

Letter Health Consultation

Manganese Emissions from

AMSTED RAIL COMPANY, INC.
(GRIFFIN WHEEL FACILITY)

KEOKUK, IOWA

**Prepared by the
Iowa Department of Public Health**

AUGUST 3, 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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Thomas Newton, MPP, REHS
Director

Chester J. Culver
Governor

Patty Judge
Lt. Governor

June 2, 2010

Brian Hutchins
Iowa Department of Natural Resources – Air Quality Bureau
7900 Hickman Road, Suite 1
Windsor Heights, IA 50324

RE: Health Consultation
Manganese Emissions from Amsted Rail Company, Inc. (Griffin Wheel) – Keokuk, Iowa

Dear Mr. Hutchins:

This letter has been prepared as a consultation to evaluate human health impacts from manganese emissions from the Amsted Rail Company, Inc. (Griffin Wheel) facility located in Keokuk, Iowa. We understand your concern and the concern of the Keokuk community, and want you to know that the Iowa Department of Public Health's priority is to ensure that you have the best information possible to safeguard the health of the citizens of Keokuk. That information is included in the following discussion.

Background and Statement of Issues

You contacted the Iowa Department of Public Health to request assistance in evaluating the results of air dispersion modeling that the Iowa Department of Natural Resources Air Quality Bureau plans to conduct at selected Iowa facilities. The air dispersion modeling being conducted across the state of Iowa is in response to concerns raised by USA Today news articles regarding toxic air emissions and their impacts on nearby schools. This health consultation evaluates the results of air dispersion modeling of hazardous air pollutant emissions from the Griffin Wheel facility in Keokuk, Iowa.

The Air Quality Bureau of the Iowa Department of Natural Resources uses AERMOD to model emissions from Iowa facilities. AERMOD is an air quality dispersion model preferred by the American Meteorological Society and the U. S. Environmental Protection Agency (EPA) (1). AERMOD requires the use of various data inputs to estimate ground-level concentrations of chemicals.

To model emissions from the Griffin Wheel facility, the Air Quality Bureau used site specific data that included:

- meteorological data from the last five years
- terrain data including the buildings and land use around the Griffin Wheel facility
- emission inventory data

The AERMOD air quality dispersion modeling provided estimates of the concentrations of substances at various distances from the source of the emissions (the Griffin Wheel facility). It included the estimated highest concentrations of lead during a rolling three-month time period and the highest concentration of manganese during a one-year time period for which comparison values are available.

Emission Rate Determination

The rates of emissions of lead and manganese from the Griffin Wheel facility were determined by an emissions inventory by staff of the Air Quality Bureau of the Iowa Department of Natural Resources and confirmed by staff of Griffin Wheel. Table 1, below, describes the rate of emissions of lead and manganese from the Griffin Wheel facility as determined by the Air Quality Bureau of the Iowa Department of Natural Resources.

Table 1 – Emission Rate of Lead and Manganese from Griffin Wheel (2)

Emission Point	Hazardous Air Pollutant	Emission Rate (lb/hr)
EP-1 (Pouring Emissions)	Lead	0.0023
	Manganese	0.0422
EP1A (Uncaptured EAF ¹ Emissions)	Lead	0.0034
	Manganese	0.0410
EP1B (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1C (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1D (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1E (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1F (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1G (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1H (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP1I (Uncaptured EAF Emissions)	Lead	0.0034
	Manganese	0.0913
EP3 (3 Electric Arc Furnaces)	Lead	0.0179
	Manganese	0.4540
EP4 (Pressurized Pouring Emissions)	Lead	0.0023
	Manganese	0.0422
EP5 (Cooling Emissions)	Lead	0.0057
	Manganese	0.0526

¹ EAF means Electric Arc Furnace

Dispersion Modeling of Ground-Level Concentrations of Hazardous Air Pollutants

The Air Quality Bureau of the Iowa Department of Natural Resources completed dispersion modeling of the emissions of lead and manganese (shown in Table 1) to determine the ground-level concentrations of lead and manganese in outside air. As previously discussed, the AERMOD modeling system was utilized to determine estimates of the estimated highest concentrations of lead during a rolling three-month time period and the highest concentration of manganese during a one-year time period. Table 2 shows the maximum modeled concentrations of lead and manganese from emission sources at the Griffin Wheel facility for these given time periods. The maximum modeled concentrations of lead and manganese are located near the sources of emissions along the east portion of the property line of the Griffin Wheel facility. Exposed populations are located in areas where the modeled concentration is less than this maximum value.

Table 2 – Maximum Modeled Concentration of Lead and Manganese (2)

Hazardous Air Pollutant	Modeled Time Period	Concentration ($\mu\text{g}/\text{m}^3$) *
Lead	3-Month Rolling Average	0.091
Manganese	1-Year Average	0.35

* $\mu\text{g}/\text{m}^3$ is micrograms per cubic meter

Discussion – Exposure to Lead and Manganese within Outside Air

A comparison can be made between the modeled levels of lead and manganese in the outside air to levels of lead and manganese that are known to have the potential to cause adverse health impacts in individuals. The Agency of Toxic Substances and Disease Registry (ATSDR) and the EPA has determined and published a set of comparison values for substances that may be found in air, water and soil. Comparison values (environmental guidelines) are measures of substance concentrations that are set well below levels that are known or anticipated to result in adverse health effects. Comparison values are determined from studies from known actual human exposures and from studies completed on laboratory animals. Table 3, on the following page, lists the comparison values for those hazardous air pollutants that were modeled in the vicinity of the Griffin Wheel facility.

Table 3 – Comparison Values for Lead and Manganese

Hazardous Air Pollutant	Comparison Value ($\mu\text{g}/\text{m}^3$)	Exposure Frequency
Lead	0.15	3 Month Average
Manganese	0.05	Chronic

The comparison value for lead shown in Table 3 is the primary National Ambient Air Quality Standard set by the EPA, and is a rolling 3-month average (3). The comparison value for manganese shown in Table 3 is the EPA Reference Concentration for chronic inhalation exposure (4).

As you can see by comparing the values in Table 2 and Table 3, the levels of the modeled concentration of lead in the vicinity of the Griffin Wheel facility is below the comparison value of $0.15 \mu\text{g}/\text{m}^3$. Since the modeled level of lead in the vicinity of the Griffin Wheel facility is below the comparison value it can be assumed that public health will not be adversely impacted by this modeled level of lead in the outside air. But the modeled concentration of manganese is above the comparison value of $0.05 \mu\text{g}/\text{m}^3$. Since the modeled concentration of manganese in the vicinity of the Griffin Wheel facility is above the EPA Reference Concentration it is necessary to look more closely at how this comparison value was developed and the health significance of the modeled level of manganese in the area near Griffin Wheel.

Development of EPA Reference Concentration for Manganese

The EPA develops the Reference Concentration by looking at health studies where health effects have been seen. Then EPA applies safety factors to come up with a level that they determine to be safe for even the most sensitive individuals who would breathe in manganese over an entire lifetime. To determine the Reference Concentration for manganese, EPA used the results of a health study on workers exposed over many years. The study showed a decrease in visual reaction times when workers were exposed to manganese at a level of $50 \mu\text{g}/\text{m}^3$. EPA then applied a safety factor of 1,000 to determine the Reference Concentration of $0.05 \mu\text{g}/\text{m}^3$.

Health Impacts from Exposure to Manganese

The Toxicological Profile for Manganese (5) prepared by ATSDR provides information about studies completed on individuals exposed to manganese. These studies look at various levels of exposure to manganese, including exposure to high levels where the health effects are severe, and exposure to very low levels of manganese where no adverse health effects were observed.

According to these studies, the greatest potential for adverse health effects is for workers in the steel industry who are exposed to high concentrations of manganese in the air. The health effects observed from exposure to high levels of manganese include behavioral changes and other central nervous system effects, which include muscle movements that may become slow and clumsy. When severe, this group of symptoms is called “manganism.” The impacts to individuals exposed to high concentrations of manganese typically do not become apparent until exposure has occurred for several years. Studies

show that workers who were routinely exposed to manganese levels between 2,000 and 22,000 $\mu\text{g}/\text{m}^3$ developed symptoms of manganism.

At lower concentrations of manganese found in the workplace, other less severe nervous system effects have been observed in some workers. Symptoms associated with lower concentrations include slow hand movements. The lowest documented manganese level that produced adverse health impacts was found in a study of adult workers. These workers experienced decreased motor movement when exposed to manganese at a level of 32 $\mu\text{g}/\text{m}^3$ for an average of 16.7 years.

The following table summarizes the various levels manganese within air and the health implications for those levels.

Table 4 – Health Implications of Manganese in Air

Level of Manganese ($\mu\text{g}/\text{m}^3$)	Health Implications
0.05	EPA Reference Concentration – Certainty of no adverse health impacts including most sensitive individuals
0.35	Highest modeled concentration of manganese – located near Griffin Wheel facility
32	Decrease in motor function ability in exposed workers
50	Decrease in visual reaction times in exposed workers
2,000	Health effects associated with “Manganism”

The highest concentration of manganese modeled in the vicinity of the Griffin Wheel facility (0.35 $\mu\text{g}/\text{m}^3$) is below levels of exposure where adverse health effects have been seen in workers. However, it is at a level above the EPA Reference Concentration for manganese.

Conclusions

The Iowa Department of Public Health concludes that exposure to the modeled levels of lead and manganese emitted from the Griffin Wheel facility and present in the outside air is not expected to harm the health of people living in Keokuk, Iowa. The modeled level of exposure to these chemicals is below the lowest levels that are known to impact human health.

Recommendations

At this time, the Iowa Department of Public Health is not overly concerned about the modeled level of lead or manganese adversely impacting the health of the Keokuk community. Nevertheless, we do recognize that additional information regarding manganese is needed in order to safeguard the health of the Keokuk community and confirm the modeling efforts by the Iowa Department of Natural Resources.

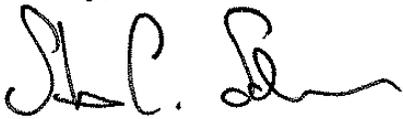
There are some limitations in using AERMOD, as with as dispersion models, in that the range of variation between predicted and observed concentrations can be as much as +/- 50 percent. There is also some uncertainty in the calculated emissions rates. Therefore, the Iowa Department of Public Health recommends that the Iowa DNR conducts ambient air monitoring for manganese in the vicinity of the Griffin Wheel facility located in Keokuk, Iowa to better determine actual concentrations of manganese in ambient air.

References

1. U.S Environmental Protection Agency web site:
http://www.epa.gov/ttn/scram/dispersion_prefrec.htm
2. Griffin Wheel Lead and Manganese Emissions Modeling, Iowa Department of Natural Resources – Air Quality Bureau, December 2009.
3. U.S. Environmental Protection Agency web site: <http://www.epa.gov/air/lead/standards.html>
4. U.S. Environmental Protection Agency Integrated Risk Information System web site:
<http://www.epa.gov/ncea/iris/subst/0373.htm#refinhal>
5. Toxicological Profile for Manganese, Agency for Toxic Substances and Disease Registry web site:
<http://www.atsdr.cdc.gov/toxprofiles/tp151.html>

If you have any questions regarding the information in this letter, please contact me at (515) 281-8707 or by email at sschmitz@idph.state.ia.us.

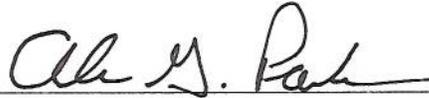
Sincerely,



Stuart C. Schmitz, M.S., P.E.
Principal Investigator / Environmental Toxicologist
Hazardous Waste Site Health Assessment Program

CERTIFICATION

The Iowa Department of Public Health, Hazardous Waste Site Health Assessment Program, has prepared this letter health consultation evaluating human health impacts from the exposure to modeled levels of lead and manganese in ambient air generated by Griffin Wheel in Keokuk, Iowa under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This document is in accordance with approved methodology and procedures existing when the health consultation was prepared. The editorial review of this document was completed by the cooperative agreement partner.



Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation has reviewed this health consultation and concurs with its findings.



Team Lead, CAT, CAPEB, DHAC, ATSDR