Health Consultation

Final Release

U.S. Environmental Protection Agency Comprehensive Environmental Response Compensation and Liability Act (CERCLA)

St. REGIS PAPER COMPANY

CASS LAKE, CASS COUNTY, MINNESOTA

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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.

The Public Comment Period is an opportunity for the general public to comment on agency findings or proposed activities for this written consultation. The purposes of the comment period are to 1) provide the public—particularly the community associated with a site—the opportunity to comment on the public health findings, 2) evaluate whether the community health concerns have been adequately addressed, and 3) provide ATSDR with additional information. The time period for written comments, was from August 28, 2003 until November 14, 2003. See Appendix H for public comments to this health consultation.

The conclusions and recommendations presented in this health consultation are the result of site specific analyses and are not to be cited or quoted for other evaluations or health consultations.

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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 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), Agency for Toxic Substances and Disease Registry (ATSDR) and 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 offers 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.*

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I. Introduction

This Health Consultation (HC) is a collaborative effort between the Agency for Toxic Substances and Disease Registry (ATSDR) Region V, Leech Lake Band of Ojibwe (LLBO), and the Minnesota Department of Health (MDH). This HC is the first in a series of consultations that will focus on the health impacts associated with environmental exposures to the St. Regis Superfund site contamination in Cass Lake, Minnesota. Each HC will address a specific environmental medium (soil, sediment, water, and fish) and will be combined into a comprehensive public health assessment. This document examines soil contaminants, transport mechanisms, and routes of exposure (ingestion, inhalation and dermal contact) to determine the magnitude of exposure to residents living in the area surrounding the St. Regis site. The United States Environmental Protection Agency (USEPA), ATSDR and MDH project files, along with electronic documents provided to MDH, were reviewed. These documents and numerous site visits form the basis for this HC. Health effects associated with dioxin exposure are also discussed. This HC focuses on soil data results presented in the EPA document, *Final Data Evaluation Report for the St. Regis Paper Company Superfund Site, Cass Lake, Minnesota* (August 23, 2002).

II. Background

A. Site Description and History

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 Site Review and Update, July 1993; ATSDR 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; and USEPA Field Sampling Plan For Removal Site Evaluation, March 2003.

The St. Regis Paper Company site, also known as “St. Regis/Wheeler” or “Champion”, is a former wood preserving facility that operated from 1957 through 1985. In 1957, the Wheeler Division of St. Regis Corporation started a wood-treatment operation on land leased from the Great Northern Railroad, which through merger has become part of Burlington Northern Santa Fe (BNSF) Railroad. The St. Regis Corporation eventually expanded the site to its current boundaries by purchasing land south of the leased facility. Then, in January 1985, Champion International Corporation assumed responsibility for the site when it acquired and merged with St. Regis Corporation. The wood preserving operation ceased in September 1985.

Groundwater, surface water, sediment, and soil on and in the vicinity of the site have been contaminated as a result of the wood preserving process and waste disposal activities. 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 site consists of 125 acres on the Leech Lake Reservation within the Chippewa National Forest and is located in Section 15, Township 145N, Range 31W, in Cass County, in the City of Cass Lake, Minnesota. The entire site is located within the exterior boundaries of the Leech Lake Reservation. The approximate site boundaries are the BNSF Railroad tracks on the north, state Highway 371 on the west, and the channel between Pike Bay and Cass Lake on the east, and to the south, Fox Creek,

which empties into Pike Bay (See Figure 1). This area is part of the Mississippi River headwaters, and surface water drains into Pike Bay and Cass Lake.

1) Facility Operations

In 1957, creosote was the first preservative material used to treat wood at the Treating Facility. It continued to be used until the facility closed. Pressure treatment of lumber with creosote occurred in a 72-inch diameter by 75-foot long pressure cylinder, which was installed at the wood treating plant located in the north central portion of the site. Wastewater discharged from the cylinder passed through a baffled separator tank and a charcoal filter before being discharged into a disposal pond, "Pond A," located adjacent to the treating plant (Figure 1). Creosote is a flammable, heavy, oily liquid with a characteristic sharp, smoky smell, and caustic burning taste. The chemical composition of creosote is determined by the source crude oil and the manufacturing process. Creosote is a complex chemical mixture that may contain guaiacol, creosols, phenols, cresols, pyridine, and numerous other aromatic compounds (Reference: Handbook of Toxic and Hazardous Chemicals and Carcinogens, Second Edition, Marshall Sittig).

The use of pentachlorophenol (PCP) as a pressure treatment chemical for wood products began in 1960. At that same time a 49-foot long extension was added to the original cylinder. PCP, like creosote, was used until the facility closed. Two underground tanks were installed to further separate the water from the PCP in the treatment discharge. Beginning in about 1960, wastewater was discharged into a series of three disposal ponds collectively called "Pond B" (see Figure 1). PCP was generally combined with a carrier solvent, usually No. 2 fuel oil. When present as a free phase product in water, this mixture tends to float. In the latter years of facility operations a water dispersible PCP concentrate, which was a proprietary mixture of PCP and ketone, was used. This PCP concentrate was denser than water, and would sink if present as a free-phase product in water.

A second cylinder was added in 1969 to treat wood during the non-freezing months with a water-soluble metal salt solution, believed to be chromated copper arsenate (CCA). The small amount of water that was routinely generated when the water-soluble preservatives were used was recycled as makeup water for preparing the treating solution; however, some cylinder wash water was discharged to the disposal ponds.

St. Regis reportedly received PCP in a dry mixture that was mixed on site and the bags, along with scrap materials, were burned in two "Tee-Pee" burners **(**see Figures 2 and 8**)**. The "Tee-Pee" burners were approximately 40 feet tall and 20 feet wide. One burner was located immediately west of Pond C as shown in Figure 2. The other Tee-Pee burner shown in Figure 8 was located south of the Former Spray Irrigation and Landfill Area. However, according to former employees this Tee-Pee burner was moved from a location approximately 200 yards west of the other Tee-Pee burner.

The use of "Tee-Pee" burners could have contributed to widespread distribution of ash and smoke containing dioxin and furans. The incomplete combustion of PCP packaging materials and PCP treated scrap materials provides the necessary ingredients and temperatures leading to the potential synthesis of dioxins and furans. These contaminants could be entrained with the smoke and ash plume emitted from the top of the Tee-Pee and distributed downwind of the site during burning activities. How often the Tee-Pees were used and the types and quantities of materials burned are not known. The wind can blow in any direction, but the prevailing winds in Minnesota are generally from the northwest from November through approximately May and from the south in June through October.

2) On-site Wastewater Disposal

The series of three disposal ponds (Pond B) were covered with sand in 1971 and replaced with a new pond, "Pond C." In 1972, the cylinder that had been used for treating wood with CCA was added as an expansion tank to the original cylinder. A new 72-inch diameter by 150-foot long cylinder was installed for treating wood with PCP and CCA. In addition, a 20,000 gallon underground wastewater separation tank was added for each cylinder.

In 1974, improvements were made to the wastewater treatment system. With these improvements, wastewater from each cylinder was routed to a primary separation tank, about 8 feet in diameter and 40 feet long. The oil that accumulated on top of the wastewater was skimmed from the top of the tank and recycled. The water was then pumped to a mixing station, a settling tank, and a sand filter. Water from the sand filter was carried to a sawdust filter located next to Pond C.

From 1974 to 1980, the average wastewater flow to Pond C was estimated to be 12,000 gallons per day, with a maximum flow rate of 17,000 gallons per day. Water in Pond C was aerated and nutrients were added to improve the treatment of the wastewater. This system operated from 1974 until the pressure treating system was again revised in 1980. From 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 1976, a 3,000-gallon spill of creosote was recovered by absorption with sawdust, which was later burned in a brush-burning project. During two occasions in 1976, sludge from the cleaning of tanks was hauled to a disposal site in the southwestern corner of the vault property (RCRA vault, see page 4). Pond C was dredged on one occasion, and the dredged bottom material was placed on the south, east, and north sides of the pond. Sawdust used for removing oil from the filters was deposited in a landfill area immediately northeast of Pond C.

In 1980, wastewater from Pond C was sprayed on the ground in various areas of the property. Timber, metal and other demolition wastes were deposited in the landfill area. Empty containers that once contained water-soluble, wood preserving chemicals were also reportedly placed in the landfill area or were burned in "Tee-Pee Burners" (see figures 2 and 8). Sludges and waste water were dumped and sprayed in many areas of the site.

In 1982, a groundwater investigation was initiated by St. Regis Corporation and conducted by Barr Engineering at the site. The investigation concluded that PAH compounds and PCP were present in the upper aquifer east of the wood treatment operations. Arsenic, chromium, and copper were found at low levels in the groundwater.

3) Off-site Disposal at Cass Lake City Dump Pit

Between 1957 and 1960, wastewater from Pond A and sludge from the storage tanks were hauled to a pit at the city dump and burned. This disposal from Pond A occurred almost daily at an estimated rate of 500 gallons per day, for an estimated total of 547,500 gallons for those 3 years. From 1960 to 1975, unknown quantities of sludge were hauled to the pit. It is probable that the contents of the pit were burned during this time period as well. The pit containing the ash and unburned residuals was eventually covered. All three types of wood treatment chemicals—creosote, PCP, and CCA—were

used at the facility during the time that waste was hauled to the pit. The facility regularly dumped site related waste and materials in the City Dump (see Figure 1).

4) Environmental Investigation

As stated earlier, in September 1984 the site was placed on the NPL and in January 1985 Champion assumed responsibility for the site. In 1985 and 1986, Champion performed response actions (RA) at the site to fulfill Response Orders on Consent for the site dated February 1985. The final RA report provides a complete description of RA activities.

The ATSDR St Regis Site Review and Update documents dated July 1993 and March 1995 both recommended that additional actions be taken to investigate and remove contaminant wastes in contact with groundwater, surface water, and near the ground surface in all areas of the site (56, 57). Both documents concluded that direct contact with soil contaminants were still viable human exposure pathways. The latter document recommended that confirmatory sampling be collected in remediated areas (57).

In March 1995, the Minnesota Pollution Control Agency (MPCA) submitted a 5-year review report of the RAs implemented at the St. Regis site on behalf of USEPA. In April, USEPA approved the report. This first 5-year review revealed that some of the RAs were not adequate and that further action was needed to ensure protection of human health and the environment. The first 5-year review recommended that if significant soil, sediment, or surface water contamination related to the groundwater treatment plant or former city dump pit is found, a risk assessment should be performed to assess existing and potential impacts of site-related contaminants on potential human, terrestrial, and aquatic receptors.

In 1995, upon completion of the first 5-year review, USEPA assumed the lead oversight role for the site. The Leech Lake Band of Ojibwe (LLBO) provides local oversight personnel. In the first 5-year review, USEPA, MPCA, and the Leech Lake Division of Resource Management (DRM) have identified several areas that require further investigation.

USEPA began the second 5-year review process in 2000, even as it was planning to implement sampling recommendations from the first 5-year review. ATSDR attended a USEPA-sponsored public meeting in Cass Lake on July 25, 2001. At this meeting USEPA announced to the community its plans to collect samples. In October 2001, Tetra Tech (EPA START contractor) conducted a field investigation of the site that included sampling of soil, surface water, groundwater, sediment, and fish. ATSDR was provided a copy of the Final Data Evaluation Report for the St. Regis Paper Company site and was asked to provide a public health assessment to USEPA, based on a review and analysis of the new environmental data.

Using the October 2001 sample data, EPA mailed sample results to all the current owners and residents whose properties were sampled. ATSDR, LLBO, and MDH co-authored a letter sent February 2003 to 40 residents south of the site advising them to avoid contact with contaminated soils (Appendix A contains the contaminated soil fact sheet).

5) Resource Conservation and Recovery Act (RCRA) Vault

As part of the regulatory action under MPCA, a soil containment vault was built during the mid-1980s on site and filled with approximately 42,000 cubic yards of soils and sludges contaminated

with polycyclic aromatic hydrocarbons (PAHs), dioxins, and pentachlorophenol (PCP). The vault is designed with a double liner, a leachate collection system, leak detection system, and a covering liner (54). The operation and maintenance of the vault is a concern because wells near the vault provide water to a fish hatchery. Individuals have expressed concern that vault leachate could escape containment and impact groundwater.

B. Current Conditions

Currently, it appears that International Paper has fenced its property. However, some of the site property no longer belongs to International Paper. Portions of the site were given to the City of Cass Lake. Some of the most contaminated areas remain unfenced in the north storage area. The United States Environmental Protection Agency (EPA) plans to address the most contaminated areas in the summer of 2004. There are 43 residences on the site, one of which is a licensed day care facility. Sand and salt are stock piled by the City of Cass Lake near the corner of 3rd St. and Cedar. A concrete building at 3rd St. and Elm is used for storage by Reimer's Marine, a boat and marina business. Cass Forest Products maintains two drying kilns on the site and stock piles newly kiln dried wood on the northwest corner of the site. Most of the site soils have been disturbed during remedial activities in the former pond areas on the east end of the site and during the soil grading in the Northern Storage Area.

C. Site Visits

Region 5 ATSDR (two representatives), Leech Lake Band of Ojibwe (LLBO) (two representatives) and MDH (six representatives) met in November 2002 at the St. Regis site to discuss co-authoring a series of media specific health consultations that would become a public health assessment on the St. Regis site. Representatives from each agency also met in January 2003 to discuss the HC progress, tour the site, and take pictures of the site. During site visits, it was noted that large areas of the St Regis site and many of the residential areas on the site do not have ground cover such as grass or landscaping. Furthermore, nearly all roadways and driveways on site are gravel. Automobile traffic on the dirt roads on the site, as well as the mowing of the area generates dust and may spread contamination off site. Erosion may also contribute to off-site soil migrations. Very few residential properties have fencing, and many have toys in the yard, suggesting the presence of children. The recent installation of fencing at the site has begun to restrict automobile and foot traffic in areas that have been fenced. However, not all the site operational areas have been fenced. The soil vault is the one area that does contain a complete fence around its boundaries.

D. Demographics, Land Use, and Natural Resources Use

Cass Lake has a population of 863 (2000 census). The St. Regis site is located in Cass Lake, on the Leech Lake Indian Reservation. The site contains homes, businesses, and vacant lots owned by tribal and non-tribal individuals. The City of Cass Lake also owns portions of the site. It is estimated that one half of the site population is Indian and the other half non-Indian. The site is located within the Leech Lake Band of Ojibwe (LLBO) Indian Reservation. The land contains forests, wetlands, and large water bodies. Local residents and tourists use lakes and channels near the site area for recreation. People also fish and harvest wild rice in wetlands and lakes near the site (1).

In the mid-1980s a soil containment vault was built on site and filled with site soil contaminated with polycyclic aromatic hydrocarbons (PAHs), dioxins, and pentachlorophenol (PCP). There is concern that vault leachate could escape containment and impact groundwater and impact the nearby fish hatchery wells. The engineered life of the vault is not known.

E. General Regional Issues

The largest employers in Cass County are tribal, state and local government services, wood product industries, retail trades, and tourism. There is growing concern that site-related contamination may be impacting local flora and fauna. Citizens are concerned that hunting, fishing, and wild rice harvesting will be curtailed due to site related contamination. There is concern that tourism could suffer from bad publicity associated with the St. Regis Superfund site, and residents are concerned about property values.

F. Community Concerns

The Leech Lake Community is deeply concerned about the St. Regis Paper Company Superfund site contamination in and around the Cass Lake/Pike Bay area. Community members (Tribal and non-tribal) expressed concern about the potential health and environmental impacts and the health of the community residents who live on or utilize resources near the site. Community members have expressed concern that site soil continues to migrate off site into surface waters and residential areas. Residents who live on the site want to know if they are or will become sick from exposure to site-related contamination. Community members have expressed concern about a perceived increase in cancer incidence and other health effects in families that live next to the site. The City of Cass Lake has expressed interest in fencing the entire site and posting warning signs. The City has also expressed interest in community education to help residents avoid contact with site contamination.

Tribal members are concerned that their treaty rights to hunt, fish, and gather resources will be limited by site related contamination. 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. Furthermore, tribal members believe that all parts of the natural environment are connected to their well-being and are to be respected. Their philosophy is that the natural environment is not a resource but a source of life. It provides food, medicines, and construction materials for hobbies and crafts that are shared with family and friends. The knowledge that their source of life is polluted or is rendered hazardous weighs heavily on the emotional and spiritual well-being of tribal members.

G. Agency For Toxic Substances and Disease Registry (ATSDR) 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 (NPL). In cooperation with ATSDR, the Minnesota Department of Health (MDH) has drafted several documents regarding the public health significance of St. Regis. For further background information on the site, the 1995 Site Review and Update (SRU), 1993 SRU or the 1989 Public Health Assessment should be consulted.

III. Evaluation of Contamination and Exposure

Using observations made during numerous site tours and review of environmental data reports, we (MDH, ATSDR, and LLBO) have determined that a complete exposure pathway via soil exists for site contamination. MDH is most concerned about the polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) on site. Mixtures of PCDDs and PCDFs are referred to

as dioxins throughout this document. For a more detailed discussion of these compounds see section titled Properties of the Contaminants of Concern (page 13).

Site contaminants include metals and semi-volatile organic compounds (SVOCs) associated with wood treatment. The SVOCs include the 17 compounds found in the wood preservative creosote. Creosote is a petroleum mixture of organic chemicals that include pentachlorophenol (PCP) and a group of compounds known as polycyclic aromatic hydrocarbons (PAHs). PCP is used by itself or with other SVOCs as a wood preservative. PCP also contained PCDDs and PCDFs contaminants in various quantities. These contaminants are very resistant to environmental degradation. They can remain in the soil for many years after other SVOCs will have degraded. Copper, chromium, and arsenate (CCA) are three metals used for wood treatment. These metals will not degrade in the soil, but site-specific soil conditions can influence their environmental fate and transport.

Surface soil samples were collected and analyzed by EPA or their contractor for the following compound groups:

- 23 metals including known site contaminants copper, chromium, and arsenic;
- 48 volatile organic compounds (VOCs); all soil samples were non-detect for VOCs;
- 49 semi-volatile organic compounds (SVOCs), including 17 suspected contaminants, including PAHs and pentachlorophenol (PCP); and,
- 7 dioxin congeners and 10 dioxin-like furan congeners.

A. Soil Sample Collection Procedures

Soil samples were collected with a shovel that was decontaminated before sampling each residential yard. Although the precise sample depths were not recorded, all the samples were collected within the 0- to 1-foot depth, and approximately 95% of the surface soil samples were collected from 0–6 inches below ground surface (see Appendix B). Each composite sample consisted of five sub-samples collected within an area quadrant (1). Soil was collected from the four corners and center of 20 residential yards (1). The five sub-samples were homogenized by stirring for 1 minute in a stainless-steel mixing bowl using a stainless-steel trowel or spoon (1). The sample was divided into 4 quadrants, and sample containers were filled by spooning soil from one quadrant into the container and then spooning soil from the opposite quadrant (1). This procedure was followed until the sample container was full. This sampling method effectively mixed all contaminants from each of the sub-samples, and provides a reasonable screen of contaminant presence in a yard. However, this sampling method does not characterize the surface soil concentrations in the top 3 inches of soil, nor does it identify “hot spots” in yards. The top 3 inches of soil are the most accessible to human contact; this is especially the case if the soil is bare.

B. Composite Samples

Composite sampling is best used to determine if contamination is present. It is also useful for determining average exposure concentrations across an exposure area, but may not characterize potential exposures that occur within discrete areas. For example, children may dig holes or play in a mud puddle within an exposure area. While composite sampling is consistent with EPA guidelines, the use of composite sampling does not permit determination of the extent and the maximum level of the contamination in surface soil. Without analysis of individual point samples, it cannot be determined if one or more of the sub-samples used to make up the composite are contributing the majority of the dioxins and furans. The utility and interpretation of composite sample data can be

confounded by low sample density (low number of sub-samples per unit area), and alterations to the soil profile.

C. Soil Sampling Results

All soil samples were reviewed by comparing results to Minnesota Pollution Control Agency (MPCA) residential Soil Reference Values (SRVs). SRVs are concentrations in soil that are considered to be safe for residential use. SRVs are used to determine cleanup levels in Minnesota.

1) Reference Samples

Two background soil reference samples were collected to compare site contaminant concentrations to natural soil contaminant levels **(**see Figure 3). All the metal concentrations were below Residential Soil Reference Values (SRVs). Arsenic was not detected (the detection limit was 1.1 ppm (parts per million)). Chromium concentrations were 5.4 and 4.6 ppm. Copper concentrations were 2.5 and 2.7 ppm. No VOCs were detected in the reference soil samples. Nearly all the SVOC concentrations—including the PAHs—were non-detect in the reference samples. Benzo-a-pyrene (BaP) is a PAH and a potent toxicant. The BaP SRV (2000 parts per billion (ppb)) is 10 to 1000 times lower than any of the other PAH SRV values. The BaP concentrations in the reference samples were 45 and 28 ppb. Other PAH concentrations in the reference samples were similar to BaP. The PCDDs and PCDFs soil Toxic Equivalence (TEQ) value is 1 part per trillion (ppt) in the reference samples (see Toxic Equivalence Factor section, page 16, for a TEQ definition).

2) Former North Storage Area Samples

The Former North Storage Area (approximately 50 acres) was used for product storage (see Figure 1). The 50 acres were divided into a grid consisting of approximately 126 sub-areas. Composite soil samples (130) were collected from the sub-areas and field screened for SVOCs, arsenic, copper, and chromium using an immunoassay for SVOCs and an XRF instrument (hand held instrument used for metal detection). Out of the 126 field screen results, 22 samples (including 1 duplicate) were selected for laboratory analysis. The 22 laboratory samples were selected by EPA based on elevated contaminant concentrations in the field screening results. Note that more than 22 field screen test results were positive for contaminants.

The 22 laboratory samples were analyzed for SVOCs, VOCs, metals, and dioxins. Two samples were above the SRV for Benzo(a)pyrene (BaP) Equivalence (see Appendix C for an example BaP Equivalency calculation). Sample SR-SS-B1-2-0000 had a BaP Equivalence of 2839 parts per billion (ppb). See Figure 4 for SVOC soil sample locations. The BaP SRV is 2000 ppb. Sample SR-SS-J28-29-000 had a BaP Equivalence of 2353 ppb, but most of the contributing SVOCs were analytical estimates. All the VOCs collected in the North Storage Area were non-detect possibly due to natural attenuation and sample preparation procedures. Sample SR-SS-A2-3-0000-D had an iron concentration of 8,540 parts per million (ppm) and the Residential Iron Soil Reference Value is 7000 ppm. No other metal SRVs were exceeded in this area. As indicated in Table 4, all the Former Northern Storage Area soil samples show dioxin impacts when compared to the reference samples (dioxin TEQ 1ppt). The Northern Storage Area soil dioxin TEQ concentrations ranged from 6 to 5639 ppt. Only one sample was below the MDH Dioxin Health Based Screening Value of 50 ppt (see section VII, Risk Assessment and Dioxin, page 23 for a discussion of MDH's Dioxin Health Based Screening Value). A total of 17 samples, including one duplicate, had dioxin TEQ values greater than 200 ppt. The PCA SRV for dioxin is 200 ppt (see section VII. Risk Assessment and

Dioxin page 23 for a discussion of the dioxin SRV). This group's dioxin TEQ concentrations ranged from 241 to 5639 ppt (See Table 1).

The North Storage Area served as an area for the storage of treated lumber. It contained scattered piles of scrap materials and had a more varied topography before it was graded in the mid-1980s (See Figure 5). The North Storage Area was not remediated but its soils were spread across the site when it was graded. Because the North Storage Area soils were not well characterized before grading, contaminated soil was distributed into other areas of the site. Therefore thin lenses of clean soil layered between lenses of contaminated soil likely exist in many areas of the site.

Table 1 Former North Storage Area Surface Soil (0- 6 inches) Composite Sample TEQs*

Samples collected October 2001				
Sample ID	TEQ (ppt)		Sample ID	TEQ (ppt)
SR-SS-A2-3-0000	**380**		SR-SS-E21-22-0000	**291**
SR-SS-A2-3-0000-D	**826**		SR-SS-E28-29-0000	**702**
SR-SS-A4-5-0000	**3963**		SR-SS-F8-9-0000	**250**
SR-SS-A11-12-000	**2660**		SR-SS-F23-24-0000	**418**
SR-SS-A25-26-0000	**308**		SR-SS-G9-10-0000	6
SR-SS-B1-2-0000	**101**		SR-SS-G16-17-0000	**70**
SR-SS-B4-5-0000	**5051**		SR-SS-I24-25-0000	**119**
SR-SS-C14-16-0000	**141**		SR-SS-J21-22-0000	**262**
SR-SS-C26-27-0000	**454**		SR-SS-J27-28-0000	**1904**
SR-SS-D11-13-0000	**514**		SR-SS-J28-29-0000	**5639**
SR-SS-D24-25-0000	**768**		SR-SS-SEEP-0000	**241**

* = 2,3,7,8 -Tetra-Chloro-Dibenzo-Dioxin Toxic Equivalence (TEQ) ng/kg
ng/kg = parts per trillion
Bold = Exceedance of MDH Health Based Screening Value (50 ng/kg); and see Table 6.
"D"= samples are duplicates
Composite sample = 5 sub-samples
22 samples were analyzed out of 126 field screened samples

3) Former Ponds A, B, and C Samples

On the basis of photographs and historical site descriptions, the locations of the former ponds were estimated (see Figure 1 for former Pond Locations). Two surface soil samples were collected from Pond A. One soil composite was collected from Pond B, and one from Pond C. The pond samples were analyzed for metals, SVOCS, and VOCs. All the metal test results were below Residential Soil Reference Values (SRVs) including the wood preservative metals arsenic, chromium, and copper. All the SVOCs in the samples were below SRVs. The pond locations were not sampled for PCDD/PCDF (dioxins). MDH believes that the former pond areas should be sampled for surface soil dioxins to determine if the ponds have residual surface contamination. Because Pond C was not dewatered before it was excavated and backfilled, it may also have considerable site related contamination below the ground surface (see Figure 2).

4) Former Spray Irrigation Area and Landfill (FSIL) Samples

Two surface soil samples were collected in the FSIL area (see Figure 1 for FSIL location). These samples were analyzed for metals, VOCs, and SVOCs. The FSIL soil metal concentrations were all below the SRVs. All VOCs were non-detect in the FSIL samples. All the SVOC soil concentrations were also below SRVs. However, one sample had a PCP concentration of 700 ppb. The PCP SRV is 85,000 ppb and reference sample concentration was 61 ppb. The presence of PCP in the surface soil at levels greater than background suggests that dioxins may also be present. The FSIL samples were not analyzed for dioxins. We believe the FSIL areas should be sampled for surface soil dioxins to determine if residual surface soil contamination is present.

5) Former City Dump Pit (FCDP) Samples

One surface soil sample and a duplicate were collected at the FCDP (see Figure 1 for FCDP location). A laboratory analysis for metals, SVOCs, and VOCs was performed. No metal SRVs were exceeded in the FCDP samples. The arsenic, chromium, and copper concentrations were similar to the background samples. All the SVOCs including PCP, and PAHs were below SRV values and only slightly above background concentrations. All VOCs were non-detect or well below SRVs. Dioxins were not included in the analysis. The reported dumping of sludge and other wastes in the FCDP needs further investigation for dioxins, PCP, PAHs, arsenic, chromium, and copper at greater soil depths.

6) South West Area (SWA) Samples

An old site map shows that the SWA samples appear to have been collected near the location of a sludge pit near the southwest corner of the vault (see Figure 6). Furthermore, it is alleged that

Table 2 South West Area Surface Soil (0-6 inches) Sample TEQs*

Samples collected October 2001

Sample ID	TEQ (ppt)		Sample ID	TEQ (ppt)
SR-SS-SW1-0000	**230**		SR-SS-SW32-0000	**428**
SR-SS-SW3-0000	**140**		SR-SS-SW35-0000	42
SR-SS-SW7-0000	**3137**		SR-SS-SW37-0000	**168**
SR-SS-SW7-0000-D	**3001**			

* = 2,3,7,8 -Tetra-Chloro-Dibenzo-Dioxin Toxic Equivalence (TEQ) ng/kg
ng/kg = parts per trillion
Bold = Exceedance of MDH Health Based Screening Value (50 ng/kg); and see Table 6.
"D"= samples are duplicates
Composite sample = 5 sub-samples

treated wood products were stored where the vault was constructed. Seven samples, including one duplicate, were collected in the SWA. Samples were analyzed for metals, SVOCs, VOCs, and dioxins. No metal SRVs were exceeded in the SWA samples. No SVOC results were above SRVs. However, Sample SR-SS-SW32-0000 had a BaP Equivalence value of 1281 ppb. The BaP Equivalence SRV is 2000 ppb. All VOC results were non-detect or well below SRVs. All the SWA soil samples show dioxin impacts when compared to the Reference samples (dioxin TEQ 1ppt). The SWA Dioxin TEQ Values ranged from 42 to 3137 ppt. Six of the seven SWA samples were above the MDH Soil Dioxin Health Based Screening Value (50 ppt) (see Table 2). MDH is concerned that soils excavated for vault construction may have been contaminated and used as fill in the North Storage Area.

7) Residential Samples

Twenty surface soil samples were collected from residential properties near the northern storage area. These samples were analyzed for metals, SVOCs, VOCs, and dioxins. Two residential samples exceeded the Residential Iron SRV (7000 ppm). Samples SR-SS-Res1-0000 and SR-SS-Res19-0000 had iron concentrations of 12,100, and 7,370 ppm respectively. It is likely that these elevated iron concentrations are native to Minnesota iron range soils. Sample SR-SS-Res9-0000 had a lead soil concentration of 693 ppm; the Lead SRV is 400 ppm. It is possible that this sample may have been contaminated with lead paint or some other source of lead because none of the other samples had elevated lead. Sample SR-SS-Res9-0000 also had an antimony soil concentration of 83.7 ppm and the Antimony SRV is 14 ppm. All the other residential samples contained 1 to 3 ppm antimony or were non-detect. No SVOC results were above SRVs. Samples SR-SS-Res13-0000, and SR-SS-Res19-0000 had a BaP Equivalence concentrations of 1525, and 1405 ppb respectively. The BaP Equivalence SRV is 2000 ppb. All VOC results were non-detect or well below SRVs. All the residential soil samples show dioxin impacts when compared to the reference samples (dioxin TEQ 1ppt). Residential soil sample dioxin TEQ concentrations ranged from 10 to 485 ppt. Eight residential samples were above the MDH Health-Based Screening Value For Soil Dioxin (50 ppt) (see Table 3).

Table 3 Residential Samples Surface Soil (0–6 inches) Sample TEQs*				
Samples collected October 2001				
Sample ID	TEQ (ppt)		Sample ID	TEQ (ppt)
SR-SS-RES1-0000	45		SR-SS-RES12-0000	32
SR-SS-RES2-0000	**81**		SR-SS-RES13-0000	10
SR-SS-RES3-0000	12		SR-SS-RES14-0000	31
SR-SS-RES4-0000	18		SR-SS-RES14-0000-D	30
SR-SS-RES5-0000	11		SR-SS-RES15-0000	45
SR-SS-RES6-0000	47		SR-SS-RES16-0000	**485**
SR-SS-RES7-0000	**124**		SR-SS-RES17-0000	26
SR-SS-RES8-0000	**162**		SR-SS-RES18-0000	20
SR-SS-RES9-0000	**214**		SR-SS-RES19-0000	28
SR-SS-RES10-0000	**117**		SR-SS-RES20-0000	**241**
SR-SS-RES11-0000	**63**			

* = 2,3,7,8 -Tetra-Chloro-Dibenzo-Dioxin Toxic Equivalence (TEQ) ng/kg
ng/kg = parts per trillion
Bold = Exceedance of Health Based Screening Value (50 ng/kg); see Table 6.
"D"= samples are duplicates
Composite sample = 5 sub-samples

For a summary of all surface soil dioxin concentrations and sample locations see Table 4 and Figure 7)

Table 4 St Regis Soil Dioxin TEQs Summary
(See Figure 7 for Sampling Locations)

SAMPLE_ID	TEQ ppt	TEQ Range
SR-SS-RF2-01-0000	1	Below MDH's Dioxin Health Based Screening Value (50ppt)
SR-SS-RF1-01-0000	1	
SR-SS-G9-10-0000	6	
SR-SS-RES13-0000	10	
SR-SS-RES5-0000	11	
SR-SS-RES3-0000	12	
SR-SS-RES4-0000	18	
SR-SS-RES18-0000	20	
SR-SS-RES17-0000	26	
SR-SS-RES19-0000	28	
SR-SS-RES14-0000-D	30	
SR-SS-RES14-0000	31	
SR-SS-RES12-0000	32	
SR-SS-SW35-0000	42	
SR-SS-RES1-0000	45	
SR-SS-RES15-0000	45	
SR-SS-RES6-0000	47	
SR-SS-RES11-0000	63	Exceeds MDH's Dioxin Health Based Screening Value (50ppt)
SR-SS-G16-17-0000	70	
SR-SS-RES2-0000	81	
SR-SS-B1-2-0000	101	
SR-SS-RES10-0000	117	
SR-SS-I24-25-0000	119	
SR-SS-RES7-0000	124	
SR-SS-SW3-0000	140	
SR-SS-C14-16-0000	141	
SR-SS-RES8-0000	162	
SR-SS-SW37-0000	168	
SR-SS-RES9-0000	214	
SR-SS-SW1-0000	230	
SR-SS-SEEP-0000	241	
SR-SS-RES20-0000	241	
SR-SS-F8-9-0000	250	
SR-SS-J21-22-0000	262	
SR-SS-E21-22-0000	291	
SR-SS-A25-26-0000	308	
SR-SS-A2-3-0000	380	
SR-SS-F23-24-0000	418	
SR-SS-SW32-0000	428	
SR-SS-C26-27-0000	454	
SR-SS-RES16-0000	485	
SR-SS-D11-13-0000	514	
SR-SS-E28-29-0000	702	
SR-SS-D24-25-0000	768	
SR-SS-A2-3-0000-D	826	
SR-SS-J27-28-0000	1904	
SR-SS-A11-12-000	2660	
SR-SS-SW7-0000-D	3001	
SR-SS-SW7-0000	3137	
SR-SS-A4-5-0000	3963	
SR-SS-B4-5-0000	5051	
SR-SS-J28-29-0000	5639	

SouthWest Area (7samples including 1 duplicate)

Northstorage Area (22 samples including 1 duplicate)

Residential Sample (21 samples including I duplicate)

Reference Samples (2 samples)

TEQ = Toxic Equivalence

8) Limitations of Sampling

The data in this document came from the first round of planned EPA sampling. Several areas of the site have not been sampled at all or did not have sufficient numbers of samples collected to adequately characterize the site. Composite samples may provide an efficient way of estimating the average concentration of subsamples collected in a given area. However, important information about the subsample concentration is lost. The range of the concentrations cannot be determined from a composite sample because the highest concentrations are not detected; hot spots may not show up in the data. Composite samples generally do not provide complete information on the range and distribution of concentrations within the area sampled. Furthermore, the utility and interpretation of composite sample data can be confounded by low sample density (low number of subsamples per unit area), and alterations to the soil profile (54).

D. Properties of the Contaminants of Concern

MDH screened the substances reported in sampling data to select those that require public health evaluation. Each substance was screened by comparing its concentration level in the environment with SRVs. The SRV comparison values are set *below* the levels that would be expected to harm public health to assure a margin of safety to the public. MDH emphasizes that comparison values are screening tools for health assessments, and are *not* to be confused with clean up levels, health effect levels, or toxicity levels. Substances at the St. Regis site that were found at levels above comparison values are called contaminants of concern and are evaluated further. Substances for which no comparison values have been established are automatically assigned contaminant of concern status.

1) Pentachlorophenol

Pentachlorophenol (PCP) has been one of the most widely used chemicals for the preservation of wood products. It was recognized and used as an insecticide, fungicide, herbicide, molluscicide, and algicide in a wide variety of applications (ATSDR 1994). PCP was used as preservative for utility poles, fence posts, railroad ties, and other common industrial wood products. Because of its widespread use, PCP is common in the environment, and is found across the United States in surface waters, sediments, rainwater, groundwater, soils, food, and living organisms, including humans. Historically it has been estimated that volatilization from the surface of PCP-treated wood products releases as much as 760,000 pounds of PCP to the air per year in the United States (ATSDR 1994).

PCP was not found above the SRV (71,000 ppb) in the surface soil samples reviewed for this report. In the environment, PCP may adsorb to soils depending on the pH of the soil and its organic matter content. The amount of PCP adsorbed at a given pH increases with increasing organic content of the soil (ATSDR 1994). PCP is more mobile in soil under neutral or alkaline conditions, and adsorption is minimal at pH values above 6.8. PCP may also have the ability to bioaccumulate, or build up, in the tissues of animals (such as fish) exposed to it. It has not been shown to become concentrated in animal tissues as it moves up the food chain, however. Microorganisms in the soil metabolize PCP, and biodegradation is thought to be the major cause of PCP degradation in the environment. The use and disposal of PCP at St. Regis is thought be the major source of dioxin contamination on the site. PCP may be found in other media (sediments, surface and groundwater).

Short-term exposure to high concentrations of PCP is associated with adverse effects to the kidneys, blood, lungs, nervous system, immune system, and gastrointestinal tract (ATSDR 1994). It can also cause a potentially serious increase in body temperature as the body attempts to metabolize it. Dermal contact can irritate the skin, eyes, and mouth. These types of exposures and concentrations

are usually only experienced in the workplace. Former St. Regis employees have described skin, eyes, mouth, and nose irritation from handling or breathing vapors from PCP treated materials.

Long-term exposure to lower levels of PCP can cause damage to the liver, kidneys, blood, and nervous system. PCP is considered a probable human carcinogen. Some of the adverse effects associated with exposure to PCP may be caused by impurities present in commercially produced PCP, such as dioxins and furans. International Paper has collected residential soil dioxin data from several areas north of the site. The results have been preliminary reviewed by MDH, and results are less than or equal to 50 ppt. However, a detailed review of the soil samples collected along Railroad Street was not possible because sample location maps and electronic soil data results were not available before final draft release of this document. A more detailed analysis of the sample locations, laboratory results, and the data validation methodology are warranted and are forthcoming.

2) Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) are produced by the incomplete combustion of organic materials such as coal, oil, wood, tobacco, and even food products (ATSDR 1995). They are also found in petroleum products such as asphalt, coal tar, creosote, and roofing tar. As a result, they are very common in the environment from such processes as volcanic eruptions, forest fires, home wood burning, and vehicle exhaust. Over 100 PAHs have been identified, and they are usually found in the environment as mixtures. PAHs generally fall into two groups based on their potential health effects: those that are carcinogenic (cancer causing, known as cPAHs), and those that are not (non-carcinogenic PAHs, or nPAHs). The PAHs found on the site (a mixture of cPAHs and nPAHs) are likely present as a result of the use of creosote in wood treatment. Creosote itself is usually derived from coal tar, and is described as a thick, oily liquid that is amber or black in color, and contains hundreds or even thousands of different chemicals including PAHs and phenols (ATSDR 1996). It has been in use as a wood preservative and waterproofing agent for over 100 years.

PAHs tend to bind to soil particles, especially organic matter, and therefore tend to remain in soils and sediments. Because of their affinity for organic matter, PAHs can accumulate in aquatic and terrestrial organisms, but unlike PCP can become concentrated as they move up the food chain (ATSDR 1995). This effect is somewhat balanced by the ability of many organisms, such as fish, to metabolize PAHs. In soil, microorganisms can metabolize PAHs. Environmental factors like soil nutrients, types of microbes present, and the properties and concentrations of PAHs present influence the extent and rate of decomposition (ATSDR 1995).

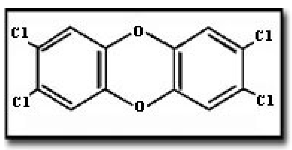
Individual cPAHs are classified as probable or possible human carcinogens by the International Agency for Research on Cancer (IARC) (ATSDR 1995). MDH uses information developed by the California Environmental Protection Agency to evaluate the carcinogenicity of cPAHs, and the list of cPAHs of concern has been expanded from prior lists typically reported by EPA (MDH 2001b). Exposure to high levels of PAHs in general has also been associated in animals with reproductive difficulties and adverse effects on the skin and immune system. Adverse effects on the liver and gastro-intestinal tract have also been noted.

Because most of the soil sample carcinogenic PAHs do not exceed SRVs in the data reviewed for this report, PAHs do not contribute significantly to the theoretical soil cancer risk when compared to the dioxins and furans. Therefore the emphasis will be on health risks associated with exposure to dioxins and furans in soils at the St. Regis site.

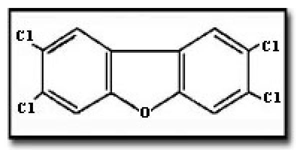
3) Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs)

The polychlorinated dibenzo-p-dioxins (PCDDs) include 75 individual compounds, and the polychlorinated dibenzofurans (PCDFs) include 135 individual compounds. These individual compounds are technically referred to as congeners. Only 7 of the 75 congeners of PCDDs are thought to have dioxin-like toxicity; these are ones with chlorine substitutions in, at least, the 2,3,7, and 8 positions. Only 10 of the 135 possible congeners of PCDFs are thought to have dioxin-like toxicity; these also are ones with substitutions in the 2,3,7, and 8 positions. The 17 PCDD and PCDF congeners with dioxin like toxicity (i.e., chlorine in the 2,3,7, 8 positions) are collectively referred to as dioxins.

The names of individual dioxin compounds denote both the number and position of the chlorine (Cl) atoms. Furans differ from dioxins structurally by the lack of one of the two oxygen (O) atoms between the benzene (six-carbon atom, circle-shaped) ring structures. The chemical structures of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and 2,3,7,8-tetrachlorodibenzo-p-furan (TCDF) are shown below:



TCDD



TCDF

Dioxins and furans are formed as a result of the incomplete combustion of fossil fuels, organic matter, and waste materials, during the bleaching of paper in pulp and paper mills, and as a by-product in the production of other chemicals such as the wood preservative PCP, and the herbicide 2,4,5-T (ATSDR 1998). In the environment, dioxins and furans always occur as various combinations of all the possible congeners. In soil, dioxins tend to bind to small particles or organic matter. They do not volatilize easily into air or dissolve in water (hydrophobic).

As a result, they tend to settle out of the air or water as they attach to organic particulate and end up in soils or sediments. In sediments, dioxins are taken up by aquatic microscopic organisms, animals through feeding, or direct contact. Dioxins can then pass through the foodchain and become concentrated in the tissues of larger aquatic animals, especially in the fatty tissue. Dioxins accumulate in organisms (bioconcentration effect) because they do not metabolically breakdown and they are lipophilic (dissolve into fat). Dioxins in soil can be transported to surface water bodies via runoff, where humans and animals may be exposed to them through indirect ingestion or dermal contact. Plants do not efficiently take up dioxins through their roots, but may have dioxins on their surfaces as a result of particle deposition (ATSDR 1998). Animals (e.g., cows, chickens) or humans that eat the plants or ingest soils may then ingest the dioxins.

Environmental fate modeling of PCDDs and PCDFs requires knowledge of a number of fundamental physical and chemical parameters, such as water solubility, vapor pressures, Henry's law constants, octanol-water partition coefficients (Kow), and organic carbon partition coefficients (Koc). Dioxins are a class of high molecular weight, highly hydrophobic compounds, and solubility values are available for only a handful of dioxins (Doucette and Andren 1988). Dioxins have very low water

solubilities, with solubility decreasing as chlorine substitutions increase (Doucette and Andren 1988).

On the surface of the soil, dioxins may be broken down by sunlight, a process known as photodegradation. The half-life of TCDD on soil may be on the order of 15 years at the soil surface (Paustenbach et al 1992). This process is only effective in the top few millimeters of soil where ultraviolet light can penetrate (EPA 2000). Burial in place (by the constant accumulation of airborne dust and dirt, erosion, and the buildup of organic matter) and or erosion to surface water bodies are likely the main environmental fate of dioxins in soil. Once buried (i.e. in the sub-soil), TCDD has been shown to have a half-life of up to 100 years, and becomes tightly bound to soil organic matter (EPA 2000).

As a result of natural and man-made processes, dioxins are found nearly everywhere in the environment. Dioxins have been found in the fat tissue of humans across the U.S., even in those who have no known exposure to dioxins. This indicates that exposure is widespread, and is likely occurring through the food supply. Foods containing animal fat, such as meat, fish, and dairy products are the most common dietary sources. Dioxins may also be passed from mother to fetus via maternal blood and the infant through breast milk.

According to an EPA summary of available studies, background levels of dioxins in soils in rural areas in North America average 2.5 parts per trillion (ppt, or 0.0025 ppb) as expressed using TEFs, with a range of between 0.1 to 6 ppt (EPA 2000). Background soil dioxin levels measured for the St. Regis site are 1ppt TEQ. In urban areas, the average cited by EPA is 9.4 ppt (0.0094 ppb), with a range of between 2 and 21 ppt. Background levels in sediments average 5.31 ppt (0.00531 ppb) with a range of from less than 1 ppt to 20 ppt.

Toxic Equivalency Factors (TEFs) for Dioxin

Not all dioxins and furans are as toxic as TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin), but all are thought to cause adverse effects through the same mechanisms. Penta- and hexachloro-dioxins with chlorine atoms in the 2,3,7 and 8 positions appear to have similar toxicities, while other dioxins that do not have chlorine atoms in those positions are relatively less toxic (ASTDR 1998). To estimate the toxicity of dioxin and furan mixtures, a series of toxicity equivalency factors (TEFs) have been developed that compare the toxicity of other dioxin and furan congeners to TCDD. The overall toxicity of a mixture can then be calculated in terms of total TCDD equivalents (see Appendix D). The TEFs used in this health consultation were published by the World Health Organization (WHO) in 1998 (EPA 2000). The TEFs are based on existing toxicological data on individual dioxins and furans, or are estimated using a number of different methodologies. They are intended to be used pending additional research on specific dioxin and furan compounds. The current WHO TEFs are listed in Table 5 (EPA 2000):

Table 5		Dioxin/Furan TEFs, WHO 1998	
Dioxin (D) Congener	TEF	Furan (F) Congener	TEF
2,3,7,8-TCDD	1.0	2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDD	1.0	1,2,3,7,8-PeCDF	0.05
1,2,3,4,7,8-HxCDD	0.1	2,3,4,7,8-PeCDF	0.5
1,2,3,6,7,8-HxCDD	0.1	1,2,3,4,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDD	0.1	1,2,3,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDD	0.01	1,2,3,7,8,9-HxCDF	0.1
1,2,3,4,6,7,8,9-OCDD	0.0001	2,3,4,6,7,8-HxCDF	0.1
		1,2,3,4,6,7,8-HpCDF	0.01
		1,2,3,4,7,8,9-HpCDF	0.01
		1,2,3,4,6,7,8,9-OCDF	0.0001

E. Exposure Routes

Area residents have to come into physical contact or *be exposed* to the hazardous materials disposed of at the St. Regis site for these toxic chemicals to cause the development of adverse health effects in these residents. For the residents to come into contact with these chemicals, there must be the development of a *completed exposure pathway*. A completed exposure pathway consists of *five main parts* that must be present for exposure to the chemicals to occur. These include:

- A source of the toxic chemicals of concern (chemical releases and spills);
- Environmental transport which allows the chemical to move from the site and bring it into contact with the residents (soil, air, groundwater, surface water, subsurface gas);
- A point of exposure which is the place where a resident comes into direct contact with the chemical;
- A route of exposure which is how the resident comes into contact with the chemical (drinking it, eating it, breathing it, touching it); and
- A population at risk which are people living near the site who could possibly come into physical contact with site-related chemicals.

Exposure pathways can also be characterized by when the exposure occurred or might occur in the *past*, *present*, or *future*. Physical contact with a chemical contaminant in and by itself *does not* necessarily result in adverse health effects. A chemical's ability to affect a resident's health is also controlled by a number of other factors including:

- How much of the chemical a person is exposed to (the *dose*).
- How long a person is exposed to the chemical (duration of exposure).
- How often a person is exposed to the chemical (acute versus chronic).
- The chemical's toxicity and how it impacts the body.

Other factors affecting a chemical's likelihood of causing adverse health effects upon contact include the resident's:

- History of past exposure to chemicals;
- Smoking, drinking alcohol, or taking certain medicines or drugs;
- Current health status;

- Sensitivity to certain substances;
- Age and sex; and,
- Family medical history.

The potential routes of exposure to St. Regis contaminated soil include:

- Ingestion of contaminated soil
- Dermal (skin) exposure to contaminated soil
- Inhalation of airborne particulates

If the top 3 inches of soil are bare, soil ingestion, soil dermal exposure, and inhalation of soil particulate is more probable. At the St. Regis site, a complete exposure pathway exists for contaminants found in the top 3 inches of soil.

1) Ingestion

The ingestion of contaminated soil is typically the primary means of exposure to non-volatile contaminants in soil, including dioxins. Such ingestion is usually incidental, and occurs from hand-to-mouth contact while gardening or work activities (in the case of adults) or outdoor play activities (in the case of children) (18). An extreme case of hand-to-mouth behavior (pica) occurs in children whose ingestion of significant amounts of soil is the defining characteristic. Pica behavior is expected at this site due to the number of small children in the area and the barren soil areas.

The amount of contaminant absorbed by the body from incidental soil ingestion and available to cause an adverse effect is dependent on a number of variables, including but not limited to (18):

- Contaminant concentration in accessible soil
- Soil ingestion rate
- Oral bioavailability of soil contaminant

a) Contaminant concentrations in accessible soil

During the most recent sampling event, 50 surface soil samples were collected in the Northern Storage, Residential and the Southwest Areas (see Figure 7). A total 36 samples out of 50 exceeded the MDH Dioxin Health Based Value (50 TEQ ppt) (see Table 4). MDH considers all the sample locations to be areas of current or potential exposure to contaminated soil. All of the areas are easily accessible and are in or near residential areas. Observations during site visits and communications with community members indicate that children play on the soil either in residential yards or on the site. Even the most contaminated areas are frequently traversed and/or used by members of the surrounding community. It should be noted during publication of this document fencing was being installed in some areas of the site, but not in all the areas with the highest concentrations.

Although most of the residential soil samples did not exceed the MDH Dioxin Health-Based Value (50 ppt), the most accessible soils (top 3 inches) could have much higher dioxin concentrations. Soil contaminant concentrations were potentially diluted because the samples were composited. The samples were composited samples consisting of 5 sub-samples with a 6 inch sample interval (ground surface to 6 inch depth). Furthermore, many of the samples with the highest dioxin concentrations are next to residential properties where children and adults have easy access. Figure 7 shows the spatial distribution of dioxin soil concentrations in residential and non-residential areas. Note that

most of the yellow highlighted dots are residential samples. Accessible soil dioxin concentrations in non-residential areas that have not been fenced range from 70 to 5639 ppt.

b) Soil ingestion rate

Determining the soil contamination exposure dose via ingestion is difficult. The frequency and amount of soil ingestion are usually estimated using default exposure assumptions. The amount of contaminant absorbed is assumed to be 100% or is based on animal absorption studies. Most screening exposure scenarios utilize a residential setting, where exposure to soil could be expected to occur on a regular basis. In a survey study of soil contact behavior by adults in a similar climate to Minnesota, the adults surveyed reported contact (at the 95^{th}-percentile) with soil at their residence through such activities as home repairs or digging a little more than one time per week (51). The median soil exposure rate was less, on the order of once per month for home repairs or digging. Exposure frequency from activities such as gardening, other yard work, and team sports appeared to be much more frequent, although the survey units for the two groups of activities made direct comparison difficult. Some adults may also have higher soil ingestion rates. People who have frequent contact with soil, such as gardeners, also tend to ingest more soil. Behaviors that involve frequent hand to mouth contact, such as smoking, can also lead to higher soil ingestion rates. Kimbrough et al., estimated that the lifetime uptake of TCDD from soil will consist of 95% from soil ingestion, 3% from soil dermal exposure, and 2% from inhalation (11).
The following soil ingestion rates have been reported for children (17, 52):

- Age 0–1 years old, 50 - 250 mg/day
- Age 1–6 years old, 100 – 500 mg/day
- Age 6–11 years old, 50 – 250 mg/day
- Age 11 years and older 50 – 100 mg/day

However, about 1–2% of children are geophagic (condition where children eat non-food substances such as earth) and ingest 5–10 grams of soil daily (17, 52). Furthermore, soil eating behavior appears to be more pronounced among children in lower socioeconomic groups and among the mentally retarded (14). ATSDR views default ingestion rates of 100 mg/day and 200 mg/day for adults and children, respectively, to be reasonable (17). The Minnesota Pollution Control Agency utilizes ingestion values of 100 and 50 mg/day in its derivation of the Dioxin Soil Reference Values for children and adults respectively (3).

It has been estimated that as much as 32% of indoor dust could originate from outdoor soil through foot tracking or other transport mechanisms (9). For young children indoor dust can be a significant exposure route due to hand to mouth, and object to mouth activity.

c) Oral Bio-availability

The oral bio-availability of dioxins in soil is partially dependent on the soil organic content, and for TCDD has been found to range from 0.5% to 50% in animals (19).

The bio-availability of other dioxin compounds, such as the octa-CDDs may be less, perhaps 10% the absorption rate of TCDD. In a study of digestive absorption of dioxins and furans in humans (from food) using a mass-balance approach, the maximum absorption of TCDD was 63%; again the absorption of the more highly chlorinated congeners was reportedly much less (49). The same study

also found considerable variability in absorption rates among the test subjects, with age being a key factor. Absorption rates in older test subjects were much less than in younger subjects.

2) Dermal Exposure

Children and adults may receive additional TCDD exposures from dermal contact if they play or work with contaminated soils. The absorption of contaminants and the potential effects of dermal (skin) exposure to contaminants in soil are influenced by several factors, including but not limited to (19):

- Dermal bio-availability.
- Skin surface area available for contact.
- Skin adherence properties of soil.

a) Dermal Bioavailability

Several studies have investigated the bioavailability of TCDD for uptake by dermal exposure. An *in vitro* human (cadaver) skin study showed that 2,3,7,8 TCDD did not readily penetrate into the human skin; the vehicle of exposure played an important role in the penetration (11). The TCDD applied with acetone resulted in 30 – 45 % absorption mostly into the epidermis (11). When mineral oil was used as the exposure vehicle, absorption was limited and took over 300 minutes to reach 10% of the dose (11). In this study, minimal TCDD reached deeper vascularized tissues where it could be distributed systemically. The rate of absorption into deeper dermal tissues per unit time appears to be a first order function (11). Absorption increased with higher doses over time. When TCDD was applied dermally to Fisher 344 rats, absorption followed first order kinetics, but was dependant on the vehicle used during the dosing. Absorption of TCDD was significantly reduced by the application of Vaseline or polyethylene glycol, and was practically eliminated in soil or activated carbon (12). In another study, dermal absorption of radioactively labeled 2, 3, 7, 8 TCDD in soil vehicle was reported to be only 1% of the administered dose during a 24-hour contact in rats (13). The amount of chemical contaminant that can be absorbed through the skin from soil is dependent on the condition of the skin, the amount of contaminated soil applied, the soil characteristics, and the physical properties of the chemical. Dioxins appear to be absorbed slowly through the skin, indicating that if the exposed area is adequately washed within a reasonably short time after exposure, much of the absorption can be prevented (47).

b) Dermal Contact Area

The area of skin available for contact with soil will vary according to season and personal habits. Typically, it is assumed that skin contact involves the hands and lower arms, but can include the legs, feet, or other body parts. Skin available for contact with soil increases in warmer weather when individuals wear less clothing. The opportunity to be in contact with soil during activities like gardening, construction, and recreational activities also increases during warmer seasons. Note that exposed skin does not necessarily equal the area of skin that actually comes into contact with soil.

c) Soil Adherence to Skin Surfaces

When skin comes into contact with soil, only a small amount is usually left on the skin surface once the contact has ceased. Contaminants that remain on the skin may be absorbed through it, at a rate that is based on the properties of the contaminant. EPA summarized several studies of dermal soil loading in children and adults and cited values between 0.5 and 1.5 milligrams of soil per square

centimeter of skin (mg/cm^2) (50). These values were derived mainly from studies using the hands, which typically have a higher soil adherence factor than other body parts. Theoretically, there is a point at which an increase in soil loading does not result in further absorption of a chemical due to the establishment of a uniform layer of soil on the skin—any additional soil is not in contact with the skin. In a study of pesticide absorption from soil using cadaver skin, this value was estimated to be between 1 and 5 mg/cm^2 (50). The type of soil (clay, sand, etc) will influence adherence, and absorption. The Minnesota Pollution Control Agency utilizes soil adherence values of 0.2 and 0.13 mg/cm^2 in its derivation of the Dioxin Soil Reference Value for individuals less than 18 years of age and adults respectively (3).

3) Inhalation

No quantitative data have been located for the absorption of TCDD in humans following inhalation exposure. However, hepatic aryl hydrocarbon hydroxylase induction and histological alterations were observed in rats following a single intra-tracheal instillation of TCDD in corn oil vehicle or as a laboratory-prepared contaminant of gallium oxide particles (8). Another study (15), found that the pulmonary bioavailability of TCDD on respirable soil particles was 100% as compared to the gallium oxide vehicle. Studies (18,15) suggest that inhaled TCDD will be absorbed; however, the degree and rate of absorption is dependant on the vehicle, and percent chlorination. Site-specific conditions at St. Regis such as particle size, percent chlorination, and organic carbon content will influence the inhalation absorption of dioxins/furans.

IV. Background Exposure

Current estimates of the mean daily exposure in the general U.S. population to dioxins and furans are one picogram per kilogram of body weight per day (1 picogram per kilogram per day (pg/kg/day)) of TCDD equivalents (20). A picogram is one-trillionth of a gram (0.000000001 gram). Estimates of the 95^{th} and 99^{th} percentile intake rates are two times the mean and three times the mean, respectively. Intake rates may be as much as three times the mean for children. The vast majority of this exposure is through the diet. Studies have shown that levels of dioxins and furans measured in human body fat samples have declined from the early 1980s to the present as a result of the increased regulation of emission sources and the subsequent decrease in levels measured in the environment (20).

Dioxin and dioxin-like compounds readily enter the food chain, and it is estimated that approximately 90% of exposure occurs through food for the general population (8, 17). The main sources of background exposure to dioxins are foods like meat, cheese, dairy products, and fish. Fruits and vegetables are expected to have much lower levels of dioxin present. The amount of background exposure is dependant on the amount and types of food consumed and the level of contamination. Certain sub-populations, such as those who eat a particularly fatty diet, subsistence fishermen, and nursing infants may have a higher daily intake.

In general, urban and industrial soils have higher TCDD levels than rural soils. The average background intake of dioxin and dioxin-like compounds, and of all TEQs of TCDD for adults in the general population are 0.35 pg/kg/day and 1.9 pg/kg/day respectively (17). Higher levels of background exposure are possible in elevated dioxin environments like the St. Regis site when one considers other potential pathways.

Many of Cass Lake's residents enjoy the open spaces and lakes near the site. Many residents near the site have or have had vegetable gardens. Cass Lake has a large Indian population that practices traditional use of the flora and fauna found on or near the site. Traditional use of local flora and fauna for ceremonial, medicinal, or dietary purposes could result in additional exposure to site related contamination. Additional exposure to dioxins above background may result from traditional practices such as:

- Ingestion of various plant materials like roots, leaves, inner and outer plant barks, fruits, berries, nut parts of the plants, and wild rice. Plant parts are sometimes boiled and drank or are just chewed.
- Consumption of ducks, deer, muskrat, and fish.
- Dermal exposure stemming from the preparations and use of traditional poultice materials or topical solutions, preparation and use of medicinal solutions for eye and ear conditions. Exposure could occur while harvesting plant or animal materials in contaminated soils, water and sediments.

If these types of exposures produce increased TCDD body burdens, standard TCDD health criteria may not be protective. Furthermore, some local residents worked at the St. Regis site and may have had high occupational exposures. Many people have lived in the community all of their lives and have raised children there. Exposures to the fetus and to nursing infants have likely occurred, and could be especially high in worker families. The issues will be discussed further in the final public health assessment.

V. Child Health Considerations

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to contaminants at hazardous waste sites. A child's behavior and lifestyle will influence exposure. Children can be additionally exposed to environmental dioxins because children play in the dirt, put things in their mouth, and they ingest inappropriate items. Children often bring food into contaminated areas risking cross contamination when they eat items that have fallen to the ground or floor (See Figure 9). In general, children ingest more soil than adults. Children often spend significant time outdoors with little or no clothing (see Figure 10). See Appendix E for additional contemporary site photos. A child's exposure to dioxins starts during their gestational development and continues with the ingestion of contaminated breast milk. The developing body systems of children can sustain permanent damage if exposures occur during critical growth stages. Children drink more fluids, eat more food, breath more air per kilogram of body weight than adults resulting in higher doses of chemical exposure per body weight. Children have a larger skin surface in proportion to their body volume than adults. Children have different eating habits and food preferences like milk, cheese and meat. In addition, children whose families are subsistence fisherman can be additionally exposed to dioxins from locally caught fish. We believe that children who live near the St. Regis site can be easily exposed to dioxin contaminated soil or dust in their houses, private yards, and throughout their neighborhood. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

VI. Cancer Risk Assessment

Human exposure to TCDD is associated with an increased theoretical risk of soft tissue cancers, rather than increased risk of specific types of cancers. TCDD is believed to be a cancer promoter, rather than an initiator (48). Cancer initiators cause direct genetic damage that can also lead to mutations. The initial mechanism by which dioxins are thought to induce adverse health effects, including cancer promotion, is by binding with a cellular protein known as the aryl hydrocarbon receptor (AhR). The AhR protein is part of a family of cellular proteins that is thought to play an important role in normal physiological function. The AhR mediated response to dioxin and dioxin like compounds has been established in several species, but how its induction leads to potential adverse health effects is poorly understood (17, 19).

The potency of a carcinogen is typically estimated using mathematical models. In general, cancer potency is estimated from the linear term in the equation used to describe the observed data. The resulting number is known as a cancer slope factor, and describes the cancer risk per unit dose. For ingestion, it is expressed in terms of the risk per milligrams of contaminant ingested per kilogram of body weight per day (mg/kg/day).

In the evaluation of safe levels of cancer-causing chemicals, MDH uses a negligible excess lifetime cancer risk of 1 in 100,000, or 1×10^{-5}. This means that a person exposed to a concentration of a carcinogen equal to the lifetime risk level of 1×10^{-5} for a lifetime would have up to a 1 in 100,000 chance of developing cancer from this exposure. MDH regards an incremental risk from a single source as negligible at this level, and it is a very small risk compared to the overall existing lifetime cancer rate in Minnesota of approximately 40%.

The cancer slope factor, the MDH negligible lifetime excess cancer risk number, and standard default exposure parameters are used to generate environmental screening criteria such as MDH's Health Risk Limits (HRLs), Health Risk Values (HRVs), and MPCA's SRVs. Site-specific information may be used where appropriate to develop more refined criteria. The common use of conservative exposure assumptions means that the actual risk from exposure to levels of contaminants at the various screening levels lies somewhere between zero and 1 in 100,000.

A possible shortcoming in this approach is the typical use of a 70-year lifetime exposure model. Chemical exposures are often unequally distributed over a lifetime, and there are critical periods of susceptibility at varying times, especially during pregnancy and childhood. Children may be especially susceptible during periods of rapid tissue growth and development, and have a longer time in which to develop adverse health effects. A significant portion of lifetime risk may therefore be accumulated in a relatively short time. Traditional risk assessment methods do not adequately address the issue of the proportion of cancer risk accrued during different time periods when exposures are for less than a lifetime. Children also typically receive higher doses per body weight than adults (as in the case of dioxin), and may be able to absorb higher doses of some contaminants than adults, increasing their dose relative to adults for a given level of environmental exposure.

VII. Risk Assessment and Dioxin

The U.S. EPA is in the midst of a comprehensive dioxin reassessment and cross program appraisal of the reassessment's findings. The draft EPA document has classified dioxins as potent animal carcinogens and likely human carcinogens. Congener 2,3,7, 8 TCDD is considered to be a known human carcinogen. The measure of the relative potency of a carcinogen is a value called the cancer

slope factor. The EPA draft risk assessment has assigned dioxin a cancer slope factor between 1 x 10^6 (mg/kg-d)$^{-1}$ and 1.4 x 10^6 (mg/kg-d)$^{-1}$, which is approximately six to nine times higher than the previous draft EPA dioxin cancer slope factor of 1.56 x 10^5 (mg/kg-d)$^{-1}$ (EPA 2000). MDH recommends using a slope factor of 1.4 x 10^6 (mg/kg-d)$^{-1}$ to evaluate the incremental theoretical cancer risk (MDH 2003).

If the current dioxin SRV (200ppt) was derived using the EPA recommended cancer slope factor of 1 x 10^6 (mg/kg-d)$^{-1}$, it would be approximately 8 times lower if the same methodology were used (see Appendix F for Residential Dioxin Calculation). EPA (Region 9**)** has a Preliminary Remedial Goal (PRG) of 3.9 ppt for dioxin contaminated soils and its derivation is very similar to the SRV. The dioxin PRG is more conservative because it utilizes slightly different exposure parameters such as, greater number of dermal exposure days, larger particle emission factor, and does not utilize absorption adjustment factors **(**see Appendix F for details**)**. MDH has adopted the new dioxin cancer slope factor 1.4 x 10^6 (mg/kg-d)$^{-1}$ for use in the derivations of health criteria like Health Risk Limits (water), and recommends its use in the derivation of Residential Soil Reference Values (SRVs). However, the standard default exposure parameters are subject to change, and the impact of the dioxin reassessment is still being realized. Meanwhile, both MDH and ATSDR agree that using the Dioxin Health Based Residential Screening Value criterion (50 ppt) as a site cleanup goal for dioxin contaminated soil at the St. Regis site is protective of public health. This site contains approximately 40 residential properties including a child care center, and site impacted areas are used by Tribal members as a resource for hunting and gathering activities. A value of 50 ppt or less of dioxins and furans in soil would fall within the range of criteria calculated using the proposed EPA cancer slope factor, and is protective of public health. Further discussion of ATSDR's dioxin guidance is presented in Appendix G. Note that the LLBO have a soil dioxin (TEQ) cleanup standard of 10 ppt (53).

The presence of dioxins in the St. Regis soils remains a significant concern for MDH, ATSDR, and LLBO. Due to the potential toxicity of these compounds and the fact that people are already exposed to them through their diet, we believe that potential exposure to dioxins from man-made sources such as the St. Regis soils should be minimized.

VIII. ATSDR's Decision Framework For Dioxin Contaminated Sites

The Decision Framework For Dioxin Contaminated Sites **(**see Table 6, page 25**)** helps health professionals determine a course of action based on TCDD TEQ concentrations in environmental media. The use of such a hierarchy or framework of quantitative conclusions for purposes of screening, evaluation, and consideration of action is not intended to serve as a surrogate for professional judgment (17). A key limitation inherent in the use of any soil action level is the incomplete understanding of how such a soil action level would contribute to body burdens in at-risk populations (17). This would be the case at the St. Regis site where there are children who may already have elevated background exposures. This is especially true of tribal children who may be exposed by other routes not relevant for non-tribal children.

ATSDR has evaluated non-cancer risks associated with exposure to dioxin. An ATSDR Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects for a specified route and duration of exposure (17). MRLs contain some degree of uncertainty because of the lack of precise toxicological information on the people who might be most sensitive (e.g., infants, elderly, individuals with liver disease, and nutritionally or immunologically compromised) to the effects of

hazardous substances (17). Adding to the uncertainty are at-risk populations who may already have higher body burdens. For a more detailed discussion of the studies that ATSDR reviewed for its derivation of the chronic oral MRL see Appendix G.

The dioxin MRL was used to calculate an Environmental Media (soil) Evaluation Guide (EMEG). EMEGs are media-specific (soil, water, air) comparison values used to select contaminants for further evaluation at hazardous wastes sites (17). EMEGs are based on inhalation and oral MRLs for air and water/soil exposures, respectively. ATSDR selects a critical study for establishing an MRL (in this case, a monkey chronic TCDD oral study), then the MRL is used to derive an EMEG. The 50-ppt Soil EMEG for children was derived using a child's body weight of 10 kg, and a soil ingestion rate of 200 mg/day **(**see Appendix G for details**)**. Note that an EMEG is an estimation of exposure dose from one source and does not include other relevant exposures or background. The ATSDR EMEG for adults is 700ppt. ATSDR emphasizes that these are screening values, and not values at which health effects are known to occur.

This health consultation has initiated the evaluation of site-specific factors for the soils and ATSDR, LLBO, and MDH will evaluate other site media (waters, sediments, and fish) in the near future. Each media specific health consultation will be combined to form a comprehensive St. Regis Public Health Assessment. MDH has also initiated some community education in the form of sending maps to residents informing them what site areas to avoid, and a fact sheet describing ways to avoid contact with contaminated soil (see Figure 11 and Appendix A**)**. MDH has informed local health professionals, city and tribal officials of the health hazard associated with exposure to St. Regis environmental contamination.

Table 6 ATSDR's Decision Framework For Dioxin Contaminated Sites

Screening Level	Evaluation Levels	Action Level *
≤ 50 ppt (0.05 ppb) TEQs • Environmental Media Evaluation Guide (EMEG) = 50 ppt • Minimal Risk Limits (MRL) 1 pg/kg/day TCDD (Oral Chronic) • For Screening Purposes 50 ppt TCDD is assumed to be equivalent to 50 ppt TEQs	≤ 0.05 ppb but < 1 ppb TEQs Evaluation of site-specific factors: • Bioavailability • Ingestion Rates • Pathway Analysis • Soil Cover • Climate • Other Contaminants • Community Concerns • Demographics • Background Exposures	≥ 1 ppb TEQs Potential Public Health Actions: • Surveillance • Research • Health Studies • Community Education • Physician Education • Exposure Investigations

* = A concentration of a chemical at which consideration of action to interdict/prevent exposure occurs, such as surveillance, research, health studies, community education, physician education, or exposure investigations. Alternately, based on the evaluation by the health assessor, none of these actions may be necessary.

IX. Conclusions

- The site poses a public health hazard because there is unrestricted access to highly contaminated soils (especially in the northwestern portion of the site). The site is surrounded by residential properties. There is evidence of human activity and incomplete ground cover in all the soil sample areas. Surficial soil contamination presents an ongoing health risk to adults and children who live near or pass through the site.

- Although most of the residential samples were below the MDH Health-Based Screening Value for dioxins in residential soils (50 ppt), the samples were composites and therefore surface soil dioxin concentrations in localized areas may be much higher.

- Nearly all the dioxin concentrations in the North Storage Area, and South West Area exceeded the MDH Health-Based Screening Value for residential soils (50 ppt). One sample from each area did not exceed the screening value. Additionally, several samples were above the EPA action limit (1ppb).

- Tracking soil into the house and wind deposition are factors for indoor dust contamination.

- It is probable that site contamination is migrating offsite via wind and water erosion due to poor ground cover, and sandy soils.

- A preliminary MDH review of the composite soil sample data collected in off-site residential areas along Railroad Street finds that residential properties contain less than or equal to 50 ppt dioxin (MDH Soil Dioxin Health Based Screening Value for residential soils).

- There is evidence that portions of the site have been graded or backfilled with contaminated soils.

- Many residents have lived in the area for many years, and several worked at the site when it was in operation. Given waste disposal practices of the facility, burning of waste materials in the Tee-Pee burners, fugitive air emissions from the operations, unrestricted access of children to the disposal ponds, and close proximity of homes to the facility, historical exposures could have been significant.

- Cultural and dietary practices of local residents may result in more intensive exposures to dioxins in soil, sediment, and food sources than would be predicted using standard exposure assumptions.

IIX. Recommendations

- MDH/ATSDR and LLBO recommend that all areas of the site that are not currently fenced be fenced, and warning signs be posted (as recommended in MDH's 1993 and 1995 Site Review and Updates). MDH/ATSDR and LLBO recommend that the public not trespass on contaminated areas on the St. Regis property (see Figure 11). MDH and ATSDR agree that using the Dioxin Health Based Residential Screening Value criterion (50 ppt) as a site cleanup goal for dioxin contaminated soil at the St. Regis site is protective of public health.

- MDH/ATSDR and LLBO recommend that all residents south of the tracks minimize contact with soils in their yards (see Appendix A). This recommendation was conveyed in a letter from MDH /ATSDR, and LLBO, to residents south of the railroad tracts.

- MDH/ATSDR and LLBO recommend that the extent and magnitude of soil dioxins be comprehensively characterized in all residential properties south of the tracks, and in all areas associated with St. Regis manufacturing and disposal activities.

- MDH/ATSDR and LLBO recommend that residential properties north of the site along Railroad Street be individually sampled (not composited with other properties) for surface soil dioxins.

Public Health Action Plan

MDH, ATSDR, and LLBO will continue to work with Region 5 EPA, and the City of Cass Lake in addressing community concerns, assisting site investigations, and mitigating exposures through community education. MDH/ATSDR and LLBO are available for reviewing any site sampling plans and sample data results. MDH/ATSDR and LLBO recommend that other pathways including groundwater, surface water, sediments, and fish be investigated further.

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Figures

Figure 1 Site Map

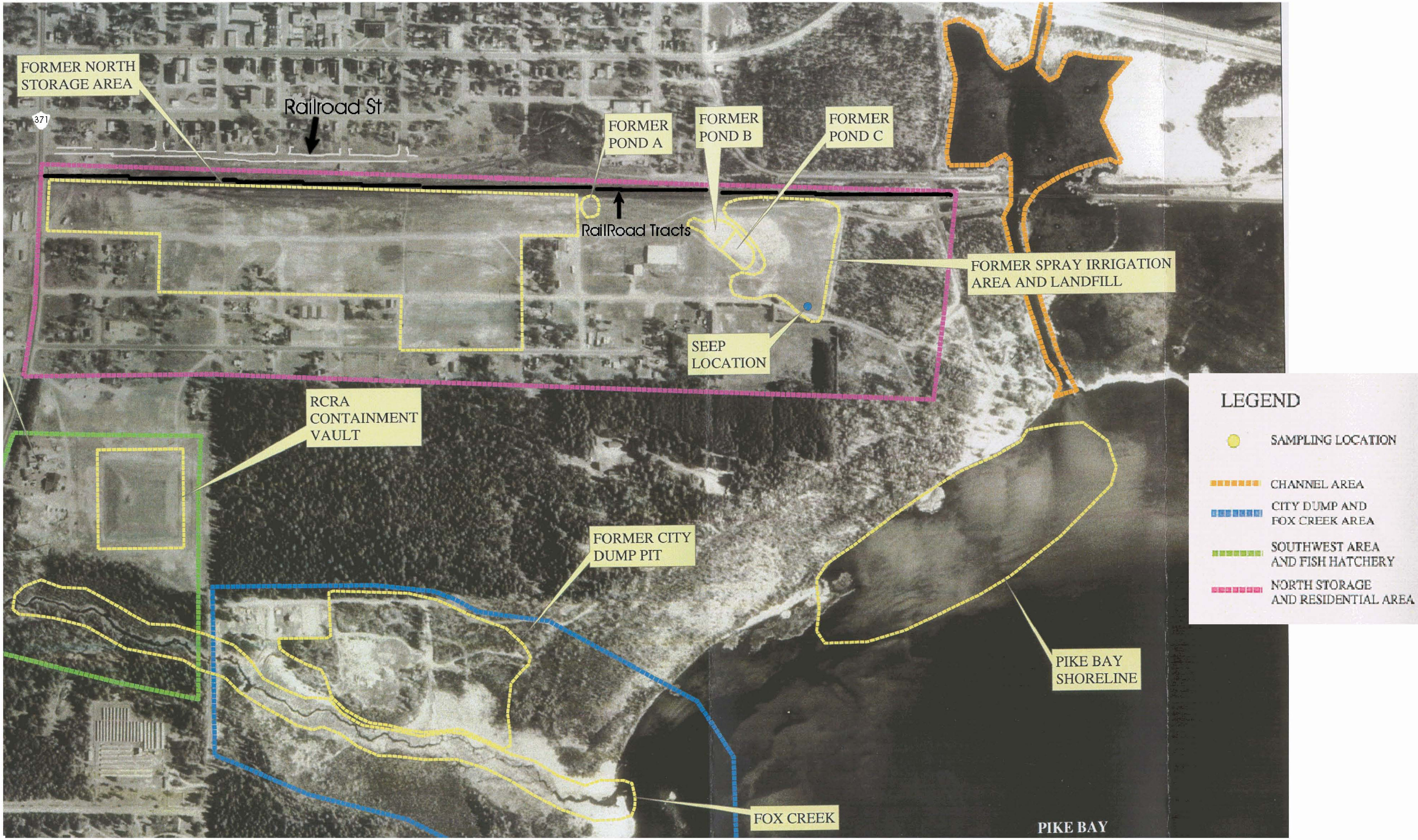


Figure 2 Backfilling Pond C

Figure 3 Reference Surface Soil Sample Locations

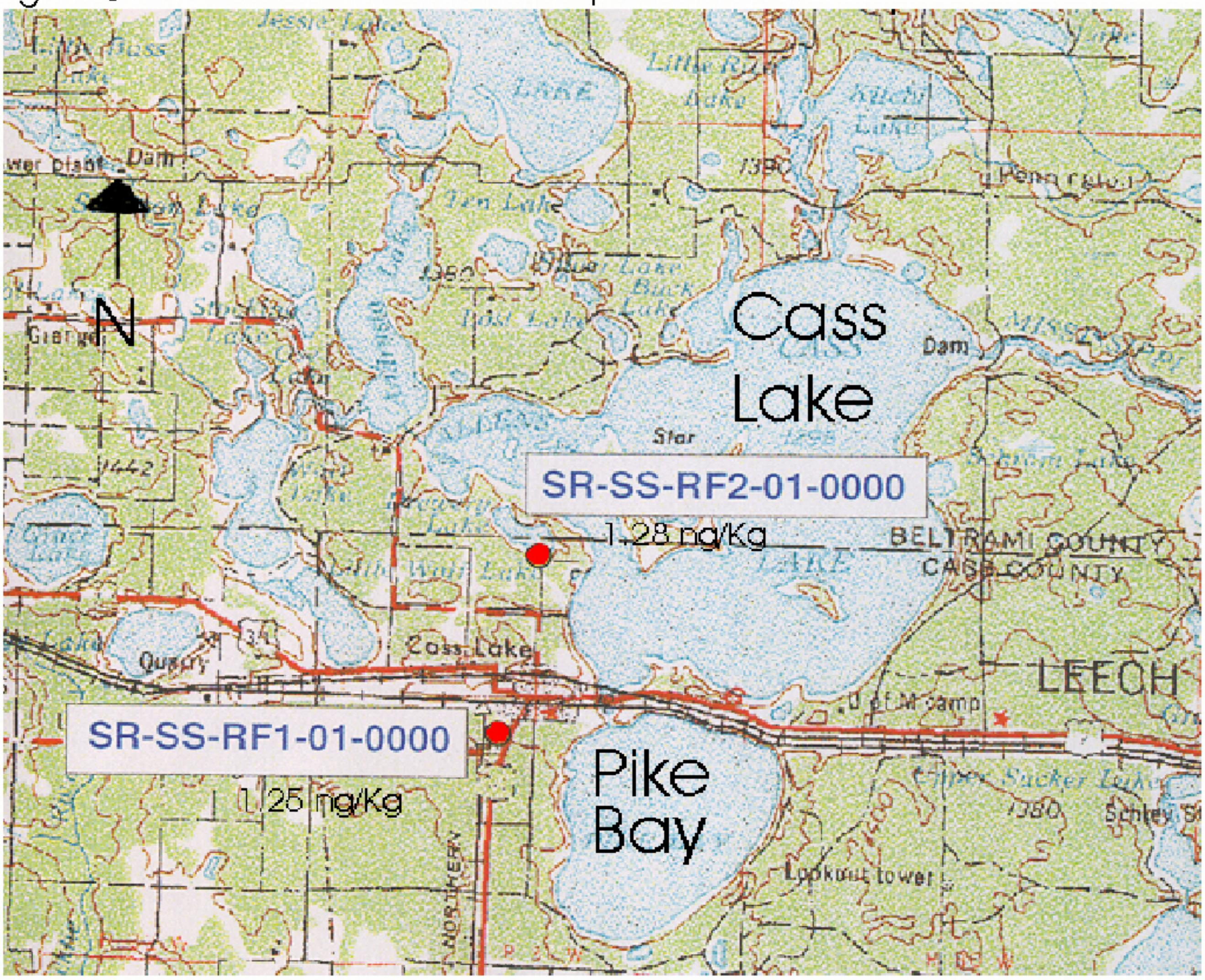
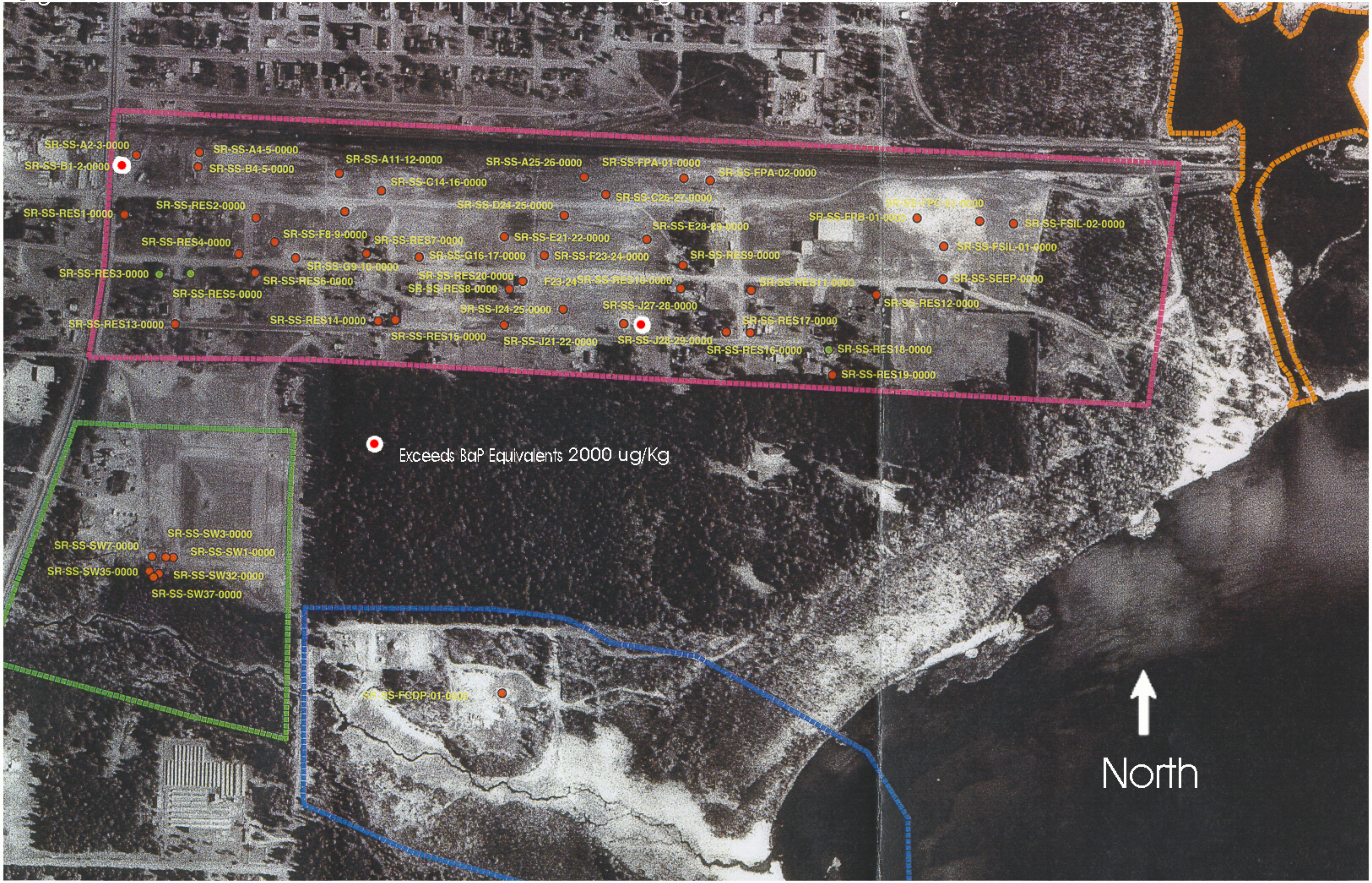


Figure 4 Surface Soil Sample Locations for Semi Volatile Organic Compounds (SVOCs)



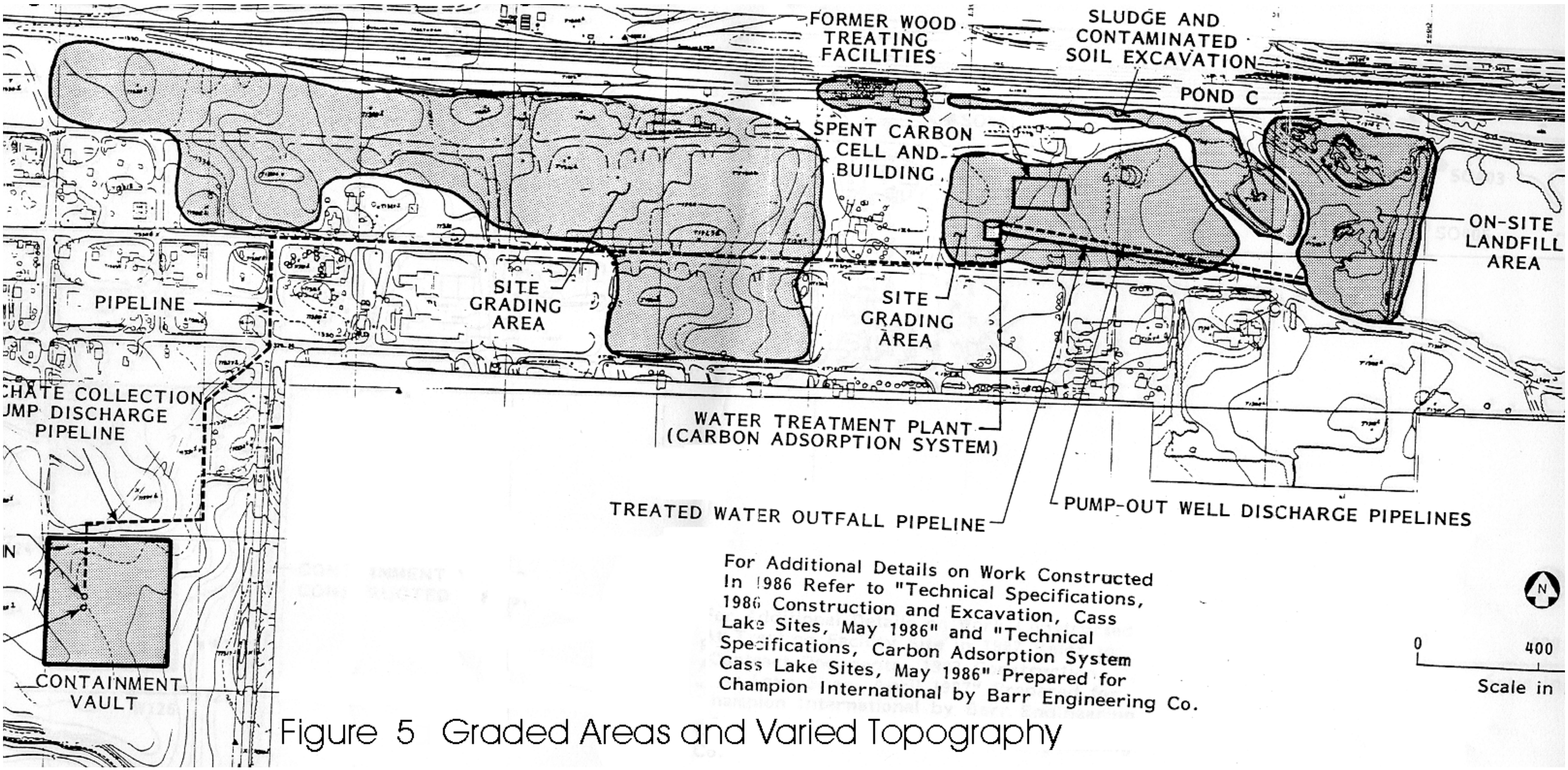


Figure 5 Graded Areas and Varied Topography

Figure 6 Sludge Disposal Pit

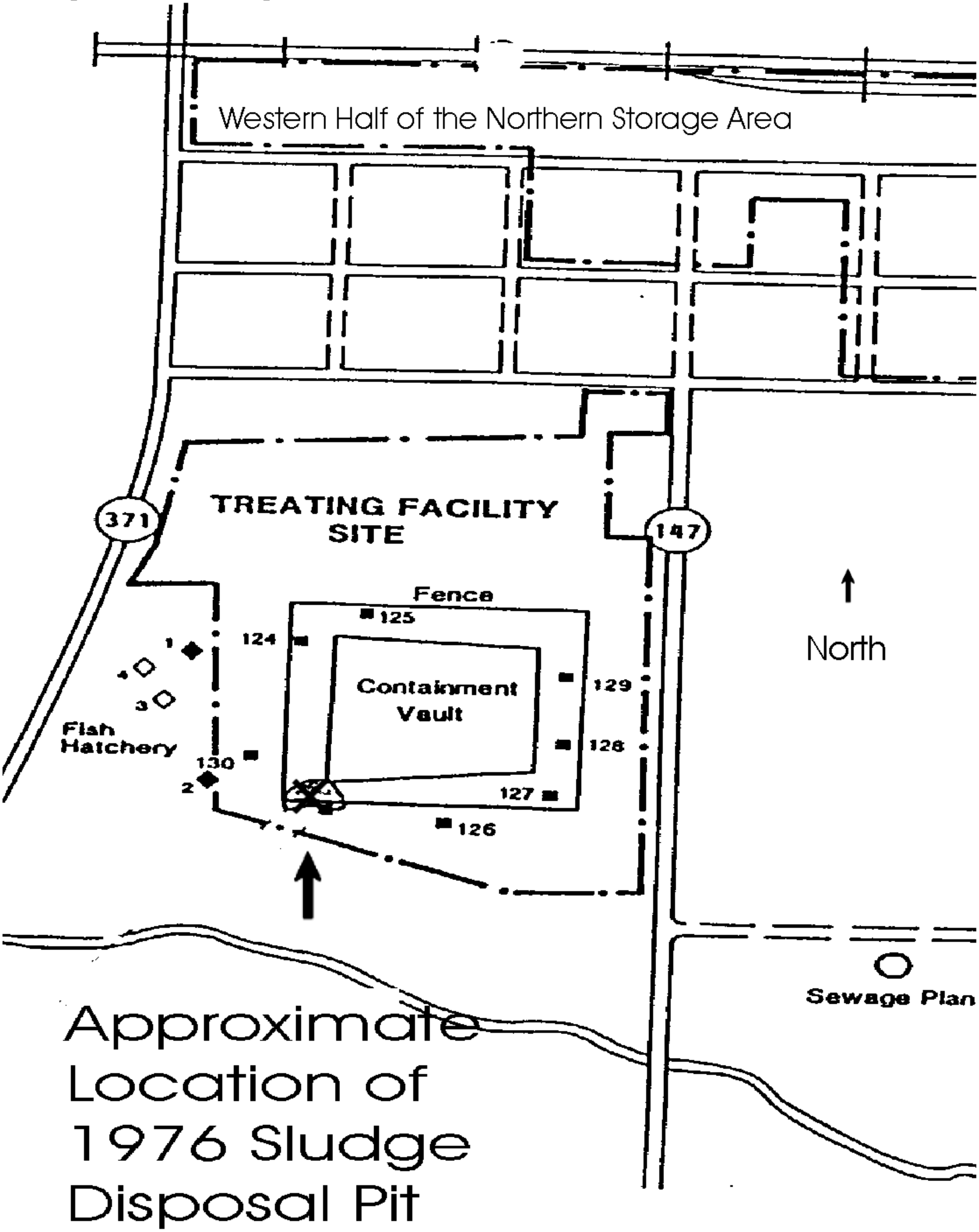


Figure 7 Summary of Surface Soil Dioxin TEQs

Figure 8 Teepee Burner 2

Figure 9
Child's play toys in a backyard dirt pile

Figure 10 Recent Photo of Children Playing in Backyard Puddle

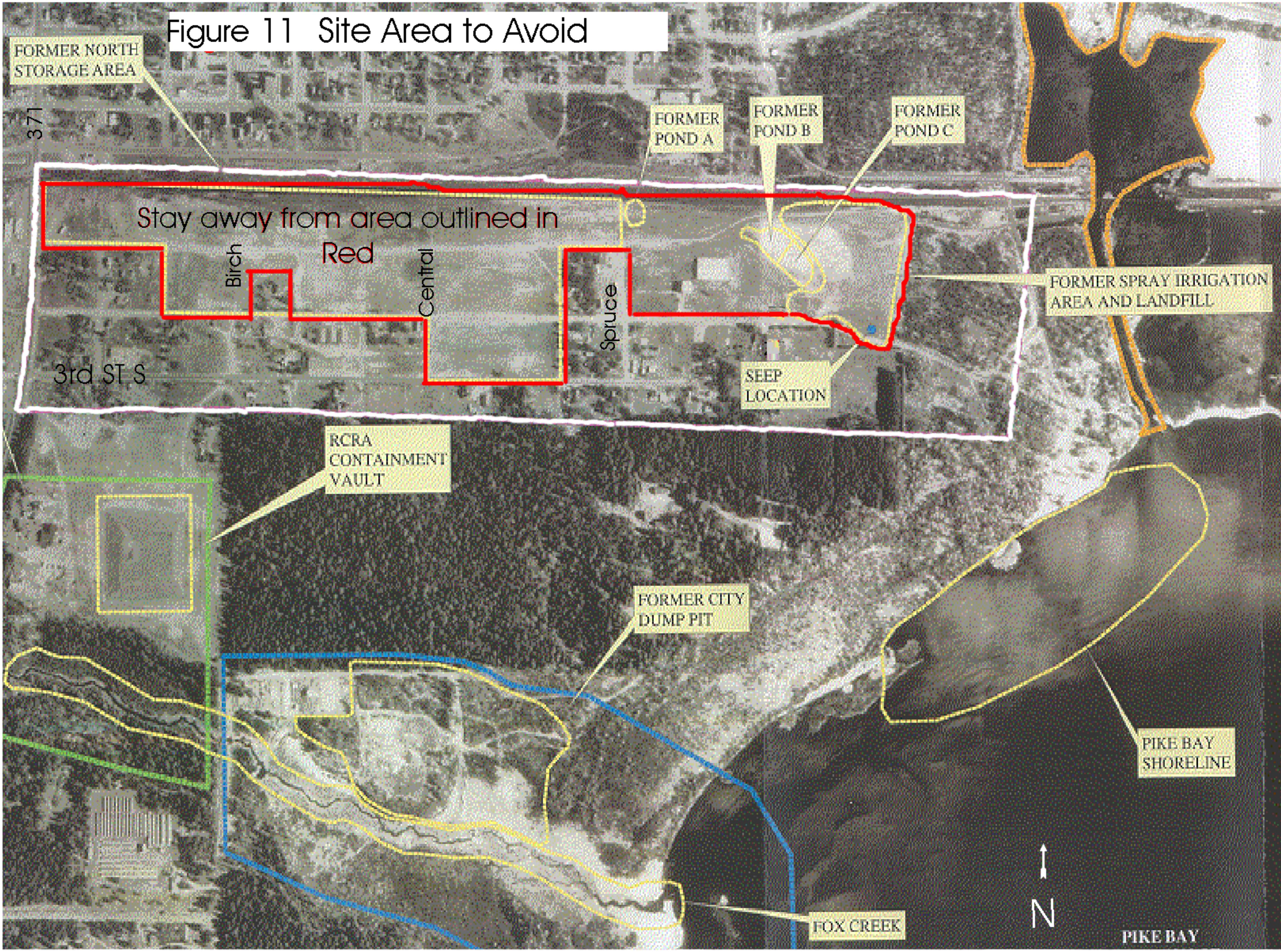


Figure 11 Site Area to Avoid
FORMER NORTH STORAGE AREA
371
Stay away from area outlined in Red
Birch
Central
Spruce
3rd ST S
FORMER POND A
FORMER POND B
FORMER POND C
FORMER SPRAY IRRIGATION AREA AND LANDFILL
SEEP LOCATION
RCRA CONTAINMENT VAULT
FORMER CITY DUMP PIT
PIKE BAY SHORELINE
FOX CREEK
N
PIKE BAY

APPENDIX A

Reduce Your Contact With Contaminated Soils Fact Sheet

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

Tetra Tec Letter to the EPA Regarding: Surface Soil Sampling Depths

Tetra Tech EM Inc.

200 E. Randolph Drive, Suite 4700 ◆ Chicago, IL 60601 ◆ (312) 856-8700 ◆ FAX (312) 938-0118

June 2, 2003

Mr. Tim Drexler
Remedial Project Manager (SRF-5J)
U.S. Environmental Protection Agency Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Subject: **Surface Soil Samples Collected During the October 2001 Sampling Event St. Regis Paper Company, Cass Lake, Minnesota**

Dear Mr. Drexler:

Per your request, Tetra Tech EM, Inc. (Tetra Tech) reviewed the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPP), and field logbooks for the October 2001 sampling event at the St. Regis Paper Company (St. Regis) site in Cass Lake, Minnesota. Specifically, Tetra Tech reviewed surface soil sample collection procedures at the Former North Storage Area and the nearby residential yards.

As indicated in the FSP, QAPP, and logbooks, surface soil samples were collected from five subsample locations and composited into one sample. The subsamples were homogenized in a stainless-steel mixing bowl using a stainless-steel trowel and placed into a sample container. The FSP and QAPP specified that each surface soil subsample was to have been collected within the 0- to 1-foot below ground surface (bgs) interval. Although precise sample depths were not recorded, discussions with the field sampling team and their recollection of the sampling depths indicate that surface soil samples were collected within this interval; however, approximately 95 percent of the surface soil samples were actually collected from 0- to 6-inch bgs.

Should you have any questions about the surface soil sampling procedures at the site, please contact me at 312-946-6442.

Thank you,

Michelle Culleton

Michelle Cullerton
Project Manager

APPENDIX C

Example of a Benzo-a-pyrene (BaP) Equivalence Calculation

Example of a Benzo(a)pyrene Equivalence Calculation

Sample ID No.	Residential Soil Reference Values (ug/Kg)	SR-SS-B1-2-0000	Benzo(a)pyrene (BaP) Equivalents				
Sampling Date		10/21/01	Chemical	CAS No.	Site Concen. (µg/kg)	Relative Potency Factor	BaP Equivalent (µg/kg)
Unit		µg/kg					
Acenaphthene	1,200,000						
Anthracene	7,880,000	170 J					
Benzaldehyde		1,100 U					
Benzo(a)anthracene		**1,600**	Benz[a]anthracene	56-55-3	1600.000	0.1	160.0
Benzo(a)pyrene	2,000	**2,100**	Benzo[a]pyrene (or BaP equivalents)	50-32-8	2100.000	1	2100.0
Benzo(b)fluoranthene		**2,600**	Benzo[b]fluoranthene	205-99-2	2600.000	0.1	260.0
Benzo(g,h,i)perylene		320 J					
Benzo(k)fluoranthene		1,900 J	Benzo[k]fluoranthene	207-08-9	1900.000	0.01	19.0
Bis(2-ethylhexyl)phthalate							
2-Chlorophenol							
Chrysene		**2,300**	Chrysene	218-01-9	2300.000	0.1	230.0
Dibenzo(a,h)anthracene			Dibenz[a,h]anthracene	53-70-3	0.000	0.035	0.0
Di-n-butylphthalate							
Di-n-octylphthalate							
2,4-Dinitrophenol							
2,4-Dinitrotoluene							
Fluoranthene	1,080,000	**4,100**					
Fluorene	850,000						
Indeno(1,2,3-cd)pyrene		700 J	Indeno[1,2,3-cd]pyrene	193-39-5	700.000	0.1	70.0
Naphthalene							
N-nitroso-di-n-propylamine							
Pentachlorophenol	85,000						
Phenanthrene		**1,200**					
Pyrene	890,000	**3,700**					
					Method 8270 BaP Equivalence*		2839.0
Method 8270 SIM							
Acenaphthene	1,200,000	--					
Acenaphthylene		--					
Anthracene	7,880,000	--					
Benzo(a)anthracene		--	Benz[a]anthracene	56-55-3	--	0.1	
Benzo(a)pyrene		--	Benzo[a]pyrene (or BaP equivalents)	50-32-8	--	1	
Benzo(g,h,i)perylene		--					
Benzo(k)fluoranthene		--	Benzo[k]fluoranthene	207-08-9	--	0.01	
Chrysene		--	Chrysene	218-01-9	--	0.1	
Dibenzo(a,h)anthracene		--	Dibenz[a,h]anthracene	53-70-3	--	0.035	
Dibenzofuran		--					
Fluoranthene	1,080,000	--					
Fluorene	850,000	--					
Indeno(1,2,3-cd)pyrene		--	Indeno[1,2,3-cd]pyrene	193-39-5	--	0.1	
Pentachlorophenol	85,000	--					
Phenanthrene		--					
Phenol	1,100,000	--					
Pyrene	890,000	--					
					Method 8270 SIM BaP Equivalence*		0.0

Notes:
J=estimated value
µg/kg = microgram per kilogram (parts
*Compare Value to BaP Equivalence Soil Reference Value (2000 µg/kg)

Appendix D

Example of a Dioxin Equivalence Calculation

Example of Dioxin Toxic Equivalence Calculation

Dioxin/Furan Congener	Comparison Health Value For Soil Dioxin TEQ (ng/Kg)	SR-SS-RES16-0000 10/18/01 ng/kg	1998 World Health Organization (WHO) Toxic Equivalancey Factor (TEF)	Toxic Equivalent ng/kg
2,3,7,8-TCDD	50	1.100	1.000	1.100
1,2,3,7,8-PeCDD		133	1.000	133.000
1,2,3,4,7,8-HxCDD		93	0.100	9.250
1,2,3,6,7,8-HxCDD		463	0.100	46.300
1,2,3,7,8,9-HxCDD		245	0.100	24.500
1,2,3,4,6,7,8-HpCDD		1460	0.010	14.600
OCDD		98600	0.0001	9.860
			TEQ for TCDD=	**238.610**
2,3,7,8-TCDF	50	24.6	0.100	2.460
1,2,3,7,8-PeCDF		33.7	0.050	1.685
2,3,4,7,8-PeCDF		196	0.500	98.000
1,2,3,4,7,8-HxCDF		405	0.100	40.500
1,2,3,6,7,8-HxCDF		328	0.100	32.800
1,2,3,7,8,9-HxCDF		103	0.100	10.300
2,3,4,6,7,8-HxCDF		207	0.100	20.700
1,2,3,4,6,7,8-HpCDF		3480	0.010	34.800
1,2,3,4,7,8,9-HpCDF		400	0.010	4.000
OCDF		10600	0.0001	1.060
			TEQ for TCDF=	**246.305**
			TCDD TEQ + TCDF TEQ =	**484.915**
ng/kg = parts per Trillion (ppt)				
Shaded Cells = estimated values				
Bold = Exceedance Of Comparison Health Value For Soil Dioxin (50 ppt)				

Appendix E

Contemporary Site Photos

Child's play area near dirt pile in residential yard

One of the few fenced yards near the site. Note the incomplete ground cover.


Bare soil in residential yard

Most of the roads near the site are dirt and many areas do not have complete ground cover.

Home made tent in residential yard

Appendix F

Residential Dioxin Soil Reference Value Calculation

Residential Dioxin SRV Calculation With New Cancer Slope Factor

Combined Exposures to Carcinogenic Contaminants in Residential Soil

$$C\ (mg/kg) = \frac{TR \times ATc}{EF \times [\underbrace{[(IFSadj \times CSFo)/(1E+6\ mg/kg)]}_{ingestion} + \underbrace{[(SFSadj \times ABS \times CSFo)/(1E+6\ mg/kg)]}_{Dermal} + \underbrace{[(InhFadj \times CSFi)/PEF]}_{Inhalation}}$$

Parameter		Region 9		MPCA SRV	Region9/SRV
TR =	Target cancer risk	1.00E-06		1.00E-05	0.10
ATc =	Averaging time - carcinogens (days)	25550		25550	1.00
EF =	Exposure Frequency (days/yr)	350	ingestion	350	1.00
		350	dermal	97	3.61
		350	inhalation	350	1.00
IFSadj =	Age-adjusted ingestion factor ([(mg-yr)/(kg-d)])	114		44	2.59
CSFo =	**Cancer slope factor oral (mg/kg-d)-1**	**1.40E+06**		**1.40E+06**	1.00
SFSadj =	Age-adjusted dermal factor ([(mg-yr)/(kg-d)])	361		395	0.91
ABS =	Skin absorption	0.03		0.03	1.00
InhFadj =	Age-adjusted inhalation factor ([(m3-yr)/(kg-d)])	11		18	0.61
CSFi =	**Cancer slope factor inhaled (mg/kg-d)-1**	**1.40E+06**		**1.40E+06**	1.00
PEFs	Particulate Emission Factor (m3/kg)	1.32E+09		7.70E+08	1.71
Absorption	Adjustment for Soil vs Toxicity Study Vehicle (diet)	NA		0.55	
Oral Toxicity Value Absorption Adjustment Factor for Dermal Exposure		NA		0.5	

C (mg/kg)= 4.18E-07 using Region 9 default values
C (mg/kg)= 1.73E-05 using MPCA default values

Appendix G

ATSDR Health Assessment of Dioxins and the Derivation of a Minimal Risk Level (MRL) and Environmental Media Evaluation Guides (EMEGs)

ATSDR Health Assessment of Dioxins and the Derivation of a Minimal Risk Level (MRL)
ATSDR selected a number of relevant epidemiological and animal studies to serve as a basis for establishing Oral Minimal Risk Levels (Acute, intermediate-duration, and chronic) for dioxins. An ATSDR Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects for a specified route and duration of exposure (16). Tables 1-3 outline the human (adult and infant), and animal health studies ATSDR reviewed for establishing its dioxin health guidance values. Table 4 lists the critical studies and uncertainty factors ATSDR utilized for establishing Dioxin MRLs (oral).

Health Effects Associated with Human Dioxin Body Burdens
Several non-cancer human health effects have been described in the literature including chloracne, hyper-pigmentation and excessive body hair (17). Several human health studies have demonstrated a positive correlation between TCDD exposure and subtle health effects like immunosuppression, changes in hormone levels, and increased cancer risk. However, several of the human health studies show no association between TCDD exposure and spontaneous abortion, peripheral neuropathy, and risk of clinical hepatic disease. See Table 1 for a list of epidemiological studies reviewed by ATSDR. Note that epidemiological studies are usually criticized for having poor estimates of exposure.

Table 1 **Health Effects Associated With Exposure To TCDD And Body Burdens in Humans**

Duration of Exposure	System	Effect	Body Burden ng/kg Body Weight	Reference
< 1 year	Dermal	Chloracne in Children	2357	Mocarelli et al., 1991
< 1 year	Reproductive	No increased risk of spontaneous abortion	> 24	Wolfe et al., 1995
≥ 15 year	Hepatic	No increased risk of clinical hepatic disease	418	Calvert et al., 1992
≥ 15 year	Gastrointestinal	No increased risk of clinical gastrointestinal disease	418	Calvert et al., 1992
Not Specified	Dermal	Chloracne in 5/7 subjects	80.5, 18	Schecter et al., 1993
11 years	Dermal	Chloracne	646	Jansing and Korff, 1994
6.5 years	Immunological	Immunosuppression	156-176	Tonn et al., 1996
≥ 15 years	Neurologic	No increased risk for peripheral neuropathy	418	Sweeney et al,. 1993
≥ 15 years	Reproductive	Increased prevalence of high lutenizing hormone and low testosterone levels	31	Egeland et al., 1994
Not Specified	Genotoxicity	No chromosome aberrations or sister chromatid exchanges	63-833	Zober et al., 1993
≥ 1 year	Cancer	Increased cancer mortality risk	124-459	Fingerhut et al., 1991
≥ 20 years	Cancer	Increased cancer mortality rate	69-461	Manz et al., 1991

Adapted from Reference 17

Children's Susceptablity
Children differ from adults in their exposures and may differ in their susceptibility to hazardous chemicals. Children can be exposed during pre-natal and post-natal life during critical stages of organ development. A developing child can metabolize and distribute toxicants differently than an adult. The detoxification systems of a child may not be fully developed making them more susceptible to contaminant exposures. Children also have a longer lifetime in which to express damage from hazardous chemicals. **Table 2** lists subtle infant health effects associated with exposure to breast milk contaminated with TCDD equivalents (TEQs) reported in the literature. Infant exposure to breast milk with dioxin TEQ levels ranging from 28 to 93 picograms/g resulted in lower vitamin K levels, mild changes in liver enzymes, changes in hormone levels, and increased total T cell counts (see Table 2).

Table 2

Breast Milk Levels of Total TEQs Associated With Health Effects In Human Infants

Number of Children	Breast Milk Mean TEQs pg/g	Health Effects	References
17	29.85-92.88	Late-type hemorrhagic disease of newborns correlated with increased TCDD in breast milk	Koppe et al., 1991
32	29.4, 13.7-62.6	Decreased vitamine K_1 and decarboxylated prothrombin levels in infants correlated with increased levels of 2,3,7,8-tetraCDF and 1,2,3,6,7,8-hexaCDF levels, respectively in breast milk at 11 weeks of age	Pluim et al., 1994a
78	> 30.75	Higher CDD and CDF levels in breast milk correlated with higher plasma levels of thyroid-stimulating hormone in infants (2^{nd} week and 3^{rd} month postnatally)	Koopman-Esseboom et al., 1994
104	30.19	Higher CDD and CDF levels were related to reduced neonatal neurological optimality	Huisman et al., 1995
48	Not specified	Higher exposure to CDDs in breast milk was associated with increase in total T cells and lower monocyte and granulocyte counts	Weisglas-Kuperus et al., 1995
35	28.1, (8.7-62.7)	Cumulative intake correlated with aspartate aminotransferase and alanine aminotransferase plasma activities; inverse correlation was found between cumulative intake and number of platelets at 11 weeks of age	Pluim et al., 1994b
19	37.5, (29.2-62.7) high exposure group	Increased thyroxine levels and increased thyroxine/thyroid binding globulin ratios in a group with higher breast milk exposure as compared to lower exposure group	Pluim et al., 1992
19	18.6, (8.6-28) low exposure group	Baseline control values	Pluim et al., 1992

Adapted from Reference 17

Animal Studies
Studies in animals have shown that long-term exposure to lower levels of dioxins can affect the liver, and may cause reproductive or developmental effects. Dioxin exposure may also be associated with changes in the immune system (Stehr-Green et al., 1987). The dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was recently classified as a "known human carcinogen" by the National Toxicology Program (NTP), and the International Agency for Cancer Research (IARC) based on studies in humans and animals. Table 3 lists several animal studies that associate TCDD body burden with immunological, reproductive, developmental, and cancer health effects.

ATSDR has noted that the TEQ body burden range (18-2357 ng/kg) in the human health studies resulting in health effects (Table 1**)** is very similar to the animal TEQ body burden range (26-2976 ng/kg) resulting in health effects (Table 3) (17). ATSDR used the 90 day guinea pig study to formulate an oral Minimal Risk Level (MRL) for exposures that are of intermediate duration. ATSDR selected the 16 month monkey study to formulate a chronic oral MRL (see Table 4 for MRL calculation).

Table 3

Animal Body Burdens Associated with Health Effects

Study Duration	System	Effect	Body Burden ng/Kg	Reference
14 days	Immunological	Suppressed serum complement in mice	74	White et al., 1986
90 days	Reproductive	Decreased litter size in rats	26	Murray et al., 1979
90 days	Immunological	Decreased thymus weight in guinea pigs	164	*DeCaprio et al., 1986
16 months	Developmental	Behavioral alterations in offspring in monkeys	32	**Schantz et al., 1992
2 years	Cancer	Liver, lug carcinoma in rats	2976	Kociba et al., 1978
2 years	Cancer	Liver carcinoma in mice	944	NTP, 1972

*= study which serves as the basis for ATSDR's intermediate oral health guidance value
**= study which serves as the basis for ATSDR's chronic oral health guidance value
Adopted from Reference 17.

Minimal Risk Levels

An ATSDR Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects for a specified route and duration of exposure (16). MRLs contain some degree of uncertainty because of the lack of precise toxicological information for the people who might be most sensitive (e.g., infants, elderly, individuals with liver disease, and nutritionally or immunologically compromised) to the effects of hazardous substances (16).

MRLs are substance-specific estimates intended to serve as screening levels to identify potential health risks associated with contaminant exposure. It is important to note that MRLs are not intended to define clean-up or action levels.

Although human data are preferred, MRLs are often based on animal studies because human studies usually lack good exposure information. In the absence of evidence to the contrary, ATSDR assumes that humans are more sensitive to the effects of a hazardous substance than animals and that certain persons may be particularly sensitive (17). With the use of safety factors, MRLs may be as much as a hundredfold below levels that have been shown to have an effect in laboratory animals.

MRLs for the dermal route of exposure are not derived because ATSDR has not yet identified a method suitable for this route of exposure (17). MRLs are generally based on the most sensitive chemical-induced end point considered to be of relevance to humans. Serious health effects (such as irreparable organ damage, or birth defects) are not a basis for establishing MRLs. Exposure to a level above the MRL does not mean that adverse health effects will occur. MRLs may also be viewed as screening criteria to identify those hazardous waste sites that are not expected to cause adverse health effects. Table 4 lists the animal studies that ATSDR has used to derive oral TCDD MRLs. The Chronic Oral MRL is 1 pg/kg/day based on neurobehavioral effects in monkeys. The MRL was calculated using a safety factor of 3 for the use of a Lowest Observed Adverse Effect Level (LOAEL), a safety factor of 3 for animal to human extrapolation, and a safety factor of 10 for human variability.

Table 4

Oral TCDD Minimal Risk Levels (MRLs) Studies

Species	Endpoint	Exposure	Duration	Safety Factors	MRL	Author
Mice	Immuno-suppression	Oral gavage	Acute	3 for Animal to Human 10 for Human variability 0.7 for bioavailability Safety Factor Total (21)	200 pg/kg/day	Burleson et al., 1996
Guinea Pig	Decreased Organ weight	Oral Diet	Inter-mediate	3 for Animal to Human 10 for Human variability Safety Factor Total (30)	20 pg/kg/day	DeCaprio et al., 1986
Monkey	Neuro-behavioral Effects	Oral Diet	Chronic	3 for LOAEL 3 for Animal to Human 10 for Human variability Safety Factor Total (90)	1 pg/kg/day	Schantz et al., 1992

Pg = picogram ; kg = kilogram

Environmental Media Evaluation Guides (EMEGs)

EMEGs are media-specific (soil, water, air) comparison values that are used to select contaminants of concern at hazardous wastes sites (17). EMEGS are based on inhalation and oral MRLs for air and water/soil exposures, respectively. In short, ATSDR selects a critical study for establishing a MRL (in this case a chronic TCDD oral study); the MRL is then used to derive an EMEG. A soil TCDD EMEG of 50 ppt was derived using the following formula:

$$\text{Soil EMEG} = \text{Oral Chronic MRL} \times \frac{BW}{IR}$$

BW= Child body weight (10 kg)
IR = Soil ingestion rate (child = 200 mg/day)
MRL = Minimal Risk Level (1 pg/kg/day)

ATSDR believes that exposure to soils with 50 ppt dioxin is protective. Note that an EMEG is an estimation of exposure dose from one source and does not include other relevant exposures including "background" exposures, such as may occur through the general food supply.

Appendix H

Public Comments

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December 1, 2003

Mr. Daniel Peña
Health Assessor – Site Assessment and Consultation Unit
Division of Environmental Health
Minnesota Department of Health
121 East 7th Place
Saint Paul, MN 55164-0975

Subject: **Health Consultation – Public Comment Release**
St Regis Paper Company Superfund Site, Cass Lake, Minnesota

Dear Mr. Peña:

Attached please find International Paper's initial comments on the August 28, 2003 draft Health Consultation related to potential health concerns associated with exposure to soils at the St. Regis Paper Company Superfund Site. Please note that these are initial comments only and we reserve the right to supplement or amend these comments in the future.

Overall, International Paper is concerned that the Health Consultation, in its current form, contains numerous technical inaccuracies, presents unbalanced and incomplete information, and reaches speculative and subjective conclusions regarding site conditions and potential human health concerns. These problems prevent the document from successfully achieving its stated purpose "to assess any current or future impact on the public's health, develop appropriate health-based recommendations, and identify further study or action needed to evaluate or prevent human health effects from soil exposures." These problems also may contribute to public misperceptions of actual site conditions and potential health risks.

Our detailed comments provided in the attachment focus on the following specific concerns:

- The draft consultation does not consider all available site data, the omission of which renders many of its conclusions and recommendations both inaccurate and inappropriate with respect to current site conditions and potential health concerns
- The draft consultation relies on outdated science and superceded U.S. EPA guidance regarding chemical toxicity and exposure assumptions for soil
- The draft consultation wrongly identifies metals as "known site contaminants," despite the fact that extensive sampling performed in 2001 confirmed that metals are not contaminants of concern in site soils

- The draft consultation inappropriately recommends applying a 50 part 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 consultation does not appear to fully take into account the effects of prior response actions, nor can it fully account for planned actions that have not yet occurred, particularly the planned soil removal action on City-owned portions of the North Storage Area of the site, which will address most of the highest dioxin/furan concentrations identified during the 2001 and 2003 sampling.

Based on the very serious concerns identified in our comments, we believe the Health Consultation must be substantially revised before it can be a useful document for informing the public of potential health risks associated with soils at the St. Regis site. Please feel free to contact me if you have any questions.

Sincerely,

Thomas B. Ross

Attachment A
Review Comments on ATSDR's Health Consultation, Dated August 28, 2003

St. Regis Paper Company Site

Cass Lake, Cass County, MN
USEPA Facility ID: MND05759740

The following comments focus on specific elements presented in the consultation, such as soil ingestion rates and chemical bioavailability, as well as the accuracy and application of site historical information and site-specific data. The comments parallel the organization of the health consultation, with specific references to the report sections, page numbers, paragraphs, and line numbers.

I. Introduction

First paragraph. The Health Consultation states that it focuses on soil data results presented in the EPA document, *Final Data Evaluation Report for the St. Regis Paper Company Superfund Site, Cass Lake, Minnesota* (August 23, 2002). The Health Consultation should be updated to reflect other significant data sources for soil in addition to the EPA Final Data Evaluation Report. These include International Paper's 2001 split and supplemental sampling performed in conjunction with EPA's 2001 site investigation and the results of the recently-completed 2003 Removal Site Evaluation and Supplemental Assessment. International Paper has provided all of these data to EPA, and they are part of the Administrative Record for the Site. Moreover, representatives from MDH and ATSDR were present at meetings with EPA and other stakeholders over the past year when these additional data sources were discussed extensively.

Because the Health Consultation does not consider these important additional data sources, many of the statements made throughout the document regarding data gaps and unsampled areas are obsolete and inaccurate. For example, fourteen composite soil samples from former process areas at the wood treating facility, including the former treatment pond areas, were collected and analyzed for dioxins/furans in the 2003 investigation. Dioxin TEQs from these areas ranged from 9 parts per trillion (ppt) to 721ppt. In addition, thirteen composite soil samples were collected and analyzed from wind deposition areas immediately north and south of the former limits of operation at the wood treating facility. Dioxin TEQs in these samples ranged from 8 ppt to 51 ppt. Finally, composite soil samples were collected and analyzed from seven remaining residences in the immediate vicinity of the North Storage Area that were not sampled in EPA's 2001 investigation. Dioxin TEQs in these residential samples ranged from 18 ppt to 287 ppt; five of the seven were below 50 ppt.

II. Background

A. Site Description and History

4) Environmental Investigation, 1st paragraph. ATSDR/MDH should provide a summary of response actions that have taken place at the St. Regis site because they are relevant to determining exposure pathways. In addition, if the Health Consultation will be finalized before the planned soil removal action in the North Storage Area is completed, it should acknowledge the anticipated positive impacts of this removal on potential human health exposures at the site. The consultation does not appear to fully take into account the impacts of prior actions, nor can it fully account for planned actions that have not yet occurred. Below is a brief summary of the response actions to date and a description of the planned removal action that identifies some of the important aspects of each of these actions relevant to the Health Consultation.

Environmental Investigation and Response Actions

In 1985, Champion International Corporation closed the Cass Lake facility and signed two Response Orders by Consent with the MPCA. One order was applicable to the wood treating facility and the second order was applicable to the city dump pit site. The site investigation and remedial action plans developed for both sites by Champion International were consistent with the National Contingency Plan (NCP). The State of Minnesota issued two Minnesota Enforcement Decision Documents (MEDDs) in 1986 that selected the appropriate

response actions for the two sites based on the process identified in the Consent Orders and the NCP. Public input was obtained prior to response action selection. Consistent with the NCP and the Consent Orders for the sites, the State of Minnesota determined that the selected response actions were protective of public health, welfare, and the environment. Champion extended the City of Cass Lake municipal water supply to nearby residents in 1985 and implemented the other selected response actions between 1986 and 1988. Visibly contaminated soil was excavated from portions of the wood-treating facility and the city dump pit in 1986. Backfill for the excavated areas was borrowed from the North Storage Area. The excavated soils were disposed of in a containment vault constructed on the wood-treating facility property. The vault was closed in 1987. A groundwater extraction and treatment system was put into operation at the wood-treating facility in January 1987. In the fall of 1988, a groundwater extraction system was also put into operation at the city dump, with extracted groundwater pumped to the groundwater treatment plant at the wood-treating facility. The groundwater extraction and treatment systems have operated continuously since startup. At the request of the City of Cass Lake, Champion donated a large portion of the former facility property to the City in 1988 for the intended purpose of redevelopment as an industrial park.
Based on the results of soil sampling performed at the St. Regis site in 2001 and 2003, EPA and International Paper are planning a removal action for surface soil on City-owned portions of the former North Storage Area with dioxin/furan TEQs of 1 ppb or greater. International Paper anticipates that EPA will issue a Unilateral Administrative Order requiring that surface soils from these areas be excavated and disposed in an offsite landfill during the 2004 construction season.

B. Current Conditions

Page 8
International Paper recently erected fencing around land at the site owned by International Paper. ATSDR/MDH should revise this section accordingly.

Page 9
The statement that the engineered life of the vault is reportedly 20 years is not correct. The life of the vault is indefinite since the bottom-most liner is constructed of a natural material (i.e., 3 feet of compacted clay) that is not subject to freeze thaw cycles, desiccation, or other significant degradation stresses. The overlying synthetic membrane acts in concert with the clay to minimize leachate migration. Groundwater quality monitoring has shown no impacts related to the vault.

III. Evaluation of Contamination and Exposure

Page 10, description of site contaminants. This section should be revised to state that extensive sampling performed in 2001 confirms that metals are not contaminants of potential concern in soils at the former St. Regis site. During the 2001 investigation EPA collected and performed metals analysis on samples from the following 54 sample locations:

- 20 samples from the North Storage Area
- Four samples from the areas of former ponds A, B, and C
- Two samples from the former spray irrigation area and landfill
- One sample from a reported seep area south of the former ponds and landfill
- Six samples from the Southwest Area and Fish Hatchery
- One sample from the former City Dump Pit
- 20 samples from nearby residential properties.

Metals concentrations in ALL of these samples were below human health screening levels, with the exception slight exceedances of residential Soil Reference Values (SRVs) for iron in three samples, and for antimony and lead in one residential sample. As described in the Health Consultation, it is probable that the elevated iron concentrations are attributable to naturally occurring conditions in Minnesota iron range soils. Lead and antimony are likely attributable to a domestic source rather than operations at the wood treating facility.

Based on these results, the ATSDR/MDH should delete the phrase “known site contaminants copper, chromium, and arsenic” from the first bullet on page 10.

A. Soil Sample Collection Procedures, pages 10-11. Based on observations conducted by International Paper and later confirmed with EPA’s field contractor, the actual sample collection depth intervals ranged from 0- to 2-inches to 0- to 5-inches during the 2001 investigation. ATSDR/MDH should revise this paragraph to reflect actual sample collection practices. Additionally, potential “hot spots” are not relevant for evaluating risks associated with chronic exposure to dioxins/furans in soil. The last three sentences of this paragraph should be deleted.

B. Composite Samples, page 11. This paragraph should be revised to emphasize the relevance and appropriateness of composite samples for assessing potential risks to human health. The concern raised by ATSDR/MDH about the inability to determine if one or more of the sub-samples used to make a composite sample contributes the majority of the dioxins/furans is not relevant to assessing chronic exposures that are based on daily average intakes. Risk-based screening values, which are based on chronic exposures, should only be compared to an average concentration for an area in which a receptor is likely to be exposed (USEPA 2002). Consequently, an average or composite concentration for a residential yard is appropriate for comparison with chronic risk-based levels. For non-residential areas, exposure units may be much larger than a residential yard. In addition, it is unlikely that any one exposure point will be significantly higher than another in a residential yard given the site history and chemical migration mechanisms.

C. Soil Sampling Results

Tables 1, 2, 3, and 4
These tables do not include all available data and should be revised or deleted.

1) Reference Samples, page 11. Metal concentrations in this section are stated to be ppb levels. There appears to be an error in the concentration units presented in this section because metals are more typically found at ppm levels.

8) Limitations of Sampling, page 15
ATSDR/MDH should delete or substantially revise this section. Recent sampling performed in 2003 addressed known data gaps for surface soils. If any additional critical data gaps are identified in the risk assessment planning process, they will be addressed in future sampling efforts. As discussed above, the statement regarding sample compositing and hotspot identification is inappropriate and misleading in the context of evaluating human health risks and should be deleted.

D. Properties of the Contaminants of Concern
1) Pentachlorophenol, page 17, last paragraph. ATSDR/MDH state that burning of PCP in the Tee-Pee burners included the correct ingredients and temperatures to create dioxins during combustion. A reference should be provided to support this statement or it should be deleted.

1) Pentachlorophenol, page 17, last paragraph, last sentence. This sentence should be revised to reflect the findings from the wind deposition area sampling performed in 2003 and summarized above.

E. Exposure Routes
1) Ingestion, page 20, first paragraph, last sentence. Using the phrase "(pica) may sometimes occur in children" in place of "(pica) is found in children" would better reflect the definition of pica behavior. See comment regarding pica behavior below [(*b) Soil ingestion rate, page 21, second paragraph, first sentence]*.

a) Contaminant concentrations in accessible soil, page 21, second paragraph, first sentence. ATSDR/MDH state that the top 3 inches could have much higher dioxin concentrations compared to concentrations in the top 6 inches that were sampled. Based on data from other sites, this statement is unlikely to be true except in areas that have recently been impacted by fallout from large air point sources such as smelter stacks. Furthermore, as described previously, actual sample compositing depths in the 2001 investigation ranged from 0- to 2-inches to 0- to 5-inches below ground surface. The uppermost surface soil samples in the 2003 investigation were collected from the 0- to 4-inch depth interval.

b) Soil ingestion rate, page 21, first paragraph, third sentence. ATSDR/MDH state that "[T]he amount of contaminant absorbed is assumed to be 100%...." This statement is not correct. Instead, in assessing oral exposures to chemicals in soil, the magnitude of absorption of the chemical from soil is typically assumed to be the same as the magnitude of absorption in the studies used to derive the toxicity value.

b) Soil ingestion rate, page 21, first paragraph, fifth sentence. The citation used at the end of this sentence (Garlock et al 1999) should be added to the reference list at the end of the consultation. We would appreciate having a copy of this reference provided to us so that we can properly review it and the statement it supports.

b) Soil ingestion rate, page 21, first paragraph, last sentence. The default soil ingestion rates for children and adults (200 mg/day and 100 mg/day, respectively) listed by ATSDR/MDH do not reflect recent scientific analysis of soil ingestion data. In addition, the references cited for the rates do not appear to be relevant to the subject matter. These inaccuracies prevent comprehensive review of this draft document.

As noted in USEPA's *Exposure Factors Handbook* (1997), distributions derived from short-term population surveys will overestimate upper percentile values for long-term daily average values for the population. For soil ingestion, surveys based on 3- to 7-day observations in children have typically been used to derive mean and 95th percentile daily soil ingestion estimates, but the 95th percentiles represent the short-term distribution, rather than the distribution of long-term average daily soil ingestion across a population of children. This issue was recently addressed by Stanek and Calabrese (2000) and Stanek, *et al*. (2001), who showed that 95th percentile estimates drop substantially when the distribution represents a longer time period (Table 1). Stanek and Calabrese (2000) estimate one-year average 95th percentiles of 106 and 124 mg/day for the Anaconda and Amherst datasets, respectively, (with means of 31 and 57, respectively) for 1-4 year old children. Based on this analysis, a better estimate of an upper bound soil and dust ingestion rate for young children in northern Minnesota would be 106-124 mg/day.

TABLE 1
ESTIMATES OF TRUE AVERAGE 95TH PERCENTILE SOIL INGESTION FOR CHILDREN OVER VARIOUS AVERAGING TIMES
95th Percentile Soil Ingestion Per Day (mg)

Time Period (days)	Anaconda[a]	Amherst[b]
1	141	210
7	133	177
30	112	135
90	108	127
365	106	124

Data from Stanek and Calabrese (2000).
[a]Study of 64 children aged 1-4 years residing in Anaconda, MT, mean soil ingestion = 31 mg/day.
[b]Study of 64 children aged 1-4 years residing in Amherst, MA, mean soil ingestion = 57 mg/day.

Adults exhibit markedly less hand-to-mouth activity than children, and because this is thought to be the primary means of ingesting soil, adults are also assumed to ingest less soil than children. The USEPA default value of 100 mg/day for soil ingestion by adults therefore likely overestimates RME adult exposures. Stanek et al. (1997) recently estimated an average soil ingestion rate of 10 mg/day for adult soil ingestion. USEPA (1997) recommends 50 mg/day as a "reasonable central estimate of adult soil ingestion"; however, this estimate was based on an earlier study by Calabrese et al. (1990) that did not include the more recent Stanek et al (1997) analysis. Certainly an upper-bound soil ingestion value for adults should be no more than half the value for young children, or 62 mg/day.

b) Soil ingestion rate, page 21, second paragraph, first sentence. The term geophagic appears to be inappropriately used in this sentence. Geophagy is defined as the intentional ingestion of subsurface clays or earths associated with cultural practices (ATSDR 2001), rather than consumption of soils from residential properties. The term "pica" is more relevant when discussing soil ingestion.

According to ATSDR (2001), pica behavior is characterized by sporadic ingestion of 1 to 5 grams of soil per day, which is in contrast to ATSDR/MDH's assertion that 1-2 percent of children ingest 5 to 10 grams per day. Panelists at the ATSDR 2000 Soil-Pica Workshop agreed that 5 grams per day appears to be supported by only a few subjects in soil ingestion studies (ATSDR 2001) and is likely to be a high estimate. Based on the distribution of soil ingestion rates published in the scientific literature, some workshop panelists agreed that this ingestion rate for soil-pica children is high, and that there is no evidence that this behavior occurs on a chronic basis.

c) Oral Bioavailability, page 22. The text describes the highly variable bioavailability of TCDD in soil, as well as the decreasing bioavailability with increasing chlorination of dioxin congeners. Definitive conclusions regarding the magnitude of risks associated with exposure to dioxins in Site soil would require site-specific bioavailability data. Risk estimates could be reduced as much as 10- to 100-fold depending on the outcome of such studies.

2) Dermal Exposure, c) Soil Adherence to Skin Surfaces, page 23. USEPA recently issued guidance for dermal risk assessment (USEPA 2001) that contains much more recent data than the 1992 document cited by ATSDR/MDH. This guidance provides the most recent USEPA default values for use in assessing risks from dermal exposures, and it incorporates recent research on soil-to-skin adherence factors. USEPA (2001) lists default soil-to-skin adherence factors of 0.2 and 0.07 mg/cm^2 as upper-end default residential exposure values for children and adults, respectively. USEPA (2001) identified an adherence factor for industrial workers as 0.2 mg/cm^2. These factors are substantially less than the adherence values of 0.5 to 1.5 mg/ cm^2 cited by ATSDR/MDH based on the outdated USEPA document.

VII. Risk Assessment and Dioxin, page 26, second and third paragraphs. Because of recent events in the reassessment of dioxin risks, using the cancer slope factor range developed by USEPA to evaluate incremental cancer risks is burdened with a high level of scientific uncertainty. Specifically, USEPA's draft dioxin risk study is undergoing an extensive technical re-examination, the extent of which the consultation report does not adequately acknowledge. The White House is asking the National Academy of Sciences (NAS) to address questions regarding USEPA's cancer risk estimates, modeling assumptions, the uncertainties and variability that surround those estimates, whether human studies support USEPA'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 2003, Crump et al. 2003, Starr 2001, and Mackie et al. 2002).

For example, the results of several studies (Aylward et al. 2003a & b, Geusau et al. 2002, Michalek 2002) demonstrate that elimination of dioxin from the body occurs at a higher rate than previously assumed by USEPA, which suggests that the cancer potency of dioxin determined in USEPA's dioxin study is overestimated. The analysis by Aylward et al. (2003a) also suggests that the margin of exposure between highly exposed industrial cohorts and current general population background exposures is probably greater than previously estimated. In addition, meta analyses of cancer mortality and dioxin exposure (Crump et al. 2003, Starr 2001, and Mackie et al. 2002) yield conflicting results, with one study showing no additional background cancer deaths due to dioxin exposures, another showing a statistically significant relationship between dioxin background exposure levels and cancer, and yet another suggesting a lack of evidence for a dioxin cancer threshold.

MDH cites a 2003 MDH document as the source of their justification for using the high end slope factor from the draft reassessment. We assume that this corresponds to item 4 in the reference list, which, although incomplete, appears to refer to a March 17, 2003 memorandum that appears on the MDH website (http://www.health.state.mn.us/divs/eh/risk/chemicals/dioxinnm.html). Notably, many of the new studies that we cite above were published subsequent to the release of the MDH memorandum. Starr (2003) recommends that several issues related to studying dioxin exposures need to be further scrutinized to resolve the disparate conclusions among researchers. These aspects include 1) consideration of causes of elevated cancer mortality other than dioxin exposure, 2) different choices for dose metric, 3) assumptions regarding dioxin's elimination half-life in humans, and 4) assumptions regarding the impact on cancer mortality of the most recent 15 years of exposure.

Based on these new studies, as well as USEPA's own caveats warning against premature reliance on the draft dose response reassessment, it is scientifically inappropriate to use the high end estimate of dioxin potency from the reanalysis as the basis for issuing public health warnings. At a minimum, risk communications with the public should clarify the great uncertainty associated with such risks and also present risk estimates based on the currently approved potency factor. Using the MCPA SRV of 200 ppt which is based on the current potency factor, only 3 residential properties exceed the SRV. Depending of site-specific bioavailability of dioxin and other exposure considerations, it is possible that none of these yards has dioxin concentrations sufficient to pose a health risk.

The MDH has not provided an adequate technical basis for recommending that their 50 ppt dioxin health-based screening value be used as a cleanup goal at this site. This recommendation is particularly indefensible in the absence of a more thorough site-specific risk evaluation. Screening levels represent, and should be portrayed to the public, as contaminant concentrations in environmental media that are considered to be protective of human health (including sensitive groups) over a lifetime of exposure. They should be used as a point of departure for more detailed evaluation to determine if a chemical poses a risk at a particular site. We need to review all of MDH's detailed scientific support for advancing this recommended cleanup goal.

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USEPA. 2002. Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels. EPA 9355.0-91. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

The following are responses to International Paper Company's comments to the St. Regis Paper Superfund Health Consultation (Public Draft).

International Paper Comment

- The draft consultation does not consider all available site data, the omission of which renders many of its conclusions and recommendations both inaccurate and inappropriate with respect to current site conditions and potential health concerns

MDH Response

MDH has conducted a preliminarily review of the recently completed 2003 Removal Site Evaluation and Supplemental Assessment data. Results do not warrant any changes in MDH's recommendations. A more detailed review of the 2003 Removal Site Evaluation and Supplemental Assessment data will be possible when the data are available electronically. It would be helpful if the data submitted include the laboratory PCDD/PCDF Toxicity Equivalence (TEQ) Summary table (Form 3) for each soil sample. The TEQ calculations listed in Form 3 will facilitate a more thorough review of International Paper's validated data. Please provide MDH with electronic versions of the laboratory PCDD/PCDF Toxicity Equivalence (TEQ) Summary table (Form 3) and International Paper's validated data TEQ calculations for all the soil data it has collected (see MDH Data Request Attachments for examples).

International Paper Comment

- The draft consultation relies on outdated science and superceded U.S. EPA guidance regarding chemical toxicity and exposure assumptions for soil

MDH Response

The Health Consultation relies on Minnesota Pollution Control Agency Draft Guidance: Risk-based Guidance for the Soil – Human Health Pathway, Technical Support Documents (I & II) for ATSDR's Interim Policy Guideline for Dioxin and Dioxin-like Compounds in Soil, and EPA's Exposure and Human Health Reassessment of TCDD and Related Compounds (SAB Review Draft). All of the support documents are based upon relevant peer reviewed scientific literature.

International Paper Comment

- The draft consultation wrongly identifies metals as "known site contaminants," despite the fact that extensive sampling performed in 2001 confirmed that metals are not contaminants of concern in site soils

MDH Response

Based on MDH's review of soil data presented in EPA's *Final Data Evaluation Report for the St. Regis Paper Company Superfund Site*, MDH acknowledges that metals were not commonly found on-site. However, this does not mean that past site operations did not include water soluble metal salts. Furthermore, all the areas that may have been impacted by past site operation have not been fully characterized for site related contamination.

International Paper Comment

- Based on observations conducted by International Paper and later confirmed with EPA's field contractor, the actual sample collection depth intervals ranged from 0- to 2-inches to 0- to 5-inches during the 2001 investigation. ATSDR/MDH should revise this paragraph to reflect actual sample collection practices. Additionally, potential "hot spots" are not relevant for evaluating risks associated with chronic exposure to dioxins/furans in soil. The last three sentences of this paragraph should be deleted.

MDH Response

Please see Tetra Tec's (EPA contractor) letter that states, "Although the precise sample depths were not recorded (during the 2001 investigation), all the samples were collected within the 0- to 1-foot interval, and approximately 95 % of the surface soil samples were collected from 0-6 inches below ground surface."

Although composite samples are an important means of estimating average exposure within an area, there are other considerations that influence the quality of the data such as soil profile alterations, low sample density (low number of subsamples per unit area), sample intervals, and activity patterns of potential receptors. The interpretation of soil data results is confounded when site soils have been altered by human activities. Furthermore, composite sampling does not provide complete information on the range and distribution of concentrations within the area sampled. Some of these areas may be relatively large: several residential lots. Furthermore, MDH has requested that every residential property south of the tracts be sampled for dioxin.

International Paper Comment

- ATSDR/MDH state that burning of PCP in the Tee-Pee burners included the correct ingredients and temperatures to create dioxins during combustion. A reference should be provided to support this statement or it should be deleted.

MDH Response

Currently, burn barrels are one of the major sources of dioxins. MDH believes that uncontrolled burning in the Tee-Pee burners is also a potential source for dioxins.

International Paper Comment

- ATSDR/MDH state that the top 3 inches could have much higher dioxin concentrations compared to concentrations in the top 6 inches that were sampled. Based on data from other sites, this statement is unlikely to be true except in areas that have recently been impacted by fallout from large air point sources such as smelter stacks.

MDH Response

It is inappropriate to assume too much about soil dioxin concentrations at the St Regis site when the site has been altered by one remedial action and many years of unrestricted human activity. MDH is drawing attention to the fact that it is not clear where and how site related contamination has been moved and deposited.

International Paper Comment

- ATSDR/MDH state that "[T]he amount of contaminant absorbed is assumed to be 100%...." This statement is not correct. Instead, in assessing oral exposures to chemicals in soil, the magnitude of absorption of the chemical from soil is typically assumed to be the same as the magnitude of absorption in the studies used to derive the toxicity value.

MDH Response

The St. Regis Health Consultation states, "The amount of contaminant absorbed is assumed to be 100% or is based on animal absorption studies."

International Paper Comment

- IP has many comments regarding uncertainty of the human cancer slope factor reported in the EPA Dioxin Reassessment.

MDH Response

MDH utilizes the animal model dioxin cancer slope factor in its criteria calculations. For more detailed information see www.health.state.mn.us/divs/eh/risk/chemicals/index.html

International Paper Comment

- "Based on this analysis, a better estimate of an upper bound soil and dust ingestion rate for young children in northern Minnesota would be 106-124 mg/day."…."Certainly an upper-bound soil ingestion value for adults should be no more than half the value for young children, or 62 mg/day."

MDH Response

MDH utilizes the Minnesota Pollution Control Agency's ingestion values of 100 and 50 mg/day in its derivation of the Dioxin Soil Reference Values for children and adults respectively.

International Paper Comment

- USEPA (2001) lists default soil-to-skin adherence factors of 0.2 and 0.07 mg/cm2 as upper-end default residential exposure values for children and adults, respectively. USEPA (2001) identified an adherence factor for industrial workers as 0.2 mg/cm2. These factors are substantially less than the adherence values of 0.5 to 1.5 mg/ cm2 cited by ATSDR/MDH based on the outdated USEPA document.

MDH Response

MDH utilizes the Minnesota Pollution Control Agency's soil adherence values of 0.2 and 0.13 mg/cm^2 in its derivation of the Dioxin Soil Reference Value for individuals less than 18 years of age and adults respectively.

International Paper Comment

- The draft consultation inappropriately recommends applying a 50 part 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

MDH Response

MDH has followed conservative health protective state policy in recommending 50ppt (TEQ) as remedial goal for dioxin contaminated sites. MDH has also recommended 50ppt as a remedial goal at the Joslyn Manufacturing and Supply Company Site (CERCLIS No. MND044799856).

International Paper Comment

- The draft consultation does not appear to fully take into account the effects of prior response actions, nor can it fully account for planned actions that have not yet occurred, particularly the planned soil removal action on City-owned portions of the North Storage Area of the site, which will address most of the highest dioxin/furan concentrations identified during the 2001 and 2003 sampling.

MDH Response

The St. Regis Health Consultation documents current site conditions and cannot “fully account for planned actions that have not occurred yet” without making unwarranted predictions or assumptions. Based on past site history, it is not prudent to assume too much about “planned actions”. MDH will draft subsequent Health Consultations based on its review of site information and data as they become available. Since the site investigation is ongoing, managing site risks and remedial activities are in a constant state of flux, and it is impractical to include all this evolving information into one report. For more information on prior response actions see MDH’s Site Review and Updates for the St. Regis Paper Company dated July 22, 1993, and April 26, 1995.

Please provide MDH with a copy of the following document:

USEPA. 2002. Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels. EPA 9355.0-91. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

MDH was not able to secure a copy of the document because EPA is internally reviewing it.

United States Environmental Protection Agency
Region 5

December 19, 2003

Daniel Peña
Minnesota Department of Health
121 East Seventh Place, Suite 220
St. Paul, Minnesota 55164

Re: Comments on Draft St. Regis Paper Company Health Consultation

Dear Mr. Peña:
Thank you for the opportunity to comment on the draft St. Regis Paper Company Health Consultation. Attached are the comments of U.S. EPA Region 5 to the draft St. Regis Paper Company Health Consultation. If you have any questions on these comments, please feel free to contact Tim Drexler at (312) 353-4367.

II. Background A. Site Description and History

4) Environmental Investigation
Para. 2. The MPCA 5-year review refers only to the performance of an ecological risk assessment and does not state "potential human...receptors." as stated in the Consultation.

5) RCRA Vault
This section is vague. Currently there is an existing operation and maintenance (O&M) schedule for the vault. Please explain whether the "concern" is with the current O&M requirements or with the design specifications of the vault and then explain those concerns.

B. Current Conditions
Please update fencing statement to reflect fences constructed during Summer 2003.

C. Site Visits
Please revise statement on the likelihood of off-site migration of dust based on the results of the August 2003 sampling event which showed offsite migration is limited.

D. Demographics...
Again, please elaborate concerns regarding RCRA vault as being with the O&M currently in place or with specific design flaws.

F. Community Concern
Please clarify that residents are concerned about the possibility off-site migration of contaminated soil into surface waters and residential areas. At this time, there is little evidence proving this migration. In addition, MDH appears to conclude that there is a proven elevated incidence of cancers in families that live next to the site.

III. Evaluation of Contamination and Exposure

This section needs to be updated to include the August 2003 sampling since this document post-dates the completion of that sampling. If not, the statements regarding the inadequacy of soils sampling are misleading. In particular, the 2003 sampling was at a depth of 0-4" to better characterize the risk to human health.

Para. 2. "Site contaminants include metals..." No sampling, to date, indicates metals contamination in the On-Site Wastewater Disposal Area. Metals contamination may be a concern in the City Dump area.

B. Composite Samples

Composite sampling is not only or best used to determine the presence or absence of contamination, as the first sentence states. This should be clarified. In addition, composite sampling, <u>does</u> determine extent, as defined by detect/nondetect, in a sampled area as long as the composite sample size does not exceed the criterion value (in this case even if defined as 50 ppt.) divided by the detection limit. Composite sampling is not only consistent with EPA guidelines for determining the average exposure risk for human health evaluations, it is also consistent with ATSDR guidelines. It should be stated that composite sampling to determine exposure is used and recommended by State and Federal health agencies. In addition, residential composites were for single residences. Wind dispersion sampling included multiple residences.

C. Soil Sampling Results

8) Limitations of Sampling
This section needs to be updated based upon the August 2003 sampling.

IIX. Conclusions

Bullet three: This statement is misleading and may unnecessarily raise fear in the community regarding soil exposure. As stated earlier, composite sampling is a widely used tool for State and Federal health agencies to determine an average risk to human health in an area. This should be stated or MDH must distinguish between ATSDR and MDH interpretation on this issue.
Bullet four: Please cite the documentation on the uniformity of dioxin concentration on site. Most information does not appear to support an overall uniformity.

Bullet five: Wind deposition may be a factor. There is no evidence to suggest that it is significant.

Bullet seven: Sampling to-date suggests that offsite migration is limited.

IX. Recommendations...

Bullet three: Sampling to-date shows limited off-site migration of contaminants from the site to residential yards to either the north or the south side of the tracks. The south residents should not, as a general statement, be singled out.

Bullet five: Please update to reflect August 2003 sampling.
Thank you again for the opportunity to comment.

Sincerely,

Tim Drexler

Tim Drexler
Remedial Project Manager,
St. Regis Site

The following are MDH's responses to EPA's comments to the St. Regis Paper Superfund Health Consultation (Public Draft).

EPA Comment
4) Environmental Investigation
Para. 2. The MPCA 5-year review refers only to the performance of an ecological risk assessment and does not state "potential human...receptors." as stated in the Consultation.

MDH Response
The 1995 five-year review stated "DRM (Division of Resource Management) potable water supply was at risk" and warranted "quarterly monitoring for Site-related compounds." The document also stated that " concentrations of contaminants on the surface soils left on the Site are unknown" and "Until these levels are ascertained and evaluated, the RA for the soils can not be determined protective of human health and the environment."

EPA Comment
5) RCRA Vault
This section is vague. Currently there is an existing operation and maintenance (O&M) schedule for the vault. Please explain whether the "concern" is with the current O&M requirements or with the design specifications of the vault and then explain those concerns.

MDH Response
MDH has modified the paragraph with the following statement. The vault is designed with a double liner, a leachate collection system, leak detection system, and a covering liner. The operation and maintenance of the vault is a concern because wells near the vault provide water to a fish hatchery and a drinking water well. Individuals have expressed concern that vault leachate could escape containment and impact groundwater. Furthermore some of these wells have had low detections of PAHs in the past.

EPA Comment
B. Current Conditions
Please update fencing statement to reflect fences constructed during Summer 2003.

MDH Response
MDH has changed the document to reflect that some of the areas have been fenced. However, the fencing is not complete.

EPA Comment
C. Site Visits
Please revise statement on the likelihood of off-site migration of dust based on the results of the August 2003 sampling event, which showed offsite migration, is limited.

MDH Response
MDH does not have all the necessary information to conduct a detailed review of the August 2003 sampling event. A more detailed review of the 2003 Removal Site Evaluation and Supplemental Assessment data will be possible when the data are available electronically. It would be helpful if the data submitted include the laboratory PCDD/PCDF Toxicity Equivalence (TEQ) Summary table (Form 3) for each soil sample. The TEQ calculations listed in Form 3 will facilitate a more thorough

review of International Paper's validated data. Please provide MDH with electronic versions of the laboratory PCDD/PCDF Toxicity Equivalence (TEQ) Summary table (Form 3) and International Paper's validated data TEQ calculations for all the soil data it has collected (see MDH Data Request Attachments for examples).

The August 2003 sampling does show offsite impacts to surficial soils boarding the Site. A more detailed review and interpretation of the data is forthcoming.

EPA Comment
F. Community Concern
Please clarify that residents are concerned about the possibility off-site migration of contaminated soil into surface waters and residential areas. At this time, there is little evidence proving this migration. In addition, MDH appears to conclude that there is a proven elevated incidence of cancers in families that live next to the site.

MDH Response
Surface soil dioxin concentrations north of the tracts are above background and suggest that Site related contamination has migrated off-site. MDH does not "conclude nor suggest that there is a proven elevated incidence of cancers in families that live next to the site." MDH does report that "Community members have expressed concern about **a perceived increase cancer incidence,** and other health effects in families that live next to the site."

III. Evaluation of Contamination and Exposure

EPA Comment
This section needs to be updated to include the August 2003 sampling since this document postdates the completion of that sampling. If not, the statements regarding the inadequacy of soils sampling are misleading. In particular, the 2003 sampling was at a depth of 0-4" to better characterize the risk to human health.

MDH Response
MDH will review the August 2003 sampling when it receives the electronic sample data. MDH will draft another Soil Health Consultation after its review of the new data.

EPA Comment
Para. 2. "Site contaminants include metals..." No sampling, to date, indicates metals contamination in the On-Site Wastewater Disposal Area. Metals contamination may be a concern in the City Dump area.

MDH Response
MDH changed the sentence to "Potential Site contaminants include…"

EPA Comment
B. Composite Samples
Composite sampling is not only or best used to determine the presence or absence of contamination, as the first sentence states. This should be clarified. In addition, composite sampling, does determine extent, as defined by detect/nondetect, in a sampled area as long as the composite sample size does not exceed the criterion value (in this case even if defined as 50 ppt.) divided by the detection limit. Composite sampling is not only consistent with EPA guidelines for determining the average exposure

risk for human health evaluations, it is also consistent with ATSDR guidelines. It should be stated that composite sampling to determine exposure is used and recommended by State and Federal health agencies. In addition, residential composites were for single residences. Wind dispersion sampling included multiple residences.

<u>MDH Response</u>
According to the MN Pollution Control Risk Based Guidance for the Soil (draft):
Composite samples may provide an efficient way of estimating the average concentration of the subsamples. However, important information about the subsample concentration is lost. The range of the concentrations cannot be determined form a composite sample because the highest concentrations are not detected, hot spots may not show up in the data. Therefore, compositing may be an efficient way to obtain an average, it generally does not provide complete information on the range and distribution of concentrations within the area sampled.

Furthermore, the utility and interpretation of composite sample data can be confounded by low sample density (low number of subsamples per unit area), and alterations to the soil profile. MDH has recommended that all the houses south of the tracts be sampled for dioxin.

IIX. Conclusions

<u>EPA Comment</u>
Bullet three: This statement is misleading and may unnecessarily raise fear in the community regarding soil exposure. As stated earlier, composite sampling is a widely used tool for State and Federal health agencies to determine an average risk to human health in an area. This should be stated or MDH must distinguish between ATSDR and MDH interpretation on this issue.

<u>MDH Response</u>
See MDH comments regarding composite samples.

<u>EPA Comment</u>
Bullet four: Please cite the documentation on the uniformity of dioxin concentration on site. Most information does not appear to support an overall uniformity.

<u>MDH Response</u>
Bullet four was modified.

<u>EPA Comments</u>
Bullet five: Wind deposition may be a factor. There is no evidence to suggest that it is significant.
Bullet seven: Sampling to-date suggests that offsite migration is limited.

<u>MDH Response</u>
The offsite migration impacts have not been completely characterized.

IX. Recommendations...

EPA Comments

Bullet three: Sampling to-date shows limited off-site migration of contaminants from the site to residential yards to either the north or the south side of the tracks. The south residents should not, as a general statement, be singled out.

Bullet three: Sampling to-date shows limited off-site migration of contaminants from the site to residential yards to either the north or the south side of the tracks. The south residents should not, as a general statement, be singled out.

Bullet five: Please update to reflect August 2003 sampling.

MDH Response

Based on the data that MDH has reviewed, not all the residential yards bound by Highway 371 on the west, the rail road tracts on the north, Pike bay on the east and the Chippewa National Forest on the south have not been sampled. MDH will review the August 2003 sample results when the data is available electronically and complete. MDH will present its findings in a Health Consultation.

Reference

Minnesota Pollution Control Agency Site Remediation Section: Draft Guidance For The Soil-Human Health Pathway, Volume 2. Technical Support Document. Working Draft January 1999.

MDH Data Request Attachment:

Table 1
Validated Dioxin/Furan Concentration in Surface Soil
St. Regis Paper Company Site
Docket No: V-W-'03-C-748
(concentrations in µg/kg (ppb))

Location	F27-29 0-4	F27-29 4-12	* * * H25-26 0-4	I26-27 0-4	I27-29 0-4	J29-30 0-4
Date	8/6/2003	8/6/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003
Lab	CAS	CAS	CAS	CAS	CAS	CAS
Dup						
2,3,7,8-TCDD	0.003	0.002	0.00055 j	<0.00034	0.00079 j	0.0017 EMPC
1,2,3,7,8-PeCDD	0.068	0.032	0.008	0.004	0.021	0.046
1,2,3,4,7,8-HxCDD	0.260	0.123	0.024	0.010	0.054	0.166
1,2,3,6,7,8-HxCDD	0.963	0.274 j	0.108	0.064	0.320	3.072
1,2,3,7,8,9-HxCDD	0.295 j	0.242	0.049	0.022	0.112	0.389
1,2,3,4,6,7,8-HpCDD	30.852	11.364	2.344	2.496	11.694	186.701
OCDD	248.540 e	133.473 e	22.122 e	24.152	124.075	2182.551 e
2,3,7,8-TCDF	0.026	0.006	0.001	<0.00098	0.004	0.014
1,2,3,7,8-PeCDF	0.111	0.064	0.008	0.007	0.030	0.123
2,3,4,7,8-PeCDF	0.113	0.065	0.010	0.009	0.035	0.140
1,2,3,4,7,8-HXCDF	0.723	0.460	0.144	0.061	0.308	2.625
1,2,3,6,7,8-HxCDF	0.233	0.128	0.032	0.016	0.076	0.262
1,2,3,7,8,9-HxCDF	0.041	<0.035	0.032	0.021	0.084 EMPC	0.063
2,3,4,6,7,8-HxCDF	0.366	0.229	0.056	0.026	0.129	0.887
1,2,3,4,6,7,8-HpCDF	7.167	2.489	0.530	0.450	2.713	28.274
1,2,3,4,7,8,9-HpCDF	0.639	0.447	0.080	0.045	0.207	2.125
OCDF	29.433	14.042	1.686	1.682	12.664	132.899
TCDD, Total	0.016	0.004	0.002	<0.00034	0.003	0.010
PeCDD, Total	0.279	0.111	0.039	0.014	0.082	0.183
HxCDD, Total	7.753	2.747	0.548	0.257	1.388	5.045
HpCDD, Total	75.414	46.496	6.977	4.105	23.525	82.565
TCDF, Total	0.143	0.052	0.010	0.004	0.047	0.116
PeCDF, Total	2.648	1.686	0.229	0.154	0.759	2.490
HxCDF, Total	7.251	4.152	1.909	0.926	5.721	8.468
HpCDF, Total	34.820	30.590	3.558	2.094	13.912	53.718
TEQ_{DF} - WHO_{98} (ND = 1/2 DL) (1)	0.840	0.370	0.120	0.060	0.310	3.300

Please provide electronically

MDH Data Request Attachment:

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
H25-26 0-4

Lab Name: Columbia Analytical Services Episode No.:
Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E2300499-001A

Client Name: BARR ENGINEERING Sample Wt/Vol: 13.255 g or mL: g

Matrix (Aqueous/Solid/Ash): Solid Initial Calibration Date: 08/05/03

Sample Receipt Date: 08/08/03 Instrument ID: 70S

Ext. Date: 08/13/03 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: B15550#9

Analysis Date: 18-AUG-03 Time: 17:39:40 Blank Data Filename: B15550#2

Dilution Factor: 1 Cal. Ver. Data Filename: B15549#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 10.13

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	0.554	0.130	J	0.85	1.000	0.97
1,2,3,7,8-PeCDD	7.988	0.133		1.58	1.000	0.93
1,2,3,4,7,8-HxCDD	24.097	0.155		1.16	0.998	1.00
1,2,3,6,7,8-HxCDD	107.760	0.133		1.24	1.000	1.16
1,2,3,7,8,9-HxCDD	49.055	0.148		1.21	1.009	1.04
1,2,3,4,6,7,8-HpCDD	3557.550	5.598	E	1.05	1.079	0.93
OCDD	35056.413	0.518	E	0.87	1.172	1.00
2,3,7,8-TCDF	1.657	0.114	C	0.75	1.000	0.91
1,2,3,7,8-PeCDF	8.212	1.039		1.62	1.001	0.89
2,3,4,7,8-PeCDF	9.694	1.065		1.60	1.025	0.87
1,2,3,4,7,8-HxCDF	143.957	5.641		1.26	1.000	1.14
1,2,3,6,7,8-HxCDF	32.185	5.244		1.31	1.004	1.22
1,2,3,7,8,9-HxCDF	31.771	7.590		1.26	1.041	0.85
2,3,4,6,7,8-HxCDF	56.259	6.416		1.28	1.017	1.00
1,2,3,4,6,7,8-HpCDF	849.206	3.605	E	1.04	1.000	1.40
1,2,3,4,7,8,9-HpCDF	79.605	5.396		1.04	1.039	0.93
OCDF	3335.163	0.617	E	0.89	1.004	1.14
Total Tetra-Dioxins	1.735	0.130				
Total Penta-Dioxins	38.663	0.133				
Total Hexa-Dioxins	548.324	0.133				
Total Hepta-Dioxins	6976.685	5.598				
Total Tetra-Furans	9.510	0.114				
Total Penta-Furans	229.318	1.065				
Total Hexa-Furans	1909.050	5.244				
Total Hepta-Furans	3557.684	3.605				

(1) Qualifiers: See flag definitions.

Please Provide Electronically

MDH Data Request Attachment:

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE (TEQ) SUMMARY

Client ID: **H25-26 0-4**

Lab Name: Columbia Analytical Services

Lab Code: CAS 8290

Client Name: Barr Engineering

Lab Sample ID: E2300499-001A

Sample Wt/Vol: 13.255 g

Matrix (Solid/Aqueous/Waste/Ash/Tissue): Solid

Sample Receipt Date: 8/8/03

Ext. Date: 8/13/03

Ext. Vol (ul 20.0 Inj. Vol (uL 1.0

Analysis Date: 8/18/03

Analysis Time: 17:39:40

Initial Calibration Date: 8/5/03

Instrument ID: 70S

GC Column ID: db5

Sample Filename: B15550#9

Blank Data Filename: B15550#2

Dilution Factor: 1

Calibration Verification Filename: B15549#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg

Solids/Lipids, %: 10.13

PARAMETER	Detection Limit (DL)	DL/2	CONCENTRATION	TEF (1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD			0.55	1.0	0.55
1,2,3,7,8-PeCDD			7.99	1.0	7.988
1,2,3,4,7,8-HxCDD			24.10	0.1	2.41
1,2,3,6,7,8-HxCDD			107.76	0.1	10.78
1,2,3,7,8,9-HxCDD			49.06	0.1	4.91
1,2,3,4,6,7,8-HpCDD			3557.55	0.01	35.58
OCDD			35056.41	0.0001	3.51
2,3,7,8-TCDF			1.36	0.1	0.14
1,2,3,7,8-PeCDF			8.21	0.05	0.41
2,3,4,7,8-PeCDF			9.69	0.5	4.85
1,2,3,4,7,8-HxCDF			143.96	0.1	14.40
1,2,3,6,7,8-HxCDF			32.19	0.1	3.22
1,2,3,7,8,9-HxCDF			31.77	0.1	3.18
2,3,4,6,7,8-HxCDF			56.26	0.1	5.63
1,2,3,4,6,7,8-HpCDF			849.21	0.01	8.49
1,2,3,4,7,8,9-HpCDF			79.61	0.01	0.80
OCDF			3335.16	0.0001	0.33
				Total TEQ:	**107.15**

↑ Please provide electronically

St Regis Health Consultation Comment Form Received on October 30, 2003. The following is the typed version of a hand written note.

I have lived and worked over here for 10 years now. St. Regis has now got all of their property fenced off so I'm thinking they know this land over here is contaminated. They don't want people on it because of this yet we are supposed to continue to live and work over here until this is all figured out. Would they choose to do this with their family's health at risk? We have no choice! I think this needs to be dealt with as quickly and accurately as possible.

They requested we call them on the response form.

St Regis Health Consultation Comment Form Received on January 4, 2004. The following is the typed version of a hand written note.

It's a scary thought to know I might have raised my five children in a hazardous environment. We lived right in the contaminated area. I think it was 1961, 1962, and 1963. We have had some health problems. My children: one has sinus and bronchial problems, two had precancerous cells removed. Some have high blood pressure. I am diabetic, high BP, and high cholesterol. I don't know how much of all this could be related to St. Regis, but it would be interesting to find out. We also lived on First St (just north of the railroad tracts near incinerators). The smoke from them come right at our house.

They requested we call them on the response form.

CERTIFICATION

This St. Regis Paper Company 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.

Technical Project Officer, Cooperative Agreement Team, SPAB, DHAC, ATSDR

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

Team Leader, Cooperative Agreement Team, SPAB, DHAC, ATSDR