

Letter Health Consultation

Public Health Implications of Inhalation of Manganese in

DOWNRIVER SOILS
RIVER ROUGE AND ECORSE, MICHIGAN

Prepared by:
Michigan Department of Community Health

DECEMBER 16, 2010

Prepared under a 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
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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STATE OF MICHIGAN
DEPARTMENT OF COMMUNITY HEALTH
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

JANET OLSZEWSKI
DIRECTOR

November 23, 2010

Steven Hoin, Project Manager
MDNRE Remediation Division
Southeast Michigan District Office
27700 Donald Court
Warren, MI 48092

Dear Mr. Hoin:

This letter is follow-up to the health consultation, "Public Health Implications of Inhalation of Manganese in Downriver Soils (Cities of River Rouge and Ecorse)," dated March 26, 2009, and prepared by the Michigan Department of Community Health (MDCH). The then Michigan Department of Environmental Quality (MDEQ), now the Michigan Department of Natural Resources and Environment (MDNRE), requested assistance in determining the level of public health threat posed by the inhalation of airborne manganese-contaminated soil. At that time, MDCH was unable to determine public health implications because the ambient air data were reported as Total Suspended Particulate (TSP) and not Particulate Matter less than 10 microns in aerodynamic diameter (PM₁₀). It was necessary to use PM₁₀ manganese data to compare to health-based screening levels, and MDCH recommended that the MDNRE Air Quality Division (AQD) collect PM₁₀ manganese data at the River Rouge air monitoring station (ATSDR 2009; MDCH 2007, 2010).

Since the beginning of 2009, AQD has collected manganese air samples, as PM₁₀, at the River Rouge air monitoring station. There were occasional excursions above the U.S. Environmental Protection Agency (EPA) Reference Concentration (RfC) of 0.05 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) (EPA 1993) and the Agency for Toxic Substances and Disease Registry (ATSDR) chronic Minimal Risk Level (MRL) of 0.04 $\mu\text{g}/\text{m}^3$. (Both the RfC and the MRL are health-based values.) The annual average, when calculated as the arithmetic mean, ranged from 0.020 to 0.028 $\mu\text{g}/\text{m}^3$. When the annual average was calculated for the 95% Upper Confidence Limit (95% UCL) of the mean, the range was 0.022 to 0.049 $\mu\text{g}/\text{m}^3$. These concentrations all fell below the RfC, which has been adopted as a State of Michigan regulatory value. However, the 95% UCL for four consecutive averaging periods was greater than the MRL, which is not a regulatory but an advisory value. Meteorological data and information regarding production levels at local steel manufacturers suggest that the increased ambient manganese may have been due to emissions from the steel mills and not from soil. **The ambient air concentration of manganese as PM₁₀, regardless of the source of manganese in the air, as measured in 2009 and the first half of 2010 at the River Rouge monitor and averaged on an annual basis, fell within acceptable health-based regulatory levels. Because the MRL exceedances were minor and have not continued, MDCH does not expect harm to public health.** More detailed discussion follows.

Background and Statements of Issues

Figure 1, attached, shows the area of interest: the cities of River Rouge and Ecorse, the U.S. Steel property, and the surrounding vicinity, including Dearborn, in Wayne County, Michigan. The then MDEQ received information from the city of River Rouge suggesting levels of manganese in the soil were greater than the applicable MDEQ Part 201 Particulate Soil Inhalation Criterion (PSIC) for that metal (ATSDR 2009). The PSIC addresses the emission and dispersion of contaminated soil particulates into the ambient air. The criterion identifies concentrations of hazardous substances in soil that, upon becoming airborne particulates, are not expected to impact ambient air at levels that may cause adverse human health effects (MDEQ 2007). MDEQ Remediation and Redevelopment Division (RRD) conducted further investigations and requested public health assistance from MDCH (ATSDR 2009).

The exposure route of concern at this site was inhalation of airborne manganese. MDCH requested historic air monitoring data from AQD. Although there were 15 years of ambient air monitoring data for manganese in River Rouge, the concentrations were all in TSP (ATSDR 2009). The RfC is based on PM10 concentrations of manganese (EPA 1993). TSP cannot be converted to PM10; direct sampling and analysis is necessary. MDCH requested that AQD perform PM10 sampling for manganese at the River Rouge station (MDCH 2007, 2010). This monitoring program began in January 2009 and is on-going as of the date of this letter (MDNRE 2010b). The map in Figure 1 shows the approximate location of the River Rouge air monitoring station. The monitor is located in a residential area less than one-half mile west of the U.S. Steel fenceline.

Discussion

Figure 2, attached, shows a graph of the air concentrations of PM10 manganese at the River Rouge monitor from January 25, 2009 to May 26, 2010 (the most recent available data) compared to the RfC. Air samples were taken every six days, according to the air monitoring protocol AQD follows. Eighty-two samples were taken. Concentrations ranged from 0.002 to 0.223 $\mu\text{g}/\text{m}^3$. Nine sample results were higher than the RfC.

MDNRE Air Quality Division uses an annual averaging time when evaluating ambient air concentrations of manganese (MDNRE 2010a). The annual average of the River Rouge data, when calculated as the arithmetic mean of 61 consecutive data points (365 days/year divided by a sample taken every 6 days equals about 61 samples/year), ranged from 0.020 to 0.028 $\mu\text{g}/\text{m}^3$. When the annual average was calculated for the 95% Upper Confidence Limit (95% UCL) of the mean of 61 consecutive data points, that range was 0.022 to 0.049 $\mu\text{g}/\text{m}^3$. (Statistics were calculated using ProUCL 4.0 software, available at <http://www.epa.gov/esd/tsc/software.htm>.)

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None of the annual averages exceeded the EPA RfC. However, four consecutive averaging periods, starting the period that began March 14, 2009, exceeded the ATSDR chronic MRL. (AQD calculates annual averages only on the calendar year and does not report the “moving” average [A. Robinson, MDNRE AQD, personal communication, 2010].) Following those four periods, the annual averages were below the MRL. The exceedances were minor and have not continued. Therefore, no public health harm is expected as a result. To ensure that public health is protected in the future, air monitoring for PM10 manganese should continue and corrective action should be enforced as necessary.

According to AQD’s Bernardo Sia, who oversees compliance at several sites in southeast Michigan, U.S. Steel, which has plants in River Rouge and Ecorse, was completely shut down for eight months in early 2009, returning to a “full cycle of production but at a reduced production rate” at about the beginning of October that year. Severstal, in Dearborn, had been operating at about 60% of their normal capacity earlier that year as well (B. Sia, MDNRE AQD, personal communication, 2009). (U.S. Steel and Severstal are two major point sources of manganese emissions in the downriver-Detroit area.) Most of the high-concentration (greater than the RfC) data points in Figure 2 occurred after October 2009, suggesting that they might be associated with emissions due to production activities. Amy Robinson, the AQD laboratory scientist who provided the data in Figure 2, studied the meteorological data collected during the monitoring in River Rouge. She noticed that, during the two highest concentration days (January 2, 2010 and February 25, 2010), the winds, which normally come from the southwest quadrant, were predominantly from the northwest quadrant, including north-by-northwest and west-by-northwest (A. Robinson, MDNRE AQD, personal communication, 2010). That quadrant contains Severstal, located in Dearborn. As mentioned in my earlier health consultation for this site, there are other possible sources of manganese emissions in the downriver-Detroit area that are contributing to airborne concentrations, besides U.S Steel, Severstal, and contaminated soil (see ATSDR 2009). It is my understanding that the AQD Manganese Workgroup is investigating manganese emissions in the downriver-Detroit area and determining appropriate regulatory action.

You had raised concerns that the air data represented more regional, than local, conditions because of the height of the air monitoring equipment. The equipment is situated on top of the trailer that houses the data-logging computer and other supplies. Thus, wind data and particulate matter samples were taken at a height of 20 and 15 feet, respectively (A. Robinson, MDNRE AQD, personal communication, 2010). While ground-level (breathing zone) data may provide a clearer picture of human exposure, the air monitoring protocol followed by AQD is an acceptable procedure used by regulatory and public health agencies.

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Conclusions

The ambient air concentration of PM10 manganese as measured in 2009 and the first half of 2010 at the River Rouge monitor and averaged on an annual basis, fell within acceptable health-based regulatory levels. Because the MRL exceedances were minor and have not continued, MDCH does not expect harm to public health. However, there may be regulatory issues still needing resolution for this site. Also, air monitoring must continue in this location to ensure continued compliance and protection of public health.

MDCH remains available for further consultation on this site if new information has the potential to change these public health conclusions.

Sincerely,

Christina Bush, Toxicologist
Toxicology and Response Section
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Bureau of Epidemiology

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Attachments

CC: Amy Robinson, MDNRE AQD

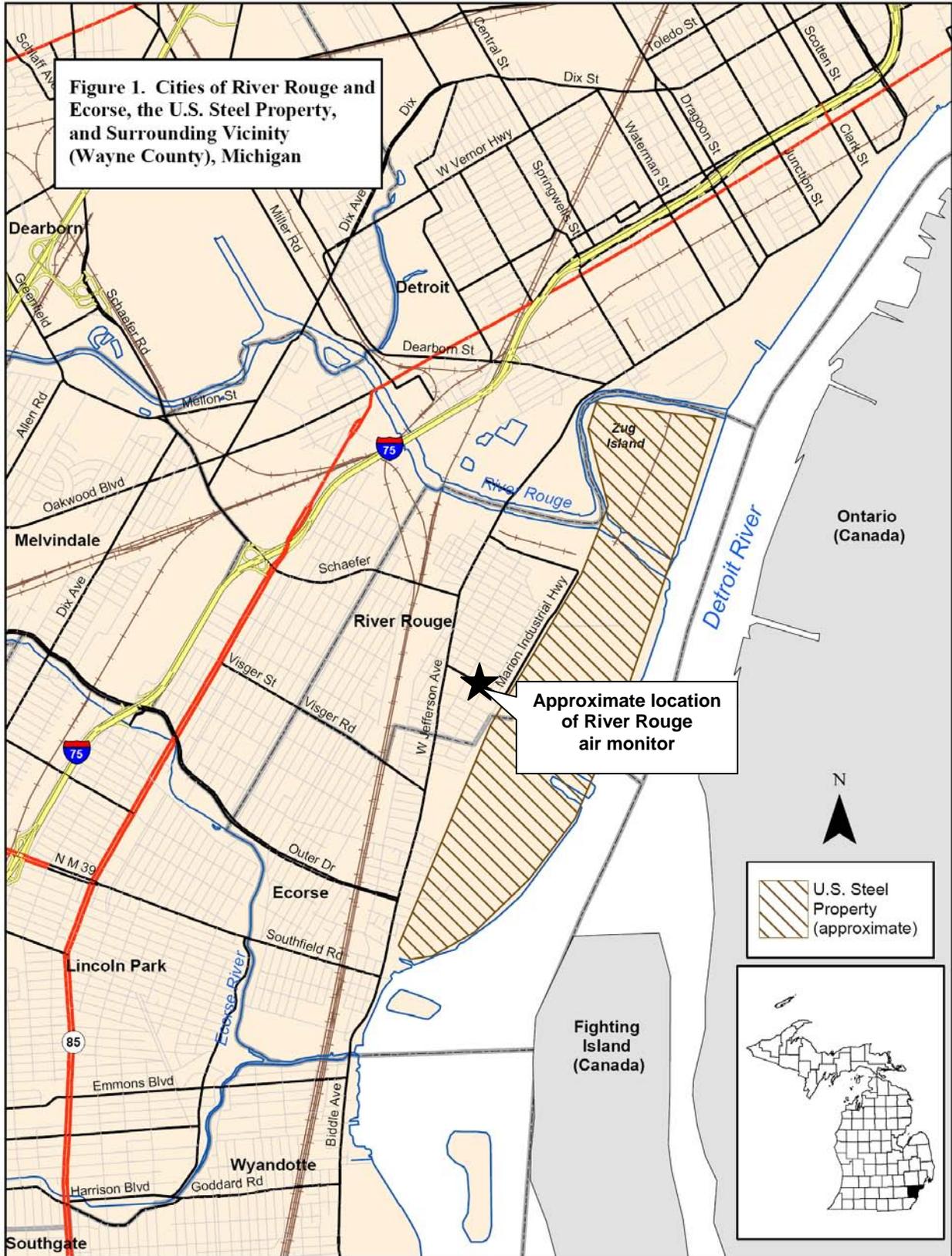
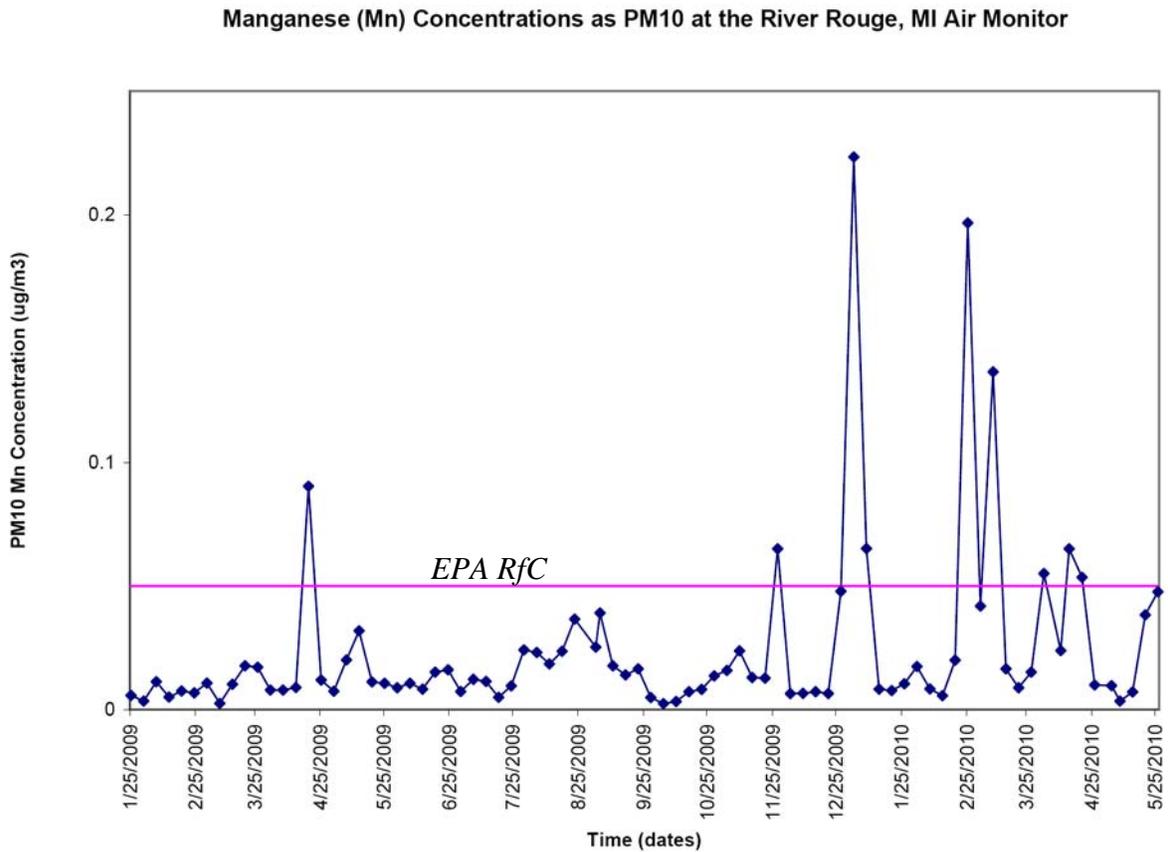


Figure 2. Ambient manganese (Mn) concentrations as Particulate Matter less than 10 microns in aerodynamic diameter (PM10), measured every six days at the air monitoring station in River Rouge (Wayne County), Michigan from January 25, 2009 to May 26, 2010, and compared to the U.S. Environmental Protection Agency (EPA) Reference Concentration (RfC) of 0.05 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Data and graph provided by Michigan Department of Natural Resources and Environment, Air Quality Division.



Calculation of Exposure Doses

On August 2, 2010, the Agency for Toxic Substances and Disease Registry (ATSDR) Division of Health Assessment and Consultation (DHAC) provided to its cooperative-partner states a Standard Operating Procedure regarding the inclusion of exposure dose calculations in public health assessment documents. Preparers of these documents are required to discuss how an expected exposure dose was calculated (the assumptions and site-specific data used) and the comparison to a health-based screening value, typically the ATSDR Minimal Risk Level (MRL) for the chemical of interest or its U.S. Environmental Protection Agency (EPA) Reference Dose (RfD) or Reference Concentration (RfC).

Screening values for oral exposures are expressed as milligrams per kilogram body weight per day (mg/kg/day) whereas inhalation exposures are expressed as micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). While it is necessary to convert soil and drinking-water concentrations to exposure doses for comparison to an MRL or RfD, air concentrations can be directly compared to the MRL or RfC. Therefore, no exposure-dose calculations are necessary when discussing inhalation-only exposures.

References:

Agency for Toxic Substances and Disease Registry (ATSDR). Health consultation concerning “Public Health Implications of Inhalation of Manganese in Downriver Soils (Cities of River Rouge and Ecorse), Wayne County, Michigan.” Atlanta: US Department of Health and Human Services; 2009 Mar 26.

http://www.atsdr.cdc.gov/HAC/pha/DownriverSoils/Downriver_SoilsHC3-26-2009.pdf

Michigan Department of Community Health (MDCH). Memorandum to Dr. Mary Ann Heindorf, Michigan Department of Environmental Quality (MDEQ) Air Quality Division, from Christina Bush, MDCH Division of Environmental Health, Toxicology and Response Section, concerning comments on MDEQ Air Quality Division Draft Report “Michigan Annual 2006 Ambient Air Monitoring Network Review” (July 17, 2007). Lansing, Michigan. August 17, 2007.

Michigan Department of Community Health (MDCH). Letter to Dr. Mary Ann Heindorf, Michigan Department of Natural Resources and Environment (MDNRE) Air Quality Division, from Christina Bush, MDCH Division of Environmental Health, Toxicology and Response Section, concerning comments on the MDNRE 2011 Ambient Air Monitoring Network Review (May 13, 2010). Lansing, Michigan. May 21, 2010.

Michigan Department of Environmental Quality (MDEQ). Remediation and Redevelopment Division Operational Memorandum No. 1: Technical Support Document – Attachment 7; Part 201 Generic Soil Inhalation Criteria for Ambient Air, Part 213 Tier I Soil Inhalation Risk-based Screening Levels for Ambient Air; 2007 July. http://www.michigan.gov/documents/deq/deq-rrd-Op_Memo1_Attach7-SoilInhalationCleanupCriteria-TSD_285498_7.pdf

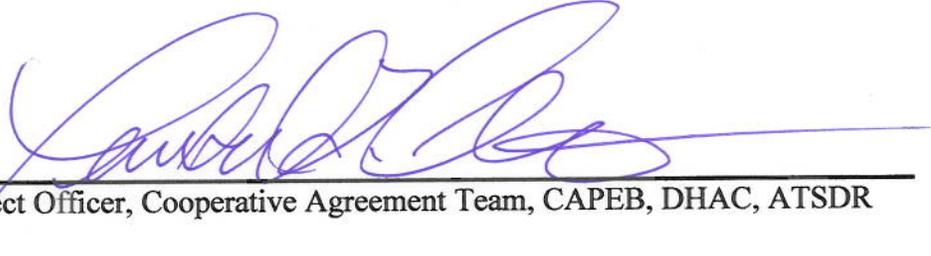
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U.S. Environmental Protection Agency (EPA). Integrated Risk Information System – Manganese (CASRN 7439-96-5): Reference Concentration for Chronic Inhalation Exposure (RfC). Last revised 12/1/1993. <http://www.epa.gov/ncea/iris/subst/0373.htm>

Certification

The Michigan Department of Community Health prepared this Letter Health Consultation, Downriver Soils (cities of River Rouge and Ecorse), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). At the time this Health Consultation was written, it was in accordance with the approved methodologies and procedures. Editorial review was completed by the Cooperative Agreement partner.



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

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



Team Leader, Cooperative Agreement Team, CAPEB, DHAC, ATSDR