

Health Consultation

RIPON MANUFACTURED GAS PLANT

RIPON, FOND DU LAC COUNTY, WISCONSIN

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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

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HEALTH CONSULTATION

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RIPON, FOND DU LAC COUNTY, WISCONSIN

Prepared by:

Wisconsin Department of Health and Family Services
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Summary

The Wisconsin Bureau of Environmental Health, Department of Health and Family Services (BEH/DHFS), at the request of the Wisconsin Department of Natural Resources (WDNR), reviewed environmental assessment data collected in a former manufactured gas plant (MGP) site in Ripon Wisconsin that is now a public park. The purpose of this review was to evaluate any health hazard associated with contamination in sediment and to identify other areas where health hazards might exist. Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) are present in sediment. Contaminants in sediment are not an apparent health hazard under current use patterns at the park and pond, but remediation is needed to address current ecological concerns and to avoid future human health concerns.

Background and Statement of Issues

Selfridge Park, in the city of Ripon, Fond du Lac County, Wisconsin, is the former site of a manufactured gas plant that operated from 1873 to about 1929. The Ripon former MGP used naphtha, a clear, low-viscosity, low density petroleum mixture, as feedstock. The park and the adjoining Mill Pond are being investigated for the presence of hydrocarbons and other contaminants associated with the former MGP. Previous investigations of the site (Hydro-Search 1991, ThermoRetec 2001, MWH 2002a) detected minor exceedances of U.S. Environmental Protection Agency (EPA) standards for polycyclic aromatic hydrocarbons (PAHs) in the surface layer (0-0.5 feet) of the soil. In addition, concentrated amounts of an oily, petroleum-like material have been detected several feet below the soil surface. DHFS (2002) previously addressed the issue of PAH-contaminated soil in Selfridge Park. That report concluded that PAHs in soils are not an immediate health concern, but that remediation of deeper soils is needed. This report serves as follow-up to the 2002 recommendations. As of October 2002, unresolved issues remained regarding PAH-contaminated sediment in the Mill Pond surrounding Selfridge Park. The most recent investigation was conducted to determine the degree and extent of sediment contamination from the gas plant operation (MWH 2002b). The investigation is being conducted by Alliant-Wisconsin Power & Light (Alliant-WPL) at the request of the Wisconsin Department of Natural Resources (WDNR). The major issues discussed in this report are the potential for harm from direct contact with or ingestion of PAH-contaminated sediments and the possibility of exposure to PAHs through consumption of fish from Mill Pond.

Public Health Evaluation of Mill Pond Sediments

The public health evaluation of Mill Pond consisted of several visits to the site, followed by an independent interpretation of the sediment investigation conducted by Alliant-WPL (MWH 2003).

Site visit. During site visits to Selfridge Park, most recently during May 2004, DHFS learned that part of the park peninsula had been excavated and backfilled with sand to form a beach and swimming area (Figure 1). The area is not currently maintained as an official beach, but nonetheless is used for swimming.

During one of the site visits, DHFS staff waded Mill Pond, where possible, around the perimeter of Selfridge Park. Every few feet, wading boots and a probe were used to disturb the upper part of the sediment, as would occur during recreational activities, for signs of hydrocarbon contaminants. At several other former MGP sites in Wisconsin, this method has readily revealed oil sheens and sediment with coal tar odors. These were not seen at Selfridge Park.

Evaluation of sediment results. The sediment study, conducted in May 2003 by environmental consultants for Alliant-WPL, consisted of a series of transect points at various sediment depths within Mill Pond. The samples covered the area of Mill Pond approximately 600 feet downstream and 500 feet upstream of the former MGP. Background samples were taken from approximately 850 feet upstream. The consultants, Montgomery Watson Harza, had the samples analyzed for PAH content, and later submitted their results to environmental and health agencies (MWH 2003).

In assessing the sediment data reported for Mill Pond, DHFS first summarized the seven probable human PAH carcinogens (EPA class B2) found in the sediment. Table 1 lists both the mean and the maximum concentration of each compound. The maximum concentrations were reported from near the site where several fuel storage tanks were located when the MGP operated (Figure 1). Unfortunately, there are no widely accepted health-based values available for comparison to these mean and maximum concentrations. Therefore, the PAH concentrations in Table 1 are compared to several different sediment quality values. The table includes health-based values proposed by the Alliant-WPL consultant (MWH 2003), ecologically-based WDNR sediment values, and values derived by DHFS that extrapolate from existing water quality standards.

The conclusions made here are based on the DHFS-derived sediment values, which were calculated using a conceptual exposure model for water depths greater than 18 inches. This model predicts that swimmers and waders stir up some of the bottom sediments into the water, and that a small amount of this water is accidentally ingested. This exposure scenario is appropriate for Mill Pond, because the only area suitable for swimming is the sand-filled beach area. The park shoreline downstream from the beach consists of demolition concrete fill (slabs and debris). The filled shoreline drops off sharply over abrasive concrete and is not suitable or attractive for wading or swimming.

The exposure model for exposure to contaminated sediment was derived from drinking water standards and health-based guidelines. Assuming that incidental ingestion of surface water during recreation amounts to 0.01 liters per day (L/day), and that per capita consumption of drinking water is 2 L/day (see Wisconsin Administrative Code, chapter NR 105.08), then a contaminant concentration in surface water that is 200-fold greater

than the corresponding drinking water standard would amount to the same adult exposure.

The next assumption in the exposure scenario is that sediments account for 5% of the mass of a given volume of water (i.e., 50 grams of sediment in 1 liter of water. This is an overestimate-see U.S. Dept. of Energy, 1999) becomes suspended in surface water by swimmers. This fraction of the sediment (1/20 of the total sediment) is available to expose people using the water recreationally. Therefore, the concentration of a contaminant in sediment that would result in a daily exposure equivalent to that acceptable from drinking water is 4000-fold (20 x 200) greater than the corresponding NR 140 enforcement standard. Finally, a factor of 26 is applied to adjust from a lifetime exposure duration (365 days/year, 70 years) to an assumed maximum recreational exposure of 100 days/year, 10 years.

By combining each of these assumptions, an acceptable concentration of contaminants in sediment would be 1.04×10^5 ($= 20 \times 200 \times 26$) greater than the corresponding acceptable drinking water concentration. Applying this factor to the Wisconsin Administrative Code, ch. NR 140 enforcement standard results in a sediment comparison value similar to those proposed as sediment quality guidelines by consultants for Alliant-WPL (MWH 2003: see Table 1). In contrast, applying this factor to the Agency for Toxic Substances and Disease Registry (ATSDR) Cancer Risk Evaluation Guide (CREG) for a one in 100,000 excess cancer risk results in a more stringent comparison value (Table 1). One in 100,000 is the human cancer criteria applicable to surface waters under Wisconsin Administrative Code ch. NR 105.09. The CREG values applied to various PAHs are toxic equivalency factors relative to benzo(a)pyrene. The CREG-based comparison values are slightly higher than the mean PAH concentrations measured in sediment (Table 1). The most contaminated sediments just offshore of the former naphtha tank area (sample F01; MWH 2003) exceeds these comparison values for benzo(a)pyrene, chrysene, and benzo(b)fluoranthene.

Discussion

Discussion of sediment results. Although state groundwater standards (Wisconsin Administrative Code, NR 140), surface water standards (NR 105), and sediment quality guidelines (WDNR 2003) are in effect, none clearly address the exposure scenario of ingestion or contact with sediments suspended in surface water. Furthermore, when disturbed hydrocarbons in sediment form a sheen on the water surface, this may result in a more concentrated contact exposure to swimmers than could be considered here. A comparison of the PAH concentrations detected by MWH (2003) with the risk values listed in Table 1 supports the conclusion that there is a small risk associated with contact with sediments in Mill Pond. However, the condition of the wading areas and the use patterns in the park suggest that public contact with contaminated sediments will be infrequent. In perspective, most of our lifetime exposure to PAHs comes from other sources, particularly engine exhaust, wood smoke, cigarette smoke, and charred food (ATSDR 1995; Boström et al. 2002). In light of the use of the park by swimmers and the presence of several PAHs above the CREG-derived comparison value, DHFS

considers the contaminated sediments to be a complete exposure pathway, but with no apparent public health hazard. No direct exposure is expected when swimmers remain within the sand-filled area. However, there are no rope barriers or buoys around the sand area, and the beach had eroded in some areas, revealing a plastic sheet barrier beneath the sand. Therefore, DHFS recommends that the present “no wading or swimming” advisory remain in effect for Selfridge Park pending improvements to Mill Pond. Such improvements might entail some combination of removing of the most contaminated sediments and placing additional sand, ropes, and buoys around the swimming area.

Exposure to PAHs through ingestion of fish. DHFS concurs with scientific sources that indicate no health risk from consuming fish from waters having PAH-contaminated sediment. PAHs have been shown to accumulate in clams and crabs living in contaminated sediment. However, due to metabolism, there appears to be no significant accumulation in fish muscle (Nakata *et al.* 2003, Hellou *et al.* 1999). PAHs are detectable in fish liver (Meador *et al.* 1995), the liver being the primary organ of PAH metabolism. DHFS does not consider monitoring fish for PAH content necessary to protect public health at Selfridge Park.

Child Health Considerations

Children are the population most likely to encounter risk from swimming and wading in Selfridge Park, because of both behavioral and physiological differences from adults. There is a small risk during wading from exposure to PAH-contaminated sediments around the park. However, the shoreline in the most affected areas discourages wading. The sand-filled beach limits exposure to contaminated sediments, but the extent of the swimming beach is not monitored or restricted, and the sand fill is in disrepair. As noted in a previous report (DHFS 2002) adjacent parkland has surface soils that are contaminated with PAHs. However, these soils do not represent a current public health risk for children. The park has a well-maintained ground cover consisting primarily of sod, as well as wood chips around play structures. This ground cover, if maintained, prevents direct contact with PAH-contaminated surface soil.

Conclusions

The conclusions and recommendations of this report are based on interim results of an ongoing environmental investigation and may change with new information. This report does not address the broader environmental and ecological issues of the contaminants, nor does it address the possibility that site conditions may change, for example from erosion or dredging, to increase the human exposure potential. Remediation of the property is the best course to remove potential long-term hazards.

- Although some areas of Mill Pond sediment have elevated PAH contamination, the sediment poses no apparent health hazard under current patterns of use at the park and pond. Wading and swimming is infrequent at most in the areas where contaminated sediments are a concern.

- PAHs exposure from eating fish from Mill Pond represents no public health hazard.

Recommendations

- Because of the concentration of PAHs in some parts of Mill Pond sediment, and the possibility for exposure outside of the beach area, DHFS recommends that the present “no wading or swimming” advisory remain in effect for Selfridge Park, pending improvements to Mill Pond.

Public Health Action Plan

Signs advising “no wading or swimming” in Mill Pond are already in place. No other actions are recommended or planned at this time.

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References

- ATSDR. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Dept. Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.
- Boström C-L, Gerde P, Hanberg A, Jernström B, Johansson C, Kyrklund T Rannug A, Törnqvist, M, Victorin K, Westerholm R. 2002. Cancer risk assessment, indicators, and guidelines for polycyclic aromatic hydrocarbons in the ambient air. *Env. Health Persp.* 110, supp 3: 451-489.
- DHFS. 2002. *Health consultation: Ripon Manufactured Gas Plant, Ripon, Fond du Lac County Wisconsin*. WI Dept. Health and Family Services, in cooperation with U.S. Dept. Health and Human Services, Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/HAC/PHA/ripongasmrg_p1.html
- Hellou J, Mackay D, Banoub J. 1999. Levels, persistence and bioavailability of organic contaminants present in marine harbor sediments impacted by raw sewage. *Chemosphere.* 38: 457-73.
- Hydro-Search, Inc. April 1991. Environmental Investigation, Manufactured Gas Plant Site, Ripon, Wisconsin, Wisconsin Power & Light Company. Project no. 388E13043.
- Meador JP, Stein JE, Reichert WL, Varanasi U. 1995. Bioaccumulation of polycyclic aromatic hydrocarbons by marine organisms. *Rev Environ Contam Toxicol.* 143:79-165.
- MWH. 2002a. *Alliant Energy Corporation-Wisconsin Power and Light Company. April 2002. Initial Phase II Site Investigation Report, Ripon Manufactured Gas Plant Site.* Montgomery Watson Harza, Inc. Project no. 1912250.0101.
- MWH. 2002b. *Alliant Energy Corporation-Wisconsin Power and Light Company. June 2002. NR 716 Phase III Investigation Work Plan, Ripon Manufactured Gas Plant Site.* Montgomery Watson Harza, Inc. Project no. 1912250.0101.
- MWH. 2003. Phase III site investigation, addendum sediment investigation for the former manufactured gas plant site, Ripon, Wisconsin. Prepared for Alliant Energy/Wisconsin Power and Light. Montgomery Watson Harza, Des Moines, IA, proj. 1912622.0101.
- Nakata H, Sakai Y, Miyawaki T, Takemura A. 2003. Bioaccumulation and toxic potencies of polychlorinated biphenyls and polycyclic aromatic hydrocarbons in tidal flat and coastal ecosystems of the Ariake Sea, Japan. *Environ Sci Technol.* 15;37: 3513-21.
- ThermoRetec, Inc. May 2001. Workplan for Phase II Site Investigation, Ripon Manufactured Gas Plant Site, Ripon, Wisconsin. Project no. AE100-14837-621.

U.S. Department of Energy, Office of Environmental Management. 1999. Analysis and Visualization System (AVS) Lookup Tables.
<http://web.em.doe.gov/closure/update99/attb-6.html>

WDNR. 2003. Consensus-Based Sediment Quality Guidelines: Recommendations for Use & Application. Wisconsin Department of Natural Resources. Document WT-732 2003. Available: http://dnr.wi.gov/org/aw/rr/technical/cbsqg_interim_final.pdf

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Table 1. Polycyclic aromatic hydrocarbons (PAHs) detected in sediments (0 -1 ft depth) of Mill Pond, Ripon Wisconsin, 2003^a.

PAH	EPA cancer class	Mean mg/kg ± standard error n=35	Maximum reported, mg/kg (sample site)	NR 140-derived sediment comparison value ^b mg/kg	CREG-derived sediment comparison value ^d mg/kg	Mean BaP equiv ^f mg/kg	DNR CBSQG ^g Prob. Effect Conc. mg/kg	MWH SQG ^h
Benzo(k)fluoranthene	B2	0.47±0.10	3.5 (F01)	2080 ^c	502	0.005	13.4	2100
Benzo(a)anthracene	B2	0.70± 0.22	7.8 (F01)	208 ^c	50	0.07	1.1	210
Indeno(1,2,3cd)pyrene	B2	0.77±0.13	4.7 (F01)	208 ^c	50	0.08	3.2	210
Benzo(b)fluoranthene	B2	1.18±0.17	6.3 (F01)	20.8	5	1.18	13.4	210
Benzo(a)pyrene	B2	1.24±0.32	11 (F01)	20.8	5	1.24	1.5	21
Chrysene	B2	3.04±0.52	15 (F01)	20.8	5	3.04	1.3	21,000
Dibenz(a,h)anthracene	B2	0.05±0.02	0.7 (F01)	20.8 ^c	5	0.05	0.14	21
Total PAH ^e		11.1±1.0				na		
Total PAH, BaP equiv.		na	na	na		5.67		

na: not applicable

mg/kg: milligram per kilogram

^a Data from: MWH. 2003. Phase III site investigation, addendum sediment investigation for the former manufactured gas plant site, Ripon, Wisconsin. Prepared for Alliant Energy/Wisconsin Power and Light. Montgomery Watson Harza, Des Moines, IA, proj. 1912622.0101.

^b Acceptable sediment concentration estimated as 1.04×10^5 -fold greater than the corresponding NR 140 enforcement standard. See text for discussion.

^c Not listed in NR 140. Value extrapolated from Relative Potency Factor in comparison to benzo(a)pyrene.

^d CREG: ATSDR Cancer Risk evaluation guide, see text for discussion.

^e Total PAH accounts for additional compounds, having lower cancer rating, that were not otherwise assessed.

^f PAH concentration in sediment, adjusted for benzo(a)pyrene toxic equivalency.

^g Consensus-based sediment quality guidelines. See WDNR 2003.

^h SQG: Sediment Quality Guideline proposed by MWH 2003

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Figure 1. Aerial photograph of Mill Pond and Selfridge Park in Ripon, Wisconsin.



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Certification

This public health consultation for the Ripon Manufactured Gas Plant was prepared by the Wisconsin Department of Health and Family Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methods and procedures existing at the time the Public Health Consultation began.



Technical Project Officer, DHAC

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



Roberta Erlwein, Cooperative Agreement Team Leader, DHAC, ATSDR