

Health Consultation

LONE STAR INDUSTRIES, INCORPORATED
CAPE GIRARDEAU, CAPE GIRARDEAU COUNTY, MISSOURI

EPA FACILITY ID: MOD981127319

APRIL 7, 2004

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

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

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HEALTH CONSULTATION

LONE STAR INDUSTRIES, INC

CAPE GIRARDEAU, CAPE GIRARDEAU COUNTY, MO

EPA FACILITY ID: MOD981127319

Prepared by:

Missouri Department of Health and Senior Services
Division of Environmental Health and Communicable Disease Prevention
Section for Environmental Public Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Statement of Issues and Background

Statement of Issues

The U.S. Environmental Protection Agency (EPA) Region 7 requested that the Missouri Department of Health and Senior Services (DHSS), in cooperation with the Agency for Toxic Substance and Disease Registry (ATSDR), complete a health consultation to address public health issues raised by the community during a recent modification to the Hazardous Waste Permit of Lone Star Industries, Inc. Community concerns centered around emissions from the facility in general and the increase in the allowed emissions and potential adverse health effects related to these emissions.

Background

Lone Star Industries, Inc. (Lone Star) is a 93-year old facility that manufactures cement near Cape Girardeau in southeastern Missouri. The facility is located at 2524 South Sprigg St, Cape Girardeau, MO 63702. The facility includes the cement production plant, an active quarry that provides raw materials, a barge-loading facility and various stockpile areas. The Mississippi River is approximately 1,800 feet east of the main cement producing plant. The site is bordered on the east by the Mississippi River floodplain. Agricultural fields, primarily soybeans, predominate the area surrounding the facility (1).

The nearest highly populated residential area is as a subdivision located approximately 1.9 miles north of the facility (See Figure 1, Site Map, Hackberry Street and Brenda Kay Court). Two residences, occupied by plant personnel who rent the homes, exist within one-half mile of the facility. There are two private residences approximately 0.5 mile south of the facility. Another private residence is located approximately 0.9 mile from the plant on a farm directly north of the quarry. A city waste transfer station is located about 800 feet north of the plant on Lone Star's property. Lone Star granted permission for the city's use of their land for this facility.

Citizen Concerns

Citizens expressed concerns about emissions from the Lone Star facility during the public comment period for a Hazardous Waste Management Facility permit modification. The concerns included:

- Emissions from the facility in general, and in particular, plumes of "smoke" leaving the Lone Star facility;
- An increase in the allowed emissions of chromium and beryllium from the facility; and
- Potential adverse health effects, particularly respiratory problems, which may be related to the increased emissions from the facility.

Facility Emissions

DHSS spoke to Lone Star personnel and an MDNR Air Quality inspector while attempting to address the concern expressed by one citizen who has seen a “smoke” plume leaving Lone Star’s boundaries. Lone Star refers to this as a “detached plume.” Lone Star has found that the plume occurs primarily when the raw mill is not being used. Material is ground into fine particles at the raw mill before being fed into the kiln. When the fine material comes in contact with gases in the cyclones and the kiln, a chemical reaction takes place (primarily between sulfur and lime). This chemical reaction has the effect of a scrubber, which helps to reduce emissions. Lone Star found that the plume appeared when the raw mill experienced downtime due to regular maintenance activities or emergency shut-downs. Consequently, Lone Star began experimenting with substituting a wet lime injection to temporarily take the place of the raw mill when it was down. This substitution provides a method by which the scrubber reaction could take place during downtimes. The resulting emissions are condensed salt crystals, not particulates, which would eliminate the detached plumes (conversation with Rich Baker, Air Emissions Environmental Manager for Lone Star, June 12, 2003).

It should be noted that DHSS did not witness “smoky” emissions during a site visit. The weather was sunny and warm on the day of the site visit. The plant was very clean and orderly and no fugitive dust emissions were witnessed on the visit. The quarry was not in operation during the visit. However, conveyor belts with several transfer points were in operation, and no fugitive dust emissions were witnessed.

Permits

In the original cement-making process Lone Star used only non-hazardous fuels, such as coal and tires, in their rotary kiln. In 1999, EPA, in conjunction with the Missouri Department of Natural Resources (MDNR), issued a Hazardous Waste Management Permit to Lone Star (2). This permit allowed Lone Star to store hazardous wastes at their facility and burn these wastes as fuel in their kiln. Lone Star later requested a permit modification to increase the amount of chromium and beryllium that can be fed into their cement kiln. The permit modification was requested because the raw materials currently used by Lone Star to manufacture cement have more naturally occurring chromium and beryllium than the raw materials previously used by the facility. Lone Star has not increased the amount of these metals in the hazardous waste that they burn as fuel.

Hazardous Waste Management Permit

The aspects of the Hazardous Waste Management Permit modification which are most closely related to the citizen’s concerns are:

- 1) *Emission limits for various metals, including chromium, beryllium, lead, arsenic and cadmium.* The permit modification changed the theoretical emission limits for chromium from 0.00105 pounds per hour (lb/hr) to 0.00224 lb/hr, which more than doubles the

maximum allowable emissions of chromium. Beryllium limits were increased from 0.0000588 lb/hr to 0.0003127 lb/hr (3), which is a five-fold increase.

- 2) *Feed rate limitations that control the amount of certain metals contained in all the waste and non-waste material being fed into the kiln (4).* These constituents include chromium and beryllium as well as antimony, barium, mercury, silver, thallium, lead, arsenic, cadmium and chlorine. The permit modification changed the feedstream limits of chromium from 0.25 lb/hr to 1.0 lb/hr, which is a four-fold increase in the maximum allowable feed rate of chromium. For beryllium, the total feedstream changed from 23.7 lb/hr to 50 lb/hr (3), which represents a doubling of the feedstream. The calculations used to set the feedstreams limits relied heavily on the calculations of risk effects of these metals on human health.

Air Pollution Control Operating Permit

In April 2001, Lone Star applied to the MDNR Air Pollution Control Program for an Air Pollution Control Operating Permit. This permit addresses broad requirements about particulate matter in ambient air on Lone Star's property. This permit sets general criteria that must be met in relation to visual inspections of particulate matter. The permit does not specify the direct, continuous monitoring of particulate emissions to ensure they remain below emission limits. Rather, it requires the electronic monitoring of certain parameters, such as raw material and fuel throughputs, along with cement clinker (waste product) production to correlate with the latest stack emissions test production levels. The permit additionally specifies that kiln gases must not exhibit greater than 20% opacity (the degree to which emissions reduce the passage of light). The permit requires that an opacity monitoring system be installed at all stacks exhausting air emissions from the kiln (5).

Chromium and Beryllium

Chromium and beryllium were specifically named as the key elements of concern in the permit modification. Therefore, this health consultation will focus primarily on those two metals.

Discussion

Facility Emissions

Currently there are no data regarding air contaminant concentrations in the community around the Lone Star facility, so there is no way to evaluate potential health risks related to the detached plume. However, Lone Star has developed a method to reduce their emissions during raw mill down times. According to the MDNR air quality inspector, this method appears to be very successful in minimizing the opacity of the visible air emissions at the kiln stack (telephone conversation with Todd Raney, Environmental Specialist for the Southeast Regional Office of MDNR, July 8, 2003). A telephone conversation with the citizen who wrote the letter expressing

concern about the plume reveals that the individual has seen a difference in the air emissions. The resident feels that Lone Star's changes have had positive results on their health.

Hazardous Waste Management/Air Pollution Control Operating Permits

It was necessary to review the Hazardous Waste and Air Pollution Control Operating permits to determine if the data collection required for compliance with the permits will be useful in answering the citizen's questions.

Hazardous Waste Management Permit

Lone Star is not conducting continuous air sampling on individual metals to comply with its Hazardous Waste permit. The permit's only data collection requirement is to have Lone Star record the feedstream rates electronically. Emission rates can be calculated from feedstream rates to determine if Lone Star is complying with their Hazardous Waste permit (4). The permit assumes that the feedstreams were properly calculated for the safety of human health. Thus, if Lone Star is in compliance with the feedstream rates, it is also in compliance with the emission rates (telephone conversation with David Maschler, MDNR Project Manager, Hazardous Waste Program, May 23, 2003). Those data do not help answer the citizens' questions about health effects in the community because the data pertain only to feedstock rates and not the actual emissions. In addition, the data do not validate the accuracy of the computer models that were used to set the emission limits. The models make assumptions about dispersion levels in the surrounding community, but there are no actual data in the community to compare to the computer model assumptions.

Air Pollution Control Operating Permit

This permit only requires electronic monitoring of process parameters, such as raw material and fuel throughputs and waste production, along with kiln gas opacity. Opacity data, in particular, have an element of subjectivity associated with them and are useful only at the source of the emission. They do not help answer the general health concerns of the community.

Chromium and Beryllium

Chromium

Chromium is a naturally occurring element found in rocks, animals, plants and soil. Chromium exists in several different forms in the environment (6). The most common and least toxic environmental form of chromium is trivalent chromium (chromium III). Hexavalent chromium (chromium VI) is less common in the environment and more toxic to receptors than is chromium III. Chromium VI is generally related to industrial processes. It is not known if the chromium emitted from Lone Star is in the form of chromium III or chromium VI, thus the potential for adverse effects cannot be determined at this point.

The body absorbs chromium VI more readily than it absorbs chromium III; however, once absorbed by the body, chromium VI is rapidly changed to chromium III. Chromium III is an essential nutrient. That means that it is a compound needed by the body for proper functioning, but is one that is not produced by the body.

The effects of chromium exposure on the human body vary according to the exposure route (inhalation, ingestion or skin contact) and form of chromium (6). Inhalation exposure to chromium VI can result in marked damage to the nasal mucosa, perforation of the nasal septum and damage to the lower respiratory tract. By contrast, breathing in chromium III does not cause irritation to the nose or mouth in most people (6). EPA has determined that chromium VI is a human carcinogen through inhalation (6). However, EPA has insufficient evidence to determine whether chromium III is carcinogenic through inhalation, ingestion or skin contact, or whether chromium VI is carcinogenic through ingestion or skin contact (6).

According to EPA, the mean concentration of chromium in ambient air in the United States ranged from 0.005 to 0.525 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) during the time period of 1977 to 1984 (6). Most chromium released into the environment is in the form of chromium III oxide. Chromium compounds will usually remain in the air for fewer than 10 days. Most chromium in soil does not dissolve easily in water and can attach strongly to the soil. The mean concentration of chromium in soils in the U.S. is 37.0 milligrams per kilogram (mg/kg) (6).

Chromium does not move easily from plant roots to the leafy, above-ground parts of plants. Therefore, most of the chromium is retained in the plant roots and does not migrate to the edible parts of the plants. This is an important consideration in regard to Lone Star because there is agriculture, primarily soybean fields, throughout the immediate vicinity of the cement plant (6).

Beryllium

Beryllium is the lightest metal and can be found in rock, coal, oil and soil (7). A key distinction among beryllium compounds is that some are soluble in water, but many are not (7). Exposure to water-soluble beryllium compounds in the environment, in general, will pose a greater threat to human health than exposure to water-insoluble forms (7). The solubility of the beryllium emitted from the Lone Star facility is not known, thus the potential for adverse effects cannot be determined at this point.

The primary adverse effects of beryllium occur from inhalation. Depending on how much and how long exposure lasts, beryllium can damage the lungs. Breathing large amounts of beryllium compounds {greater than 1 milligram per cubic meter (mg/m^3)} can cause lung damage that resembles pneumonia, with reddening and swelling of the lungs. In addition, some people can develop hypersensitivity or allergy to beryllium. Allergic individuals may develop inflammatory reactions in which white cells accumulate around the beryllium and form granulomas (masses of irritated tissue) at the point of exposure (7).

EPA restricts beryllium releases into the air to 0.01 μg beryllium/ m^3 averaged over a 30-day period. EPA has also determined that beryllium is a probable human carcinogen (7).

Like chromium, uptake of beryllium by plants appears to be restricted to the root system. This appears to be related to the solubility of beryllium. The mean concentration of beryllium in U.S. soils is 0.6 mg/kg (7).

Respiratory Problems

Data from the DHSS Office of Surveillance were analyzed to attempt to determine if there were heavy metal exposures in the vicinity of the Lone Star facility. The data analyzed were collected between 1993 and 2003 and involve information reported to DHSS by physicians in the Cape Girardeau area in response to a state law requiring physicians to report certain conditions or diseases such as heavy metal poisoning, respiratory diseases triggered by environmental contaminants, and occupational lung diseases. There were only two reported cases of chromium poisoning, and no cases involving beryllium. The highest number of cases reported to DHSS involved mercury poisoning and carbon monoxide poisoning. There was no information in any of these reports linking them to Lone Star.

ATSDR's Child Health Considerations

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of environmental media. As part of ATSDR's child health considerations, ATSDR health consultations must indicate whether any site-related exposures are of particular concern for children. This site has a potential of particular concern for children because children may be living in some of the residences within a mile of the site. With respect to both chromium and beryllium, the health effects seen in exposed children will be similar to, or possibly worse than, those effects seen in adults. For both metals, there appear to be no differences between children and adults in terms of where the metals can be found in the body and how fast they will leave the body. It is unknown whether children differ from adults in regard to their susceptibility to both metals (6,7).

Conclusions

The data collection requirements of the Hazardous Waste and Air Pollution Control Operating permits do not allow full evaluation of exposure to answer the citizens' question because the data pertain only to feedstock rates or the point at which emissions are released. The main data gap is the lack of ambient community air sampling of chromium and beryllium, as well as the other metals mentioned in the Hazardous Waste permit. Monitoring of these metals in ambient air would allow comparisons against EPA and ATSDR safe levels. Therefore, this site is classified as an Indeterminate Health Hazard due to the lack of data.

It was possible to answer one of the questions regarding a detached plume that has been seen outside of Lone Star's property boundaries. Lone Star has found a process that appears to improve this situation.

Recommendations

1. Conduct ambient air sampling not only for chromium and beryllium, but also for antimony, barium, mercury, silver, thallium, lead, arsenic and cadmium. Conduct sampling at locations most likely to be impacted by kiln emissions. If possible, ambient air sampling should attempt to distinguish the form (trivalent or hexavalent) of the chromium, if possible.
2. Compare ambient air sampling results to the assumptions made in the air modeling used to set emissions and feedstream limits. Soil sampling would not be recommended at this time, but should be considered in the future if ambient community air samples indicate a need.

Public Health Action Plan

The Public Health Action Plan (PHAP) for the Lone Star site contains a description of actions to be taken by DHSS, ATSDR and others. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but also provides an action plan to mitigate and prevent adverse human health effects resulting from present and/or future exposure to hazardous substances at or near the site. Included is a commitment from DHSS and/or ATSDR to follow up on this plan to ensure that it is implemented. The public health action to be implemented by DHSS, ATSDR and/or cooperators is as follows:

1. DHSS/ATSDR will attend public hearings or meetings as requested for this facility.
2. DHSS/ATSDR will evaluate additional ambient air sampling data as they become available. If appropriate, DHSS will update assessment documents.
3. DHSS/ATSDR will continue to address community health concerns and questions as they arise, and provide necessary community and health professional education.
4. ATSDR/DHSS will respond appropriately to any request for additional information or action.

References

1. Delta Toxicology, Inc. Draft Multipathway Risk Assessment for the Lone Star Cement Company. 1997 May.
2. Missouri Hazardous Waste Management Facility Permit, Part I. Permit Number: MOD981127319. 1999 February.
3. Missouri Hazardous Waste Management Facility Permit, Part II. Permit Number: MOD981127319. 1999 February. p.18.
4. Missouri Department of Natural Resources. Statement of Basis. Feed Rate Limitations. Jefferson City, Mo. p.8.
5. Missouri Department of Natural Resources, Division of Air Quality. Permit to Operate, Permit Number OP2001029. Jefferson City, Mo. 2001 April. p.13, 95.
6. Agency for Toxic Substances and Disease Registry. Toxicological profile for chromium. Atlanta: U.S. Department of Health and Human Services. 2000 September.
7. Agency for Toxic Substances and Disease Registry. Toxicological profile for beryllium. Atlanta: U.S. Department of Health and Human Services. 2000 September.

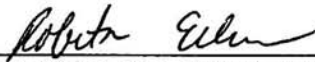
Certification

The Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) has prepared this health consultation to review and answer the public health issues raised by the community during a recent modification to the Hazardous Waste Permit of Lone Star Industries, Inc. and to indicate any additional action(s) that the EPA should take in regards to the permit modification. The health consultation is in accordance with approved methodology and procedures existing at the time the it was initiated.



Technical Project Officer, SPS, SSAB, DHAC

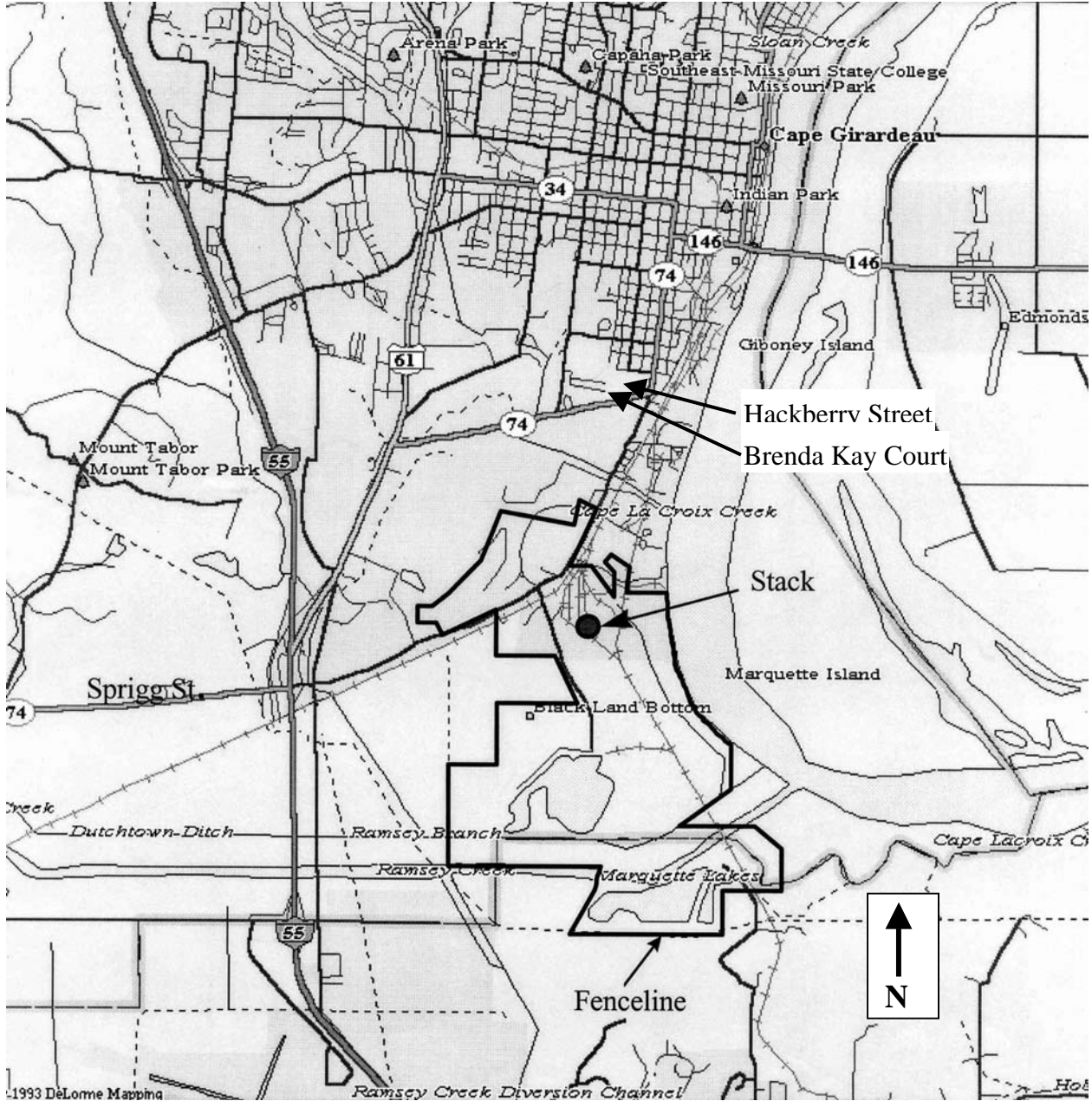
The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Section Chief, SPS, SSAB, DHAC, ATSDR

Figure 1

Lone Star Industries Site Map



Source: Delta Toxicology, Inc. Draft Multipathway Risk Assessment for the Lone Star Cement Company. May, 1997.