity that is summarized in a report: *Cancer in Minnesota, 1988-2002 Report to the Minnesota Legislature 2005* (MDH 2005, see also Appendix E for *Cancer In Minnesota: Racial and Ethnic Disparities*). Compared to Non-Hispanic Whites, American Indians in Minnesota were found to have significantly higher rates of cancers of the lung, and cervix (females).

According to the 2000 US Census it is estimated that 64% of the population living in Cass Lake is American Indian. MDH compared the number of observed cancers to the number of expected cancers in the American Indian and White populations in the 56633-zip code area to look at any racial disparities that may be observed. Racial disparities between American Indian and White populations were observed and were consistent with racial differences that have been observed throughout Minnesota. Excess lung cancers in particular were observed in the American Indian population (21 cases observed when 14 were expected based on statewide age-adjusted rates) but not in the white population. Limitations in population estimates described above are important considerations in the interpretation of this data. Cigarette smoking rates in the population may also be contributing to the excess cancers observed. Smoking is a known risk factor for lung, kidney, oral cavity and cervical cancer.

Minnesota Cancer Mortality Data

Minnesota mortality data are obtained from death certificates that are collected, coded, and computerized by the Minnesota Center for Health Statistic (MCHS). The MCHS codes contributing causes of death as well as the underlying (primary) cause of death, although the analysis below is limited to only the underlying cause of death.

Cancer mortality from 1993-2002 show a similar pattern as the MCSS data described above with respect to lung cancer and all cancers combined for zip code 56633 (Cass Lake area). An excess of cancer deaths, particularly lung cancer deaths, is observed in males. Expected counts are based upon rates for the entire State of Minnesota and the 2000 census population estimates.

Table 2. Lung Cancer and All Cancer Mortality, 1993-2002, for 56633 zip code

Cause of Death	Males		Females	
	Observed	Expected	Observed	Expected
Lung cancer	20*	11	10	7
All Cancers	46	39	27	32

\*The excess of lung cancers observed in males is statistically significant. The probability of finding an excess this large or larger due to chance alone is less than .05 or 5%.

Again, smoking is a major risk factor for lung cancer and elevated smoking rates among males in the population may contribute to the excess of lung cancer and total cancer deaths observed. Other cancer deaths are not reported by gender because of small numbers (less than 5), which cannot be adequately interpreted.

Minnesota Birth Records

MDH has received several anecdotal reports of birth defects among infants born to residents living in the area of the site. It is not possible to accurately quantify these birth defects using state records because Minnesota does not conduct statewide birth defects surveillance and birth

certificates do not provide a reliable quantitative measure of birth defects (MDH, 2003b). A search of reportable vital statistics (taken from MN birth certificates) show that the percentage of infants of low birth weight in Cass County for the period of 1992 to 1997 was 6.4%, slightly above the statewide average of 5.8%.

A Community Health Profile of Minnesota, Wisconsin, and Michigan Tribal Communities (Great Lakes Epicenter, 2001) examined maternal and child health data from birth certificates for all self-identifying American Indian/Alaska Native people with county of residence within the state boundary (regardless of Tribal affiliation). In 1999, infant mortality rates in the Minnesota Indian population (10.2 per 1,000 births) were somewhat higher than rates among all races in Minnesota (6.2 per 1,000 births).

A significant medical risk factor of pregnancy is diabetes. According to a recent report on Diabetes in Minnesota (Appendix F), babies born to mothers with pre-existing diabetes (PEDM) have twice the risk of congenital anomalies and perinatal death. From 1998-2001, the prevalence of PEDM among American Indians giving birth in Minnesota was 29.9 per 1,000 live births compared to 3.6 per 1,000 among Non-Hispanic Whites, nearly a 10-fold increase. Thus, the American Indian population living near the St. Regis site may be experiencing a higher rate of birth defects and infant mortality compared to the general population of Minnesota due to the prevalence of diabetes.

#### Future Health Studies

The health outcome data review above points out a number of inadequacies in the readily available data for assessing health impacts from the St. Regis site. State death and birth records, have limited utility due to the inaccuracies and incompleteness of disease information that is recorded. Address at time of death (county or zip code) is not an adequate measure of localized exposure to site contaminants.

MCSS data quality is very high and MCSS data provide an excellent surveillance tool for tracking cancer trends throughout the state. Recognizing these trends leads investigators to suggest or hypothesize the risk factors that may be contributing to these trends. For example, an excess in lung cancers in zip code 56633 suggests that there may be an excess in cigarette smoking compared to the state population. The observation of an excess of any particular cancer does not necessarily point to an environmental cause because many other genetic and behavioral factors contribute to cancer occurrence in a community. Conversely, the absence of a statistical excess of a particular cancer does not prove that no environmental risk to health exists.

To better understand the relationship between exposure to hazardous substances and adverse health effects in human populations, scientists must apply more precise methods for measuring both exposure and disease. Observational epidemiology is a particular type of scientific investigation that relies on observation of human populations using carefully designed protocols and statistical methods to measure the wide range of variables that can affect human health. Unfortunately, these types of studies are very expensive and can take years to reach a conclusion. They also require a large number of people, exposed and unexposed. If the population under study is too small, exposure status cannot be reliably determined, or a suitable control group cannot be identified, the study result will be inconclusive.

Basic research efforts are needed to improve our scientific understanding of the environmental causes of disease. One such effort is the study of clinical biomarkers. Biomarkers are measurements of unique substances in the body (usually in blood or urine) that indicate exposure or that represent early sub-clinical signs of an effect in the body. Even with very low environmental exposures, it is sometimes possible to measure subtle biological changes that may increase individual susceptibility to disease.

Another useful approach is to focus the investigation on a particular subset of the population that is more vulnerable to the risk. For example, investigators may choose to study a group of people who share certain genetic factors or family history of disease. Children are believed to be more susceptible to a number of environmental contaminants and are increasingly the focus of environmental health research.

While these research studies will advance our understanding of how chemical exposures impact human health, they are not very satisfying to communities and individuals living in the vicinity of a hazardous waste site. They do not answer questions about cause and effect in individual cases of disease. Questions about individual cases are best answered by qualified physicians who will examine the complete medical and family history, perform the necessary diagnostic tests, and provide appropriate medical care. For this reason, MDH/ATSDR/LLBO is engaged in providing support and education to Cass Lake area physicians, and working to enhance community access to care.

If a physician observes an unusual disease case, or a group of similar unusual cases, he/she can publish these observations as a case report or case series. These types of reports often bring new ideas to investigators and can lead to more research.

## **V. Conclusions**

MDH, ATSDR, and LLBO met with many community members, including past and current residents and site workers, in order to listen and respond to their health concerns. Concerns focused on past and present exposure to site chemicals, cancer and non-cancer health problems in the community, effects on future generations, future site remediation plans, lack of information to residents, property values, medical care and health studies. The following conclusions summarize the responses to these community concerns.

1. It is likely that workers at the St. Regis Wood Treatment Facility experienced occupational exposure to wood treating chemicals used at the plant, including creosote, PCP, petroleum-based solvents (fuel oil), dioxins, furans, and PAHs, through inhalation of dusts, smoke and organic vapors, and through direct contact with skin. Workers' reports of eye irritation and burns to the skin are consistent with known health effects from exposure to creosote and PCP.
2. During the years the plant was operating (1957-1985) residents living close to the plant likely experienced long term exposure to site chemicals at levels lower than occupational exposures.



Storage of freshly treated wood products adjacent to homes and the periodic burning of waste materials exposed nearby residents to vapors and smoke that likely contained creosote, PCP,

dioxins and furans, PAHs, and solvents. Higher exposures would have been experienced by children, due to their greater respiration rate, and through direct skin contact with site chemicals while playing in wastewater and site runoff ponds, contaminated soils, and on treated wood piles.

3. Numerous and varied health concerns are reported by residents who have lived near the site or worked at the facility. Reports of irritation, respiratory complaints, neurological complaints, skin effects, endocrine and reproductive disorders, and kidney disorders are consistent with literature reports of chronic health effects that have occurred in other groups exposed to wood treating chemicals. With no quantitative data about exposure levels in the past, we do not know whether residential exposure levels at St. Regis were comparable to the levels reported in the literature.

4. Chronic past exposure to site chemicals would likely have resulted in an increased body burden (tissue storage) of dioxins for workers and past site residents (above background levels presently found in the general population). We expect that these body burdens, which can be measured in blood or tissue samples, would be significantly decreased to near background levels today, except perhaps in a few, highly exposed individuals (such as site workers). There is no clinical treatment that can remove these chemicals from the body, and therefore blood tests are not recommended as part of routine medical care.

The following conclusions are drawn from the health outcome data review.

1. A review of cancer occurrence in the 56633-zip code area from 1992-2001 revealed an excess of some cancers, specifically cancers of the lung, kidney, oral cavity, and cervix, and a slight excess of total cancers. While an excess of total cancers is consistent with the carcinogenic effects of dioxin and PAHs from industrial exposure, this observed pattern of excesses is also consistent with excesses observed in other American Indian populations and may be attributed to a pattern of health disparities in Indian communities. Smoking may also be a contributing factor for some cancers.

2. A review of cancer mortality data for the same time period, revealed a similar pattern of excess lung cancer in the 56633 zip code area, particularly in males. An excess of total cancer deaths was observed only in males.

3. Health outcome data reviews, which examine MCSS and mortality data for communities living near hazardous waste sites, are usually not helpful for understanding the health impacts of site chemicals, particularly in small communities. Large population studies are necessary to understanding the causes of cancer due to the long latency period, and multiple risk factors for cancers. Community and physician education is the best tool for understanding the causes of cancer in individuals and in small communities, so that individual case differences can be examined. An unusual case, or cluster of cases, can best be described in medical case reports.

4. The population of Cass Lake includes a sensitive subpopulation as described under Superfund Risk Assessment policy guidance (EPA, 2001). This subpopulation includes people with long term historical exposures from living in close proximity to the plant during the years of operation and who may already be at increased risk for developing diseases, particularly cancers. The American Indian population of Cass Lake, which makes up 64% of the community, currently is experiencing an increased burden of cancers and diabetes.

5. Much uncertainty remains in understanding the immunotoxicity, reproductive and developmental toxicity of exposure to site chemicals. The lack of a surveillance system for monitoring birth outcomes, developmental disorders and autoimmune diseases prevents any valid measurement of these effects.

#### Public Comment Edition of Health Consultation

A draft version of this document was made available for public comment from January 1, 2006 until March 30, 2006. Seven comments from the public as well as comments from the International Paper Company were received. A summary of the comments and how they were addressed is included in this document as Appendix H.

## **VI. Recommendations**

1. To address the contamination at this site, a permanent remedy that is protective of human health and the environment is needed. The Cass Lake community and LLBO, together with EPA and Federal, State and local health officials should remain actively engaged in the EPA Superfund remedial investigation process to ensure that the Human Health Risk Assessment and Site remediation goals address their concerns. Protective policies for handling uncertainties in the data are needed.

a) EPA's site remediation goals should consider the unique status of the site as a homeland for the LLBO and ensure that all treaty rights are protected. This would mean that residential land use and traditional lifestyle scenarios must be used in the human and ecological health risk assessments. Also, the LLBO Hazardous Substance Control Act value of 10 ppt for dioxins in soil should be given careful consideration.

b) EPA's human health risk assessment should consider the unique vulnerabilities of the affected population, particularly the known excess burden of cancer and diabetes among American Indian residents, and ensure that site remediation goals are protective.

c) EPA's human health risk assessment should address the endocrine, reproductive and development effects of dioxin and ensure that site remediation goals are protective of children and future generations living on the site.

2. Residents should continue to avoid all contact with contaminated site soils >50 ppt dioxin as advised by MDH and LLBO until a final remedy is completed. Residents wishing to further reduce risks might avoid contact with soils above 20 ppt. Residents should seek medical care for

health problems as needed, and should describe any history of chemical exposure from the site to their physician.

## **VII. Health Action Plan**

1. The Cass Lake community, together with MDH, ATSDR and LLBO, should continue to provide or seek support for ongoing health education in the Cass Lake and LLBO community that has been impacted by the St. Regis site. Educational efforts should place special emphasis on: 1) understanding the health risks of site chemicals; 2) understanding and engaging in the EPA decision making process for site remedial action; 3) encouraging appropriate actions that community members can take to protect their health, including reducing exposure to dioxin; and 4) appropriate health care and support services that are available to the community.

2. The Cass Lake community, together with MDH, ATSDR and LLBO, should continue to provide or seek support for ongoing health professional education with those who serve the medical needs of the Cass Lake and LLBO community. These efforts should focus on: 1) providing physicians with the tools they need to provide patient education and risk information in response to patient concerns about their health and exposure to site chemicals; and 2) increasing the capacity of local health professionals and health educators to obtain additional support services that they identify as necessary to improving the health of the community. Additional support services that may be needed to address the concerns of the community, include:

- Minnesota Children with Special Needs Program (MCSN)
- Pregnancy Risk Assessment Monitoring Program (PRAM)
- March of Dimes
- MDH Diabetes Program
- MDH Cancer Prevention Program
- Mental Health support services
- Lupus Foundation

3. Future public health surveillance efforts should be focused on providing additional surveillance tools for assessing pregnancy and birth defects, reproductive and developmental disorders, and immune system disorders in the Minnesota population.

4. The population of the Leech Lake Band of Ojibwe places a unique value, rooted in Ojibwe culture and beliefs, on the protection of future generations and the health of their permanent homeland, the Leech Lake Ojibwe Reservation. Special needs of children and future generations should be the focus of interventions aimed at improving the health of the Cass Lake community, to reduce future cancer risk and disease burden.

5. Current exposures to residents living near the site may potentially include exposure to dioxin-contaminated soils, primarily through ingestion. This is particularly a concern for young children, who are known to ingest more soil than adults. Ongoing exposure to dioxin in soils may contribute a small incremental increase in lifetime risk of developing cancer. Residents have been advised to avoid all contact with soils with >50 ppt dioxin.

6. EPA, MDH, ATSDR and LLBO are currently reviewing the health risks and potential for ongoing exposure to site contaminants (dioxins and furans) through dermal exposure, and incidental ingestion of sediments, incidental ingestion of trace amounts in dust, and ingestion of contaminated drinking water, plants, fish and wild game. Multiple exposures through these pathways would contribute to overall lifetime exposure and cancer risk, and is a particular concern for Tribal members living a subsistence lifestyle. Any risk assessment undertaken should reflect these exposure pathways.

CERTIFICATION

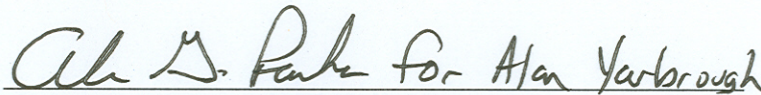
This St. Regis Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.



Alan Parham

Technical Project Officer, SPS, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.



Alan Yarbrough

Chief, State Program Section, CAPEB, DHAC, ATSDR

## References

- ATSDR, 1989. public health assessment, St. Regis Paper Company National Priorities List (NPL) Site, April 1989.
- ATSDR, 1993. St. Regis Site Review and Update (written by MDH). July 22, 1993.
- ATSDR. 1993. Pentachlorophenol Toxicity. Case Studies in Environmental Medicine. V. 23. Agency for Toxic Substances and Disease Registry.
- ATSDR 1994. Toxicological Profile for Pentachlorophenol. Agency for Toxic Substances and Disease Registry, May 1994.
- ATSDR, 1995. St. Regis Site Review and Update (written by MDH). March 29, 1995
- ATSDR. 1996. Toxicological Profile for Creosote. Agency for Toxic Substances and Disease Registry, August 1996.
- ATSDR. 1998. Toxicological Profile for Chlorinated Dibenzo-p-Dioxins. Agency for Toxic Substances and Disease Registry, December 1998.
- ATSDR. 2001. Tribal Exposures to Environmental Contaminants in Plants. Agency for Toxic Substances and Disease Registry, March 23, 2001.
- ATSDR/MDH/LLBO 2004. health consultation on Soils Final Release, St. Regis Paper Company, Agency for Toxic Substances and Disease Registry, August 2004.
- Baader EW and Bauer HJ. 1951 Industrial Intoxication Due to Pentachlorophenol. *Ind Med Surg.* 20(6): 286-90.
- Barr Engineering, 2004. Final Report, Unilateral Administrative Order Docket No: V-W-'03-L-748 For International Paper. January 2, 2004
- Begley J, Reichert EL, Rashad MN, Klemmer HW. 1977. Association between Renal Function Tests and Pentachlorophenol Exposure. *Clinical Toxicology* 11(1): 97-106.
- CDC, 2003. Second National Report on Human Exposure to Environmental Chemicals, NCEH Pub. No. 03-0022, January 2003.
- Cline, RE, Hill, RH, Phillips, DL, Needham, LL. 1989. Pentachlorophenol Measurements in Body Fluids of People in Log Homes and Workplaces. *Arch. Environ. Contam. Toxicol.* 18: 475-481.

Cramner, JM and Goldberg L. 1986. Human Aspects of Solvent Neurobehavioural Effects. Report of the Workshop Session On Clinical and Epidemiological Topics, Neurotoxicology. 7:43-56.

Daniel, V., Huber, W. Bauer, K., Suesal, C. Mytilineos, J., Melk, A. Conradt, C., Opelz, G. 2001. Association of Elevated Blood Levels of Pentachlorophenol (PP) with Cellular and Humoral Immunodeficiencies. Arch. Env. Health 56 (1): 77-83.

EPA. 2000. Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds. Part 1, Vol 3, pp 80-81. EPA/600/P-00/001Bc. September 2000.

EPA. 2001. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual. September 2001.

EPA Region 5. Data Evaluation Report for the St. Regis Paper Company Site, Cass Lake, Minnesota. August 23, 2002

Fortin, M., Gilbert, R, Besner, A, Labrecque, JF, Hebert, J. *Investigation of the Volatile Organic Substances that Cause the Characteristic Odor of Pentachlorophenol Treated Wood Utility Poles*, Environ Sci. Technol. 36:5014-5020. 2002.

Proudfoot, A., 2003. Pentachlorophenol Poisoning. Toxicol Rev. 22(1): 3-11

Gerhard, I, Frick, A., Monga, B. Runnebaum, B. 1999. Pentachlorophenol Exposure in Women with Gynecological and Endocrine Dysfunction. Environ. Research Section A 80, 383-388, Academic Press.

Gilbert, FI Jr., Minn, CE, Duncan, RC, Wilkinson, J. 1990. Effects of Pentachlorophenol and Other Chemical Preservatives on the Health of Wood-Treating Workers in Hawaii. Arch. Environ. Contam. Toxicol. 19:603-609.

Gorman, D, Monigatti, J, Glass, B, Gronwall, D, Beaseley, M. 2001. Assessment of Pentachlorophenol-exposed Timber Workers Using A Test-of-Poisoning Model. Int. J Occup Environ Health. 7: 189-194.

Great Lakes Epicenter, 2001. A Community Health Profile of Minnesota, Wisconsin, and Michigan Tribal Communities. Report from Great Lakes Inter-Tribal Council, Inc., Lac du Flambeau, WI.

Heikkila PR, Hameila M, Pyy L, Raunu P. 1987. Exposure to Creosote in the Impregnation and Handling of Impregnated Wood. Scand. J Work Environ Health 13:431-437.

Hulster, A., Muller, J., Marschner, H., 1994, Soil - Plant Transfer of Polychlorinated Dibenzo-p-dioxin and Dibenzofurans to Vegetables of the Cucumber Family (Cucurbitaceae). Environ. Sci. Technol 28. 1110-1115.

Integral, 2005, Human Health and Ecological Risk Assessment, St. Regis Paper Company Site, Cass Lake, MN. Prepared by Integral Consulting, Inc. for International Paper pursuant to Unilateral Administrative Order Docket No. V-W-04-C-1076. Draft submitted to US EPA November 16, 2005.

Jorens PG, Janssens JJ, Van Tichelen WI, Van Paesschen W, De Deyn PP, Schepens PJC. 1991. Pentachlorophenol Concentrations in Cerebrospinal Fluid. *Neurotoxicology*. 12:108

Jorens, PG, Schepens, PJC, 1993. Human Pentachlorophenol Poisoning. *Human & Experimental Toxicology* 12:479-495.

Klemmer HW, Wong L, Sato MM, Reichert EL, Korsak RJ, Rashad MN. 1980. Clinical Findings in Workers Exposed to Pentachlorophenol. *Arch Environ Contam Toxicol*. 9(6): 715-25.

Koopman-Esseboom C, Morse DC, Weisglas-Kuperus N, Lutkeschipholt IJ, Van der Paauw CG, Tuinstra LGMT, Brouwer A, Sauer PJJ. 1994. Effects of Dioxins and Polychlorinated Biphenyls on Thyroid Hormone Status of Pregnant Women and Their Infants. *Pediatric Research* 36 (4): 468-473.

Lambert J, Schepens P, Janssens J, Dockx P. 1986. Skin Lesions as a Sign of Subacute Pentachlorophenol Intoxication. *Aca Derm Veneriol (Stockh)*. 66:170-172.

MDH. 2003a. Memo to the Minnesota Pollution Control Agency, March 17, 2003: Methods for Estimating the Carcinogenic Health Risks from Dioxin-Like Compounds ([www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo.html](http://www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo.html))

MDH, 2003b. Review of Birth Defect Data Sets and Their Usefulness. Report of the Environmental Impacts Analysis Unit, Minnesota Department of Health, St. Paul, MN.

MDH 2005. Cancer in Minnesota, 1988-2002. Report to the Minnesota Legislature 2005. Minnesota Cancer Surveillance System, Minnesota Department of Health, St. Paul, MN.

MPCA, 2005. Douglas, David. Memo: Preliminary Remediation Goals for the West Area of the Joslyn Manufacturing and Supply Company Superfund Site.

MPCA. 2006. Risk-Based Guidance for the Soil. Tier 1 (Screening) and Tier 2 (Industrial Scenario) Risk Evaluation (September, 2006) accessed on June 11, 2007 at [www.pca.state.mn.us/publications/risk-tier1srv.xls](http://www.pca.state.mn.us/publications/risk-tier1srv.xls) and [www.pca.state.mn.us/publications/risk-tier2srv.xls](http://www.pca.state.mn.us/publications/risk-tier2srv.xls).

O'Malley MA, Carpenter AV, Sweeney MH, Fingerhut MA, Marlow DA, Halperin WE, Mathias CG. 1990. Chloracne Associated with Employment in the Production of Pentachlorophenol. *Am J Ind Med* 17:411-421.



Pluim HJ, Koppe JG, Olie K, Van der Slikke JW, Slot PC, Van Boxtel CJ. 1994. Clinical Laboratory Manifestations of Exposure to Background Levels of Dioxins in the Perinatal Period. *Acta Paediatr* 83:583-7.

Tepper A, Burt S, Piacitelli L, Patterson DG Jr. 1997. Coplanar PCBs and the Relative Contribution of Coplanar PCBs, PCDDs, and PCDFs to the Total 2,3,7,8-TCDD Toxicity Equivalents in Human Serum. *Chemosphere* 35(3):503-11.

Walls, CB, Glass, WI, Pearce NE, 1998. Health Effects of Occupational Pentachlorophenol Exposure in Timber Sawmill Employees: A Preliminary Study. *NZ Med. J* 11:362-4.

Weisglas-Kuperus N, Sas T, Koopman-Esseboom C, Van der Zwan CW, De Ridder MAJ, Beishuizen A, Hooijkaas H, Sauer PJJ. 1995. Immunologic Effects of Background Prenatal and Postnatal Exposure to Dioxin and Polychlorinated Biphenyls in Dutch Infants. *Pediatr Res* 38:404-410.

Williams, PL, 1982. Pentachlorophenol, An Assessment of the Occupational Hazard. *Am. Ind. Hyg. Assoc. J.* 43 (11); 799-810.

Wood, S., Rom, WN, White, GL Jr., Logan, DC, 1983, Pentachlorophenol Poisoning. *J of Occup. Med.* 25 (7): 527-530.

**Preparers of Report:**

Jean Johnson, Ph.D.  
Epidemiologist  
Chronic Disease and Environmental Epidemiology  
Minnesota Department of Health  
(651) 201-5902  
[jean.johnson@health.state.mn.us](mailto:jean.johnson@health.state.mn.us)

Tannie Eshenaur, M.P.H.  
Health Educator  
Site Assessment and Consultation Unit  
Minnesota Department of Health  
(651) 201-4873  
[tannie.eshenaur@health.state.mn.us](mailto:tannie.eshenaur@health.state.mn.us)

John Soler, M.S.  
Epidemiologist, Minnesota Cancer Surveillance System  
Chronic Disease and Environmental Epidemiology  
Minnesota Department of Health  
(651) 201-  
[john.soler@health.state.mn.us](mailto:john.soler@health.state.mn.us)

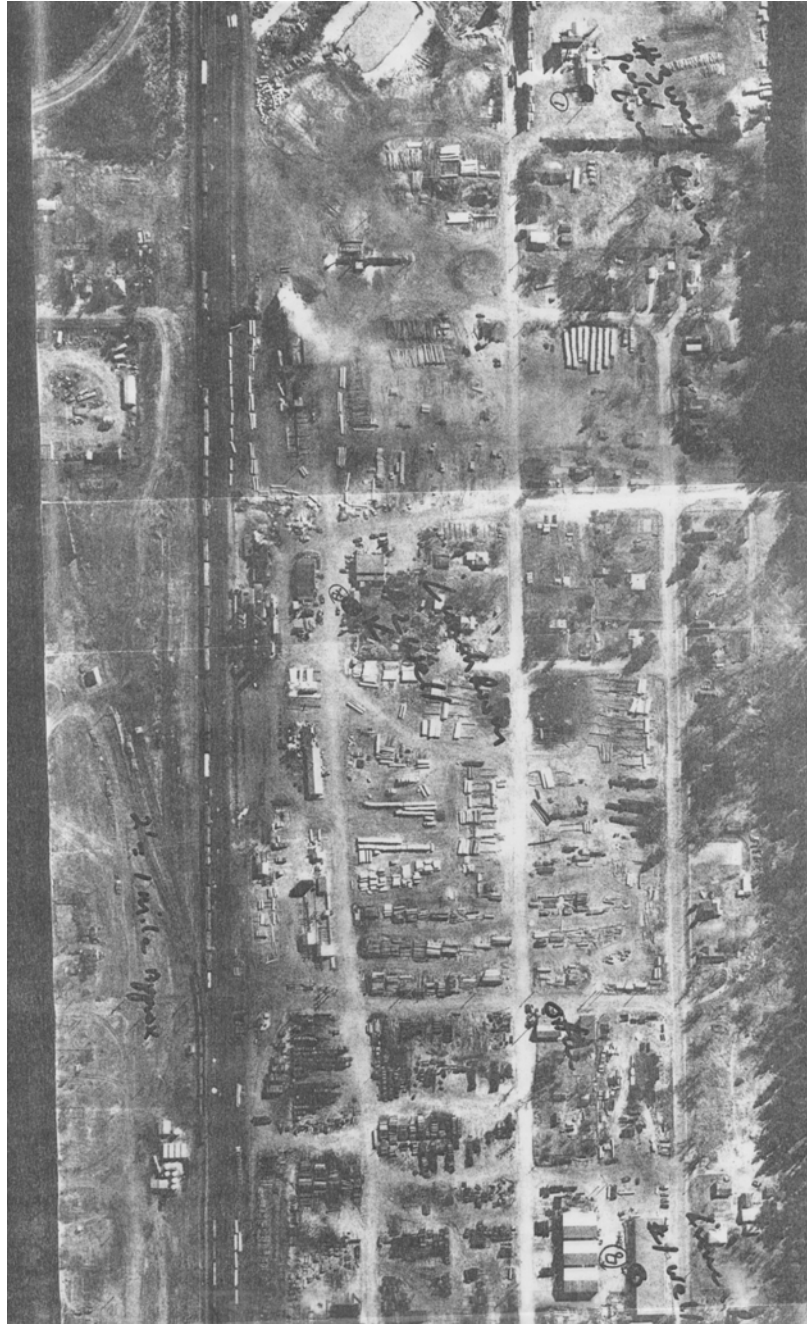
Shirley Nordrum  
Environmental Director  
Division of Resource Management  
Leech Lake Band Of Ojibwe  
(218) 335-7417  
[lldrm@paulbunyan.net](mailto:lldrm@paulbunyan.net)

Figure 1. St. Regis Superfund Site Map

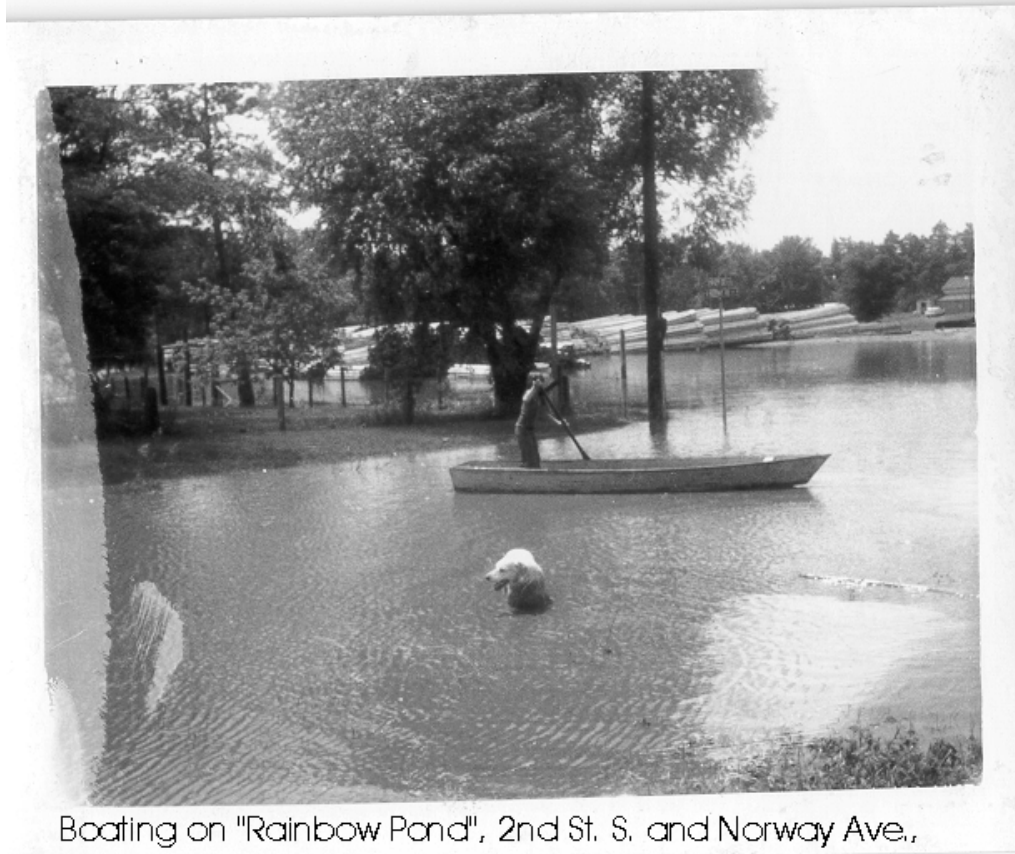


Figure 1 Site Map

**Figure 2. Historical Aerial Site Photograph of Site Operations**



**Figure 3. Historical Site Photograph of “Rainbow Pond” (1960s)**

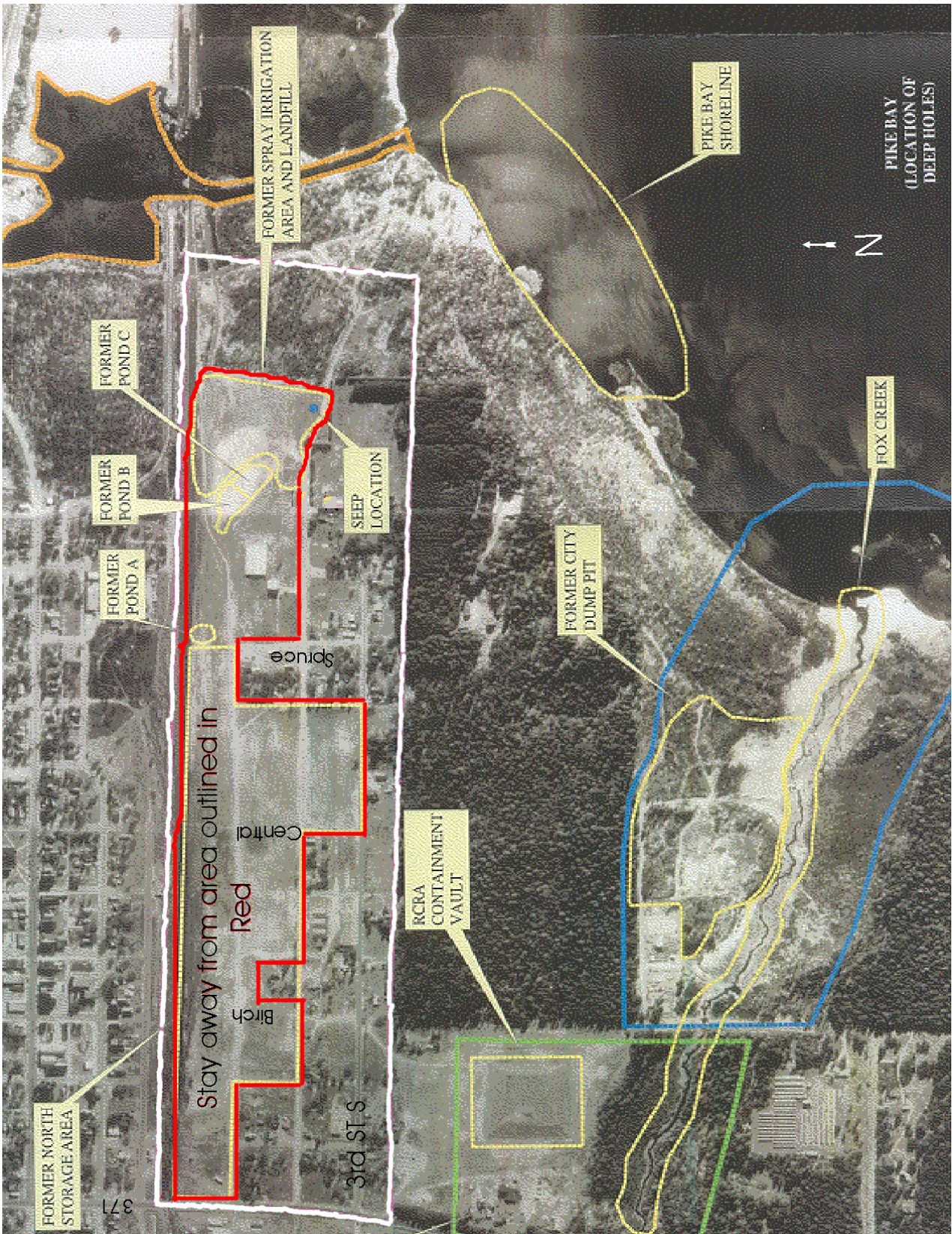


Boating on "Rainbow Pond", 2nd St. S. and Norway Ave.,  
Cass Lake, MN, 1960's. (Photo by Permission.)

**Figure 4. Area of former “Rainbow Pond” following EPA Soil Removal, July 2004.**



Figure 5. Map to Residents Showing Area of Contamination



**Appendix A. MDH/ATSDR/LLBO Letter to Residents and Factsheet**





## DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances  
and Disease Registry

Atlanta, GA 30333

February 21, 2003

NAME

ADDRESS

Cass Lake, MN 56633

RE: Property at ADDRESS

Dear NAME:

This letter provides you with important health information. Please read this letter carefully. Federal, tribal, state and local agencies are working together to protect the health of your family, but we need your help. **We strongly recommend that everyone stay away from the areas where St. Regis/Wheeler used to treat wood as outlined in red on the enclosed map.**

In October 2001, the U.S. Environmental Protection Agency (EPA) took soil samples from properties south of the railroad tracks in Cass Lake. The area where the soil samples were taken is outlined in white on the map. Based on the soil sample results, we recommend that residents living in the area outlined in white limit their contact with the soil. **The enclosed Environmental Health Information sheet lists some tips for limiting contact with dirt and dust that may contain dangerous chemicals.** We recommend you follow these tips to make sure your family and friends are safe.

### **What's the Problem?**

St. Regis/Wheeler used hazardous chemicals to treat railroad ties and telephone poles. Some of these chemicals spread to soil, groundwater, streams and lakes on or near the site. Some cleanup was done at the site in 1985. The EPA soil sampling is part of a five-year review of the site. Five-year reviews are done to determine whether the cleanup is protective of human health and the environment and what other cleanup may still be needed. The soil sample results indicate that more study needs to be done.

We are especially concerned about two groups of chemicals called dioxins and furans. These substances can cause health effects, depending on how long or how much of the chemical comes in contact with a person. Scientists refer to the "how long" and "how much" factors as **exposure**. Exposure can happen when people touch, breathe or swallow contaminated dirt and dust.

Even when a chemical is present in the soil, people may not come in contact with it. If there is no contact with the contaminated soil, people have not been exposed. When there is contact with the contaminated soil, it could affect some people more than others. Unborn children, young children, elders and those with compromised immune systems may be more affected by chemical exposure.

The amount of dioxins and furans found in many of the soil samples in the neighborhood are a health concern for people who are exposed over a long period of time. Also, dioxins and furans were found in higher amounts in samples taken in the neighborhood than from samples taken at other places not affected by the St. Regis/Wheeler plant.

### **What Happens Next?**

These first soil samples do not tell us everything we need to know. More study needs to be done to understand the extent of the pollution in your area. Fixing the problems may take a long time. Federal, tribal, state and local officials are looking at ways to solve the problems with the chemicals.

**The EPA is hosting a public meeting on Wednesday, February 26, at the Jack Kimball Post 284 American Legion Hall at 217 Second Street NW in Cass Lake. There will be an informal open house from 1-4 p.m. and a public meeting with presentations from 7-9 p.m.** We hope you will plan to come and meet with us about your concerns and questions.

Sincerely,

Shirley Nordrum  
Division of Resource Management, Leech Lake Band

Mark D. Johnson  
U.S. Agency for Toxic Substances and Disease Registry

Rita B. Messing  
Minnesota Department of Health

#### **Names and Telephone Numbers for More Information**

**Linda Kern, US Environmental Protection Agency**

1 (800) 621-8431, ext. 67341

**Don de Blasio, US Environmental Protection Agency**

1 (800) 621-8431, ext. 64360

**Shirley Nordrum, Leech Lake Band Resource Management**

1 (800) 442-3942

**Tannie Eshenaur, Minnesota Department of Health**

1 (800) 657-3908, press 0

**Clayton G. Koher, US Agency for Toxic Substances and Disease Registry**

1 (800) 621-8431 ext. 3-6086



# Environmental Health Information

---

## Reducing Your Contact with Contaminated Soils

### **How can you be exposed to contaminants in soil?**

You can be exposed by breathing contaminated dust, swallowing or touching contaminated soil, or eating food that may have contaminated soil on it. Children who live and play in a contaminated area can have more exposure than adults. Preschool-age children are more likely to be exposed because of their frequent hand to mouth activity. Dust from contaminated soil can be tracked into the house on shoes and can end up on indoor surfaces and toys.

### **What can you do to prevent or reduce contact with contaminants?**

#### *Keep hands clean.*

- \* Wash children's hands and faces frequently, especially before eating and bedtime. Keep their fingernails short and clean. Frequently clean toys or objects that children put in their mouths.
- \* Adults should wash their hands before feeding their children, smoking, eating or drinking.

#### *Try to keep soil dust out of the house.*

- \* Take off your shoes when you enter your home to prevent tracking contaminated soil inside. Store outdoor shoes at entryways. Remember that pets can carry in soil dust on their paws.
- \* Vacuum carpeting, rugs and upholstery often. Regular vacuuming will keep dust from accumulating.
- \* Dust often with a damp cloth.
- \* Scrub tile and linoleum floors and wash windowsills.
- \* Keep windows closed on windy days, at least on the windward side of the house. This will keep dust from blowing inside.
- \* Wash gardening gloves and clothes separately from family clothes.
- \* Change the furnace filter every 3 months.

*Reduce outdoor activities that stir up dust.*

- \* Eliminate patches of bare soil. Bushes and grass help keep soil in place and reduce the amount of dust in the air. Seed or sod bare areas in your yard.
- \* Minimize mowing over areas of sparse lawn during periods of dry weather.
- \* Avoid dirt biking, mountain biking, ATV use or any other recreational activities that disturb the soil on the site.
- \* Avoid digging or disturbing soil. If it cannot be avoided, keep the soil moist to reduce making dust.

*Take special care when gardening or harvesting*

- \* Use gardening gloves (leather is better than cloth) when gardening to keep contaminated dust out from under fingernails and limit possible hand to mouth exposure.
- \* Keep garden tools and gloves in one area of the garage or shed.
- \* Periodically rinse tools off.
- \* All plants used for traditional or cultural purposes should be rinsed off carefully, even if they will not be used as food.
- \* Use the same tips when harvesting wild vegetation on the site (use gloves and rinse tools).

*Give children a safe play area.*

- \* Build a sandbox with a bottom and fill it with clean sand. Cover it when not in use to keep contaminated dust out.
- \* Find other places for children to play.

*Prepare food carefully to reduce the amount of contaminants.*

- \* Thoroughly wash and peel all home-grown vegetables before eating or cooking them. Or, if possible, grow vegetables in a raised garden bed filled with clean soil.
- \* Rinse the dust off of wild vegetation carefully before using.



**Appendix B. ATSDR Public Health Statements for Creosote,  
Pentachlorophenol, and Dioxin**

This fact sheet answers the most frequently asked health questions (FAQs) about creosote. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS: Creosote is a mixture of many chemicals. Eating food or drinking water with high levels of creosote may cause burning in the mouth and throat, and stomach pain. Long-term contact with creosote has been associated with increased risk of contracting cancer. Creosote has been found in at least 46 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What is creosote?

Creosote is the name used for a variety of products: wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles. These products are mixtures of many chemicals created by burning of beech and other woods, coal, or from the resin of the creosote bush.

Wood creosote is a colorless to yellowish greasy liquid with a smoky odor and burned taste. Coal tar creosote is a thick, oily liquid typically amber to black in color. Coal tar and coal tar pitch are usually thick, black, or dark-brown liquids or semi-solids, with a smoky odor.

Wood creosote has been used as a disinfectant, a laxative, and a cough treatment, but has since been replaced by better medicines. Coal tar products are used in medicines to treat skin diseases such as psoriasis, and also as animal and bird repellents, insecticides, animal dips, and fungicides. Coal tar creosote is the most widely used wood preservative in the United States. Coal tar, coal tar pitch, and coal tar pitch volatiles are used for roofing, aluminum smelting, and coking.

### What happens to creosote when it enters the environment?

- Coal tar creosote is released to water and soil mainly as a result of its use in the wood preservation industry.
- Components of creosote that do not dissolve in water will remain in place in a tar-like mass.
- Some components of coal tar creosote dissolve in water and may move through the soil to groundwater.

- Once in groundwater, it may take years for it to break down.
- Coal tar creosote can build up in plants and animals.
- We do not know what happens to wood creosote when it enters the environment.

### How might I be exposed to creosote?

- Using products that contain creosote to improve skin problems such as eczema or psoriasis.
- Eating herbal remedies containing the leaves from the creosote bush, which are sold as dietary supplements.
- Working in the wood preservative, coke-producing, or asphalt industries.
- Using creosote-treated wood in building fences, bridges, or railroad tracks, or installing telephone poles.
- Living in treated-wood houses that may result in air or skin contact with creosote.
- Drinking water contaminated by a hazardous waste site.

### How can creosote affect my health?

Eating food or drinking water contaminated with high levels of creosotes may cause a burning in the mouth and throat, and stomach pains. Taking large amounts of herbal remedies containing creosote bush leaves may cause damage to the liver or kidney.

Brief direct contact with large amounts of coal tar creosote may result in a rash or severe irritation of the skin, chemical burns of the surfaces of the eyes, convulsions and mental confusion, kidney or liver problems, unconsciousness, and even death. Longer direct skin contact with low levels of

ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>

creosote mixtures or their vapors can result in increased light sensitivity, damage to the cornea, and skin damage. Longer exposure to creosote vapors can cause irritation of the respiratory tract.

### How likely is creosote to cause cancer?

Long-term exposure to low levels of creosote, especially direct contact with the skin during wood treatment or manufacture of coal tar creosote-treated products, has resulted in skin cancer and cancer of the scrotum. Cancer of the scrotum in chimney sweeps has been associated with long-term skin exposure to soot and coal tar creosotes. Animal studies have also shown skin cancer from skin exposure to coal tar products.

The International Agency for Research on Cancer (IARC) has determined that coal tar is carcinogenic to humans and that creosote is probably carcinogenic to humans. The EPA has determined that coal tar creosote is a probable human carcinogen.

### How can creosote affect children?

There is no unique exposure pathway of children to creosote. Children exposed to creosote will probably experience the same health effects seen in adults exposed to creosote. Children who played on soil contaminated with creosote had more skin rashes than children who played in uncontaminated areas. We do not know whether children differ from adults in their susceptibility to health effects from creosote.

Studies in animals have shown birth defects in the young of mothers exposed to high levels of creosote during pregnancy, but we do not know whether the same effects would occur in humans. Some animal studies indicate that creosotes may cross the placenta and reach the fetus. Because chemical components (PAHs, cresol, phenols) of coal tar creosote may be stored in body fat, they may be found in breast milk and could pass to nursing infants.

### How can families reduce the risk of exposure to creosote?

- If you live in a residential area that used to have a wood preservation facility or gas manufacturing plant nearby, wear long-sleeved shirts and long pants when working or playing outside and avoid using water contaminated with creosote.
- Instruct children not to come in contact with creosote-treated wood when playing on or near railroad tracks, in ditches close to utility poles, in old barns or other farm structures, or on bridges or piers.
- Avoid using herbal remedies containing the leaves of the creosote bush and seek alternatives to skin remedies containing creosote.
- If you are exposed to creosote in the workplace, make sure you do not carry the chemical home in your clothing, skin, hair, tools, or other objects from the workplace (shower before going home).

### Is there a medical test to show whether I've been exposed to creosote?

There is no medical test to determine if you have been exposed to creosote. Some components of creosote mixtures can be measured in body tissues, urine, or blood after exposure to creosote. These tests cannot tell whether harmful health effects will occur. The tests are not routinely available at the doctor's office because they require special equipment.

### Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.2 milligrams of coal tar pitch volatiles per cubic meter of air (0.2 mg/m<sup>3</sup>) in workplace air during an 8-hour day, 40-hour workweek.

### References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Creosote (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about chlorinated dibenzo-p-dioxins (CDDs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS: Exposure to chlorinated dibenzo-p-dioxins (CDDs) (75 chemicals) occurs mainly from eating food that contains the chemicals. One chemical in this group, 2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD, has been shown to be very toxic in animal studies. It causes effects on the skin and may cause cancer in people. This chemical has been found in at least 91 of 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What are CDDs?

CDDs are a family of 75 chemically related compounds commonly known as chlorinated dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied.

In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

CDDs are not intentionally manufactured by industry except for research purposes. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

### What happens to CDDs when they enter the environment?

- When released into the air, some CDDs may be transported long distances, even around the globe.

- When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water.
- CDD concentrations may build up in the food chain, resulting in measurable levels in animals.

### How might I be exposed to CDDs?

- Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.
- Breathing low levels in air and drinking low levels in water.
- Skin contact with certain pesticides and herbicides.
- Living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs.
- Working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

### How can CDDs affect my health?

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, dis-



ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>

coloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Some animal species exposed to CDDs during pregnancy had miscarriages and the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

### How likely are CDDs to cause cancer?

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD.

The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen.

The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

### How can CDDs affect children?

Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. We don't know if CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

### How can families reduce the risk of exposure to CDDs?

- Children should avoid playing in soils near uncontrolled hazardous waste sites.
- Discourage children from eating dirt or putting toys or other objects in their mouths.
- Everyone should wash hands frequently if playing or working near uncontrolled hazardous waste sites.
- For new mothers and young children, restrict eating foods from the proximity of uncontrolled sites with known CDDs.

### Is there a medical test to show whether I've been exposed to CDDs?

Tests are available to measure CDD levels in body fat, blood, and breast milk, but these tests are not routinely available. Most people have low levels of CDDs in their body fat and blood, and levels considerably above these levels indicate past exposure to above-normal levels of 2,3,7,8-TCDD. Although CDDs stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

### Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 µg/L). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The Food and Drug Administration (FDA) recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt).

### References

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological profile for chlorinated dibenzo-p-dioxins. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about pentachlorophenol. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Pentachlorophenol is a manufactured chemical which is a restricted use pesticide and is used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings. Exposure to high levels of pentachlorophenol can cause increases in body temperature, liver effects, damage to the immune system, reproductive effects, and developmental effects. This substance has been found in at least 313 of the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA).

### What is pentachlorophenol?

Pentachlorophenol is a manufactured chemical that does not occur naturally. Pure pentachlorophenol exists as colorless crystals. Impure pentachlorophenol (the form usually found at hazardous waste sites) is dark gray to brown and exists as dust, beads, or flakes. Humans are usually exposed to impure pentachlorophenol (also called technical grade pentachlorophenol).

Pentachlorophenol was widely used as a pesticide and wood preservative. Since 1984, the purchase and use of pentachlorophenol has been restricted to certified applicators. It is no longer available to the general public. It is still used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings.

### What happens to pentachlorophenol when it enters the environment?

- Pentachlorophenol can be found in the air, water, and soil. It enters the environment through evaporation from treated wood surfaces, industrial spills, and disposal at uncontrolled hazardous waste sites.
- Pentachlorophenol is broken down by sunlight, other chemicals, and microorganisms to other chemicals within a couple of days to months.
- Pentachlorophenol is found in fish and other foods, but tissue levels are usually low.

### How might I be exposed to pentachlorophenol?

- The general populations can be exposed to very low levels of pentachlorophenol in contaminated indoor and outdoor air, food, drinking water and soil.
- People who work or live near a wood treatment facility or in the production of utility poles, railroad ties, or wharf pilings may be exposed to pentachlorophenol in the air or by coming in contact with the treated wood.
- People living near hazardous waste sites may also be exposed to higher than usual levels of pentachlorophenol.

### How can pentachlorophenol affect my health?

Studies in workers show that exposure to high levels of pentachlorophenol can cause the cells in the body to produce excess heat. When this occurs, a person may experience a very high fever, profuse sweating, and difficulty breathing. The body temperature can increase to dangerous levels, causing injury to various organs and tissues, and even death. Liver effects and damage to the immune system have also been observed in humans exposed to high levels of pentachlorophenol for a long time. Damage to the thyroid and reproductive system has been observed in laboratory animals exposed to high doses of pentachlorophenol. Some of the harmful effects of pentachlorophenol are caused by the other chemicals present in technical grade pentachlorophenol.

ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>

**How likely is pentachlorophenol to cause cancer?**

Some studies have found an increase in cancer risk in workers exposed to high levels of technical grade pentachlorophenol for a long time, but other studies have not found this. Increases in liver, adrenal gland, and nasal tumors have been found in laboratory animals exposed to high doses of pentachlorophenol.

The EPA has determined that pentachlorophenol is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it possibly carcinogenic to humans.

**How can pentachlorophenol affect children?**

Infants who were exposed to diapers and bedding which was accidentally contaminated with pentachlorophenol had high fevers, a large amount of sweating, difficulty breathing, and harmful effects on the nervous system and liver, and some died. Although these effects are similar to effects seen in adults exposed to pentachlorophenol, we do not know whether children and adults differ in their susceptibility to pentachlorophenol.

We do not know if exposure to pentachlorophenol will result in birth defects or other developmental effects in people. Death, low body weights, decreased growth, and skeletal effects have been observed in laboratory animals exposed to high levels of pentachlorophenol during development.

**How can families reduce the risk of exposure to pentachlorophenol?**

Pentachlorophenol was a widely used pesticide for a long time. Today its use is restricted and it can only be used by certified applicators. You may have old containers of pesticides in your attic, basement, or garage that contain pentachlorophenol. Removing these old containers will reduce your family's risk of exposure to pentachlorophenol.

If you live near utility poles and railroad tracks, you should prevent your children from playing, climbing, or sitting on

them especially in the hot summer months.

Though pentachlorophenol has been found in some food, its levels are low. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.

Children should avoid playing in soils near hazardous waste sites where pentachlorophenol may have been discarded.

**Is there a medical test to show whether I've been exposed to pentachlorophenol?**

Tests are available to measure pentachlorophenol and its breakdown product in blood, urine, and body tissues. These tests cannot be performed in the doctor's office because they require the use of special equipment. Because pentachlorophenol leaves the body fairly quickly, these tests are best for finding exposures that occurred within the last several days. These tests do not tell you how much pentachlorophenol you have been exposed to and cannot be used to predict the occurrence, nature, or severity of toxic effects.

**Has the federal government made recommendations to protect human health?**

The EPA has set a limit for drinking water of 1 part of pentachlorophenol per billion parts of water (1 ppb).

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.5 milligrams of pentachlorophenol per cubic meter of workplace air (0.5 mg/m<sup>3</sup>) for 8 hour shifts and 40 hour work weeks.

**References**

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Toxicological Profile for Pentachlorophenol Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



## **Appendix C: Health Information Resources**

## Health Information Resources for St. Regis Health Concerns HC

Health Information Resource	What You Will Find
Agency for Toxic Substances and Disease Registry (ATSDR) Center for Disease Control Atlanta, Georgia Toll free: 888-422-8737 Website: <a href="http://www.atsdr.cdc.gov">www.atsdr.cdc.gov</a>	ATSDR advises the EPA on health issues at hazardous waste sites. This web site provides information about health effects of toxic materials, lists hazardous waste sites by state and by contaminant, and site investigation documents (public health assessments).
American Cancer Society (Minneapolis chapter) 3316 W. 66 <sup>th</sup> St. Minneapolis, MN 55435 Phone: (952) 925-2772 Web site: <a href="http://www.cancer.org">http://www.cancer.org</a>	The American Cancer Society web site provides information about cancer, treatment options, and coping strategies. You can connect with others who have had cancer. You can also learn about local resources, including support groups and referral services.
American Liver Foundation 1500 McAndrews Road West Suite 214 Burnsville, MN 55337 (952) 892-8441 Fax: (952) 892-8442 Email: <a href="mailto:anelson@liverfoundation.org">anelson@liverfoundation.org</a> Web site: <a href="http://www.liverfoundation.org">www.liverfoundation.org</a>	The American Liver Foundation (ALF) is a national, nonprofit organization dedicated to the prevention, treatment, and cure of hepatitis and other liver diseases through research, education, and advocacy. ALF provides information and materials, a national HelpLine, physician referrals, outreach programs, and an extensive grants program.
American Lung Association of Minnesota State headquarters: 490 Concordia Avenue St. Paul, MN 55103-2441 651-227-8014 Toll free: 800-642-LUNG Fax: 651-227-5459  Northeast Branch: 424 W. Superior St., Suite 203 Duluth, MN 55802 218-726-4721 E-mail: <a href="mailto:info@alamn.org">info@alamn.org</a>  Web site: <a href="http://www.alamn.org">www.alamn.org</a>	The American Lung Association of Minnesota provides answers to questions regarding lung health, including lung cancer, asthma, allergies, and environmental health. Questions can be answered on the phone, the web site, or through mailed educational resources (available in several languages).

---

American Skin Association (ASA)  
346 Park Ave. S, 4th Floor  
New York, NY 10010  
Phone: 212-889-4858  
or toll free: 800-499-SKIN  
Fax: 212-889-4959  
email: [info@americanskin.org](mailto:info@americanskin.org)  
Web site: [www.americanskin.org](http://www.americanskin.org)

The American Skin Association is an organization dedicated to supporting research on skin diseases. It promotes public education on preventative treatments and the cure of skin disorders. The web site lists informational brochures available to the public as well as information and updates on skin diseases.

---

Anxiety Disorders Association of America  
8730 Georgia Avenue, Suite 600  
Silver Spring, MD 20910, USA  
Main # (240) 485-1001  
Fax # (240) 485-1035  
Web site:  
<http://www.adaa.org/aboutADAA/index.cfm>

The ADAA promotes the early diagnosis, treatment and cure of anxiety disorders, and is committed to improving the lives of the people who suffer from them. The web site provides educational information on anxiety disorders, lists self-help groups in your area, and provides information on cost-effective treatments for anxiety disorders.

---

The Cancer Center at the University of Minnesota  
Mayo Mail Code 806  
420 Delaware Street S.E.  
Minneapolis, MN 55455  
612-626-5456  
Fax: 612-626-5135  
  
Information Line: 1-888-CANCER MN  
(1-888-226-2376) or (612) 624-2620  
Web site: [www.cancer.umn.edu](http://www.cancer.umn.edu)

The Cancer Center at the University of Minnesota strives to advance knowledge about the causes, prevention, detection, and treatment of cancer. They provide information for the public on what cancer is, how to prevent cancer, and how to cope with living with cancer. The web site includes a list of current clinical trials being conducted for cancer research.

---

Centers for Disease Control and Prevention (CDC)  
1600 Clifton Rd.  
Atlanta, GA 30333  
Phone: (404) 639-3311  
(800) 311-3435  
Web site: <http://www.cdc.gov>

The CDC is the main federal agency in the U.S. that aims to protect the health and safety of people. The CDC website provides information on a wide range of health topics including environmental health and disease prevention. There is a health index on their web site to look up information on a specific health topic.

---

---

Leukemia and Lymphoma Society, Minnesota  
Chapter  
5217 Wayzata Boulevard, Suite 221  
St. Louis Park, MN 55416  
Phone: (951) 545-3309  
(800)-220-4440  
FAX: (952) 545-5926  
Information Resource Center:  
(800)-955-4572  
Email: [brovoldk@mn.leukemia-lymphoma.org](mailto:brovoldk@mn.leukemia-lymphoma.org)  
National web site: [www.leukemia-lymphoma.org](http://www.leukemia-lymphoma.org)

The Leukemia & Lymphoma Society is a voluntary health organization that is dedicated to funding blood cancer research, education and patient services. The Society's mission is to cure leukemia, lymphoma, Hodgkin's disease and myeloma, and to improve the quality of life of patients and their families. The chapter serves patients and families in Minnesota, North Dakota and South Dakota and offers Family Support Groups and First Connection, a peer-to-peer support program.

---

The Lupus Foundation of Minnesota  
The Atrium, Suite 135  
2626 East 82<sup>nd</sup> Street  
Bloomington, MN 55425  
952.746.5151  
1.800.645.1131  
Email: [Mnlupus@aol.com](mailto:Mnlupus@aol.com)  
Web site: [www.lupusmn.org](http://www.lupusmn.org)

The Lupus Foundation of Minnesota provides educational materials; offers a source of hope, strength, empowerment and comfort; and supports research focused on finding the cause of and cure for lupus. The web site provides general information about lupus, lists different support services available, and gives updates on events in your area that help to spread knowledge and awareness about lupus.

---

March of Dimes, Minnesota Chapter  
Central Division, Minnesota Chapter  
5233 Edina Industrial Boulevard  
Edina, MN 55439  
951.835.3033

Northland Division, Minnesota Chapter  
130 West Superior Street, #100  
Duluth, MN 55802  
218.727.1318

The mission of the March of Dimes is to improve the health of babies by preventing birth defects and infant mortality. They offer information on pregnancy and caring for your baby as well as updates on the latest research and legislative initiatives in your area.

Web site: [www.modimesmn.org](http://www.modimesmn.org)

---

---

Mental Health Association of Minnesota  
2021 East Hennepin Avenue, Suite 412  
Minneapolis, MN 55413-2726  
Phone: 612-331-6840  
Toll free: 1-800-862-1799  
Fax: 612-331-1630

205 West Second Street  
Arrowhead Place, Suite 412  
Duluth, MN 55802  
Phone: 218-726-0793  
Fax: 218-727-1468  
Email: [info@mentalhealthmn.org](mailto:info@mentalhealthmn.org)  
Web site: [www.mentalhealthmn.org](http://www.mentalhealthmn.org)

The Mental Health Association of Minnesota helps individuals find access to services, or problem-solve a situation, on a one-to-one basis. They offer community support referrals, education materials, workshops, and family support groups for those with mental illness, including depression, bipolar disorder, schizophrenia, obsessive-compulsive disorder, post-traumatic stress disorder, social phobia, generalized anxiety disorder, and postpartum depression.

---

Minneapolis Heart Institute Foundation  
920 East 28th Street, Suite 100  
Minneapolis, MN 55407  
(612) 863-3833 or (877) 800-2729  
Fax: 612-863-3801  
HeartLine: a free telephone information line at 888/245-6300 or locally at 612/863-3794.  
Web site: [www.mplsheartfoundation.org](http://www.mplsheartfoundation.org)

The Minneapolis Heart Institute Foundation seeks to improve cardiovascular health through education and clinical research. The web site provides information on heart disease, resources such as smoking cessation programs, an interactive page for kids, and upcoming community education programs.

---

Minnesota Department of Health, Environmental Health Division  
121 E 7th Pl  
Saint Paul, MN  
Phone: (651) 215-0700  
Web site:  
<http://www.health.state.mn.us/divs/eh/index.html>

The Minnesota Department of Health, Environmental Health Division provides information on a wide array of environmental health issues, including water quality, food safety, indoor air quality, ground water quality and hazardous sites.

---

Minnesota Pollution Control Agency (MPCA)  
520 Lafayette Rd  
Saint Paul, MN  
Phone: (651) 297-2274  
Web site: <http://www.pca.state.mn.us/>

The purpose of the Minnesota Pollution Control Agency (MPCA) is to protect Minnesota's environment through monitoring environmental quality and enforcing environmental regulations. The web site provides information on air and water quality, waste disposal, and cleanup of spills, leaks, and hazardous materials.

---



---

National Heart, Lung and Blood Institute  
(National Institutes of Health)  
NHLBI Health Information Center  
Attention: web site  
P.O. Box 30105  
Bethesda, MD 20824-0105  
Phone: (301) 592-8573  
Fax: (301) 592-8563  
Web site: <http://www.nhlbi.nih.gov/index.htm>

The NHLBI conducts educational activities, including development of materials with information on heart, lung and blood diseases. The web site provides a wide variety of health information on heart, lung, and blood diseases. There is an index of health issues so that you can look up a specific health topic.

---

National Cancer Institute (National Institutes of Health)  
NCI Public Inquiries Office  
6116 Executive Boulevard  
Room 3036A  
Bethesda, MD 20892-8322  
Web site: <http://www.cancer.gov>

The NCI coordinates the National Cancer Program, which supports research, training and health information dissemination to the public. The web site provides information on all different types of cancer and the risk factors for each type of cancer.

(800) 4-CANCER (1-800-422-6237)

---

National Center for Learning Disabilities  
381 Park Avenue South Suite 1401  
New York, NY 10016  
Phone: (212) 545-7510  
Fax: (212) 545-9665  
Toll-free: (888) 575-7373  
Web site: <http://www.nclld.org>

The National Center for Learning Disabilities aims to increase opportunities for all individuals with learning disabilities by increasing public awareness and by conducting educational programs. The web site provides information on a wide range on learning disabilities as well as a search page to look for resources in your area that may help with specific issues related to learning disabilities.

---

National Institute of Neurological Disorders and Stroke (National Institutes of Health)  
NIH Neurological Institute  
P.O. Box 5801  
Bethesda, MD 20824  
Phone: (800) 352-9424 or (301) 496-5751  
Web site: <http://www.ninds.nih.gov/index.htm>

The NINDS web site provides an extensive index of different neurological disorders, such as aneurisms and stroke. It gives a description of the disorder, treatments available, and the latest research being conducted in that area. It also lists additional resources that can be contacted for more information.

---

---

National Kidney Foundation of Minnesota, Inc.  
1660 Hwy 100 S., Suite 530  
St. Louis Park, MN 55416  
Phone: (952)-544-7300  
Toll Free: 1-800-866-4499  
Fax: 952-544-2320  
National web site: [www.kidney.org](http://www.kidney.org)

The aim of the National Kidney Foundation of Minnesota, Inc. is to prevent kidney and urinary tract diseases and to provide resources for those afflicted with these diseases. The web site provides information on a wide variety of topics related to kidney health, including treatment, rehabilitation, and organ donation.

---

National Stroke Association, Minnesota Chapter  
500 Carlson Parkway, Suite 301  
Minnetonka, MN 55305  
Toll-Free: 800-647-4123  
Direct: 952-473-2060  
Website: [www.strokemn.org](http://www.strokemn.org)  
E-mail: [info@strokemn.org](mailto:info@strokemn.org)

The Minnesota Stroke Association strives to reduce the impact of stroke in the state of Minnesota. The web site provides information on how to prevent stroke, support group information, and rehabilitation information for those who have suffered from a stroke.

---

## **Appendix D: Cancer and The Environment**



© Peter Eshenaur

## **Cancer and the Environment**

*This publication is written for people who are concerned about cancers that they have experienced themselves or in members of their family or community. The information is presented for the purpose of answering common questions about cancer risks and the environment, including a list of steps people can take to prevent or minimize cancer risks.*

*The term “environment” includes air, water, and soil, but also substances and conditions in the workplace and at home. It includes diet; the use of tobacco, alcohol or drugs; exposure to chemicals; and exposure to sunlight and other forms of radiation.*

*We all learn about risks at an early age—how to recognize them and how to avoid them. Some risks are obvious and immediate: proximity to hot stoves, use of chain saws, driving on the highway. But other risks (especially those associated with cancer) like tobacco use, and chemical and radiation exposures, are delayed in their effects and are often hard to understand.*



Environmental Health Division  
Environmental Surveillance and Assessment  
Site Assessment and Consultation Unit  
P.O. Box 64975, St. Paul, MN 55164-0975

## **What is cancer?**

Cancer is not a single disease; it is a group of more than 100 different diseases. Cancer is the uncontrolled growth and spread of abnormal cells in the body. Different types of cancer have differing rates of occurrence, causes, and chances for survival.

The development of cancer is a multi-step process, starting with genetic changes in cells, followed by cell division and growth over time. The time from genetic change to the development of cancer, known as the “latency period,” is usually decades long, often 30 years or longer. This means that many cancers diagnosed today may be due to genetic changes that occurred in cells a long time ago.

Cancer can develop in individuals of all ages, but is most commonly found in people who are older than 60 years. Nearly one half of all Minnesotans will develop cancer at some point in their lives. Because people are living longer, the risk of developing cancer is increasing.

## **What causes cancer?**

Since cancer is not a single disease, it does not have a single cause. There are a variety of causes (better known as “risk factors”). These factors act over many years to increase an individual’s chance of developing cancer. They can include such things as age, race, gender, other genetic factors, chemical exposures, diet, radiation, exposure to tobacco, and reproductive history.

For many cancers, such as breast and colon cancer, genetics play a role. This means that a family history can be a risk factor for some types of cancers. It is not unusual for several cases to occur within a family.

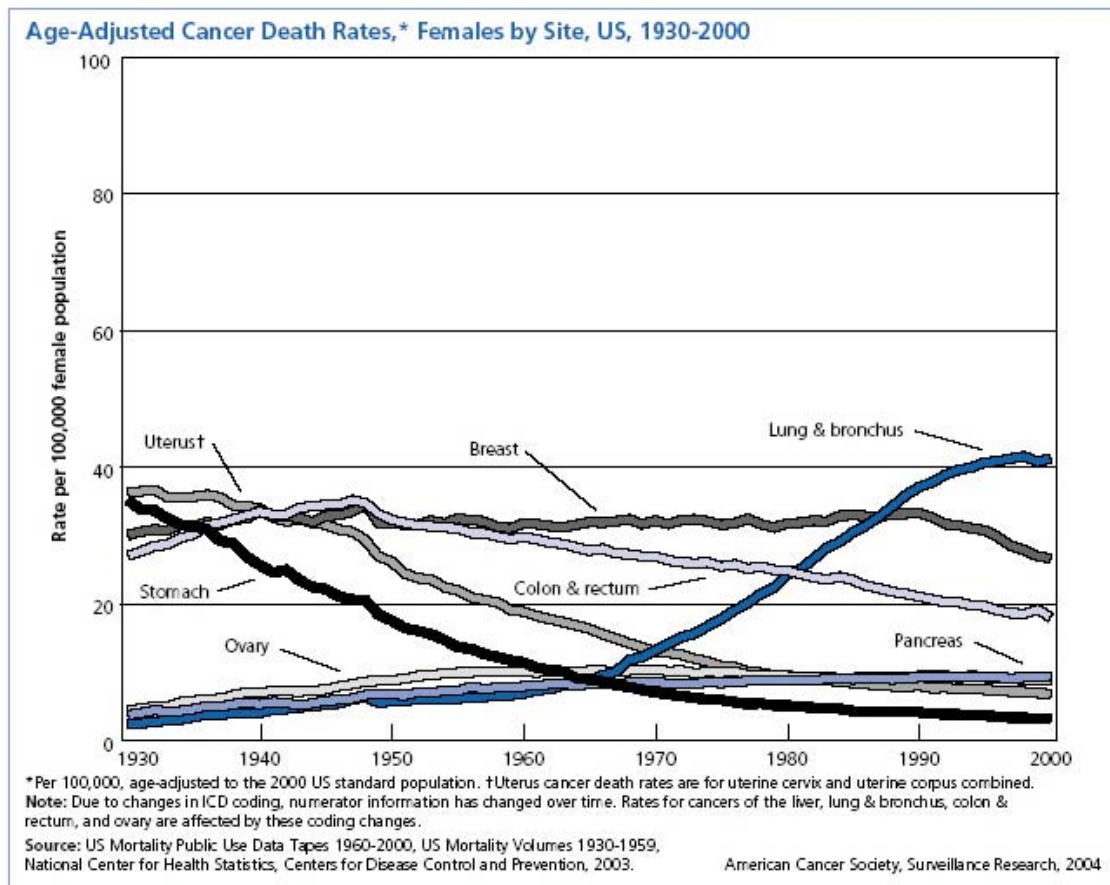
In addition, there are things we do in our daily lives that can increase our chance of developing cancer. These factors, sometimes called “lifestyle factors,” include: cigarette smoking; heavy drinking; and eating foods that have excess calories, high fat, and low vegetable intake. Other lifestyle factors that increase risk have to do with reproductive patterns, sexual behavior, and sunlight exposure.

Cigarette smoking is a leading cause of cancer deaths in the U.S. today. In addition to being responsible for 80 to 90 percent of lung cancers, cigarette smoking is also associated with leukemia and cancers of the mouth, pharynx, larynx, stomach, esophagus, pancreas, kidney, bladder, cervix, and endometrium (lining of the uterus).

Approximately 30 percent of all cancer deaths are related to smoking, and the risk of dying from lung cancer is 10 to 20 times higher for smokers compared to non-smokers. In fact, smoking is the most preventable cause of death in our society.

## Are cancer rates increasing in the U.S.? In Minnesota?

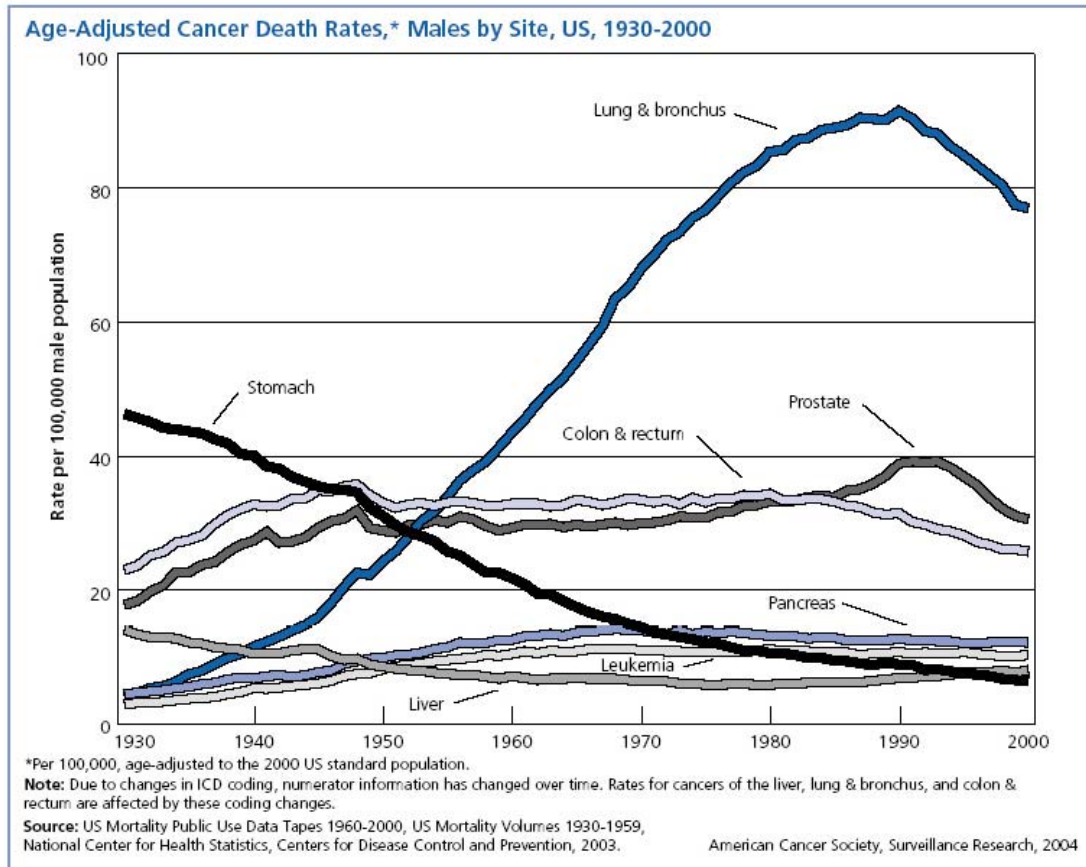
From the 1930s until 1991, there was a steady rise in the overall cancer death rate in the U.S. The major cause of this rise was the increase in lung cancer; this was strongly associated with increases in smoking. Death rates for many cancers—other than lung cancer—declined by 15 percent between 1950 and 1990. These decreases are due to improvements in the early detection and treatment of specific types of cancers, such as breast, colon, and cervical cancers. Between 1990 and 2000 the national cancer death rate fell 7.6 percent.



In Minnesota, the incidence of cancer (new cases) is monitored by the Minnesota Cancer Surveillance System. Created by the Minnesota Legislature in 1987, this statewide system collects information on all new cancers diagnosed in Minnesotans.

Minnesota's cancer rates are similar to the national rates for most types of cancer. However, our lung cancer rates are lower compared to the U.S. population. This may be due to the fact that smoking prevalence in Minnesota was lower years ago. Today our smoking rate is similar to the national average and the gap between the national lung cancer rate and Minnesota's rate is closing.

In men, cancer incidence has declined in Minnesota since 1988, largely due to decreases in colorectal, stomach and lung cancer. Prostate cancer incidence increased in the early 1990's when a new screening test found many cancers that would not have been found until later, or may never have become apparent, without screening.



In women, overall cancer incidence rates increased, largely due to increases in breast and lung cancer, which outweighed decreases in colorectal, stomach and cervical cancer. Despite these increases, breast cancer deaths decreased due to earlier diagnosis and improved treatment.

Odds of Cancer in Minnesota Males		
	<i>Diagnosis</i>	<i>Death</i>
<i>Prostate</i>	1 in 6	1 in 27
<i>Lung</i>	1 in 13	1 in 15
<i>Colo-rectal</i>	1 in 16	1 in 40
<i>Bladder</i>	1 in 26	1 in 125
<i>Any Cancer</i>	1 in 2	1 in 4

Odds of Cancer in Minnesota Females		
	<i>Diagnosis</i>	<i>Death</i>
<i>Breast</i>	1 in 7	1 in 29
<i>Colo-rectal</i>	1 in 17	1 in 40
<i>Lung</i>	1 in 20	1 in 23
<i>Uterine</i>	1 in 33	1 in 167
<i>Any Cancer</i>	9 in 20	1 in 5

In Minnesota, as in other parts of the country, racial differences have been observed. African American men have the highest cancer rates in Minnesota. Among American Indians, smoking-related cancers of the lung, larynx, and oral cavity, as well as prostate, colorectal and cervical cancers are unusually common.

## **What about cancer in children?**

Many pediatric cancers occur early in life and parents want to know why. Nearly 1 in 450 children will be diagnosed with cancer before the age of 15. Although some childhood cancers are associated with specific genetic, prenatal, and environmental factors, in most cases the causes remain largely unknown.

It is believed that the organ systems of children are especially vulnerable to injury when undergoing periods of rapid growth and development. Factors that are *suspected* of playing a role in childhood cancers include genetics, infectious diseases, prenatal conditions, environmental pollutants, radiation, and use of medications. However, few studies have been able to show a consistent association between cancer and these factors.

The types of cancer most often seen in children are different from those seen in adults. The three most common types of cancer in children are: (1) leukemias; (2) tumors of the brain and nervous system; and (3) lymph node cancers. In contrast, the most common types of cancer in adults are: (1) lung cancer; (2) breast cancer; (3) colon or rectal cancer; and (4) prostate cancer.



© Peter Eshenaur



## What about chemicals in the environment?

Lifestyle factors present some significant risks. However, exposures to certain chemicals in the environment, at home, and at work may also contribute to an individual's risk of developing cancer. Benzene, asbestos, vinyl chloride, and arsenic are examples of toxic substances that can increase the risk of cancer to those who are exposed. The International Agency for Research on Cancer (IARC) has classified these substances as "*known human carcinogens*."

Some chemicals have been shown to cause cancer in animals, but there is not enough evidence to show that these chemicals cause cancer in humans. These chemicals are classified by IARC as "*possible or probable (suspected) human carcinogens*."

Most of what we know about chemicals and cancer in humans comes from scientists' observations of workers. Historically, the most significant exposures to cancer-causing chemicals have occurred in workplaces where large amounts of toxic chemicals were used. That is why safe work practices, personal protection, ventilation, and other controls are so important in protecting workers and their families.

The amount of toxic chemicals found in food, air, and drinking water are typically much lower than in the work environment. Therefore, cancer risk from environmental exposures is thought to be very low compared to the risk in occupational settings. In fact, the cancer risk from environmental exposures is so low that it is difficult to measure in scientific studies.

Scientists have compiled a list of substances that are either known or suspected of causing human cancer in The 10th Report on Carcinogens published in 2003. The report also describes where these substances are found in our environment. For a condensed list of these substances, see Table 1 at the end of this publication. The complete report is available on the internet at: <http://ntp-server.niehs.nih.gov/NewHomeRoc/AboutRoC.html>

## How do I interpret information in the news about cancer and the environment?

There are several principles to keep in mind when you read an article or hear a news report about a new scientific study:

*\*A single study on the causes of cancer is seldom conclusive.* Scientists look for multiple studies with consistent results before drawing conclusions. Each new study that you hear or read about adds to the body of evidence that scientists use for understanding the causes of cancer.

*\*The dose determines the poison.* Scientific results are usually specific to a particular dose or route of exposure to a specific population being studied. Yet each individual's chance of getting cancer from an exposure will be different depending on:

- The amount of a contaminant to which a person is exposed
- The length of time a person is exposed
- The number of times a person is exposed
- How the person was exposed, such as by eating, breathing, or touching the substance

*\* Realize that uncertainties are always present in any study of environmental exposure and cancers.* Due to the long latency period of cancer development, it is often difficult to collect information regarding exposures years or decades after they occur. Individual genetic differences, age, gender, and health status interact with lifestyle habits, as well as environmental exposures -- causing some people to be more sensitive to developing cancer than others. Because it is difficult to account for all of these variables and how they interact, “uncertainties” exist in the study of cancer and environmental risk factors.

*\*“Safety factors” or “uncertainty factors” are used to set acceptable levels of exposure.* These factors take into account that certain individuals might be more sensitive to chemicals because of age (children and the elderly), genetic make-up, gender, diet, or health status. In addition, if mice or rats were used to test the chemical, the possibility is considered that people may be more sensitive to the cancer-causing effects of the substance than the rodents. To ensure that the acceptable level of exposure will protect the public, government agencies use safety factors that result in setting acceptable levels of exposure as much as 10,000 times lower than the level that causes cancer in mice and rats.

*\*Sometimes it is necessary to weigh risks vs. benefits.* Some drugs are prescribed even though they may increase the risk of cancers in later years. An example is the use of certain drugs to treat cancer that increase the risk of secondary cancers. In these situations, the immediate benefits of treating an often imminently life-threatening disease have been determined to outweigh the risks of developing cancer several years later. Before taking any medication that increases the risk of cancer in future years, discuss the risks versus the benefits with your physician.

## **What is being done to control cancer-causing chemicals?**

Strict federal and state standards have been set to minimize our exposures to cancer-causing chemicals. On the federal level, the U.S. Environmental Protection Agency (EPA) is charged by the U.S. Congress to set environmental regulatory standards to protect human health and the health of the environment from substances released into air, water or soil.

In the State of Minnesota, the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDH) have state programs to meet or exceed the federal standards to protect human health and the health of the environment. Activities include monitoring of air, water, and soil, conducting scientific research, setting standards, proposing rules, and enforcement.

MDH, Division of Environmental Health protects people from environmental hazards in drinking water, the home, workplace, and community. Activities include monitoring health trends, assessing environmental exposures in communities, evaluating the scientific evidence and recommending safe exposure levels or other actions to protect public health. MDH has established standards for chemicals in air (called Health Risk Values) and water (called Health Risk Limits) specifying levels that are considered safe. MDH also provides education about hazardous substances for communities and health professionals.

Many hazardous substances, such as certain pesticides and metals, continue to be found in our environment from past use. Dioxin, for example, is widespread and persistent in the environment. Small amounts of dioxin can be found in our food and in our bodies. It will take many years for such persistent chemicals to break down or be removed from the environment.

Ironically, one of the most potent and well-known cancer-causing chemicals, tobacco, is still largely uncontrolled. There are over 40 known or suspected carcinogens present in tobacco smoke. Progress has been made, however, in controlling exposure to secondhand smoke in public buildings and on the job.

Some carcinogens in the environment occur naturally and are much more difficult to control. Arsenic in underground rock can get into drinking water wells. Radiation from the sun is also a strong cancer-causing agent. Sometimes our own actions offer the best control for exposure. When necessary, we can purify drinking water or use clothing and sunscreen to protect ourselves from the sun.

Many other agencies work to protect the public from harmful environmental exposures. For a listing of some of these agencies, see “Where can I get more information?” at the end of this booklet.



© Peter Eshenaur

### **What if I see an unusual number of cancers among my neighbors or co-workers? Could it be something in our environment?**

Cancer is a personal tragedy for those affected. But what may appear to be an “outbreak” of cancer does not, by itself, signal a special risk related to something in the environment. Unfortunately, cancer is common in our population, and differing types of cancer have differing causes.

It is not unusual to observe many cases of cancer in a single community or neighborhood, particularly if the community is aging. In fact, using information from our cancer surveillance system, we know that cancers *frequently* occur in clusters. Clusters often occur by chance and cancer cases are not evenly distributed throughout the population.

At MDH, patterns of disease are investigated by epidemiologists who study the frequency, distribution, risk factors, and control of diseases in populations. Epidemiologists look for an unusual pattern of a specific type of cancer, rather than several different types. They find out whether the specific type of cancer is a primary cancer or a cancer that is the result of metastasis (spread from another organ in the body).

Using statistical methods, epidemiologists can determine whether a reported excess of cancer in a population is really more than would normally be expected to occur. They must also take into account other characteristics of the population that can affect disease patterns, such as age, gender and heredity.

Most of our knowledge about the causes of cancer in people comes from studying large populations. Even our best scientific methods cannot tell us the cause of cancer in an individual, or in a small group of individuals.



© Peter Eshenaur

## **What steps can I take to minimize my cancer risks?**

We can't eliminate all risks in our lives. But we can, to a certain extent, manage them by adopting healthy lifestyles. MDH endorses the following American Cancer Society recommendations to prevent or minimize cancer risks:

- \* Stop smoking and avoid all tobacco products
- \* Avoid excessive exposure to sunlight
- \* Eat more fruits and vegetables, along with a low-fat, high-fiber diet

- \* Limit consumption of smoked and nitrite-cured foods
- \* Limit alcohol intake
- \* Avoid obesity
- \* Exercise regularly
- \* Have routine physical exams since not all cancers have obvious symptoms
- \* Practice early detection—learn to practice self-exam and seek prompt medical attention for changes in your body which include:
  - A thickening or lump in any part of your body
  - An obvious change in a wart or mole
  - A sore that does not heal
  - A nagging cough or hoarseness
  - A change in bowel or bladder habits
  - Indigestion or difficulty swallowing
  - Unexplained changes in weight
  - Unusual bleeding or discharge

## **How Can I Protect Myself from Toxic Exposures in the Environment?**

### **At Home:**

We spend about 90% of our time indoors. The air inside your home may be more polluted than the air outside. If you use chemicals in the home, such as pesticides, paints, paint thinners, cleaning solvents, or preservatives, the following steps may decrease exposure:

- Read labels and follow directions carefully
- Use these chemicals only in a well ventilated environment— outdoors when possible
- Throw away partially full containers of old or unneeded chemicals (following community guidelines for disposal of household hazardous waste)
- Make substitutions for less toxic substances whenever possible
- Have the basement of your home tested for radon. An estimated 1 out of 3 homes in Minnesota contain radon gas. For a list of local city or county agencies that distribute radon information and test kits, contact MDH at: 1-800-798-9050 or 651-215-0909. Or log on to the internet at:

<http://www.health.state.mn.us/divs/eh/indoorair/radon/index.html>

If you have an older home (built before 1978)...

- Your home may contain flooring, roofing, insulation or other products with asbestos -- do not disturb or remove any asbestos containing material. For more information, contact MDH at: 651-215-0900. Or log on to the asbestos web site: <http://www.health.state.mn.us/divs/eh/asbestos/index.html>
- Old paint may contain lead or other toxic metal. Peeling paint should be safely removed or covered.

### **At Work:**

- Be aware of any carcinogenic substances used in your workplace
- Participate in work hazard communication training programs
- Read labels and take precautions as directed
- Use recommended personal protective equipment

### **In Your Community:**

- Stay informed. If you have concerns regarding pollutants in your community, contact the agencies responsible for safeguarding our environment and our health, such as MPCA and MDH, Division of Environmental Health.
- Members of tribal communities may contact their Natural Resource Management or Environmental Health departments.

### **Where can I get more information?**

#### **National Cancer Institute (NCI):** <http://www.cancer.gov>

The largest cancer research organization in the country; supports research at universities, hospitals, foundations, and businesses throughout the U.S. and abroad.

- Cancer Prevention: <http://www3.cancer.gov/prevention/>
- NCI's SEER Program is the most authoritative source of information on cancer incidence and survival in the U.S.: <http://www-seer.ims.nci.nih.gov>
- NCI's Toll-Free Cancer Information Service for information about cancer and to request publications: 1-800-4-CANCER/1(800) 422-6237

#### **National Institute of Environmental Health Sciences (NIEHS):** <http://niehs.nih.gov>

Established to reduce human illness caused by unhealthy substances in the environment.

Activities include biomedical research, prevention, and intervention programs along with training, education, and community outreach efforts.

- National Toxicology Program (NTP): Coordinates toxicology research and testing activities within the U.S. Department of Health and Human Services (DHHS). Publishes a biennial Report on Carcinogens: <http://ntp-server.niehs.nih.gov/NewHomeRoc/AboutRoC.html>

#### **Centers for Disease Control and Prevention (CDC):** <http://www.cdc.gov/>

CDC is an agency of the U.S. DHHS that is charged with promoting health and quality of life by controlling disease, injury, and disability:

- National Center for Environmental Health (NCEH) Health Line: 1(888) 232-6789  
<http://www.cdc.gov/nceh/ncehhome.htm>
- For information about the *National Report on Human Exposure to Environmental Chemicals*, March 2002, call 1(866) 670-6052 or log on to:  
<http://www.cdc.gov/nceh/dls/report>

#### **Agency for Toxic Substances and Disease Registry (ATSDR):** <http://www.atsdr.cdc.gov>

ATSDR is an agency of the U.S. DHHS that advises the EPA on hazardous waste issues.

ATSDR has educational fact sheets about toxic chemicals.

- ATSDR Informational Center: 1(888) 422-8737

#### **The International Agency for Research on Cancer (IARC):** <http://www.iarc.fr>

IARC is part of the World Health Organization (WHO) and has a mission to coordinate and conduct research on the causes of human cancer.

**Environmental Protection Agency (EPA):** <http://www.epa.gov>

A government regulatory agency charged by the U.S. Congress to protect human health and safeguard the natural environment:

- Indoor Air Quality: <http://www.epa.gov/iaq>
- Envirofacts Warehouse: <http://www.epa.gov/enviro>
- Environmental Atlas: <http://www.epa.gov/ceisweb1/ceishome/atlas>
- EPA National Pesticide Information Center: <http://npic.orst.edu/>  
Phone: 1(800) 858-7378
- EPA Superfund Hotline for hazardous waste: 1(800) 535-0202

**Cornell University Program on Breast Cancer and Environmental Risk Factors (BCERF) in New York State:** <http://envirocancer.cornell.edu>

A program developed by faculty and staff from Cornell University in Ithaca, New York, and the Joan and Sanford Weill Medical College of Cornell University in New York City. The website provides information about environmental risk factors and breast cancer.

**The American Lung Association:** <http://www.lungusa.org>

A voluntary health organization in the United States that has many programs and strategies to fight all forms of lung disease, which include funding professional research and promoting environmental health.

- Facts about lung cancer: <http://www.lungusa.org/diseases/>

**Food & Drug Administration (FDA):** <http://www.fda.gov/>

The FDA monitors products for safety and helps safe and effective products reach the market in a timely way.

- The National Center for Toxicological Research: <http://www.fda.gov/nctr>
- FDA Consumer Hotline: 1(800) 532-4440

**Occupational Safety and Health Administration (OSHA):** <http://www.osha.gov>

OSHA is an agency of the U.S. Department of Labor charged with preventing work-related injuries, illnesses, and deaths.

- OSHA information: 1(800) 321-6742

**National Institute for Occupational Safety and Health (NIOSH):** <http://cdc.gov/niosh>

An agency of the CDC that researches and makes recommendations to prevent work-related disease and injury.

- NIOSH information: 1(800) 356-4674

**The Harvard School of Public Health:** <http://www.yourcancerrisk.harvard.edu/>

An interactive website designed to help you identify and decrease your personal risk factors for several types of cancer.

*This information was prepared in cooperation with the U.S. Agency for Toxic Substances and Disease Registry. To request this document in another format, call: (651) 215-0700 or toll-free 1-800-657-3908, press 4 and leave a message; TDD: (651) 215-0707 or 1-800-627-3529.*

Table 1. Categories, Source, and Associated Sites of Known or Suspected Carcinogens

<b>Substance</b>	<b>Source of Exposure</b>	<b>Cancer Site Associated with Exposure</b>
<b>Aflatoxins</b>	Toxins from fungi in contaminated foods (peanuts and grains) or contaminated grain dust (agricultural workers exposed)	Liver
<b>Alcoholic Beverages</b>	Consumption of more than 2 alcoholic drinks per day	Mouth, throat, voice-box, and esophagus; possible link with breast and liver cancer.
<b>Arsenic</b>	Naturally occurs in soils and groundwater from the weathering of rock. Industrial uses: wood preservative, glass, and pesticides. Exposure can occur through food and drinking water, automobile emissions or emissions from industrial facilities, and smoking.	Skin, lung, bladder, kidney and liver
<b>Asbestos</b>	Air-born microscopic fibers released from products, mostly found in homes and buildings, also brake linings.	Lung, larynx and lining of the lung (mesothelioma)
<b>Benzene</b>	Used in chemical and drug industries, and as a gasoline additive. Found in gasoline vapors, auto exhaust, and cigarette smoke.	Leukemia
<b>Benzidine and Benzidine-based Dyes</b>	Exposure can occur near dye and pigment plants where wastes may be discharged.	Bladder
<b>Diesel Exhaust Particles</b>	Diesel automobiles, trucks and engines	Lung
<b>Dioxin (TCDD)</b>	By-product during paper and pulp bleaching, incineration of wastes, forest fires, and in some pesticides and wood preservatives. Most human exposure is dietary: meat, dairy, fish.	Cancers, no specific site
<b>Formaldehyde</b>	Used in construction products, textiles, disinfectants, coatings, moldings, furnishings; exhaust from cars, power plants, wood stoves, kerosene heaters and cigarettes.	Nasopharyngeal, brain
<b>Ionizing Radiation</b>	Medical X-rays, rays entering the earth's atmosphere, naturally radioactive substances	Leukemia, breast, thyroid, lung, stomach, and other organs at very high doses
<b>Ultraviolet Radiation</b>	Sun, sunlamps, or tanning beds	Skin-melanoma
<b>Medical Drugs:</b> Cyclophosphamide, Chlorambucil, Melphalan  Estrogen  Tamoxifen  Diethylstilbestrol (DES)	Cancer therapy agents  Treatment of menopause and gynecologic conditions  Synthetic hormone  Synthetic estrogen	Increased occurrence of secondary cancers  Endometrium (lining of the uterus)  Endometrium (lining of the uterus)  Cervix and vagina; in daughters exposed prenatally
<b>Metals:</b> Cadmium and cadmium compounds  Nickel and Nickel Compounds	Industrial processes, contamination can be released into air, surface water, ground water and topsoil.  Steel, dental fillings, copper, brass, glazes, and storage batteries. Found in air, water, soil, food, and consumer products.	Lung  Lung, nasal cavity, and larynx



Chromium VI Compounds	Used in corrosion protection, electroplating, textile and tanning, paper, pigments, roofing, and glass. Contaminant in soil, air, water, food.	Lung
Beryllium Compounds	Industrial uses: aerospace and defense, electrical components, aircraft brakes, fuel additive, ceramics, glass, fiber optics and plastics. Exposure occurs through burning of coal and fuel oil.	Lung
Lead Compounds	Lead acetate used in dyes, metal coatings, paints, varnish, pigments. Found in contaminated soils, water, dust, food and paint chips.	Lung, stomach
<b>Obesity</b>		Colon, esophagus, stomach, gall bladder, endometrium, kidney, and breast
<b>Pesticides</b>	Used for agricultural practices, restricted use. About 20 out of 600 are carcinogenic: e.g. lindane, ethylene oxide, DDT, chlorophenoxy herbicides, toxaphene, hexachorobenzene, lead acetate.	Lymph system, prostate, and stomach, increased cancers among highly exposed occupational groups
<b>Polycyclic Aromatic Hydrocarbons (PAHS)</b>	Produced from burning organic fuels such as wood and gasoline, and waste incinerators. Also in diesel exhaust, coke oven emissions, cigarette smoke, and charcoal-broiled food.	Lung, genital-urinary
<b>Radon</b>	Naturally occurring radioactive gas seeps into lower levels of homes and buildings from soils.	Lung
<b>Solvents</b>	Industrial solvents: carbon tetrachloride, chloroform, methylene chloride, tetrachloroethylene and trichloroethylene; used in paint thinners, paint and grease removers, and dry cleaning solvents.	Lung, liver
<b>Tobacco</b>	Cigarettes, cigars, chewing tobacco, snuff and environmental tobacco smoke (ETS)	Lung, bladder, oral cavity, throat, voice box, esophagus, lip, pancreas, and nasal sinus
<b>Vinyl Chloride</b>	Major release is from plastics industry. Also found in groundwater near solvent waste sites.	Liver, brain, blood, and lung
<b>Viruses and Bacteria:</b>		
Helicobacter pylori	Waste-tainted food or water, oral contact.	Stomach
Human papilloma-virus	Sexually transmitted virus	Cervix
Hepatitis B and C viruses	Direct contact with blood and/or body fluids	Liver
Epstein-Barr virus	Contact with oral secretions	Lymphoma
Human Immunodeficiency virus (HIV)	Direct contact with blood and/or body fluids	Kaposi's Sarcoma, endothelial layer of blood, lymph system
<b>Wood Dusts</b>	Inhalation of small air-born particles from wood	Lung

Information in this chart is based on materials from the National Cancer Institute and National Institute for Environmental Health Sciences

**Appendix E: Cancer in Minnesota: Racial and Ethnic Disparities**

# CANCER IN MINNESOTA:

## Racial and Ethnic Disparities

A Report on Cancers for Which Prevention  
or Early Detection Can Make A Difference

**Cancer is the leading cause of death in Minnesota for persons between the ages of 35 and 74. Each year, an estimated 20,600 Minnesotans are diagnosed with cancer and 9,000 die from the disease.**

In Minnesota, cancer death rates are significantly higher in non-whites compared with whites. While overall cancer incidence rates are similar for whites and non-whites, racial and ethnic disparities in incidence exist for certain cancers for which prevention or early detection can make a difference.

### New Data by Race Available

This report focuses on cancer incidence and mortality rates by race and ethnicity for cancers for which prevention and/or early detection has been shown to save lives. These include cancers of the breast, cervix, colon and rectum, lung, prostate, and skin. Until now, cancer incidence data have not been available by race for Minnesota. These new data, combined with cancer mortality data by race and ethnicity, can help guide public health and community activities to reduce the burden of death and disability from cancer.

Cancer incidence data are now available by race in Minnesota for American Indians,

Asian/Pacific Islanders, blacks, and whites. The category “black” encompasses persons of varying ethnic and geographic origins. Incidence data are not available for persons of Hispanic origin because ethnic origin is not usually reported to Minnesota’s cancer registry. Cancer mortality data are available for all of these racial and ethnic groups.

### Interpreting these Data

This report’s focus on racial and ethnic disparities should not be interpreted to suggest that the burden of cancer is not significant in cases where there is no notable disparity between racial and ethnic groups. For some cancers, the burden of the disease is high among all racial and ethnic groups even though there is no difference among groups. For example, few disparities emerge for colorectal cancer despite the fact that it is the second leading cause of cancer death among Minnesotans.

It also should be noted that the absolute number of cancer cases among non-white racial and ethnic groups in Minnesota is relatively small, making statistical analysis more difficult to interpret. As more data become available, additional disparities in cancer incidence and mortality may become apparent.



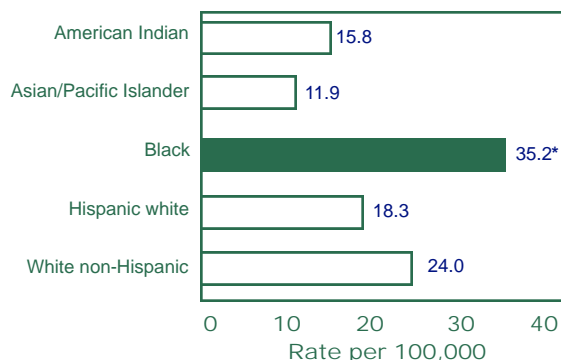
## KEY FINDINGS AND RECOMMENDATIONS

### BREAST

Breast cancer is the most common form of cancer in Minnesota women and the second leading cause of cancer death. Each year in Minnesota, approximately 3,200 women develop breast cancer and 700 die from the disease. One third of breast cancer deaths can be prevented through routine screening using mammography and clinical breast examination.

**KEY FINDINGS:** The breast cancer mortality rate in Minnesota is 50% higher in black women than in white non-Hispanic women even though the incidence rates are similar. A greater proportion of black women have their cancers diagnosed at a later, less treatable stage.

Breast Cancer Mortality: 1990-1999



\*Indicates a rate significantly higher than the rate for white non-Hispanics

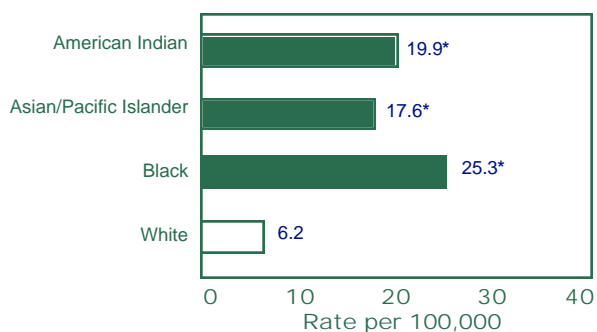
**RECOMMENDATIONS:** All women age 40 and older should be screened regularly for breast cancer with mammography and clinical breast examination. Particular efforts should be made to screen black women and to ensure their access to appropriate follow-up and treatment services.

### CERVIX

Each year, approximately 200 women in Minnesota develop invasive cervical cancer and 50 die from it. Virtually all invasive cervical cancer occurrence and death is preventable through regular screening with Pap smears followed by treatment of pre-cancerous cervical abnormalities.

**KEY FINDINGS:** Black women in Minnesota have a cervical cancer incidence rate that is four times as high as the rate for white women. American Indian and Asian/Pacific Islander women have a cervical cancer incidence rate that is three times as high as the rate for white women. Deaths due to cervical cancer also occur at a higher rate among Asian/Pacific Islanders and blacks compared with white non-Hispanics.

Cervical Cancer Incidence: 1995-1997



\*Indicates a rate significantly higher than the rate for white non-Hispanics

**RECOMMENDATIONS:** All women who are age 18 and older or sexually active should be regularly screened with Pap smears. Particular emphasis should be placed on outreach to non-white women to encourage regular screening for cervical cancer. Women with significant pre-cancerous abnormalities should be promptly referred for treatment.

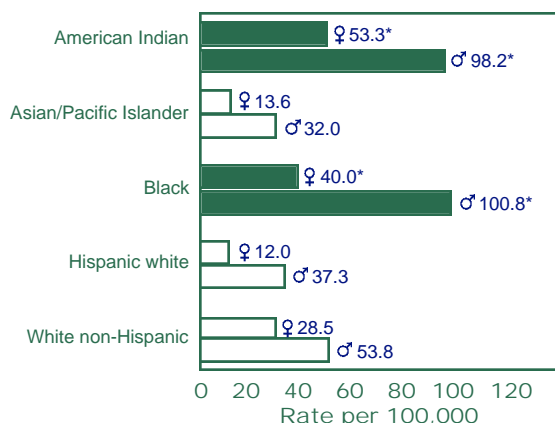
### LUNG

Lung cancer is the leading cause of cancer death in Minnesota for both men and women and has one of the poorest prognoses of any cancer. Each year in Minnesota approximately 2,400 men and women develop lung cancer and 2,300 die from it. The vast majority of lung cancer cases are tobacco-related.

**KEY FINDINGS:** Lung cancer mortality rates for American Indian men, American Indian

women, and black men are nearly double the rates for whites. Mortality rates for black women are 40% higher than for white non-Hispanic women. Asian/Pacific Islander and Hispanic white men and women have lung cancer mortality rates lower than those for white non-Hispanics.

Lung Cancer Mortality: 1990-1999



\*Indicates a rate significantly higher than the rate for white non-Hispanics.

**RECOMMENDATION:** Smoking prevention and tobacco cessation efforts should continue for all groups, but especially for American Indians and blacks.

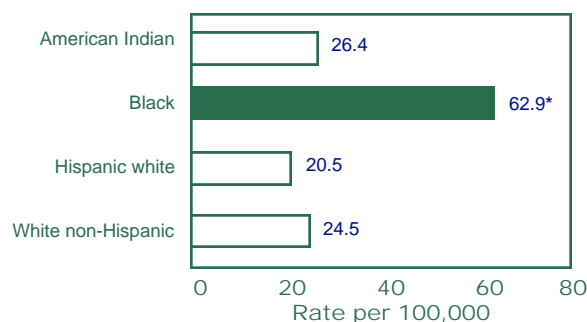
## PROSTATE

Prostate cancer is the most common cancer among men in Minnesota. Each year roughly 3,600 men are diagnosed with prostate cancer and 600 die from it. Use of prostate specific antigen (PSA) testing for prostate cancer is

increasingly common but the benefits of mass screening are uncertain at this time. Early detection may be associated with improved outcomes for some individuals.

**KEY FINDINGS:** The prostate cancer incidence rate is one third higher in black men compared with white men, and the prostate cancer mortality rate is two and a half times higher for black men. Prostate cancer incidence rates are lower for American Indians and Asian/Pacific Islanders than for whites.

Prostate Cancer Mortality: 1990-1999



\*Indicates a rate significantly higher than the rate for white non-Hispanics. Asian/Pacific Islanders not represented because fewer than ten deaths reported.

**RECOMMENDATIONS:** Health care professionals should discuss the risks and benefits of prostate cancer screening with their male patients, taking into consideration individual risk factors, health status, and age. Black men should be aware of their elevated risk.

### Definitions and Data Sources

The Minnesota Cancer Surveillance System (MCSS) collects cancer incidence data. This report examines cancer incidence rates for the years 1995-1997, the first years for which complete race data are available. Cancer incidence rate refers to the number of newly diagnosed cancers per 100,000 persons per year.

The Minnesota Center for Health Statistics compiles data on cancer mortality. Cancer mortality data by race and ethnicity are reported here for the years

1990-1999. Cancer mortality rate refers to the number of deaths from cancer per 100,000 persons per year.

The source for population data is the United States Census Bureau. The adjusted census count was used for 1990 and interim ("intercensal") estimates were used for the years 1991-1999.

All rates cited in this report are annual rates that have been age-adjusted using the 1970 U.S. population as the standard.

Age-adjustment makes it possible to compare populations that may have different age distributions.

For the cancers discussed in the report, both incidence and mortality rates for American Indians, Asian/Pacific Islanders, and blacks are compared with rates for whites. Cancer mortality rates for Hispanic whites are also compared with those for white non-Hispanics.

## COLON AND RECTUM

Colorectal cancer strikes an estimated 2,100 Minnesota men and women and results in 900 deaths each year. At least one third of all colorectal cancer deaths can be prevented by routine screening with fecal occult blood testing (FOBT), sigmoidoscopy and/or colonoscopy. Screening can detect both early cancer as well as pre-cancerous polyps, which can be removed before they develop into cancer.

**KEY FINDING:** Colorectal cancer mortality is higher among white non-Hispanic women than Hispanic white women. No other significant differences are noted among racial groups in Minnesota.

**RECOMMENDATION:** All men and women age 50 and older should be regularly screened for colorectal cancer.

## SKIN (Melanoma)

An estimated 800 Minnesotans are diagnosed with malignant melanoma and 120 die from it each year. The most effective way to prevent melanoma is to avoid exposure to ultraviolet radiation.

**KEY FINDINGS:** White men have an incidence rate of melanoma nine times as high as the rate for non-white men. White women have an incidence rate of melanoma eight times as high as the rate for non-white women.

**RECOMMENDATIONS:** Children and adults should avoid exposure to direct sunlight. White and fair-skinned individuals should be made aware that they are at increased risk.

## CONCLUSION

**N**ational data have long been available on cancer incidence and mortality by race and ethnicity. State level data are now available for the first time in Minnesota for use by community groups, researchers, and public health officials. This report highlights some of the more striking findings on disparities in cancer occurrence and death in Minnesota and suggests areas for which targeted cancer control activities may be warranted. More detailed cancer incidence and mortality data by race and ethnicity are available at [www.health.state.mn.us](http://www.health.state.mn.us).

**MINNESOTA DEPARTMENT OF HEALTH**  
**Division of Chronic Disease Prevention and Control**  
PO Box 9441, Minneapolis, Minnesota 55440  
612-676-5500 (phone), 612-676-5520 (fax), 651-215-8980 (TDD)

If you require this document in another format such as large print,  
Braille or cassette tape call 612-676-5500  
Printed on recycled paper

October 2001

## **Appendix F: Diabetes in Minnesota**

# Diabetes in Minnesota

For more diabetes data, please visit the full *Diabetes in Minnesota* report on the

World Wide Web: <http://www.health.state.mn.us/diabetes/diabetesinminnesota/>

## Scope of the Problem

One in ten Minnesotans either have diabetes or are at high risk of developing it.<sup>1,2</sup>

- 276,000 Minnesotans have diabetes; of that total, 180,000 know they have diabetes and 96,000 do not know that they have diabetes.
- 253,000 Minnesotans have impaired fasting glucose (IFG), a form of pre-diabetes.

Source: Estimated prevalence of diagnosed diabetes is based on the Minnesota Behavioral Risk Factor Surveillance Survey (BRFSS) and the National Health Interview Survey (NHIS). Undiagnosed diabetes and IGT are estimated from the Third National Health And Nutrition Examination Survey (NHANES III).

Each year, more than 15,000 Minnesotans are newly diagnosed with diabetes. This means that every 30 minutes in Minnesota, a doctor tells someone for the first time that they have diabetes.

Source: Estimated incidence is based on National Health Interview Survey (1990-1992) and the Minnesota population.

Diabetes is the 6th leading cause of death in Minnesota.

- Every day in Minnesota, 11 people die from diabetes or diabetes-related causes.
- Diabetes contributed to 3,388 deaths last year; of these, diabetes was the underlying cause of 1,207 deaths.<sup>3</sup>

Source: 2001 Minnesota death certificates.

## Risk Factors

Among adult Minnesotans without diabetes, significant, common and potentially modifiable risk factors place many at risk for developing diabetes.

- 3 in 5 are overweight or obese.
- 1 in 2 have sedentary lifestyles.
- 1 in 4 have no leisure time physical activity.

Source: Minnesota Behavioral Risk Factor Surveillance Survey (BRFSS).



Minnesota Diabetes Program  
Center for Health Promotion  
85 E 7<sup>th</sup> Place  
St. Paul, MN 55105  
651/281-9849  
[www.health.state.mn.us](http://www.health.state.mn.us)

## Preventive Care

Among Minnesotans with diabetes:

- 9 in 10 see a doctor or nurse at least once a year for their diabetes.
- 3 in 4 have had a dilated eye exam in the past year.
- 3 in 4 have had a foot exam in the past year.
- 7 in 10 have had their cholesterol checked in the past year, but 2 in 10 have *never* had their cholesterol checked.
- 6 in 10 check their blood glucose at least once per day.
- 7 in 10 have had a flu shot in the past year.
- 5 in 10 have ever had a pneumonia vaccination.

Source: Minnesota Behavioral Risk Factor Surveillance Survey (BRFSS).

## Long Term Complications

The risk of cardiovascular disease (CVD) and stroke are 2 to 4 times higher in people with diabetes.

- Half of all Minnesotans with diabetes have been told by a doctor they have high blood pressure.
- Minnesotans with diabetes are 2-3 times more likely than those without to have been told by a doctor that they have high blood pressure.
- CVD is present in nearly 4 out of every 5 diabetes-related deaths in Minnesota.

Source: Minnesota Behavioral Risk Factor Surveillance Survey (BRFSS) and Minnesota death certificates.

Diabetes is the leading cause of non-traumatic lower extremity amputations (LEAs). Among Medicare beneficiaries in Minnesota, the rate of LEAs is almost 13 times greater for those with diabetes compared to those without diabetes.

Source: Morbidity and Mortality Weekly Report August 14, 1998, Vol. 47, No. 31.

Diabetes is the leading cause of blindness among people age 20-74.

- Approximately 3,300 Minnesotans have diabetes-related blindness.
- Each year between 400 and 700 Minnesotans go blind due to complications of diabetes.

Source: Estimated prevalence and incidence of diabetes-related blindness are based on the Massachusetts State Commission for the Blind (MCB) registry and the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR).<sup>4</sup>

Diabetes is the leading cause of end-stage renal disease (ESRD), or kidney failure.

- Diabetes accounts for over 35% of new cases of ESRD treatment annually.



# Diabetes in Minnesota— page 2

- There were 441 new cases of ESRD treatment among Minnesotans with diabetes; 1,899 Minnesotans with diabetes were being treated for ESRD (estimate of prevalence).
- 31 Minnesotans with diabetes received kidney transplants.
- There are marked racial and ethnic disparities in ESRD in Minnesota.

Source: U.S. Renal Disease System (2003), 2001 data, adjusted for age and sex.

New cases of diabetes-related ESRD.	
Race/Ethnicity	Cases per million
Non-Hispanic White	75
Black	105
Asian	177
Hispanic	314
American Indian	433

Source: U.S. Renal Disease System, 1998 data, adjusted for age and sex.

## Mothers and Infants

Diabetes during pregnancy, if not tightly managed, can predispose infants to obesity, heart disease and diabetes as adults. For mothers, pre-existing diabetes (PEDM) can accelerate development of complications from diabetes, and mothers with gestational diabetes (GDM) have a significantly greater risk for developing type 2 diabetes.

- Last year, PEDM complicated 275 live births to Minnesota residents; gestational diabetes GDM complicated 2,284 Minnesota births.<sup>3</sup>
- Diabetes is the 2nd leading medical risk factor of pregnancy in Minnesota, behind hypertension.
- Babies born to Minnesota mothers with pre-existing diabetes have twice the risk of congenital anomalies and perinatal death.
- There are marked racial and ethnic disparities in diabetes-complicated pregnancy.

Prevalence of diabetes among live births to Minnesota residents.		
Race/Ethnicity	Per 1,000 Live Births	
	PEDM	GDM
Non-Hispanic White	3.6	29.4
Black	8.0	40.3
Asian	3.4	58.8
Hispanic	7.9	62.5
American Indian	29.9	67.2

Source: Minnesota birth certificates. PEDM rates are for 1998-2001. GDM rates are for 2001. Both are age-adjusted to the total maternal population, 1993-2001.

## Economic Cost

Diabetes costs Minnesota \$2 billion annually, including medical care, lost productivity and premature mortality. Source: Centers for Disease Control & Prevention (2001)

## Management and Prevention

Blood glucose control reduces the risk of long-term complications for people with type 1 and type 2 diabetes. Sources: Diabetes Control and Complications Trial (1993); United Kingdom Prospective Diabetes Study (1998).

Blood pressure control reduces the risk of complications, including stroke and heart failure, for people with type 2 diabetes.

Source: United Kingdom Prospective Diabetes Study (1998).

Blood lipid control reduces the risk of heart failure and death for people with heart disease and diabetes or impaired fasting glucose levels.

Source: Scandinavian Simvastatin Survival Study (4S) (1999).

Being active and eating healthfully sharply lowers the risk for developing type 2 diabetes among those at highest risk. The Diabetes Prevention Program showed that lifestyle changes are more effective than oral diabetes medications at preventing or delaying the onset of diabetes (58% vs. 31% reduction in risk). Lifestyle changes are effective for preventing diabetes among men and women of all ages and in all ethnic groups.

Source: Diabetes Prevention Program (2001).

For more information on diabetes management and prevention, please visit the Minnesota Diabetes Program's site on the World Wide Web:

<http://www.health.state.mn.us/diabetes/>

## Technical Notes

1. The Minnesota BRFSS is an annually administered telephone survey among randomly sampled Minnesota residents 18 years or older. The prevalence of diagnosed diabetes is assessed with the question: "Has a doctor ever told you that you have diabetes?"

2. Estimates derived from national surveys—National Health Interview Survey (NHIS) and the National Health and Nutrition Examination Survey III (NHANES III)—are based on a national sample, which may vary slightly from the Minnesota population.

3. Vital statistics may seriously underestimate diabetes prevalence and mortality. Surveys have found that diabetes is under-reported both as a cause and a contributing condition of death. Diabetes is mentioned on only about 40% of all death certificates among people with diagnosed diabetes. Diabetes may be reported for only 50% of all live births to mothers with diabetes.

4. The Massachusetts State Commission for the Blind (MCB) registry includes those 20 years or older; the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) includes all ages. Though estimates provided in this report assume they are the same, these populations may differ from the Minnesota population.

## **Appendix G: Health Outcome Data Review: Methods and Limitations**

## **Health Outcome Data Review: Methods and Limitations**

### **Methods**

Cancer incidence numbers (observed values) were obtained from the Minnesota Cancer Surveillance System (MCSS) that is the central cancer registry of the State of Minnesota. MCSS collects information on microscopically confirmed, malignant tumors, as well as benign tumors occurring in the head and spinal cord. An external audit of the completeness and quality of MCSS data done in 2002 found case completeness to be estimated at 99.9 percent, with an overall accuracy of 98.7 percent. The MCSS began operations in 1988. Race and ethnicity was collected passively from 1988 through 1994. From 1995 to present, race has been actively collected. In other words, if race were not submitted in a report, MCSS would go to the hospital record to try and determine race. In addition to this, MCSS has done a series of linkages with the Indian Health Service to try to better identify those individuals who are American Indian, since hospital records are often incomplete or in error. Permanent address at the time of diagnosis and therefore zip code is obtained from the medical record. Most of the residents of Cass Lake have P.O. Boxes rather than street names in their submitted addresses and so cannot be geocoded below the zip code level.

Zip code population numbers by five-year age groups for 1990 and 2000 were obtained from the Census Bureau. Zip code population numbers for the 1990 Census were not determined by the Census Bureau but rather contracted out to an outside vendor (personal communication). The 2000 zip code populations were calculated by the Census Bureau. For the purpose of racial counts for Minnesota as a whole, MCSS used the Census Bureau's "bridged" estimates.

The expected number of cancers is calculated by applying the sex, five year age group, and site specific cancer rates of the State of Minnesota to the zip code population of 56633 to determine how many cancers would have appeared over the 10 year period if the zip code of 56633 had the same age-specific rates as that of the State of Minnesota. The 1990 population numbers were used for the years 1993 and 1994 and the 2000 population numbers were used for the years 1995-2002. Statistical significance was determined using a Chi Square test.

Mortality data are obtained from death certificates which are collected, coded and computerized by the Minnesota Center for Health Statistics. Only the underlying cause of death was used in calculating cancer mortality. The same methods were used to calculate expected deaths as were used for expected incident cases by applying sex, five year age group, and site specific cancer mortality rates of the State of Minnesota to the zip code population of 56633.

### **Limitations**

There are several important considerations that limit the interpretation of the health outcome data review. The most important limitations are errors in the assessment due to confounding, exposure misclassification, and measurement error.

### 1. Confounding

In the Cass Lake community, the observation of an excess of any particular cancer does not necessarily point to an environmental cause attributable to the St. Regis site because many other genetic and behavioral factors are known to cause or contribute to cancer occurrence in a community. These analyses (observed to expected cancer incidence ratios) do not account for the ways that the Cass Lake community living near the St. Regis site and the Minnesota population differ with respect to other risk factors for cancer. According to the 2000 Census, the population living in the 56633 zip code area is 58% American Indian, 38% white, and 3% two or more races. This is in stark contrast to the statewide population, which is 1.1% American Indian and 89.4% white. In the 56633 zip code area the median household income is \$27,909, and 20% of families lived below the poverty level in 1999, compared to a statewide median household income of \$47,111 and 5.1% of families living below the poverty level. Racial, ethnic and socioeconomic differences tend to also be related to differences in genetic factors, smoking rates and other behavioral risk factors for certain cancers, and may explain a portion of the disease differences observed.

### 2. Exposure Misclassification

Chronic diseases, such as cancer, may be causally associated with environmental exposures that occurred 15 years or more in the past. In-migration and out-migration of the population over time will result in significant misclassification of the “exposed” population when residence in a specific geographic area at time of diagnosis or death is used as a proxy measure for past exposure to site contaminants. The 56633 zip code area, with a population of 4,323 in the 2000 U.S. Census, is the smallest geographic area for this analysis because geo-coded data were not available in the smaller census block units. However, the population that was most likely exposed to site contaminants at the St. Regis site lived within the City of Cass Lake, with a 2000 U.S. Census population of 839, with the highest exposure occurring during the years the plant was operating (1948-1985) among persons living in close proximity to the site. In Minnesota, it is estimated that one fourth of the population does not reside in the same household for ten years (from one census to the next). This migration rate may be even greater in lower income communities. Therefore, the majority of the population living within the 56633 zip code boundary today includes many people who are not exposed to site contaminants and persons with exposure are known to have moved out of the zip code area. This misclassification of the exposed population would make it unlikely that any observed differences in current disease or death rates in the population today compared to statewide rates could be attributed to exposures from the site. It also lessens the ability of this analysis to see any true excess disease that may be attributable to site exposure. Therefore, the absence of a statistical excess of a particular cancer or health outcome does not prove that no environmental risk to health from the site exists.

### 3) Measurement Error

This analysis measured all cancers and deaths that occurred during the 10-year time interval from 1993–2002 in the 56633 zip code area and compared that number to the number that would have been expected in that time period based on statewide age-

specific rates. Given the extended time period during which exposures to site contaminants have most likely occurred (starting in 1948) and the latency period for most carcinogens (15-30 years post-exposure), the time period used in this analysis (limited by the available data) likely has not captured outcomes that may have occurred prior to 1993. In addition, the analysis of cancer registry data presented in the report only examined the most common cancers, though MCSS collects information on approximately 80 different cancers. The report is limited because, in a small population, it is not possible to observe statistical excesses in rare outcomes due to the very small numbers.

While MCSS makes efforts to correctly determine a person's "permanent" address at the time of their cancer diagnosis, for people with more than one address, the address listed on the medical record at diagnosis may not match the address the person would have listed on the census form. This error can either inflate or deflate the count of observed cases, or outcomes, leading to an under- or overestimate in the standardized ratio.

Errors in the U.S. Census Bureau's counts of the size of the population at risk from which the expected numbers of cancers in the 56633 zip code area are calculated also will lead to errors in the ratio of observed to expected health outcomes. In an area with numerous P.O. boxes and rural routes, it is not possible to know precisely who does and does not live within the geographic boundary of the zip code. Also, according to data collected by the U.S. Census Bureau, undercounting of the population is a greater problem among the poor and minorities. For example, the U.S. Census estimates that the percent net undercount among American Indians living on reservations was 12.2 % in 1990 and 4.7% in 2000, compared to total population undercounts of 1.6% and 1.2% respectively. These undercounts will lead to underestimates in the expected health outcomes and overestimates of the standardized ratios.

In conclusion, while these analyses of available health outcome data can often help to inform the discussion about the overall health of the community relative to the larger statewide population, they should not be interpreted as an assessment of the health impacts from contaminants at the St. Regis site. Furthermore, other possible outcomes for which no population-based disease surveillance data exist are not captured in this analysis. For example, effects on the immune system, reproductive systems, neurological disorders, and developmental disorders have not been assessed in this health outcome review.

## **Appendix H: Public Comments and Responses**

Appendix H  
Public Comments Received and Responses

A draft of the St. Regis Paper site Health Concerns and Health Outcome Data Review Health Consultation was made available for public comment from January 1, 2006 until March 30, 2006. Comment letters were received from the general public, the City of Cass Lake, and two sets of comments from the International Paper Company. The original comments are on file and available for review from MDH/ATDSR/LLBO.

The comments are summarized and addressed below.

**Comments from community members**

A total of eight comments from community members were received between February 13, 2006 and April 24, 2006.

Comment #1: A resident expressed his frustration with the length of the Superfund process and little progress made after many years. He asserts that agency efforts have resulted in further contamination of Pike Bay, Cass Lake and other connected lakes. He suggests that all residents should be relocated and that to delay will only benefit others, not the residents. The resident attributes hundreds of cases of disease to exposure to chemicals from the site.

Response #1: Resident frustration at the slow pace of the Superfund process is understandable, however it is the process mandated by law. While the remedial plan has yet to be determined, the most contaminated soils, those above 1,000 ppb, have been removed by the US EPA.

MDH/ATDSR/LLBO have evaluated surface water near Cass Lake for site-related contaminants and concluded that the surface waters near the site do not pose a public health hazard. Low levels of several site-related contaminants were found in the water in Fox Creek, Pike Bay, the channel, and to a lesser extent in Cass Lake, but not at levels harmful to humans and only in some instances slightly above the state surface water criteria for aquatic organisms. MDH/ATSDR/LLBO did note that some additional sampling was needed in areas used more frequently for swimming and wading. However, there is no evidence that activities at the site are creating additional releases to the surface water or making the situation worse. In fact, the groundwater recovery system is preventing some contaminated groundwater from moving into these surface waters.

As noted in the health outcome data section of the report, while some past exposures, particularly occupational, were higher than would be acceptable today, we are unable to conclusively link diseases with site exposures due to many factors, including a lack of data. MDH/ATDSR/LLBO do support a public health intervention to reduce current exposures to dioxin on site, whether through additional soil removal, relocation or another effective remedy.

Comment #2: The commenter expresses concern over the construction and lifetime of the vault containing contaminated soils removed from the site. He was involved in the vault construction, familiar with the plans and recounts that the lifetime of the geo-membrane lining the vault was estimated to be five years from the time of construction in 1985. He concludes that EPA and state agencies have been unresponsive to his concerns and that once the vault releases leachate into the groundwater; it will once again be compromised.

Response #2: The vulnerability of the vault over its lifetime is also a concern to MDH/ATDSR/LLBO as leachate containing contaminants from the removed soils could migrate into the groundwater and pose a completed exposure pathway if that groundwater was used for human consumption or in fisheries producing fish for human consumption. This potential pathway has been evaluated in another MDH/ATDSR/LLBO health consultation on Surface Water, Ground water and Sediments that was released for public comment in 2005.

To date, shallow monitoring wells near the vault have not shown evidence of leakage of contaminants from the vault. However, sampling of the deeper fish hatchery wells located west of the vault has detected low levels of PAHs. The area where the vault is located was used for storage of treated lumber and spraying of wastewater from ponds at the site. So it is not clear if the detection in the fish hatchery wells are related to contamination that was in the area prior to construction of the vault or from the vault itself. MDH/ATSDR/LLBO recommended that additional groundwater investigation work be completed in the area near the vault.

Comment #3: The writer describes a former management employee of the plant who worked there for over 35 years and appears to be in good health, The man is now 87 years old and continues to enjoy elk hunting and hiking in the Rocky Mountains. If there are health issues from site contaminants, the writer suggests that this man would be likely to experience health problems. He also wonders why MDH/ATDSR/LLBO has not interviewed him.

Response #3: The informal interviews and community discussions that formed the basis for the health concerns portion of this document occurred over several years and in varied contexts. People volunteered to be interviewed; MDH/ATDSR/LLBO did not conduct formal interviews based on a random sample of the population. MDH/ATDSR/LLBO acknowledges the limits of this approach if the concerns and health issues gathered were to be offered as representing a larger population or as a means to link specific historical exposures with subsequent health problems. This health consultation is not a health study, but rather a descriptive summary of health concerns expressed over years of interaction by community members who feel that their concerns have not been adequately articulated to the state and federal agencies, responsible party, media and public.



As such, this document likely under-represents those people who do not believe that their health has been adversely affected by site activities and conditions, and we thank the commenter for pointing this out.

Comment #4: The commenter commends the agencies for their efforts to investigate and facilitate remediation of the site. He remains concerned about residual surface soil contamination that has percolated down through the sub-soils and contaminated the groundwater. He suggests that the agencies consider the work of Justine and Michael Toms in the Bioneers project which uses natural approaches and organisms to break down organic toxins.

Response #4: This information has been passed on to MDH/ATDSR/LLBO's hydrogeologist for the site, the project manager for the site from the Minnesota Pollution Control Agency and the remedial project manager for the site from the US Environmental Protection Agency.

Comment #5: The resident refers to the importance of her family's health and her role as a parent raising children on the site. Feeling that their house on the site was not a safe environment for children, they have relocated to a rental property off-site. The family now bears double expenses for housing; a mortgage for a home on site and rent for the home in which they now live.

Response #5: MDH/ATDSR/LLBO has heard from many residents/homeowners that the current situation presents a difficult economic burden for residents/homeowners of properties on site.

Comment #6 A resident of the City of Cass Lake for over 60 years expressed his frustration with the length of the process, the lack of agreement among the various government agencies and the emphasis placed on residents of the site versus the entire city. He further expresses the hope that all involved will stop finding fault and move on to pursuing economic development and a plan for the future for the city as a whole.

Response #6: MDH/ATDSR/LLBO acknowledges the need for the process to move forward as quickly as possible consistent with appropriate health protective measures.

Comment #7: A resident of the site relates his health history with a particular type of cancer and the treatment process that has occurred over several years. The implication is that the cancer is a result of exposure to contaminants from living on site.

Response # 7: MDH/ATDSR/LLBO is unable to comment on the possible link between site contaminants and this case of cancer. However, MDH/ATDSR/LLBO is committed to working for a remedy that will reduce contaminants to levels that will not contribute to excessive cancer risks for site residents in the future.

Comment #8: A citizen asked about the evidence for links between dioxins and endometriosis, allergies and multiple chemical sensitivities. She inquired about exposure to dioxins through consumption of fish from Pike Bay. Another question asked if there was any tracking of health effects among residents from the site.

Response #8: The available data regarding health effects in humans are limited to studies involving occupational or accidental exposures to complex mixtures of chemicals that included dioxins. Therefore, it is not certain that the observed effects are attributable only to dioxins. Also, the mixtures in these studies were often contained in an unusual matrix (e.g., pesticide mixtures, contaminated rice cooking oil) that may not resemble the environmental matrices or mixtures to which most people are exposed. Health effects such as endometriosis and alterations in immune function have not been consistently reported in human epidemiology studies that evaluated these endpoints (i.e., some studies report an association between the effect and the body burden of dioxins but others did not). As a result the association of these health effects to dioxin exposure in humans remains uncertain.

MDH is currently evaluating exposure to dioxin through consumption of fish from Pike Bay.

MDH does not have a statewide surveillance system for endometriosis, allergies or chemical sensitivity. While this report does include self-reports of disease and health concerns, it is not a scientific study of diseases in residents. We are not aware of any other study of site residents at this time.

### **Comments from the City of Cass Lake**

The City of Cass Lake submitted comments through the city's legal representative, Peters and Peters, PLC. Their letter is included in whole at the end of this appendix. The city's major concern was that the health consultation suggests that all of the areas excavated as part of the time-critical removal action were backfilled with clean soil and remain fenced currently. The city points out that some areas were never backfilled with clean soil. Areas had temporary fencing that was later removed and then were seeded with a vegetative cover.

### **Response**

The descriptions included in the public comment draft were summary statements that were intended to reflect the general state of the site removal and may not have been an accurate picture of each area of removal. The city is correct that, except for one yard with an occupied home, the excavated areas were not backfilled with clean soil. Excavated areas were temporarily fenced and covered until a vegetative cover could be seeded. Further work, which could include backfilling, will be based on the findings of the Human Health and Ecological Risk Assessment. The health consultation has been revised to reflect the City's comments.

## **Comments from the International Paper Company**

International Paper (IP) submitted general comments on two MDH/ATSDR/LLBO documents that were released for public comment at the same time (the Health Concerns and Health Outcomes Data Review Health Consultation and the Groundwater, Surface Water and Sediments Public Health Assessment), as well as individual comments on each document. Both the general letter and the specific comments may be found at the end of this appendix.

### Responses to International Paper Company general comments

*On the lack of an earlier opportunity to review the health consultation:* Normally, a health consultation is not offered for public comment, so IP being offered an opportunity to comment on this document is unusual. However, due to the complex nature of the site and the high degree of community interest in this site, MDH followed the standard ATSDR process for other documents in soliciting public comments; the opportunity for the responsible party to comment is extended at the same time as the affected community and the general public are invited to comment.

*On the lack of inclusion of the Human Health and Ecological Risk Assessment (HHERA) completed by IP:* This risk assessment was not yet completed, even in draft form, during the initial draft of this health consultation and therefore not referenced in the document. At this time, a final HHERA is still not available.

*On the implementation of the indoor dust interim response action:* This is an interim measure to reduce the residents' current exposures to dioxin from their yards and from house dust. This measure was designed and implemented after the initial draft of this document. Furthermore, the focus of the document is on a permanent remedy that will protect public health, not an interim measure

*On the integration of the various government agencies and consistency in public communications:* In fact, most health consultations for the state of Minnesota are authored by MDH as the state cooperative agreement partner and then certified by ATSDR. This health consultation is unusual in having three authors; MDH, ATSDR and the Leech Land Band of Ojibwe. It is especially important for this third party to be included as this reflects their status as a sovereign nation and the site's location on reservation land.

Furthermore, the public communications from the three agencies are a result of extensive collaboration. The volume of information, documents, assessments and technical background data for this site is overwhelming and would prohibit public participation or actions to protect health by residents if it were not for the agencies' efforts to communicate and educate about site conditions. Due to the lengthy process of risk

assessment and the yet to begin determination of remedial action, residents must be educated about actions they can take to protect their family's health in the interim.

IP's comments on MDH's previous soil health consultation are outside the scope of this document.

Further general comments by IP are directed at the Groundwater, Surface Water and Sediments Public Health Assessment. A response to these comments is in progress.

Responses to International Paper Company (IP) specific comments:

*Health Consultation, page 16. third paragraph -*

IP is correct that an industrial/commercial SRV has been used at the Joslyn site. However, the SRV is 35 ppt, not 350 ppt as asserted by IP. Changes have been made in the text to clarify the MPCA's residential SRV of 20 ppt and use of the industrial/commercial SRV at the Joslyn site on pages 7, 16 and 25 of the main narrative.

*Health Consultation, page 16, Potential for ongoing exposure from surface waters and lake sediment*

*page 17, Potential for ongoing exposure from consumption of fish and game on or near the site*

*page 17, Potential for ongoing exposure from uses of garden and native plants*

IP's draft Human Health and Ecological Risk Assessment (IP, 2005) was not accepted by EPA. MDH and the Leech Lake Band of Ojibwe (LLBO) have commented numerous times to EPA that the conclusions of the draft HHERA are not reliable. IP excluded data validated by EPA. IP did not use appropriate exposure factors. IP did not apply appropriate non-cancer reference doses to evaluate exposures to children. IP did not do parallel risk calculations for cancer, including a higher potency slope, as directed by EPA. These are just a few of the many shortcomings of the draft HHERA. The risks from exposures to environmental media remain to be assessed.

*Health Consultation, page 2, Cancer Concerns*

The Science Advisory Board directed EPA to consider using a non-linear model to assess carcinogenicity of dioxins and furans. Whether or not tetrachloro-dibenzo-*p*-dioxin is a known human carcinogen is irrelevant for risk assessment; dioxins are probable human carcinogens and cancer must be considered as an endpoint. Neither MDH, nor the LLBO, nor ATSDR, nor IP, nor EPA for that matter, know how yet another re-assessment of potency of dioxin carcinogenicity may turn out. At present, the only such assessments are the potency slopes published in the EPA dioxin reassessment. In order to calculate a range of possible alternative cancer risks EPA has directed IP to perform parallel cancer risk calculations in the HHERA. IP has so far failed to do this.

Further, MDH has a policy for assessing cancer risk from dioxins. This policy is stated on our website at:

<http://www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo1.html>

MDH recommends using a potency slope of  $1.4E+6[\text{mg}/\text{kg}\cdot\text{d}]^{-1}$  for assessing cancer risks from exposures to dioxins. The MPCA has used this to derive Soil Reference Values for dioxins. As noted above, the industrial/commercial SRV is 35 ppt. This criterion was used at the Joslyn site. The residential SRV is 20 ppt.

*Health Consultation, page 22, Health of Children and Future Generations; Page 24 Future Site Remediation*

The technical basis for the ATSDR/MDH conclusion that a site cleanup goal of 50 ppt is protective of public health is the ATSDR screening level (see ATSDR/MDH/LLBO, 2004). The screening level was derived from the ATSDR chronic Minimal Risk Level for dioxins (that should be used to assess non-cancer health effects for all exposures of 1 year or more), and conservative exposure assumptions for soil. MDH and LLBO believe that conservative exposure assumptions are appropriate for the Cass Lake community. We are unaware of any evidence that would lead to the use of less conservative exposure assumptions.

Similarly, MDH and the LLBO are not aware of any evidence that would warrant the use of exposure assumptions for the Cass Lake community that would lead to using a residential criterion, based on cancer, higher than the MPCA SRV of 20 ppt.

MDH and the Leech Lake Band agree that there is uncertainty in risk assessment. We have explained this to the public on many occasions. Because of uncertainties, MDH and the LLBO believe that conservative criteria should be used for decision-making.

*Health Consultation, page 30, Conclusions*

MDH, LLBO and ATSDR agree that “background” exposures from dioxins are important. Therefore, MDH, LLBO and ATSDR believe that site-related exposures should be kept to a minimum. ATSDR considered the possibility of background exposures in their development of the screening criterion of 50 ppt for soil.

*Health Consultation, page 31 and 32, Recommendations, Items 1 and 1a*

The IP draft HHERA has not been accepted by the EPA. It has many deficiencies, and is not a basis at this time for assessing uncertainties or for implementing remediation decisions.

*Health Consultation, page 31 and 32, Recommendations, Item 1b*

Consideration of excess cancer burden is a community concern and is addressed in the Health Consultation for that reason.

Additionally, the members of the Leech Lake Band constitute a vulnerable subpopulation due to chronic illness according to the US EPA’s Risk Assessment Guidance for Superfund (December 1989: Part A, Chapter 6, page 7). The potential impact of incremental dioxin exposure to this subpopulation, which is already experiencing excess disease (diabetes), has not been fully accounted for to date. Because research literature suggests that dioxin exposures affect metabolism and increase risk of diabetes, any

remedy must address the site specific risks to this vulnerable subpopulation already experiencing chronic illness.

*Health Consultation, page 32, Recommendations, Item 2*

The Health Consultation specifies safe levels of dioxins in soil (using the criteria of 20 ppt and 50 ppt to evaluate safe levels). Exposures to levels above these criteria could engender health risk. There is no statement that such exposures will result in adverse health effects.

Received 23 Jan 06



PETERS & PETERS PLC  
ATTORNEYS AT LAW

507 N. Nokomis St. #100  
Alexandria, MN 56308  
320-763-8458

Karna M. Peters\*  
James P. Peters

\*Also Admitted in California

January 20, 2006

Tannie Eshenaur  
Community Relations Coordinator  
Site Assessment and Consultation Unit  
Minnesota Department of Health  
625 Robert St. N.  
Box 64975  
St. Paul, MN 55164-0975

Re: Health Consultation Report on St. Regis Superfund Site

Dear Ms. Eshenaur:

I represent the City of Cass Lake with respect to the St. Regis Superfund Site. The City Council has discussed certain parts of the November 23, 2005 Health Consultation Report (Public Comment Version) on the St. Regis Superfund Site.

The City Council asked me to pass on a few comments to you. First, on pages 7 and 8 of the Report, there are discussions of the City of Cass Lake property that had been excavated in 2004 as part of the time-critical removal action. In the lower middle of page 7, there are suggestions that this area was later backfilled with clean soil, and that it is currently fenced. In the paragraph before the heading "Agency for Toxic Substances . . ." it says: "As of September 2004, excavations ranging from 4 inches to several feet in depth have been covered with an impermeable cloth and the area enclosed with temporary fencing to limit access, or backfilled with clean soil." The second paragraph under the heading "Current Conditions" on page 8 says that "Areas of the site recently excavated by EPA have been covered and surrounded by temporary plastic fencing."

However, despite the City of Cass Lake's repeated requests that International Paper place a cover of clean soil on this area, International Paper refused to do so. Also, International Paper removed the fencing in this area after planting a vegetative cover. Currently there is no fencing. The City of Cass Lake continues to request that as part of a final remedial action on the Site, with respect to this excavated area, International Paper should be required to put clean soil at sufficient depth over the area that previously was excavated.

Tannie Eshenaur  
January 20, 2006  
Page 2

The City asks that these parts of the Health Consultation Report be revised as noted above. Thank you for your continued work on this matter.

Very truly yours,

A handwritten signature in black ink, appearing to read "Karna M. Peters", written in a cursive style.

Karna M. Peters

Cc: City of Cass Lake, Clerk Renee Eckerly



**Thomas B. Ross**  
Manager  
EHS Services

6400 Poplar Avenue  
Memphis, TN 38197

T 901 419 3988  
F 901 419 4545  
[Tom.Ross@ipaper.com](mailto:Tom.Ross@ipaper.com)

March 29, 2006

**Via Overnight Delivery**

Ms. Tannie Eshenaur, M.P.H.  
Ms. Ginny Yingling  
Minnesota Department of Health  
625 North Robert Street  
St. Paul, MN 55155

**RE: Public Health Assessment for Groundwater, Surface Water, and  
Sediments at the St. Regis Superfund Site, Cass Lake, Cass County,  
Minnesota**

**Health Consultation—St. Regis Paper Company Site, Community Health  
Concerns and Health Outcome Data Review**

Dear Mses. Eshenaur and Yingling:

International Paper has reviewed the above-referenced draft *Public Health Assessment* and draft *Health Consultation* relating to the St. Regis Paper Company Site in Cass Lake, Minnesota and is herein providing comments on those documents during the public comment period. International Paper was not provided an earlier opportunity for comment or review of the documents. While we acknowledge and fully support the important roles of MDH and ATSDR in evaluating public health issues at the Site and providing information to the public regarding potential health hazards, these documents do not meet the minimum standards for accurate, timely, and complete risk communication and should be withdrawn. The documents should be redrafted to address all of the concerns identified in this letter and its attachments, and re-released for public comment.

The timing and content of these documents are important to International Paper and the community, particularly in light of our very high level of ongoing activity to address potential environmental and health concerns at the Site. As you should be aware, International Paper recently completed a comprehensive human health and ecological risk assessment of the Site, which was submitted to U.S. EPA and its agency partners, the Minnesota Pollution Control Agency (MPCA) and Leech Lake Band of Ojibwe (LLBO), in November 2005. This risk assessment provides a rigorous and comprehensive assessment of site-specific risks to human health at the Site. International Paper is also implementing, under U.S. EPA oversight, an interim response action to reduce potential exposures to hazardous substances in house dust at residences in the vicinity of the Site. Because both of the draft documents released by

Ms. Tamie Eshenauer  
Ms. Ginny Yingling  
March 29, 2006  
Page 2 of 4

MDH do not adequately acknowledge these efforts and current site conditions, they are outdated, misleading, and represent a backward step in public risk communication.

There is a very high degree of community and regulatory interest in environmental conditions at the Site and their potential implications for public health. For this reason, it is critically important that evaluations of site conditions and proposals for future actions to reduce any unacceptable health risks be rooted in a complete and accurate understanding of the facts and solid scientific analysis. It is also important that the activities of the regulatory community are well-integrated and, in particular, that public communications regarding health concerns be accurate and consistent. Unfortunately, the draft *Public Health Assessment* and draft *Health Consultation* oversimplify and misrepresent many important issues related to site conditions and public health.

We are particularly concerned with the draft *Public Health Assessment*, which is so deeply flawed that it will only create confusion and misunderstanding regarding environmental conditions at the Site and their potential implications for public health. The draft *Public Health Assessment* contains numerous factual inaccuracies, ignores or misrepresents much of the information that has been collected to characterize environmental and health conditions at the Site, presents unbalanced and misleading information, and reaches speculative and subjective conclusions regarding site conditions and potential human health concerns. Furthermore, the draft *Public Health Assessment* gives only passing acknowledgment to the recently completed risk assessment and incorporates none of its specific findings, even ignoring the extensive data set collected in 2004, despite the fact that this data set was available in April 2005, long before the December 2005 date of the draft document. Our detailed comments on the draft *Public Health Assessment* are presented as Attachment 1 to this letter and focus on the following broad areas of concern:

- The draft *Public Health Assessment* wrongly concludes that public health hazards associated with exposures to groundwater, sediment, and surface water are “indeterminate”; the human health risk assessment submitted to EPA in November 2005 presents a comprehensive evaluation of risks to human health from all relevant exposure media, including soil, groundwater, sediment, surface water, and biota.
- The draft *Public Health Assessment* fails to consider all available site data, including data collected in 2004 in support of the human health and ecological risk assessments, the omission of which renders many of the conclusions and recommendations inaccurate, obsolete, and inappropriate with respect to the adequacy of site characterization, current site conditions, and potential health concerns.
- The draft *Public Health Assessment* wrongly asserts that that former operations at the St. Regis facility resulted in contamination with PCBs and metals. Extensive sampling conducted at the site has produced no evidence of any release of PCBs or metals from the former wood treating operation to soil or groundwater.

- The draft *Public Health Assessment* applies inconsistent/inappropriate screening criteria to evaluate potential health hazards.
- The draft *Public Health Assessment* is inappropriately alarmist in tone and is based on an incomplete and selective analysis of available data.
- The draft *Public Health Assessment* includes numerous speculative statements that are either unsupported by the data and scientific analysis or in direct conflict with the facts.
- The draft *Public Health Assessment* contains numerous factual inaccuracies and omissions regarding the history of site operations, environmental investigations and remediation.

Regarding the *Health Consultation*, International Paper supports MDH and ATSDR's intended purpose of providing accurate, timely, and complete responses to the public's stated concerns about health issues that may be related to the Site. Unfortunately, this document also has serious deficiencies that prevent it from achieving these important risk communication goals. Detailed comments are provided as Attachment 2. Our most serious concerns with this document include:

- The draft *Health Consultation*, while acknowledging the recent human health risk assessment submitted to U.S. EPA in November 2005, incorporates none of its findings. Without considering the results of this comprehensive assessment of human health risks, the *Health Consultation* cannot provide accurate and complete responses to community concerns.
- The draft *Health Consultation* inaccurately portrays various media (including fish, plants, and game species) in the vicinity of the Site as sources of ongoing potential exposure to COPCs when the site-specific human health risk assessment indicates that many potential exposure pathways are either non-existent or result in risks that are within background levels or EPA's acceptable human health risk range.
- Information presented in the draft *Health Consultation* does not reflect the current state of the science regarding dioxin toxicity and mode of action, particularly with respect to carcinogenic effects.
- The draft *Health Consultation* inappropriately recommends applying a 50 parts per trillion health-based screening level for dioxin as a remediation goal for the site, rather than as a point of departure for a more detailed risk evaluation.
- The draft *Health Consultation*, overall, omits critical information that would provide a more accurate picture of the potential for human health risks associated with the Site, and of the state of knowledge about dioxin/furan toxicity and background exposure.

On a separate but related matter, while ATSDR/MDH's December 2005 final *Health Consultation* for soil at the Site included responses to International Paper's review comments on the draft *Health Consultation* in an appendix, International Paper's

Ms. Tamie Eshenauer  
Ms. Ginny Yingling  
March 29, 2006  
Page 4 of 4

comments and supporting information were largely ignored in the main body of the final document. International Paper is still concerned that the soils *Health Consultation* was prematurely finalized before all available Site data and the findings from the site-specific human health risk assessment were considered. More recent research on dioxin toxicity and background exposures, critical to the risk assessment of dioxins and furans, also remains absent from the final version of the soils *Health Consultation*. By omitting this critical information, the final consultation presents an incomplete picture of potential human health risks, and renders many of its conclusions and recommendations both inaccurate and inappropriate.

MDH's statement of vision includes the commitment to "keeping all Minnesotans healthy...using balanced and trusted science- and research-based information to guide policy and decision-making." MDH's recent documents related to the St. Regis site fall short of this standard and do not advance the goal of providing accurate information to the public regarding potential health risks at the St. Regis site. The draft *Public Health Assessment*, which has the most serious flaws, should be withdrawn and not referenced in the future. The draft *Health Consultation* must also be substantially revised to address the shortcomings we have identified before it is finalized.

Sincerely,



Thomas B. Ross

#### Attachments

cc: Rita Messing, MDH  
John Stine, MDH  
Tim Scherkenbach, MPCA  
Susan Johnson, MPCA  
William Cibulas, ATSDR  
Jeff Kellam, ATSDR  
Sven Rodenback, ATSDR  
Mark Johnson, ATSDR  
Clayton Koher, ATSDR  
Shirley Nordrum, LLBO  
John Percell, MN Chippewa Tribe  
Tim Drexler, U.S. EPA  
Steve Ginski, IP  
Rick Rothman, Bingham McCutchen  
Bill Locke, Integral  
Tom Mattison, Barr

## ATTACHMENT 2

March 29, 2006

### **SPECIFIC COMMENTS HEALTH CONSULTATION, ST. REGIS PAPER COMPANY SITE, COMMUNITY HEALTH CONCERNS AND HEALTH OUTCOME DATA REVIEW**

#### **Page 16. Third Paragraph**

The draft *Health Consultation* states that dioxin/furan TEQ values in soil from residential properties neighboring the St. Regis Site “exceed the MPCA residential/recreational SRV of 20 ppt that is being used to guide the investigation and cleanup of the Joslyn NPL site.” The fact is that the MPCA’s residential/recreational SRV is not being used to guide investigation and cleanup of the Joslyn site. The majority of the Joslyn Site was remediated and developed using a commercial/industrial SRV of 350 ppt. The remainder of the Joslyn Site is primarily wetlands and it is likely that ecological criteria and not human health SRVs will be used as the basis for future remedy, if any. In any event, 20 ppt is not the appropriate cleanup criterion for the Joslyn Site because the Site is zoned for commercial/industrial use.

#### **Page 16, Potential for ongoing exposure from surface water and lake sediment**

The draft *Health Consultation* reiterates the recommendation stated in ATSDR’s 2006 Public Health Assessment that access to Fox Creek and the channel area should be restricted and that warning signs be posted. As discussed in our separate review comments on the draft Public Health Assessment of groundwater, surface water, and sediment, this recommendation, without having considered all relevant information to make such conclusive remarks, is premature and can unnecessarily distress the public about recreating in nearby surface water bodies. Evaluation of the sediment data in the human health risk assessment (Integral 2005) indicates that the sediment exposure pathways (i.e., incidental ingestion and dermal contact) do not constitute a public health hazard. In fact, the findings of the risk assessment demonstrate that no adverse noncancer health effects are expected to occur in individuals engaged in traditional tribal lifeways or recreational activities as a result of contact with chemicals of potential concern in Fox Creek, Pike Bay, or the channel sediment. The risk assessment also concludes that all estimated incremental increases in cancer risks associated with sediment exposures are within or below EPA’s acceptable cancer risk range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  for both traditional tribal lifestyle and recreational scenarios. These conclusions are based on reasonable maximum exposures, as specified by EPA guidance (USEPA 1989).

**Page 17, Potential for ongoing exposure from consumption of fish and game on or near the site**

The draft *Health Consultation* states that fish tissue levels of dioxin are a potential health concern for people who consume fish regularly or as part of a traditional subsistence diet. International Paper recognizes that community members may have concerns about whether consumption of fish caught from Pike Bay or Cass Lake constitutes a complete exposure pathway for chemicals of potential concern. The site-specific human health risk assessment, submitted to U.S. EPA and its agency partners in November 2005 (Integral 2005), was conducted to determine whether this potential pathway, among several others, could result in unacceptable risks to Cass Lake residents and those visiting the area for recreational purposes. The risk assessment findings show that dioxins/furans risk estimates from eating fish caught in Cass Lake and Pike Bay are not higher than risks associated with eating fish caught in background comparison lakes.

Specifically, the risk assessment provides a detailed comparison of concentrations of chemicals of potential concern in fish collected from Cass Lake and Pike Bay and fish collected from three nearby reference lakes (Ball Club Lake, Bowstring Lake, and Sand Lake), along with additional reference lakes included in EPA's National Lake Fish Tissue (NLFT) study (USEPA 2005) for the Northern Lakes and Forest ecoregion of Minnesota. The statistical comparisons presented in the risk assessment show that concentrations of dioxins/furans (expressed as TEQdf) are not higher in Cass Lake and Pike Bay than in reference lakes. This finding applies to all tissue types (fillet, whole body, and eggs). Therefore, dietary exposures to TEQdf in fish from Cass Lake and Pike Bay are indistinguishable from background.

While consumption of wild birds and game that eat local vegetation may be a possible exposure pathway, the habitat within potentially impacted areas in the vicinity of the site is either non-existent or has marginal value for foraging compared to other nearby areas and most animals forage for food over a large area. In addition, the total acreage within these areas is not sufficient to sustain large populations of small game. For example, the density of rabbits is expected to be approximately 1.1 rabbits per hectare (USEPA 1993), which would provide limited harvesting potential. Furthermore, exposure of small game to chemicals of potential concern in local vegetation may be negligible because plant uptake of site-related chemicals, such as dioxins/furans and PAHs, does not occur to a significant degree (USEPA 2003; ATSDR 1995). Because of the combination of these factors, the July 2004 *Human Health and Ecological Risk Assessment Work Plan* (USEPA 2004), finalized and approved by EPA Region 5, concluded that consumption of game and birds is considered a potentially complete but a minor exposure pathway compared to direct contact pathways (e.g., soil ingestion).

In addition, International Paper is not aware of any additional sampling of game species or an intent by EPA to evaluate game species as a primary food source for human health

risk. If such sampling has been conducted by U.S. EPA or its agency partners, International Paper requests the data and any evaluation resulting from such sampling be forwarded to its attention.

**Page 17, Potential for ongoing exposure from uses of garden and native plants**

In response to public concerns about ingestion of plants grown in the vicinity of the site, the draft *Health Consultation* states that this exposure pathway is an ongoing concern and advises residents near the site to avoid gardening or collecting native plants. The consultation also asserts that there is some evidence that PAHs and dioxins may be taken up from the soils by plants and incorporated into plant tissues. Without the findings of the November 2005 human health risk assessment incorporated into the draft *Health Consultation*, these statements provide an incomplete picture of the potential for exposure via consumption of plant material. International Paper recognizes that community members may have concerns about whether consumption of homegrown produce and native plants represent a complete exposure pathway for chemicals of potential concern. The site-specific human health risk assessment was conducted to determine whether this potential pathway, among others, could result in unacceptable risks to Cass Lake residents. As discussed below, the findings indicate that potential exposures via these pathways are either non-existent, are within acceptable human health risk levels, or are small compared to other more direct contact pathways (e.g., soil ingestion).

A visual survey of residences in the vicinity of the site conducted during the 2004 field sampling event identified only three existing gardens, all of which were grown in either amended or imported soil (Barr 2005; Integral 2005). Residents who were interviewed during the field survey explained that the native sandy soil does not support quality plant growth and soil typically is imported for gardens and lawns (Integral 2004). It is unlikely that gardens will be grown in the native soil in the future. Because of the low potential for the presence of gardens with unamended native soil in the vicinity of the site, ingestion of vegetables from home gardens is not considered a complete exposure pathway. However, for the purposes of future land use and risk management planning, an evaluation of this hypothetical pathway was included in the uncertainty analysis of the human health risk assessment (Integral 2005).

To evaluate the potential for exposure via home garden vegetables, plant uptake models that predict produce tissue concentrations of lipophilic chemicals such as dioxins/furans, PAHs, and pentachlorophenol were used in the risk assessment (Integral 2005). Because of the considerable variability in the models available in the literature, three models were selected to represent a range of chemical uptake estimates. None of the three models resulted in estimates of uptake to garden plants that resulted in unacceptable risks from ingestion of garden plants. Specifically, all hazard indices were below one for noncarcinogenic risk. For cancer risk calculations, the method judged most likely to be

representative predicted incremental increases in cancer risks that were below or within EPA's acceptable cancer risk range.

In addition, a review of plant uptake literature revealed that transfer from soil to vegetables is limited for the soil chemicals of potential concern (dioxins/furans, PAHs, and pentachlorophenol) identified in the human health risk assessment (ATSDR 1995, 1998; Wild and Jones 1992; Beck et al. 1996; O'Connor et al. 1991; Jacobs et al. 1987). Uptake that might occur would generally be limited to soil-to-root transfer, primarily in the root peel (e.g., carrot peels).

With respect to gathering and using native plants, a comprehensive qualitative evaluation of exposure pathways specific to a traditional tribal lifeways scenario, such as those listed in the Public Health Assessment for groundwater, surface water, and sediments, is provided in the human health risk assessment (Integral 2005). The assessment indicated that potential exposures via these pathways are either non-existent, are very low, or are small compared to other more direct contact pathways (e.g., soil ingestion).

### **Page 21, Cancer Concerns**

The statements provided in the draft *Health Consultation* on the carcinogenicity of dioxins/furans fail to acknowledge the ongoing research and debate in the scientific community about the potential carcinogenicity of dioxins/furans. Including this information can provide a more complete picture of the state of knowledge about dioxins/furans and human health effects at low environmental concentrations.

For example, there is skepticism among scientists about the conclusions of EPA's dioxin reassessment (USEPA 2000, 2003). While there is a general consensus among the scientific community that a causal relationship between TCDD exposure and increased incidences of cancer in laboratory animals is adequately supported by existing studies (USEPA 2001; Pohl et al. 2002), the interpretation of evidence that TCDD is carcinogenic in humans is much more controversial. The Science Advisory Board (SAB) panel members and other scientists who reviewed EPA's draft dioxin reassessments are skeptical about whether the strength of the epidemiological data supports EPA's (USEPA 2000; 2003) conclusion that dioxin is carcinogenic to humans (USEPA 2001; Pohl et al. 2002; Starr 2003; Howlett et al. 2004). Many SAB panel members did not support the classification of dioxin as a human carcinogen because the evidence was judged not to meet the causal criteria outlined in EPA's 1996 draft cancer guidelines (USEPA 2001).

Specifically, these panel members expressed skepticism in EPA's conclusion that the primary increase in cancer incidence was due to all cancers combined. Typically an agent does not have the ability to affect all cancers combined. The SAB found that there was an inconsistent cancer response across epidemiological studies and only small relative risks were observed in each study over a wide range of exposures (USEPA 2001). In addition,



the possible impact of confounding exposures, such as cigarette smoking or exposure of workers to other occupational chemicals, was not accounted for in the reassessment, resulting in a high degree of uncertainty in exposure estimates. The SAB panel suggested that other chemical carcinogen exposures in the occupational cohorts could be generating an inflated cancer slope factor (CSF). Two of the cohorts included in the CSF derivation were exposed to substantial amounts of dioxin-like compounds in addition to 2,3,7,8-TCDD, while EPA attributes all of the excess cancer mortality to 2,3,7,8-TCDD in its dose-response analyses (USEPA 2001).

Further, there is a lack of understanding of the specific mechanism of action of TCDD, and evidence does not support EPA's conclusion that the mode of action is similar across humans and animals; therefore, one cannot infer human cancer causality from animal study results (USEPA 2001; Pohl et al. 2002). These factors cast doubt as to whether the epidemiological and animal data collectively show a causal relationship between dioxin exposure and cancer in humans.

Finally, both EPA and other health agencies recognize that TCDD is not a genotoxic agent and acts via a receptor-mediated, multistep pathway (USEPA 2001; Pohl et al. 2002; Aylward et al. 1996). That is, it does not damage genetic material, or DNA, and therefore is not a mutagen that initiates cancer. Instead, TCDD is viewed as a cancer promoter, which while not carcinogenic itself, may act to enhance the effects of other substances known to be carcinogenic (USEPA 2001, 2003; Pohl et al. 2002). Walker et al. (2004) found that TCDD was not mutagenic in both *in vitro* and *in vivo* short-term tests, substantiating the general consensus that TCDD should be described as a cancer promoter rather than a genotoxic agent.

**Page 22, Health of Children and Future Generations; Page 24, Future Site Remediation**

The draft *Health Consultation* states that MDH and LLBO consider 50 ppt TCDD TEQ as a conservative cleanup action for dioxin in residential soil. The draft *Health Consultation* also repeatedly refers to values of 20 ppt and 50 ppt TCDD TEQ as soil concentrations above which contact by residents should be avoided, implying to the public that soil concentrations above these levels will result in adverse health effects. MDH has not provided an adequate technical basis for recommending that its 50 ppt dioxin health-based screening value be used as a cleanup level at this site. MDH's value is particularly unsupportable given the findings of the site-specific risk assessment recently conducted (Integral 2005), the dioxin policy set forth by ATSDR, and the widespread scientific skepticism about EPA's dioxin reassessment. Screening levels represent, and should be portrayed to the public, as chemical concentrations in environmental media below which no adverse effects are expected to occur. Exceedance of a screening level does not necessarily indicate the existence of unacceptable risk, but instead indicates that further evaluation of the chemical may be warranted. The confusion between screening levels

and cleanup levels in the text of the draft *Health Consultation* is troubling and should be corrected.

The ATSDR policy guideline upon which MDH's screening value is based (De Rosa et al. 1999), specifically defines the ATSDR dioxin health guidance value of 50 ppt TEQ as a non-site-specific screening level. The policy also states that soil concentrations above the guidance values recommended by ATSDR, including the 50 ppt TEQ level, should not be interpreted as indicating actual health effects. The values are only provided as a protective framework for beginning to evaluate the health implications of exposure to dioxin in residential soils on a site-specific basis (De Rosa et al. 1999).

Similarly, ATSDR does not provide a rationale for suggesting that the public avoid dioxin soil concentrations above the MPCA soil reference value (SRV) of 20 ppt. This generic, non-site-specific value is also considered a screening level (MPCA 1998), and should be used as a point of departure for more site-specific assessment, rather than a remediation goal.

Furthermore, the 20 ppt SRV is based on a CSF that is associated with a high level of scientific uncertainty. This CSF, based on the proposed value presented in EPA's 2000 draft reassessment (1.4E+6 kg-day/mg) (USEPA 2000) is the subject of ongoing review by the National Academy of Sciences (NAS) and has not gained widespread technical acceptance or application in risk assessments. NAS is charged with addressing questions about EPA's cancer risk estimates, modeling assumptions, the uncertainties and variability that surround those estimates, whether human studies support EPA's risk conclusions, and the agency's method for comparing various types of dioxins through the use of toxicity equivalence factors. The purpose is to go beyond the policy issues and focus on the fundamental science behind the dioxin study, the findings of which have been confounded by many technical problems. New findings from recently published studies on the pharmacokinetics of dioxin and the meta-analyses of dioxin exposure suggest that the dioxin dose response needs further evaluation before credible risk estimates can be determined (Aylward et al. 2005a,b; Crump et al. 2003; Starr 2001; Mackie et al. 2002).

For example, new research findings demonstrating that TCDD elimination from the human body is dose-dependent and age-dependent call into question the accuracy of the reconstruction of historical exposures in occupational cohorts exposed to dioxin. Exposure estimates and the dose-response assessment of workers in these cohorts, relied upon by EPA for deriving the CSF, are based on back-calculations of serum lipid TCDD levels over several years assuming fixed first-order elimination rates (USEPA 2003). In a recent examination of data from high TCDD exposure cases (patients in Vienna, Austria, and workers in Seveso, Italy), Aylward et al. (2005a) found that the elimination rate of dioxin from humans is dose-dependent and significantly faster at higher exposure levels

than previously thought. Using data from the Seveso, Italy, cohort, Aylward et al. (2005a) reconstructed exposure estimates for a subset of the National Institute for Occupational Safety and Health (NIOSH) cohort EPA relied upon to calculate the TCDD CSF. They estimated exposures using a dose-dependent elimination model (known as the Carrier et al. model), modified to account for the apparent differences in elimination processes assumed in the model and those observed in humans.

Depending on the dose metric and summary measure selected, exposure estimates were at least 25 times as high as previous estimates obtained assuming a constant elimination half-life of 7.5 years. Aylward et al. (2005a) found that the elimination rate for TCDD varies with body concentration, with substantially faster elimination at elevated body concentrations than at lower body concentrations. Thus, at peak concentrations, which were assumed to occur during the last year of exposure, elimination of TCDD was highest. In addition, their analyses showed that TCDD half-life was positively correlated with age, indicating that younger individuals on average metabolize TCDD more rapidly than older individuals. Gender of exposed individuals also substantially influenced the TCDD half-life, with males eliminating TCDD faster than females.

These results clearly indicate that for human dose estimates back-calculated over long time periods and to elevated body burdens, the assumption of simple first-order elimination kinetics is not valid because of the nonlinear nature of the elimination process (Aylward et al. 2005a). It is likely, therefore, that previous cancer dose-response assessments of the TCDD-exposed occupational cohorts have underestimated exposures, leading to an overestimation of the TCDD cancer slope factor presented in EPA's reassessment.

Based on this important new study, as well as EPA's own caveats warning against premature reliance on the draft reassessment (USEPA 2006), it is scientifically inappropriate to use the high end estimate of dioxin potency from the reassessment as the basis for issuing public health warnings. At a minimum, risk communications with the public should clarify the great uncertainty associated with risk levels based on the reassessment CSF.

### **Page 30. Conclusions**

The draft *Health Consultation* correctly states that exposure to dioxin in the general population primarily occurs through consumption of food, particularly animal and dairy products (on pages 17 and 22). Given the importance of background dioxin exposure to a person's overall risk for exposure to dioxin from both site and non-site related sources, it is critical that the consultation provide a more meaningful discussion of this issue in context of the site and the conclusions presented in the consultation. For example, the human health risk assessment recently conducted for the site (Integral 2005) includes an evaluation of non-point sources of dioxins/furans in the environment and of background

intake levels identified in the scientific literature. This evaluation then provided the basis for comparing background intake levels to site-specific intake levels.

Based on recent estimates, the average (central tendency) adult background intake of dioxins/furans (TEQ<sub>DF</sub>-WHO<sub>98</sub>) in the U.S. is 0.61 pg/kg-day (43 pg/day assuming a 70 kg adult body weight) for combined exposures via soil ingestion and dermal contact, inhalation of dioxins/furans in air, water ingestion, and food intake (USEPA 2003). Of this estimate, ingestion of foods accounts for approximately 95 percent (0.58 pg/kg-day) of total exposures for all media combined (e.g., water, soil, air, and food). Ingestion of fish and shellfish (20 percent of the total), beef (21 percent of the total), and milk and dairy (23 percent of the total) contributed most to the total daily intake of dioxins/furans via food. By comparison, combined exposures via inhalation, soil and water ingestion, and dermal contact with soil accounted for only about 5 percent of the total exposures for the average U.S. adult (USEPA 2003). The remainder of the total was contributed by ingestion of other meat products (e.g., eggs, pork, poultry) and to a lesser extent by vegetable fats.

For individuals with higher than average food consumption rates, USEPA (2003) estimated upper end background exposures for the general adult population of 1.1 pg/kg-day (77 pg/day for a 70 kg body weight) by combining average foodstuff concentrations of dioxins/furans with upper percentile intake rates. This estimate is approximately 1.8 times greater than that for a typical adult exposure. For this estimate, only upper percentile intake rates for food were applied; for soil, water, and air exposures, average intake rates used for the typical adult were used (USEPA 2003). Of this total upper end background intake estimate, 0.98 pg/kg-day is attributable to dietary sources alone (USEPA 2003).

Intakes for children are typically higher on a unit body weight basis than intakes for adults, because children eat more on a unit body weight basis than do adults. For children ages 1 to 5 years, average background exposure due to all sources is estimated at 2.2 pg/kg-day (34 pg/day assuming a 15 kg child body weight), roughly 3.6 times the adult average. Of this estimate, 2.1 pg/kg-day is attributable to dietary sources (USEPA 2003).

In comparing the background exposure levels described above with site-specific upper end exposure levels, only one sample location exceeded the average background intake for adults by about 1.8 times. This occurred at a location on Cass Lake City-owned property, in which a hypothetical future residential scenario was assumed. For existing residential area sampling locations, only one location was above 50 percent of background, and none of the locations was above 33 percent of background for cancer intakes. For half of the locations, site-related intakes represented no more than 6 percent of the average background intake estimate for dietary exposure to dioxins/furans (Integral 2005).

All of the site-related intakes for existing and hypothetical future adult residents in the vicinity of the site are within the World Health Organization's tolerable daily intake (TDI) range of 1-4 pg/kg-day for dioxins (TEQ<sub>DF-WHO98</sub>) (WHO 1998). According to the World Health Organization, this range represents "a tolerable daily intake for life-time exposure and that occasional short-term excursions above the TDI would have no health consequences provided that the averaged intake over long periods is not exceeded" (WHO 1998). The highest intake (0.7 pg/kg-day) for existing residential sampling locations was less than the low end of WHO's tolerable daily intake range (Integral 2005).

For average childhood intakes (ranging from 0.009 to 1.2 pg/kg-day) estimated for existing and hypothetical future child residents, only one sample location was above 50 percent of background intakes, and half were below 5 percent of background intakes. For upper end intakes, one location was above background intakes and half were below 10 percent of background intakes. For upper end exposure assumptions, the highest childhood intake was 2.8 pg/kg-day. Upper end background intake values for children were not available for comparison (Integral 2005).

**Page 31 and 32, Recommendations, Items 1 and 1a**

The protective policies for handling uncertainties in the data identified as necessary in the draft *Health Consultation* are built into the CERCLA risk assessment process and were implemented in the St. Regis site human health risk assessment. Specifically, the site-specific risk assessment recognizes the unique LLBO activities that residents may engage in at the site and surrounding area by evaluating both residential and traditional tribal lifeways scenarios. Both scenarios include detailed descriptions of potential exposure pathways and site-specific risk estimates (Integral 2005).

The risk assessment also addresses the potential for noncancer health effects of dioxin in human receptors by comparing site-specific daily intake levels with reference doses (RfDs) when estimating noncancer risk in the risk characterization step (i.e., hazard indices). RfDs are toxicity values that represent average daily exposure levels at which no adverse noncancer effects are expected to occur with chronic exposures (or subchronic exposures in the case of children or construction workers where exposure is less than 7 years). RfDs reflect the underlying assumption that systemic toxicity occurs as a result of processes that have a threshold (i.e., that a safe level of exposure exists and that toxic effects will not be observed until this level has been exceeded).

The RfDs used in the human health risk assessment are based on ATSDR's minimum risk levels (MRLs). The current MRL of 1 pg/kg-day for chronic exposure is based on the lowest-observed-adverse-effect level (LOAEL) for reproductive effects in rhesus monkeys, adjusted by a 90-fold uncertainty factor. Data from a subsequent rhesus monkey study showing neurobehavioral effects support this value for the MRL. The results of the

second study, combined with a better understanding of interspecies differences, reduce the degree of uncertainty in the data and increase the level of confidence in the current MRL (Pohl et al. 2002; ATSDR 1998). ATSDR scientists concluded that based on a review of available literature on dioxin, the chronic MRL of 1 pg/kg-day is approximately 2 orders of magnitude below any health effect levels demonstrated either in laboratory animals or in epidemiologic studies for both cancer and noncancer health endpoints (Pohl et al. 2002; De Rosa 1999).

ATSDR's intermediate or subchronic MRL of 20 pg/kg-day is based on the no-observed-adverse-effect level (NOAEL) for decreased thymus weight in guinea pigs. This value includes a 30-fold uncertainty factor to account for extrapolation from animals to humans and human variability (ASTDR 1998).

**Page 31 and 32, Recommendations, Item 1b**

The draft *Health Consultation* states that the human health risk assessment should consider the unique vulnerabilities of the affected population, particularly the known excess burden of cancer and diabetes among American Indian residents, and ensure that site remediation goals are protective given these excess burdens. The observed and expected cancer incidence data presented in the draft *Health Consultation* demonstrates a significant excess of lung, kidney, oral cavity, and cervical cancers for residents within the 56633 zip code area. As stated in the draft *Health Consultation*, all of these types of cancer are associated with cigarette smoking, and increased incidences of lung and cervix cancer are found in American Indian populations across Minnesota.

EPA guidance specifies that risk assessments must specifically investigate risks to subpopulations of potential concern and their unique vulnerabilities (USEPA 1989). However, consideration of excess cancer burden and other diseases associated with non-site-related factors (e.g., smoking) is not specified in EPA risk assessment guidance and is outside the scope of a CERCLA risk assessment. Subpopulations are identified as groups that may be at increased risk from chemical exposures due to increased sensitivity, behavior patterns that may result in high exposure, and/or current or past exposures from other sources (USEPA 1989). According to this definition, the human health risk assessment (Integral 2005) complies with the requirement that assessment of all relevant subpopulations of potential concern must be made. The risk assessment includes evaluation of those that may be more sensitive to chemical exposures (e.g., young children), those potentially at higher risk due to behavior patterns (e.g., those practicing tribal lifeways), and those at higher risk due to exposures to chemicals of potential concern from other sources (e.g., workers).

**Page 32, Recommendations, Item 2**

The draft *Health Consultation* recommends that soils with dioxin concentrations above 20 ppt or 50 ppt TCDD TEQ should be avoided by residents, implying to the public that

soil concentrations above these levels will result in adverse health effects. However, as discussed above in a comment about similar statements on page 21, *Health of Children and Future Generations* and page 24, *Future Site Remediation*, these values are unsupportable given findings from the site-specific risk assessment recently conducted, the dioxin policy set forth by ATSDR, and the high degree of skepticism in EPA's dioxin reassessment. Screening levels represent, and should be portrayed to the public as, chemical concentrations in environmental media that should be used as a point of departure for determining whether a chemical warrants further evaluation. Screening levels are not indicators of adverse effects or equivalent with cleanup goals.

## References

- ATSDR. 1995. Toxicological profile for polycyclic aromatic hydrocarbons. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. December. [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov). Accessed September 20, 2005.
- ATSDR. 1998. Toxicological profile for chlorinated dibenzo-*p*-dioxins. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. December. [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov). Accessed May 11, 2005.
- Aylward, L.L., S.M. Hays, N.J. Karch, and D.J. Paustenbach. 1996. Relative susceptibility of animals and humans to the cancer hazard posed by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin using internal measures of dose. *Environ. Sci. Technol.* 30:3534-3543.
- Aylward, L.L., R.C. Brunet, G. Carrier, S.M. Hays, C.A. Cushing, L.L. Needham, D.G. Patterson, P.M. Gerthoux, P. Brambilla, and P. Mocarelli. 2005a. Concentration-dependent TCDD elimination kinetics in humans: toxicokinetic modeling for moderately to highly exposed adults from Seveso, Italy, Vienna, Austria, and impact on dose estimates for the NIOSH cohort. *J Expos. Anal. Environ. Epidemiol.* 2005: 15, 51-65. [www.nature.com/jea](http://www.nature.com/jea).
- Aylward, L.L., R.C. Brunet, T.B. Starr, G. Carrier, E. Delzell, H. Cheng, and C. Beall. 2005b (in press). Exposure reconstruction for the TCDD-exposed NIOSH cohort using a concentration- and age-dependent model of elimination. *Risk Anal.*
- Barr. 2005. Data report. Human health and ecological risk assessment unilateral administrative order docket no. V-W-'04-C-796. St. Regis Paper Company Superfund Site, Cass Lake, MN. Prepared for International Paper, Memphis, TN. Prepared by Barr Engineering Company, Minneapolis, MN.
- Beck, A.J., D.L. Johnson, and K.C. Jones. 1996. The form and bioavailability of non-ionic organic chemicals in sewage sludge-amended agricultural soils. *Sci. Tot. Environ.* 185:125-149.
- Crump, K.S., R. Canady, and M. Kogevinas. 2003. Meta-analysis of dioxin cancer dose response for three occupational cohorts. *Environ. Health Perspect.* III (5):681-687.
- De Rosa, C.T., D. Brown, R. Dhara, W. Garrett, H. Hansen, J. Holler, D. Jones, D. Jordan-Izaguirre, R. O'Conner, H. Pohl, and C. Xintaras. 1999. Dioxin and dioxin-like compounds in soil, Part I: ATSDR policy guideline and Part II: technical support document for ATSDR policy guideline. *Tox. Indust. Health* 15:552-576.
- Integral. 2004. Home gardener survey, conducted by Integral Consulting Inc. staff during 2004 field sampling, St. Regis Paper Company Site, Cass Lake, MN. September.
- Integral. 2005. Human health and ecological risk assessment. St. Regis Paper Company Site, Cass Lake, MN. Prepared by Integral Consulting Inc., Mercer Island, WA, for



International Paper pursuant to Unilateral Administrative Order Docket No. V-W-04-C-796. November 16.

Howlett, C.T., R.G., Tardiff, and L.L. Aylward. 2004. Comments offered to the committee to "Review EPA's assessment of the health implications of exposure to dioxin." Board on Environmental Studies and Toxicology, National Academy of Sciences, Washington, DC. November 22.

Jacobs, L.W., G.A. O'Connor, M.A. Overcash, M.J. Zabik, P. Pygiewicz, P. Machno, S. Munger, and A.A. Elsewi. 1987. Effects of trace organics in sewage sludges on soil-plant systems and assessing their risk to humans. Chapter 6. Land Application of Sludge – Food Chain Implications. Lewis Publishers, Inc. pp. 101-143.

Mackie, D., J. Liu, Y. Loh, and V. Thomas. 2002. No evidence of dioxin cancer threshold. *Env. Health Perspect.* Online, doi:10.1289/ehp.5730 (<http://dx.doi.org/>)

MDH. 2003. Memorandum to the Minnesota Pollution Control Agency, March 17, 2003: Methods for Estimating the Carcinogenic Health Risks from Dioxin-Like Compounds ([www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo.html](http://www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo.html)).

MPCA. 1998. Draft guidelines risk-based guidance for the soil-human health pathway user's guide. Working draft. Minnesota Pollution Control Agency, Site Remediation Section. September.

O'Connor, G.A., R.L. Chaney, and J.A. Ryan. 1991. Bioavailability to plants of sludge-borne toxic organics. *Reviews of Environ. Contam. Toxicol.* 121:129-155.

Pohl, H.R., H.E. Hicks, D.E. Jones, H. Hansen, and C.T. De Rosa. 2002. Public health perspectives on dioxin risks: two decades of evaluations. *Hum. Ecol. Risk Assess.* 8:233-250.

Starr, T.B. 2001. Significant shortcomings of the U.S. environmental Protection Agency's latest draft risk characterization for dioxin-like compounds. *Toxicol. Sci.* 64:7-13.

Starr, T.B. 2003. Significant issues raised by meta-analyses of cancer mortality and dioxin exposure. *Environ. Health Perspect.* Online May 22, 2003. [www.ehponline.org](http://www.ehponline.org).

USEPA. 1989. Risk assessment guidance for Superfund (RAGS): Volume 1 – Human health evaluation manual (Part A). Interim final. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 1993. Wildlife exposure factors. Volume I of II. EPA/600/R-93/187a. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

USEPA. 2000. Exposure and human health reassessment of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and related compounds. Draft. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

- USEPA. 2001. Dioxin reassessment – an SAB review of the Office of Research and Development’s reassessment of dioxin. EPA Science Advisory Board. U.S. Environmental Protection Agency, Washington, DC.
- USEPA. 2003. Exposure and human health reassessment of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and related compounds. NAS Review Draft. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. EPA/600/P-00/001. December.
- USEPA. 2004. Human health and ecological risk assessment work plan: St. Regis Paper Company Site, Cass Lake, Minnesota. Unilateral administrative order for human health and ecological risk assessment. Docket No. V-W-04-C-796. U.S. Environmental Protection Agency, Washington, DC. August 11.
- USEPA. 2005. National lake fish tissue study. Office of Water Science, U.S. Environmental Protection Agency. Results available online at: <http://www.epa.gov/waterscience/fishstudy/overview.htm>.
- USEPA. 2006. National Center for Environmental Assessment website. <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=55264>
- Walker, N.J., P. Crockett, A. Nyska, A. Brix, M.P. Jokinen, D.M. Sells, J.R. Hailey, M. Easterling, J.K. Haseman, M. Yin, M.E. Wyde, J.R. Bucher, and C.J. Portier. 2004. Dose-additive carcinogenicity of a defined mixture of “dioxin-like compounds.” *Environ. Health Perspect.* Online October 19, 2004. [www.ehponline.org](http://www.ehponline.org).
- WHO. 1998. Assessment of the health risk of dioxins: re-evaluation of the tolerable daily intake (TDI), executive summary. World Health Organization. As cited in CCC. 2005: The Chlorine Chemistry Council. 2005. Accessed online ([http://www.dioxinfacts.org/questions\\_answers/index.html](http://www.dioxinfacts.org/questions_answers/index.html)) August 2005.
- Wild, S.R., and K.C. Jones. 1992. Organic chemicals entering agricultural soils in sewage sludges: Screening for their potential to transfer to crop plants and livestock. *Sci. Tot. Environ.* 119:85-119.