Health Consultation

WALKER'S BAY LAGOON HERBICIDE SPILL

POUND, OCONTO COUNTY, WISCONSIN

AUGUST 1, 2007

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

Health Consultation: A Note of Explanation

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

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HEALTH CONSULTATION

WALKER'S BAY LAGOON HERBICIDE SPILL

POUND, OCONTO COUNTY, WISCONSIN

Prepared By:

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

Background and Statement of Issues

High concentrations of the herbicide simazine were illegally applied to the heavily used Walkers Bay lagoon, a small finger-shaped bay in the southeastern corner of White Potato Lake, Oconto County (Figure 1). A criminal investigation by the Wisconsin Department of Natural Resources (WDNR) revealed that local residents were involved. Subsequently, an environmental cleanup was undertaken by the WDNR and the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP). The Wisconsin Department of Health and Family Services (DHFS) was asked to assist in assessing health hazards and in providing information to the public regarding the implications of the herbicide spill on allowable lake use both before and after cleanup of the simazine crystals.

The public has a high potential for exposure to improperly applied herbicide in Walkers Bay Lagoon, since these waters are heavily used for aquatic recreation, including fishing, boating, wading, and swimming. The purpose of this health consultation is to estimate the amount of simazine that users of the lagoon may be exposed, and to determine whether surface waters, vegetation, and sediments of the lagoon contain simazine at levels that would present a public health concern.

Data summary of sediment and surface water contamination. The DNR warden sampled surface water and suspended sediment debris from several locations in or near Walkers Bay for the presence of simazine (Table 1). Simazine concentrations in water samples taken prior to the herbicide removal ranged from 85 parts per billion (ppb) in the mouth of the lagoon near the open lake to 92,500 ppb in a sample taken close to the bottom near visible herbicide crystals near the apex of the lagoon.

On April 20, 2007, 3 days after the discovery of the excess simazine application, DNR arranged for their emergency spill contractor to remove the granular simazine from the concrete pier and lake bottom. The contractor used a vacuum truck and other equipment to vacuum simazine off the bottom of the lake bed and pier. The recovered simazine and water was then transported for analytical sampling and proper disposal.

DATCP staff sampled surface water and sediment on May 1, 2007, twelve days after the April 20, 2007 cleanup, to determine the amount of detectable herbicide remaining in the lagoon. The most simazine detected on that date in sediment was 1650 ppb, along with 49.5 ppb in mid-water column samples (Table 1).

Affected population. White Potato Lake is a popular recreation destination, with over one hundred homes and vacation cottages on or near the southern shoreline and on the lagoon. The lake is 978 acres, with a maximum depth of 11 feet. The lagoon (Figure 1B) is accessible, sheltered, shallow, and is a productive fishery. These features combine to increase the possibility that the public will be exposed to herbicide inappropriately applied to this water body. The number of people potentially exposed is difficult to determine due to the seasonal and transient vacation population, but based on the number

of local dwellings, is estimated to be 10-50 people per day during the warm season, and 5-10 per day at other times.

Figure 1. Location of unregulated simazine application in White Potato Lake, Oconto County, during April 2007. A: Location of Walkers Bay lagoon; B: View from apex of lagoon, with the open lake in the distance. Herbicide was applied around much of the perimeter of the lagoon. Map reference: *http://www.dnr.state.wi.us/org/water/fhp/lakes/lakemap/0515100z.htm*

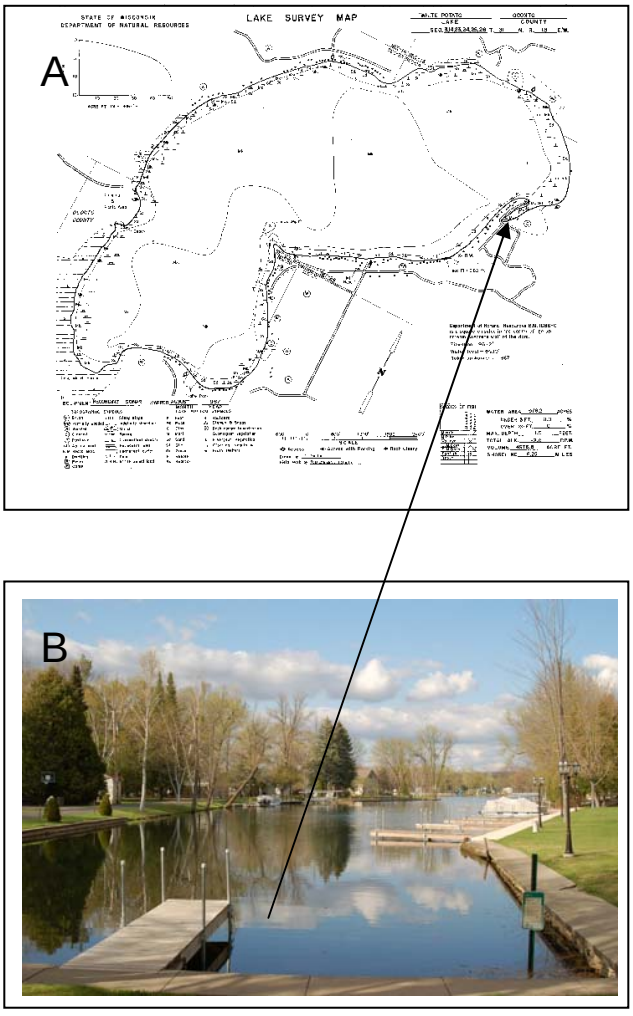

Table 1. Analysis for Simazine in Walkers Bay Lagoon of White Potato Lake, Oconto County, Wisconsin.

	Sample location	Simazine ppb	Comparison value[2] ppb
Simazine pre-cleanup [1]	Water sample date 4/17/2007		
	SE corner of lagoon above leaves on bottom	412	200
	SE corner of lagoon with bottom debris	83,100	200
	SE corner of lagoon- disturbed bottom	3020	200
	W side of lagoon- material scraped from submerged metal structure.	1160	200
	W shore of lagoon submerged concrete wall.	92,500	200
	Surface water-E shore of lake outside lagoon	85	200
Simazine post-cleanup	Sample date 5/1/2007		
	Mid-depth water sample from mouth of Walker Bay into greater White Potato Lake	1.5	200
	Mid-depth water sample from the other from the apex of the Bay	49.5	200
	Sediment	560	104,000
	Sediment	1090	104,000
	Sediment	1650	104,000

[1]Unfiltered water samples included disturbed sediment and bottom debris
[2]Unpublished comparison values derived for this assessment from EPA 4 ppb drinking water Maximum Contaminant Limit (MCL).
ppb: parts per billion

Discussion

Representativeness of data.

The relatively few samples analyzed were sufficient to address public health questions posed in this consultation. This is primarily because the WDNR investigation revealed recent and first hand knowledge of where the applications were made, and because of the low aqueous solubility (6.2 mg/liter; Knuteson 2002) of the simazine crystals. Both of these allowed visual targeting of the simazine allowing an effective cleanup, and targeting of the pre- and post-cleanup samples to bias for worst-case conditions.

Exposure pathways evaluation.

Ingestion of fish from Potato Lake. There was no apparent health hazard due to simazine exposure from ingesting fish from Walkers Bay Lagoon. Simazine has low toxicity to fish, and a similarly low potential for bioaccumulation (Turner 2003; EPA 2007). As a

precaution during the initial discovery and investigation of the herbicide in the lagoon, temporary restrictions were posted (Appendix 1), while health and environmental officials assessed hazards to the public. The WDNR later lifted these restrictions based on the DHFS review of post-cleanup environmental tests for simazine.

Exposure to simazine from incidental ingestion of surface water and suspended sediments. DHFS reviewed tests for simazine in Walkers Bay Lagoon performed both before and after the cleanup, and concluded the presence of a health hazard before the cleanup and no apparent health hazard post-cleanup for current and future conditions. DHFS received analytical results from the WDNR of post-cleanup sediment and water column samples, taken May 1 2007, for simazine herbicide residues in Walker Bay lagoon of White Potato Lake. Three sediment samples and two mid-depth water column samples were analyzed. One water column sample was taken from the mouth of Walker Bay Lagoon into greater White Potato Lake; the other from the apex of the lagoon. To the extent that these samples are representative of the total residues in the lagoon, there is no remaining health hazard from the excess simazine application for people swimming or boating in the bay.

The conclusions made here regarding the health implications of exposure to water and sediment are based on exposure estimates previously developed by DHFS (ATSDR 2004), 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 during swimming and splashing. This exposure scenario is appropriate due to the shallow depth of the lagoon.

The exposure model for exposure to contaminated sediment was derived from the EPA Maximum Contaminant Level (and Wisconsin Enforcement Standard) of 4 parts per billion (ppb) simazine in drinking water. Assuming that incidental ingestion of surface water during recreation amounts to 0.01 liters per day (L/day) (see Wisconsin Administrative Code, chapter NR 105.08), and that average daily consumption of drinking water by children is 0.5 L/day, then a contaminant concentration in surface water that is 50-fold greater than the corresponding drinking water standard (200 ppb, or 50 x 4 ppb) would amount to the same child exposure. Note that the use of the adult water consumption factor (2 L/day) would result in a less stringent exposure to children. The water column concentrations for simazine reported from the May 1 samples were 1.5 ppb from the mouth of the lagoon and 49.5 ppb from the apex of the lagoon.

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 water mass) 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 1000-fold (20 x 50) 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, the concentration of contaminants in sediment that would result in recreational exposure equivalent to that from drinking water would be 2.6×10^4 (= 20 x 50 x 26) greater than the corresponding acceptable drinking water concentration. Applying this factor to the Wisconsin Administrative Code, ch. NR 140 Enforcement Standard (4 ppb simazine in drinking water aquifers) results in a comparison value of 104 parts per million simazine in sediment. The maximum reported in the May 1, 2007 samples was 1.65 ppm (Table 1).

Based on this analysis, the Division of Public Health concludes that the simazine cleanup in Walker Bay lagoon was sufficient to protect human health. This exposure analysis is intended only for human health and not for ecological effects that for many chemicals are often more sensitive. Since the mechanism of simazine's toxicity specifically targets plants, aquatic plants in the lagoon will still be affected, and that the surface water may not be presently suitable for irrigating lawns or garden plants.

Public health implications of the excess simazine application. Prior to the simazine cleanup in the lagoon, a situation existed posing the potential for ongoing exposure to concentrated levels of simazine in water and sediment at the publicly accessible shoreline of Walkers Bay Lagoon. The simazine concentrations present prior to the cleanup exceeded comparison values derived for this case from the Wisconsin Groundwater Enforcement Standard for simazine (Table 1). Simazine has a low aqueous solubility with persistence that varies with environmental conditions. The reported half life of simazine in the environment ranges from 30-200 days, with 30 days being most commonly cited (EPA 2007). Using this half life range for the highest simazine concentration found (92,500 ppb in unfiltered water), and assuming natural logarithmic decay, it would take 267-1779 days for 92,500 ppb simazine to degrade to a level below the 200 ppb comparison value used in Table 1. Based on this analysis, there was a potential for unhealthy exposures to simazine prior to the cleanup. Fortunately, there was little evidence of any actual harmful exposures to the public. This is due to the short duration between the spill and the cleanup, and the low use of this lake area prior to the opening of fishing season. Some herbicide residues remain in sediment following the cleanup work, but these residues do not exceed conservatively calculated exposure comparison values developed for this consultation. Currently, there is no apparent public health hazard from simazine residues remaining in surface water and sediment of Walkers Bay and nearby waters of White Potato Lake, nor from consuming fish anywhere in White Potato Lake.

Simazine toxicity.

Simazine (*6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine*) is a triazine-class, broad-spectrum herbicide that targets photosynthesis as its mechanism of plant toxicity. Acute effects are noted for aquatic vascular plants at water concentrations of 140 ppb simazine (EPA 2007). The toxicity of simazine in mammals has been thoroughly reviewed by the

U.S. EPA (2006). Toxicity studies indicate a relatively low toxicity of simazine to rats, with an acute lethal dose of 5000 mg/kg, and no-effect levels of the most sensitive endpoints studied (for example, altered leutenizing hormone surge in female rats) of 1.8 milligrams per kilogram body weight per day (mg/kg/d). One study reviewed by EPA in 2006 indicated altered or interrupted bone development in fetal rats when pregnant dams were fed an acute oral dose of 30 mg/kg/d. Both of these effects in rats occurred at doses higher than would be expected based on the human exposure evaluation described below. The EPA's carcinogenicity assessment of simazine concluded in that simazine is "not likely to be carcinogenic to humans" (EPA 2006). Based on these studies, in 1994 the EPA's Office of Water established a Maximum Contaminant Level (MCL) for simazine in finished drinking water of 4.0 parts per billion (ppb) (EPA 2006). This MCL reflects uncertainties due to limited data of neuroendocrine and developmental effects. Wisconsin has adopted this MCL as the groundwater Enforcement Standard for simazine.

Child Health Considerations

Children are the population most likely to exposed, during swimming and wading, to residual simazine in Walkers Bay Lagoon. This is due to both behavioral and physiological differences from adults. The concentration of simazine following the cleanup of the lagoon is low enough that no problems from exposure to children are expected.

Conclusions

The following conclusions are divided into hazards presented by Simazine-contaminated surface water and sediment both before and after the cleanup of the herbicide spill.

- Adverse health effects were unlikely from short term exposure before remediation.
- Prior to and following the simazine cleanup, there is no apparent public health hazard from consumption of fish from Walkers Bay Lagoon.
- After the simazine spill cleanup, contact with simazine-contaminated waters and sediment of Walkers Bay Lagoon, such as from swimming and wading, was not an apparent public health hazard.

Recommendations

- DHFS worked with WDNR and DATCP to recommend temporary restrictions against fishing, direct contact, drinking, or irrigation uses of waters of Walker's Bay Lagoon prior to the herbicide cleanup and confirmatory testing (see notice, Appendix 1). These recommendations have since been lifted by environmental and health officials.
- The waters of Walkers Bay Lagoon in White Potato Lake should not be used for irrigation, due to the effects of residual herbicide on lawn and garden plants, until further notice by environmental and health officials.

Public Health Action Plan

- DHFS participated in interagency planning meetings to coordinate plans to protect public health and the environment following the simazine spill.
- Signs advising visitors of Walkers Bay Lagoon in White Potato Lake of the recommendations listed above have been posted by the WDNR, in cooperation with DHFS.
- The WDNR's environmental contractor removed and disposed of excess simazine from the lagoon. Confirmatory water and sediment samples were analyzed.
- DHFS participated in a public meeting informing area residents of the spill, its implications, and the responses of responsible public agencies.
- During the calendar year of April 2007-April 2008, WDNR will analyze samples from the water column of Walkers Bay Lagoon in White Potato Lake for the presence of simazine.

References

ATSDR. 2004. Public health consultation, Ripon manufactured gas plant. Ripon, Fond du Lac County, Wisconsin. US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Internet: http://www.atsdr.cdc.gov/HAC/pha/RiponManGasPlant110304HC-WI/RiponManGasPlant110304HC-WI.pdf

EPA. 2006. Reregistration eligibility decision for Simazine. United States Environmental Protection Agency, document 738-R-06-008 April 2006

EPA. 2007. Technical Overview of Ecological Risk Assessment
Aquatic Life Benchmark Table. United States Environmental Protection Agency, Office of Pesticide Programs. Internet:
http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm

Knuteson SL, Whitwell T, Klaine SJ. 2002. Influence of plant age and size on Simazine toxicity and uptake. *J. Environ. Qual. 31:* 2096-2103. 2002

Turner, L. 2003. Simazine analysis of risks to salmon and steelhead. United States Environmental Protection Agency, Office of Pesticide Programs. Internet:
http://www.epa.gov/espp/effects/simazine_final.pdf

Consultation author

Robert Thiboldeaux, Ph.D.
Toxicologist
Health Hazard Evaluation Unit
Bureau of Environmental and Occupational Health
Division of Public Health
Wisconsin Department of Health and Family Services.

Certification

This Health Consultation on Walker's Bay Lagoon 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 the approved methodology and procedures existing at the time the Health Consultation was begun. Editorial review was provided by the cooperative agreement partner.

Jennifer A. Freed
Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
ATSDR

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

Alan Yarbrough
Team Leader
CAPEB, DHAC, ATSDR

Appendix 1. Temporary restriction posted at Walkers Bay lagoon, White Potato Lake.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 N OGDEN RD
PO BOX 208
PESHTIGO, WI 54157
Telephone 715-582-5004
FAX 715-582-5005
TTY Access via relay - 711

Jim Doyle, Governor
Scott Hassett, Secretary
Ronald W. Kazmierczak, Regional Director

April 20, 2007

CAUTION – SIMAZINE CONTAMINANT IN LAKE!

Notice:

The Wisconsin DNR and Department of Agriculture Trade and Consumer Protection are jointly investigating and removing a recent dumping of granular simazine in the entire lagoon/canal area of White Potato Lake.

On April 20, 2007, Veolia Environmental Services, on behalf of the Wisconsin DNR, will remove the granular simazine from the concrete pier and water. Veolia will access the Walkers Bay Lagoon via the private drive with a vacuum truck, tanker truck, and other small response vehicles. The simazine will be vacuumed off the bottom of the lake bed and pier. The recovered simazine and water will be transported to a Veolia Facility in Mineral Springs, Wisconsin, for analytical sampling and disposal.

Please stay away from this area while the contractor is working in the area in order to avoid disturbance of the simazine. There has already been several dead fish recovered from this area. We have taken samples but are waiting for lab analysis to confirm toxicity levels.

We urge people to stay away from this area for safety reasons, do not use this water for irrigation or drinking and avoid eating any fish until further notice.

If you have any information or leads about this release into the waters of the State please contact Warden Joe Paul at 715-276-1582 or me at 715-582-5004. You can also contact our confidential DNR Hotline at 800-TIP-WDNR.
Thank you for your cooperation.

Sincerely,

Robert Goerlinger
Conservation Warden Supervisor