

Health Consultation

BOURNE BRIDGE

CAPE COD CANAL, MASSACHUSETTS

AUGUST 18, 2005

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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Background

The U.S. Army Corps of Engineers (“Corps”) operates the Bourne bridge, which spans the Cape Cod Canal and connects Buzzards Bay on the Massachusetts mainland with the town of Bourne on Cape Cod. Since 2004, the Corps has been removing existing paint from the bridge. Work began first on the lower span of the north side of the bridge and was completed at the end of August 2004. In early September 2004, work began on the lower span of the south side of the bridge and was completed at the end of June 2005. At present, work is ongoing on the upper span of the south side of the bridge and will continue to the north side. The remaining work on the bridge is expected to last 15–20 weeks.

The U.S. Environmental Protection Agency (EPA) became involved at the bridge site during the week of July 5, 2005, in response to citizens’ complaints.

Earlier complaints were filed with the Massachusetts Department of Environmental Protection (MA DEP) who then contacted EPA. The complaints focused on debris, which allegedly results from the ongoing lead paint abatement and repainting operations on the bridge. Gritty material has been deposited on vehicles and exposed surfaces in the area.

In response to the complaints, staff from EPA’s lead abatement and air program, enforcement programs, and air monitoring program visited the site on several occasions and participated in a meeting with the Corps in Bourne on July 15, 2005, to discuss the situation. EPA requested that ATSDR provide assistance in evaluating the potential for public health problems that may result from air emissions containing lead and in evaluating the overall exposure of the public to lead in the environment, including the lead paint chips and gritty material that were the basis of the original complaints.

Two articles (on 7/7/05 and 7/12/05) appeared in the local newspaper, *The Upper Cape Codder*, regarding the citizens’ complaints. The articles contained information about EPA following up with debris testing for possible contaminants, mainly lead (Pb). To date, EPA has sampled several kinds of debris that allegedly is emanating from the work on the bridge. This debris is a result of the current steel blasting/abatement operation, which during various circumstances and extenuating conditions (such as inclement weather and high wind events) either caused breaches in the containment tarps and therefore a route for debris to escape, or is a result of the historical (ongoing and worsening) failure of the “paint system” that has resulted in larger paint chips falling off the bridge over time.

The EPA inspectors and sampling technicians have found that the debris consists of one of the following:

- 1) rust-colored grit particles (appearing smaller than a pinhead) that “rusted” or became affixed to the finishes of local residents’ property and appurtenances such as patio furniture, decorative fences, pool covers and motor vehicles. These rust-colored grit particles sometimes appear to be just particles, but they sometimes are accompanied by fine, “rusty dust” debris.
- 2) silvery-colored paint chips of various sizes, ranging from smaller than postage stamp size to larger than two inches square.

The Corps has been conducting an air monitoring program for lead, including installing upwind and downwind samplers on both sides of the bridge (high volume air sampler). As the work has progressed, the sampler locations have been moved. The data from these samplers were supplied to EPA and to ATSDR along with the results of EPA's analysis of paint chips and wipe samples from surfaces in the area.

Question to ATSDR Strike: Does the proposed action plan protect the public from unhealthy exposures to airborne lead derived from the Bourne bridge paint removal activities?

Summary of the Proposed Action Plan

EPA proposed a monitoring plan along with an action plan that will provide real time warning to prevent the possibility of excessive exposures to lead from airborne paint chips. The proposed plan is summarized as follows:

- 1) Monitor for total suspended particulate (TSP) in the air (in real time).
 - a. Modify blasting/mitigation activities when the TSP exceeds a 1-hour time weighted average (TWA) of $150 \mu\text{g}/\text{m}^3$.
 - b. Stop blasting activities when the TSP exceeds a 1-hour TWA of $300 \mu\text{g}/\text{m}^3$.
- 2) Sample the amount of particulate in the air and analyze that particulate for lead content—yielding the percentage of lead in the particulate.
 - a. Modify blasting/mitigation activities when the TSP multiplied by the lead percentage exceeds a 1-hour average of $4.5 \mu\text{g}/\text{m}^3$.
 - b. Stop blasting activities when the TSP multiplied by the percentage of lead exceeds an 8-hour average of $4.5 \mu\text{g}/\text{m}^3$.

Discussion of the Plan

The monitoring equipment proposed provides a real time warning system. The procedures outlined above are designed to provide protection from lead and particulate exposure.

The monitors proposed for this plan will detect paint chips as particulates but will be more likely to overestimate particulate concentration rather than to underestimate them because aerosols and droplets are measured as particulate. The TSP warning system is appropriate because it will allow for a quick calculation of potential lead exposure and will also allow for a warning system for non-lead particulate exposure.

Particulate Exposure Protection: The TSP warning system is adequate to protect residents from respirable particulates because the thresholds established for this monitoring plan are for all particulates and are not restricted to respirable particulates only. These respirable particulates are often referred to by particulate size (PM10 for all particulates and PM2.5 for respirable particulates).

EPA's 24-hour National Ambient Air Quality Standard (NAAQS) for PM10 is $150 \mu\text{g}/\text{m}^3$ and EPA has proposed a PM2.5 standard of $65 \mu\text{g}/\text{m}^3$. TSP generated by the wind tends to contain less than 55% PM10 and less than 15% PM2.5. TSP generated by aggressive blasting tends to be made up of many particles larger than PM10 [EPA 1996]. The paint chips found in the Bourne bridge area also indicated the presence of many larger particles. Therefore, a threshold of $300 \mu\text{g}/\text{m}^3$ for TSP will ensure that PM10 will be near or below $150 \mu\text{g}/\text{m}^3$, and PM2.5 will remain below $50 \mu\text{g}/\text{m}^3$. Furthermore, a 1-hour time average warning value will prevent the possibility of elevated 24-hour average exposures.

Lead Particulate Exposure Protection: Establishing a percentage fraction of lead in the TSP may take a number of samples because paint's lead concentration often varies. However, once an appropriate value is obtained, the calculation is straight forward.

For Example: If the average TSP dust samples from a portion of the bridge contains 20% lead, then the protective TSP measurement would be $22.5 \mu\text{g}/\text{m}^3$.

EPA's 3-month NAAQS for lead is $1.5 \mu\text{g}/\text{m}^3$. This value was derived to protect people from such continual daily exposure to lead that the lead can be detected in blood. The value of $4.5 \mu\text{g}/\text{m}^3$ over 8 hours is similar to $1.5 \mu\text{g}/\text{m}^3$ over 24 hours for one day. However, the measures in place to prevent the levels of lead from exceeding $4.5 \mu\text{g}/\text{m}^3$ daily also ensure that the 3-month average exposure is much lower. In addition, lead is efficiently removed from the body after short-term exposure to low levels.

Health Effects from Lead Particulate Exposure: One scientific investigation in the literature presents methods to judge the likelihood of adverse health effects after exposure to lead paint chips. In the study [Griffin 1975], men were exposed to very fine lead particles, most of which were less than 0.18 microns. Paint chips contain less lead and are larger than 10 microns; therefore, the amount of lead that becomes available internally is much less than that from lead particles.

The Griffin study found that daily exposure to $10.9 \mu\text{g}/\text{m}^3$ for 18 weeks was related to an increase of blood lead levels and a decrease in the ALAD enzyme,¹ which participates in heme synthesis. Daily exposure to $3.2 \mu\text{g}/\text{m}^3$ for 18 weeks did not decrease the enzyme but did increase blood lead levels. ALAD is the most sensitive indicator of exposure, and although the decrease in activity does not harm people, the decrease indicates an effect and suggests that daily exposures to lead should be kept to concentrations below $10.9 \mu\text{g}/\text{m}^3$. The study found that blood lead levels began increasing soon after exposure and took 3 months to plateau. After exposure ceased, normal blood lead levels returned in 2 months. Urinary lead levels correlated with the blood lead levels, but they always remained within normal limits, indicating that the human lead removal processes work slowly but work well. The human removal process reduces blood lead levels caused by low level exposures but may not be enough to prevent the accumulation of lead in the blood at higher exposures. The study supports the decision of EPA to set a 3-month NAAQS because that amount of time is needed for the blood lead levels to reach equilibrium. The study also justifies allowing exposures between 3.2 and $10.9 \mu\text{g}/\text{m}^3$ for much shorter periods than 3 months because the body's removal processes will reduce the blood

¹ ALAD (aminolevulinic acid dehydrogenase) is an enzyme in the heme synthesis pathway.

lead levels. The $4.5 \mu\text{g}/\text{m}^3$ action level is close to the level that was not associated with the enzyme decrease, and the exposure duration is approximately 1/3 that value. Therefore, the daily dose from an 8-hour exposure to $4.5 \mu\text{g}/\text{m}^3$ lead is approximately half the dose as that from a 24-hour exposure to $3.2 \mu\text{g}/\text{m}^3$.

Other Metal Exposure Protection: Several other metals have been made airborne during the blasting of the lead paint and rust from the bridge. Some of the iron shot, which is used as the blasting agent, becomes airborne along with the paint. The metals and other compounds within the particulate will vary the toxicity of the particulate [Marrack 1995]. Some studies have shown iron to be a concern; however, an iron chelator had to be present, and the mobility of the iron was not concentration-dependent [Aust 1995]. Therefore, iron concentration protective values cannot be calculated. Because iron content is high in most TSP, the iron (and other metals') content will be limited when the TSP is limited. Since lead levels are likely to be much higher than those of other metals, the lead and TSP monitoring criteria should ensure that other metals derived from the abrasion blasting of the Bourne bridge will remain low. Simple analysis of all metals during the initial lead analysis should confirm this.

Question to ATSDR Strike: Does the proposed action plan protect the public from unhealthy exposures to airborne lead derived from the Bourne bridge paint removal activities?

Conclusion

The proposed action plan is protective of public health because it will ensure that lead and particulate exposures from the Bourne bridge are below those expected to pose a health hazard for the people near the bridge.

Recommendations

Collect enough particulate lead samples to adequately characterize the concentration of lead in the particulate. Fewer samples are necessary when the sampled lead concentrations in the particulate are similar, and more samples are needed if the lead concentrations differ widely.

Analyze for other metals during the initial particulate sampling to ensure that the content of other metals are low.

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