DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

JAN 4 2007

Charles Konigsberg, Jr., M.D., M.P.H.
Health Director
Alexandria Health Department
4480 King Street
Alexandria, Virginia 22302

Dear Dr. Konigsberg:

Last January, you requested that the Agency for Toxic Substances and Disease Registry (ATSDR) review existing air quality and other environmental data related to operations at the Mirant Potomac River Generating Station. You also asked ATSDR to assess whether existing data indicate a potential for health effects for nearby residents and to recommend the need for additional data. I am writing today to respond to these requests.

For the purpose of this report, ATSDR reviewed information provided by Mirant, the City of Alexandria, the Virginia Department of Environmental Quality (VDEQ), and the Environmental Protection Agency (EPA).

Our initial review of air dispersal modeling suggests a hazard to vulnerable populations from short-term, acute sulfur dioxide ($SO_2$) exposures based on ATSDR health-based guidance values. However, there is significant uncertainty with the modeling data and this interpretation. On-going monitoring for air pollutants may show that the air dispersal model has over-estimated $SO_2$ exposures. Because of the uncertainty in the air dispersal model and the need to collect additional monitoring data, we cannot determine at this time if a public health hazard exists. ATSDR's evaluation has identified the need for the following additional data:

- Monitoring data to evaluate modeling estimates of the concentration and location of contaminant levels of potential health concern. Mirant is currently conducting a Model Evaluation Study, which will include a modeling and monitoring comparison. This study was approved by EPA and reviewed by the VDEQ. The regulatory agencies are currently reviewing the initial monitoring results from this study. Monitoring data began to be collected under this study in June 2006. The Model Evaluation Study may require as much as a year of monitoring data. Therefore, EPA is not expected to reach a conclusion about the accuracy of the modeled concentrations before late 2007. At your request, ATSDR is also available to evaluate the study results after data collection is complete; and

- Data on the intensity, duration, and frequency of emissions at a subhourly level. ATSDR will discuss this further with Mirant in early 2007, but this information is not collected by the regulatory agencies and may not be available for this site; and

- Indoor/outdoor contaminant ratio data. The relationship between indoor and outdoor air contaminant concentrations will help us estimate actual exposures. At your request, ATSDR is available to pursue an exposure investigation to collect these sampling data in the community.

You may wish to provide health messages to your community. We recognize the difficulty of doing so with incomplete information. Still, some messages may be worthwhile. Messages designed to educate teachers, parents, and children about the importance of recognizing and treating asthma and the hazards of certain air pollutants seem reasonable. Feel free to contact my staff should you need any assistance in developing such messages.

Thank you for your patience during our initial evaluation. ATSDR looks forward to continuing to work with you and is available for additional consultation. Please contact Ms. Lora Werner, ATSDR Senior Regional Representative, at (215) 814-3141 if you have any questions concerning this response.

Sincerely yours,

William Cibulas

William Cibulas, Jr., Ph.D.
CAPT, U. S. Public Health Service
Director
Division of Health Assessment and Consultation

Enclosure

**Attachment**

ATSDR considers whether evidence of adverse health effects has been reported in animal or human studies when exposures to a pollutant of concern may have been near ambient levels estimated by air dispersion modeling. ATSDR uses an assessment approach to apply professional judgment to the strength of evidence from available sources. In general, ATSDR assigns greater weight to human studies such as controlled exposures than to epidemiological studies or experimental animal studies, although all evidence is considered at varying levels of uncertainty. Scientific uncertainty decreases as the preponderance of evidence increases. Although individual responses cannot be predicted at most exposure levels with any degree of certainty, ATSDR tries to describe the likelihood of effects occurring for a described exposure based on site-specific factors.

ATSDR evaluated scientific information about sulfur dioxide ($SO_2$) in terms of short- and long-term exposures. ATSDR considers the scientific literature strongest for short-term exposures, which are generally described as acute exposures to human subjects in a controlled environment such as a chamber or the use of a mouthpiece or facemask. Long-term exposures to human populations are described in epidemiological studies, which cannot prove cause and effect for a contaminant, but can provide associations between a contaminant and health effects that suggest potential causes. Although experimental animal studies provide the most control of both exposure and genetic homogeneity, their exposure, responses, and relevance to human exposures and responses may not be equivalent.

**Short-term Exposures**

The strongest scientific information was generated in controlled acute human exposures to levels of $SO_2$ that were similar to ambient air levels estimated by air dispersion modeling of air emissions from Mirant. A level of concern was generally exceeded for past operating scenarios and for short-term current operating scenarios. Acute exposures to short-term $SO_2$ levels estimated by air dispersion modeling of Mirant air emissions under current operating conditions may be of public health concern to exercising asthmatics and asthmatic children. Healthy, nonasthmatic individuals are generally

unaffected by acute exposures to concentrations of $SO_2$ that are below about 1 parts per million (ppm) (2600 micrograms per cubic meter [$\mu g/m^3$]) – 2 ppm (5200 $\mu g/m^3$). ATSDR concludes that considerable evidence exists that brief exposure (5-10 minutes) to $SO_2$ levels greater than 0.5 ppm (1300 $\mu g/m^3$) may cause adverse health effects or reduced quality of life in exercising asthmatics. Adverse health effects or reduced quality of life is defined as resulting in the disruption of ongoing activities, the need for medication, or the seeking of medical attention.

For brief exposures (5-10 minutes) between 0.1 ppm (260 $\mu g/m^3$ ) and 0.5 ppm (1300 $\mu g/m^3$), the evidence is less certain for a response that would result in disruption of ongoing activities, the need for medication, or the seeking of medical attention. In this range of exposure, subjects generally exhibited a response that may be considered adverse or may be considered adaptive when the response is equivalent to a response to other stimuli (such as cold air or dry air or exercise) or within the normal daily variation. One study measured a response in some asthmatic individuals to concentrations as low as 0.1 ppm (260 $\mu g/m^3$)(Sheppard D, Saisho A, Nadel JA, et al. 1981 Exercise increases sulfur dioxide-induced bronchoconstriction in asthmatic subjects. Am Rev Respir Dis 123:486-491). ATSDR's minimum risk level (MRL) for acute inhalation exposure to $SO_2$ (0.01 ppm) was based on this study. The extent to which the participants in the studies reflect the asthmatic population is not known, but the types of responses have been generally consistent.

Therefore, for exposure to levels between 0.1 ppm (260 $\mu g/m^3$) and 1 ppm (2600 $\mu g/m^3$) to have resulted in a response, the individuals have been asthmatic or atopic, moderately exercising, or breathing through both the mouth and nose. (Nasal only breathing has a scrubbing effect, reducing the $SO_2$ delivered to the lungs. Deep, rapid breathing simulates breathing during exercise and results in similar effects at similar levels.) The following table summarizes the above information.

| Sulfur dioxide | General health effects |
|---|---|
| < 0.1 ppm (260 μg/m$^3$) | No response has been reported in asthmatics. |
| 0.1 – 0.5 ppm (260-1300 μg/m$^3$) | Some asthmatic subjects experienced increased airway resistance, decreased expiratory volume. |
| 0.5 – 1.0 ppm (1300-2600 μg/m$^3$) | Some asthmatic subjects required medication, had to stop exercising, or sought medical attention. Some experienced wheezing, chest tightness, cough, and/or dyspnea (shortness of breath). |
| > 1.0 ppm (2600 μg/m$^3$) | Some nonasthmatics start to develop symptoms such as increased airway resistance, sense of irritation, cough; also reported are increased pulse, increased inflammatory cells in lavage fluid, and decreased tidal volume. |

Air dispersion modeling of Mirant $SO_2$ emissions showed historical maximum 3-hour and 24-hour averages (AERO Engineering, August, 2005) estimated to be in excess of levels reported to cause health effects in sensitive populations and in excess of levels reported to cause health effects in nonsensitive populations. Historical $SO_2$ air modeling estimates (ENSR Corporation, August, 2005) exceeded 2.6 ppm (7000 μg/m$^3$) for maximum 3-hour averages, and 24-hour maximum averages ranged from 1.2 ppm (3000 μg/m$^3$) to 1.9 ppm (5000 μg/m$^3$) in each of the years modeled (2000 – 2004). Other maximum modeling estimates of $SO_2$ were as high as 3.8 ppm (10,000 μg/m$^3$) for a 3-hour average (AERO Engineering, August, 2005).

Current ambient air maximums have been estimated to average 0.35 ppm (900 μg/m$^3$) – 0.39 ppm (1000 μg/m$^3$) for 3-hour average concentrations (ENSR Corporation, January 2006, Options A and B, Updates 5 and 6). Adverse health effects and reduced quality of life become more likely considering that the 3-hour estimate is an average value and adverse health effects and reduced quality of life have been demonstrated at lower levels during 5-10 minute durations. Some nonsensitive individuals may also be affected because peaks may be high enough to cause a response during brief exposures. An important data gap is the frequency and duration at which exposures of concern may occur. The nature of emissions becomes important in predicting ambient levels and potential health effects in relation to the average values.

**Long-term Exposures**

Potential health effects from chronic exposures are less clear, but evidence from epidemiology studies suggest an association between adverse health effects and $SO_2$ exposure, although cause and effect is uncertain. Developing information on the pathophysiology of asthma is providing insights into potential chronic health effects from repeated short-term inflammatory responses, such as may occur during short-term $SO_2$ exposure. Inflammation is often, but not always, a feature of mild or moderate persistent asthma. Chronic inflammation may help to explain some of the potential chronic health effects associated with air pollution in epidemiology studies.

In actual practice, exposure occurs to more than one contaminant, and the potential for adverse health effects from exposure should include potential effects from coexposures, such as $SO_2$ and particulate matter. In addition, exposures should be further characterized by how often peaks occur, the extent of the peak, and where the peak is located.