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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

MAY 30 1995

CDR Austin Jones
Navy Environmental Health Center
2510 Walmer Avenue
Norfolk, Virginia 23513-2617

Dear Commander Jones:

We are writing to provide you with the Agency for Toxic Substances and Disease Registry's health consultation regarding the Naval Industrial Reserve Ordnance Plant (NIROP), Fridley, Minnesota. The health consultation was requested by Captain David Macys on February 2, 1995.

If you have any questions, please contact Ms. Vicki Smith at (404) 639-6016.

Sincerely yours,

Robert C. Williams, P.E., DEE
Director
Division of Health Assessment
and Consultation

Enclosure

cc:
Yvonne Walker, Navy Environmental Health Center
David Cabiness, SOUTHNAVFACENGCOM
John Flora, Fridley Public Works
Adam Kramer, Minneapolis Water Works Commissioner
Louise Fabinski, ATSDR Regional V Representative

Health Consultation

Naval Industrial Reserve Ordnance Plant
Fridley, Minnesota
May 18, 1995

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

STATEMENT OF ISSUES

Purpose

The Navy requested the Agency for Toxic Substances and Disease Registry (ATSDR) to determine the public health implications of two alternatives for the release of groundwater treated for volatile organic compounds (VOCs) at the Naval Industrial Reserve Ordnance Plant (NIROP), Fridley, Minnesota. The Navy asked the ATSDR to focus the evaluation on the VOC trichloroethene (TCE).

The Navy will construct a groundwater treatment plant on NIROP property in Fall 1995. The Navy has two options for discharge of the treated water. The first option is to provide the treated water to the City of Fridley for use in their municipal drinking water supply. The alternative is to discharge the treated water to the Mississippi River. In either scenario, the VOCs would not exceed their respective drinking water standards established by the Environmental Protection Agency (EPA). The EPA drinking water standard for TCE is 5 parts per billion (ppb).

Findings

The planned groundwater treatment system is reliable, effective, and expected to consistently meet EPA's drinking water standard for each VOC. No adverse health effects are expected to result from exposure to water containing chemicals at or below EPA's drinking water standards. Thus, the water will be safe to drink if it is released to the City of Fridley and no health impact is expected as a result of discharge to the Mississippi River.

BACKGROUND

Source of contamination

NIROP is an 82.61 acre plant where advanced naval weapons systems are designed and manufactured. As a result of past waste disposal practices, the groundwater at NIROP is contaminated with VOCs, including TCE. TCE contamination was first detected in one of three production wells at the plant in April 1981. Those wells were shut down and the plant started using City of Minneapolis water for potable purposes.[1] All uses of TCE at NIROP were discontinued in March 1987. The plant currently uses the City of Fridley's water for potable purposes.

Current groundwater treatment

In order to contain the contaminated groundwater to the NIROP facility a groundwater containment, recovery, and treatment alternative was agreed to by the Navy, the Minnesota Pollution Control Agency, and the EPA in a Record of Decision (ROD) signed September 1990. Currently, the groundwater is extracted by four wells (with an additional two wells planned for the summer of 1995) and discharged without treatment to a sanitary sewer owned by the Metropolitan Council Wastewater Services (MCWS). From system startup in 1992 until March 28, 1995, VOCs in the groundwater were removed by air stripping before discharge to the sewer.[2] Pretreatment is no longer necessary because TCE and other VOC concentrations in the extracted groundwater have decreased significantly and are currently below MCWS permit limits.[3,4] The permit discharge limit for any one toxic organic parameter is 3,000 ppb and 10,000 ppb for combined total toxic organic parameter concentrations.[4]

Proposed Treatment Plant

The Navy plans to construct a groundwater treatment plant on site later this year to provide long-term, cost effective groundwater treatment in lieu of paying the MCWS sewer discharge fee of $500,000 a year. The plant must be able to treat VOCs to the legally required permit limits. These limits are the same as EPA's drinking water standards or more stringent. The permit limit for TCE in water is 5 ppb, the maximum contaminant level (MCL) allowed by EPA. In order to ensure that the MCL is met the treatment plant will be designed to lower the concentration of TCE in the groundwater to 2-3 ppb. The plant will operate for 20-30 years to remediate the groundwater.

The Navy will treat the groundwater through two random packed media stripping towers with forced air counterflowing the wastewater stream. This is a stable and proven technology and will provide reliable, effective treatment to meet the permitted levels for the VOCs. Air stripping of TCE to EPA's drinking water standard assures adequate reduction of other VOCs of concern from the groundwater because they are all highly volatile based on Henry's law constant.[5,6] The possibility that the treatment system could break down and VOC concentrations above permit limits could be discharged from the system is extremely remote because of system reliability and planned routine monitoring. In addition, if the treatment system broke down or otherwise did not meet permit limits, the groundwater extraction system would be shut down and the treatment system repaired.

RELEASE OPTIONS

City of Fridley

The first option being considered by the Navy is for the City of Fridley to operate the groundwater treatment system and use the treated water in their municipal drinking water supply. TCE has been detected from 1-3 ppb in the City of Fridley's potable water supply.[7] Currently, they do not treat to remove TCE because the concentrations are below EPA's MCL. If they receive water from NIROP, it will enter their existing system. Blending of the Navy's water with the City of Fridley's main water supply is expected to be minimal because of hydraulic pressure and flow conditions in the city's system. Therefore, some residents' entire water supply may come from the NIROP plant.

The treatment plant will be designed to treat the groundwater to reduce the TCE concentration to 2-3 ppb. The City of Fridley would like the Navy's TCE concentrations to be non-detectable, or $\leq$0.5 ppb. However, reducing TCE to 0.5 ppb is expensive. The city does not want the additional expense of treating water to the desired 0.5 ppb concentration, so they would like the Navy to build the plant with the capability to treat TCE to 0.5 ppb at no additional expense to the city.[8] Negotiations are ongoing between the Navy and the City of Fridley.

Mississippi River

The second option is to discharge the treated water into the Mississippi River. The Navy has applied for a National Pollution Discharge Elimination System (NPDES) permit from the Minnesota Pollution Control Agency. The permit requirements are very strict, requiring VOCs to meet drinking water standards; thus, TCE concentrations again would be at 5 ppb or below when discharged. The VOCs to be tested monthly are listed in Attachment A.

Monthly grab samples will be analyzed for TCE and eight other VOCs to monitor the treatment process. This frequency should be adequate to detect any upward trend in TCE and other VOC levels. Complete VOC monitoring of the treated water by EPA methods will be required twice a year under the NPDES permit.[4] TCE levels are not expected to increase because the source of TCE has been removed and the TCE concentrations have been decreasing since extraction began. In addition, the chances of encountering "slugs" of highly concentrated TCE or other VOCs are remote. Isolated pockets of higher TCE concentrations might exist in the groundwater under certain conditions, but the groundwater would tend to slowly flush the TCE into the main groundwater flow at low concentrations, not in large "slugs".[9]

The City of Minneapolis has an intake for their municipal water treatment facility approximately 2000 feet downstream of NIROP's proposed discharge point on the same side of the river. The City of Minneapolis is required to meet federal drinking water standards for VOCs in their water supply, thus no one will be exposed to VOCs above drinking water standards. In addition, the City of Minneapolis should not detect any chemicals above drinking water standards from NIROP discharge at their intake because of dilution by the river.[10] The effluent discharged to the river will be diluted by a factor of approximately 1:5000 based on the average flow of the river. For low flow conditions, the dilution factor will be about 1:1550.[1]

Even if the City of Fridley accepts the treated groundwater, the Navy plans to have a NPDES permit for discharge to the Mississippi River as an alternative.[11]

PUBLIC HEALTH IMPLICATIONS

No adverse health effects are expected to result from exposure to water containing VOCs at or below EPA's drinking water standards. The groundwater treated at the proposed NIROP treatment plant will consistently meet the drinking water standards. Thus, the water will be safe to drink. Following is a toxicological discussion focusing on TCE.

Acute Exposure (< 14 days)

TCE concentrations would have to be approximately 10,000 times higher than 5 ppb for acute exposure to result in adverse health effects.[12] Thus, no adverse health effects are expected to result from acute exposure to 5 ppb.

Some people in the City of Fridley may have concerns about the treatment plant process failing and higher TCE concentrations going through the municipal water system. This is extremely unlikely. Even if this were to happen and people were exposed, the maximum TCE concentrations would probably not exceed the current groundwater concentrations of 3,000 ppb and exposure would be of short duration. Brief exposures to 3,000 ppb TCE are not expected to result in adverse health effects. The health impact would be even less if elevated TCE concentrations were released to the Mississippi River.

Intermediate exposure (< 1 year)

The estimated total daily exposure (ingestion, inhalation, and dermal contact) for children and adults from 5 ppb TCE is one thousand times less than the ATSDR health guideline for intermediate exposure. Thus, adverse noncancerous health effects are not expected to result from intermediate exposure to water containing 5 ppb TCE.

Chronic exposure (> 1 year):

Non-cancerous effects: The EPA's maximum contaminant level (MCL) of 5 ppb is considered protective of public health over a lifetime (70 years). Also, TCE concentrations known to cause adverse noncancerous health effects in humans after chronic exposure are several orders of magnitude higher than 5 ppb.[12] Thus, chronic exposures to 5 ppb TCE in water is not likely to result in adverse noncancerous health effects.

Cancerous effects: Using the EPA's cancer slope factor (CSF) and the daily estimated exposure to 5 ppb TCE (dose) for a period of 20-30 years, exposure would not result in an increased risk of cancer. The CSF allows a quantitative (numerical) assessment defining the relationship between the chemical dose and the risk of developing cancer to be calculated.

Even though the EPA has developed a CSF for TCE, it has not been conclusively demonstrated that TCE is a human carcinogen.[12,13] The EPA has classified TCE as a B2-C carcinogen, meaning that it is under consideration for placement into either the B2 (probable human carcinogen: inadequate human, sufficient animal studies) or the C (possible human carcinogen: no human, limited animal studies) category.[14] The National Toxicology Program does not consider TCE a carcinogen and the International Agency for Research on Cancer has determined that TCE is not classifiable as to human carcinogenicity.[12]

CONCLUSIONS

1. Water containing VOCs at or below the EPA's drinking water standards including 5 ppb TCE is safe to drink and no adverse health effects are expected, whether it is released to the City of Fridley's water supply or to the Mississippi River.

2. The planned groundwater treatment is reliable, effective, and expected to meet drinking water standards for VOCs.

3. The possibility of VOC concentrations higher than EPA's drinking water standards reaching residential water taps is extremely unlikely. However, if this happened adverse health effects would not be expected to result because the exposure would be of short duration and VOC concentrations are not expected to exceed current levels.

PREPARERS OF CONSULTATION

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2. Agency for Toxic Substances and Disease Registry. Record of Activity. Communication between David Cabiness, US Navy, and Vicki Smith and LF Bell, ATSDR. March 31, 1995.

3. RMT, Inc., Annual Monitoring Report for 1994 Groundwater Extraction and Pretreatment System. Naval Industrial Reserve Ordnance Plant. January 1995.

4. Metropolitan Council Wastewater Services, Industrial Discharge Permit No. 2154 for NIROP Fridley. August 26, 1992.

5. National Institute for Occupational Safety and Health. Pocket Guide to Chemical Hazards. Atlanta: US Department of Health and Human Services. Public Health Service. June 1994.

6. Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual. Lewis Publishers. 1992.

7. Department of the Navy. Navy Environmental Health Center. Letter from David A. Macys to Carol Aloisio, ATSDR. February 2, 1995.

8. Agency for Toxic Substances and Disease Registry. Record of Activity. Communication between John Flora, Fridley Public Works, and LF Bell, ATSDR. April 3, 1995.

9. Mehran M, Olsen R, and Rector B. 1987. Distribution Coefficient of trichloroethylene in soil-water systems. Ground Water 25:(3):275-282.

10. Agency for Toxic Substances and Disease Registry. Record of Activity. Communication between Adam Kramer, Minneapolis Water Works Commissioner, and LF Bell, ATSDR. April 28, 1995.

11. Agency for Toxic Substances and Disease Registry. Record of Activity. Communication between Caroline Voelkers, Minnesota Pollution Control Agency, and Vicki Smith. March 22, 1995.

12. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Trichloroethylene. Atlanta: US Department of Health & Human Services. Public Health Service. 1993.

13. Campos-Outcalt D. 1992. Trichloroethylene: environmental and occupational exposure. American Family Physician 46:(2):495-500.

14. IRIS. 1994. Integrated Risk Information System. Online Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati.

Attachment A

Monitored under the NPDES permit (twice a month):

	Permit limit (ppb)
trichloroethene (TCE)	5.0
methylene chloride	5.0
carbon disulfide	700.0
1,1-dichloroethene	6.0
1,1-dichloroethane	70.0
1,2-dichloroethene (cis)	70.0
1,2-dichloroethene (trans)	100.0
1,1,1-trichloroethane	200.0
tetrachloroethene (PCE)	3.8