Health Consultation

ATSUGI JAPAN NAVAL AIR FACILITY

ATSUGI, JAPAN

APRIL 21, 1998

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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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Prepared by:

Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

PURPOSE

The Navy's Environmental Health Center (NEHC) requested the Agency for Toxic Substances and Disease Registry (ATSDR) to provide a health consultation regarding air quality at the U.S. Naval Air Facility (NAF) Atsugi, Japan. This document will summarize ATSDR's evaluation of the sampling and modeling data provided by NEHC and the risk calculations conducted by NEHC for the purpose of illustrating their reliability for use in evaluating the impact on human health. Additionally, we will evaluate the feasibility of biological monitoring and make recommendations regarding the sampling plan to be conducted by NEHC as part of their full risk assessment.

BACKGROUND

The Jinkanpo incinerator is an off-base privately owned incinerator located approximately 250 meters from the NAF Atsugi base housing. U.S. military personnel and their dependents have been and continue to be periodically exposed to air emissions from the incinerator. Dependents and military personnel have reported health concerns and symptoms which they attribute to their exposure. In August 1997, the incinerator increased operations from an 8 hour burning time to a 24 hour burning time.

In July, August, and September 1994, NEHC conducted ambient air monitoring on the base at a location where modeling predicted the highest concentrations of air contaminants from the incinerator. At the time of sampling, the monitoring point was impacted by a visible plume from the incinerator stacks. In 1997, NEHC conducted additional air samples to characterize air emissions from the incinerator in order to assess the health impact on the base population.

In December 1997, NEHC requested ATSDR to review their data, evaluation, and conclusions and to make recommendations on actions needed 1) to protect the exposed populations, 2) for follow-up sampling, and 3) for follow-up medical intervention. ATSDR's preliminary assessment was sent in the December 30, 1997 letter to Captain R.L. Buck, NEHC Commander (attached Appendix A). This health consultation is a follow-up to that letter which details ATSDR's evaluation and recommendations.

DISCUSSION

A. Evaluation of Sampling and Modeling Data

The results, both predicted and measured, are reliable for 1) determining short-term ambient air concentrations, 2) determining the region of maximum impact for a short-term release, and 3) determining the region of maximum impact for a long-term release. However, ATSDR has concerns about the application of these results for determining long-term average ambient air concentrations which are required for evaluating carcinogenic risks.

Summa canister samples were collected over 30-second intervals and analyzed for volatile organic compounds (VOCs). Tennax tube samples were collected over a two-hour period and analyzed for VOCs. PUF cartridges samples were collected over a 24-hour period and analyzed for pesticides, polyaromatic hydrocarbons (PAHs), polycarbonated biphenyls (PCBs), and dioxins. Particulate samples (PM10) were collected over a 24-hour period and analyzed for metals.

The data was provided to ATSDR within the document, *Air Quality Impact Study and Human Health Preliminary Risk Evaluation of Jinkanpo Incinerator Complex Activities on Naval Air Facility, Atsugi, Japan. September 1995.*

Sampling Method

The values obtained during the sampling event may be indicative of short-term exposures because they were collected during events in which the prevailing wind direction was toward the sampling station. However, the following issues make the estimated concentrations unreliable for estimating-long term dose.

In reviewing the meteorological conditions measured at the time of sampling, an argument can be made that there are atmospheric conditions that can produce concentrations much higher than those measured during those specific time periods. If all other atmospheric conditions were held constant and the wind was reduced by half, the concentrations obtained via sampling may have been doubled. Had these emissions occurred during a period when a temperature inversion was eroding (after sunrise), then fumigation conditions may have occurred, increasing the ambient concentrations by a factor of 10 or more.

Using these short-term sampling results to make a long-term health impact decision is difficult. Long-term conditions are variable and, therefore, usually produce sufficient mixing to disperse the contaminants into the atmosphere, thus, reducing downwind concentration though dilution.

Regulatory procedures for first level screening suggest an annual factor of 0.15 for a 1-hr sample (or 0.375 for a 24-hr sample). Thereby, one can obtain the annualized concentration by multiplying a 1-hr (24-hr) concentration by 0.15 (0.375). Air/Superfund suggests a 1-hr to annual concentration conversion factor of 0.08. Recent studies have provided annual conversion values within the range of 0.025-0.1 for dispersion from sources which undergo initial mixing (which occurs frequently in industrialized centers). These values imply a large variability (0.025 - 0.15) in the differences between long (annual) and short-term (hourly) average ambient concentrations.

Modeling Method

To obtain estimates of long-term ambient concentrations from the isopleths, the method of multiplying the measured emission rates is usually applied. The method used for Jinkanpo uses the values obtained via a mass balance of the expected destruction efficiencies along with the expected waste throughput, an accepted method for providing a conservative estimate for permitting purposes and a reasonable method for determining an upper-bound estimate. The values for Jinkanpo were obtained via acceptable emission limits, the lower limit in which an incinerator should operate.

To illustrate the effect of using lower-limits this way, a classic example for thermal destruction was used. A design equation used to evaluate destruction efficiency of toluene (based on molecular structure) gave a 99 % destruction efficiency at 1259° F and a 99.9 % destruction efficiency at 1267° F. This means that a variation of less than 10° F will produce a ten fold change in the destruction efficiency. Put another way. a variation of less than 1 % in the temperature will produce a 1000 % change in the efficiency. The resultant emission rate predicted at 1259° F would be ten times that of the rate predicted at 1267° F. Typically a conservative estimate is made when evaluating a system. Engineering estimates made for particulate emissions are also conservative to public health in that they over estimate rather than underestimate. This resultant error will directly be passed on to the dispersion model and passed on into the exposure, dose, and risk calculations.

Should the sampling and modeling results be used as a screening method to predict average-annual concentrations for cancer risk calculations, it should be noted that the level of confidence in the values is low, and the estimated values may be an over-estimate of two orders of magnitude (100 times) from the actual ones.

B. Evaluation of Risk Calculations Conducted by NEHC

The general process used to evaluate the risk of air emissions from the incinerator is consistent with EPA's methods for obtaining a permit for the facility to operate. ATSDR concurs that risk calculations conducted by NEHC indicate a potential health hazard for people being exposed to contaminant plumes in air originating from the Jinkanpo incinerator. However, because of limitations in the data and assumptions used to generate the risk assessment, these risk calculations should not be used as the basis for definitive health conclusions. Instead, ATSDR recommends that precautionary actions be taken to reduce risk until more substantial definitive data is collected as part of the proposed full risk assessment planned in 1998.

NEHC calculated health risks using EPA cancer and non-cancer risk numbers. ATSDR did not verify the NEHC calculations, except to note that they followed standardized EPA risk assessment protocols. Using the average values of the contaminants detected, NEHC calculated that a 30-year, continuous exposure would equate to a cancer risk of 1.15×10^{-3} and a Hazard Index of about 27. These preliminary risk calculations indicate that incinerator operations may adversely affect the health of personnel who live and work on the base. However, there are numerous factors that contribute substantial uncertainty to the estimated risks. Factors that could increase or decrease the estimated risks are discussed below.

Considerations that could decrease the calculated risks:

(1) NEHC collected ambient air samples at a location where maximum concentrations of air contaminants were expected. At the time the samples were collected, the sampling station was in the path of a visible particulate plume from the incinerator. These factors indicate that the measured contaminant levels may represent worst-case exposure conditions. The actual contaminant levels that people are exposed to would be significantly less depending on wind direction, weather conditions, distance from the incinerator, etc.

(2) During ambient air monitoring, background air contaminant levels were measured at a location adjacent to the incinerator. Significant concentrations of air contaminants were detected at this background location. This is not surprising, since the base is located in an industrialized area. Heavy vehicular traffic, on and off the base, could also contribute to background air contamination. Risk calculations indicate that almost 50 percent of the cancer risk attributed to incinerator emissions may be accounted for by background contamination.

(3) Exposures were assumed to occur for 24 hours a day and 350 days a year. This would yield a conservative, upper-bound estimate of risk.

(4) NEHC collected relatively few air samples, and some were for intervals as short as 30-seconds. These data would not be representative of long-term contaminant levels.

Considerations that could increase the calculated risks:

(1) Since the time samples were taken, the incinerator has expanded operations from 8 to 24 hours a day and from 30 to 90 tons per day which would significantly increase contaminant emissions and the resulting risks.

(2) Air particulates, nitrogen oxides, sulfur oxides, ozone, carbon monoxide, and other chemicals in air emissions could contribute to the total health hazard posed by incinerator operations, but which are not captured in risk calculations.

(3) Incinerator operations may impact other environmental media (soil, groundwater, biota) to which people are exposed. Combining these would increase human health risks.

(4) The risk assessment does not address risks resulting from upset conditions at the incinerator, such as during a power failure. The acute health risks associated with such emergency events can be more significant than risks from long-term, low-level exposures.

The preliminary risk evaluation indicates a potential health concern that should be further evaluated by a full risk assessment. Because of limitations in the data and assumptions used to generate this preliminary risk assessment, it should not be used as the basis for definitive health conclusions.

C. Evaluation of Feasibility of Biological Monitoring

Based on the preliminary air sampling, monitoring, and modeling data, biological monitoring may be able to provide some information on general exposure to certain chemicals such as lead and chromium. However, such testing would not be able to address whether or not exposure would have come from breathing contaminated air from Jinkanpo incinerator. Moreover, results of biological testing are not always able to be linked to health effects. Results are best used to provide evidence of the level of exposure in order to be used for recommendations to reduce or stop future exposure.

Environmental sampling is a crucial part of the risk assessment process. It can be used to quantitate potential exposures from incinerator operations and estimate the resulting

health risks. However, environmental sampling does not measure actual exposure or health effects. For these endpoints, other types of testing are required such as biological monitoring, health effects testing, or health studies.

Biological monitoring can measure actual exposure to an environmental contaminant. Because a chemical or its metabolite is directly measured in a body fluid or tissue, it is not necessary to make any assumptions regarding the length or frequency of exposure, environmental contaminant levels, or amount of contaminant absorbed. An ideal biomarker would be one that meets the following criteria: is unique for the source of exposure, easily measured, and readily interpreted.

None of the contaminants identified as posing significant health risks at NAF Atsugi satisfy all these criteria. Of the contaminants detected, chromium posed the greatest non-cancer health risk. Furthermore, the downwind concentrations of chromium were 2 to 5 times higher than background concentrations. Therefore, biomonitoring for chromium might be of value, particularly if some of it were in the +6 valence. In occupational settings, urine biomonitoring for chromium is sometimes conducted for welders and other workers who are exposed to airborne chromium +6. Chromium +3 is less well absorbed, so urine biomonitoring for exposure to chromium +3 would be a less sensitive indicator of exposure.

Health effects testing is also problematical, since there is no unique health endpoint that can be attributed to incinerator emissions. Longitudinal pulmonary function tests are sometimes used as an indicator of decreased pulmonary capacity that could result from exposure to respiratory toxicants. However, it would be difficult to dissect out the effects of general air pollution, smoking, and allergies from the effect of exposure to incinerator emissions. Furthermore, when the duration of pulmonary function measurements span only 3 to 4 years, the difference due to instrument and testing variation may exceed the small differences that might be due to environmental exposure.

It might be more useful to associate acute changes in pulmonary peak flow parameters with episodic increases in air pollutants from incinerator emissions. For example, a panel of residents, such as children with asthma who may be more susceptible to air pollutants, could record peak flows 2 to 3 times a day, and the daily variability in peak flow could be correlated with the level of particulates or other air pollutants. Panel studies usually last 3 to 6 weeks and can be done in seasons when the pollen counts are low to reduce confounding by airborne allergens.

D. Evaluation of Proposed Sampling Plan

ATSDR believes that the proposed sampling plan is comprehensive and uses many of the most reliable technologies, including some that are recent developments. It is expected to provide sufficient data to evaluate the long and short-term impacts of the incinerator and affiliated operations on those people exposed.

NEHC's previous sampling events are indicative of short-term exposures and can be used to determine short-term health impacts, but they are not sufficient for determining long-term health effects. A simple solution to determining long-term exposures would be to sample at the stack. However, this is not possible because the authorization to enter the facility grounds is not likely to be granted.

To answer the concern for potential long-term exposures to the incinerator, NEHC developed a sampling plan to be conducted in 1998. The information was provided to ATSDR within the following document: *Sampling and QA/QC Plan to Demonstrate Health Impacts from the Jinkanpo Incineration Complex Naval Air Facility, Atsugi, Japan, November 1997.*

The sampling plan intends to meet the following objectives: 1) define the extent of chronic and acute risk to NAF Atsugi base personnel likely to be caused by the operation of the Jinkanpo Incineration Complex; and 2) define the contribution of the risk attributed by the Jinkanpo Incineration Complex.

To follow is a record of the issues contained within the document. This record will summarize ATSDR's evaluation of the sampling to be conducted by NEHC for the purpose of illustrating their reliability for use in evaluating the impact on human health. This list of issues may complicate or may improve the success of the field activities and data collection. Each is prefaced by the sections in the sampling plan that most apply

3-10 & 4-5: The plan does not discuss how interferant compounds will be considered when sampling the indoor air. ATSDR suggests a questionnaire be distributed to inquire about all indoor and/or house-hold items used. This inventory list would allow people to check off what they have in their home which would help identify where the compounds are coming from (gasoline, turpentine, cleanser, nail polish remover, Freon, etc.) We also suggest a background of the indoor air be determined to account for the substances that are already there.

5-8: For the sampling strategy that is outlined, ATSDR recommends that an attempt be made to collect up wind and down wind samples simultaneously.

5-17: The plan does not state that sector-sampling will be used. ATSDR recommends that sector samplers be used because it will provide stronger support for identifying a single source as being responsible for an elevation of the downwind concentrations.

5-19: ATSDR is concerned that the method for measuring mercury may not be effective for both the vapor and particulate form. ATSDR recommends the method for measuring mercury be verified by sending a percentage of the samples to a lab for confirmation.

5-20: To better identify health impacts, (rather than regulatory impacts) ATSDR recommends that criteria pollutants also be sampled at the 1.5-meter height.

5-27: ATSDR recommends that the plan lists the FTIR (open path) scan periods (duration) and the ability of the meteorological station to support the time periods. The ability to determine stability is important when determining a source term as well as to extrapolate concentrations downwind. This instrument does not measure concentrations to directly determine exposures, so meteorology is important.

5-41: The specifications of the data acquisition system should be listed.

10-15: ATSDR recommends that the frequency of the instrument reporting and acquisition be listed.

12-15: Determine in advance the lower limit (wind speed) at which the data frequency is sufficient to determine stability for the use with the FTIR (due to response).

12-18: Please be more explicit with the audits of the VOC (SUMMA) samplers. ATSDR recommends quarterly checks including checks while the pumps are under different loads because flow rates do vary. For example, when there is different negative and positive pressures in the can.

ATSDR believes that a sampling plan that includes these suggestions could be used to determine health impacts from multi pathway exposures to air emissions from this facility.

REFERENCES

U.S. Environmental Protection Agency, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, PB89-159396, Research Triangle Park, NC, 1988.

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