Health Consultation

AMERY-DRESSER TRAIL

AMERY, POLK COUNTY, WISCONSIN

JANUARY 23, 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

AMERY-DRESSER TRAIL

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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

Summary
The Amery-Dresser trail, a former railroad corridor under proposal for conversion to an all-terrain vehicle (ATV) trail, was assessed by the Wisconsin Department of Health and Family Services (DHFS) for soil contaminants that might pose a health hazard if dispersed as dust. Although soils contaminated with arsenic were not observed in initial tests of surface soils in the Amery-Dresser corridor, dust exposure to users and neighbors of the proposed Amery-Dresser trail is an *indeterminate health hazard* due to incomplete information about those contaminants that might be found in surface and subsurface soil. DHFS recommends that additional tests sample soil 0.5-3 feet below the surface for the presence of metals, pesticides, and hydrocarbons. DHFS recommends that the trail should be regularly maintained and that dust suppressants be applied to avoid the dispersion of subsurface soils.

Background and Statement of Issues
The Wisconsin Department of Health and Family Services (DHFS) was asked, via a citizen request to ATSDR, to assess health risks from soil dust that would result from ATV use on a former railroad corridor in Polk County, Wisconsin. The trail has been planned for about 13.5 miles of railroad corridor from the city of Amery on the eastern end to Lotus Lake in the township of Osceola on the western end (Wilson 2002).

The conversion of abandoned railroads to recreational trails in the United States began in the Midwest in the mid-1960s; the movement continues to grow today (TrailDart, 2004). Most of these projects were developed with the intent to promote non-motorized recreation, although some trails allow winter use by snowmobiles. In recent years, some trails have been developed for use by wheeled ATVs.

Public Health Issues. The soils of railroad corridors are frequently contaminated with herbicide residues and tars and oils applied to rail ties. Rail corridors may also contain former storage tanks sites and various contaminants remaining on industrial sites served by the railroad. However, contaminants in railroad beds may also be covered by successive layers of gravel fill placed during maintenance of the railroad. A concern in converting rail corridors to recreational use is the possibility for exposure of the public to harmful substances remaining in soil. Where trails are “capped” with asphalt or crushed gravel and bordered by vegetation, the exposure potential is greatly lessened, even if contaminants remain beneath the cap. However, if the trail is not capped, or if trail use creates excessive soil erosion and dust dispersal, then the possibility for exposure is increased.

The use of vehicles, including ATVs, on unpaved roads and trails can be expected to create plumes of soil dust. The amount of dust created varies with vehicle weight and speed (Etyemezian *et al.* 2003; Kuhns *et al.* 2002), trail substrate, and atmospheric conditions. Users of the trail will be exposed to soil by direct contact to skin, by swallowing dust captured in mucous of the nasopharynx, and by inhalation of soil dust into the lungs. Some neighbors of the trail may be similarly exposed to soil dust. Neighbors of the trail might also ingest soil dust deposited from air onto garden vegetables, although no adjacent gardens were identified during the site visit or from

aerial photographs. The purpose of this health consultation is to estimate the amount of dust that users and neighbors of the trail may be exposed, and to determine whether the dust contains chemical contaminants at levels that would present a public health concern.

Exposure Estimate

Affected population. Users of the trail will be the group most exposed to airborne trail dust. Neighbors of the trail would also be affected to a degree dictated by distance from the trail, the amount of dust created at any particular location, and daily conditions such as wind and rain. Based upon aerial photographs taken in 2001 of the project corridor (Wilson 2002), most of the trail traverses rural farms, forest, and wetlands. There are scattered pockets of population along the trail, with approximately 35 homes and businesses open to the public lying within 200 feet of the trail center. Ten of these are in Amery, including a school. Within 300 feet of the trail center, there are approximately 95 homes and businesses. Twenty seven of those are in Amery. From this interpretation of the aerial photos, the affected population within 300 feet of the trail is estimated to be between 100 and 500, including the school in Amery.

Soil contaminants. Soil from 0-6 inches below the surface were sampled at three locations along the railroad corridor (Figure 1) in order to determine whether the soil contains sufficient chemical contaminants to present a public health concern. The soil was analyzed at the Wisconsin State Laboratory of Hygiene for lead, arsenic, and chromium (Table 1). Hydrocarbons were not analyzed, since the soils were weathered and contained no obvious stains or odors indicative of tars or oils. In each case, arsenic and chromium were present at concentrations no higher than what is usually present in native Wisconsin soil. However, in one sample, taken 60 feet from the trail bed (Figure 1, Table 1), lead was found at a concentration (479 mg/kg) exceeding EPA (1998) recommendations for residential soil. The EPA recommendation, 400 mg/kg, is based on an exposure scenario of incidental ingestion of soil that children play in frequently.

Inhalation exposure. The potential for health problems from inhaling dust along the trail is determined largely by the amount of dust in air and the concentration of toxic contaminants in that dust. The few soil samples reported here represent a preliminary characterization of contaminants along the trail. DHFS has recommended that DNR undertake a more complete characterization of trail soils before it is opened to the public.

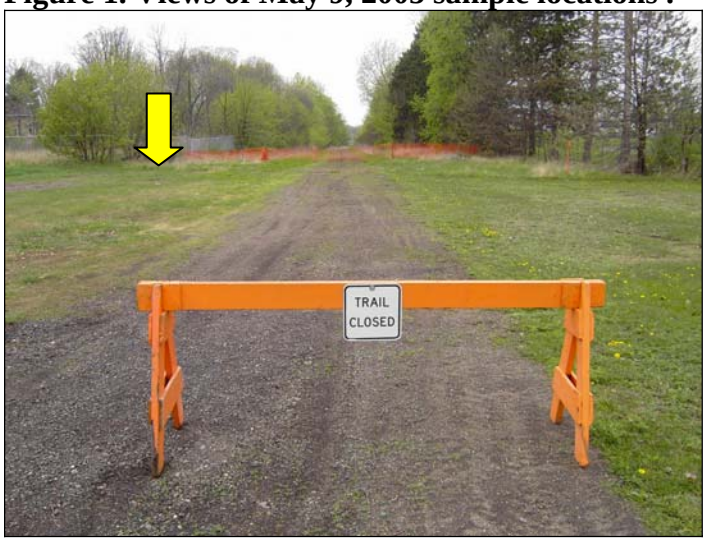
Since the trail is not yet open, the amount of dust created by vehicle use on the trail can only be estimated from studies done elsewhere. Studies of dust created by vehicles on unpaved roads (Etyemezian *et al.* 2003) suggest that dust concentrations in the 10-micron (PM_{10}) "inhalable" particle range could be as high as 0.5-1.0 mg/m^3. An empirical multiplier of 0.15 (Cowherd and Kuykendal 1996) can be used to infer that 0.075-0.15 mg/m^3 of the PM_{10} dust is less than $PM_{2.5}$. The $PM_{2.5}$ dust is the "respirable fraction" that can be expected to be inhaled deep into the lungs. Exposure to 1 mg/m^3 PM_{10} over the course of three hours of trail use (see appendix I) leads to an estimated 6.3 mg exposure to adults and 9.6 mg exposure to a 10 year old, which is roughly twice the estimated exposure predicted from 24 hours of exposure to air polluted at the PM_{10} National Ambient Air Quality Standard.

Those expected to be most exposed to vehicle-generated soil dust are vehicle operators, especially if following another vehicle, as well as people walking along or residing adjacent to the trail. The risk from exposure cannot be determined at this time because more information is needed about the soils on the trail. In the absence of contaminants of concern, the effects of exposure to dust along the trail are assumed to be similar to mineral dusts from unpaved roads.

Table 1. Analysis for metals in soil, Amery-Dresser Trail, Polk County Wisconsin. Samples collected May 9, 2005

Location	Field identifier	Arsenic (total) mg/kg	Lead (total) mg/kg	Chromium (total) mg/kg
Amery terminus, 60' north of trail[1]	1-1	5	479	16.9
Amery terminus, 30' north of trail	1-2	nd	83	13.7
Amery terminus, center of trail	1-3	nd	14	12.5
Amery terminus, 30' south of trail	1-4	nd	16.2	157
Amery terminus, 60' south of trail	1-5	nd	23	19.5
Trail center, 75 yd. north of Co. Rd. C	2-1	nd	8	12.1
Trail center, 180 yds. south of Co. Rd. C	2-2	nd	7	13.9
Dresser terminus, trail center, 150 yd. east of hwy.	3-1	nd	9	15.8
Dresser terminus, trail center, 30 yd. east of 90th Ave.	3-2	nd	4	27.6

Figure 1. Views of May 9, 2005 sample locations .



Sample site 1 at eastern terminus of the trail in Amery. Arrow shows where elevated lead was found.

Sample site 2 along near intersection with Polk County Road C.

Sample site 3 at the western terminus of the trail at 90th Ave. near Lotus Lake in Town of Dresser, showing proximity of new residential development.

Discussion

The information available at this time does not identify any health hazard from soil contaminants to trail users, but more information is needed to exclude the possibility of arsenic contamination in deeper soil in the trail corridor. Because the results reported here cover only surface soil at only three locations, they should be considered preliminary.

The one sample location where lead was detected was in a vegetation-covered area just outside of the trail corridor, on the edge of a soil and gravel parking lot. This may have been a former building site. The specific location would probably not be eroded by ATV use on the adjacent trail, but does illustrate the need for a more complete environmental assessment of the trail corridor.

At many former railroad corridors, arsenic is a primary chemical of concern (e.g. ATSDR, 2003; FST, 2005). The exposure risks calculated here indicate that total arsenic concentrations less than 1200 mg/kg soil are acceptable when considering inhaled soil dust. Arsenic concentrations in the surface soils analyzed for this report were ≤ 5 mg/kg, which is not an uncommon background concentration in Wisconsin. However, if sustained use by ATVs is planned for this trail, then soils 0.5-3 feet below surface should be analyzed for arsenic and other metals in order to exclude the potential for exposure to soils that can be uncovered by vehicle erosion. In addition, a regular program of trail maintenance should include some method of dust suppression.

Although chemical hazards have not been detected in surface soils of the Amery-Dresser trail, exposure to respirable particulate matter (PM_{10}) by trail users may exceed the National Ambient Air Quality Standard (NAAQS) for particles in air. The NAAQS PM_{10} 24-hour standard is 0.150 mg/m^3. There is no standard particulate dose corresponding to this air quality standard, but an estimate (Table 2) based on a time budget of varying inhalation rates over the course of a day is 3.8 mg/day for adults and 4.4 mg/day for a 10 year old. As described above, exposure to 1 mg/m^3 PM_{10} over the course of three hours of trail use leads to an estimated 6.3 mg exposure to adults and 9.6 mg exposure to the 10 year old, roughly twice the estimated exposure predicted from 24 hours of exposure to air polluted at the PM_{10} NAAQS. General public health messages for ATV trail users would be to minimize the duration of exposure during dusty conditions and to use a dust mask as needed. ATV products to protect engines and suspension systems from dust damage are heavily marketed. Relatively few products, such as helmets with dust filters, are marketed to similarly protect lungs.

Neighbors of the trail would be secondarily affected by dust created by vehicle use. The exposure to dust would be less than that of trail users, due both to distance from the trail and the lesser frequency of dust created by passing vehicles compared to driving behind a vehicle. The lack of identified chemical hazard described above also applies to trail neighbors, although this conclusion could change with new information. The main effect of ATV use on neighbors of the trail would be intermittent nuisance noise and dust.

Child health statement
As discussed above, the volume of air inhaled by active children is greater than that inhaled by adults. Children also ingest more soil than adults. Both of these statements, combined with the lower weight of children, translate to higher levels of exposure to children than to adults of dust created by ATV use on railroad corridors.

Conclusions

- Although soils contaminated with arsenic were not observed in initial tests of surface soils in the Amery-Dresser corridor, dust exposure to users and neighbors of the proposed Amery-Dresser trail is an *indeterminate health hazard* due to incomplete information about those contaminants that might be found in surface and subsurface soil.

Recommendations

- Characterize the trail soil 0.5-3 feet below the surface for the presence of metals, pesticides, and hydrocarbons.
- The trail should be regularly maintained to minimize the creation of dusty conditions, and to avoid the dispersion of subsurface soils.
- DHFS recommends that ATV users practice trail etiquette that minimizes the creation of dust, especially when passing residences, businesses, public parks, and non-motorized trail users. Based on exposure estimates included in this report, ATV users in general should also consider filter masks under very dusty conditions, particularly for children.

Public Health Action Plan

- The WDNR will conduct a phase II environmental investigation of the Amery-Dresser corridor prior to opening the trail to ATV use.
- The WDNR, in cooperation with DHFS, has agreed to analyze soil samples to better represent the entire length of the Amery-Dresser corridor.
- If the trail is opened to ATV use, it will be regularly maintained by the Polk County Parks Department, with funding from the WDNR.

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Appendix I. Estimate of exposure to vehicle-generated soil dust to users of ATVs on an unpaved road or trail.

This hypothetical scenario for exposure to arsenic in road dust considers soil with 5 mg/kg arsenic (As), which is similar to naturally-occurring As levels in many parts of Wisconsin. The scenario also assumes a sustained level of very dusty conditions (1 mg/ m^3, PM_{10}) generated by vehicle use, and an adult and child exposed to those dusts for three continuous hours. The scenario assumes that larger dust particles are captured in the upper respiratory tract and swallowed, while fine dust particles are respired deep into the lungs (Derelanko and Hollinger 2002). Exposure to inhaled As was calculated under these conditions, and the calculated exposures were compared to EPA and ATSDR health-based table values. The results of the exposure estimate, shown in the table below, suggest that the swallowed dust does not contain enough As to be harmful. In contrast, the concentration of As in the respired dust slightly exceeded the ATSDR cancer media evaluation guide (CMEG) value for lifetime inhalation exposure to As. Exceeding this concentration is not an immediate indication that people will get sick from these exposures, but rather that further study may be warranted and that efforts may be needed to limit exposures. In the case of inhaled As, the CMEG is based largely on health effects to workers exposed to As aerosols around metal smelters (ATSDR 2005). The chemical and physical form of As in the smelter studies does not necessarily correspond toxicologically to the method of dispersion, the concentration, and the duration of exposure presented in this exposure scenario. However, it does support the position that exposure to As in soils should be limited where possible and that dust dispersion from vehicle use should be controlled with proper trail maintenance.

Estimation of $PM_{2.5}$ in PM_{10}. Most studies of fugitive road dust created by vehicle use have focused solely on the PM_{10} fraction. Measurements of $PM_{2.5}$ have problems with interference with vehicle exhaust, making it difficult to differentiate between fine particulates from various sources. A few studies have attempted to quantitatively estimate the $PM_{2.5}$ fraction in fugitive dust. For this estimate of dust exposure from ATV use, an EPA-recommended multiplier of 0.15 is used to infer $PM_{2.5}$ from PM_{10} concentrations (Cowherd and Kuykendal 1996). For example, if the measured PM_{10} concentration is 1.0 mg/m^3, the inferred PM_{10}-$PM_{2.5}$ fraction is 0.85 mg/m^3 and the $<PM_{2.5}$ fraction is 0.15 mg/m^3.

The following approach was used in calculating exposure to dust and secondary exposure to arsenic.

Dust exposure = (amount of dust impacted into upper respiratory tract and swallowed) + (amount of dust respired into lungs)

amount of dust impacted into upper respiratory tract and swallowed = (concentration of PM10 in air) x (0.85 correction for $PM_{2.5}$- PM_{10} fraction) x (daily or hourly volume of inhaled air)

amount of dust respired = (concentration of PM_{10} in air) x (0.15 correction for < $PM_{2.5}$ fraction) x (daily or hourly volume of inhaled air)

Respiratory parameters for exposure to atmospheric particulates estimated from daily activity levels and inhalation volumes.**

Activity level	Inhalation rate (m^3/hour)		Hours per day at each inhalation rate	Particulates inhaled at each interval*	
	Adult	Child		Adult	Child
Resting	0.5	0.4	8	0.6	0.48
Light	0.6	1.0	12	1.08	1.80
Moderate	3.9	3.2	3	1.76	1.44
Heavy	2.1	4.2	1	0.32	0.63
Total PM_{10} inhaled				3.76	4.35

Adapted from Derelanko MJ, Hollinger MA (*eds.).* 2002. *Handbook of Toxicology, 2nd ed.* CRC Press.
*PM_{10} concentration = 0.150 mg/m^3
**Total daily PM_{10} at 0.150 mg/m^3 compared to 3 hours at 1.0 mg/ m^3:
Child: 1.0 mg PM_{10}/m^3 x 3.2 m^3air/hr x 3hr/day = 9.6 mg
Adult: 1.0 mg PM_{10}/m^3 x 2.1 m^3air/hr x 3hr/day = 6.3 mg

An adult (mean average, male and female) engaged in moderate activity such as ATV driving or light outdoor work inhales an average 2.1 m^3/hr (Derelanko and Hollinger, 2002). A 10 year old child under similar conditions has an average inhalation rate of 3.2 m^3/hr. Assume exposure occurs in three hour increments to ATV users, and two hour increments to neighbors. Maximum exposure occurs two days per week, three months per year. For the purpose of this exposure estimate, it is assumed that when ATVs are in operation, 10-micron particles (PM_{10}) are suspended in the air around the trail at a concentration of 0.5-1.0 mg/m^3. This concentration is based upon studies of dust created by vehicles on dirt roads (Etyemezian *et al.* 2003). It is expected that particles in the 10-micron range will lodge in the nasopharynx and are eventually swallowed or expectorated, but that particles in the $PM_{2.5}$ range are respired. Therefore using the 0.15 mg/m^3 conversion estimate for $PM_{2.5}$, and assuming that the PM_{10} fraction is impacted and swallowed,

The calculated exposure to dust, rounded to milligrams, for a 10 year old child is:

0.5 to 1.0 mg PM_{10}/m^3 x 3.2 m^3air/hr x 3hr/day x 1 or 2d/week x 12 wk/yr = 57.6 to 230.4 mg/yr.
or 0.5 to 1.0 mg PM_{10}/m^3 x 3.2 m^3air/hr x 3hr/day = 4.8 to 9.6 mg/d

of which 49-156 mg/year are swallowed, and 9-35 mg/year are inhaled.
(or 4-8 mg/day swallowed, 0.7-1.4 inhaled)

The calculated exposure to dust for an average adult is:

0.5 to 1.0 mg PM_{10}/m^3 x 2.1 m^3air/hr x 3hr/day x 1 or 2d/week x 12 wk/yr = 37.8 to 151.2 mg/yr
or 0.5 to 1.0 mg PM_{10}/m^3 x 2.1 m^3air/hr x 3hr/day = 3.2 to 6.3 mg/d

of which 32-129 mg/year are swallowed, and 6-23 mg/year are inhaled.
(or 3-5 mg/day swallowed, 0.5-1 mg/d inhaled)

The reference dose (RfD) for lifetime oral exposure to arsenic is 3.0×10^{-4} mg/kg/d (EPA 2005). This converts to 0.011 mg/d for a 36 kg child and 0.021 mg/d for a 70 kg adult.

Summary of exposure estimate if inhaled 1 mg/m^3 road dust containing 5 mg/kg arsenic.

Dust exposure Where dust is 1.0 mg/m^3	Corresponding respired As exposure if As = 5 mg/kg in soil	Max As soil conc. to fall under inhaled RfC	CV for inhaled As ATSDR CREG	Corresponding oral As exposure if As = 5 mg/kg	Max As soil conc. to fall under oral RfC	CV for oral As exposure, calculated from EPA oral RfC
Child oral exposure 8.2 mg/d	na	na	na	0.041µg/d		11.0µg/d
Child respired exposure 1.4 mg/d	0.007 µg/d Or 0.075 $\mu g/m^3$		0.0019µg/d or 0.0002 $\mu g/m^3$	na	na	na
Adult oral exposure 5.3 mg /d	na	na	na	0.027 µg/d		21 µg/d
Adult respired exposure 1.0mg/d	.005 µg/d Or 0.075 $\mu g/m^3$		0.0013 µg/d or 0.0002 $\mu g/m^3$	na	na	na

Certification

This Health Consultation on the Amery-Dresser Trail 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.

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

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