



Marianenette Miller-Meeks, B.S.N., M.Ed., M.D.  
Director

Terry E. Branstad  
Governor

Kim Reynolds  
Lt. Governor

December 9, 2011

Amber Wolf  
Iowa Department of Natural Resources – Field Office 3  
Gateway North Mall, Suite E17  
Spencer, IA 51301

RE: Health Consultation  
Exposure to Fluff Material from Shine Brothers and Noise Concerns – Spencer, Iowa

Dear Ms. Wolf:

This letter has been prepared as a consultation to determine some potential health concerns raised by a resident of Spencer from exposure to wire shredder fluff material emitted by Shine Brothers metal salvaging facility in Spencer, Iowa on July 10, 2011 and, a concern regarding the health impacts from the level of noise measured by a resident near the metal salvaging facility.

### **Background and Statement of Issues**

A resident of Spencer has expressed some concern regarding potential adverse health effects from exposure to wire shredder fluff material that was emitted by Shine Brothers on July 10, 2011. It is our understanding that this wire shredder fluff material was accidentally emitted by Shine Brothers when a cyclone separator within the facility was not properly emptied and overflowed emitting the wire shredder fluff to the outside environment.

A concern regarding inhalation exposure to the fluff material and exposure to the chemicals that may be found within the wire shredder fluff material was expressed by the resident. Samples of the fluff material were collected by you and analyzed for fiber content and for the concentration of a few heavy metals. This consultation will address some general issues regarding inhalation exposure to wire shredder fluff, a discussion of the potential health effects of exposure of heavy metals from incidental ingestion of the wire shredder fluff during release events and issues arising for individuals routinely exposed to the wire shredder fluff.

In addition to health concerns from exposure to the wire shredder fluff, another resident expressed concerns regarding the noise contribution of the Shine Brothers facility and submitted sound level measurements that they had conducted in Spencer near the facility to the Iowa Department of Public Health. This consultation will address some general issues regarding acceptable noise levels and the levels measured near the Shine Brothers facility.

### Discussion – Nuisance Issues from Inhalation Exposure to Wire Shredder Fluff

Fiber analysis of the wire shredder fluff indicates that this material is ninety-six percent cellulose fibers. From the attached pictures of the wire shredder fluff that were provided by a concerned resident, it is apparent that the wire shredder fluff had the potential to be a dust problem at the time of the release. It is generally recognized that exposure to small particles of dust can cause adverse health impacts. These impacts will range from minor respiratory irritation and inflammation to the mucous membranes of the respiratory track to more serious health impacts if the particles are small enough to be inhaled deeply into the lungs. More serious health impacts from particulate matter in the air can result from particles that are smaller than 2.5 microns in size commonly referred to as PM 2.5.

In the case of the wire shredder fluff that was emitted by Shine Brothers, the health impacts from inhalation exposure cannot be fully known since the range of particle sizes of the wire shredder fluff has not been determined. If a particle size analysis would be completed on the wire shredder fluff, then a more detailed analysis of the potential health impacts from inhalation exposure might be able to be provided. At this point in time, with the information provided to the Iowa Department of Public Health, we can only say that the presence of the wire shredder fluff within the air during the July 10, 2011 event most likely caused some short term nuisance issues to individuals exposed to the wire shredder fluff.

### Discussion – Incidental Ingestion of Wire Shredder Fluff

Another concern from exposure to the wire shredder fluff would be the potential for ingestion exposure to small amounts of heavy metals that can be present within the wire shredder fluff. A sample of the wire shredder fluff was collected on July 10, 2011. Results were provided of the analytical testing of the total metal content of the wire shredder fluff. The following table includes the concentration of metals found in the samples of wire shredder fluff.

Table 1 – Concentration of Total Metal Concentrations within Wire Shredder Fluff (1)

| <b>Metal Constituent</b> | <b>Concentration (mg/kg)<br/>Sample 1</b> | <b>Concentration (mg/kg)<br/>Sample 2</b> |
|--------------------------|---|---|
| Antimony, total          | 940                                       | 1,500                                     |
| Barium, total            | 5,000                                     | 7,600                                     |
| Copper, total            | 2,700                                     | 1,900                                     |
| Lead, total              | 300                                       | 1,100                                     |
| Mercury, total           | <1  | NA  |

NA means not analyzed

A comparison can be made to the levels of metals within the wire shredder fluff to levels of metals that have been shown to have the potential of causing adverse health impacts to individuals. One of the

federal agencies that has been involved in the study of toxicological impacts to human health from exposure to chemicals, the Agency of Toxic Substances and Disease Registry (ATSDR), has calculated a set of comparison values for substances that may be found in air, water and soil. Comparison values (or environmental guidelines) are substance concentrations set well below levels that are known or anticipated to result in adverse health effects. It is assumed that exposure to environmental concentrations below comparison values will not adversely impact human health, even to the most sensitive individuals. Comparison values have been developed for exposure to incidental ingestion of soil from dust and from direct exposure to soil. Since the wire shredder fluff was observed to be on the ground around the Shine Brothers facility, it is felt that looking at the comparison values developed for exposure to soil is appropriate. The following table is a list of available comparison values for some of the metals found in the wire shredder fluff. The comparison values for mercury are not included in the table since mercury was not detected in the wire shredder fluff.

Table 2 – Comparison Values for Metals within Soil (2)

| <b>Metal</b> | <b>Comparison Value<br/>(mg/kg)</b> | <b>Exposure Frequency</b> | <b>Person</b> |
|--------------|-------------------------------------|---------------------------|---------------|
| Antimony     | 20                                  | Chronic                   | Child         |
|              | 300                                 | Chronic                   | Adult         |
| Barium       | 10,000                              | Chronic &<br>Intermediate | Child         |
|              | 100,000                             | Chronic &<br>Intermediate | Adult         |
|              | 400                                 | Intermediate              | Pica Child    |
| Copper       | 500                                 | Intermediate              | Child         |
|              | 7,000                               | Intermediate              | Adult         |
|              | 20                                  | Acute &<br>Intermediate   | Pica Child    |
| Lead         | 400*                                | Chronic                   | Child         |

“Chronic” exposure is for longer than 1 year

“Intermediate” exposure is between 14 days and 1 year

“Acute” exposure is up to 14 days

“Pica Child” is a child beyond the age of 18 months that exhibits a behavior of eating non-food items such as soil

\* EPA’s screening level for lead in residential soils

The concentration of several of the metals in the wire shredder fluff is greater than at least one of the comparison values shown in the table above. These metals, their highest concentrations and corresponding comparison values are as follows:

Antimony at 1,500 mg/kg (CV = 20 mg/kg for chronic exposures to children, and CV = 300 mg/kg for chronic exposure to adults)

Barium at 7,600 mg/kg (CV = 400 mg/kg for intermediate exposure to Pica children)

Copper at 2,700 mg/kg (CV = 500 mg/kg for intermediate exposures to children, and CV = 20 mg/kg for acute and intermediate exposure to Pica children)

Lead at 1,100 mg/kg (CV = 400 mg/kg chronic exposures to children)

In order to determine potential health effects from incidental ingestion exposure to the wire shredder fluff that escaped the Shine Brothers facility a closer look at the toxicological information of the components of the wire shredder fluff and likely exposure to the wire shredder fluff is needed. A toxicological evaluation can be made utilizing assumed information on incidental ingestion of the wire shredder fluff and then comparing the estimated ingested amount of each metal of concern to any studies showing actual health effects from ingestion of each metal of concern. According to ATSDR's Public Health Assessment Guidance Manual (3) it is estimated that an average adult may incidentally ingest up to 100 mg/day of soil and dust from various sources and a child may incidentally ingest up to 200 mg/day of soil and dust from various sources.

According to the same guidance manual, it is estimated that a child exhibiting Pica behavior may ingest up to 5,000 mg/day of soil. When considering the exposure of the wire shredder fluff to a child exhibiting Pica behavior, it is necessary to assume that a significant amount of wire shredder fluff from the Shine Brothers facility would need to be regularly deposited in areas where the child plays, and then this child would have to ingest significant amounts of this wire shredder fluff by direct ingestion. This exposure scenario is very unlikely given 1) the few number of times that a child exhibiting Pica behavior would be exposed to the wire shredder fluff, and 2) the length of time that a child would be exposed to the wire shredder fluff, and will not be considered further in this consultation. Therefore, the previously discussed exceedance of the comparison value for exposure to barium will also not be considered further in this consultation.

#### *Health Effects from Antimony Exposure*

In order to determine if there is a potential for adverse health impacts from the amount of antimony found within the wire shredder fluff, we can look at information on studies that evaluated health impacts from oral exposure to antimony. Sources of information on studies evaluating health effects from human and animal exposure to antimony can be found in references made available by the ATSDR and by the EPA. In the case of antimony, there are no relevant studies on human exposure, but there is some information on exposure to animals. The lowest level of oral exposure to antimony that has been found to produce adverse health effects from evaluating animal studies completed on chronic oral exposure to antimony is 0.35 mg/kg/day (4). Non-fasting blood glucose levels were observed to be decreased in treated male rats, and cholesterol levels were altered in both sexes of rats when orally exposed to antimony. This information from an animal study can be applied to exposure to humans. If we assume that an average adult would ingest 100 mg/day of soil containing antimony at a concentration of 1,500

mg/kg (the concentration of antimony present in the wire shredder fluff), the amount of antimony ingested on a daily basis would be determined by the following equation:

$$\frac{1,500 \text{ mg antimony}}{\text{kg soil}} \times \frac{100 \text{ mg soil}}{\text{day}} \times \frac{1}{70 \text{ kg}^*} \times \frac{1 \text{ kg soil}}{10^6 \text{ mg soil}} = 0.0021 \text{ mg/kg/day}$$

\* 70 kilograms (154 pounds) is the assumed average weight of an adult

The estimated amount of antimony that would be incidentally ingested by an adult exposed on a daily basis to wire shredder fluff is about 170 times lower than the lowest amount of antimony shown to produce adverse health effects in animal studies. This estimation assumes that all incidental ingestion of dust and soil would be from the wire shredder fluff – a very conservative assumption.

Using a similar equation to the one above, estimation can be made of the amount of antimony ingested by a child:

$$\frac{1,500 \text{ mg antimony}}{\text{kg soil}} \times \frac{200 \text{ mg soil}}{\text{day}} \times \frac{1}{15 \text{ kg}} \times \frac{1 \text{ kg soil}}{10^6 \text{ mg soil}} = 0.02 \text{ mg/kg/day}$$

The estimated amount of antimony that would be incidentally ingested by a child exposed to wire shredder fluff is 17.5 times lower than the lowest amount of antimony shown to produce adverse health effects in animal studies.

#### *Health Effects from Copper Exposure*

The lowest level of oral exposure to copper that has been found to produce adverse health effects from evaluating human health studies completed on intermediate oral exposure to copper is 0.091 mg/kg/day (5). The adverse health effects were gastrointestinal impacts such as nausea. In this same study the level where no adverse health effects were observed was at a dose of 0.042 mg/kg/day (5). There are no good chronic studies on human exposure to copper and very limited chronic studies on animal exposure, so the information from these intermediate studies will be used as the most conservative evaluation as is available. If we assume that an adult would ingest 100 mg/day of soil containing copper at a concentration of 2,700 mg/kg, the amount of copper ingested on a daily basis would be determined by the following equation:

$$\frac{2,700 \text{ mg copper}}{\text{kg soil}} \times \frac{100 \text{ mg soil}}{\text{day}} \times \frac{1}{70 \text{ kg}} \times \frac{1 \text{ kg soil}}{10^6 \text{ mg soil}} = 0.0039 \text{ mg/kg/day}$$

The estimated amount of copper that would be incidentally ingested by an adult exposed to wire shredder fluff is roughly 11 times lower than the lowest amount of copper shown to produce no adverse health effects in human health studies.

Using a similar equation to the one above, estimation can be made of the amount of copper ingested by a child:

$$\frac{2,700 \text{ mg copper}}{\text{kg soil}} \times \frac{200 \text{ mg soil}}{\text{day}} \times \frac{1}{15 \text{ kg}} \times \frac{1 \text{ kg soil}}{10^6 \text{ mg soil}} = 0.036 \text{ mg/kg/day}$$

The estimated amount of copper that would be incidentally ingested by a child exposed to wire shredder fluff is roughly equivalent to the amount of copper shown to produce no adverse health effects in human health studies.

#### *Health Effects from Lead Exposure*

The level of lead in the blood of children has been extensively measured and certain levels have been associated with increased risks of adverse health impacts. At blood lead levels as low as 10 micrograms per deciliter ( $\mu\text{g/dl}$ ), children's intelligence, hearing, and growth are affected (6). Human health studies have observed that children exposed to levels of lead in yard soil greater than 500 mg/kg have experienced blood level levels of greater than 10  $\mu\text{g/dl}$ . Because of this the EPA has established a soil screening guidance concentration of 400 mg/kg lead in soil (6). This level applies to bare soil in areas where children play. In order for this screening level to be exceeded the wire shredder fluff would need to be regularly deposited in areas with children play. If a child would be exposed to the wire shredder fluff on a daily basis, then a risk to excessive lead exposure might be a possibility. Given that exposure to the wire shredder fluff is not a regular occurrence; the risk to excessive lead exposure from the wire shredder fluff is not very likely.

#### **Discussion – Acceptable Noise Levels in Communities**

The Iowa Department of Public Health does not have any guidelines regarding acceptable noise levels in communities, but some other agencies and health organizations do have some guidelines that can be offered for consideration. One of those organizations, the World Health Organization (WHO) has some guidelines for acceptable community noise. The table on the following page includes some of the guidelines that are provided by the WHO. The sound level is expressed in decibels (dB). The time frame, in hours, is the time period in which the average sound level is calculated.

Table 3 – Guideline Values for Community Noise in Specific Environments (7)

| Specific Environment       | Critical Health Effects                         | Average Sound Level (dB) | Time Frame (Hrs) |
|----------------------------|---|--------------------------|------------------|
| Dwelling, inside bedrooms  | Sleep disturbance, nighttime                    | 30                       | 8                |
| Dwelling, indoors          | Moderate annoyance, daytime and evening         | 35                       | 16               |
| Dwelling, outside bedrooms | Sleep disturbance, window open (outdoor values) | 45                       | 8                |
| Outdoor living area        | Serious annoyance, daytime and evening          | 55                       | 16               |
| Indoors & Outdoors         | Hearing Impairment                              | 70                       | 24               |
| Indoors & Outdoors         | Hearing Impairment                              | 85                       | 1                |

The WHO guidelines indicate that a level of 30 dB could cause some sleep disturbance; but this sound measurement would be measured inside the bedroom. The WHO guidelines indicate that a level of 35 dB could cause some moderated annoyance; but this sound measurement would be measured inside the building. The WHO guidelines indicate that a level of 45 dB, measured outside the home, may cause some sleep disturbance for a person in a bedroom with the windows open. According to the WHO guidelines a level of 55 dB is expected to cause severe annoyance whether the sound is measured outside or inside. According to WHO guidelines a risk to hearing impairment does not begin until the level of continuous exposure reaches 70 dB, or the level reaches 85 dB for one hour.

A resident of Spencer provided the Iowa Department of Public Health with some sound measurements that they had conducted in the Spencer area within Riverview Park. Riverview Park is located to the south of Shine Brothers facility. The data provided indicated that for short times periods the average sound levels in Riverview Park were approximately 60 dB. According to WHO guidelines, if these levels were to continue throughout the day at the 60 dB level, severe annoyance to individuals frequenting the park may be possible.

### Conclusions

The Iowa Department of Public Health concludes that the July 10, 2011 release of wire shredder fluff from the Shine Brothers facility in Spencer most likely caused some short term nuisance to the residents

of Spencer in the area where the release occurred. The Iowa Department of Public Health is uncertain on any inhalation health risks from exposure to the wire shredder fluff since a particle-size analysis was not completed on the wire shredder fluff.

The Iowa Department of Public Health has some concerns regarding the incidental ingestion of any wire shredder fluff by children. If children were exposed to the wire shredder fluff on a daily basis for longer than one year, then the amount of copper or lead that they might ingest may exceed a level where adverse health impacts could occur. This long time frame for exposure would seem to be unlikely since wire shredder fluff is not normally emitted by the facility to the ambient air and would most likely not remain on the ground for lengthy times in areas where children are exposed.

It would appear that there is a potential for some concerns regarding the noise level experienced in the area near the facility. The information provided to the Iowa Department of Public Health indicates there is a potential for annoyance to individuals near the Shine Brothers facility if the noise levels that had been measured for short time frames in Riverview Park by a concerned citizen in Spencer are maintained for a large portion of the day.

### **Recommendations**

- Additional steps should be taken to determine any causes of the release of the wire shredder fluff from the Shine Brothers facility and to take steps to prevent releases in the future. In the event that a release of the wire shredder fluff occurs, local and state authorities should be notified so that information can be provided to the public to alert them to potential short term adverse health impacts from potential exposure to the wire shredder fluff.
- Additional sound measurements should be made at various times around the Shine Brothers facility to ensure that the public is not exposed to sound levels that have a potential to cause public annoyance. The City of Spencer may wish to consider promulgation of an appropriate sound ordinance for public places if one has not already been established.

### **References**

1. Information provided by Amber Wolf, IDNR Field Office 3.
2. Agency for Toxic Substances and Disease Registry. Soil Comparison Values. Atlanta: US Department of Health and Human Services; April 2010.
3. Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual – Appendix F, ATSDR web link: <http://www.atsdr.cdc.gov/HAC/phamanual/appf.html>
4. U.S. Environmental Agency. Integrated Risk Information System web link: <http://www.epa.gov/iris/subst/0006.htm>
5. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Copper. Atlanta: US Department of Health and Human Services; September 2004.
6. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Lead. Atlanta: US Department of Health and Human Services, August 2007.
7. World Health Organization Guidelines for Community Noise, WHO web link: <http://www.who.int/docstore/peh/noise/Commnoise4.htm>

If you have any questions regarding the information in this letter please contact me at (515) 281-8707 or by email at [stuart.schmitz@idph.iowa.gov](mailto:stuart.schmitz@idph.iowa.gov) .

Sincerely,

A handwritten signature in black ink, appearing to read 'S.C. Schmitz', with a long, sweeping horizontal flourish extending to the right.

Stuart C. Schmitz, M.S., P.E.

Principal Investigator / Environmental Toxicologist  
Hazardous Waste Site Health Assessment Program



Photograph 1 – Wire Shredder Fluff on Street



Photograph 2 – Wire Shredder Fluff on Street (Close-Up)



Photograph 3 – Wire Shredder Fluff on Nearby Car



Photograph 4 – Wire Shredder Fluff on Nearby Roof of Home