Municipal Regulation of Medical Waste Incineration

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Executive Summary

During the recent review of the master plan for Northwest Hospital, the adjacent residential community requested an environmental study of the new medical waste incinerator. Although the City could not legally conduct such a study at that time, a more general "review [of] Medical Waste Incineration in the city with regard to land use policy and regulation" was promised. This report is that review.

Although this report provides information about the three Seattle medical waste incinerators, it was not intended to and does not present detailed analysis of the health or environmental exposures or risks that might exist in residential neighborhoods surrounding the hospitals. Nor does this report present an assessment of the potential health and environmental risks that might be associated with the use of any alternative treatment or disposal technology.

This summary follows in the same order as the report and the chapter where each subject is discussed is indicated.

(Chap. 2) Medical waste is different from general municipal solid waste because it contains potentially infectious wastes, including human tissue, hypodermic needles, laboratory wastes, blood, other body fluids, etc. Actually, infectious wastes make up only about 10 to 25 percent of all these wastes coming from a hospital. The remainder is paper, food, glass, etc. that is very similar to ordinary municipal waste. A primary difference between medical waste and municipal waste is the greater amount of plastic in medical 2waste, which is often used in sterile packaging and for non-reusable items.

Incineration. (Chap. 3) Historically, steam sterilization (autoclaving) and incineration have been the two main ways hospitals have treated their wastes prior to disposal. The most common kind of incinerator used in hospitals is called "controlled air". It is the type used in the three Seattle hospitals with incinerators (Northwest, Swedish, and VA). Using two combustion chambers, it is possible for a controlled air incinerator to achieve a combustion temperature of more than 1800 F and to effectively destroy almost all of the organic compounds in the exhaust gas.

Particulate matter emissions from larger, newer medical waste incinerators are generally controlled by a baghouse. Acid gas emissions will most often be controlled by a scrubber, which injects powdered lime or a similar chemical into the exhaust gas to react with the acids. The reacted lime is then removed in the baghouse. Low temperatures in the pollution control device are important for the control of metals and dioxins. A stack that is high with respect to the adjacent and surrounding buildings is important to avoid the possibility of winds blowing the plume directly back down to the ground.

Alternatives. (Chap 4) Emissions from medical waste incinerators can be reduced by decreasing the amount of waste that goes to the incinerator and by selectively diverting certain wastes away from the incinerator. Other methods to disinfect the waste prior to disposal, besides incineration, are also becoming widely used.

Programs to recycle plastics are in place in several Washington hospitals and can divert as much as 20 percent of the waste (by volume). One study found that up to 47 percent of the waste (by weight) could be recycled or eliminated.

Electrothermal deactivation (ETD) is used by all the Seattle hospitals without incinerators, except the University of Washington, which uses and autoclave. This process requires the waste to be carried to a central facility at Morton, Washington where the wastes are heated to kill spores, bacteria, and viruses. The treated residual, except for the plastics that have been segregated for recycling, is currently being landfilled, but permits have been obtained to burn it in a Seattle cement kiln.

Other systems are available for use in hospitals that employ various heating methods to reduce the infectious potential of the waste. Disinfection of shredded wastes with a solution of bleach is also used. Blood and body fluids can be disposed directly to the sewer.

Regulations. (Chap. 6) The emissions of pollutants from medical waste incinerators to the atmosphere are regulated by both air quality standards and emission rate limits. The air quality standards are intended to protect the public from inhalation of pollutants in harmful amounts. Emission limits are based more on a requirement for sources to use a particular control technology, which results in ground-level pollutant concentrations from the source much lower than the air quality standards. For the more toxic air pollutants, the technology-based emission rate is checked against an acceptable air quality concentration for each new installation.

The Puget Sound Air Pollution Control Agency (PSAPCA) is responsible for regulating air emissions sources in Seattle. It requires any new source to utilize the best available control technology. PSAPCA has adopted emission limits that apply to medical waste incinerators that essentially require a baghouse and acid gas control equipment. Other emission limits implicit in PSAPCA's toxic pollutants regulations are also approximately those expected from an incinerator with a baghouse and acid gas control equipment.

PSAPCA has conducted a review of toxic air pollutant emissions from the Northwest Hospital incinerator. If the current operating schedule were an enforceable condition of the Northwest permit, no further air toxics review of the Northwest incinerator would be justified. No air toxics review has been conducted of either the Swedish or Veterans incinerators.

Specific regulations for medical waste incinerators have been adopted by several other states. The PSAPCA regulations are similar to, and in many instances more strict than, these specific regulations. The California regulations are very similar to the PSAPCA requirements for both particulate matter and dioxin emissions.

Emission measurements. (Chap. 7) Emissions tests have been conducted for particulate matter and hydrochloric acid (HCL) from each of the three active medical waste incinerators in Seattle. The measured emissions of particulate matter from Swedish Medical Center and the VA Medical Center were roughly half the emission rate allowed by PSAPCA while their HCL emissions were

less than one-third the allowed rate. The measured emissions of particulate matter from Northwest Hospital were about one-fifth the allowed rate and the measured HCL emissions were less than one-sixth the allowed rate. A measurement of metals emissions from Northwest Hospital did not find detectable levels of cadmium and the emission rate of mercury was more that 200 times below the level allowed by PSAPCA regulations.

Data from emissions measurements at similar hospital incinerators with similar control equipment are provided in the report. Many of the measurements of particulate matter and HCL are in the same range as the measured emissions from the three Seattle incinerators, although some are less and some are more. Data are also available for emissions of dioxins from some of these units. Partly because the data represent several types of control equipment, the emission rates of dioxins range over more than a factor of 100.

Health risks of incineration. (Chap. 8) Opportunities for exposure to medical waste include, in addition to inhalation of air emissions, rodents or insects that contact the waste during storage, spills during transport of untreated waste, contamination of groundwater from poorly controlled landfills, and contact by health care and waste industry workers. Of these, the opportunities for occupational exposure are clearly the most important. Surveys of workers have found significant numbers of actual exposure events. Reducing the exposure of health care workers is one of the reasons hospitals have moved to disposables from reusable materials. Reducing the number of times medical waste is handled is a significant advantage of on-site incineration.

Dioxins are found everywhere in the environment. Dioxin sources in urban areas include motor vehicles, industrial and chemical manufacturing, industrial combustion sources, woodstoves, and fires. Models of how dioxins move in the environment suggest that a least half the human intake of doxins is through food.

Dioxins are the most important air pollutant from medical waste incinerators that already have good particulate matter and acid gas controls. Dioxins are currently classified by the U.S. Environmental Protections Agency as a probable human carcinogen. This identification has been strengthened by recent studies. Studies have also identified reproductive and developmental effects from dixoin exposure.

The next most important pollutants from controlled medical waste incinerators are chromium^{VI}, hydrochloric acid, lead, and mercury. Over the long-term, mercury, cadmium, and lead are toxic to vital human organs. Chromium^{VI}, HCL and sulfur dioxide are highly irritating to the lungs.

Risk Assessment. (Chap. 9) Studies of the potential cancer risk from exposure to emissions of dioxins and other carcinogenic compounds from medical waste incinerators must take into account the variety of ways people may come into contact with these compounds as well as the compounds toxicity. In addition to inhalation, exposure can occur from drinking water, food, absorption through the skin, etc., although not all of these will be applicable in an urban area. The increase in the risk of cancer with each increase in the concentration of the pollutant studied and multiplier factors have been developed from the medical research.

Ground-level concentrations of pollutants are estimated from meteorological dispersion models. When all the data are assembled, the resulting risk assessment estimates the incremental risk of cancer to a "maximum exposed individual."

The EPA has been conducting an extensive review of dioxin over the past several years which is coming to a conclusion in the next few months. While it is not certain exactly what conclusions will be reached, it is clear their estimate of dioxin toxicity will not be increased (i.e., will not predict higher levels of cancer risk). Further consideration of the reproductive and developmental effects appear to support the risk estimates based on the cancer studies.

In evaluating risk assessment analyses it is necessary to first determine if the risk is significant and, if it is, is it at a level which will be unacceptable. The level of insignificance has been most frequently set at one in one million (10^6) and the level of unacceptable risk has been most often chosen between 10^{-5} and 10^{-4}.

A detailed risk assessment has been prepared for a new incinerator of the Mayo Foundation in Minnesota. This analysis assumed an incinerator with a one ton per hour capacity and calculated the health risk for a farm family living a the point of maximum ground-level impact of the exhaust gas. The greatest risk was associated with consuming beef and milk produced at the farm. Inhalation was about one-third of that. Consumption of garden produce produced only a very small risk, by comparison. The overall risk of an additional cancer was calculated to about 5.4 chances in a million (5.4×10^{-6}).

Less detailed studies were conducted for eight medical waste incinerators in California and for a hypothetical incinerator in New York City, all of similar sizes to the units operating in Seattle. The results of the California risk assessments ranged from 3 to 180×10^{-6}. The estimate for the New York City incinerator was 5×10^{-6}.

Land Use. (Chap. 10) Land use laws are intended to minimize adverse impacts on adjacent properties. The potential land use impact of medical waste incineration on nearby residential property will be primarily from an increase in real or perceived health risks from the incinerator's air emissions. Attempts to study the effects of incinerators on residential property values have been inconclusive.

Currently Seattle regulates hospitals and incinerators at hospitals through its land use laws and environmental impact review procedures. Because many hospitals are located in or adjacent to residential neighborhoods, the City had established special requirements for hospitals in the Major Institution Overlay District. Specifically, city review of hospital construction plans are conducted through a major institution master planning process. This process incorporates citizen review and provides opportunity for public review. However, since air quality permits are granted not by the City but by PSAPCA, the development of operating conditions for a medical waste incinerator is not well integrated into the City's process.

(Chap. 11) Other jurisdictions have attempted to regulate hospital incinerators in several different

ways. In Baltimore County, Maryland, as in Seattle, air pollution control is not the responsibility of the county government. With a desire to gain control over medical waste incinerators, the county developed, but did not adopt, a Special Exception review process that required the applicant to prove that the new incinerator is needed, that it can be operated safely, that it will not cause a public nuisance, and that it will be compatible with the neighborhood. In Hall County, Georgia a detailed ordinance was developed and adopted that required extensive documentation of financial responsibility, operating and emergency procedures, transportation plans, and a site closure plan, and provided emissions standards similar to the adopted California standards. The entire process would be overseen by an appointed citizen board. This ordinance is so onerous that a prospective applicant withdrew and no other has applied. The State of Wisconsin law requires proposed medical waste incinerators to justify the need for new incinerator capacity and the appropriateness of the proposed site. One application has been processed and the application was granted, although it was for replacement of an existing unit.

Policy options. (Chap. 12) The city can choose from five broad policy options how it will address the review of existing and future medical waste incinerators:

Maintain the status quo. Under this option, no further legislative action would be taken by the City of Seattle.

Increased utilization of PSAPCA expertise. One approach would be the adoption of an agreement between the City and PSAPCA that would strengthen coordination in the review of applications and provide inspectors from PSAPCA to aid in enforcement of provisions of the City land use permits. Another approach would e to request PSPACA to consider adoption of additional standards or emissions testing requirements.

Land use code amendments. Regulation of medical waste incinerators could be specified in the Major Institution Overlay District standards. Incinerators could be allowed as an administrative or Council conditional use, prohibited, or regulated according to size. Standard conditions could be incorporated into the master plans of all hospitals with incinerators.

Solid waste code amendments. The City could extend flow control to medical waste. It could either specify a hauler or a treatment operator that would accept all or a specific portion of local medical waste and dispose of it according to City-defined standards.

Separate medical waste incinerator ordinance. A single ordinance could integrate into one document all rules and regulations regarding medical waste incinerators. The scope of the ordinance could include many elements, such as, permit process, public and peer review, justification of need, waste reduction and recycling goals, siting criteria, emissions limits and testing, and medical waste handling and transportation.