Health Consultation

1,4 – DIOXANE IN PRIVATE DRINKING WATER

MOHONK ROAD INDUSTRIAL PLANT
HAMLET OF HIGH FALLS, ULSTER COUNTY, NEW YORK

EPA FACILITY ID: NYD986950012

JUNE 22, 2005

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

Health Consultation: A Note of Explanation

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

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

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HEALTH CONSULTATION

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EPA FACILITY ID: NYD986950012

Prepared by:

New York State Department of Health
Center for Environmental Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Superfund Program Assessment Branch
Atlanta, Georgia

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BACKGROUND AND STATEMENT OF ISSUES

Under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the New York State Department of Health (NYS DOH) evaluated the public health significance of private well contamination related to the Mohonk Road Industrial Plant Site in a public health assessment (ATSDR 2005). In this public health consultation, NYS DOH evaluated 1,4-dioxane, which was recently detected in private water supplies and was not evaluated in the initial public health assessment. Recommended actions listed at the end of this document are aimed at reducing exposure and potential health risks associated with 1,4-dioxane in private water supplies. The Mohonk Road Industrial Plant Site was proposed to the National Priority List (NPL) in September 1998 and was placed on the NPL in 1999.

A. Site Description and History

The Mohonk Road Industrial Plant Site is outside the Hamlet of High Falls in a rural area of Ulster County. Groundwater is currently the only drinking water source for the community. The site covers approximately 14.5 acres, most of which is undeveloped property. The site is bounded on the southeast by Mohonk Road and to the northeast, northwest, and southwest by homes on large wooded lots.

Several owners used the property for manufacturing since the 1960s. The plant began operation in the mid-1960s as Varifab. Varifab reportedly used trichloroethene in assembling and finishing metal parts for cash registers. In 1972, R.C. Ballard Corporation conducted a wet spray painting process at the site and operated a vapor-degreasing machine in its manufacturing process. Degreasing typically requires large quantities of solvents, including 1,1,1-trichloroethane, to clean the metal surfaces. 1,4-Dioxane was commonly used as a stabilizer for 1,1,1-trichloroethane, and it was likely first introduced to this site when 1,1,1-trichloroethane came into use. Daniel E. Gelles purchased the property in 1976 and began manufacturing plastic and metal store display fixtures at the site. Gelles' coating process generated "waste lacquer" until 1991, when the company began using electrostatic powder coating. 1,4-Dioxane is also used in lacquers, paints, and varnishes, and these activities may also have been a source of the 1,4-dioxane groundwater contamination.

In 1995, groundwater and private wells were found to be contaminated with VOCs. Granular activated carbon (GAC) filters were installed on 74 wells starting in 1995, thereby removing or significantly reducing many of the VOCs from the well water. In July 2003, the United States Environmental Protection Agency (US EPA) analyzed 20 private well water samples for 1,4-dioxane at a point before the GAC filter due to 1,4-dioxane's association with the contaminant 1,1,1-trichloroethane. 1,4-Dioxane is not included in the standard target compound list (TCL) scan, and was, therefore, not detected until its analysis was specifically requested of the laboratory. 1,4-Dioxane was first detected in the groundwater in July of 2003. The contaminant was present at concentrations ranging from 0.5 micrograms per liter (mcg/L) to 40.6 mcg/L.

In December 2003, levels detected in drinking water after filtration ranged from 1 mcg/L to 96 mcg/L, and in January of 2004, levels detected after filtration ranged from 11.1 mcg/L to 87 mcg/L. Since sampling for this contaminant began in July 2003, levels of 1,4-dioxane were below US EPA's action level of 600 mcg/L (US EPA Fact Sheet 2004b). During this timeframe, two sampling locations exceeded the New York State public drinking water standard of 50 mcg/L based on 1,4-dioxane's designation as an unspecified organic contaminant.

The New York State Department of Environmental Conservation (NYS DEC) provided bottled water to the two locations where the 1,4-dioxane levels were above the New York State drinking water standard. US EPA concluded that the carbon filters that had been installed to remove the majority of VOC contamination did not effectively remove the 1,4-dioxane from the drinking water. Since the filters were not designed to remove 1,4-dioxane, a contaminant not identified in the wells until June of 2003, exposures to this chemical continued. A public water supply system is being developed to provide an alternate source of drinking water and reduce the potential health risks to residents consuming contaminated water from private wells.

NYS DOH is providing the opportunity for persons known to have been exposed to site-related contaminants at the Mohonk Road site in drinking water to be included in the New York State Volatile Organic Compounds Exposure Registry (VOC Registry). The VOC Registry is a statewide project used to help evaluate exposures and health status for people who were exposed to VOCs in drinking water and in indoor air. Enrollment in the registry involves completing a survey about possible exposures to VOCs, the health status of each exposed person, and other factors related to health, such as exposure to tobacco smoke. Individuals who choose to enroll will then be contacted approximately every 2 years to update address information and monitor changes in health status.

B. Site Visit

Scarlett Messier of NYS DOH, accompanied by the US EPA Project Manager of the Mohonk Road Site, visited the site on July 21, 2004. The primary objective of this visit was to observe site characteristics and evaluate potential human exposures. In December of 2000, the US EPA excavated and removed contaminated soils from several locations on the site. The soil was remediated, thereby eliminating that exposure pathway. An on-site building is rented out to various commercial businesses. The building is locked after hours. The site perimeter is not fenced. Soil was removed from these areas and confirmatory sampling was done. Ms. Messier entered the groundwater treatment area currently in service that consists of air strippers, aqueous phase GAC filters, and vapor phase GAC filters. Treated water is discharged to the Coxing Kill. The water treatment building is fully automated and locked when not occupied by US EPA or consultant staff.

C. Demographics

NYS DOH estimated, from the 2000 Census, that approximately 348 people live within the proposed High Falls water district that includes the private wells with GAC filters installed. The age distribution of the area is similar to that of the rest of Ulster County as well as New York State, excluding New York City (NYC), with a slightly higher percentage of individuals age 64 years and older living in the area. There were 64 females of reproductive age (ages 15-44) within the water district. The population of the High Falls water district has somewhat lower racial and ethnic diversity than the rest of the county or state (excluding NYC). Based on the 2000 Census, a lower percentage of the population is living below the poverty level while the median household income is slightly lower than the rest of the county and state. These comparisons are provided in the following table. In addition, there are no schools or nursing homes in the proposed High Falls water district.

2000 Census Demographics	New York State excluding NYC	Ulster County	High Falls Water District
Age Distribution			
<6	8%	7%	6%
6-19	20%	19%	15%
20-64	58%	61%	60%
>64	14%	13%	19%
Race Distribution			
White	85%	89%	94%
Black	8%	5%	3%
Native American	<1%	<1%	0%
Asian	2%	1%	<1%
Pacific Islander	<1%	0%	0%
Other	2%	2%	1%
Multi-Racial	2%	2%	1%
Percent Minority*	18%	15%	10%
Ethnicity Distribution			
Percent Hispanic	6%	6%	5%
1999 Median Income	$47,517	$42,551	$40,760
% Below Poverty Level	10%	11%	6%

* Minority includes Hispanics, African-Americans, Asian-Americans, Pacific Islanders and Native Americans.

DISCUSSION

A. Environmental Contamination and Exposure Pathways

The Ulster County Health Department (UCHD) and NYS DOH collected samples from 137 private or commercial water supply wells in 1995 and found that 70 wells contained at least one or more site-related contaminants at levels exceeding NYS DOH drinking water standards. The four most prevalent contaminants (1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethane and 1,1-dichloroethene) were found at levels above drinking water standards established for public drinking water in 29 wells. Carbon filters were supplied to residents with contaminants in drinking water exceeding NYS DOH drinking water standards; however, residents with contaminated water supplies may have been exposed to site related contaminants via ingestion, inhalation, and dermal contact for up to 30 years. The potential health risks associated with these exposures were addressed in the public health assessment for the Mohonk Road Industrial Plant Site (ATSDR, 2005).

Groundwater and private wells were found to be contaminated with VOCs. GAC filters were installed on 74 wells starting in 1995 thereby removing or significantly reducing many of the VOCs from the well water. US EPA then considered the possibility of 1,4-dioxane contamination because of its association with the known VOCs in the groundwater. In July of 2003, US EPA sampled 20 private wells for 1,4-dioxane at a point before treatment by the GAC filters. Of those samples, 18 had detectable levels of 1,4-dioxane. The levels were all below the NYS public drinking water standard of 50 mcg/L, which is based on 1,4-dioxane's classification as an unspecified organic chemical (UOC).

In December of 2003, five pre-filter and 80 post-filter samples were taken from private wells. 1,4-Dioxane was detected in all five pre-GAC filter samples, with one of these samples showing levels above the New York State drinking water standard. 1,4-Dioxane was detected in 62 of the 80 post-GAC filter samples. Two of those detections were above the NYS drinking water standard of 50 mcg/L.

In January of 2004, two pre-GAC and eight post-GAC samples were collected. 1,4-Dioxane was detected in three of the post-GAC samples at levels from 11.1 mcg/L to 87 mcg/L and the two pre-GAC samples contained 33 mcg/L and 106 mcg/L respectively. The US EPA immediate action level for drinking water for 1,4-dioxane is 600 mcg/L (US EPA Fact Sheet 2004).

In summary, after the GAC filtration systems were installed, US EPA tested for the contaminant 1,4-dioxane in 20 wells before filtration. These samples were collected in July of 2003 and the contaminant was found at levels up to 40.6 mcg/L. In December of 2003, 1,4-dioxane was found at levels in drinking water (after filtration) up to 96 mcg/L in the 80 wells tested. US EPA concluded that the filtration system did not effectively remove 1,4-dioxane from the water. Residents with contaminated water supplies may have been exposed to 1,4-dioxane via ingestion, inhalation, and dermal contact for up to

30 years, and may continue to be exposed until a permanent alternative water supply is available. NYS DEC, in conjunction with NYS DOH, provided bottled water to the two locations with 1,4-dioxane levels exceeding the NYS drinking water standard of 50 mcg/L for UOCs. US EPA did not take further action because their immediate action level of 600 mcg/L was not reached in these wells.

US EPA, UCHD, NYS DOH, and NYS DEC continue to analyze data from private wells and off-site monitoring wells to determine if more private wells, including any known newly drilled wells, are threatened by the contaminant plume. US EPA collects samples from wells that appear to be threatened; therefore, there is reduced potential for significant current or future exposures to contaminated groundwater. Groundwater sampling of monitoring wells and private wells occurs quarterly.

Subsurface soils (1 to 6 feet below the ground surface) at the site were contaminated with VOCs, but 1,4-dioxane is highly soluble, and may not stay in soil. Exposures to the various VOCs in soil were unlikely because the contaminants were found in on-site subsurface soil, not in surface soil. US EPA excavated and removed on-site soil in December of 2000. Influent samples at the groundwater treatment plant show levels below drinking water guidelines for 1,4-dioxane.

B. Public Health Implications - Toxicological and Epidemiological Evaluation

To evaluate the potential health risks from exposure to 1,4-dioxane associated with the Mohonk Road Industrial Plant Site, NYS DOH assessed the risks for cancer and noncancer health effects. The risk of health effects is related primarily to contaminant concentration, exposure pathway, exposure frequency, and exposure duration. Long-term exposure to chemicals in drinking water is possible by ingestion, dermal contact and inhalation from water uses such as showering, bathing and cooking. Accordingly, for the purpose of estimating potential exposure, NYS DOH doubled the concentrations of 1,4-dioxane detected in drinking water to account for possible additional exposures via the inhalation and dermal routes. Although exposure varies depending on an individual's lifestyle, each of these exposure routes can contribute to the overall daily intake of contaminants and may potentially increase the risk for long term health effects. For additional information on how NYS DOH determined health risks applicable to this health consultation, refer to Appendix B.

For an undetermined period of time, possibly for up to 30 years (i.e., from the time manufacturing operations began on-site in the mid-1960s to the mid-1990s), private water supply wells near the Mohonk Road Industrial Plant Site have been contaminated with 1,4-dioxane and other VOCs. The health risks for VOCs other than 1,4-dioxane found in drinking water near the site were evaluated in a previous public health ATSDR, 2005). Of the 80 post-GAC private drinking water samples taken in December of 2003, 62 were found to contain 1,4-dioxane, but only two of those wells (57 mcg/L and 96 mcg/L) exceeded the NYS public drinking water of 50 mcg/L (Table 1).

US EPA has classified 1,4-dioxane as a "probable carcinogen" based on studies in which laboratory animals were given large oral doses over their lifetimes (US EPA, 2004c). Chemicals that cause cancer in laboratory animals may also cause cancer in humans who are exposed to lower levels over long periods of time. Whether 1,4-dioxane causes cancer in humans is unknown. Based on the results of animal studies, people drinking water containing 1,4-dioxane over a period of up to 30 years at levels between 4 mcg/L and 96 mcg/L (the highest level detected) are estimated to have a low increased risk of getting cancer. The cancer risk for 1,4-dioxane in drinking water is uncertain because of the lack of information on past exposures. There are no sampling data prior to July of 2003, and the amount of time the contaminant has been present is not known. Consequently, we do not know how long or to what levels people may have been exposed to 1,4-dioxane.

Long-term exposure to high levels of 1,4-dioxane can also cause noncancer health effects in laboratory animals, primarily on the liver and the kidney (NCI 1978; ATSDR 1995; EPA 2004c). Although the risks of non-carcinogenic effects from past exposures in drinking water are not completely understood, the existing data suggest that they could be minimal for 1,4-dioxane at the highest level detected (96 mcg/L).

C. Community Health Concerns

This public health consultation was distributed for public comment on April 13, 2005. The public comment period ended on May 6, 2005. NYS DOH received no comments from the residents. The following section responds to any specific health concerns identified by the community through written correspondence and during telephone conversations.

Concern: One resident, whose private well contained 1,4-dioxane at concentrations lower than the NYS DOH drinking water standards, requested bottled water.

Response: NYS DEC provides bottled water when levels of 1,4-dioxane exceed the NYS drinking water standard of 50 mcg/L.

Concern: One resident expressed concern over low levels of VOCs found in her private drinking water well. The resident believes that the contaminants are contributing to a specific medical condition. The resident's home is located outside the contaminant plume and all detected levels were well below drinking water standards.

Response: NYS DOH discussed the medical condition with the resident, risk factors for the condition and what is known about the health effects of the levels and kinds of chemicals found in the resident's well water. The resident provided a letter from her doctor to US EPA requesting a filtration system be installed on her private drinking water well.

Concern: One resident expressed a concern about drinking water quality in the past.

Response: After receiving the residents permission, NYS DOH staff obtained the resident's past private drinking water well sampling results from US EPA. There were no detectable levels of contaminants found in the well on any of the sampling occasions.

D. ATSDR Child Health Considerations

The ATSDR Child Health Considerations emphasizes the on-going examination of relevant child health issues in all of the Agency's activities, including evaluating concerns about children's health through its mandated public health assessment activities. ATSDR and NYS DOH consider children when we evaluate exposure pathways and potential health effects from environmental contaminants. We recognize that children are of special concern because of their greater potential for exposure from play and other behavior patterns. Children sometimes differ from adults in their susceptibility to hazardous chemicals, but whether there is a difference depends on the chemical. Children may be more or less susceptible than adults to health effects, and the relationship may change with developmental age.

The possibility that children or the developing fetus may have increased sensitivity to 1,4-dioxane was taken into account when evaluating the potential health risks associated with the groundwater contamination near the Mohonk Road Industrial Plant Site. There is limited information on the reproductive and developmental toxicity of 1,4-dioxane. One animal study showed that the offspring of rats exposed to high levels 1,4-dioxane in drinking water during pregnancy had reduced body weights and delayed development of the sternum (Giavini et al., 1985). All other developmental parameters evaluated in this study were within normal ranges. The level of 1,4-dioxane exposure that caused these effects is about 190,000 times higher than the estimated levels of exposure to 1,4-dioxane in drinking water near the Mohonk Road Industrial Plant Site.

CONCLUSIONS

Human exposure to contaminants in private water supplies near the Mohonk Road Industrial Plant Site occurred via ingestion, inhalation and dermal contact for an undetermined period of time, possibly up to 30 years. Carbon filters were installed in 1995 to reduce exposures to volatile organic contaminants such as chlorinated solvents. Since the filters were not designed to remove 1,4-dioxane, a contaminant not identified in the wells until June of 2003, exposures to this chemical continued. In March 2004, bottled drinking water was provided to two properties where the water from their private wells was contaminated with 1,4-dioxane above New York State drinking water standards. The construction of a permanent, alternate drinking water supply is planned to be completed in 2007.

Exposures to 1,4-dioxane at levels below drinking water standards may continue until public water is provided. Because the carbon filtration systems remove chlorinated solvents, and bottled water was provided to the locations with 1,4-dioxane levels above NYS drinking water standards, provided that monitoring and current remedial actions are maintained, the site is no apparent public health hazard (Appendix C). However, public health actions are needed to reduce continued long-term exposure to this chemical.

NYS DOH is providing the opportunity for persons known to have been exposed to site-related contaminants in drinking to be included in the VOC Registry. The VOC Registry is a statewide project used to help evaluate exposures and health status for people who were exposed to VOCs in drinking water and in indoor air. Enrollment in the registry involves completing a survey about possible exposures to VOCs, the health status of each exposed person, and other factors related to health, such as exposure to tobacco smoke. Individuals who choose to enroll will then be contacted approximately every 2 years to update address information and monitor changes in health status.

RECOMMENDATIONS

Recommendations contained in the Mohonk Road Industrial Plant Site Public Health Assessment (ATSDR 2005) remain applicable. These include: continued monitoring and treatment of affected private drinking water supply wells; continued monitoring of groundwater; provision of a permanent, alternate supply of drinking water to dissociate people from the contaminated water on a long-term basis; and notification of all owners of properties with underlying groundwater contamination.

Recommendations for the Mohonk Road Industrial Plant Site based on 1,4-dioxane include: continue to provide bottled water to residents whose well levels of 1,4-dioxane are in excess of the NYS DOH drinking water standard of 50 mcg/L; continue to develop a public water supply system; and continue to monitor the levels of 1,4-dioxane in drinking water in conjunction with US EPA monitoring that occurs semi-annually. In addition, wells that contain levels of 1,4-dioxane approaching the NYS drinking water standard should be tested periodically so that bottled water can be provided should levels reach 50 mcg/L.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan for the Mohonk Road site describes the actions taken or to be taken by the ATSDR, NYS DOH, US EPA, NYS DEC, or UCHD following completion of this health consultation. The purpose of the Public Health Action Plan is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from present and/or future exposures to 1,4-dioxane at or near the site. ATSDR and/or NYS DOH will ensure that this plan is implemented. The public health actions for the Mohonk Road site are as follows:

1. US EPA will continue to monitor semi-annually the private water supply treatment systems to verify that well water meeting drinking water standards is available until a permanent drinking water supply is provided. NYS DOH and UCHD will continue to review sampling results.

2. Bottled water will be provided to residents whose water exceeds the New York State drinking water standard of 50 mcg/L for 1,4-dioxane.

3. US EPA will monitor groundwater to determine if the contaminant plume has advanced and to help identify private drinking water wells, both existing and newly drilled wells, which may become affected.

4. NYS DOH and ATSDR will work with US EPA to implement the provisions of the Record of Decision that selected the permanent, alternative water supply for residents affected by groundwater contamination.

5. For properties with underlying groundwater contamination, NYS DOH will work with UCHD, US EPA and NYS DEC to notify existing property owners of the presence of groundwater contamination and encourage the owners to notify future owners of the property should they sell or otherwise transmit ownership.

ATSDR will reevaluate and expand the Public Health Action Plan as needed. New environmental, toxicological, or health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at the site.

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CERTIFICATION

The Health Consultation for the Mohonk Road Industrial Plant site was prepared by the New York State 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 initiated. Editorial review was completed by the Cooperative Agreement Partner.

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Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation, and concurs with its findings.

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Team Leader, CAT, SPAB, DHAC, ATSDR

Appendix A
TABLES

Table 1. Range of Detection, Water Quality Standards/Guidelines and Public Health Assessment Comparison Values for 1,4-Dioxane at the Mohonk Road Industrial Site [All values in micrograms per liter (mcg/L)]

		Water Quality Standards/Guidelines							
		New York State			US EPA	Comparison Values*			
Contaminant	Range of Detection	Ground Water	Surface Water	Drinking Water	Drinking Water	Cancer	Basis**	Noncancer	Basis
1,4-dioxane	1 - 96	--	--	50	600***	3.2	EPA CPF	700	ATSDR MRL

* Comparison values determined for a 70 kg adult who drinks 2 liters of water per day.

** EPA CPF: US EPA Cancer Potency Factor
ATSDR MRL: ATSDR Minimal Risk Level

*** Immediate action level

Table 2
1,4-Dioxane in Residential Drinking Water Wells (mcg/L)

WELL ID	July/03	December/03		January/04	
	Pre GAC	Pre GAC	TAP	Pre GAC	TAP
1**					ND*
2**			5		11.1
3**					ND
6**					ND
16**			ND		
18**					ND
30**			ND		
37**			ND		
49**					ND
54**			ND		
60**			ND		
64**			ND		
GAC/RW-1	0.5J**		2.3		
GAC/RW-2	5		6		
GAC/RW-3	3.3		7		
GAC/RW-4	40.6	56	96	105 / 70	82 / 87
GAC/RW-5	1.3		ND		
GAC/RW-6		7	6.2		
GAC/RW-7	10.5		16		
GAC/RW-8			ND		
GAC/RW-9	12		7.8		
GAC/RW-10	2		13		
GAC/RW-11	1.7		7.8		
GAC/RW-12	<0.5***		4.6		
GAC/RW-13			4.5		
GAC/RW-14	1.6		17		
GAC/RW-15	10.2	6.7	6.8		
GAC/RW-16			9		
GAC/RW-17	0.4J		2.6		
GAC/RW-18			7.8		
GAC/RW-19			3.1		
GAC/RW-20			2.4		
GAC/RW-21			ND		
GAC/RW-22			17		
GAC/RW-23			1		
GAC/RW-24			7.6		
GAC/RW-25	<0.5		11		
GAC/RW-26			ND		
GAC/RW-27		7.6	10		
GAC/RW-28			1.3		
GAC/RW-29			20		
GAC/RW-30	0.6		Not Collected		
GAC/RW-31			11		
GAC/RW-32	10.6		24		
GAC/RW-33			1.1		
GAC/RW-34			13		
GAC/RW-35			11		
GAC/RW-36			9.1		
GAC/RW-37			1.8		
GAC/RW-38	0.9		4.1		

Table 2 (continued)
1,4-Dioxane in Residential Drinking Water Wells (mcg/L)

WELL ID	July/03	December/03	January/04		
	Pre GAC	Pre GAC	TAP	Pre GAC	TAP
GAC/RW-39			1.2		
GAC/RW-40			ND		
GAC/RW-41	14.2		ND		
GAC/RW-42			4.8		
GAC/RW-43			16		
GAC/RW-44			21		
GAC/RW-45			2.9		
GAC/RW-46			ND		
GAC/RW-47			11		
GAC/RW-48			24		
GAC/RW-49			ND		
GAC/RW-50			57	33J / 65J	45 / 52
GAC/RW-51			12		
GAC/RW-52			3.5		
GAC/RW-53			12		
GAC/RW-54			1.5		
GAC/RW-55			4.7		
GAC/RW-56			16		
GAC/RW-57			ND		
GAC/RW-58			15		
GAC/RW-59			ND		
GAC/RW-60			4.1		
GAC/RW-61			5.4		
GAC/RW-62			ND		
GAC/RW-63			5.3		
GAC/RW-64			4.6		
GAC/RW-65			ND		
GAC/RW-66			7.3		
GAC/RW-67			12		
GAC/RW-68			6.6		
GAC/RW-69			2.8		
GAC/RW-70			9.8		
GAC/RW-71			3.7		
GAC/RW-72	14.2		2.4		
GAC/RW-73	15.2	9	14		
GAC/RW-74			3.9		

* ND = None detected
** Sample taken outside of VOC contaminant plume
J = Contaminant is present, result is an estimated value
< = Less than minimum detectable value
Note 23 of the 86 wells sampled contained no detectable levels of 1,4-dioxane

Appendix B

NEW YORK STATE DEPARTMENT OF HEALTH PROCEDURES FOR EVALAUTING POTENTIAL HEALTH RISKS FOR CONTMAINANTS OF CONCERN

NEW YORK STATE DEPARTMENT OF HEALTH PROCEDURES FOR EVALAUTING POTENTIAL HEALTH RISKS FOR CONTAMINANTS OF CONCERN

Increased cancer risks were estimated by using site-specific information on exposure levels for the contaminant of concern and interpreting them using cancer potency estimates derived for that contaminant by the US EPA or, in some cases, by the NYS DOH. The following qualitative ranking of cancer risk estimates, developed by the NYS DOH, was then used to rank the risk from very low to very high. For example, if the qualitative descriptor was "low", then the excess lifetime cancer risk from that exposure is in the range of greater than one per million to less than one per ten thousand. Other qualitative descriptors are listed below:

Excess Lifetime Cancer Risk

Risk Ratio	Qualitative Descriptor
equal to or less than one per million	very low
greater than one per million to less than one per ten thousand	low
one per ten thousand to less than one per thousand	moderate
one per thousand to less than one per ten	high
equal to or greater than one per ten	very high

An estimated increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is a plausible upper bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to that contaminant.

There is insufficient knowledge of cancer mechanisms to decide if there exists a level of exposure to a cancer-causing agent below which there is no risk of getting cancer, namely, a threshold level. Therefore, every exposure, no matter how low, to a cancer-causing compound is assumed to be associated with some increased risk. As the dose of a carcinogen decreases, the chance of developing cancer decreases, but each exposure is accompanied by some increased risk.

There is general consensus among the scientific and regulatory communities on what level of estimated excess cancer risk is acceptable. An increased lifetime cancer risk of one in one million or less is generally not considered a significant public health concern.
For noncarcinogenic health risks, the contaminant intake was estimated using exposure assumptions for the site conditions. This dose was then compared to a risk reference dose

(estimated daily intake of a chemical that is likely to be without an appreciable risk of health effects) developed by the US EPA, ATSDR and/or NYS DOH. The resulting ratio was then compared to the following qualitative scale of health risk:

Qualitative Descriptions for
Noncarcinogenic Health Risks

Ratio of Estimated Contaminant Intake to Risk Reference Dose	Qualitative Descriptor
equal to or less than the risk reference dose	minimal
greater than one to five times the risk reference dose	low
greater than five to ten times the risk reference dose	moderate
greater than ten times the risk reference dose	high

Noncarcinogenic effects unlike carcinogenic effects are believed to have a threshold, that is, a dose below which adverse effects will not occur. As a result, the current practice is to identify, usually from animal toxicology experiments, a no-observed-effect-level (NOEL). This is the experimental exposure level in animals at which no adverse toxic effect is observed. The NOEL is then divided by an uncertainty factor to yield the risk reference dose. The uncertainty factor is a number which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the general human population. The magnitude of the uncertainty factor takes into consideration various factors such as sensitive subpopulations (for example, children or the elderly), extrapolation from animals to humans, and the incompleteness of available data. Thus, the risk reference dose is not expected to cause health effects because it is selected to be much lower than dosages that do not cause adverse health effects in laboratory animals.

The measure used to describe the potential for non-cancer health effects to occur in an individual is expressed as a ratio of estimated contaminant intake to the risk reference dose. A ratio equal to or less than one is generally not considered a significant public health concern. If exposure to the contaminant exceeds the risk reference dose, there may be concern for potential non-cancer health effects because the margin of protection is less than that afforded by the reference dose. As a rule, the greater the ratio of the estimated contaminant intake to the risk references dose, the greater the level of concern. This level of concern depends upon an evaluation of a number of factors such as the actual potential for exposure, background exposure, and the strength of the toxicologic data.

Appendix C

PUBLIC HEALTH HAZARD CATEGORIES

INTERIM PUBLIC HEALTH HAZARD CATEGORIES

CATEGORY / DEFINITION	DATA SUFFICIENCY	CRITERIA
A. Urgent Public Health Hazard This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.
B. Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.
C. Indeterminate Public Health Hazard This category is used for sites in which "*critical*" data are *insufficient* with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.	This determination represents a professional judgement that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.
D. No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.
E: No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future	

*Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data; monitoring and management plans.