MEDICAL WASTE TASK FORCE

Report To The Minnesota Legislature

September 1992

Pursuant to 1991 Laws, Chapter 344, Section 8

MEDICAL WASTE TASK FORCE

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EXECUTIVE SUMMARY

This summary contains an overview of the Medical Waste Task Force; a review of the statute which created the task force; a description of medical and infectious waste management in Minnesota; an explanation of health risks from infectious waste; and a synthesis of the subcommittee reports related to each of the statutory mandates. Conclusions and recommendations from the entire task force are then offered to the legislature for a balanced approach to medical waste issues and concerns.

The Medical Waste Task Force

The 1991 legislature mandated the Commissioner of Health to appoint a medical waste task force (MWTF). Nineteen individuals from, as specified in the legislation, "the pollution control agency, the department of health, the office of waste management, representatives of local government units, citizen groups, environmental organizations, organized labor, the academic community, medical waste generators, and persons in the business of managing medical waste" were appointed to the task force. In addition to comprising the broad representation required by statute, the membership represented the range of important stakeholder interests in the development of a strategy report on medical waste management in Minnesota.

MWTF members provided knowledge, expertise, diverse experience, and special interests and concerns related to the issues of medical and infectious waste management. Members' interests and ideas were at times in direct conflict with other members'. Although there were broad areas of agreement, as reflected in the Conclusions and Recommendations, consensus could not be achieved on certain important ideas. Support for each member to fully contribute in discussing and examining all significant issues and in formulating conclusions and recommendations was urged initially by the Commissioner of Health and throughout the process by the task force chair. The final report represents the sincere and diligent efforts of all of the members of the MWTF to consider the issues presented, balance their own special interests, and develop a meaningful response to the legislature on the subject of medical and infectious waste in the state of Minnesota.

The process began with a series of background presentations to all the members on infectious and solid waste (since most medical waste is solid waste), statutes, rules, procedures and available waste management resources. Then, to make the broad scope of the legislative mandate more manageable, subcommittees were assigned to address each separate charge, bringing issues to the complete task force for discussion and direction. The MWTF agreed to try to reach consensus on issues rather than present majority and minority reports. Therefore, although the report is physically arranged to present the work of the subcommittees, all sections were developed and adopted by the entire task force.

The Legislative Mandate

Public concern about disease risk from infectious waste, particularly for AIDS and hepatitis B, has prompted much of the existing state and federal infectious waste legislation. In 1989, following a report from the Minnesota Attorney General's task force, the Infectious Waste Control Act was enacted by the state legislature to regulate the management of infectious waste. Incineration is a common method of treating and disposing of both infectious waste and medical solid waste. Recent intense public debate over incineration -- and a desire to seek environmentally conscious ways of managing medical waste -- led to the legislation creating the MWTF.

The legislation creating the MWTF identified four specific charges for the task force:

(1) estimate the quantity and composition of medical waste currently generated in the state;
(2) assess the current infectious waste decontamination capacity in the state;

(3) design a state policy that focuses on alternatives to landfilling and incineration as the primary means of infectious waste disposal according to the order of preference in Minnesota Statutes, section 115A.02, paragraph (b); and
(4) submit, by September 1, 1992, a medical waste management strategy report to the Legislative Commission on Waste Management, and to the Legislative Committees on Environment and Natural Resources and Health and Human Services, recommending a statewide medical waste management policy.

The magnitude of the mandate was somewhat challenging given the complexity of the issues and overlapping state and federal roles. In addition, the task force had difficulty in "reading between the charges," that is, discerning the underlying assumptions of the charges and their order in the statute. For instance, if one charge is to develop a policy based on alternatives to incineration, must the task force start with an anti-incineration premise? Or can the policy discuss a role for incineration and alternatives? The chair, in consultation with the Commissioner of Health, decided to approach each charge and the mandate as a whole as if there were no foregone conclusions.

Thereafter, the first assignment for the MWTF was to establish working definitions for the terms *infectious waste* and *medical waste*, which are both contained in the mandate but are not synonymous. *Infectious waste* is statutorily defined in the Infectious Waste Control Act (1989) and comprises a special waste stream which potentially contains agents that could transmit disease. Special handling and segregation practices are required for infectious waste. *Medical waste* is not defined by statute. It includes both infectious waste and non-infectious solid waste produced by health-care facilities.

To make matters confusing, once decontaminated, infectious waste, with the exception of sharps, becomes non-infectious waste and can be handled according to rules governing the disposal of all municipal solid waste. Sharps -- needles, razor blades, broken glass -- can create an opening for other infections and, even though decontaminated, can not be mixed with other wastes unless approved by the Commissioners of Health or the Pollution Control Agency.

Clarifying these terms was important to meet the legislative mandate and to understand that the two different waste streams pose different health risks and different waste-management regulations. This required the MWTF to review both infectious waste management and solid waste management in the state and to think about how changes in one might affect changes in the other.

Regulatory Review of Infectious and Medical Waste Management

The Infectious Waste Control Act (1989) was enacted in 1989. The act authorizes the Minnesota Department of Health to regulate generators and the activities that take place at the generating facilities, with the exception of on-site incineration. The Minnesota Pollution Control Agency (MPCA) regulates incinerators, commercial transporters, and off-site decontamination, storage and disposal facilities. The regulated parties are required to submit management plans every two years to these agencies. These plans include the types and quantities of infectious waste generated, transported, and disposed.

Standards for the Performance of Incinerators, Minnesota Rules 7005.0600 to 7005.0650, apply to infectious medical waste incinerators. Although the rules currently establish standards for incinerators in Minnesota, most hospitals' incinerators, because of small size, were never permitted. Recent studies documented high levels of toxic emissions from hospital-based medical waste incinerators and new MPCA rules have been proposed to address this problem. MPCA will require an air emissions permit for anyone who plans to construct, modify, reconstruct, or operate an incineration facility. The proposed rules state specific requirements for controlling toxic emissions and will significantly re-

duce toxic emissions. Currently operating hospital incinerators will need to be upgraded to meet the new rules or cease operation. The MPCA Air Quality Division is requiring compliance by all hospital incinerators by March 1993. It is expected that most of the state's smaller to medium-sized hospitals will not be able to meet the requirements and will close their incinerators. The amount and type of capacity existing in and around the state for those hospitals' waste was an issue for the task force. In addition, cost of waste disposal was a very big issue for the task force because hospitals already are under financial stress.

The Minnesota Employee Right-to-Know Act was passed in 1983 and includes infectious agents. This Act requires employers to train their employees in infectious-agent recognition and necessary control measures. On June 6, 1992 the Minnesota OSHA Bloodborne Pathogen Standard 1910.1030 became effective. The standard is directed towards protecting employees in the health-care industry, but also applies to other employees for whom there is a reasonable anticipated risk of exposure to bloodborne pathogens.

The solid (non-infectious) waste portion of the generators' waste comprises most of the waste generated and is currently covered by the Waste Management Act (WMA). The legislation, through its goals and objectives, requires every county in Minnesota to develop and implement a solid waste plan. "The plans shall require the most feasible and prudent reduction of the need for and practice of land disposal of mixed municipal solid waste" (section 115.46, subd. 2(c). To determine this, "...plans shall address at least waste reduction, separation, recycling, and other resource reduction options, and shall include specific and quantifiable objectives, immediate and over specific time periods, for reducing the land disposal of mixed municipal solid waste" (section 115.46, subd. 2(d).

The Minnesota Office of Waste Management (OWM), a non-regulatory agency which works with government, business, and the general public to manage solid waste in an environmentally sound manner and improve existing management practices, has responsibilities for oversight of the county solid waste management plans and issuing Certificates of Need for greater Minnesota county landfill capacity. The OWM has no specific responsibilities or programs relating to infectious waste or non-infectious medical waste. The agency provides technical assistance and has worked closely with a greater Minnesota hospital to accomplish solid waste source reduction projects.

As for the toxicity of solid waste, the state legislature has sought to lower toxics in solid waste through requirements to limit the amounts of selected metals in packaging and products, and also requires that solid waste incinerators establish programs to achieve reduction of the toxicity and quantity of incinerator ash. However, the MPCA municipal solid waste ash management rules do not apply to ash from the combustion of infectious waste or medical waste in a facility built solely for the management of infectious waste.

Currently federal medical waste legislation appears to be tied into the reauthorization of the Resource Conservation and Recovery Act (RCRA). Two Senate bills were introduced, one by Senator David Durenberger (MN) and one by Senator Max Baucus (MT) in 1991 and one by Senator Baucus again in 1992. Pending legislation is expected to authorize the U.S. Environmental Protection Agency to establish a process for approval and certification of treatment technologies capable of rendering medical waste harmless. It should be remembered that any such legislation may affect available alternative treatment technology options for Minnesota. Draft legislation allows incineration and autoclaving without approval. Centers for Disease Control (CDC) Guidelines recommend only autoclaving and incineration for the treatment of infectious waste.

Health Risks from Infectious Waste

Although public concern has prompted much of the state and federal infectious waste regulation, several scientific authorities have concluded that, with the exception of sharps, there is virtually no risk to the general public from infectious waste. Studies have demonstrated that the microbial contaminant load of infectious waste is actually similar to, if not less

than, that of household waste. Although actual studies have not been conducted, there have been no cases reported of disease transmission to the general public from infectious waste.

For disease transmission from infectious waste to occur, several conditions are required: a person must come in contact with infectious waste; a portal of entry must be created during contact; and viable infectious agents must enter the susceptible person in sufficient quantity to cause infection. These conditions do not exist for the general public unless the disposal of infectious waste has been grossly inappropriate.

Conditions for transmission of infectious disease are present in the occupational setting. Due to the greater likelihood of contact with recently generated waste, infectious waste--particularly improperly handled and disposed of sharps--does pose a real threat of injury to health-care workers and waste handlers. Existing handling practices for workers help to control occupational risk.

Workers at processing facilities, such as solid waste composting and refuse-derived fuel (RDF) facilities, face potential exposure to improperly segregated infectious waste, including sharps, in the solid waste and also to sharps disposed of in the solid waste by nonregulated generators. The nature of the work often requires handling and sorting waste during some processes. Workers' fears may range from almost any item which appears to be medical waste to potentially hazardous sharps. Worker education is recommended for help in reducing unwarranted fear over the transmission of AIDS and hepatitis, but that will not solve the problem of random sharps. Continued emphasis on proper segregation at the source of generation, and management of non-regulated generator sharps are suggested for reducing worker risk.

Task force members debated options to address worker concerns such as encouraging the use of clear bags for solid waste disposal and recommending that RDF facilities should not have to accept non-infectious medical waste. However, even though some generators are voluntarily using clear bags for a final check on segregation, the task force concluded that formally recommending use of clear bags for that purpose could not be justified when weighed against environmental and cost concers. And although currently any solid waste processing or disposal facility may refuse to accept any waste, the task force concluded that it did not want to formalize a recommendation reinforcing that right because doing so might actually foster unwarranted fears about non-infectious medical waste from health-care facilities.

Infection control and patient safety is another health issue of major concern. The use of disposables has improved infection control practices and patient safety in medical facilities. At the same time the use of disposables has increased the amount of plastics disposed of as medical waste--sometimes infectious, sometimes solid.

CDC's Universal Precautions and the OSHA Bloodborne Pathogen standard have mandated the use of protective gloves when there is a potential for exposure to blood or other potentially infectious body fluids. The use of plastic disposable syringes and disposable needles has limited the handling of sharps and the potential for cross contamination. These and other practices have benefits for both patients and health-care workers which far outweigh the waste disposal concerns. Any efforts to reduce products or packaging or to re-use supplies must keep infection control and patient safety as a primary priority. As described in the report, the MWTF found a variety of other areas for solid-waste stream reduction in health-care facilities. It also found that there are significant efforts being made to reduce medical waste.

Synthesis of Subcommittee Reports

The subcommittees brought their information and analyses to the entire task force for consideration. This enabled the group to both focus on necessary technical points and step back for a larger perspective, which is presented here.

According to the 1992 MPCA Solid Waste Economic Report, Minnesotans generated 4.13 million tons of municipal solid waste from July 1, 1990 through June 30, 1991. Medical waste is estimated to be 1% of the municipal solid waste stream or an estimated 44,128 tons per year. Currently the Minnesota Department of Health (MDH) estimates 14,980,000 pounds (7,490 tons) of regulated infectious waste is generated per year. A little over one-half of this infectious waste is generated by 158 hospitals in the state. This amounts to a very small portion, 0.18%, of the total solid waste stream in Minnesota.

Many entities generate infectious waste, but not all generators are regulated. There are no estimates for non-regulated generators; i.e., households, diabetics, farm operators, agricultural businesses, and others. Regulated generators in Minnesota include physicians, dentists, chiropractors, podiatrists, veterinarians, mortuaries, hospitals, nursing homes, clinical and some industrial laboratories, correctional facilities, regional treatment centers, military units, colleges, universities, technical colleges, public health clinics, and home health-care providers.

A major theme of the task force has been education -- education about the scientific information on risk for waste handlers and the general public, and education within health-care facilities about segregation of infectious and non-infectious waste. Not only can education on segregation address risks by minimizing segregation error, but also potentially benefit the generators by reducing the amount of waste to be handled as infectious waste. At the present time some solid waste may be unnecessarily handled as infectious waste because of over-cautious practices or other factors. This practice can increase the generator costs since infectious waste is substantially more expensive to dispose of than solid waste. Once waste is designated as infectious, reuse and recycle approaches are limited. Infectious waste is not considered suitable to recycling unless first decontaminated. The report documents successful adherence to the Waste Management Act, "reduce, reuse, and recycle" solid waste principles by a medical center, which is the major emphasis for overall medical waste management.

For the residual waste that is truly infectious, the report describes the possible technologies for treatment and/or disposal. Incineration and eight non-incineration treatment alternatives are covered in detail in the report with their advantages and disadvantages. Four of the alternatives described are currently approved by MPCA for off-site treatment of infectious waste. Infectious waste is usually thought to require decontamination before it can be considered for disposal as a solid waste in a landfill, but some members expressed that landfilling untreated infectious waste would be acceptable (based on a lack of scientific evidence to the contrary) with appropriate packaging and handling practices. However, concern was expressed over possible negative public perception of landfilling given the awareness that many states do not allow it for untreated infectious waste. Landfilling is currently possible in Minnesota but would need prior approval of the MPCA. None of the alternatives described is suitable for dealing with pathological waste, research animal waste, and chemotherapeutic waste, all of which require incineration.

Minnesota medical waste generators currently have the option of upgrading their incinerators to meet MPCA standards or using available off-site treatment. To date MPCA has approved steam autoclaving, microwaving, chemical decontamination, and electrothermal deactivation for off-site non-incineration treatment of infectious waste and these are considered capable of meeting current pollution control standards. MDH is currently promulgating rules for approval of alternative on-site decontamination. Although generators presently could also choose this option, none has applied for approval. As the MPCA combustor rules go forward and more

hospital incinerators are forced to close, this option may become more desirable.

Off-site commercial treatment capacity in Minnesota presently consists of a medical waste incinerator in Cannon Falls and a large capacity steam autoclave in St. Paul. Their combined permitted capacity for infectious waste is currently 28,000,000 pounds per year (14,000 tons), with a potential capacity to handle 37,000,000 pounds per year (18,500 tons). Three additional private, non-commercial incinerator facilities that process their own waste or waste from affiliated or selected generators also operate in Minnesota. A recently completed Minnesota Healthcare Partners, Inc. (MHP) feasibility study has recommended the siting of a non-incinerator decontamination facility specifically for the 18 MHP hospitals. In addition, there are eight mass-burn municipal solid waste incinerators that could potentially accept infectious waste. If all the potential capacity were utilized, Minnesota would be a net importer by three times its own need.

All current off-site capacity in the state is located in or near the seven-county metropolitan area. Out-of-state capacity is present with three nearby operating infectious waste incinerators in Wisconsin, North Dakota and South Dakota, with a combined capacity of 18,000,000 pounds per year (9,000 tons).

Whether this represents sufficient available treatment capacity was repeatedly discussed by the task force. Some members felt that there is already ample capacity to handle the state's infectious waste volume and that development of new capacity is not necessary, while others asserted that capacity was only one issue. The task force concluded that other factors of cost containment, technology type, liability and geographic location need to be taken into account when deciding if capacity is sufficient.

The task force unanimously agreed that it would not endorse a specific technology, but instead present all of the options, including incineration, with their various advantages and disadvantages. The charge to focus on "alternatives to incineration and landfilling" became somewhat difficult to agree on and to finalize. Task force members identified that the alternative decontamination technologies were treatment, not disposal, methods. After any treatment, the decontaminated residue must be landfilled. Under this analysis incineration is more of a treatment method than a disposal method as the ash from incineration must be managed. Members agreed that no treatment method is considered environmentally benign and all methods create a residue or ash which must then be managed by landfilling.

Discussions ensued over the state's primary role, whether it should be as a regulator and educator, or a more activist role in encouraging development and implementation of alternative non-incineration treatment technologies. Some members felt that once known scientific health and environmental issues were considered, market forces should determine how waste is handled; that is, each health care facility should have the flexibility to determine the option most suitable for its needs, including incineration. In this view the state's primary role is education. The state's role as regulator was viewed as intact, with MPCA rules in place for approving new decontamination technologies and MDH rules forthcoming. While incinerators were felt to be fairly well understood, very little is known about the potential impacts of some of the newer alternative technologies since they are under development and have no operational history.

All members agreed that the state should continue to play a regulatory and educational role, but some felt that the state should also play an activist role and identify and take measures to overcome economic, regulatory, and other barriers to the development of alternative infectious waste management strategies. After much discussion, the task force concluded that it could not unanimously endorse a policy favoring proactive development of non-incineration alternative technologies; however, in order to be responsive to the legislative charge, the task force did develop recommendations based on such a policy (see Recommendations for Alternatives to Incineration). Thus, these recommendations are intended to serve as a resource should the legislature decide to take a proactive position on non-incineration technologies as implied in the charge, but are <u>not</u> recommendations adopted and submitted by the task force for implementation.

While the majority of the report was agreed on by the entire task force, finalizing this section was the most difficult task. The basic premise of the section to promote alternative technologies and subsequently the section recommendations continue to be highly controversial among the MWTF members.

Supporters of the recommendations propose to encourage regional cooperation and development of alternative decontamination capacity, the identification of areas without affordable access, and the development of a financial assistance program for alternative decontamination projects. Despite the qualifications that the recommendation were not adopted or submitted by the MWTF for implementation, some members expressed extreme opposition that a recommendation to develop a financial assistance program should be included at all. A vote of members was called for with seven requesting deletion, five favoring retention, and six providing no response. (The chair did not vote.) Thus, the seventh recommendation (''The state should develop a financial assistance program for regional infectious waste storage and alternative decontamination capacity. Both public and private sector applicants should be eligible.''), was deleted from the recommendation. Deletion of this recommendation and inclusion of the others should not lead the legislature to believe there is greater agreement on implementing the remaining recommendations.

When the task force began its work, the strong convictions and stakeholder interests of the members appeared to pose incompatible and potentially insurmountable obstacles to meeting the legislative charge. The members took their appointment to the task force very seriously, and conscientiously invested time and energy to listen, dialogue, represent and attempt to balance their divergent interests and perspectives. At the conclusion, as at the onset, the primary area of controversy remains. Among the task force members there is a full range of views, from strong support for to strong opposition against the state adoption of a non-incineration infectious and medical waste management policy. Despite this area of controversy, the task force was in agreement on many more subjects, ideas and concerns related to infectious and medical waste management and presents this comprehensive report with the following unanimously supported conclusions and recommendations to the legislature.

MEDICAL WASTE TASK FORCE CONCLUSIONS AND RECOMMENDATIONS

Of the total solid waste generated in Minnesota, approximately 1% is medical waste. Generally, infectious waste is estimated to be 10-15% of the medical waste stream. The Minnesota reported data indicates that 0.18% of the total solid waste is regulated infectious waste.

Conclusions

Health and Safety Issues

1) Public, patient, and occupational health and safety should be the primary consideration in any decisions relative to management of infectious and non-infectious medical waste. Environmental protection and generator costs should be considered once health and safety assurances have been provided.

2) Non-infectious medical waste presents no health or safety risks beyond those associated with community solid waste and can be managed or recycled as any other solid waste.

3) Infectious and pathological wastes present no significant health or safety risk to the general public if properly managed. No evidence has emerged to indicate a case of AIDS or hepatitis B being transmitted to the general public through exposure to infectious or pathological waste.

4) The only populations facing significant risk from infectious and pathological waste are health-care workers and waste-management employees. Special handling practices for these wastes serve mainly to protect these workers.

5) Based on epidemiological evidence, the category of infectious waste posing the greatest occupational health threat is sharps.

6) There is a public perception of disease risk associated with medical waste that is not supported by scientific evidence.

Environmental Concerns

1) All treatment options currently available for infectious waste result in a residue which must be disposed of through landfilling, incineration (with landfilling of ash), or sewering (with landfilling or incineration of sludge). Thus there is no currently available treatment or disposal option which can totally fulfill the mandate to seek non-burn, non-landfill solutions to the medical waste problem.

2) No method for treating or disposing of infectious or pathological waste is completely benign from an environmental perspective. Some degree of air or water emissions is inevitable regardless of method. The control technologies exist to significantly reduce those emissions and comply with Minnesota statutes and rules.

3) Management activities that reduce environmental impact:

   a) Adherence to proper segregation practices reduces the quantity of material that must be managed as infectious waste.

   b) Source reduction of the quantity and toxicity of medical waste reduces the environmental impacts of treatment and disposal. Currently, source reduction of properly separated infectious and pathological wastes is not as feasible as for non-infectious medical waste.

c) Recycling can reduce the quantity of material that must be managed as waste. Recycling of materials from the infectious waste stream can occur only after decontamination.

4) Incineration, steam autoclaving, microwaving, chemical decontamination, and electro-thermal deactivation are currently approved by MPCA for off-site treatment of infectious waste. These methods are capable of decontaminating the infectious waste and of meeting current pollution control standards.

5) Compliance with recent enforcement actions has resulted in the closing of several substandard hospital incinerators and has the potential to improve air quality.

Management and Cost Issues

1) There is controversy over whether sufficient decontamination capacity currently exists in Minnesota. Other considerations such as liability, cost containment, technology type and geography should be considered when evaluating capacity.

2) Waste reduction and recycling programs are being initiated in many health care facilities at this time. However, these efforts are directed almost entirely at the non-infectious component of the medical waste stream. Reduction of packaging volume is the most promising approach to making significant volume reductions.

3) For pathological wastes, research animals and trace chemotherapeutic waste, incineration is the only currently identified manage ment option.

4) Small generators and remote rural generators may have fewer cost-effective options available to them for managing infectious waste.

5) There is controversy about whether decontaminated infectious waste should be disposed of by incineration or landfilling.

Specific Recommendations

1) State agencies should provide information to generators relative to all treatment and disposal options.

2) The state should promulgate extensive educational efforts to inform generators and the general public about known scientific facts relative to the various options specifically to counter false perceptions. These efforts should extend to waste management facilities and their employees who discourage or prohibit medical wastes from their facilities based on misconceptions of risk.

3) Several agencies now share responsibility for regulation of infectious waste. Division of responsibility should be periodically evaluated to ensure regulatory consistency and to meet the needs of the regulated community most efficiently.

4) The state should have a structured, fair, and consistent enforcement policy.

5) The legislature should require that medical waste incinerator ash be disposed of according to MPCA municipal solid waste ash management rules.

6) MDH should complete the infectious waste generator rules as soon as possible to assure the availability of a clear approval process for both on-site and off-site treatment options.

7) State agencies, in cooperation with the regulated community trade and professional associations, should develop a waste audit guidance manual for hospitals and other health care facilities including information on purchasing practices, source reduction, recycling, and reuse options.

8) County designation plans and ordinances should assure that all generators have access to cost-effective options for both infectious and non-infectious waste and treatment residues. The plans and ordinances should not pose obstacles to such options without scientifically sound health, safety, or environmental pollution rationale.

9) County programs should address mechanisms for disposing of non-regulated household generated sharps.

10) Health-care facilities and organizations, through purchasing practices, should use their influence to convince suppliers that packaging and packaging toxicity must be reduced.

11) New air quality rules should be promulgated in a timely manner.

CONTENTS

Page

BACKGROUND INFORMATION

Introduction

During the 1991 legislative session the Minnesota Legislature directed the Commissioner of Health to appoint a Medical Waste Task Force (MWTF). The legislation specifies that the MWTF have representatives from the Pollution Control Agency, the Department of Health, the Office of Waste Management, local government units, citizens' groups, environmental organizations, organized labor, the academic community, medical waste generators, and persons in the business of managing medical waste.

The MWTF was appointed in November and held its first meeting on November 25, 1991. The MWTF has held twelve meetings, with the last meeting on August 13, 1992. (Meeting dates in Appendix B-1. Minutes and tapes available at MDH.)

The Legislative Charges

The MWTF was charged by the Legislature to accomplish four tasks. To expedite the legislative charges, the MWTF members were appointed to subcommittees devoted to specific charges.

The Data Subcommittee was formed to collect the data required for the first two legislative charges:

1. estimate the quantity and composition of medical waste currently generated in the state;
2. assess current infectious waste decontamination capacity in the state.

The Policy Subcommittee was formed to respond to the third charge:

3. design a state policy that focuses on alternatives to landfilling and incineration as the primary means of infectious waste disposal according to the order of preference in Minnesota statutes, section 115A.02, paragraph (b).

The Strategy Subcommittee was formed to respond to the fourth charge:

4. submit, by September 1, 1992, a medical waste management strategy report to the Legislative Commission on Waste Management and to the Legislature's committees on Environment and Natural Resources and Health and Human Services recommending a statewide medical waste management policy.

A Drafting Subcommittee was also appointed to coordinate the compiling of the final report.

The Data, Policy and Strategy Subcommittees met and developed outlines for the subcommittee reports, which were presented to the MWTF for discussion. Then the subcommittees drafted their reports, which were reviewed by the MWTF. The final reports were adopted by the MWTF and are submitted in this report.

In preparation for the subcommittee meetings, several MWTF meetings were held to discuss background issues, such as waste legislation, agency roles, health risks, and special problems of medical waste.

Waste Legislation

Minnesota Waste Management Act (1980)

The Waste Management Act (WMA), enacted in 1980, authorizes the state programs that the MPCA and OWM administer for the management of solid and hazardous waste. Any new strategies and policies regarding medical waste must adhere to the WMA.

The Legislative Declaration of Policy; Purposes for the WMA is stated in Section 115A.02:

(a) It is the goal of this chapter to improve waste management in the state to serve the following purposes:

(1) Reduction in waste generated;
(2) Separation and recovery of materials and energy from waste;
(3) Reduction in indiscriminate dependance on disposal of waste;
(4) Coordination of solid waste management among political subdivisions; and
(5) Orderly and deliberate development and financial security of waste facilities including disposal facilities.

(b) The waste management goal of the state is to foster an integrated waste management system in a manner appropriate to the characteristics of the waste stream. The following waste management practices are in order of prefer ence:
(1) Waste reduction and reuse;
(2) Waste recycling and yard waste composting;
(3) Resource recovery through mixed municipal solid waste composting or incineration; and
(4) Land disposal.

County Solid Waste Management Plans

Each county in Minnesota is required by the Waste Management Act to develop and implement a comprehensive solid waste management plan or a solid waste master plan. The seven counties in the metropolitan area are required to submit their plans to the Metropolitan Council for review and approval. The eighty counties in greater Minnesota and the Western Lake Superior Sanitary District are required to submit their plans to the Office of Waste Management for review and approval. Plans must be developed pursuant to the requirements of Minn. Stat. § 115A.46. For a plan to be approved by the designated agency the county must adopt a solid waste management system that manages solid waste according to the priorities established in Minn. Stat § 115.02 above.

The Medical Waste Task Force believes all county plans should include provisions for medical solid waste. (All generators of infectious waste also generate solid waste. Abatement goals for the county and the means to implement them should include the solid waste generated by the infectious waste generators.) Therefore, a review of pertinent plan requirements is in order.

The plans shall require the most feasible and prudent reduction of the need for and practice of land disposal of solid waste. To determine this, plans shall address at least waste reduction, separation, recycling, and other resource recovery options, and shall include specific and quantifiable objectives, immediately and over specific time periods. The plans shall describe the proposed mechanisms for complying with the recycling requirements of section 115A.551, as follows:

"**County recycling goals.** By December 31, 1993, each county outside of the metropolitan area will have as a goal to recycle a minimum of 25 percent by weight of total solid waste generation; and by December 31, 1993, each county within the metropolitan area will have as a goal to recycle a minimum of 35 percent by weight of total solid waste generation. Each county will develop and implement or require political subdivisions within the county to develop and implement programs, practices, or methods designed to meet its recycling goal. Nothing in this section or in any other law may be construed to prohibit a county from establishing a higher recycling goal." (Minn. Stat. § 115A.551, subd. 2)

"**County solid waste plans.** (a) Each county shall include in its solid waste management plan described in section 115A.46, or its solid waste master plan described in section 473.803, a plan for implementing the recycling goal established in subdivision 2 along with mechanisms for providing financial incentives to solid waste generators to reduce the amount of waste generated and to separate recyclable materials from the waste stream. The recycling plan must include detailed recycling implementation information to form the basis for the strategy required in subdivision 7. (b) Each county required to submit its plan to the office under section 115A.46 shall amend its plan to comply with this subdivision within one year after October 4, 1989." (Minn. Stat. § 115A.551, subd. 6)

"**Recycling implementation strategy.** Within one year of office approval of the portion of the plan required in subdivision 6, each nonmetropolitan county shall submit for office approval a local recycling implementation strategy. The local recycling implementation strategy must:

(1) be consistent with the approved county solid waste management plan;

(2) identify the materials that are being and will be recycled in the county to meet the goals under this section and the parties responsible and methods for recycling the material; and

(3) define the need for funds to ensure continuation of local recycling, methods of raising and allocating such funds, and permanent sources and levels of local funding for recycling." (Minn. Stat. § 115A.551, subd. 7)

Greater Minnesota Requirement

When the Office of Waste Management (OWM) approves a greater Minnesota county plan, the OWM issues the county a certificate of need for land disposal capacity. A certificate of need is addressed in Minn. Stat. § 115.917. Medical waste management practices should be considered when decisions are made concerning the need for land disposal capacity.

"No new capacity for disposal of mixed municipal solid waste may be permitted in counties outside the metropolitan area without a certificate of need issued by the office indicating the office's determination that the additional disposal capacity is needed in the county. A certificate of need may not be issued until the county has a plan approved under section 115A.46. If the original plan was approved more than five years before, the office may require the plan to be revised before a certificate of need is issued under this section. The office shall certify need only to the extent that there are no feasible and prudent alternatives to the additional disposal capacity, including waste reduction, source separation, and resource recovery, that would minimize adverse impact upon natural resources. Alternatives that are speculative or conjectural are not feasible and prudent. Economic considerations alone do not justify the certification of need or the rejection of alternatives." (Minn. Stat. § 115A.917)

Waste Designation

The Waste Management Act states in section 115.80 that in order to further its policy and purposes section and to advance the public purposes served by effective solid waste management, it may be necessary pursuant to sections 115A.80 to 115A.89 to authorize a qualifying solid waste management district or county to designate a solid waste processing or disposal facility.

Minn. Stat. § 115A.81, subd. 2, defines designation in the following terms:

"'Designation' means a requirement by a waste management district or county that all or any portion of the mixed municipal solid waste that is generated within its boundaries or any service area thereof be delivered to a processing or disposal facility identified by the district or county."

The designation plan is then reviewed and approved by the same agency responsible for the approval of the solid waste management plan or its solid waste master plan, namely, the Office of Waste Management or the Metropolitan Council. Before the designation is put in place, the designation plan must be approved and additional requirements fulfilled, including a designation ordinance pursuant to sections 115A.80 to 115A.89.

Toxicity Reduction Goals

In addition to infectious and solid waste, many medical facilities generate regulated hazardous waste. Facilities which fall into the Very Small Quantity Generator (VSQG) size are able to benefit from MPCA rules relating to the management of VSQG wastes. They are also eligible for technical and financial assistance for pollution prevention under the Toxic Pollution Prevention Act (Minn. Stat. § 115D.01-.12). Manufacturers of medical equipment (most of which is classified in SIC Group 38)

are subject to pollution prevention fees and planning requirements.

Minn. Stat. § 115A.965 requires that, "no later than August 1, 1993, no manufacturer or distributor may sell...a product that is contained in packaging if the packaging itself, or any inks, dyes, pigments, adhesives, stabilizers, or any other additives to the packaging contain any lead, cadmium, mercury, or hexavalent chromium that has been intentionally introduced...." Exemptions may be granted by the commissioner of the Minnesota Pollution Control Agency, if the manufacturer can make a convincing argument that there is no feasible alternative.

The 1992 legislature restricted the sale, use, and disposal of products containing mercury (Minn. Stat. § 115A.932). The sale of mercury is restricted to medical, dental, instructional, research, and manufacturing purposes. Mercury and mercury-containing devices, such as medical and scientific instruments, may not be discarded into the solid waste or waste water systems. Certain products which contain mercury must be labeled to inform the buyer as to the contents and the special disposal requirements. Medical facilities may not routinely distribute thermometers which contain mercury. Disposal restrictions are placed on fluorescent and high intensity lamps containing mercury.

Incinerator Ash Toxicity

In enacting these restrictions, the state intends to prevent the entry of toxic metals into the solid waste stream so that concentrations of the metals in solid waste incinerator ash will be reduced over time. In addition, the legislature has made solid waste incinerator operators responsible for devising methods to reduce the toxicity of ash. (Minn. Stat. § 115A.97.) Reduction in toxicity may be accomplished through removal of certain items from the waste prior to incineration, recovery of metals from the ash prior to disposal, or treatment of ash to reduce the availability of the metals.

Ash from the combustion of infectious waste or medical waste in a facility built solely for the management of infectious waste is not covered. However, the infectious and other medical waste ash is technically an industrial waste and must be tested according to hazardous waste rules (see Appendix B-2 for MPCA fact sheet). Therefore, test results will determine proper handling and disposal methods of infectious waste incinerator ash. MPCA is tracking ash test results from the commercial infectious waste incinerator operating in the state. MPCA ash management rules allow facilities which produce better quality ash to dispose of ash in a less costly manner.

In the long run, considerable reduction of toxic metals in mixed municipal solid waste incinerator ash should be realized through prohibition of the metals in packaging and through improved management of solid waste.

Medical Waste Tracking Act (1988)

The federal Medical Waste Tracking Act (MWTA) was enacted in record time as a result of the East Coast beach washups in the summer of 1988. The public outrage and economic losses of prime coastal communities resulted in extremely expedient legislation and passage of the Medical Waste Tracking Act by the U.S. Congress in November 1988. The MWTA required the states of New York, New Jersey and Connecticut to participate in a two-year demonstration program and states contiguous to the Great Lakes were given an option to participate. All of the Great Lakes states opted out of the program while Rhode Island and Puerto Rico asked permission to participate.

The MWTA defined regulated medical waste (using a broader definition than Minnesota) and established a cradle-to-grave manifest (list of cargo) system for tracking medical waste. The EPA was required to evaluate the effectiveness of the program and provide to Congress a series of reports on whether a national program should be developed. Two interim reports to Congress were prepared and the final report which has been long delayed is expected to be final by fall of 1992. The two year demonstration program expired on June 22, 1991 and was not extended by Congress. MWTA states continue to carry on with their own state programs as do non-MWTA states.

MPCA senses that many states would like to see EPA develop some consistent guidelines for packaging and labeling medical waste and for registering waste transporters. EPA could also provide background and assistance in alternative technology reviews. Mandatory manifesting appears to be overly costly and burdensome without providing any additional public health or environmental benefit.

Currently, federal medical waste legislation appears to be tied into the reauthorization of the Resource Conservation and Recovery Act (RCRA). Two Senate bills were introduced in 1991 by Senator Durenberger (MN) and Senator Baucus (MT). Of the two bills, the Baucus bill is less detailed and offers the EPA some flexibility in how best to implement a federal program. The MPCA met with Karen Humphrey from Senator Durenberger's office and submitted formal comments to the Senate Committee on Environment and Public Works on the Baucus bill. It is expected that medical waste will be part of the RCRA Reauthorization. The final EPA Report to Congress should influence the content of that final legislation if it is released in time. Minnesota participated in the EPA's Medical Waste Roundtable meetings during the two-year demonstration program and hopes that the input given will result in a reasonable federal program that will take into consideration the good programs already underway in many states.

An important aspect of the proposed federal legislation grants EPA the authority to establish a process for approval and certification of treatment technologies. The proposed legislation outlines the operating standards for incineration and steam autoclaving which it considers acceptable technologies.

Infectious Waste Control Act (1989)

The federal waste tracking system was not adopted by Minnesota. The state's Infectious Waste Control Act (IWCA), initially adopted in 1989, instead specified the basic elements for the establishment of the state's infectious waste management program. The state law was based on "Report and Recommendations on the Regulation of Infectious Waste" prepared by the Office of the Attorney General, August 10, 1988. This report was developed in consultation with an interagency task force convened by the Attorney General's office to examine infectious waste issues. The representatives on the task force included the following agencies: the Minnesota Pollution Control Agency, the Minnesota Department of Health, the Minnesota Waste Management Board, the Metropolitan Waste Control Commission, the Metropolitan Council, and a county health department representative. Representatives of the federal and state Occupational Safety and Health Administration programs also participated.

The Attorney General report noted at that time that existing state regulations were not helpful in determining which biomedical wastes presented a significant infection hazard. Those regulations based their definition of infectious waste on the infection status of the source (i.e., whether the patient had a contagious disease) rather than the potential of the waste itself serving as a vehicle of disease transmission.

Pamela Sulmer of the Attorney General's office noted in a presentation to the MWTF:

> "The chief goal of the task force was to create a regulatory scheme by which the infectious portion of the waste stream could be segregated from the remainder of the solid waste stream and managed in a manner that would specifically and effectively address the unique hazards associated with the management of infectious waste."

When the Infectious Waste Control Act was enacted in 1989, the Minnesota Department of Health (MDH) was authorized to regulate generator waste management and all related activities at generating facilities except for on-site incineration. Generators are required to develop and submit management plans to MDH (see Data section). The plans must identify the types of infectious or pathological waste generated, decontaminated, incinerated or disposed of on site, and the volume for each. The plans must also identify how waste is segregated, packaged, labeled, collected, stored or decontaminated on site; how employees are protected from infectious agents; and who are the transporters and disposal facilities.

The IWCA authorized the MPCA to regulate incinerators, commercial transporters, and off-site decontamination storage and disposal facilities. Commercial transporters are licensed by MPCA and are required to develop a management plan as part of the registration process (see Data section). Storage, decontamination, incineration, and disposal facilities also must submit detailed management plans to MPCA for approval.

The Infectious Waste Control Act states that both agencies may adopt rules to implement the Act. The Act specifies that MDH has primary responsibility for rules relating to facilities generating infectious waste. The MPCA has primary responsibility for rules relating to transportation of infectious waste and facilities storing, transporting, decontaminating, incinerating, and disposing of infectious waste. IWCA has been interpreted by the agencies to mean that decontamination that takes place at the generating facility is regulated by MDH and decontamination that takes place at a facility other than a generating facility is regulated by MPCA. Occupational exposures of employees are regulated by the Minnesota Occupational Safety and Health Act administered by the Minnesota Department of Labor and Industry.

Agency Roles in Medical Waste Management

Office of Waste Management

OWM is a non-regulatory agency which works with government, business, and the general public to manage solid waste in an environmentally sound manner and improve existing management practices, including waste reduction and toxic pollution prevention.

The Office does not have any specific responsibilities or programs relating to infectious waste or non-infectious medical waste. However, medical waste generators are encouraged to take advantage of any OWM or county program that can assist them in improving their waste management practices and reducing their waste management costs.

In the area of source reduction, OWM has been working closely with Itasca Medical Center in Grand Rapids to identify, implement, and evaluate a number of solid waste source reduction projects. Information from this hospital source reduction case study is being disseminated to other hospitals and medical facilities (See Appendix B-3). The Office has also worked with the Minnesota Hospital Association and several hospitals around the state to develop guidelines and educational materials for hospital recycling programs.

Minnesota Department of Health

MDH has an Infectious Waste Control Unit to administer its authority under the Infectious Waste Control Act (Minn. Stat. §§ 116.76 to 116.83). MDH has no involvement with generators of just solid or mixed municipal solid waste.

Under IWCA, MDH is primarily responsible for enforcement involving generators. MDH enforcement activities include:

- Assuring generators submit waste management plans to cover all generating facilities owned and operated by the generator and that the relevant fees for each site are submitted.

- Conducting site visits to see that management plans have been implemented according to the Act. Generators are required to take the necessary action(s) to comply.

- Notifying generators of any deficiencies found when their management plans are reviewed.

- Responding to complaints against generators if infectious waste has not been properly segregated at the generator's site so that infectious waste is mixed with solid waste and is disposed of at a solid waste disposal facility. All enforcement activities to date have been violations by generators. The MDH and the counties have been the responding authorities. The MPCA has been notified of the events.

Funding

MDH's Infectious Waste Control Program is a fee-funded program. The fees for generating facilities are established in section 116.79, subd. 3(b). The fees are based on specific categories of generators and are site-specific. The biennial fees range from $40 to $600 for each generating site, with few exceptions. The fee is waived for federal facilities, the Bureau of Indian Affairs, state agencies and a generating satellite facility or mobile facility used for an average of less than 5 hours per week on an annual basis. A community health board or migrant health service may pay one fee to cover all generating sites.

Minnesota Pollution Control Agency

In addition to its authority to regulate off-site infectious waste management under the Infectious Waste Control Act, MPCA's Ground Water and Solid Waste Division has a permitting and enforcement role in solid waste management. All solid waste facilities go through a permitting process--landfills, transfer stations, municipal solid waste (MSW) compost facilities, and refuse-derived fuel (RDF) processing facilities. New facilities are also required to do extensive environmental review and reports such as Environmental Assessment Worksheets (EAW) and Environmental Impact Statements (EIS). Joint solid waste and air quality permits are required for MSW and RDF incinerators. Enforcement is done by combined efforts of the central office staff and staff from the five regional offices located in Detroit Lakes, Brainerd, Duluth, Rochester, and Marshall. The MPCA also monitors landfill closures and oversees remedial cleanup of contaminated sites.

Under IWCA, MPCA is primarily responsible for enforcement involving commercial transporters and off-site storage and decontamination facilities. MPCA infectious-waste enforcement activities include:

- Assuring waste management plans and fees are submitted and plans are complete and consistent with rules.

- Conducting facility inspections to assure management plans are being implemented.

- Monitoring commercial transporter destination facilities (in-state and out-of-state) assuring only approved facilities are recipients of the infectious waste.

- Responding to reports of mismanagement of infectious waste by commercial transporters or decontamination facilities.

- Responding to illegal disposal incidents where no regulated generator has been identified.

Funding

The fees for MPCA regulated parties are established in section 116.79, subd. 4 and section 116.80, subd. 3. The fees for commercial transporters and off-site storage and decontamination facilities are $225 every two-years. Previously on-site incinerators were required to pay a $100 fee to the MPCA. The 1991 statutory amendment left confusion as to the requirement that on-site incinerator facilities would have to pay a $225 fee to the MPCA in addition to the generator fee paid to the MDH. This remains unclear. Currently, a large hospital generator fee is $600 and a large commercial transporter/decontamination facility fee is $225. The fee structure should be evaluated to make sure it is fair and equitable for all regulated parties and to assure that sufficient monies are available for the development of comprehensive training and education programs.

Waste Combustor Rules

Minnesota Rules parts 7005.0600 to 7005.0650, set forth by MPCA's Air Quality Division, establish the current standards of performance for incinerators in Minnesota. The standards apply to all types of waste combustors, regardless of technology being used or waste stream incinerated. The standards contain a particulate matter standard, an opacity standard, and the requirement to install and operate an afterburner with a 0.3 second gas retention period at 1,200° F. The particulate matter standards applied depend on the number of pounds of waste incinerated.

As of March 1991, Minn. Stat.§116.801 requires that an air emissions permit be obtained for new medical waste incinerators operating at more than 350 pounds per hour. Since the older Minnesota

Rule part 7001.1210 exempts incinerators that incinerate less than 1,000 pounds per hour from obtaining an air emissions permit, few existing hospital or nursing home incinerators were required to get permits. The 1,000-pounds-per-hour standard held for all incinerators. However, findings presented in "Report on the Assessment of Operation and Emissions of On-Site Medical Waste Incinerators" (1991) indicated that health-care facility incinerators were emitting 100 times more dioxins than other incinerators.

In the assessment study, three non-metropolitan hospitals were chosen to represent a range of practices and sizes. Each of their incinerators tested (with capacities of less than 200 pounds per hour) was found to be in violation of existing rules. They did not have tall stacks (chimneys) or pollution control equipment. Based on these results, MPCA staff concluded that most hospital incinerators were likely to be in violation.

In addition to the permitting change, the MPCA Air Quality Division will be proposing revised standards of performance for all waste combustors (included medical waste combustors) in late Fall 1992. The proposed rules would:

- Establish a permit-by-rule requirement for waste combustors that are currently unpermitted by statute;
- Apply standards-of-performance based heat release rate rather than the current amount of waste processed;
- Reduce particulate-matter limits for all sizes of waste combustors;
- Create dioxin-emission limits for larger waste combustors;
- Expand continuous monitoring requirements;
- Require waste combustor personnel to be routinely trained; waste combustor operators will need to become certified.

The state rules are proposed; final rules may be different depending on the outcome of public hearings.

It should be noted that at the federal level, waste combustor standards are required under the Clean Air Act to be promulgated by 1992. EPA has not yet adopted standards. The proposal is not expected until 1993.

Effect of Changes on Medical-Waste Incinerators

At a February 1992 Air Quality Committee meeting, MPCA staff proposed contacting all operators to inform them that they must demonstrate compliance with standards of performance or shut down. The MPCA mailed out notices to all of the state's hospitals on April 2 and 14, 1992 giving them between 180 and 300 days to demonstrate compliance, discontinue operation, or apply for a permit upgrade. (See Appendix B-4.)

In response to the efforts by the MPCA to enforce existing air emissions rules and develop new combustor rules, an estimated 90 percent of Minnesota's hospitals will have to close their on-site incinerators. (3) This will have a much greater impact on non-metropolitan hospitals. Only five metropolitan hospitals still operate on-site incinerators, but as of March 1992, 68 greater Minnesota hospitals were still operating their on-site incinerators.

Health Risks Associated with Medical Waste

Risk of General Exposure to Infectious Waste

Epidemiologic data relevant to the issue of disease transmission from infectious waste is sparse. Nonetheless, based on established principles of the transmission of infectious disease, several authorities have concluded that, with the possible exception of sharps, infectious waste poses virtually no threat to the health of the general public (Rutala & Weber, 1991; Agency for Toxic Substances and Disease Registry, 1990; Rutala & Mayhall, 1992). For disease transmission from infectious waste to occur, several conditions are required: a person must come in contact with medical waste; a portal of entry must exist or be created during the contact; and viable infectious agents must enter the susceptible person in sufficient quantity to cause infection. Clearly all of these conditions are rarely if ever met outside of

the site of generation.

The general public is not exposed to infectious waste unless its disposal has been grossly inappropriate. Even if exposure occurs, it is extremely unlikely that any infectious organisms which may have been present initially are still viable and exist in quantities sufficient to cause infection by the time the public comes in contact with the waste. The ability of an infectious agent to survive outside a host is variable, and depends on factors such as temperature and moisture. Viruses, including hepatitis B virus (HBV) and HIV, must be inside a living cell to replicate. HIV in particular dies rapidly in the external environment (Agency for Toxic Substances & Disease Registry, 1990). In addition, in the absence of sharps, an appropriate portal of entry usually does not exist. There are no documented cases of disease transmission from non-sharp medical waste in the community or the occupational setting. However, in the occupational setting, such transmission remains a theoretical possibility due to the greater likelihood of exposure to recently generated medical waste.

Sharps, including hypodermic needles, syringes, pipettes, scalpels, blood vials, needles with attached tubing, and broken or unbroken glassware in contact with infectious agents, may pose a potential threat to people who occupationally handle them, specifically health care workers and waste handlers. This threat is directly related to the ability of sharps to create a portal of entry. Nonetheless, only one documented case of disease transmission from sharps in medical waste has occurred: a housekeeper developed a staphylococcal infection from a discarded sharp (Agency for Toxic Substances & Disease Registry, 1990). However, improperly packaged sharps in infectious waste do pose a real threat of occupational injury to both health care personnel and waste handlers. A Virginia study reported that 13 percent of needle-stick injuries occurred from needles contacted during or after disposal (Jagger, Hunt, Brand-Elnaggar, & Pearson, 1988). A Washington survey of waste industry workers found that 10 percent of waste collectors had sustained needle-stick injuries during the previous year (Turnberg & Frost, 1990).

Other considerations also suggest that the public health threat of non-sharp infectious waste is nonexistent (Rutala & Mayhall, 1992). Several studies have demonstrated that the microbial contaminant load of infectious waste is actually less than or similar to that of household waste (Rutala & Mayhall, 1992). No study has demonstrated that waste handlers who are in contact with municipal waste are at increased risk of infectious disease (Cimino, 1975; Corrao, Zotti, Sciacovelli, Bosia & Piccioni, 1985). In fact, disposal of untreated infectious waste in a landfill makes good public health sense: worker contact with waste once it leaves the hospital is minimized, and properly operated landfills provide microbiological environments that are hostile to most pathogens (Rutala & Weber, 1991). Furthermore, while systematic studies have not been conducted, there have been no reports that the way in which hospitals disposed of their waste, prior to regulation, ever had an adverse impact on their workers or the community (Rutala & Weber, 1991; Agency for Toxic Substances and Disease Registry, 1990; Rutala & Mayhall, 1992).

In summary, sharps that have been improperly disposed of in infectious waste are clearly capable of causing disease and injury. This is largely an occupational health problem for health care providers and waste handlers. There is no evidence that non-sharp, medical infectious waste is either an occupational health or a public health threat.

Risk of Occupation Exposure to Infectious Waste

Again, occupational exposure is the most likely source of disease from infectious waste materials. Those exposed may be health-care workers, waste haulers, treatment facility operators, or disposal site personnel. Several regulatory actions have addressed these exposure problems and potential problems. The state legislature passed the Minnesota Employee Right-to-Know Act in 1983, including infectious agents in addition to chemical agents in its scope. The Employee Right-to-Know Act was followed by regulations promulgated by Minnesota OSHA that included a list by the MDH of the most common potentially communicable infectious disease agents. The regulations require that employees

be trained in both infectious agent recognition and the necessary control measures. The employer must train new employees--before exposure--on those infectious agents to which they may be routinely exposed and provide annual refresher training to established employees. The employer must have written Employee Right-to-Know information which describes how the training, availability of information and labeling provisions of the regulation will be met.

In 1987 federal OSHA invited comments on the subject of worker protection from bloodborne pathogens. A standard was proposed in May 1989 and hearings on that standard were held during 1989 and early 1990. The final Federal OSHA Bloodborne Pathogen Standard, 1910.1030, was published in the Federal Register on December 6, 1991. Minnesota OSHA has adopted the federal OSHA Bloodborne Pathogen Standard in its entirety by reference effective June 6, 1992. The standard is directed toward protecting employees in the health care industry but also applies to other employers where there is reasonably anticipated exposures to bloodborne pathogens. The standard requires segregating, packaging, and labeling "regulated waste," to render it safe for handling within the facility and during subsequent transportation and disposal. In addition, federal and Minnesota OSHA standard 1910.120, the Hazardous Waste Operations and Emergency Response Standard, covers three groups of employees:

(1) workers involved in cleanup operations at hazardous waste sites involving infectious waste,
(2) workers at Resource Conservation Recovery Act (RCRA) permitted incinerators that burn infectious waste, and
(3) workers responding to an emergency caused by the uncontrolled release of regulated waste (e.g., a transportation accident).

The Minnesota Infectious Waste Control Act of 1989 also recognizes that occupational exposures are a primary concern to be addressed in the infectious waste generator's management plan. Specifically it says that "the management plan must describe the steps that will be taken to minimize the exposure of employees to infectious agents throughout the process of disposing of infectious or pathological wastes."

As a general rule the more infectious waste is handled, the greater is the chance of an employee exposure occurring. Also, the more complex the handling, treatment or disposal process the greater becomes the chance of employee exposure. When treatment and disposal technologies are evaluated, normal operations should be considered, but the time of greatest hazard to employees is during spills, equipment malfunctions, conveyor plugging, equipment cleaning, etc. These operations can almost always be done safely if proper personal protective equipment is provided and approved work practices are used. Exposure problems arise when urgent responses are called for and employees short circuit protective measures, or their employer directs them to forgo safety measures for the sake of expediency.

Risks of Infectious Waste Treatment Methods

The MWTF did not formally discuss the comparative health risks of the various treatment technologies. In the Policy Section, different technologies' advantages and disadvantages are listed, including but not emphasizing emissions. However, health risk depends on the quantity as well as the toxicity of emissions and the circumstances under which the emissions take place.

Little is known about the potential health risks of alternative technologies. The dioxins resulting from incineration were discussed earlier in the subsection on Waste Combustor Rules. The risk these dioxins present was disputed by the MWTF, but the task force agreed that without adequate air pollution control equipment, incinerators are potentially harmful to the public health and the environment. The task force supported the efforts of MPCA to develop new combustor rules. The task force did not agree on the amount of risk that would remain after the rules were enforced.

Some of the alternative technologies are new and in some cases still in the design process. Thus, data about emissions under actual operating conditions is very limited. The New York City Medical Waste

Management Study (1992) stated that "Steam disinfection and other thermal treatments will volatilize organics, several of which are known human carcinogens. However, the extent of emissions and the degree to which they can be controlled has not been tested" The study characterized these as methods which result in unknown risks.

Risk from Solid Waste

For comparison with infectious medical waste risks, it should be remembered that a variety of substances, chemicals, and microorganisms exist in municipal solid waste which may be of occupational concern for people who handle and transport waste and those persons who come in contact with waste in so-called waste processing facilities (RDF processing and material-recovery facilities). The probability of public exposure is quite low since trucks which transport waste usually enclose the waste, and facilities which process and dispose of solid waste are either enclosed or have limited access.

Researchers in 1974 failed to isolate *Salmonella*, which causes gastrointestinal disease, in municipal solid waste. They did find fecal coliforms in garden waste, textiles, and paper. They identified fecal streptococci in fines, garden waste, ash, dirt, and rock categories (Swartzbaugh, Hentrick, and Sabel, 1977; and Jackson and Strong, 1976). Microorganisms are found everywhere in the environment. A variety of the organisms colonize in and on humans. Therefore, it is not surprising to find them in municipal solid waste.

A route of exposure for these microorganisms is through penetration of the skin by sharps. Separation of such items from the mixed municipal solid waste stream would be an effective method to reduce the probability of injury to solid waste workers. The public health threat is minimal, unless the items are carelessly discarded.

Special Problems for Medical Waste Generators

Disposables versus Reusables

Composition studies indicate that infectious and non-infectious solid medical waste has a much higher plastic content than that of municipal solid waste. This presents a dilemma. Plastics cause disposal and environmental problems, but the use of disposables has lowered costs and, more importantly, improved infection control and safety.

The use of disposable plastic syringes has been a vast improvement over the old practices of resharpening and sterilizing needles and cleaning and sterilizing glass syringes. The occupational exposures were very evident when some products were not acceptable for steam sterilization. The alternative was gas sterilization using ethylene oxide, a chemical known to be highly toxic and a potential hazard to workers. The old glass syringes also posed the risk of broken glass which could potentially penetrate the skin of workers and create a portal of entry for infectious agents. Today in the era of AIDS it is very unlikely that reusable syringes would be allowed to be used.

Other disposables include sterilizer pack wraps, disposable surgical drapes, and laboratory vials and pipettes. All of these have been evaluated for cost effectiveness and infection control. For the most part, these products eliminate the need for handling by, and potential exposures for, the health-care worker. As discussed earlier, health-care workers are at the greatest risk of exposure to infectious waste.

Any return to the use of reusables would have to be fully evaluated. The perceived higher cost of sterilizing reusables (which includes labor costs) and the higher occupational exposure risks associated with reusables must be addressed before reusables are favored to ease the waste disposal concerns.

Not all plastic used has replaced a reusable material. A source of plastic in the medical waste stream is the use of gloves, one of the biggest improvements in occupational infection control. CDC's Universal

Precautions and OSHA have mandated the use of gloves by many medical, nursing, laboratory, and housekeeping staff. Gloves provide the primary barrier to blood and body fluids. Most people agree that while gloves sometimes add to the volume of the infectious and mostly the non-infectious medical waste streams, the protective benefits far outweigh the waste disposal concerns.

Increase in Disposal Cost

Generators should segregate their infectious waste and non-infectious waste according to the definition of infectious waste in IWCA. By so doing, their infectious waste disposal costs may be reduced. However, waste haulers and other waste disposal workers fear and reject even non-infectious medical waste. Solid waste from health-care facilities has been rejected from landfills, mass-burn incinerators, and RDF facilities in Minnesota.

Because hospitals may have to find and use expensive disposal means for some of their solid waste in addition to their infectious waste, many have become cautious, putting into their infectious-waste streams any ''medical-looking'' item that may be rejected by haulers or disposal companies. This makes their infectious waste volume much larger, more potentially toxic, more expensive, and open to criticism.

Liability

Current state and federal environmental laws hold waste generators liable for the proper handling and disposal of their wastes. Infectious waste generators, including hospitals, can be held legally liable for cleanup and other related legal costs if their waste is not properly handled and disposed of. The generator's liability applies not only to the actions of the generator itself, but also applies to the actions of other third parties who handle waste on behalf of the generator. There have recently been several incidents where generators or third parties have experienced difficulties in disposing of the generator's waste.

Beside the exposure to legal liabilities, some generators are increasingly concerned about the negative impact waste problems may have on their public image. They do not want the public to conclude that they, the public, cannot trust a particular health care provider with decisions affecting their health and life when that provider cannot even handle its waste safely and properly.

Given their growing awareness of these liability exposures, more and more generators are weighing liability concerns more heavily in their management decisions -- from segregation to treatment to place and type of disposal.

DATA SUBCOMMITTEE REPORT

Introduction

Minnesotans generated an estimated 4.13 million tons of municipal solid waste from July 1, 1990 through June 30, 1991. During 1991, hospitals and other health care facilities generated an estimated 44,128 tons of medical solid waste. 7,490 tons were considered to be infectious waste.* Minnesota infectious waste data is derived from reports required of generators, transporters, and commercial off-site decontamination facilities. (Table D-1 shows these figures as percents.) Minnesota is fortunate to have more detailed information from waste composition studies, further refining our picture of the overall generation, decontamination and disposal of infectious waste in the state.

* In this report most solid waste data is given in tons and infectious waste data in pounds in keeping with industry standards. For comparison purposes, the opposite unit of measurement is provided in parentheses.

Infectious Waste Generator Data (MDH)

The information provided in Tables D-2 and D-3 summarizes the volumes reported to MDH in the 1992 submittal of the Infectious Waste Generator Management Plans. The Infectious Waste Control Act requires MDH to establish a procedure for randomly reviewing the infectious waste management plans. Since the program began in 1989 (see Appendix D-1 for memo to generators), the Infectious Waste Control Unit of MDH has received management plans from over 5,000 generators. By evaluating a ten percent random sample, and extrapolating this for the entire regulated generator population, a reasonable estimate of infectious waste generation in the state can be made. The 1992 data (for 1990 and 1991) is the most current information on the infectious waste generated in the state. Also, since the generators are becoming more familiar with the requirements, these numbers are presumed to be the most accurate.

Table D-1
Estimated Quantities of Medical and Infectious Waste Generated in Minnesota

Type of Waste	MPCA Municipal Solid Waste	MCPA Extrapolated Medical Waste	MDH Reported-Data Infectious Waste
Estimated Tonnage	4,130,000	44,128[1]	7,490
Percentage	100	1.0	0.18

[1]Medical waste includes solid waste and infectious waste..

Table D-2

Estimated Infectious Waste Volume Reported on 1992 MDH Generator Management Plans

Generator Category	No.In Sample	Total No. Generator Plans Rec'd	Mean Lbs/2 Yrs	Total Inf. Waste Generated Lbs/2 Yrs.	Percent of Total Generaltion
Data From 10% Random Sample					
Board/care	1	11	3	33	<0.01
Chiropractors	9	126	11	1386	<0.01
CHS Agencies	5	20	130	2,600	<0.01
Clinics	68	572	9,745	5,574,140	18.61
Companies	11	77	226	17,402	0.06
Corrections	2	23	25,907	595,861	1.99
Colleges	4	67	56	3,752	0.01
Dentists	173	1,720	50	86,000	0.29
Facilities-M[1]	2	38	60,825	2,311,350	7.71
Facilities-O[1]	5	40	1,606	64,240	0.21
Home Health	6	56	243	13,608	0.05
Hospitals	2	158	101,269	16,000,502[2]	53.41[2]
Laboratories	7	91	18,526	1,685,866	5.63
Military	1	9	5	45	<0.01
Mortuaries	31	323	3,206	1,035,538	3.46
Nursing Homes	52	403	1,940	781,820	2.61
Physicians	75	719	2,382	1,712,658	5.72
Podiatrists	4	4	130	5,850	0.02
Reg Trmnt Ctr	3	8	3,529	28,232	0.09
Veterinarians	36	417	91	37,947	0.13
WIC Clinics	1	18	22	396	<0.01
TOTAL	519	4941		29,959,226[3]	100.00
DATA FROM ALL HOSPITALS					
Hospitals	158	158	97,693	15,435,570[2]	52.51[2]

[1] Facilities are divided into health care facilities other than a hospital, long term care facility, or laboratory (FACM) and non-health care facilities, such as corporate occupational health clinics (FACO).

[2] Hospitals were included in the 1992 random sample survey as well as being totalled for 100% of the population. As these numbers indicate, the ten percent sample volume extrapolated over the entire population closely correlates to the total volume from the universe of hospitals.

[3] This equals 7,490 tons per year.

In 1992 generators were asked to report, in gallons or pounds, the amount of infectious waste generated at each facility during the previous two year period (1990-91). (Table D-2 summarizes this data by type of generator.) It is understood that these numbers in no way reflect a perfect science but rather are each generator's best estimate. A form for developing a management plan is provided in Appendix D-2. This form was a guideline; however, generators were not required to use it. The statement of quantity is on page 5 of the management plan form, and it divides infectious waste generation into three categories. The "sharps" category includes those items that can induce subdermal inoculation of infectious agents, including needles, scalpel blades, pipettes and similar items, and also glass or rigid plastic vials containing infectious agents. The "pathological waste" category includes human tissues and body parts. The "infectious waste" category is a catch-all, including "non-sharps" labora-

tory waste, items soaked or dripping with blood or regulated body fluids, blood products, and anything else covered under the statute that does not fit into the other two categories. The sum of these three categories is considered the total infectious waste generated by a given facility.

For the sake of consistency, all volumes reported on the 1992 management plans were converted to pounds by MDH. By canvassing various commercial infectious waste transporters in the state, an estimated average pounds-to-gallon conversion was determined. When summing the 1992 data, all infectious and pathological waste was assumed to be 0.8 pounds/gallon and sharps were estimated to be 1.8 pounds/gallon. Sewered waste was tallied at 8.34 pounds/gallon.

Table D-3 breaks down the infectious waste generated during the 1988-89 period according to the various types of regulated generators. This is provided for comparison purposes as this is the only historical data available. Recall that the pounds-to-gallons conversions described above were adopted after the 1990 data was completed, so the formulas for converting the information provided in Table D-4 were varied. Also, at the time of the 1990 submittal, generators had no requirements on reporting units.

Table D-3
Estimated Annual Infectious Waste Volume Reported on 1990 MDH Generator Management Plans Data (October 1, 1988 - September 30, 1989)

Generator	No. in Sample	Total No. Generator Plans Rec'd.	Mean Lbs./Yr.	Total Inf. Waste Generated Lbs./Yr.	Percent of Generation
Data from 10% Random Sample (excluding hospitals)					
Chiropractors	11	120	154	18,500	0.01
CHS Agencies	5	20	72	1,400	<0.01
Clinics	53	522	2,448	1,278,100	6.61
Companies	9	62	227	14,100	0.07
Corrections	2	21	11	200	<0.01
Colleges	3	60	429	25,700	0.13
Dentists	154	1,572	64	100,200	0.52
Facilities	7	64	211	13,500	0.07
Home Health	1	53	4	200	<0.01
Laboratories	8	84	77,888[1]	6,542,600	33.83
Mortuaries	34	316	273	86,300	0.45
Nursing Homes	48	402	661	265,800	1.37
Physicians	62	725	1,408	1,021,100	5.28
Podiatrists	4	45	58	2,600	0.01
Veterinarians	32	398	49	19,400	0.10
WIC Clinic	1	19	6	100	<0.01
TOTAL	**434**	**4,483**		**9,389,80**	**48.54[2]**
Data From All Hospitals					
Hospitals[3]	162	162	61,428	9,951,300	51.45[2]
GRAND TOTAL		**4,645**		**19,341,100**	**100.00**

[1] The laboratories drawn in the random sample included some of the largest generating laboratories. The decision was made to report the data as derived because to use other facilities would have compromised the random selection of the sample.

[2] Note that the random sample does not include hospitals. The percentage of infectious waste generated in hospitals is based on the universe of hospitals. This value plus the percentages derived from the random sample are added together to yield 100%.

[3] The hospital data is derived from 162 hospitals including veterans hospitals (2), Indian hospitals (2), and an Air Force Reserve hospital. The licensed number of hospital beds for these facilities is 20,335; however, 56 hospitals also have 4,279 licensed nursing home beds included in their infectious waste volumes. At the time, the average occupancy rate for hospitals in Minnesota was 57% and for nursing home was 95%.

Since hospitals represent the largest group of generators in terms of total volume, the decision was made to quantify the data provided on 100% of hospital management plans. This information is provided in Table D-4. This table was intended to correspond directly with the information provided by the generator on the quantity sheet of the management plan. One exception to this is that the volume stored was not presented in this table. The ''stored'' volume was intended to represent the amount of total infectious waste stored on site at any one time and would not be part of the total generated or disposed of. Another exception is the addition of a ''fate not specified'' volume and a ''non-categorized'' volume. The latter represents all the infectious waste reported as a lump sum, not separated into sharps, pathological, etc. The ''fate not specified'' volume is that portion of the total waste generated which is not accounted for in any of the treatment or disposal volumes. This table is accompanied by a list of considerations when viewing this data. These are areas where uncertainty arises when tallying the generator data.

Table D-4
Hospital Infectious Waste - Two Year Summary (1990-91)
Reported on 1992 Generator Management Plans (Lbs./2 Years)[1]

	Infectious Waste Lbs.	+ Pathological Waste Lbs.	+ Sharps Lbs.	+ Non-Categorized Lbs.	Total Waste Lbs.
Incinerated On-Site	6,850,015	247,704	993,273	-	8,090,992[2]
Disposed of Off-Site	2,998,875	52,656	406,233	-	3,457,764
Decontaminated On-Site	661,959	7,560	22,868	-	692,387
Sewered	399,613	5,102	0	-	404,715[3]
Fate Not Specified	663,887	3,951	103,101	2,018,773	2,789,712
TOTAL GENERATED	11,574,349	316,973	1,525,475	2,018,773[4]	15,435,570

[1] Generators were asked to estimate total for two years in 1992 plan; 1990 plans were estimates for one year.

[2] Total amount incinerated may not be the amount generated by the responding hospital; they often accept waste from other generators but were not specific with the volumes accepted from outside the facility.

[3] Sewered waste reported in gallons was converted to pounds (8.34 lbs/gallon).

[4] Incomplete category breakdown in many generator plans (reported a combined total only).

OTHER CONSIDERATIONS:

* Units were missing or unclear in some instances.

* The total population of hospitals dropped (162 to 158) due to hospitals closing, and an Air Force Reserve Hospital being excluded. Also, Metropolitan Mount Sinai was partially acquired by HCMC.

* Management plans may cover more than one facility if owned by a common entity. Therefore, some volumes reported may include waste other than hospital waste.

Finally, Table D-5 is an estimate of the daily generation rate of infectious waste in Minnesota hospitals, based on the data provided on the most recent management plans. According to the Minnesota Hospital Association, the current estimate of occupancy rate of licensed hospital beds in this state is approximately 44%, and the occupancy rate of nursing home beds is 95%. These values were used in calculating the generation rate.

Table D-5
Infectious Waste Generation Rates Based on Generator Management Plan Received by MDH

	1990	1992
Total of Hospitals Represented:	162	158
Licensed Hospital Beds:	20,335	19,995
Nursing Home Beds Included in Hospitals:	4,279	3,991
Total Number of Beds Represented:	24,614	23,986
Pounds of Infectious Waste:	9,951,300	15,435,570[1]
Rate of Generation at 100% Occupancy: (lbs/bed/day)	1.12	0.88
Reported[2] Occupancy Rate - Hospitals:	57%	44%
- Nursing Homes:	95%	95%
Rate of Generation at Reported Occupancy: (lbs/bed/day)	1.74	1.68

[1] The 1992 volume represents two years; subsequent calculations were adjusted accordingly.

[2] Based on communications with the Minnesota Hospital Association.

Discussion of Infectious Waste Generator Data

Table D-2 shows the estimated total infectious waste generated in the state by all categories of generators to be 29,959,226 pounds in two years. In order to compare this figure with the 1990 data, it must be assumed this equals roughly 14,980,000 pounds per year, which is down from the previous review series at 19,341,100 pounds per year. However the generator category breakdowns show some striking deviations. The laboratories category, for example, has dropped to less than six percent of the total waste generated. Generally, the variations between the volumes in each category is largely due to the individual facilities that were drawn as part of the random sample, because there is a wide range of volumes generated at facilities providing similar medical services.

MDH totalled the data from 100% of the hospital management plans, both in 1990 and 1992. A comparison of these figures shows that the total infectious waste generated and/or reported in Minnesota hospitals has dropped. There are some considerations, however in making this generalization. As mentioned earlier the validity of comparing one-year data to two-year data is questionable. Since the Infectious Waste Control program was in its early stages of development, it was considered easier for the generators to estimate only one year for the 1990

submittal. (They may not have been keeping track of volumes of infectious waste prior to this). Also, an amendment to the reporting requirements made tallying the 1992 data less confusing, as generators were asked to use units of pounds or gallons.

Based on the random samples, current estimated rate of infectious waste generated in the state's hospitals is 1.68 pounds/bed/day. This number is derived by dividing the total hospital infectious waste (Table D-3) by the total number of patient days. This generation rate is in comfortable agreement with the national average of 2.2 pounds/bed/day (Rutalla, JAMA, 9/89).

For comparison, a telephone survey conducted by the MPCA Air Quality Division (May 1990) determined that if hospitals shipped their waste off-site for disposal, their generation rate was 1.95 pounds/bed/day. (It is interesting to note that for hospitals that incinerate on-site the rate was 3.93 pounds/bed/day. This would indicate that better segregation was taking place once hospitals had to pay per pound for their infectious waste disposal.) The Minnesota Healthcare Partners (MHP) data showed that the average generation rate for their 18 member hospitals was 1.81 pounds/bed/day.

Infectious Waste Decontamination Data (MPCA)

The MPCA Infectious Waste Management Rules (1990) (Minn. Rules 7035.9100-.9150) required all regulated parties (commercial transporters, off-site storage facilities, off-site decontamination facilities, and on-site incinerator facilities) to submit infectious waste management plans every two years and annual reports every year.

The first set of management plans was due November 1990 and the reported information, including quantities of infectious waste, was from the previous two years--fall of 1988 through fall of 1990 (see Tables D-6 and D-7).

Table D-6
Volume of Infectious Waste Handled by Regulated Parties

	1990	1991
Total Infectious Waste Commercially Transported	4,459,575 pounds	6,925,378 pounds
Total Infectious Waste Incinerated On-site[1]	3,543,345 pounds	*4,014,489 pounds
Total Infectious Waste Incinerated at Private Off-site Facilities	2,096,000 pounds	3,421,612 pounds
	10,098,920 pounds	*14,361,479 pounds

*Incomplete data. 89% of plans represented.

Table D-7
Total Infectious Waste Decontaminated at Minnesota Facilities

	1990	1991
Total Infectious Waste Decontaminated at Minnesota Facilities	3,153,020 pounds	6,120,383 pounds
- From Minnesota Generators	3,153,020 pounds	3,765,102 pounds
- From Out-of-State Generators (WI,IA)	-0-	2,355,291 pounds

For the commercial transporters and decontamination facilities this collected information was probably fairly accurate because most of these companies billed their customers by the pound. The data from the hospital or other on-site incinerators was probably less accurate. This is primarily due to the fact that, previous to the Infectious Waste Control Act (1989), there were no reporting requirements for the management of infectious waste and most facilities had no formal record keeping. There was, and still is, some inconsistency in what is being reported. Some hospitals incinerate infectious waste and other non-infectious medical waste. Therefore, in some cases non-infectious medical waste is being reported as infectious waste in their reporting. Also, many hospitals accepted infectious waste from other generators. This amount is now required in the Annual Report Form, but it is questionable if this amount was recorded in the past.

The first management-plan information was also cumulative for the two-year period. For on-site incinerators the common practice was to weigh or estimate weights for one week or month and then multiply by 24 months. For the commercial transporters and decontamination facilities the data submitted may have spanned the required previous 24 months, but many companies were not operational for that entire 24 month duration. During the first reporting period, there were facilities starting and ceasing operations as well as new commercial transporters entering the marketplace. Out of the 15 commercial transporters currently registered in the state, only three were operating during the entire first 1988-1990 reporting period.

All management plans submitted to the MPCA were reviewed and approved. The first set of management plans was approved between November 1990 and June 1991. The data that was submitted was evaluated and calendar year 1990 was calculated. Annual reports for the same regulated parties were due on the anniversary dates of their management plan approvals. The annual report data from eight commercial transporters (the other transporters could not be entered into our calculations) and five off-site decontamination facilities will represent calendar year 1991. Actual reporting periods ranged from October, November, or December 1990 to October, November, or December 1991. (See Appendix D-3 for Annual Report Forms.)

To date, the MPCA has annual report data from commercial transporters and off-site decontamination facilities completed. As expected, there was an increase in the amount of waste commercially transported from 1990 to 1991, which is reflected in Table D-8. This was due to more generators becoming aware of the regulations for proper disposal and the shutdowns of many on-site incinerators, a trend expected to continue in 1992.

Table D-8
Destination of Commercially Transported Infectious Waste

	1990	1991
	4,459,575 pounds	6,925,378 pounds
To Minnesota Facilities		
- Cannon Falls	832,000 pounds	1,908,371 pounds
- Perham	2,321,020 pounds	2,059,600 pounds
To Out-of-State Facilities	1,306,555 pounds (ND,SD,WI,IA,AR,SC)	2,957,407 pounds (ND,WI,SC,SD)

For more efficient data collection in the future, the MPCA would like to place all regulated parties on a calendar year reporting system for both management plans and annual reports.

Current Treatment Capacity

Commercial Capacity

Due to interstate commerce laws, these commercial facilities may accept waste from both in-state generators and out-of-state generators, which means there is no guarantee that commercial facilities' capacity will be reserved for its state's or region's infectious waste.

In Minnesota

In 1991, there were 12 registered commercial transporters operating in the state. More than 95% of the infectious waste was transported by four of those 12 commercial transporters. Of the total infectious waste they transported, approximately 40% went to destination facilities out-of-state. The remaining 60% was decontaminated at Minnesota's two commercial facilities operating at the time: the Medical Safety Systems (MSS) medical waste incinerator in Cannon Falls and the Quadrant municipal solid waste incinerator in Perham.

In 1991, two significant events occurred that created a change in in-state capacity. In May, the MSS incinerator increased its capacity from a 300 lbs./hour unit to a 1,000 lbs./hour unit. This increased their capacity to approximately 8,000,000 lbs./year. In June, the Quadrant MSW incinerator in Perham made the decision to not accept infectious waste any longer. Its capacity had been approximately 4,000,000 lbs./year.

The status in 1991 because of the industry changes resulted in Minnesota becoming a large exporter of infectious waste. The Cannon Falls facility did not have its expanded capacity available in early 1991 and in the second half of the year the Perham facility no longer accepted infectious waste. The state will see the export trend reversed in 1992.

Less waste is also expected to be transported out-of-state due to the fact that BFI Medical Waste Systems will now be processing waste at its own facility rather than transporting infectious waste to the incinerator plant in Fargo, ND.

BFI Medical Waste Systems opened a steam autoclave facility in January 1992. The autoclave unit itself is rated at 4,000 lbs./hour. The current operating permit of this facility will allow a processing capacity of approximately 20,000,000 lbs./year. If fully operational the facility could process nearly 29,000,000 lbs./year. The increased capacity of the Cannon Falls incinerator and the St. Paul autoclave are making Minnesota an importer rather than exporter. A significant volume of infectious waste from Iowa, Wisconsin and Canada is now coming

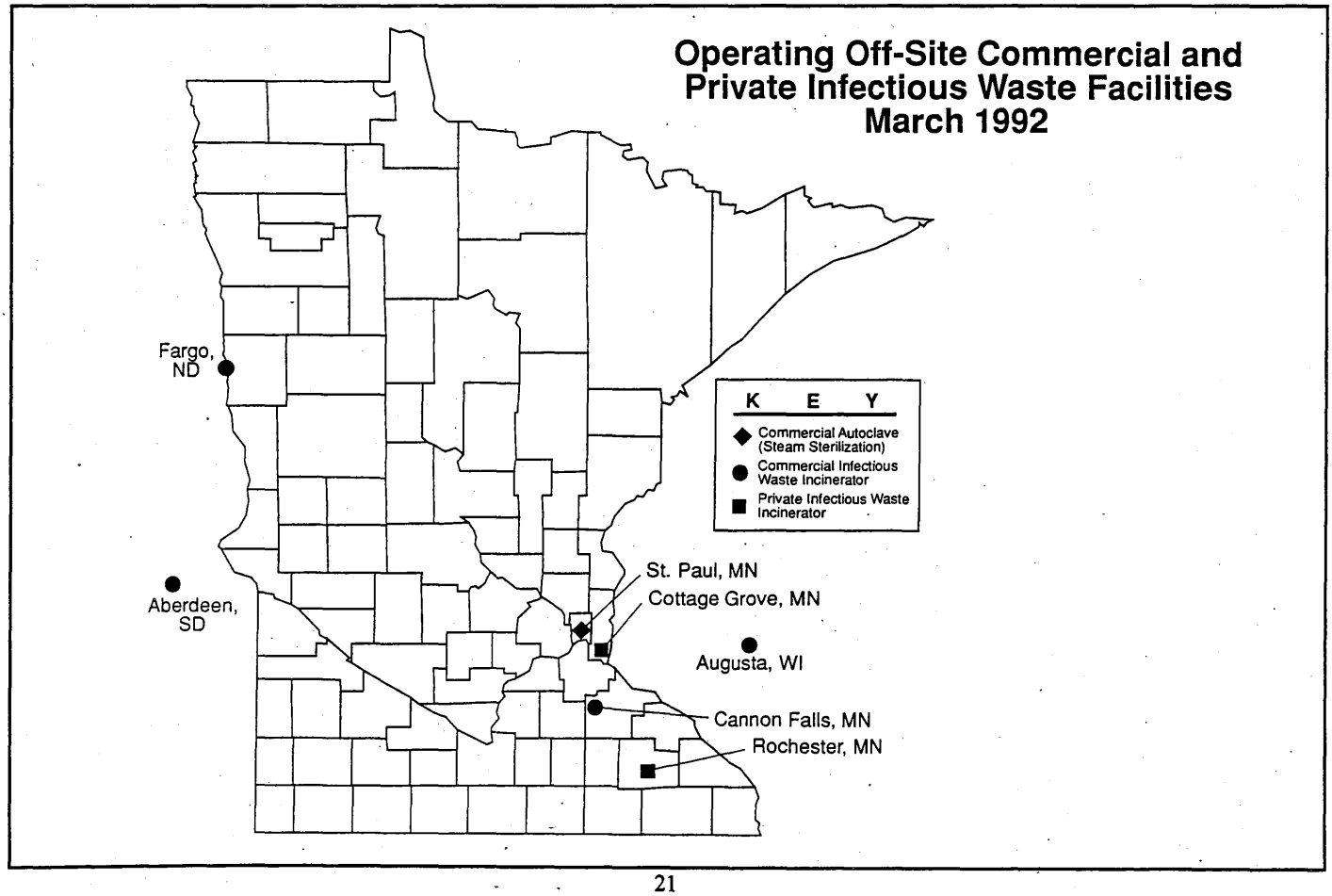
into Minnesota. In 1991 the Cannon Falls facility received a little over 2,000,000 pounds of infectious waste from Iowa and Wisconsin. In the first four months of operation, the St. Paul autoclave has received a little over 400,000 pounds of infectious waste from Iowa, Wisconsin and Canada. See Table D-9 for the two facilities now in Minnesota and their yearly capacity.

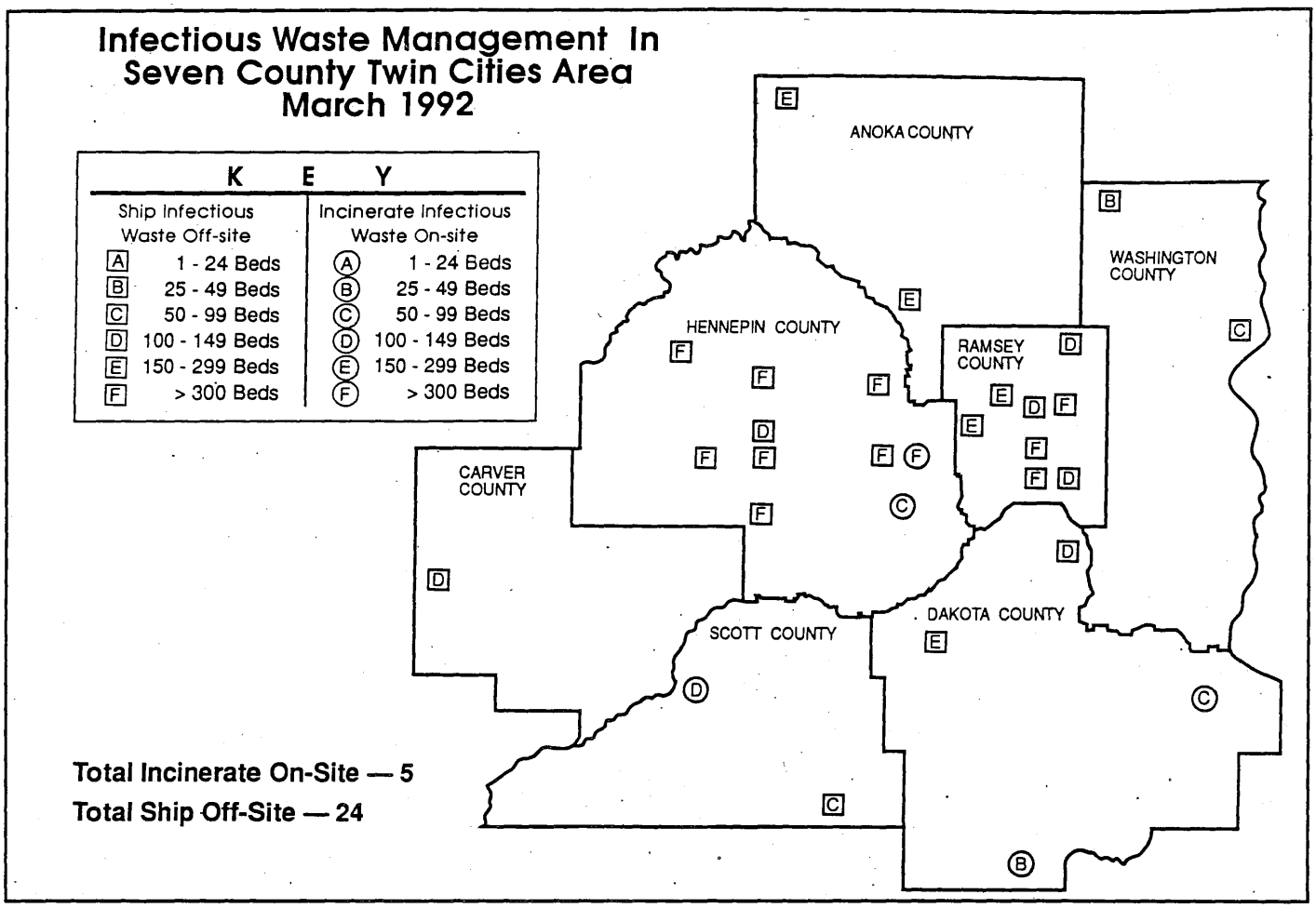
Table D-9
Existing Permitted Minnesota Commercial Capacity

Medical Safety Systems (MSS) Medical Waste Incinerator Size 1,000 lbs./hour Cannon Falls, Minnesota	8,000,000 pounds/year
BFI Medical Waste Systems Steam Autoclave Size 4,000 lbs./hour St. Paul, Minnesota	20,000,000 pounds/year (current permit)

Out of State

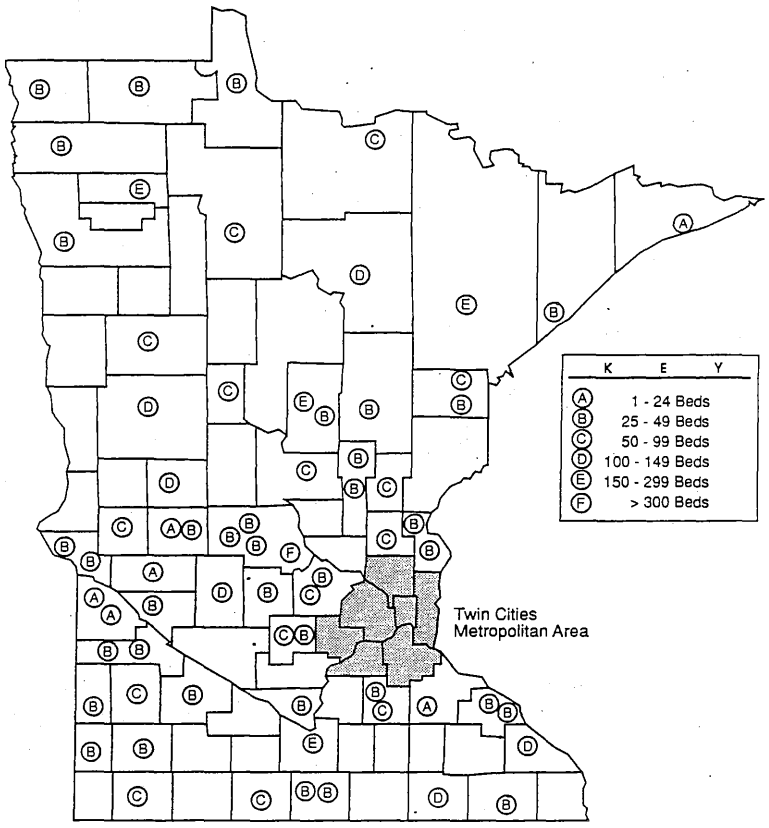
Close to Minnesota borders are three operating infectious waste incinerators: Bio-Safe (or Med-X) in Augusta, WI; Dependable Sanitation in Aberdeen, SD; and Health Care Incinerators (HCI) in Fargo, ND. (Two of these companies are also operating as registered infectious waste transporters in Minnesota.) They have a combined capacity of approximately 18,000,000 pounds per year.





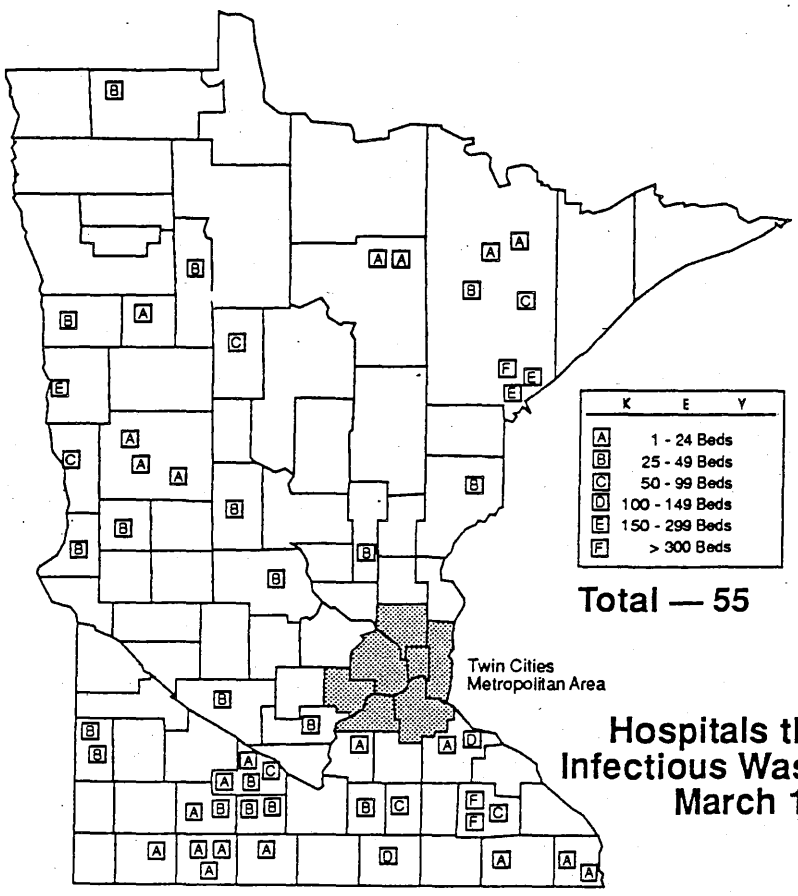
Private or Non-Commercial Facilities

Three incinerator facilities process their own waste or waste from affiliated or selected generators: 3M in Cottage Grove, the Olmsted Waste-to-Energy facility in Rochester, and the Mayo Institute Hills Incinerator in Rochester. The 3M facility incinerates only its own infectious waste generated by its research facilities. The Olmsted Waste-to-Energy facility feeds waste into the municipal solid waste incinerator separately from other mixed municipal solid waste and accepts infectious waste from only five infectious waste generators, including the Olmsted Community Hospital and the Federal Medical Center. The Mayo Institute Hills facility incinerates infectious waste for all the Mayo Foundation generating facilities in Minnesota. In 1991, these three private facilities incinerated a total of 3,421,612 pounds of infectious waste. 3,335,423 pounds of that total was from the Mayo Institute Hills facility. Mayo is now in the process of an environmental review for a new proposed facility. This would be primarily a private facility for Mayo affiliates but they will accept waste from other Olmsted and Dodge county generators. The new facility would have one 2,000 lbs./hour incinerator and two 600 lbs./hour autoclave units. The potential operating capacity of the incinerator would be 15,000,000 pounds per year. All solid waste and decontaminated infectious waste would also go through a plastics recycling unit, with residuals being incinerated.



Hospitals that Incinerate Infectious Waste On-Site March 1992

Total — 68



Total — 55

Hospitals that Ship Infectious Waste Off-Site March 1992

On-Site Incineration Capacity

On-site incineration capacity is difficult to determine. Most of the on-site incinerators operating in the state fall into the size range of less than 150 lbs./hour. The size rating does not give a clear picture of potential capacity. Infectious and medical waste has a very high BTU value (8,000-10,000 BTU/lb. versus 5,000 BTU/lb. for MSW) allowing for less feed into the incinerator than its rated capacity. Many hospitals also run their incinerators only a few days per week and only a few hours per day.

In any case, the number of on-site hospital incinerators will soon be diminishing. As stated in the Background section, the Air Quality Division of MPCA now is in the process of determining air quality compliance for hospital incinerators. Hospitals will have three choices:

1) demonstrate compliance with existing air emission standards;
2) submit a permit application for plans to meet new proposed emission standards;
3) discontinue operation of the incinerator.

By early 1993, all hospitals will have made their decision. The MPCA Air Quality Division estimates that only 10% of the current on-site incinerators will continue to incinerate once the new waste combustor rules are adopted. This would be approximately 8-10 facilities. They most likely would be larger facilities and would have incinerators in the size range of 100 to 300 lbs./hour. As of June 1992, one hospital has installed a new incinerator and expects to meet the new emission standards in the proposed waste combustor rules (Bemidji), one hospital has submitted a permit application (Winona), and 3 hospitals plan to test emissions or submit emission data (Brainerd, Montevideo, and St. Cloud).

During the past two years, many hospitals have voluntarily shut down their incinerators due to knowledge of the pending stringent air emission standards and in some cases due to local opposition to incineration. The number of on-site incinerators has gone from approximately 100 in 1990 to approximately 70 in 1992. By early 1993, this number is expected to decrease significantly.

Potential Capacity

Existing Waste Capacity

In discussing potential capacity for infectious waste, mass-burn incineration and landfilling are lesser discussed options. While the most common and approved methods for infectious waste treatment are dedicated incineration and autoclaving, other new methods are being evaluated (such as microwaving, chemical disinfection, etc.). Existing potential capacity such as MSW incineration and landfilling should be evaluated as well.

Municipal Solid-Waste Incineration

There are eight municipal solid waste (MSW) mass-burn incinerator plants operating throughout the state. Two of these plants have received approval to accept infectious waste: Quadrant in Perham and the Olmsted Waste-to-Energy facility in Rochester. The Air Quality Division did place some limitations on the amount of waste they could accept; for instance, the Quadrant facility could accept up to 510 lbs./hour (or 6 tons/day) of infectious waste along with its solid waste charge rate of 116 tons/day. Both the Quadrant facility and the Olmsted facility had to submit infectious waste management plans to the MPCA for approval. Both facilities had to devise handling protocols that would keep infectious waste separate from solid waste, starting at the unloading process and following through to the feed into the hopper. At this time Quadrant is not accepting infectious waste at their facility.

To accept infectious waste, a mass-burn incinerator would have to amend its air quality permit, update its industrial waste management plan and submit an infectious waste management plan for approval.

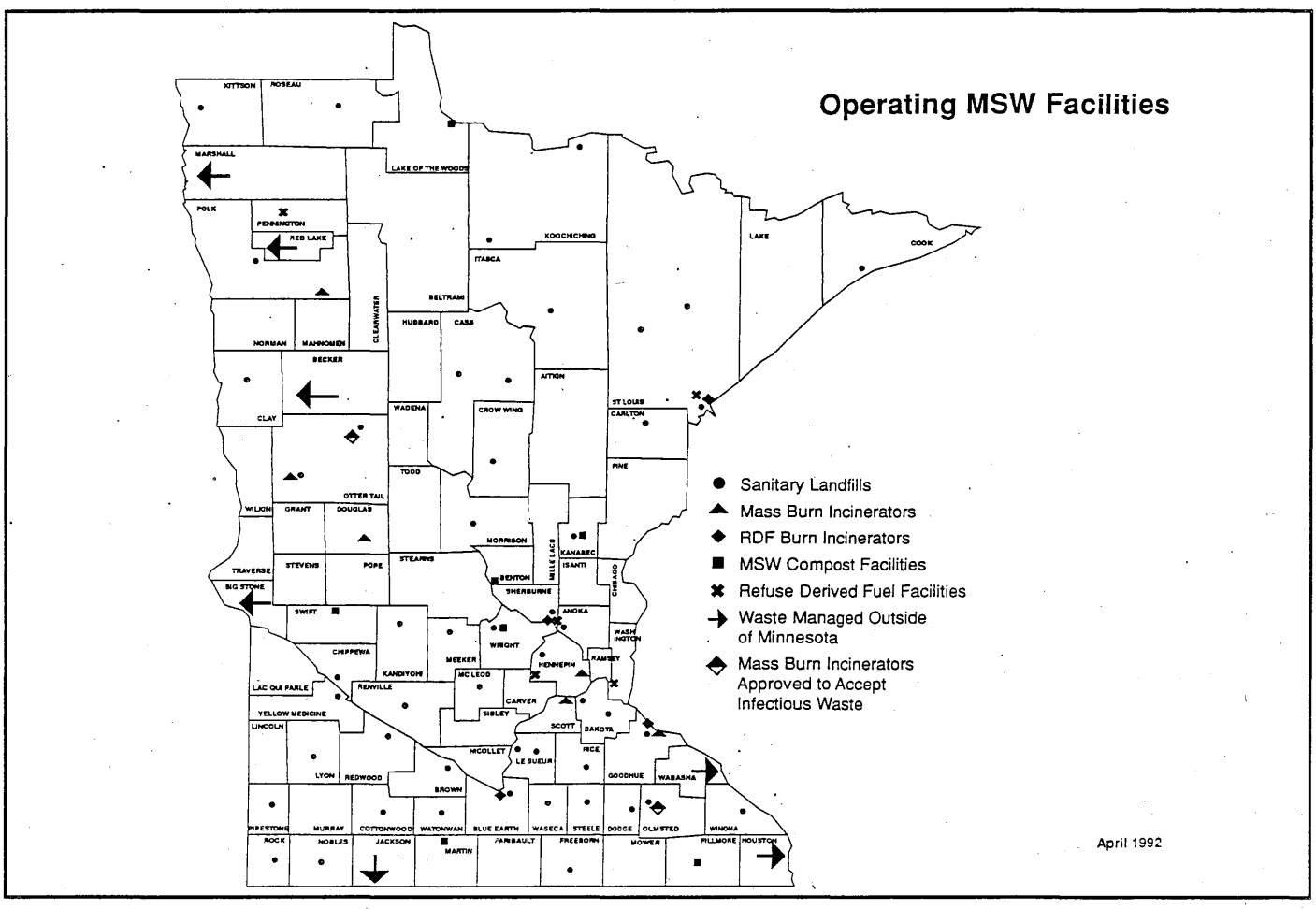
Landfilling

Currently there are 49 sanitary landfills operating throughout the state. The solid waste rules (Minn. Rules 7035.2535) state that infectious waste is "unacceptable unless approved by the Agency." In 1991, MPCA staff contacted all landfills to see if they would accept infectious waste. Most responses were "no" due to aesthetic reasons, public and

occupational health risk, public relations, and fear of regulatory burden. Several landfills did indicate that they might be interested if the state said it was acceptable.

There is much debate about whether or not to consider landfilling of infectious waste. Aesthetics and the fear of public/occupational health risks seem to be the biggest obstacles. There has been no documented evidence that there would be any increased public-health risk from landfilling most infectious waste. (Sharps, however, do pose an injury potential to solid waste workers and should be addressed separately.)

To accept infectious waste, a landfill would have to submit a proposal to accept infectious waste (much like an alternative technology proposal), update their industrial waste management plan, and submit an infectious waste management plan for approval.



New Treatment Capacity

Minnesota Healthcare Partners (MHP), a consortium of 18 metro area hospitals, just concluded a six-month process to evaluate non-burn technologies for the decontamination of infectious waste generated by their member hospitals. The conclusion of their report favored the technologies of autoclaving and microwaving. The amount of infectious waste the group generates is about 3,000,000 pounds per year. If a facility is sited, it is estimated that approximately 5,000,000 to 6,000,000 pounds of capacity would be required. Currently they are evaluating all of their options, and no site-specific information is available.

Endeco, Inc. in 1991 had submitted a permit application for two 12 tons/day medical waste incinerators for an annual capacity of approximately 15,000,000 to 18,000,000 pounds per year. An EAW had been submitted and was being reviewed by MPCA. The company was asked to resubmit a draft EAW, revised risk assessment, and permit application over a year ago. There has been no Agency correspondence with the company since

that time and it is unknown if it plans to proceed with the project. It had been trying to site the facility in Watkins and had met with considerable opposition.

Stericycle, Inc. is a company which decontaminates infectious waste by the use of radio waves. The process is called electro-thermal deactivation, or ETD, and the technology was approved by MPCA in March 1991. The company was active in trying to site a facility in Red Wing for some time, but now it appears it is reevaluating its marketing efforts and is considering siting a facility in Wisconsin rather than in Minnesota.

Medical Disposal Systems (MDS) submitted a technology proposal in May 1992 called continuous feed disinfection, or CFD, which utilizes a dry heat source applied to shredded infectious waste in an auger chamber. The technology is under review in Minnesota and a number of other states. The proposed facility plan projects an annual capacity of 30,000,000 to 50,000,000 pounds per year.

Extrapolated Medical Solid Waste Data

All of the foregoing has pertained to infectious medical waste. The MPCA has also estimated the solid-waste generation rates for health-care facilities. To do this, the MPCA contacted the Minnesota Hospital Association to find out what the occupied bed rate was for 1991. There were 2,941,840 total patient days (or occupied beds) reported in Minnesota in 1991. This number was 98,086 patient days less than in 1990. (Note: MHA does not include Veteran's hospitals or Indian hospitals in its data. MDH hospital data in Table D-5, however, did include two VA Medical Center's and two Indian hospitals.)

MPCA paired this statistic with two different estimates:

1) The estimated hospital solid-waste generation rate of 15 lbs./bed/day.
2) The "Medical Waste Management Report" by the Theta Corp. which estimated that hospitals generate 50% of the medical (solid) waste, while other generators produce the other 50% of medical waste.

Based on these estimates, the extrapolated medical solid waste appears in Table D-10.

Table D-10
Extrapolated Medical Solid Waste Data

Given that: 2,941,840 occupied beds/year x 15#/bed/day =	44,127,600 pounds
Assume Hospitals 50% of Waste and	44,127,600 pounds
Assume Other Generators 50% of Waste	+ 44,127,600 pounds
Total Medical Waste	**88,255,200 pounds** (44,128 tons)

Infectious Waste Composition

Minnesota is a leader in waste management planning. As a result, several waste composition studies have painted an interesting picture of mixed municipal waste and infectious waste in particular. The MPCA completed an infectious waste composition study for the state legislature in 1991. The Mayo Clinic performed a waste composition study to satisfy environmental impact requirements for an infectious waste incinerator plan. Minnesota Healthcare Partners surveyed members in order to estimate infectious waste composition. Results of the studies are presented in Table D-11.

Table D-11
Infectious Waste Composition Studies
(in percent by weight)
1991

Size of Hosp	Large	Medium		Small
Study	Mayo Red Bag	MHP* Lab Waste	MHP* Sharps	MPCA Red Bag
Plastic	33.7	33	56	46
Rubber	12.5			4
Paper	29.9			19
Glass	3.6	28	23	12
Path	2.7	1.6	1.6	1
Textile	12.7			
Liquid	3.2	22	24	13
Metals	1.3	7		1
Misc	.4			4

*The above percentages will not total 100% since they represent the average of the percentages reported by the surveyed hospitals and not every surveyed hospital provided data for each of the composition categories.

General Waste Composition

The Minnesota Pollution Control Agency is currently conducting a statewide solid-waste composition study, to be reported to the Legislative Commission on Waste Management in November 1992. The composition of waste varies depending on the source of solid waste and the effort placed on recycling and other waste management methods. Each MCPA sample was selected through a random number generation and weighted, on average, at 300 pounds. (See Table D-12).

Table D-12
MPCA Statewide Waste Composition Study Preliminary Data Non-Infectious Waste
Hospital Waste Composition of Eleven Samples

HOSPITALS	A Percent	B Percent	C Percent	D Percent	E Percent	F Percent	G Percent	H Percent	I Percent	J Percent	K Percent	Overall Percent
Newsprint	12.0	2.2	2.8	6.6	2.1	1.7	1.9	6.1	10.8	5.2	1.6	4.8
High Grade	9.7	6.9	1.3	7.0	6.3	6.9	5.0	1.0	1.1	5.9	6..4	5.2
Corrugated	1.2	8.2	17.4	1.2	18.2	2.6	5.4	6.1	20.7	1.9	0.7	7.6
Magazines	17.6	2.0	2.4	1.2	9.3	0.1	0.0	0.4	0.0	3.8	0.0	3.3
Other Paper	20.7	41.6	27.1	30.8	22.0	35.4	38.6	25.6	26.9	39.8	30.2	30.8
HDPE	0.7	1.9	1.0	1.2	0.0	0.7	1.7	2.4	0.8	0.1	0.3	1.0
Film	7.5	10.8	6.7	10.9	7.0	13.8	9.2	7.2	6.8	8.8	10.4	9.0
PET	0.0	0.1	0.0	0.0	0.0	0.3	0.5	0.3	1.3	0.0	1.2	0.3
Polystyrene	3.4	5.2	2.8	3.5	3.0	1.0	5.0	1.8	4.6	1.1	2.8	3.1
Other Plastic	10.7	6.8	15.9	9.7	13.9	11.6	15.0	9.8	11.2	8.8	24.1	12.5
Food Waste	3.2	6.0	2.1	5.8	2.4	9.3	3.0	13.9	7.3	9.0	1.8	5.8
Sm Yard Waste	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.0	0.0	0.0
Lg Yard Waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood Waste	0.3	0.7	0.0	0.5	0.0	0.0	0.0	1.3	0.0	0.1	0.0	0.3
Tires	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disp Diapers	0.3	0.8	0.7	4.6	4.6	1.9	3.6	2.4	2.7	4.0	10.3	3.3
Textiles	4.4	0.6	1.6	1.2	1.5	3.7	0.7	10.2	0.4	1.1	0.5	2.4
Other Organics	3.2	4.0	14.4	9.7	5.	3.1	6.0	5.1	1.3	2.4	6.5	5.6
Major Applicances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm Elec Appl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demo/Const	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1
Other Inorganics	0.0	0.0	0.0	0.0	2.3	0.2	0.0	0.0	3.0	5.2	0.0	1.0
Alum Bev Cont	0.2	0.5	0.8	0.9	0.4	0.9	0.9	0.4	0.4	0.1	0.5	0.5
Other Alum	0.0	0.7	0.1	0.0	0.2	0.1	0.1	0.1	0.0	0.1	0.2	0.2
Ferr Food Cans	0.1	0.2	1.2	0.7	0.2	0.6	0.3	2.7	0.1	0.1	0.1	0.6
Other Ferr	0.6	0.3	0.3	0.7	0.0	0.6	0.5	0.4	0.0	0.1	0.1	0.3
Other Nonferr	0.0	0.0	0.5	0.5	0.1	0.0	0.3	0.0	0.0	0.1	0.0	0.1
Glass Good/Bev	3.7	0.2	0.3	2.9	0.5	0.7	0.6	2.2	0.5	0.4	0.7	1.2
Other Glass	0.2	0.1	0.2	0.1	0.0	3.6	1.4	0.3	0.0	2.0	1.1	0.8
Hazardous Waste	0.0	0.4	0.4	0.3	0.0	0.0	0.3	0.4	0.0	0.1	0.4	0.2
Oil Filters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Weight	176.8	209.8	173.1	185.0	225.9	162.7	151.0	191.3	142.3	174.3	122.6	

The Mayo Clinic Complex Study looked at samples (cubic yard samples) from trucks which picked up solid waste from each facility in the complex. Definitions of waste types closely match the definitions used by the MPCA study. Although the Mayo Complex Study had a small number of samples, comparison of waste composition may be useful. It is interesting to note that Winona County has an aggressive household recycling program. The county has started a mandatory commercial office building recycling program for corrugated cardboard and office paper, as a result of data derived from the MPCA study.

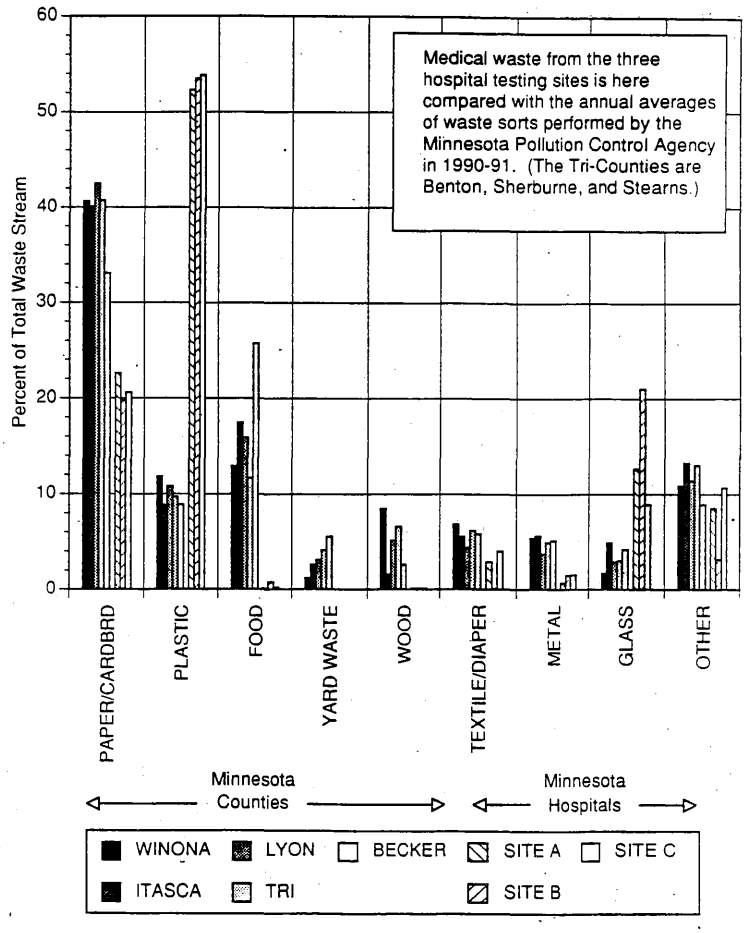
Table D-13
Comparison of General Waste Composition: Mayo Clinic Complex Compared to Minnesota Pollution Control Statewide Waste Composition Study (Winona) 1990-1992
(percent by weight)

Category	1991 Study Mayo Complex n = 13	MPCA Study Commercial Waste n = 94	MPCA Study Household Waste n = 57
Paper	58.9	42	36
Food	*	10	17
Plastics	34.8	14	10
Metals	1.3	5	6
Glass	1.8	1	2
Textiles	8	5	6
Wood		13	2
Construction/Demo		5	6
Yard Waste		1	2
Diapers		<1	4
Other	2.4	3	9

*Food was included in "Other" in the Mayo Complex Study

Table D-14

MEDICAL AND MUNICIPAL SOLID WASTE COMPARED



Conclusions

Data collected by the Minnesota Department of Health and the Minnesota Pollution Control Agency is more than adequate for decision making. Very few states, and certainly not the Federal government, have data with the degree of detail available in Minnesota. The composition and volume/weight aspects of infectious waste will become more precise as generators become more comfortable with the balance involved in properly segregating (see Strategy section for segregation discussion). Data are expected to become more reliable as hospitals and other health care organizations keep better records and become used to reporting systems. Consistency of terms and simplicity of report formats for regulated parties would contribute to improvement of data. Overall, Minnesota data is excellent. National data is helpful for a point of reference, but MDH and MPCA data should be used for policy decisions.

POLICY SUBCOMMITTEE REPORT

Introduction

The MWTF chairperson appointed members and staff to the Policy Subcommittee to address the third charge from the legislature:

> Design a state policy that focuses on alternatives to landfilling and incineration as the primary means of infectious waste disposal according to the order of preference in Minn. Stat. § 115A.02, per the legislative charge.

This charge initially appeared contradictory to the task force because, in the final analysis, there are no alternatives to landfilling for infectious waste disposal. That is, while there are treatment methods that can be used to decontaminate waste, these methods all create some type of non-infectious residue or ash, which must then be disposed of by landfilling. After consulting with legislators, it was decided that the intent of the charge was to focus on treatment technologies, with the emphasis on alternatives to incineration. Henceforth, the term alternative technologies will be used to refer to all treatment methods other than incineration.

The charge precludes addressing the Waste Management Act's order of preference for the reason that treatment happens after any reduction, and any recycling or reuse happens after treatment. The orders of preference are thoroughly addressed in the Strategy Subcommittee section, which follows this one and takes a more global perspective of medical waste.

To clarify the distinction between treatment and disposal of infectious waste:

Treatment, on the one hand, renders waste non-infectious. It frequently incorporates a shredding and/or compaction step to reduce volume, but often requires the original material to be further managed. Most treatment technologies currently landfill this non-infectious solid waste residue.

Disposal, on the other hand, directly buries or disperses infectious waste or decontaminated residue in such a manner that little or no further handling or processing is required. The three processes which are conventionally considered to be disposal are incineration, landfilling, and sewering.

Later in this section, treatment methods for decontaminating infectious waste are described, each with its advantages and disadvantages. Since some members of the task force felt that the conventional disposal methods for untreated waste should not be ruled out, the advantages and disadvantages of those are also described.

It is important to remember that while this section describes all options, state discretion may be preempted by federal law. Current proposals would grant the Environmental Protection Agency authority to review and approve treatment technologies other than incineration and steam autoclaving.

Summary of Current Infectious-Waste Policy

The federal Centers for Disease Control (CDC) currently recommends only two procedures for the treatment of infectious waste: incineration and autoclaving. A CDC representative recently stated to MDH staff that the recommendations for infectious waste have not changed since those published in "Guidelines for Handwashing and Hospital Environment Control" (1985). (See Appendix P-1.) The representative said that CDC felt that the alternatives have not been adequately evaluated.

In Minnesota, incineration and steam autoclaving using specific parameters are presently approved, and other methods may be used upon approval by the regulating agency. Currently, the MPCA has promulgated rules for and approved three alternative

methods for off-site decontamination: microwaving, chemical disinfection and electro-thermal deactivation. The technology approval is the first step of a two-step facility approval by the MPCA and is done on a case-by-case basis for each technology and company proposal (Appendix P-2).

MDH anticipates completing its rulemaking process for on-site facilities in Fall 1992 and will evaluate generator on-site decontamination proposals upon request. (For further clarification of agency roles see Infectious Waste Control Act in the Background section.)

Specific Regulations

Under the Infectious Waste Control Act

All Minnesota generators are required to handle Infectious waste and its component parts as defined in the Infectious Waste Control Act (includes laboratory waste, blood, regulated human body fluids, sharps, and research animal waste--see Glossary for definitions) as infectious unless it has been decontaminated. Discarded health care sharps, whether new, decontaminated, or contaminated, must always be handled as infectious waste unless they are "part of an infectious waste decontamination process approved by the Commissioner of Health or the Commissioner of the Pollution Control Agency that will prevent exposure during transportation and disposal."

Proper segregation of infectious waste from solid waste must be done prior to placing the waste in a container for decontamination or disposal. If solid waste is placed in an infectious waste container with infectious waste it must be treated as infectious waste until decontaminated. Once commingled all the waste is considered infectious waste.

Steam autoclaves and the other alternative technologies reviewed are not recommended for residual chemotherapy waste, human pathological waste and research animal waste. Incineration can handle all these wastes as well as untreated infectious waste. Minnesota statutes do not prohibit the disposal of infectious waste in a landfill. Minnesota solid waste rules state landfills cannot accept untreated infectious waste unless they receive approval from the Minnesota Pollution Control Agency (MPCA). Minn. Stat. § 116.78 prohibits infectious waste from being compacted or mixed with other waste material prior to incineration or disposal unless it is part of an infectious waste system approved by the Commissioner of Health or the Commissioner of the MPCA that is designed to prevent exposure during storage, transportation or disposal. Sharps, if they are decontaminated or not, may not be mixed with other waste or compacted unless this is done as part of a decontamination process approved by the commissioners listed above that will prevent exposure during transportation and disposal (Minn. Stat. § 116.78).

Under Occupational Safety and Health Administration

The generators of infectious waste who have employees must comply with the Minnesota OSHA occupational exposure to bloodborne pathogens regulation 1910.1030. Since Minnesota has a state OSHA program the state program has adopted the federal standards by reference, with no alteration. The body-fluid waste regulated under standard 1910.1030 is slightly more encompassing than that under the Infectious Waste Control Act (see Glossary--"Regulated Waste"), but it is Minnesota OSHA's intent to enforce its Bloodborne Pathogens Standard in concert with the Infectious Waste Control Act.

In its adoption notice for the 1910.1030 standard Minnesota OSHA stated "it was concluded that the 'saturated and dripping' criteria for determining 'infectious waste' is still valid" and that "the definition of regulated waste can be adequately addressed in the enforcement guidelines."

Labeling Consistency Issue

Labeling of infectious waste under more than one regulation has the potential to be confusing. The term "red bag" waste, used in the medical and medical-waste field, arose prior to the Infectious Waste Control Act in Minnesota, when infectious waste was commonly disposed of in unmarked red bags. The Act now requires all containers for infectious waste to be labeled with the biohazard

symbol or words "infectious waste." Color for containers is neither specified nor required; color alone has no meaning for labeling purposes under the Act.

However, the OSHA regulation still allows color identification of regulated waste and requires that containers of regulated waste be labeled with the word "biohazard" and/or with the biohazard symbol or that the container be red. For OSHA purposes a red bag would be appropriate packaging and would not necessarily require further labeling, but Minnesota OSHA has recognized that its "regulated waste" fits the Infectious Waste Control Act's definition of "infectious waste" and that all such waste would be required to be packaged and labeled for disposal to comply with the Act and rules adopted thereunder. In Minnesota the biohazard symbol is common in labeling requirements of both regulations and therefore must be used to identify infectious waste. OSHA regulations require regulated waste to be disposed of according to applicable federal and state regulations.

Other Waste Handled with Infectious Waste

Two categories of waste are often managed with the infectious waste stream: trace or residual chemotherapy waste and pathological waste. When evaluating the alternative technologies it is important to note that most of them classify these two waste types as "unacceptable." This results in three separate waste streams that must be segregated and sent on their respective disposal routes.

Trace Chemotherapy Waste

Seven chemotherapy drugs are classified as U-listed (toxic) hazardous. The other chemotherapy drugs, while not listed, exhibit similar characteristics. In Minnesota, if the chemotherapy container (e.g., syringe, IV bag) is "empty," then by definition, the waste does not have to be handled as hazardous waste. But when the container is "empty" of drug and is attached to a needle, it must be handled with the infectious waste stream. (See Appendix P-3--Fact Sheet.) Other trace-contaminated solid waste items, such as gloves and gowns, are also often segregated with the infectious waste stream, but if the trace contaminated item does not fit any of the infectious waste definitions, it can be handled as a solid waste.

The method of choice for disposing of trace or residual chemotherapy drugs and their containers is incineration at 1,800 degrees F. The alternative technologies which use heat, steam, or pre-shredders have the potential for aerosolizing or vaporizing the chemicals and could present a potential occupational exposure hazard.

Pathological Waste

Pathological waste is human tissue and body parts removed accidentally or during surgery or autopsy that are intended for disposal. Pathological waste is "unacceptable" to most alternative technologies because of aesthetic rather than operational or safety concerns.

Because it is usually incinerated with the infectious waste stream, there are concerns about pathological waste going to alternative facilities along with infectious waste if improperly segregated. If a given alternative technology classifies pathological waste as "unacceptable," care must be given to assure that the waste stream is segregated properly from other "acceptable" waste. Most often pathological waste, like trace chemotherapy waste, will be segregated, packaged, and labeled separately from other infectious waste and sent to an incineration facility for disposal. This would apply to both generators who send their waste off-site to a commercial or regional facility and to generators who would decontaminate infectious waste on-site with an alternative technology.

Treatment Options

In its review of technologies now in the marketplace for treating infectious and pathological waste, the Medical Waste Task Force relied in part on the work completed by the Minnesota Healthcare Partners, Inc. in their Study of Non-burn Alternatives and

Siting. Others contributing to the identification of treatment options included: Browning-Ferris Industries (autoclaving), Medical Safety Systems (incineration), and Medical Disposal Systems (continuous feed disinfection unit). It should be noted that these methods are for infectious and pathological waste only; the descriptions do not address regulated hazardous or radioactive waste.

Chemical/Mechanical Decontamination

Chemical/mechanical decontamination systems typically shred infectious waste and then disinfect the shredded waste with a treatment solution containing chlorinated compounds. Closed systems recirculate the chlorinated treatment solution and produce a moistened, solid residue which must be disposed of. Effluent systems produce a moistened residue for disposal as well as discharge the treatment solution with a substantial volume of water into the sanitary sewer. Some communities may require a discharge permit and/or pre-treatment of the treatment solution before it is discharged from an effluent system.

Advantages

- Appearance of waste is changed and unrecognizable.
- Has been accepted in a number of states.
- Some units have little water effluent.
- Some manufactured units are automated, self-contained and enclosed; require little handling.
- Variety of manufacturers.
- Generally cost-effective.
- Reduces volume.
- An approved treatment technology in Minnesota for off-site treatment by MPCA.

Disadvantages

- Not suitable for body and animal tissue, large metal objects, and any material incompatible with the chemical treatment solution; some units also can not handle large fabric material or bulk liquids.
- For units using chlorinated compounds, chlorine is toxic requiring special handling and disposal.
- For units using sulfuric acid, acid is corrosive requiring special handling and disposal.
- Safety precautions required to limit employee exposure to chlorine or other treatment solutions.
- Toxicity and corrosivity of treatment solutions increase maintenance.
- For units with liquid effluents, sewered effluent may be high in chlorides; some sewer authorities may not accept without further treatment.
- If treated, residue retains treatment solution (e.g., is high in chlorides), precautions may be necessary in disposing of treated waste residue.
- Metals (e.g., sharps) can pose problems for grinder/shredder.
- Grinder/shredder may jam if improperly fed.
- Units generally shred waste before chemical treatment.
- Special care such as HEPA filters needed to prevent fugitive emissions during grinding.
- Shredder makes it difficult to monitor whether waste is completely disinfected; potential for incomplete decontamination.
- If unit uses chlorinated compounds, chlorine odor may be offensive.
- Glass, plastic and cloth material may cause plumbing problems.
- Some units require substantial volume of water (e.g., 30 gals. per min.).
- Unless de-watered, waste weight increases substantially.
- Some units may be noisy.
- Some landfill operators may refuse to accept treated, shredded waste containing sharps.

High Heat Decontamination

1. Incineration

   Infectious and pathological waste is combusted in the presence of air at temperatures generally ranging from 1,500°F to 2,000°F, producing an ash which must be disposed of and gases which some states required to be "scrubbed" to remove various pollutants. Some states, such as Minnesota, require incinerators to have two "burning" chambers, pollution control equipment to remove pollutants, and emissions monitoring equipment.

Advantages

- Converts combustible materials into noncombustible residue.
- Significant volume reduction (by about 90%).
- Weight reduction.
- Assured destruction of material (unrecogizability).
- Sterilization.
- Ability to manage most types of waste with little processing before treatment.
- Recommended for pathological waste and trace chemotherapy.
- Air emissions can be controlled to meet air quality standards.
- Can produce usable energy, steam for electricity, or heat if built to do so.
- Moderate amount of space required.
- Approved technology in Minnesota and all 50 states.
- Several manufacturers, all of whom produce equipment that will meet Minnesota standards.
- Generally cost-effective for current facilities when compared to other treatment and disposal options.

Disadvantages

- Non-combustibles not reduced in volume (glass, metal, etc.).
- Complex operation when considering all environmental factors.
- Requires trained operators.
- Increased cost associated with controlling pollution emissions.
- The potentially hazardous nature of incinerator ash.
- Difficult to site facilities.
- Auxiliary fuel required.
- Requires regulatory permitting for air emissions.
- May require special landfilling of ash.

2. Plasma Torch

Highly ionized compressed air is used to vaporize infectious and pathological waste at temperatures over 3,000°F. Plasma torch reactors produce "off-gases" (mostly hydrogen and carbon monoxide) which, after scrubbing, can be used as an alterative fuel source. Also produced is a small amount of glass-like slag which contains those materials not vaporized.

Advantages

- Appears to handle full range of infectious and pathological waste.
- Appearance of waste is changed and unrecognizable.
- Realizes greatest reduction in weight and volume of waste.
- Completely destroys infectious and pathologi cal waste.
- Vitrified slag (residue) appears to be non-leachable and can be used for other purposes.
- By-product gases (mostly hydrogen and carbon monoxide) can be used for other purposes such as a fuel source for energy production.
- Total volume of gases produced are about 1/10th that of incineration.
- Emissions levels are substantially lower than incinerators.
- High operating temperatures appear to minimize creation of dioxins and furans.

Disadvantage

- Currently not accepted treatment method in Minnesota.
- Combustion of by-product gas appears to result in air emissions containing low levels of some regulated elements such as heavy metals.
- Use of technology to treat medical waste still under development; unaware of operating facility.
- Permitting may be difficult since process is not a widely accepted method for treatment of waste.
- Requires advanced pollution control equipment (e.g., to remove hydrogen chloride).
- Large consumption of electricity.
- Requires substantial volume of water (e.g., 20 gals. per min.).
- Requires highly trained employees.
- Relatively large capital investment required (over $1 million); may have high operating costs.

3. Pyrolysis

Pyrolysis systems break down infectious and pathological waste into gases and a small amount of ash using high temperatures (800°F to 3,500°F) in the absence of air. Depending on the system, the major components of the gases can vary from carbon dioxide and water vapor to hydrogen and carbon monoxide.

Advantages

- Appears to handle full range of infectious and pathological waste.
- Appearance of waste is changed and unrecognizable.
- Realizes greatest reduction in weight and volume of waste.
- Completely destroys infectious and pathological waste.
- By-product gases produced by some units (mostly hydrogen and carbon monoxide) can be used for other purposes such as a fuel source for energy production.
- High operating temperatures of some units appear to minimize creation of dioxins.

Disadvantages

- Currently not accepted treatment method in Minnesota.
- Disposition of ash regulated and may be difficult; ash testing may be required.
- May result in air emissions containing low levels of some regulated materials such as particulates and heavy metals.
- Use of technology for treatment of medical waste still under development.
- Requires pollution control equipment.
- Large consumption of electricity.
- Large capital investment required ($6 million); may have high operating costs.

Low Heat Decontamination

1. Electro-Thermal Deactivation

Infectious waste is shredded, loaded into special containers, heated with low frequency radio waves to a temperature under 200°F, and held in the containers for a specific period of time to kill the microorganisms. The company retaining sole rights to the technology is seeking to recycle certain separately processed plastics. This decontamination process produces a slightly moist, solid residue which must be disposed of.

Advantages

- An approved treatment technology in Minnesota for off-site treatment by the MPCA.
- Appearance of waste is changed and unrecognizable.
- Appears to have relatively minor impact on air quality; does not create regulated air emissions like incineration.
- Appears to have relatively minor impact on water quality.
- Residue can be handled as regular solid waste.
- Waste volume is reduced significantly.
- Company claims to be recycling some residue.

Disadvantages

- Not suitable for body and animal tissue and unclear whether suitable for volatile organics and chemotherapeutic drugs.
- Much of the treatment process is proprietary and remains secret.
- Only one facility in operation (in October 1991); only operating since Fall of 1990.
- Larger metal objects pose problems for grinder/shredder.
- Grinder/shredder may jam if improperly fed.
- Waste is shredded prior to treatment.
- Special care such as HEPA filters must be taken to prevent fugitive emissions during grinding.
- Appears to require large volumes of waste to be cost-effective.
- Not fully automated; appears to require substantially more handling by employees.
- May require more highly trained employees.
- Some landfill operators may refuse to accept treated, shredded waste containing sharps.
- Not suitable technology for on-site (hospital) treatment of waste.

2. Microwaving

Infectious waste is exposed to high temperature steam, shredded and then heated to a temperature of 205°F for a specific period of time by a

series of microwave generators to kill the microorganisms. The enclosed, automated systems produce a slightly moist, solid residue which must be disposed of and no liquid effluent.

Advantages

- An approved treatment technology in Minnesota for off-site treatment by the MPCA.
- Appearance of waste is changed and unrecognizable.
- Less likelihood of incomplete decontamination since material is heated from both inside (microwave) and outside (steam).
- Relatively minor impact on air quality.
- No liquid effluent; no impact on water quality.
- Residue can be handled as regular solid waste.
- Waste is subjected to high temperature steam as it is shredded.
- Accepted in several states and Europe.
- Manufactured unit is automated, self-contained and enclosed; requires little handling.
- Waste volume is reduced significantly.
- May require little permitting.
- Does not require highly trained employees.

Disadvantages

- Not suitable for body and animal tissue, and chemotherapeutic drugs; liquids should not exceed 10% by weight and metals should not exceed 1% by weight.
- Larger metal objects pose problems for grinder/shredder and microwave unit.
- Grinder/shredder may jam if improperly fed.
- Special care such as HEPA filters must be taken to prevent fugitive emissions during grinding.
- Because of shredder, difficult to monitor whether waste is completely disinfected; potential for incomplete decontamination.
- Special care must be taken to avoid exhaust of untreated volatile organics.
- Odor may be offensive.
- Safety precautions required to limit employees exposure to microwaves.
- Single known manufacturer and relatively new in the marketplace.
- Some landfill operators may refuse to accept treated, shredded waste containing sharps.

3. Steam Sterilization (Autoclaving)

Steam sterilization or autoclave systems generally expose infectious waste in its original form to high temperature steam (about 250°F to 300°F) for a specific period of time to heat the waste killing the microorganisms. Most vendors offering steam sterilization equipment recommend or offer equipment to shred or compact the waste before or after treatment. Steam sterilization equipment comes in a variety of sizes, configurations and capacities. A moist residue is produced which must be disposed of.

Advantages

- An approved treatment technology under Minnesota rules.
- Relatively minor impact on air quality; does not create regulated air emissions like incineration.
- May have liquid effluent; relatively minor impact on water quality.
- Has wide acceptance.
- May require little or no permitting.
- Some manufactured units are automated, self-contained and enclosed; requires little handling.
- Does not require highly trained employees.
- Variety of manufacturers.
- Some states use as the standard for judging effectiveness of other alternative technologies.
- Generally cost-effective.

Disadvantages

- Not suitable for body and animal tissue, bulk liquids (blood & body fluids), volatile organics, and chemotherapeutic drugs.
- Unless shredded, waste's appearance remains unchanged and recognizable.
- Potential for incomplete sterilization if material encapsulated in melting plastic or if steam cannot penetrate unopened containers.
- Greater risk of human exposure if it is required to open closed containers in non-vacuum units.
- Requires substantial volume of water (steam).
- Special care must be taken to vent steam; may require HEPA filters or other treatment method to remove volatized organics.
- Odor may be strong and offensive.

- Unless shredded, no reduction in volume or weight; use of steam increases weight.
- Landfill operators may refuse to accept treated waste unless appearance is altered (shredded).
- Some landfill operators may refuse to accept treated, shredded waste containing sharps.
- Produces some liquid effluent which may contain minute quantities of pollutants.

4. Continuous Feed Disinfection

Infectious waste is shredded and moved by a screw conveyor to a holo-flite auger. Electrically heated oil is used to sustain a temperature of 203° to 225°F for a specific period of time to kill target microorganisms. The shredded solid waste residue must then be managed.

Advantages

- Appearance of waste is changed and unrecognizable.
- Waste volume reduced significantly.
- Does not require highly trained operators.
- Does not require a supplemental fuel.
- Relatively minor impact on air quality.
- Very little liquid effluent (condensible liquids only).
- Residue handled as regular solid waste.
- Unit is automated, self-contained and enclosed thus requires little handling.
- May require little permitting.

Disadvantages

- Cannot accept pathological waste, large animals, or trace chemotherapy.
- Not an approved technology in Minnesota, currently under review.
- New technology in marketplace, no operational facility track record.
- Pre-shredder may jam if improperly fed.
- Special care such as HEPA filtration needed to control fugitive emissions during shredding and processing.
- Some landfills or solid waste processing facilities may refuse to accept shredded residue.

Electron Beam

Infectious waste is sterilized in its original container by exposing it for a relatively short period of time (1 to 3 minutes) to electrons generated from a non-radioactive source. Treated waste is then unloaded and shredded.

Advantages

- Appears to handle full range of infectious and pathological waste.
- Relatively minor impact on air quality.
- No liquid effluent; no impact on water quality.
- No radioactive material required for waste treatment.
- Residue is sterile and can be handled as regular solid waste.
- Requires little handling of waste.
- Waste is treated prior to any shredding.
- Can handle large volumes of waste in short period of time.
- Currently accepted and widely-used method to sterilize medical devices, implants and supplies.

Disadvantages

- Currently not accepted treatment method in Minnesota or other states.
- Use as a treatment method for medical waste presently only in development stage.
- Expensive and extensive safety precaution required to shield employees from exposure to electron beam and to monitor radiation levels.
- Unless shredded, waste's appearance remains unchanged and recognizable.
- Metals (e.g., sharps) can pose problems for grinder/shredder.
- Grinder/shredder may jam if improperly fed.
- May require special permitting and licensing from Minnesota and federal government.
- Public fear and apprehension of radiation.
- Appears to be offered only by a single company.
- Requires relatively large capital investment.
- Requires high trained personnel.
- Some landfill operators may refuse to accept treated, shredded waste containing sharps.

Disposal Options

Incineration

See listing under foregoing Treatment Options.

Landfilling

Infectious waste properly packaged and labeled under Minn. Rules is transported to a sanitary landfill approved to accept infectious waste. A separate cell would be prepared to accept infectious waste and special management practices would be specified in the landfill's Industrial Waste Management Plan (such as delivery, cover, etc.). Biodegradable portions of waste stream are subject to the natural microbial action found in all MSW landfills.

Advantages

- Cost would be less than other methods of treatment.
- Medical waste may be no more of a health hazard than municipal solid waste (MSW) and should not cause any additional environmental impacts.
- Landfilling properly packaged infectious waste would reduce number of times waste is handled and therefore reduce occupational exposures.
- There is existing capacity available (although it will be more limited in future).
- Landfills are located throughout the state, providing potential capacity in areas of the state which have limited commercial or on-site options.

Disadvantages

- Liquid waste restricted from going to a landfill.
- Potential for exposure and injury to workers from sharps that are not packaged correctly or have been released from containers.
- Potential for ground water contaminon.
- Potential for gas emission such as methane.
- No landfills in the state are currently approved to accept untreated infectious waste.
- Landfill space is limited and it is difficult to site new capacity.
- Potential for increased liability.

Sewering

Only applies to blood and regulated body fluids (RBFs). The blood and RBFs are decomposed by the wide variety of microorganisms which degrade all organic matter in sewage. In addition, the harsh conditions in the treatment process will destroy many of the microorganisms which may be present in the blood and RBFs. As an added protection, from March through October, when the potential for human body contact is high, the treated wastewater is disinfected, most often with chlorine or ultraviolet light. Sludge, the solid residue remaining after treatment, is recycled as a soil conditioner after additional treatment to reduce pathogens, or is incinerated. The treated wastewater is regularly tested for fecal coliform, and must meet MPCA standards prior to discharge into rivers or other bodies of water.

Advantages

- Economical, acceptable method of disposal.
- Method is accepted by CDC and OSHA.
- By-products are recyclable.
- Pathogens - destroyed by process.
- Very little handling.

Disadvantages

- Splashing when dumping may contaminate workers.
- Plumbers may not want to work in area.
- Need separate storm sewer system.
- May be prohibited by local ordinances.

Table P-2
Comparison of "Disposal" Technologies

Technology	Sanitary Landfill	SanitarySewer
Size reduction equipment	None	None, liquids only
Can effectively decontaminate waste	Unknown	Yes, with secondary treatment
Acceptable waste	Lab waste (no liquids) sharps research animals pathological, trace chemotherapy	Blood, regulated body fluids
Unacceptable waste	Liquids (blood, regulated body fluids)	Lab waste, sharps, research animals, pathological, trace chemotherapy
Effect on waste appearance	None	Diluted
Effect of waste weight	None	None
Effect on waste volume	None	None
Environmental effects - Air	Same as MSW (emissions)	None
Environmental effects - Water	Same as residue and MSW (ground water contamination)	Potential for some suspended solids and organics
Environmental effects - Land	Minimal use of capacity	None
Potential for materials reuse or energy recovery	None	None
Technology approved	MPCA approved process	Acceptable method for on-site disposal contingent on local ordinances
Generator size	Any generator	Any generator
On-Site / Off-Site	Off-site	On-site
Operating facilities	Currently none approved by MPCA	Acceptable practice at generator sites

Comparison of Off-site Treatment Technologies

The following table (Table P-1) permits a rapid comparison of the different technologies available for treating infectious waste. It has been constructed from a variety of sources, including the Mayo Environmental Impact Statement, Minnesota Healthcare Partners, Inc., and evaluations done by the Minnesota Pollution Control Agency. The focus is on those technologies that are either already operating in Minnesota or whose siting is under active consideration. Generator size in this table is defined as follows: "Small" refers to generators such as clinics or doctors' offices. "Medium" refers to an individual hospital, of any size. "Large" refers to a regional or commercial facility that produces or treats at least 25 tons per day.

Table P-1: Comparison of Off-Site Treatment Technologies

Treatment Technology	Chemical Disinfection	Medical Waste Incineration	Electrothermal Deactivation	Microwave	Autoclave/ Steam Sterilization	Continuous Feed Disinfection
Size reduction equipment	Preshredder & hammermill.	Combustion	Preshredder	Preshredder	Pre- or post-shredder, optional.	Preshredder/grinder.
Can effectively decontaminate waste	Yes	Yes	Yes	Yes	Yes	In review by MPCA.
Acceptable waste	Lab waste, blood, body fluids, sharps, small research animals.	All	Lab waste, blood, body fluids, sharps.	Lab waste, blood, body fluids, sharps.	Lab waste, blood, body fluids, sharps.	Lab waste, blood, body fluids, sharps.
Unacceptable waste	Trace chemotherapy, large research animals, pathological.	None	Trace chemotherapy, research animals, pathological.	Large quantity of liquids, trace chemotherapy, research animals, pathological.	Trace chemotherapy, research animals, pathological.	Trace chemotherapy, research animals, pathological.
Effect on waste appearance	Unrecognizable	Unrecognizable	Unrecognizable	Unrecognizable	Melted plastics/ unrecognizable with shredder.	Unrecognizable
Effect on waste weight	Slight increase.	Substantial decrease.	None	Slight increase.	Slight increase.	None
Effect on waste volume	80% decrease.	90% decrease.	80% decrease.	80% decrease.	0-30% without shredder. 30-80% with shredder.	80% decrease.
Environmental effects - air	Particulate and fugitive emissions, controlled by venting and filtration systems; potential odors.	Metals, dioxins, and acid gases controlled by best available APCE.	Particulate and fugitive emissions, controlled by venting and filtration systems; potential odors.	Particulate and fugitive emissions, controlled by venting and filtration systems; potential odors.	Particulate and fugitive emissions, controlled by venting and filtration systems; potential odors.	Particulate and fugitive emissions, controlled by venting and filtration systems; potential odors.
Environmental effects - water	Variable volume of effluent; increase in suspended solids and organics in wastewater.	None	None	None	None	None
Environmenal effects - land	Disposal of treated waste with added chlorine content.	Disposal of ash with concentrated metals.	Disposal of treated waste.	Disposal of treated waste.	Disposal of treated waste.	Disposal of treated waste.
Potential for materials reuse or energy recovery	Recyclable plastic, metal. Energy if residue incinerated.	Ash utilization, energy recovery.	Recyclable plastic, metal. Energy if residue incinerated.	Recyclable plastic, metal. Energy if residue incinerated.	Recyclable plastic, metal. Energy if residue incinerated.	Recyclable plastic, metal. Energy if residue incinerated.
Technology approved by MPCA for off-site infectious waste treatment	Yes	Per rules.	Yes	Yes	Per rules.	In review by MPCA.
Generator Size On-Site/Off-Site	Medium to large. On- or off-site.	Medium to large. On- or off-site.	Medium to large. Off-site.	Medium to large Off-site	All sizes available. On- or off-site.	Large Off-site
Operating Facilities	Yes	Yes	Yes	Yes	Yes	No

Summary and Conclusions

MWTF members all agreed that specific decontamination technologies should not be endorsed, but could not all agree on an appropriate state policy for treating and disposing of infectious waste. Some MWTF members felt that market forces should determine how infectious waste is handled. Other MWTF members felt that the state should play a more activist role in promoting alternative treatment technologies. While the task force concluded it could not unanimously endorse a policy favoring alternative treatment technologies, it felt a strategy to encourage and remove barriers to alternative technologies should be developed in order to be responsive to the legislative charge. This strategy is described in Recommendations for Alternatives to Incineration.

The Policy Subcommittee felt that market forces are preferable to legislative prescription as they allow for greater flexibility in different circumstances now and for adapting to future developments. The costs, benefits, and effects of incineration and autoclaving are fairly well understood. Some of the newer technologies do not have an established record; thus, unforeseen issues, problems, or benefits could emerge in the future. As different generators and counties face different opportunities and constraints, they should have maximum flexibility in determining how to meet their needs for infectious waste disposal.

The Policy Subcommittee felt that the state should neither promote nor discourage incineration of infectious waste and that many concerns about environmental impacts will be addressed when the MPCA air combustor rules are in effect. Incineration is seen as having several advantages: It is both a treatment and disposal method and in some cases it may be more cost-effective than other methods. Nonetheless there is significant public concern about the public-health and environmental effects of incinerators. A drawback for hospitals in rural counties is the substantial cost they may encounter for transportation of waste to available off-site treatment facilities.

Some members of the task force believe that since there is currently ample off-site capacity to handle the state's infectious waste volume, consideration of alternatives is unnecessary (see Data Subcommittee section). These members maintain there is no problem handling the waste and that other facilities are not needed. MDH and MPCA data reveals that there is about three times as much capacity as there is infectious waste generated in the state.

Other task force members, stated that sheer volume is not how they view the issue. They pointed to four other factors that must be taken into account: Liability, cost containment, technology type, and geographic location. Since current state and federal law makes the generator legally responsible for the proper management of its waste, they feel they should have some control over how to manage it and not just have to rely on commercial vendors. Given the growing need to contain costs, they expressed concern that any policy favoring existing facilities might cause unavoidable price increases and create additional transportation costs. These members cautioned against concluding that the presence of existing commercial capacity nullifies the need for other facilities or other types of treatment.

As a whole, the subcommittee felt that generators are in the best position to decide whether or not incineration is an appropriate treatment method.

In the subcommittee's view, the primary role of the state is regulation and education. The regulatory role that the state is already playing is important and effective: MPCA has established a process by which new technologies are reviewed and approved for off-site use in Minnesota, and several treatment technologies have been approved. Technology for both off-site and on-site treatment is advancing rapidly. These advances should soon result in on-site systems that are efficient and effective for use by generators of different volumes of infectious waste. The MDH will promulgate rules to govern on-site technologies.

The state should also play an educational role: MPCA and MDH should educate counties and generators about different treatment options. The state should also encourage regional approaches to dealing with waste disposal. Finally, the state should educate the public and waste handlers about the true health risks of infectious waste.

STRATEGY SUBCOMMITTEE REPORT

Introduction

The MWTF chairperson appointed members and staff to the Strategy Subcommittee to address the fourth charge from the legislature:

> submit, by September 1, 1992, a medical waste management strategy report to the legislative commission on waste managemement and the committees on the environment and natural resources and health and human services of the legislature recommending a statewide medical waste management policy.

In accordance with the WMA's waste management practices order of preference, the Strategy Subcommittee focused on a number of general management methods for: (a) reducing the amount of infectious waste that needs decontamination; (b) reducing the amount of non-infectious medical waste (which should be managed like the state's other solid waste streams); and (c) reducing the environmental impacts of management and disposal. These management methods are:

- proper segregation of infectious and non-infectious waste;
- source reduction of materials found in both waste streams;
- toxicity reduction of materials found in both waste streams;
- use of reusable products where possible and consistent with patient care and infection-control needs;
- recovery of materials for recycling from decontaminated infectious waste and non-infectious medical waste.

The Strategy Subcommittee also addressed a number of issues related to decontamination residuals and non-infectious medical waste; e.g., county planning and waste facility designation.

The Size of the Infectious Waste Stream

The volume of medical waste generated each year has increased substantially over the past decade or so. However, prior to the Infectious Waste Control Act (1989) with its definition and record-keeping provisions, no data exists which can confirm or quantify such increases. Since IWCA, it is estimated that infectious waste represents about 10 percent to 20 percent of the state's total medical waste. Rutala, Odette, and Samsa (1989) have estimated that total medical waste generated by hospitals per patient per day increased 15 percent between 1981 and 1989.

Much of the increase is due to plastics, which appear in such disposable medical products as sterile procedural kits. Plastics now are reported to represent as much as 50 percent of infectious waste streams in Minnesota (MHP, 1991; MPCA, 1992; Medical Center Hospital Center of Vermont, 1991). By comparison, non-infectious medical waste is 25 percent and mixed municipal solid waste contains approximately 10 percent plastics according to recent MPCA waste sort data.

The Generator's Dilemma

One problem is that medical waste generators, to be conservative in complying with state and national requirements, may categorize too much non-infectious waste as infectious.

After 1988, the Centers for Disease Control (CDC) Universal Precautions concept required that all blood and certain human body fluids be treated as if known to be infectious for HIV and hepatitis B (HBV) viruses and other bloodborne pathogens (U.S. Department of Health and Human Services, 1987). A national survey sampling 10 percent of U.S. hospitals in 1989 showed broad acceptance of and compliance with the CDC guidelines (Rutala, Odette, & Samsa, 1989). In December 1991, OSHA's Bloodborne Pathogens Standard, which broadly added worker safeguards became final (20 CFR part

1910.1030).

It can be difficult for generators to keep straight about what is required by the Act, OSHA Bloodborne Pathogen Regulations, and CDC's Universal Precautions. On the national level the definition of what is "regulated medical waste" has differed between OSHA, CDC and EPA. In Minnesota, most of the OSHA "regulated waste" fits the infectious waste definition except that OSHA includes teeth, blood-stained sputum from a dental office, semen and vaginal fluids. OSHA, CDC and the Act allow fluids to be disposed of directly into a sanitary sewer if not prohibited by local ordinance. OSHA and the Act have some differences in the packaging and labeling requirements (see Policy section). Both require "sharps" to be placed in puncture-resistant sharps containers. Once the waste has been segregated as infectious waste it must remain in the container and be handled as infectious waste until treatment or disposal.

Generators have responded to increased regulation by simply interpreting "infectious waste" more inclusively when segregating waste. A major New York hospital, attempting to comply with the more rigid regulations, reported 315 percent increases in volume of infectious waste and 700 percent increases in costs for its disposal over a three-year period. The cost for regulated medical waste per patient rose from $1.04 to $5.19 (Marchese, Marshall, Lavalle, & Greene, 1990).

In Minnesota, the cost of infectious waste disposal, although much less than in many areas in the U.S., remains 3 to 6 times the cost of municipal solid waste disposal. Total collection and disposal costs in Minnesota range from $150 to $300 per ton for MSW and about $360-$1,000 per ton for infectious waste (range reflects regional extremes). These costs would not go down for the new, alternative technologies for decontaimination of infectious waste now available. As described in the Policy section, most of these technologies reduce waste volume (generally by shredding), but not weight, and no technology has been developed to replace residue landfilling or incineration followed by ash landfilling for final disposal.

Generators may incur higher routine costs for discarding non-infectious wastes as infectious waste, but the cost and liability consequences for improperly discarding infectious waste with solid waste would be worse. This fact is reflected in hospital practices: a recent 3M research panel with participants from around the country found that operating room personnel have increased what they classify as "red bag" waste to avoid those liability costs. (See Appendix S-1--letter from 3M regarding 3M's Infection Control Research Panel.) Improper segregation, whether intentional or unintentional, can result in shutdowns at solid waste facilities where disposal of the infectious material is prohibited and can threaten worker safety.

Infectious Waste in the Solid Waste Stream

Since August 1989, MDH has received and acted upon 68 complaints from solid waste disposal facilities about regulated generators placing infectious waste into the solid waste stream. Some complaints have been about one needle. The complaints have been against hospitals, clinics, dental offices, physician offices and surgical centers. They have been reported at refuse-derived fuel facilities, mass burn incinerators, landfills, and transfer stations in the metropolitan area and in greater Minnesota. The alleged infectious waste was found by disposal facility staff, by consultants called in to screen solid waste from infectious waste, and by MPCA during waste sorts at the facilities.

When infectious waste is mixed with solid waste and goes to a solid waste disposal facility, it precipitates concerns for worker safety from the in-house staff who handle the waste, to the haulers transporting the waste, to the workers at the processing and/or disposal facility. When infectious waste is tracked to a regulated generator the MDH is contacted as well as the generator. Generators are requested to go to the facility to determine if they agree that the waste in question fits the definition of infectious waste and that the waste in fact was generated by this particular facility. If a generator does not go to the facility or send a representative the assumption is made that the waste was infectious and indeed from their facility. The generator is then required to arrange for appro-

priate disposal and the sender of the waste in most cases is fined by the county in which the facility is located.

MDH notifies MPCA. The MDH Office of Health Facility Complaints also is notified if certain categories of generators are involved. MPCA has currently not had to take enforcement action against medical waste transporters or the other facilities they regulate.

Segregation Education

The New York City Medical Waste Report makes this important point: "Once waste has been collected as regulated medical waste (infectious bagged waste) the opportunities for recycling and resuse are essentially eliminated." Keeping non-regulated medical waste out of the regulated medical waste stream is a critical element of medical waste reduction.

Since hospitals are the largest generators and produce a significant portion of the state's infectious waste, this discussion emphasizes them. However, clinics, laboratories, and other small generators produce infectious waste and need to address many of the same issues as hospitals.

Waste Audit and Characterization

The first step in the development of waste reduction plans and segregation guidelines is conducting a waste audit and waste characterization. Physical and chemical characteristics of a facility's waste streams must be determined in order for the facility to develop a plan for managing its wastes. As part of this, identification of products that end up as waste, through either a waste audit or a purchasing audit, will enhance waste management planning.

Internal Waste Management Plans

A facility can develop an internal waste management plan from the waste characterization and audit. Based on knowledge about its present waste, a facility waste management plan should address source reduction, segregation practices, purchasing practices and bid specifications, opportunities for reuse, recycling, special management opportunities (e.g., for food service waste), and disposal. (The facility plan can also explore infectious waste decontamination and disposal options, but internal facility plans of the type described here are distinct from the Infectious Waste Management Plan filed by generators with MDH.)

Resources

The EPA has useful guidelines on waste management planning and waste minimization which are applicable to all areas of waste management (U.S. Office of Technology Assessment, 1989). The New York City Medical Waste Report (1991) is especially helpful with the extensive discussion of the steps and implementation of a waste management plan for both infectious and solid waste. Another new source is The Hospital Waste Audit Manual from Ontario (Ortech International, 1992).

Segregation Practice

Proper segregation practices are a key means of reducing the amount of waste that must be managed as infectious waste--starting in patient care areas. Segregation practices for infectious waste will be determined primarily by regulations, by worker safety issues, and by generator liability concerns. As we move away from on-site incineration (see Background section), segregation practices will also need to be based in part on the type of infectious waste decontamination being utilized: operational problems and environmental releases will differ for different types of waste materials with different treatments. Post-treatment management options for the waste also must be kept in mind.

Generators must institute comprehensive, ongoing education for their employees on proper segregation. Improper segregation can often be traced to new employees or employees who do not regularly deal with segregation, so it is important to train all employees when hired and then on a continuing basis. Segregation guidelines should be reviewed and revised as necessary.

Workers in the solid waste field also need ongoing training and education on the risks of infectious and non-infectious medical waste, precautions to mini-

mize injury, and how to recognize improperly discarded infectious waste. (As discussed in the Background section, the primary risk to solid waste workers is needle sticks that could result in hepatitis B if not treated properly.)

Segregation Implementation Problems

Aside from the issues mentioned, generators may face some or all of the following concerns when it comes to appropriate segregation:

- Turnover of employees, especially in large facilities requires the continuous need to educate new employees and the need to evaluate the training currently provided.

- Staff acting in life-threatening situations must place life-saving actions above the concern to reduce the amount of infectious waste disposed of and often must place the questionable waste in the infectious waste container rather than taking the time to evaluate if it is "soaked, saturated or dripping."

- To assure compliance with all relevant regulations a facility may take a very conservative approach and handle "questionable" waste as infectious waste.

- If the waste fits the definition of infectious waste or not, a handler or disposal facility may refuse to handle certain waste from a facility or threaten not to accept any waste from the facility. The facility's definition of "acceptable waste" may not include waste from a hospital or other categories of generators.

- Although the off-site disposal of infectious waste is much higher than the disposal of solid waste, a generator may be required to manage solid waste as infectious waste to assure that someone will transport and dispose of the solid waste.

Excellent segregation guidelines come from waste sort analyses by the Medcycle Program (Medical Center Hospital, 1991), the New York City Medical Waste Management Report (1991), and the Waste Sort and Test Burn report from MPCA (1991).

Household Infectious Waste

The IWCA exempts households from infectious waste regulation. Infectious waste generated by households is usually included in the municipal solid waste stream. Solid waste facility workers must be able to distinguish regulated infectious waste (by definition) from non-regulated household waste. They must be alert to the fact that household infectious waste may not look different from regulated infectious waste.

As discussed in the Background section, sharps in general are of most concern to solid waste workers, and this includes household sharps. Therefore, the MPCA has developed a fact sheet that outlines management options for segregating household sharps from the regular solid waste stream. This is especially important in service areas with solid waste processing facilities (RDF and MSW composting). Direct contact with the waste stream is most likely at these facilities. (See Appendix S-2 for "Disposing of Household Sharps" fact sheet.)

Several programs are currently in place in the state to encourage segregation of household sharps from the regular solid waste stream:

1. Some clinics and pharmacies are offering sharps disposal service, usually at a small service cost. Patients are given a container with instructions on how to properly collect sharps. They then return the container to the clinic of pharmacy for proper disposal of the sharps.

2. Hospitals with on-site incinerators or other on-site decontamination capabilities are being encouraged to accept household sharps from area residents. The hospital can provide containers at a service cost or accept other containers such as coffee cans, detergent bottles, or plastic pop bottles which are properly sealed and labeled.

3. Many infectious waste disposal companies are offering mail-in sharps programs using the U.S. Postal Service. These programs usually have a cost associated with them but still remain a

viable option for the home sharps user. The sharps containers are mailed to an approved facility for proper disposal.

4. The Western Lake Superior Sanitary District (WLSSD) in Duluth and the East Central Solid Waste Commission in Mora have implemented programs to provide collection service for household sharps. As these sharps are exempt from infectious waste regulations, they can be landfilled or sent to a mass-burn incinerator for proper disposal. These disposal routes do not have the same level of potential worker exposure risk as the processing facility. The WLSSD program has opted to contract with a medical waste incinerator company for proper disposal of its collected household sharps. Other solid waste processing facilities and counties being serviced by them are encouraged to establish similar programs, which can be run like household hazardous waste collections either through periodic clean sweeps or at permanent drop-off stations.

If household sharps cannot be segregated out of the solid waste stream, they should be properly packaged and labeled before being placed in the solid waste stream. This will help both in preventing occupational exposures and in identifying household infectious waste versus regulated infectious waste.

It is important to note, however, that voluntary programs will not reach the illegal IV drug user, who may be generating the most potentially infectious (AIDS, hepatitis) sharps. Solid waste processing facility workers must continue to be on guard for these sharps that may be randomly dispersed in the solid waste stream and use all proper precautions for preventing occupational exposures.

The Toxicity of the Infectious Waste Stream

The Office of Technology Assessment, a congressional research unit, defines source reduction as activities that reduce the toxicity or quantity of discarded products before the products are purchased, used and discarded (U.S. Office of Technology Assessment, 1989). The Minnesota Office of Waste Management (1992) indicates "source reduction is the first among waste management options because it has virtually no negative effect on the environment, it conserves energy and resources, and does not require new facilities."

Hospitals across the country have initiated waste management plans. Suppliers of medical products are being asked to join in source reduction efforts. Reduced packaging, product substitution, and reusable products are part of revised purchasing plans. Source reduction efforts focusing on reusables and elimination of certain products are within the purview of facilities, while other efforts at source reduction and toxicity reduction are within the purview of manufacturers.

The amount and variety of plastics in infectious waste has increased dramatically over the past few years, both as a percentage and total quantity. Single use plastic items have replaced reusable products as well as single use products made of glass, metal, and paper. Now the percentage, quantity, and types of plastic are causing difficulties in infectious waste management. A variety of approaches will be necessary to address these problems, including the use of reusable products, source reduction, substitution of other resins (e.g. for PVC), and product design to facilitate recycling.

The MPCA's recent study of infectious waste generated at three greater Minnesota hospitals notes that a variety of packaging and products commonly found in the infectious waste stream may contain toxic metals and other hazardous substances. Any decontamination and disposal methods can release these materials into the environment, or increase management costs due to the need to control releases.

Metals and incineration are not compatible, according to Glasser, Chang, and Hickman. Their study recommends that metals be decontaminated by autoclaving of surgical instruments and sharps, and use

of other reusable and recyclable products to the extent possible. Other sources of metals in infectious waste can then be addressed through product substitution and reformulation.

It is well known that the high chlorine content of many plastics (polyvinyl chloride, or PVC) when disposed of by incineration produces high concentrations of hydrogen chloride in emissions. Because medical waste contains 40 percent more plastic than municipal waste, it assumes a high priority for segregation, especially from waste to be incinerated. Ideally, source prevention is preferred: Baxter, a supplier of medical fluid bags and tubing made from PVC, has started a search for a substitute material.

The U.S. Office of Technology Assessment study (1989, p. 22) indicated that infectious waste from two Houston, Texas facilities contained as much as 9.4 percent PVC. Depending on segregation practices, PVC may represent anywhere from 1 percent to 8 percent of infectious waste in Minnesota. A recent MPCA study (1991) of three greater Minnesota hospitals found approximately 4 percent PVC in OR/OB waste, and 1 percent to 2 percent in all infectious waste. Minnesota's definition of infectious waste does not include bags and tubing unless they contain blood or regulated body fluids, minimizing the amount of PVC which is discarded as infectious waste. When properly segregated in accordance with MN statutes, most is discarded in solid waste.

Chlorinated organic compounds, including PVC and chlorine-bleached paper/cellulose products, have been suggested as precursors to dioxins and furans in low-temperature incineration. They may also contribute to creation of these compounds in high-temperature incineration where flue gases are held at 400-700°F for a period of time. The creation of dioxins and furans from the incineration of infectious waste can be minimized by removing PVC and/or tightly controlling incineration and flue gas temperatures.

There are many opportunities for instituting reusable products and eliminating comparable single-use products from the waste stream. A recent study of infectious waste produced by five common surgical procedures (Tieszen & Gruenberg, 1992) concluded that a conversion to reusable linens would be the single most important means of reducing infectious waste weight and volume and could reduce the infectious waste stream by 40 percent. Removal of paper products and recyclable plastics could reduce the infectious waste stream by a third, for a total potential reduction of 73 percent by weight and 93 percent by volume. Reusable instruments were not specifically addressed in this study since none were found in the bagged infectious waste.

Reusing Sharps Containers

Management of sharps and sharps containers is the single most important factor in injuries and general health risks arising from solid waste management. Reusable sharps containers are cited by many as a significant source reduction measure. Single use plastics sharps containers may represent as much as 31 percent of the sharps waste stream from a facility. Plastic sharps containers may also contain heavy metals in pigments, which are undesirable in the waste management system. Single use fiberboard sharps containers are a source reduction (weight and toxicity) alternative to other single use containers and are compatible with a variety of decontamination technologies. While reusable containers are clearly preferable from a waste management perspective, single use containers have advantages from a health and injury perspective. Automated emptying and cleaning of reusable containers is required under federal and state OSHA rules, and this will address most health and safety concerns.

Recycling Materials from Decontaminated Infectious Waste

Some materials in the infectious waste stream could be recycled into new products, but they must be decontaminated before they can be recovered for recycling. Several technologies allow for post-treatment recycling, including steam autoclaving, microwaving, and continuous feed disinfection. However, heat from decontamination can render some plastics unrecyclable. Under development, however, is technology to separate the recyclable parts of the decontaminated waste from the non-

recyclable parts.

Certain of the cellulosic materials such as gowns and drapes are being evaluated for segregation and reuse. Disposable metal instruments in sterile packs for short procedures are being replaced with reusables

Disposing of Decontaminated Residues

Currently there are no specific statewide requirements for the management of decontaminated infectious waste. It is regulated as a special solid waste and its disposal at any solid waste disposal facility would fall under that facility's industrial waste management plan. (It may have a different regulatory status if decontaminated, otherwise managed, or disposed of in another state.)

Current MPCA waste combustor rules do not apply to ash that is produced by infectious waste combustion or waste that is combusted on-site by the generator. Medical waste incinerator ash must be tested to determine whether it is hazardous, in accordance with MN rules pt. 7045.0214. Ash must be tested for at least the eight RCRA metals plus nickel and zinc.

If the ash is non-hazardous, it may be disposed of in a solid waste land disposal facility under the facility's approved industrial waste management plan. If the ash tests as hazardous, it must be manifested and managed at a licensed hazardous waste disposal facility. (For additional details, see Appendix B-2, "MPCA Fact Sheet on Medical Waste Incinerator Ash.")

County Waste Designation

The state's WMA allows counties to require that all waste generated within the county be delivered to, or designated to, the county's solid waste facility. The purpose of designation is to ensure environmentally sound waste management, ensure sufficient waste and revenue flow for the economic and operational viability of the improved management system, and to prevent waste from going to lower cost, and presumably less environmentally sound, facilities. Currently there are 17 counties with designation ordinances in place.

Prior to the 1992 legislative session, only mixed municipal solid waste was subject to designation. This excluded separately managed solid waste streams, including decontaminated infectious waste, but 1992 amendments to WMA subject such separately managed waste streams to designation. Infectious waste is not subject to designation, nor is infectious waste incinerator ash for off-site decontamination facilities.

For generators that decontaminate infectious waste on-site and for some potential off-site alternative decontamination facilities, designation may raise management problems. The most significant problem stemming from the lack of designation for decontaminated residue is the possibility of having no place that will or must accept it. Some facilities continue to believe that residues may result in exposures. A problem for on-site decontamination facilities, if the state decides to promote alternatives to incineration for infectious waste (see Recommendations for Alternatives to Incineration section), is the disincentive to use alternative methods of decontamination when the designated disposal facility may be an incinerator.

There are several ways to deal with these issues:

(1) Operators of on or off-site decontamination facilities can request an exclusion from the county's designation ordinance;

(2) The state legislature could exempt decontaminated infectious waste from designation exception;

(3) The legislature could require that all designated facilities accept it, since it has been processed in a manner that has made it safe for routine handling as solid waste (local units and facility operators would retain authority to define waste as unacceptable on the basis of physical characteristics such as composition or BTU value);

(4) The legislature could require counties to specifically plan for the management of decontaminated infectious waste and medical facilities' solid waste in their solid waste plans and designation ordinances. The advantages and disadvantages of these approaches are sum marized in the following table (S-1).

The Medical Waste Task Force supports option 4 for its advantages.

Table S-1

Approach to Designation of Decontaminated infectious waste	Advantages	Disadvantages
1. County-level exclusion	- can reflect individual county circumstances - each decontamination facility can negotiate with its county - decontamination facility can appeal decision to Met Council or OWM - can occur under existing statutes	- exclusions granted at county discretion - no statewide consistency - no consistency among designating counties
2. State-level exemption	- consistent statewide policy for all infectious waste	- requires legislative action - by itself, provides no specific state or county oversight, no guarantee of environmentally sound management
3. State-level requirement that designated facilities accept unless incompatible due to composition or BTU value	- consistent statewide policy for infectious waste that is not incinerated - assures that waste will not be rejected due to perceived health risks	- inconsistent policy for waste treated by incineration vs. other decontamination methods - requires legislative action
4. Counties address infectious waste, all decontamination residuals, and non-infectious medical waste in county SW mgmt plan & designation plan/ordinance	- requires counties to plan for this waste, anticipate problems, seek solutions - encourages cooperation among generators, county, facility - can reflect individual county circumstances - assures generator access to management/disposal capacity - both plans are reviewed and approved by Met Council or OWM	- requires legislative action - may result in inconsistent policies from county to county

The Size of the Medical Solid Waste Stream

Much progress has been made in reducing the non-infectious portion of the medical waste stream. This includes packaging material, office paper, computer paper, and kitchen refuse. It is here that great strides have been made in recycling. All Twin Cities hospitals report that they separate corrugated for recycling, according to a recent survey by Minnesota Healthcare Partners (MHP) of 23 Twin Cities hospitals belonging to the Council of Hospital Corporations (CHC) (MHP, 1992). They recovered about 2.7 million pounds of corrugated cardboard in 1990-91. The MHP survey of CHC hospitals further indicated that:

- 96% of the hospitals recycle office paper- 1,870,361 lbs in 1991.
- 78% collect computer paper- 103,150 lbs in 1991.
- 100% collect aluminum- 73,244 lbs in 1991.
- 50+% collect other metals-236,481 lbs in 1991.
- 74% collect glass- 251,962 lbs in 1991.
- 100% collect clean corrugate- 2,689,866 lbs in 1991.
- 33% collect plastic- 62,620 lbs in 1991 (PET and HDPE
- the above total of 5,354,767 lbs recycled relates to a recycling rate ranging from 27% to 40%.

The Mayo Foundation EIS report indicated a similarly aggressive waste reduction and recycling effort, with a 33 percent reduction in three categories in three years (11). Office and other mixed paper constitute almost 75 percent of general hospital waste generated at the Mayo Foundation (MPCA, 1992). The Environmental Impact Statement for the Mayo Foundation Incinerator Project reported a large volume recycled for 1991 (1,280,000+ pounds). Mayo has set a goal of replacing up to 95 percent of its paper products with recyclable paper products. Mayo mentions reuse of bubble packaging material in preference to disposal.

Elsewhere in the U.S., there are reports of aggressive SW recycling efforts from Beth Israel of New York, and the Iroquois Healthcare Consortium with its 56 member facilities. The former anticipated saving $100,000 a year in disposal costs for corrugate (Council on the Environment of New York City, 1988).

It should be mentioned that the hoped for markets for recycled materials are slow in developing. Where metropolitan hospitals have been able to contract for recycling of cardboard and paper, rural hospitals have not. There are reports from rural Minnesota hospitals of well-intended efforts to separate cardboard and paper coming to nought. Either the material remained in storage for prolonged periods, was sent by boxcar to California for recycling, or it was incinerated (Skjerven, 1992).

Greater Minnesota has found opportunity for recycling the bulk of general waste more myth than reality to date. Consequently, rural hospital waste management plans and projects currently require greater emphasis on source prevention and reduction. The Office of Waste Management along with members of the Itasca Medical Center has just reported the results of a year-long study on Waste Source Reduction at this 108-bed northern Minnesota hospital. The expressed goal to reduce solid waste generated by the facility was both successful and well-documented. Infectious and pathologic waste reduction was not a part of the study. The report indicated a 60 percent reduction in contracted garbage hauling service volume, and a corresponding saving of $5,244. This represents an actual reduction of over 10,700 pounds of waste. In addition to disposal fee savings, the hospital saved $11,030 on an annual basis. Study of this report should prove rewarding to all interested in source reduction (OWM, 1992).

In medical waste planning and strategy, reduction of the infectious waste stream has now assumed a top priority.

Conclusions Regarding Managemnet of Medical Waste

The state of Minnesota is at an important point in time with regard to management of medical wastes. Over the past twelve years, the state has undertaken a number of significant changes in the management of mixed municipal solid waste, which applies to medical solid waste.

Passage of the Infectious Waste Control Act and the Medical Waste Tracking Act gave new visibility to infectious medical waste because generation, management, transportation, and disposal were now overseen by government agencies. In addition, policy makers and planners became aware of how much was being generated and managed by various methods.

Several recent attempts to site infectious waste incinerators in the state became very visible and controversial. Questions have been raised about the quantity of infectious waste and how it is best managed. Since MPCA became aware that most on-site incinerators are not operated in accordance with Air Quality rules, it has informed hospitals that they must demonstrate compliance, upgrade, or shut down.

Increased use of plastic and single-use products in the medical field has drawn attention to source reduction and reuse as infectious waste management options. Increased reliance on off-site decontamination and solid waste processing facilities has highlighted the importance of proper segregation practices.

Barriers still exist to sound waste managment priorities for health-care facilities. Barriers to segregation, reduction, and reuse are:

Barriers to segregation

1. Potential for improper segregation, consequences of improperly disposing of infectious materials in MSW.
2. Some ambiguity about what meets or does not meet OSHA or state standards for infectious waste.
3. Staff training -- old and new habits.
4. Staff time.
5. For hospitals at least, additional segregation practices may add more complexity to an already complex waste management system, can also add to some costs and increases risk of improper segregation.
6. No ambiguity about segregation with reusables (opportunity).

Barriers to Reduction and Reuse

1. Capital and operating investment in reusable equipment that can meet health care requirements.
2. Perception that reusables cannot meet health standards or have inferior performance. Need agreement among interested parties on appropriate uses for reusable and single use products. Need to balance infection control and waste management. Need to look at occupational health and safety issues and environmental costs and impacts associated with reusables and single use.
3. Manufacturers, not generators, hold key to many reduction decisions. (Generators can make decisions related to reuse.)
4. Specific needs for toxicity reduction are extremely difficult to identify.

Recommendations

The Strategy Subcommittee offers 16 specific suggestions for medical waste generators and others to improve the management and reduce the risks, costs, and environmental impacts of infectious and non-infectious medical waste management:

1. On a statewide basis, develop and adopt clear and consistent segregation practices because they are a key management tool for infectious waste and other solid waste. A specific recommendation in this area may be the use of clear bags for solid waste for easy identification of infectious waste that may have been co-mingled.

2. Educate generators, haulers, processors, and disposal facilities on infectious and solid waste issues such as segregation, risk, and manage ment options.

3. Develop a guidance manual for waste audits for hospitals and other medical waste generators with guidelines for purchasing, segregation, reduction, reuse, recycling, and general waste management.

4. Medical facilities should purchase and utilize reusable/ repairable products wherever they can be implemented without compromising patient and worker safety, and in consideration of waste management costs and impacts for the reusable and disposable alternatives.

5. Medical facilities should evaluate and request or require reduction or elimination of unnecessary packaging in the products that they purchase.

6. Manufacturers should eliminate all toxic metals and other toxic/hazardous materials in all medical products and packaging, if possible.

7. Modify products and consolidate plastic resins to facilitate recycling (including post-decontamination recycling). Primarily a responsibility of manufacturers and purchasing departments.

8. Encourage recovery of materials from decontaminated infectious waste for recycling if markets are available.

9. Manage sharps containers using the following guidelines in order, since containers represent up to one-third of the sharps stream:
   a. use reusable containers, with automated emptying and cleaning;
   b. use a container designed for recycling;
   c. use a container designed for environmentally sound disposal.

10. Particular attention should be paid to segregation and management of sharps, since they represent the highest risk of injury and infection to health-care and solid waste employees.

11. Producers of medical products should address source reduction, product substitution, and environmentally sound management in packaging and product design.

12. Medical products purchasing agents should encourage the development and use of improved products through bid specifications and other purchasing procedures. Some state guidelines are in place.

13. Counties should address the management of unregulated sharps in their county solid waste management plan. Counties served by MSW processing facilities should develop and implement a household sharps management program in cooperation with the medical community, solid waste haulers, and the solid waste facility.

14. Counties should be required to address the management of decontaminated infectious waste and other solid waste from medical facilities in their county solid waste management plan. Where applicable, counties should also specifically address management of these wastes in their designation plan/ordinance.

15. All solid waste facilities should address the management of decontamination residues in their industrial waste management plans.

16. MPCA rules should be amended to require that infectious waste incinerator ash be subject to the management requirements of the municipal solid waste combustor ash rules.

RECOMMENDATIONS FOR ALTERNATIVES TO INCINERATION

Introduction

The MWTF agreed that no specific treatment technology for infectious waste should be endorsed. There was a wide range of opinion among MWTF members about the appropriate role of the state in promoting the development of alternatives to incineration. This section was developed by the Strategy Subcommittee as a guide for implementation if the legislature decides to take a proactive position on non-incineration technologies. The full task force agreed that this section should be included as a response to the legislative charge but did not agree that the legislature should move forward with these recommendations.

The emphasis of this section is on greater Minnesota as metropolitan facilities have better access to existing and proposed non-incineration facilities. As stated in the Background section, Minnesota's hospitals generate about 7.7 million pounds of infectious waste per year. The exact breakdown between metropolitan and greater Minnesota hospital generation is not known, but it is estimated that half (50%, or 3.89 million pounds) of this is generated in greater Minnesota. (See Table R-1.) Based on MDH data, the total estimated amount of non-hospital infectious waste generated in the state is also about 7 million pounds per year. Analysis of a random sample of both hospital and non-hospital 1992 generator management plans indicates that approximately 20 percent of all regulated infectious waste is generated in greater Minnesota and 80 percent in the metropolitan area.

Table R-1
Estimated State Hospital Waste Generation Per Year
(Tons)

Waste Type	Med. Waste	%[1]	Inf. Waste	%
All MN hospitals (18,490 lic. beds)	22064[2]	100	3859[3]	100
Metro hospitals (9,853 lic. beds)	10150[1]	53	1915[3]	50
Greater MN Hosp. (excl. Mayo; 6,664 lic. beds)	6178[1]	36	1216[4]	31
Mayo Hospitals (1,973 lic. beds)	5736[1]	11	728[4]	19
Mayo Foundation	5840[5]		1000[5]	
Including the two Mayo Hospitals		-	1340[4]	-

[1] Based on percentage of total licensed beds in each region, does not reflect actual regional differences in occupancy rates or medical waste generation rates.

[2] Extrapolated data based on occupied beds times average pounds per bed per day generated.

[3] Based on 1992 (1990-91 data) reports to the Minnesota Department of Health.

[4] Information from generator plans filed with MDH for 1992.

[5] Based on the 1992 Mayo Foundation Environmental Impact Statement.

The following discussion explores a wide range of barriers faced by greater Minnesota and metropolitan-area hospitals looking for affordable, accessible infectious waste decontamination. The barriers and the need may be more significant for greater Minnesota, but recommendations are given to encourage access to alternative management options for all Minnesota hospitals.

Issues of special concern in greater Minnesota include:

1. Costs of off-site infectious waste management;
2. Lack of off-site alternative decontamination capacity outside of the metropolitan area;
3. Needs of non-hospital generators.

Improved access will occur to some extent as emerging technologies for decontamination alternatives come down in size and cost in the future. This may allow more generators to have on-site capacity.

Access to Treatment Options

Generally, metropolitan area generators have access to at least one off-site alternative decontamination option; only five hospitals continue to operate their on-site incinerators (Farmington, Hastings, Shakopee, and two in Minneapolis). Browning-Ferris Industries (BFI) operates a commercial steam sterilization facility in St. Paul with a current permitted capacity of 20 million pounds per year. Medical Safety Systems (MSS) in Cannon Falls operates an off-site medical waste incinerator with a capacity of 5,000,000 pounds per year.

Minnesota Healthcare Partners (MHP), a consortium of 18 Twin Cities hospitals, published a study in April 1992 recommending steam sterilization and microwaving as acceptable non-burn decontamination technologies and is considering the possibility of developing its own facility.

A commercial off-site alternative to incineration has not been developed in greater Minnesota. Both BFI and MSS make services available to many greater Minnesota generators. Sixty-eight hospitals were still operating on-site incinerators in greater Minnesota in Spring 1992. As described in the Background section, increased efforts by MPCA to enforce existing air emissions rules and develop new combustor rules are expected to reduce this number; 90 percent of these may cease operation by Spring 1993.

Widely used commercial incineration facilities in Fargo, ND; Aberdeen, SD; and Augusta, WI may be used during and after this transition by these greater Minnesota hospitals.

Among the other 10 percent, several Minnesota hospitals have indicated interest in upgrading their existing incinerators or building new "state of the art" incineration facilities. Several facilities with newer incinerators may be able to demonstrate compliance with current air quality standards and continue operating while they consider their options under the proposed combustor rules. The situation is currently quite fluid, but hospitals in the following locations either have a newer facility or have submitted applications or test data: Bemidji, Winona, Rochester, St. Cloud, and two in Minneapolis. Mankato has also been mentioned as a location for an upgrade or new facility, but there is no further information available at this time.

Hospitals as Waste Handlers for Others

While several greater Minnesota generators have large facilities and may have waste streams very similar to metropolitan hospitals, many deal with small amounts of infectious waste and very limited resources. Currently, many non-hospital generators such as dentists, clinics, nursing homes, mortuaries, and veterinarians rely on hospitals for incineration. Generally, hospitals have provided this service without cost to the generator. Hospitals are subject to MPCA storage facility rules if the waste is not incinerated or transported within 48 hours (excluding weekends).

Hospitals are *required* to accept infectious waste from certain generators under certain conditions.

Minn Stat. § 116.78, subd. 9 and 10, requires hospitals to accept infectious waste generated by a licensed ambulance service, a board of health, community health board, or public nursing service in a county with a population of less than 40,000, or a program providing school health services under Minn. Stat. § 123.35, subd. 17, under the following conditions:

- the infectious waste must be properly packaged according to the standards used by the hospital for its own waste;
- the waste must be of a type generated by the hospital, and;
- the hospital must be able to store the infectious waste safely.

Sixty-seven of the state's counties have populations under 40,000. These 67 counties contain 52 of the 68 on-site incinerators operating in March 1992. For the benefit of these hospitals and the generators from whom they may accept infectious waste, other management options must be readily available as many on-site incinerators are shut down over the next year.

In the interest of minimizing transportation costs and ensuring access to decontamination, hospitals could be encouraged to continue to accept waste from other generators for decontamination on-site or act as a consolidation point for commercial transport to an off-site facility. Hospitals that choose to do so may need some type of technical assistance for the development of decontamination or storage capacity. Some of greater Minnesota's approximately 120 hospitals may provide these services. Small generators in some areas may still have limited access to decontamination unless they choose to decontaminate on site themselves. Large non-hospital generators should be encouraged to offer consolidation or decontamination services where needed.

Off-Site Costs and Concerns

Off-site decontamination facilities, both non-burn and incineration, charge about $.50 a pound to greater Minnesota generators, more than twice the rate paid by metropolitan generators. Twin Cities hospitals pay $0.18 to $0.25 per pound ($360 to $500 per ton) for incineration or other decontamination. Another vendor cost for shipment, decontamination, and disposal for Twin Cities and other customers ranges from $0.18 to $0.50 per pound ($360 to $1,000 per ton). The upper end of this range applies to generators in greater Minnesota or outside the state (currently three other states) and reflects higher transportation costs and smaller quantities.

Table R-2 shows the types of off-site capacity available to different areas of the state. (For more information on capacity, see the Policy section.)

Table R-2
Grester Minnesota Off-Site Decontamination Capacity

Location	Owner	Technology
Aberdeen, SD	Dependable Sanitation	Incineration
Cannon Falls, MN	Medical Safety Systems	Incineration
Fargo, ND	Thom Linen/HCI (Pro-waste delivers to this facility)	Incineration
St. Paul, MN	BFI	Steam sterilization
Augusta, WI	Bio-SAFE, MedX	Incineration

Also, commercial infectious waste haulers have established collection routes in various regions of the state. At this time these routes tend to follow major U.S. and state highways and serve larger generators. All haulers may not serve all areas, so generators may have limited choices for commercial off-site decontamination.

Agency Roles

Work needed to facilitate development of decontamination capacity could be coordinated by the appropriate state agencies. Efforts to develop regional off-site decontamination facilities should be coordinated with the MPCA which has authority over off-site facilities under the Infectious Waste Control Act (Minn. Stat. § 116.75-.83). Past efforts by the MPCA to find new capacity for infectious waste management at solid waste incinerators provides a good model for future action. (See Appendix R-1, "MPCA Letter to SW Incinerators".) Agencies should work closely with individual generators, but more importantly, with the state associations that represent them: MAHA, MDA, MFDA, MHA, MHP, MMA, MVMA, and others (see Abbreviations and Acronyms list).

The recommendations that conclude this section should help address the lack of access to, and barriers to development of, non-burn decontamination capacity in greater Minnesota.

Barriers

Members of the Strategy Subcommittee identified a number of barriers to the development of alternative (non-incineration) decontamination facilities. These are not necessarily in order of priority or significance.

1. Unamortized investment in existing incineration facilities may provide owners with incentive to upgrade. Newer facilities may meet current air quality standards and operate until new combustor rules are effective.
2. Generator habits, customs, and knowledge -- incineration is known technology.
3. General public and generators lack knowledge regarding alternatives to incineration.
4. Availability of excess incineration capacity, both on-site and off-site.
5. Limited financial resources for capital investment in on-site capacity.
6. Management and designation of decontaminated residuals: best or preferred management methods for residuals are uncertain; incinerated ash is not subject to designation, while other decontaminated residuals may be subject to designation.
7. Actual or perceived regulatory differences arising from regulatory jurisdiction and difficulty of developing equitable regulations for different technologies:
   - on-site (MDH rules) vs. off-site (MPCA rules)
   - incineration (MPCA rules) vs. non-incineration (MPCA & MDH rules)
   - ash testing/disposal requirements vs. residuals management.
8. The need to manage very small portion of waste stream (trace chemotherapy and pathological waste) through incineration may drive management decision for remaining infectious waste.
9. Alternative decontamination facilities have not yet established a track record and operational history.
10. Current pricing structures within the commercial infectious waste market may limit the development of new facilities, off-site in particular.
11. Ability of generators to utilize (on-site) incineration capacity for non-infectious solid waste.

12. Differences between siting new off-site capacity and upgrading existing on-site capacity; siting issues also depend on the type of technology proposed.

Recommendations

1. Encourage regional cooperation and development of on-site or off-site alternative decontamination capacity where it would serve regional needs. Regional arrangements should recognize economies of scale and the costs associated with facility development and transportation.

2. Encourage the development of on-site alternative decontamination capacity instead of incineration upgrades where facilities are in vesting in new capacity.

3. OWM, in consultation with MDH and MPCA: Provide technical assistance and coordinate statewide program to promote proper segregation, source reduction, and recycling for non-infectious solid waste generated by medical facilities.

4. Agencies should identify regions of the state which may not have affordable access to alternative decontamination capacity for infectious waste. Work with generators and other interested parties to encourage and facilitate regional facility development.

5. Agencies should work with potential vendors to develop alternative decontamination capacity.

6. Ensure that needs of non-hospital infectious waste generators are addressed as all of the above are developed and implemented.

GLOSSARY

Alternative technologies -- Treatment technologies for infectious waste other than incineration. (Per third legislative charge to MWTF.)

Ash -- The incombustible material that remains after a fuel or solid waste is incinerated.

Blood -- Waste human blood and blood products in containers, or solid waste saturated and dripping human blood or blood products. Human blood products include serum, plasma, and other blood components.

Bloodborne pathogens -- Microorganisms in human blood that can cause disease in humans. They include the hepatitis B (HBV) and the human immunodeficiency virus (HIV), which causes AIDS.

Commercial transporter -- A person who transports infectious or pathological waste for compensation.

Compost facility -- A site used to compost or co-compost solid waste, including all structures or processing equipment used to control drainage, collect and treat leachate, and storage areas for the incoming waste, the final product, and residuals resulting from the composting process.

Composting -- The controlled microbial degradation of organic waste to yield a humus-like product.

Decontamination -- Rendering infectious waste safe for routine handling as a solid waste.

Disposal -- The discharge, deposit, injection, dumping, spilling, leaking, or placing of any waste into or on any land or water so that the waste or any constituent thereof may enter the environment or be emitted into the air, or discharged into any waters, including ground waters.

Disposal facility -- A waste facility permitted by the agency that is designed or operated for the purpose of disposing of waste on or in the land, together with any appurtenant facilities needed to process waste for disposal or transfer to another waste facility.

Energy recovery facility -- A site used to capture the heat value of solid waste for conversion to steam, electricity, or immediate heat by direct combustion or by first converting it into an intermediate fuel product.

Fines -- Particles that will drop through a 1/2 inch wire mesh screen which are not easily identified and which can be either organic or inorganic.

Generator -- A person whose activities produce infectious waste. Does not include a person who produces sharps as a result of administering medication to oneself. Does not include an ambulance service licensed under section 144.802, an eligible board of health, community health board, or public health nursing agency as defined in section 116.78, subdivision 10, or a program providing school health service under section 123.35, subdivision 17.

Hazardous waste -- Any refuse, sludge, or other waste material or combinations of refuse, sludge or other waste materials in solid, semisolid, liquid, or contained gaseous form which because of its quantity, concentration, or chemical, physical, or infectious characteristics may (a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Categories of hazardous waste materials include, but are not limited to: explosives, flammables, oxidizers, poisons, irritants, and corrosives. Hazardous waste does not include source, special nuclear, or by-product

material as defined by the Atomic Energy Act of 1954, as amended.

Infectious Waste Control Act (Minn. Stat., sections 116.76-116.83) -- The 1989 legislation authorizing infectious waste control in Minnesota. Also referred to in this report as IWCA and Act.

Industrial solid waste -- All solid waste generated from an industrial or manufacturing process and solid waste generated from nonmanufacturing activities such as service and commercial establishments. Industrial solid waste does not include office materials, restaurant and food preparation waste, discarded machinery, demolition debris, or household refuse.

Infectious waste -- Laboratory waste, blood, regulated body fluids, sharps, and research animal waste that have not been decontaminated.

Labeling -- All bags, boxes, and other containers used to collect, transport, or store infectious waste must be clearly labeled with a biohazard symbol or with the words "infectious waste" written in letters no less than one inch in height.

Laboratory waste -- Waste cultures and stocks, of agents that are generated from a laboratory and are infectious to humans; discarded contaminated items used to inoculate, transfer, or otherwise manipulate cultures or stocks of agents that are infectious to humans; wastes from the production of biological agents that are infectious to humans; and discarded live or attenuated vaccines that are infectious to humans.

Medical waste -- Defined by MWTF as both "infectious waste" as defined in the IWCA, "regulated waste" as defined by the state OSHA standard 1910.1030, and all generator waste excluding hazardous waste and low-level radioactive waste.

Mixed municipal solid waste -- Garbage, refuse, and other solid waste from residential, commercial, industrial, and community activities which is generated and collected in aggregate, but does not include auto hulks, street sweepings, ash, construction debris, mining waste, sludges, tree and agricultural waste, tires, lead acid batteries, used oil, and other materials collected, processed, and disposed of as separate waste streams.

Mixed municipal solid waste land disposal facility -- A site used for the disposal of mixed municipal solid waste in or on the land.

Pathological waste -- Human tissues and body parts removed accidentally or during surgery or autopsy intended for disposal. Pathological waste does not include teeth.

Person -- An individual, partnership, association, public or private corporation, or other legal entity, the United States government, an interstate body, the state, and an agency, department, or political subdivision of the state.

Radioactive waste -- (a) Useless or unwanted capturable radioactive residues produced incidental to the use of radioactive materials; or (b) Useless or unwanted radioactive material; or (c) Otherwise nonradioactive material made radioactive by contamination with radioactive material. Radioactive waste does not include discharges of radioactive effluents to air or surface water when subject to applicable federal or state regulations or excreta from persons undergoing medical diagnosis or therapy with radioactive material or naturally occurring radioactive isotopes.

Recycling facility -- A site used to collect, process, and repair recyclable materials and reuse them in their original form or use them in manufacturing processes.

Red bag waste -- A term often used to denote all waste placed in a red bag for special handling as infectious or regulated waste. IWCA requires all containers of infectious waste to be labeled with the biohazard symbol or words "infectious waste." Color for containers is neither specified nor required. Color alone has no meaning for

labeling purposes under IWCA. OSHA regulations require that containers of regulated waste be labeled with the word "biohazard" and/or with the biohazard symbol or that the container be red. The term "red bag" has a specific meaning under OSHA but has no meaning under IWCA. These definitions are further discussed in the policy section of the report.

Refuse -- Putrescible and nonputrescible solid waste, including garbage, rubbish, ashes, incinerator ash, incinerator residue, street cleanings, and market and industrial solid wastes, and including municipal treatment wastes which do not contain free moisture.

Refuse-derived fuel -- The product resulting from techniques or processes used to prepare solid waste by shredding, sorting, or compacting for use as an energy source.

Regulated human body fluids -- Cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid that are in containers or that drip freely from body fluid soaked solid waste items.

Regulated waste -- Defined by OSHA as "liquid or semi-liquid blood or other potentially infectious materials: contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or other potentially infectious materials."

Research animal waste -- Carcasses, body parts, and blood derived from animals knowingly and intentionally exposed to agents that are infectious to humans for the purpose of research, production of biologicals, or testing of pharmaceuticals.

Residue -- Matter remaining after completion of a chemical or physical process.

Resource Conservation and Recovery Act (1979 RCRA) -- To protect health and environment by conservation of resources and "cradle-to-grave" management of hazardous waste. Hazardous and solid waste amendments in 1984. RCRA is currently up for reauthorization.

Resource recovery -- Reclamation for sale, use, or reuse of materials, substances, energy, or other products contained within or derived from waste.

Sharps -- (1) Discarded items that can induce subdermal inoculation of infectious agents, including needles, scalpel blades, pipettes, and other items derived from human or animal patient care, blood banks, laboratories, mortuaries, research facilities, and industrial operations; and (2) discarded glass or rigid plastic vials containing infectious agents.

Solid waste -- Garbage, refuse, sludge from a water supply treatment plant or air contaminant treatment facility, and other discarded waste materials and sludges, in solid, semi-solid, liquid, or contained gaseous form, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include hazardous waste; animal waste used as fertilizer; earthen fill, boulders, rock; sewage sludge; solid or dissolved material in domestic sewage or other common pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents or discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended, dissolved materials in irrigation return flows; or source, special nuclear, or by-product material as defined by The Atomic Energy Act of 1954, as amended.

Solid waste land disposal facility -- A facility used to dispose of solid waste in or on the land.

Toxic pollutants -- Those pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into

any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the agency, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, including malfunctions in reproduction, or physical deformation, in such organisms or their offspring.

Treatment -- Action performed on infectious waste specifically to decontaminate it.

Waste -- Material discarded for disposal.

Yard waste -- The garden wastes, leaves, lawn cuttings, weeds, and prunings generated at residential or commercial properties.

ABBREVIATIONS AND ACRONYMS

BACT -	best available control technology
BFI -	Browning-Ferris Industries
CDC -	Centers for Disease Control
CHC -	Council of Hospital Corporations
CON -	Certificate of Need
EAW -	Environmental Assessment Worksheet
EIS -	Environmental Impact Statement
HEPA -	high efficiency particulate air
HBV -	hepatitis-B virus
HIV -	human immunodeficiency virus
IWCA -	Infectious Waste Control Act
MAHA -	Minnesota Association of Homes for the Aged
MDA -	Minnesota Dental Association
MDH -	Minnesota Department of Health
MFDA -	Minnesota Funeral Directors Association
MHA -	Minnesota Hospital Association
MHP -	Minnesota Healthcare Partners, Inc.
MMA -	Minnesota Medical Association
MPCA -	Minnesota Pollution Control Agency
MSW -	municipal solid waste
MVMA -	Minnesota Veterinary Medicine Association
MWTA -	Medical Waste Tracking Act
MWTF -	Medical Waste Task Force
OSHA -	Occupational Safety and Health Administration
OWM -	Office of Waste Management
PCDD/PCDF -	polychlorinated dibenzyl dioxins polychlorinated dibenzyl furans
PVC -	polyvinyl chloride
RBF -	regulated body fluids
RCRA -	Resource Conservation and Recovery Act
RDF -	refuse-derived fuel
SW -	solid waste
WMA -	Waste Management Act

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APPENDIX B-1

Meeting Dates

DATES OF MEETINGS

November 25, 1991	June 9, 1992
December 9, 1991	June 12, 1992
January 7, 1992	June 16, 1992
February 24, 1992	July 9, 1992
March 16, 1992	July 16, 1992
April 20, 1992	August 13, 1992

Minutes and tapes from the meetings are available from the Minnesota Department of Health Infectious Waste Control Unit.

APPENDIX B-2

Incinerator Ash Fact Sheets

MINNESOTA POLLUTION CONTROL AGENCY
FACT SHEET ON MEDICAL WASTE INCINERATOR ASH

I. DEFINITION

Medical waste incinerator ash is the material remaining after combustion of infectious waste. The municipal solid waste combustor ash rules do not apply to ash that is produced by infectious waste combustion or waste that was combusted on-site by the generator. This ash fact sheet will outline the requirements for the testing and management of infectious waste incinerator ash. This ash will also include any material collected by pollution control equipment on infectious waste incinerators.

II. APPLICABLE RULES

Medical waste incinerator ash must be evaluated to see if it is hazardous according to Minn. Rules pt. 7045.0214. If the ash is classified as hazardous waste, Minn. Rules ch. 7045 apply to the storage, transport, handling and disposal of the waste. If it is classified as nonhazardous, Minn. Rules ch. 7035 apply. (See section V. below)

III. TESTING REQUIREMENTS

To determine if a waste is hazardous or nonhazardous as required by Minn. Rules pt. 7045.0214, the Toxic Characteristic Leach Procedure (TCLP) test should be performed on enough samples to accurately identify the average ash quality. To achieve this at least three samples should be analyzed. To account for day-to-day variation in the waste stream these samples should be taken from a well-mixed composite ash sample formed from grab samples collected over a number of different days of operation of the incinerator.

Not all testing parameters of the TCLP test need to be performed on medical waste incinerator ash. The sample should be tested for at least the eight RCRA listed metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) and nickel and zinc.

IV. TESTING FREQUENCY

The ash should be initially tested to make sure it is nonhazardous and acceptable for handling as a solid waste under the industrial waste management plan of the disposal facility. Once the new waste combustor rules are in effect, they will require an ash management plan as part of the permit requirement. It is anticipated that ash will need to be tested every two years to meet this requirement. Your landfill, hauler, or county may require other testing schedules and reporting so you may want to contact them directly for questions related to your particular situation.

V. NONHAZARDOUS DISPOSAL REQUIREMENTS

Nonhazardous ash may be disposed in solid waste land disposal facilities through the facility's industrial waste disposal program. Minn. Rules pt. 7035.2535, subp. 5 requires that industrial wastes, including ash

from incinerators, be managed in accordance with an industrial waste management plan approved by the MPCA. A list of permitted solid waste land disposal facilities is available from the MPCA by calling Chris Johnson at 612/296-7332.

VI. SPECIAL CONSIDERATIONS FOR ASH COLLECTED BY POLLUTION CONTROL EQUIPMENT

If the facility is equipped with pollution control equipment which collects fine particulate known as fly ash, and the fly ash is not routinely mixed in an enclosed system with the other ashes produced, it must be tested separately.

The following MPCA staff should be contacted for questions relating to:

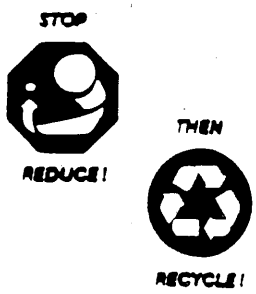
Municipal solid waste combustor ash regulations:	Bob Criswell Ground Water and Solid Waste Division 612/296- 7273
Air Quality waste combustor rules:	Anne Jackson Air Quality Division 612/296-7949
Air Quality permitting:	Peter Torkelson Air Quality Division 612/296-7260
Solid Waste-Industrial Waste Management Plans:	Jim Gaughan Ground Water and Solid Waste Division 612/296-7740
Infectious Waste Management Plans:	Laurie Mezner Ground Water and Solid Waste Division 612/296-7388

APPENDIX B-3

Hospital Solid Waste Case Study

MINNESOTA OFFICE OF WASTE MANAGEMENT

1350 Energy Lane
St. Paul, Minnesota 55108
(612) 649-5750
MN Toll Free
1-800-652-9747



WASTE SOURCE REDUCTION

A ~~HOSPITAL~~ CASE STUDY

IMC

Facility:

Itasca Medical Center
126 First Avenue SE
Grand Rapids, MN 55744

The Itasca Medical Center is a 108 bed community hospital with an attached 35 bed convalescent nursing care facility. The hospital made a commitment to source reduce its waste as much as possible. Secondarily, what they could not reduce they committed themselves to recycle.

The project demonstrates that source reduction is a viable waste management method for hospitals. Measurement of cost changes and waste prevented took place on a product by product basis. Product waste was measured through the hospitals use and disposal of a product and did not attempt to measure waste produced through the manufacturing process of the product. The hospitals goal was simple: Reduce the amount of solid waste generated by the facility.

As a result of reduction actions alone, the hospital personnel is preventing ***238 cubic yards*** and over ***10,700 pounds*** of waste. Not including the savings from avoided disposal fees, these actions result in a ***$11,030 yearly cost savings for the hospital.***

Reduction is defined as any activity that reduces waste at its source. Staff examined their own waste stream and brainstormed ideas to accomplish reduction. As they looked at their waste stream, they asked themselves the following questions:

- Where can I REDUCE the amount or the toxicity of material used to accomplish any task?
- Are there existing or new products I can REUSE over and over again?
- Are there existing or new products that are repairable, refillable or more durable to give a LONGER USEFUL LIFE?

These are the three pillars on which they based their efforts to reduce the amount of solid waste generated by their facility. The specific measures they identified are contained within this report.

This project was a team effort involving virtually all of the supervisors and staff at the hospital and had complete support of the director, David Triebes. Without their suggestions and implementation of the actions reported here, unnecessary waste would continue. Jim Thibodeau of purchasing and Judy Mager of dietary gave outstanding leadership for the project. Without this leadership the project would not have been possible. Technical support for the case study was provided by Kenneth Brown (612) 649-5743, Minnesota Office of Waste Management.

USE REUSABLE INSTEAD OF SINGLE-USE CAFETERIA SALAD PLATES

Although reusable plates are used to serve most food, the cafeteria served salads on single-use plates. Now salac are served on reusable dishes as well. As a further measure to reduce waste, cafeteria customers pay by the ounce for the salad they serve themselves, cutting down on food waste.

Volume of waste avoided: 36 cu yd/yr: A 99% volume reduction
SINGLE-USE: 8" single-use plate; 55 cases/yr x 3,316 cu"/case = 182,380 cu" shipping volume. Actual disposal volume of 25 plates is 1,760 cu" for 25 plates.
6" single-use plate; 9 cases/yr x 2,100 cu"/case = 18,900 cu" shipping volume; Actual disposal volume of 32,000 plates was calculated to be 32,000 ÷ 25 = 1,280 x 1,760 cu" = 2,252,800 cu"/yr, x 90% to allow for dumpster settling = 2,027,520 cu"/yr. Percent increase from shipping to disposal volume = 2,027,520 - (182,380 + 18,900) ÷ 2,027,520 = 90% increase.

REUSABLE: measures 8.5" diameter x .375" thick. $\pi r^2 x$ h = v; 3.14 x 4.24^2 x .375" = 21.26 cu" ea; 21.26 cu" x 72 ÷ 3 yr life = 510 cu"/yr
Net: 2,027,520 - 510 = 2,027,010 cu" ÷ 56,656 cu"/cu yd = 35.8 cu yd/yr
2,027,520 - 510 ÷ 2,027,520 = 99% volume reduction

Weight of waste avoided: 1,235 lbs/yr: 99% weight reduction /yr
SINGLE-USE: 8" single-use plate; 20 lbs/case of 500, 55 cases/yr = 1,100 lbs
6" single-use plate; 15 lbs/case of 500, 9 cases/yr = 135 lbs; 1,235 total lbs/yr
REUSABLE: plate weighs 5.625 oz x 72 ÷ 3 yr life = 135 oz/yr
Net: 1,235 lbs - (135 oz ÷ 16 oz/lb) = 1,226 lbs/yr reduction;
1,226 ÷ 1,235 = 99% weight reduction

Cost savings, not including avoided disposal fees: $2,126 /yr: 94% cost savings /yr
SINGLE-USE: 6" plate, $275/yr + 9" plate, $1,980/yr = $2,255 /yr
REUSABLE: 72 plates purchased @ $2.08 ea = $150, ÷ 3 yr life = $50 /yr
Washing cost: 14 plates /rack; 2.5 gallons of water is used /rack; 1/15¢ of electricity /rack; 3.5¢ of soap /rack. 32,000 single-use plates were used/yr, ÷ 14 plates/rack = 2,285 racks/yr.
Water: 2,285 racks x 2.5 gallons = 5,713 gallons/yr x ($2.47 per 1000 gallons for water and sewer combined) = $14.11 /yr
Electricity: 2,285 racks x 1/15¢ (.0066) = $15 /yr
Soap: 2,285 racks x 3.5¢ (.035) = $79.97 /yr
Net: Single-use $2,255 - (Reusable $50 + $14 + $15 + $80) = $2,126 savings /yr

INDIRECT COSTS: Old reusable plates are given to Goodwill for reuse, no disposal cost. On large volume days, maintenance was called to empty cafeteria trash cans one to two extra times /wk. With reusables, extra pick-ups have ceased. A reduction of 36 cu yd/yr x $6.25/yd gives a theoretical savings of $225 /yr. However, contracted hauling volu was not decreased due to this action alone.
There was a decrease in labor for purchasing maintenance departments. in managing and handling this waste. There was an increase in labor for dietary to handle the reusables. Existing staff integrated this action. There were no staff changes for the hospital as a whole.

REUSABLE DESERT DISHES REPLACE SINGLE-USE

Small ceramic dishes are now used instead of plastic, single-use desert cups. Nurses report that patients appreciate the change to the use of the more substantial ceramic dishes because they convey a more positive feeling than the thin plastic trays.

Volume of waste avoided: 62 cu yd/yr: 99% volume reduction
SINGLE-USE: Two sizes were replaced. Tray one: 138 /day x 365 days/yr = 50,370 dishes/yr with a shipping volume of 80 cu" versus 1,430 cu", actual disposal volume for 50 trays. (A 94.4% volume increase). 50,370 trays/yr ÷ 50 = 1,007.4, x 1,430 cu" for 50 trays, x 90% (dumpster settling allowance) = 1,296,524 cu"/yr
Tray two: 246 /day x 365 = 89,790 dishes/yr with a shipping volume of 65 cu" versus 1,375 cu", actual disposal volume for 50 trays. (A 95.3% volume increase). 89,790 trays/yr ÷ 50 = 1,795.8, x 1,375 cu" for 50 trays, x 90% (dumpster settling allowance) = 2,222,302 cu"/yr
1,296,524 + 2,222,302 = 3,518,826 cu"/yr
REUSABLE: 400 needed, measuring 4" x 2.75" x 1.5" = 16.5 cu in each. Life is 3 years, 400 ÷ 3 = 133.3 /yr, x 16.5 cu" = 2,200 cu"/yr
Net: 3,518,826 cu" - 2,200 cu" = 3,516,626 cu"/yr ÷ 56,656 cu"/yd = .62 cu yd/yr volume reduction; 3,516,626 ÷ 3,518,826 = 99% reduction

Weight of waste avoided: 1,230 lbs/yr: 96% weight reduction
SINGLE USE: Tray one; 6.1 oz for 50; 50,370 used /yr ÷ 50 = 1,007.4, x 6.1 oz = 6,145 oz/yr
Tray two; 8 oz for 50; 89,790 used/yr ÷ 50 = 1,795.8, x 8 oz = 14,366 oz/yr
6,146 + 14,366 = 20,512 oz/yr
REUSABLE: 6.26 oz each x 133.3 /yr = 833 oz/yr
Net: 20,512 - 833 = 19,679 oz/yr ÷ 16 oz/lb = 1,230 lbs/yr weight reduction; 19,679 oz/yr ÷ 20,512 oz/yr = 95.9% weight reduction

Cost savings, not including avoided disposal fees: $904 /yr: 60% cost savings/yr
SINGLE-USE: Cost; $64.40/case x (8.4 + 15) cases = $1,507/yr
REUSABLE: Cost 23.95 a dozen; 400 needed, ÷ 12 = 34 dozen, x $23.95 = $814; ÷ 3 yr/life = $271/yr
Costs of water, sewer, electricity and soap: 400 dishes washed /day ÷ 21 dishes on a rack = 19 racks run/day.
Water and sewer for 2.5 gallons/rack is 19 x 2.5 gal = 47.5 gal/day x 365 days/yr = 17,338 gal/yr, x $2.47/1000 gal = $42.82/yr
Electricity is .0066¢ /rack x 19 racks/day x 365 = $45.77/yr
Soap is 3.5¢ /rack x 19 racks/day x 365 = $243/yr
Net: $1,507 - ($271 + $43 + $46 + $243) = $904 cost savings/yr; $904 ÷ $1,507 = 60%

INDIRECT COSTS: A reduction of 62 cu yds of waste /yr theoretically translates into 62 x $6.25/cu yd = $387 /yr. However, contracted hauling volume was not decreased due to implementation of this measure alone. Purchasing and maintenance received a labor decrease due to less management and handling of single-use. Dietary receives a labor increase due to washing of reusable. Implementation of this action was integrated by existing labor. The hospital as a whole did not experience an increase in labor cost.

CHANGE TO RECHARGEABLE BATTERIES

For minimal disruption of patients' sleep, nursing staff used "D" cell flashlights to check on patients during the night. This practice was appreciated by patients but resulted in large quantities of spent batteries. Rechargeable flashlights are now used. Purchased over 4 years ago, the original sample still performs very well.

Volume of waste avoided: 1,272 batteries or .074 cu yd each year; 98% volume reduction
DISPOSABLE "D" cell battery purchased dropped from 120 per month to 14 per month, a decrease of 106 batteries per month.
Net change in battery volume; 106/mo x 2.77 cu"/battery x 12 = 3,523 cu"/yr
REUSABLE: 7" x 2.25" = 17.5 cu" x 18 flashlights ÷ 4 yr life = 78.75 cu"/yr
Net: 3,523 - 79 = 3,444 cu" ÷ 46,656 cu"/cu yd = .074 cu yd/yr; 3,444 ÷ 3,523 = 97.76% volume reduction

Weight of waste avoided: 394 lbs each year; 99% weight reduction
DISPOSABLE: "D" cell weighs 5 oz, 106 x 5 oz x 12 = 6,360 oz per year ÷ 16 oz for one pound = 398 lb/yr.
REUSABLE: rechargeable flashlight weighs 1 lb x 18 flashlights purchased = 18 lbs, ÷ 4 yr life = 4.5 lb/yr
Net: 398 lbs - 4.5 lbs = 393.5 lb/yr reduction; 393.5 ÷ 398 = 98.9% weight reduction.

Cost savings, not including avoided disposal fees: $260 each year: 86% cost savings
DISPOSABLE: 106 batteries/mo x 12 = 1,272 /yr x 23.7¢ ea = $302 /yr
REUSABLE: $207 was spent purchasing 18 reusable flashlights.
Flashlights are guaranteed for one year, but a four year life has been experienced. Over four years, 5,088 batteries and $1,208 in disposable battery purchase cost is avoided. Electricity used to recharge the batteries is reported insignificant compared to total hospital usage.
Net: $1,208 - $207 = $1,041 ÷ 4 years for an average of $260 saved each year; $1,041 ÷ 1,208 = 86.2% cost reduction

INDIRECT COSTS: Currently, hospitals must manage alkaline batteries as hazardous waste. Significant reduction in volume and weight reduces disposal costs.

Issues:
Staff must be trained on use of recharger. Electrical outlets must be convenient for nursing staff. Rechargeable flashlights with "low battery" indicators are recommend. With these measures in place, implementation has been successful.

Note:

Minnesota statute 115A.9155 applies to disposal of industrial batteries. Mercuric oxide and silver oxide as well as nickel-cadmium and lead-acid batteries purchased for use by government, industry, communications and medical facilities are covered. Manufacturers selling these batteries to these facilities are responsible for ensuring a system of collection and processing of these batteries by August 1, 1990.

Pilot collection for all other rechargeable batteries and appliances (primarily from households) must be in place by April 15, 1992. Rechargeable tools and appliances must have a rechargeable battery that can be easily removed after July 1, 1993.

Alkaline batteries sold in Minnesota can contain no more than 0.025 percent mercury by battery weight after February 1, 1992. Although rechargeable batteries result in substantially less solid waste than their alkaline or carbon-zinc counterparts, it is difficult to compare the complete environmental impact of these three battery types. However, in Minnesota rechargeable batteries are subject to mandatory collection which ultimately results in recycling or controlled hazardous waste disposal while low-mercury and carbon-zinc batteries can be disposed in municipal solid waste, ending up in a landfill or incinerator.

USE REUSABLE, NOT SINGLE-USE, PITCHERS ON PATIENT FLOORS

Nurses must have individual pitchers of water available for patients on each floor of the hospital. Reusable, color coded pitchers for each department are now used instead of single-use ones.

Volume of compacted waste avoided: 19 cu yd /yr; 99% volume reduction
SINGLE-USE: The hospital threw out 5,500 single-use pitchers every year, 11 cases of 500/case. Assembly of container and handle required, separate components.
The volume of one container ($\pi r^2 h = v$) $3.14 \cdot 2.5^2 \cdot 8 = 157$ cu". x 5,500 pitchers/yr = 863,500 cu"
Handle - solid plastic, must be assembled, not autoclavable (steam sterilization), case 80" x 23.5" = 1,880 cu" x 11 cases/yr = 20,680 cu"/yr
Lid - solid plastic, not autoclavable, case 60" x 14" = 840 cu" x 11 cases/yr = 9,240 cu"/yr
863,500 + 20,680 + 9,240 = 893,420 total cu"/yr, minimum volume

REUSABLE: The volume of the autoclavable, reusable pitcher is 170 cu". It has a minimum life expectancy of 3 years. 180 were purchased. 180 x 170 cu" = 30,600 cu " every 3 years; ÷ 3 = 10,200 cu"/yr.
Net: 893,420 cu" - 10,200 cu" = 883,220 cu"/yr ÷ 46,656 = 18.9 cu yd/yr volume reduction;
883,220 ÷ 893,420 = 98.8%

Weight of waste avoided: 414 lbs; 94% weight reduction
SINGLE-USE: One 500 count pitcher case has the following weights:
Pitchers, 10 lbs
Handles, 20 lbs
Lids, 10 lbs
40 lbs x 11 cases used /yr = 440 lbs/yr
REUSABLE: Pitcher weighs 7 oz x 180 purchased ÷ min. 3 yr life = 420 oz ÷ 16 oz/lb = 26 lbs/yr.
Net: 440 - 26 = 414 lbs avoided /yr.; 440 - 26 ÷ 440 = 94.1%

Cost savings, not including avoided disposal fees: $1,445 /yr: 81% savings /yr
One 500 count case of each of the following costs:
Pitchers, $49
Handles, $69
Lids, $43
SINGLE-USE: Cost = $161 x 11 = $1,771 /yr = $148 /mo.
REUSABLE: Cost = $1.77 ea x 180 needed = $318, ÷ 3 yr life cycle = $106 /yr = $8.83 /mo.
Water, electricity and soap is calculated to cost approximately $225 /yr
Net: Single-use ($148 x 12) - ($8.83 x 12 + $225) = 1,445/yr savings
$1,445 ÷ $1776 = 81% savings /yr

INDIRECT COSTS: There was a decrease of labor in ordering, stocking and delivering for purchasing and maintenance departments. No significant labor change to get reusables to kitchen because taken with other food cart items. Increase in loading/unloading dishwasher. No change in overall staff for the hospital due to implementation of this action.

Issues:
Color-coding assures pitchers are returned to correct department. Reusable pitchers are stackable and are stored where single-use pitchers used to be kept.

CHANGE FROM DISPOSABLE TO REUSABLE UNDERPADS

When nursing staff changed from plastic-lined, fiber-filled disposable underpads used on patient beds to a reusable cotton underpad, patients reported an increase in comfort.

Volume of waste avoided: 44 cu yds each year: 92% volume reduction
SINGLE USE: 300 fewer cases of disposable pads are used each year, the cases measure 21" x 14" x 15"= 4410 cu" /case x 300 = 1,323,000 cu" ÷ 46,656 cu"/cu yd = 28 cu yd. This volume represents manufacturers shipping volume, a minimum volume for the product. Actual disposal volume after use was observed to be a minimum of 70% greater. 28 cu yd ship. vol. x 70% = 19.6 cu yd., 28 cu yd + 19.6 cu yd = 47.6 cu yd/yr

REUSABLE: Each pad measures 24" x 36" x 1/2" = 432 cu in., 768 pads were purchased. Pad life is estimated to be a minimum of 2 years. 432 cu in. x 768 = 331,776 cu in of waste every 2 years, ÷ 2 = 165,888 cu in of waste/yr. 165,888 ÷ 46,656 cu in/yd = 3.55 yards/yr. When worn out, these pads will be reused as rags and [illegible]pads. When they are eventually thrown out net waste volume will be 47.6 cu yds - 3.55 cu yc[illegible]4.05 cu yds net volume reduction/yr.
47.6 - 3.55 ÷ 47.6 = 92.5% volume rec[illegible]n/yr

Weight of waste avoided: 5,537 lbs each year: 97% weight reduction
SINGLE-USE: Unused, disposable pads from one case weigh 19 lbs; 300 x 19 lbs = 5,700 total lbs. Due to fluid absorption, actual disposal weight would be higher. Minimum weight used.

REUSABLE: 6.8 oz each, 768 purchased for 2 yrs = 2,611.2 oz/yr ÷ 16 oz/lb = 163.2 lbs/yr
Net: 5,700 lbs - 163 lbs = 5,537 lbs net weight reduction/yr
5,700 - 163 ÷ 5,700 = 97% weight reduction/yr

Cost savings, not including avoided disposal fees: $5,021 each year: 67% cost reduction
SINGLE-USE: Approximately 16,000 single-use pads, a cost of $7,466, were thrown out each year.

REUSABLE: $4,440, reusable pad purchase cost ÷ 2 yr pad life = $2,220 /yr plus $225 in water, soap and electricity/yr = $2,445/yr.
Net: $7,466 - $2,445 = $5,021 /yr cost sa[illegible]gs ÷ $7,466 = 67% cost reduction/yr

Indirect costs: Reduction in disposal of 44 cu yds of single-use pads at $6.25 per cu yd = $275/yr. However, this figure was not included in savings because contracted hauling volume for the facility was not changed. Labor cost of purchasing, checking-in, moving, storing and disposing of 16,000 single-use pads/yr decreased for purchasing and maintenance departments. Labor cost of washing and folding reusable pads increased for laundry department. These changes were not incorporated into the cost figure because, though labor for individual departments changed, labor costs for the hospital as a whole did not change. This action was integrated by existing staff.

EXIT SIGN CONVERSION

There are 18 exit signs throughout the facility, all lit continuously. Existing incandescent bulb sockets were converted to fluorescent. Fluorescent bulbs were found to last 10 times longer (2.5 yrs) than the hospitals incandescent exit sign bulbs (1/4 of one yr). Although most exit signs have 2 incandescent bulbs per exit sign, the hospitals fixtures contained one. It is worthy to note that conversion to fluorescent was still beneficial.

Percent reduction of this waste stream: 89%
Incandescent count; 67 used/yr in facility
Fluorescent count; 18 needed for 2.5 yr; 7.2/yr; 89% count reduction

Volume of waste avoided: .0034 cu yd; 80% volume reduction of exit lighting waste
15-watt incandescent bulbs = 3 cu' x 67 = 201 cu'/yr
7-watt fluorescent bulb = 3.75 cu' x 18 used in 2.5 yr = 27 cu'/yr
Ballast; 4 cu', life 5 yrs, 1 yr = 19% of total life, 4 cu' x 18 count = 72 x 19% = 14 cu'/yr
Net: 201 - 27 - 14 = 160 cu' ÷ 46,656 cu'/yd = .0034 cu yd/yr
201 cu' - (27 + 14.cu') ÷ 201 = 79.6% volume reduction

Weight of waste avoided: 24 oz; 40% weight reduction of exit lighting waste
15-watt incandescent bulb; .8 oz x 67/yr = 54 oz/yr
7-watt fluorescent bulb; 1.15 oz x 18 bulbs for 2.5 yr ÷ 2.5 = 8.3 oz/yr:
Ballast; last 45,000 hrs (5 yrs); magnetic ballast wt. 7 oz; 19% life use/yr; 19% x 7 oz = 1.33 oz/yr/fixture.
Net: 18 x 1.33 = 24 oz/yr for total
54 oz/yr - (8.3 + 24) ÷ 54 = 40%

Cost savings, not including avoided disposal fees: $6/yr: 11% /yr cost savings
Incandescent bulbs cost $0.64 ea x 67 = $43/yr
Fluorescent bulbs cost $2.50 ea x 18 = $45 for 2.5 yrs, $18/yr
Retrofit kits cost $12.70 ea x 18 = $228; conservative 10 yr life = $23/yr

Electricity cost savings: $3.85; ***46% electricity cost savings***
Incandescent; $.05 /kWh x 15 watts = $01.01 /1000hrs. x 8.760 (8760 hrs/yr) = $8.45 /yr
Fluorescent: $.05 /kWh x 8 (7 watts for bulb + 1 watt for ballast) = .525 /1000hrs x 8.76 = $4.60
Net: ($43 + $8.45) - ($18 + $23 + $4.60) = $5.85/yr
$5.85 ÷ $51.45 = 11.4% /yr cost savings

INDIRECT COSTS: Labor - Each bulb change costs $8 in labor. Replacing 67 incandescents costs $536/yr. Replacing 18 fluorescents every 2.5 yrs costs $144; or $58/yr. Net labor cost change; $478 savings. However, no staff changes were made at the hospital as a direct result of implementation of this action.

ISSUES:
Although the hospitals' incandescent bulbs listed a 2,500-hour life, that proved to be a maximum. Although fluorescents listed a 10,000-hour life, in continuous-burn applications they have lasted over 2 years (22,000 hrs). Loop type PL and straight tube mini bi-pin fluorescent lamps are both available for exit sign conversion.

REPLACE INCANDESCENT FLOODLIGHTS WITH FLUORESCENT FLOODLIGHTS

During remodeling, the hospital installed 87 compact fluorescent, recessed ceiling floodlights instead of recessed incandescent floodlights. Reported benefits of the change were source reduction, less heat build-up, lower maintenance costs and improved light quality.

The fixtures have been in place over 2 years. No bulbs have burned out. Approximately half are continuously lit and half are on a computerized timer.

Volume of uncompacted waste avoided: .1 cu yd; 94% volume reduction
Incandescent; a 60-watt bulb measured 7 cu' displacement, life 1000 hrs
Fluorescent; a 13-watt bulb measured 4 cu' displacement, life 22,000 hrs (over 2 yrs)
Ballast; last 45,000 hrs (5 yrs) and measures 8.9 cu'.
Usage for 45,000 hours of one light:
Incandescent; 696 bulbs x 7 cu' = 4,872 /yr cu'
Fluorescent; 34.8 bulbs x 4 cu' = 139 cu'/yr
Ballast, 1 = 8.9 cu'; 5 yr life; 87 fixtures; 87÷5= 17.4 prorated use/yr; 17.4 x 8.9 = 155 cu'/yr
Net: 4,872 -139 - 155 = 4,578 cu' avoided ÷ 46,656 cu'/yd = .098 cu yd/yr
4,872 - 155 ÷ 4,872 = 94%

Weight of waste avoided: 26.5 lbs/yr; 64% weight reduction
Incandescent; 60 watt bulb weighs .95 oz x 696 used/yr = 661 oz/yr waste
Fluorescent; a 13 watt bulb weighs 1.75 oz; .5 life used /yr x 87 fixtures = 76.5 oz/yr/waste
Ballasts; life 45,000 hrs: Magnetic ballast weighs 9.75 oz; 19% life used /yr = 1.85 prorated oz/yr x 87 lights = 161 oz/yr waste: Electronic ballasts weighs 2.30 oz; 19% life used /yr = .437 oz/yr x 87 lights = 38 oz/yr waste.
▸Fluor. bulb (76.5) + Mag. bal. (161) = 237.5 oz/yr
▸Fluor. bulb (76.5) + Elec. bal. (38) = 114.5 oz/yr
Net: 661 - 76 - 161 = 424 oz ÷ 16 oz/lb = 26.5 lbs/yr
661 oz - 238 oz ÷ 661 oz = 64%

Cost savings, not including avoided disposal fees: $268 /yr: 36% cost savings /yr
▸Incandescent bulbs cost $0.64 ea x 696 = $445/yr
▸Fluorescent bulbs cost $2.51 ea x 34.8 prorated bulbs/yr = $87/yr
▸Ballast cost $12.70 ea for conservative 10 yr life = $1.27 prorated cost/fixture x 87 fixtures = $110/yr
▸Electricity savings; 60 watt incandescents (cost $3 /1,000 hrs) were replaced by 14 watt fluorescent (cost $.70 / 1000 hrs); 8760 hrs in one yr ÷ 1000 = 8.76 kwatt; Yearly incandescent cost $3 x 8.76 = $26/yr; Yearly fluorescent cost $0.70 x 8.76 = $6/yr; $26 - $6 = $20/yr savings = ***77% electricity cost savings.***
Net: ($445 + 26) - (87 + 110 + 6) = $268 cost savings/yr; $268 + ($445 + $26) = 36% savings/yr

INDIRECT COSTS: Labor for changing incandescent bulbs; $8/change x 696 = $5,568/yr. Labor for changing fluorescent bulbs; $8/change x 34.8 = $278/yr. A significant labor decrease for the maintenance department results from this action. However, no change was made in staff due to this action alone.

Issues:
Maintenance staff discovered that some compact fluorescent units are sold with the ballast and bulb glued together as one unit. When the bulb burns out the entire lens and ballast must be thrown out. To avoid this unnecessary waste and expense, make sure the bulbs themselves can be replaced.

USE EFFICIENT FLOW SHOWER HEADS

There are 33 showers in the hospital and long-term care center. By changing to efficient-flow fixtures, the hospital conserves water, energy and capital.

The old shower heads used 3.5 gallons /min.
The new shower heads use 1.5 gallons /min.

Volume of waste water avoided: 103,000 gallons /year: 57% volume reduction
Approximately 2,100 showers lasting an average of 7 minutes each are taken at the facility each year. OLD ▸3.5 gal./min x 7 min = 24.5 gal/shower x 2,100 showers = 51,450 gal/yr
NEW ▸ 1.5 gal./min x 7 min = 10.5 gal/shower x 2,100 showers = 22,050 gal/yr
Net: 29,400 gallons saved; 29,400 ÷ 51,450 = 57% volume reduction

Cost savings, including avoided waste water treatment cost: $89/yr: 57% cost reduction
Water cost is $1.70 /1000 gal. Sewer charge is pegged to the number of gallons of water used and is $.77 /1000 gal. Total cost of water used is $2.47 /1000 gal.
29,400 ÷ 1000 x $2.47 = $73 /yr

It takes 22 watt-hours to heat one gallon of water to 120°F x # gal heated (29,400 ÷ 2 = 14,700 gal heated) = 323,400 ÷ 1000 (for kilowatt hours) = 323.4 kilowatt hours x watt hourly rate of $0.05 /kilowatt = $16; $73 water and sewer savings + $16 electricity savings = $89
Old, 51,450 gal/yr x $2.47/1000 gal = $127/yr
New, 22,050 gal/yr x $2.47/1000 gal = $54/yr
Net: $127 - $54 ÷ $127 = 57% cost reduction

ISSUES:
Although shower heads were replaced by efficient-flow fixtures, the timing of replacement was determined by existing shower head life cycle maintenance. The hospital replaces shower heads when corrosion and mineral build up impair function. Old shower heads are given away for reconditioning and reuse. Aerators are used on faucets.

TOXICITY REDUCTION BY DEVELOPING SOLUTION CHANGE

X-ray image quality was not compromised when the hospital changed to non-toxic "T2" chemistry. The new developer contains no hexavalent or trivalent chromium, is 95% acid-free, has no irritating fumes and does not damage clothing. The fixer is borate-free and the developer starter has a neutral Ph.

Percent reduction of this toxic waste stream: 100%
The hospital no longer uses acidic developer or fixer.

Volume of toxic waste avoided: 810 gallons /year
10 gallons of fixer is used every 18 days = 203 gal/yr
10 gallons of developer is used every 6 days = 608 gal/yr

Cost savings, not including avoided disposal fees: Break even

Issues:
Improved worker safety and eliminating over 800 gallons of toxic waste were the reasons for the change. The product is manufactured by White Mountain Imaging, Webster, NH 03303 (603) 648-2124 and has medical supply distributors nationwide.

CHANGE FROM STRAIGHT TO CIRCULAR TUBES FOR X-RAY VIEW BOXES

Some X-ray view box models contain four straight fluorescent X-ray tubes, and all must be replaced when one bulb burns out. Updated versions contain only one circular tube. Life expectancy is the same, 2 years.

Volume of waste avoided: .01 cu yd/yr: 24% volume reduction /yr
STRAIGHT TUBE: measures 1" dia x 17.25" long = 54.2 cu", x 4 tubes /fixture = 217 cu" x 18 fixtures ÷ 2 year life = 1,953 cu"/yr.
CIRCULAR TUBE: measures 1.25" dia x 33.5" circum = 165 cu", x 18 fixtures ÷ 2 year life = 1,485 cu"/yr.
Net: 1,953 cu" - 1,485 cu" = 468 cu", ÷ 46,656 cu"/cu yd = .01 cu yd/yr
1,953 cu" - 1,485 cu" ÷ 1953 cu" = 24% volume reduction

Weight of waste avoided: 1 lb/yr: 22% weight reduction
STRAIGHT TUBE: 2.1 oz ea x 4 tubes/fixture x 18 fixtures ÷ 2 year life = 76 oz/yr
CIRCULAR TUBE: 6.5 oz ea x 18 fixtures ÷ 2 year life = 59 oz/yr; 76 - 59 = 17 oz, ÷ 16 oz/lb = 1.1 lb
17 oz ÷ 76 = 22% weight reduction

Cost savings: $71 /yr: 44% annual cost savings
STRAIGHT TUBE: 4 required /fixture x $2.24 ea x 18 fixtures = $161
CIRCULAR TUBE: 1 required /fixture x $4.97 ea x 18 fixtures = $90
Net: With replacement life the same, $161 - $90 = $71/yr, $71 ÷ $161 = 44% cost savings /yr

INDIRECT COSTS: Less labor is required to service circular tube units than 4 tube units.

CHANGE TO REUSABLE CUPS

Use of single-use styrofoam cups by staff was eliminated. The hospital provided high quality, reusable plastic mugs embossed with the hospital's logo for all employees. Employees are responsible for their own mugs. Reusable cups are provided for all meetings. The hospital plans to phase out single-use cups in the facility in 1993.

Volume of waste avoided: 26 cu yd/yr: 99.8% volume reduction

SINGLE-USE CUPS: Shipping volume is 6,084 cu" /case of 1000; Measured disposal volume of 50 cups is 1,287 cu"; 20 x 1,287 = 25,740 cu" for 1000 cups (76% increase from shipping to disposal volume.) A minimum of 1000 single-use cups were used/week. Allowing for settling in a dumpster, 90% of the measured disposal volume is used for calculations. 90% x 25,740 cu" = 23,166 cu" x 52.14 wks/yr = 1,207,941 cu"/yr

REUSABLE CUPS: Since cups are the property of individual staff, and they must be replace at their own expense, it is not anticipated that they will be thrown away. However, a 4-year functional life was assigned to the cups. Cups measure 3" dia. x 5" ht = 35.4 cu"; 200 cups were distributed, ÷ 4 yr life = 50 disposed/yr; 35.4 cu" x 50 = 1,770 cu"/yr
Net: 1,207,941 cu"/yr - 1,770 cu"/yr = 1,206,171 cu"/yr ÷ 46,656 cu"/yd = 25.85 cu yd/yr;
1,206,171 ÷ 1,207,941 = 99.8% volume reduction

Weight of waste avoided: 69 lbs/yr: 82% volume reduction

SINGLE-USE: 7 lbs /case of 1000; 12 cases/yr x 7 lbs = 84 lbs/yr

REUSABLE: 4.75 oz x average of 50 disposed/yr = 237.5 oz, ÷ 16 oz/lb = 14.8 lbs/yr
Net: 84 lbs - 14.8 lbs = 69.2 lbs/yr avoided; 69.2 ÷ 84 = 82.3% volume reduction

Cost savings, not including avoided disposal fees: $94 /yr: A 58% cost savings/yr

SINGLE-USE: Cost $13.50/case x 12 = $162/yr
REUSABLE: Cost $1.35 ea x 200 = $270, however future cost of purchasing single-use cups is eliminated. If the hospital decides to purchase new cups in 4 years (estimated life) instead of having employees purchase their reusable cups as is now the policy, the hospital cost savings would be $162 x 4 = $648, - $270 = $378 savings over 4 yr, = $94 /yr savings; $94 ÷ $162 = 58% cost reduction.

INDIRECT COSTS: 26 cu yd waste abatement x $6.26/yd = $162 cost reduction. However, due to implementation of this measure alone, no change was made in the hospital's contracted hauling volume. The maintenance department has a considerable reduction in labor expense due to decrease in volume and weight of waste managed. Staff are responsible for washing out their own mugs, 1 minute /day. No staff changes.

CHANGE TO BULK MILK DISPENSER

Milk was served to patients in half-pint, plastic coated, gable top milk cartons. The containers composed a major element of food service's waste. Food service staff reduced this by changing to reusable cups and a bulk milk dispenser. An average of 205 milk cartons were thrown out each day, 74,825 each year.

Volume of waste avoided:1.9 cu yds/yr: 7% volume reduction
SINGLE-USE: One 8 oz carton takes 17 cu in x 74,825/yr = 1,272,025 cu in/yr. Cartons are plastic coated cardboard, not locally recyclable. Actual disposal volume is greater than stacked volume used here.
BULK CONTAINER: One 3-gallon (128-oz) container measures 11.5" x 8.25" x 8" = 759 cu in. Plastic liner separates from cardboard box, cardboard is locally recyclable. 8 oz x 74,825 = 598,600 oz/yr, ÷ 128 oz/gal = 4,676.6 gal/yr, ÷ 3 gal/container = 1,559 containers. 759 cu in x 1,559 = 1,183,170 cu in/yr.
Reusable glass measures 3.25" dia x 3.25" high = 8.58 cu in ea. x 105 disposed/yr = 901 cu in/yr
Single-use lid measures 3.25" dia x .001" thick = .0026 cu in ea. x 205 used/day x 365 = 195 cu in/yr; 60% increase in disposal volume observed, 60% x 195 = 117, + 195 = 312 cu in disposal volume/yr
Net: carton use, 1,272,025 cu in/yr - Bulk use (1,183,170 + 901 + 312) = 87,642 cu in/46,656 cu in/cu yd = 1.88 cu yd, 6.89%
The cardboard is recycled but 59,158 cu in of currently non-recyclable plastic remains. Because the cardboard of the bulk containers is locally recyclable while the cartons are not, 26 cu yds/yr, a 95% volume reduction, is kept from the dumpsters through the use of bulk milk.

Weight of waste avoided: 740 lbs/yr: 32% weight reduction
SINGLE-USE: One 8-oz carton weighs .5 oz x 74,825/yr = 37,415 oz, ÷ 16 oz/lb = 2,338 lbs/yr.
BULK CONTAINER: One 3-gallon (128-oz) container weighs .81 lbs of cardboard and .015 lb of plastic for a total of .825 lbs, x 1,559 containers/yr = 1,286 lbs/yr.
Reusable glass weighs 2.1 oz ea., 205 used, life 2 yrs = 103 disposed/yr. 103 x 2.1 oz = 216 oz ÷ 16oz/lb = 13.5 lbs/yr
Single-use glass cover weighs .20 lb for 50, 205 used/day 365 = 74,825/yr ÷ 50 = 1,497, x .20 lb = 299 lbs/yr
Net: 2,338 lbs/yr - 1,286 -13.5 - 299 = 739.5 pounds prevented, ÷ 2,338 lbs = 31.6% weight reduction due to source reduction.
Because virtually all of the weight of the bulk milk containers is recycled, the change represents a 99% disposal weight reduction due to recyclability.

Cost: A $98/yr increase: 1% cost increase
SINGLE-USE: Cost 12¢ a carton x 74,825/yr = $8,979/yr
BULK CONTAINER: One 3-gallon (384-oz) container costs 11.6 cents/serving; 74,825 servings ÷ 48 = 1,559 3 gal containers/yr, x $5.57 = $8,683/yr. The dispenser furnished by the milk distributor
Reusable glasses cost $48/case, 80 to a case or 60¢ ea., 205 used/day. Two year life; 103 x .60 = $62/yr
Single-use cup lids are used to cover glasses, $9.15 a case of 3,000 = .00305¢ ea x 205 used/day = .62¢ x 365 = $228/yr
Washing, soap, water and energy use for 8 additional racks run/day = $104/yr
Net: $8,683 + $62 + $228 + $104 = $9,077/yr
$8,979 for cartons - $9,077 for bulk = -$98, a 1% cost increase

INDIRECT COSTS: Because the hospital's recyclable material is picked up without charge and the bulk milk container is recyclable, 26 cu yds of waste is not disposed. 26 cu yd x $6.25 cu yd = $162/yr savings, however implementation of this measure alone did not result in a decrease in contracted hauling volume for the facility. Labor handling 75,000 cartons is replaced by handling

1,600 three-gallon containers plus the 75,000 glasses and lids a year. More labor is spent using bulk milk; however the change was integrated by existing staff.

Issues: Bulk milk may be more cost effective at other facilities. Cartons usually range in price from 12 to 13 cents each. They are 12 cents for this facility. 3-gallon bulk can be less than $5.57 each.

CHANGE TO MILK POUCH

The cafeteria changed from 8 oz milk cartons to milk pouches. Staff punctures the self-sealing bag with a small straw before serving.

Volume of waste avoided: 6.2 cu yd/yr: 87% volume reduction

CARTONS: 50 cartons used/day x 365 = 18,250 cartons/yr x 17 cu in/carton = 310,250 cu in/yr. Straws are paper-wrapped, a box of 400 measures 9" x 5.5" x 6" = 279 cu in., 18,250 ÷ 400 = 45.6 boxes of straws/yr, x 279 cu in/box = 12,729 cu in/yr.
310,250 + 12,729 = 322,979 cu in/yr

PLASTIC POUCHES: 50 pouches used/day x 365 = 18,250 pouches/yr x 2.3 cu in = 41,975 cu in/yr. Straws are .056194 cu in ea. including packaging, 18,250 x .056194 = 1025.5 cu in/yr.
Net: 41,976 + 1026 = 43,002 cu in/yr
332,979 - 43,002 = 289,977 cu in/46,656 cu in/yd = 6.2 cu yd/yr, 87% volume reduction

Weight of waste avoided: 472 lbs/yr: 78% weight reduction

CARTONS: 18,250 cartons/yr at .5 oz = 9,125 oz/yr., 18,250 straws, 400 weigh 12.8 oz, 18,250 ÷ 400 = 45.6, x 12.8 oz = 584 oz., 9,125 + 584 = 9,708 oz/yr

PLASTIC POUCHES: 18,250 pouches/yr at .11 oz = 2,007 oz/yr., 18,250 straws, 400 weigh 3.3 oz, 18,250 ÷ 400 = 45.6, x 3.3 oz = 150 oz., 2007 + 150 = 2,157 oz/yr
Net: 9,708 - 2,157 = 7,551 oz ÷ 16 oz/lb = 472 lbs/yr.; 7,551 oz ÷ 9,708 oz = 77.8 % weight reduction

Cost savings: $276/yr: 12% cost reduction

CARTONS: Cost 12¢ each x 18,250 = $2,190; Straws cost $2.03 for 400, 18,250 ÷ 400 = 45.6, x $2.03 = $92.57/yr; $2,190 + $93 = $2,283 /yr

PLASTIC POUCHES: Cost 11¢ each x 18,250 = $2,007; Straws are included;
Net: $2,283 - $2007 = $276 /yr; $276 ÷ $2,283 = 12% cost reduction

INDIRECT COSTS: A reduction in disposal of 6.2 cu yd of waste x $6.25 = $39/yr. Contracted hauling volume was not changed for the facility due to implementation of this measure alone. More pouches fit into a smaller space in the walk-in cooler, more efficiently using space. No appreciable labor change for dietary department. Due to less waste, there is a labor savings for the custodial department. No staff changes.

REUSABLE DECUBITUS CARE MATTRESSES

"Egg-crate" mattresses are designed to distribute pressure so that decubitus ulcers do not develop on patients' skin. Typical egg-crate mattresses cannot be reused by another patient. The reusable mattresses accomplish the same goal but create much less waste, do not require mattress pads and save money.

Volume of waste avoided: 43 cu/yds: 97% volume reduction
SINGLE USE: 26 cases of 12 thrown out each year = 312; 30" x 80" x 2.75" ea = 6,600 cu" x 312 used/yr = 2,059,200 cu"/yr

REUSABLE: The dense foam decubitus-care insert is warranted for 5 years. They measure 27" x 72" x 3.25" = 6,318 cu in. Eight were purchased to serve the average need. Standard egg-crate mattresses will be used if need exceeds supply of reusable. Over time, the hospital will replace all standard mattresses with reusable, Bio Gard Therapeutic Mattresses. To be conservative, a 1-year life was assigned to the decubitus care component of the mattress, even though it is warranted for 5 years.
8 needed ÷ 1 year life = 8 /yr, x 6,318 cu" ea = 50,544 cu"/yr. Only the volume of the decubitus-care insert and single-use egg-crate overlay are used for calculations. Note: The whole Bio Gard mattress has replaceable components, so disposal volume is likely to be less than that of a whole, standard mattress.
Net: 2,059,200 - 55,544 = 2,003,656 cu" ÷ 46,656 cu"/cu yd = 42.9 cu yd/yr; 2,003656 ÷ 2,059,200 = 97% volume reduction.

Weight of waste avoided: 601 lbs: 96% weight reduction
SINGLE-USE: 2 lb x 312 = 624 lb
REUSABLE: 2.8 lb for decubitus care portion x 8 /yr = 22.4 lb
624 - 23 = 601 lb/yr; 601 ÷ 624 = 96% weight reduction

Cost savings, not including avoided disposal fees: $879 /yr: 62% cost reduction /yr
SINGLE-USE: Cost $4.56 ea x 312/yr = $1,423 /yr
REUSABLE: Cost of entire mattress $230 each x 8 = $1,840 ÷ 5 yr life = $368 /yr; Cost of inserts, $22 ea x 8/yr = $176 /yr
Net: $1,423 - ($368 + $176) = $879 cost reduction; $879 ÷ $1,423 = 62% cost reduction

INDIRECT COSTS: Volume and weight waste reduction results in lower disposal costs, (43 cu yd x $6.25/yd = $269); however contracted hauling volume was not decreased due to implementation of this measure alone. Purchasing and maintenance departments. have decreased labor demand because of the change. No staff changes resulted, however, so overall labor costs for the hospital did not change. The reusable decubitus-care mattress does not require use of mattress pads. When all old-style mattresses are eventually changed over, the change will result in an additional $2,445 /yr savings, the current cost of using underpads.

REUSABLE DIAPERS

Although the hospital supported this action, implementation was delayed. Several styles of reusable diapers were considered; however, commercial reusable diapers that would hold up to the hospital's laundry procedures, did not stain with meconium and were consistent in preventing leakage were not found. The hospital is continuing its search for a reusable diaper.

REUSABLE SOUP BOWLS

The dietary department is phasing in the use of reusable table ware over time. This is done to assure that existing staff can integrate the changes. The change to reusable bowls from single-use ones looks functional at this point, and implementation is expected to take place.

REINK PRINTER RIBBONS

Reinking of ribbons and remanufacture of photocopy and printer cartridges was identified as a viable source reduction measure. The hospital is currently researching remanufactures and expects savings of 33 to 50% over current costs.

SENIOR CITIZENS MAKE USE OF OLD ELECTRONIC EQUIPMENT

The hospital collects from others and also gives its own old electronic equipment to nursing home residents who disassemble, sort and recycle the components. Though this use of old electronic equipment results in the end of its functional life, reuse of the equipment in this way gives valued activity to the residents and accomplishes recycling of the components.

In ADDITION, the hospital has had these source reduction measures in place:

REUSABLE BED PANS

REUSABLE EMESIS BASINS

REUSABLE MALE URINAL BASINS

REUSABLE PATIENT EATING UTENSILS

REUSABLE STERILIZATION TRAYS

DOUBLE-SIDED PHOTOCOPYING

REUSABLE ISOLATION AND SURGICAL GOWNS

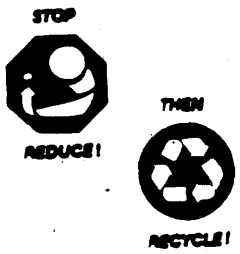
ADDITIONALLY:

As a result of the hospital's source ***reduction and recycling*** efforts, contracted garbage hauling services were decreased from one 6 cu yd dumpster 5 times a week to 2 times a week. This is a 60% decrease in contracted garbage hauling service volume. Yearly garbage hauling expense decreased $5,244.

All changes took place without additions to hospital staff. In fact, after implementing their integrated waste management program the hospital eliminated two staff positions in the maintenance department.

As a result of reduction actions alone, the hospital is preventing ***238 cubic yards*** and over ***10,700 pounds*** of waste. Not including the savings from avoided disposal fees, these actions result in a ***$11,030 yearly cost savings for the hospital.***

When the $5,244 hauling expense savings due to implementation of reduction and recycling is added to the $11,030 savings due to reduction, the ***total savings for the hospital is over $16,270*** each year.



4-1992

APPENDIX B-4

MPCA Air Quality Letter

DEPARTMENT : POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE : February 18, 1992

TO : Air Quality Committee Members

AUG 1

FROM : Lisa J. Thorvig mjt 2/18/92 for
Division Manager
Air Quality Division

PHONE : 296-7331

SUBJECT : **COMPLIANCE DEMONSTRATION OF HOSPITAL INCINERATORS**

The Air Quality Division recently completed a study entitled REPORT ON THE ASSESSMENT OF OPERATION AND EMISSIONS OF ON-SITE MEDICAL WASTE INCINERATORS. This study was first presented before the Minnesota Pollution Control Agency (MPCA) Air Quality Committee on November 25, 1991. The study examined air and ash emissions from non-metropolitan hospital incinerators with capacities of less than 200 pounds per hour. These incinerators were equipped with afterburners, with no other pollution control devices present. All had undergone pretest maintenance.

One of the findings of this study was that the three incinerators tested all violated existing Minnesota rules for air emissions. Minnesota currently regulates incinerator opacity and particulate matter [Minn. Rules pts. 7005.0610 and 7005.0620]. Two of the incinerators tested were in violation of the opacity standard and two were in violation of the particulate matter standard.

Based on these results, MPCA staff concludes that most hospital incinerators operating without pollution control equipment are likely to be in violation of existing Minnesota air emission rules. MPCA staff proposes to contact all hospitals operating incinerators and inform them that they must either demonstrate compliance with Minnesota rules or cease operation.

Although all compliance demonstrations ultimately would require emissions testing (ballpark cost = $5000 per hospital), compliance could be achieved by more than one method. Some hospitals might be able to meet emission limits through waste reduction and good combustion practices. Others might need, or opt, to upgrade their incinerator equipment prior to emissions testing. These options (and their proposed timelines) are illustrated graphically on the attached page.

Upgrading is complicated due to the fact that Minnesota will be promulgating new air quality rules, most likely before the year is over. Hospitals choosing to upgrade their incinerator would be required to satisfy not only the existing air quality rules but the proposed rules as well. Unfortunately, since the proposed rules are not yet in effect, facilities would be aiming at a moving target. Therefore, MPCA staff proposes that hospitals choosing to upgrade would be issued a five-year permit from MPCA, enabling them to operate at emission levels as proposed in the draft rules for those first five years.

Within 180 days of written MPCA notification, hospitals would submit to MPCA staff either their demonstration of compliance, their permit application to upgrade, or their notice of discontinued operation. Those opting to discontinue operation would provide an updated infectious waste management plan to both MPCA and the Minnesota Department of Health.

Included in the MPCA written notification would be copies of both the existing and proposed incinerator rules. Hospitals would be informed that existing incinerators which pass tests for current emission limits might be required to test and demonstrate compliance with the new rules, once these rules are in effect. Also included in the letter would be an invitation to participate in a meeting of hospitals, hosted by MPCA, to address issues and concerns surrounding the compliance requirements.

MPCA's first mailing would be to the largest one-third of the hospitals in the state. The second and third mailings would be to the middle and smallest hospitals, respectively. The mailings would be separated by 60 days.

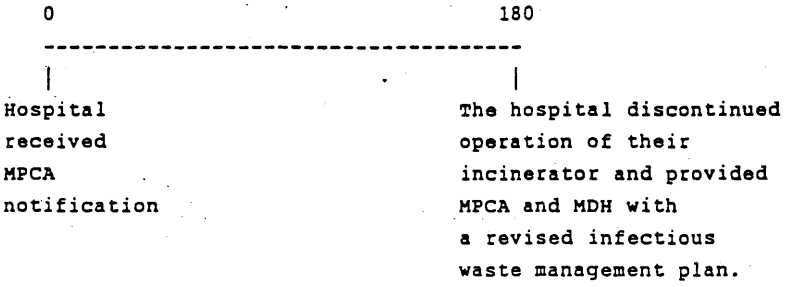
LJT:PJT:kjg

Attachment

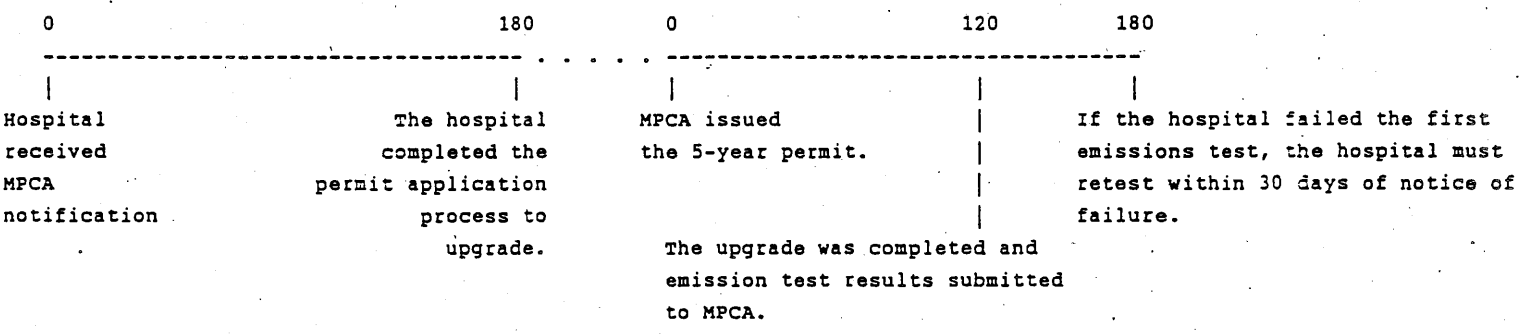
TIME LINES FOR HOSPITAL INCINERATOR COMPLIANCE DEMONSTRATION

Shown below are three possible paths for hospitals to follow in order to meet Minnesota air emission rules. Times are in days.

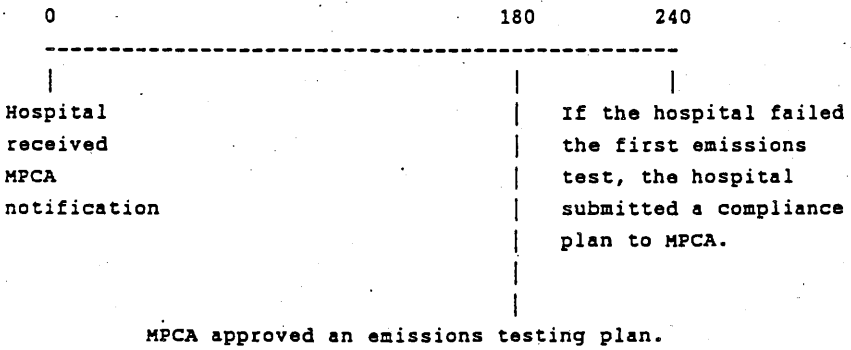
Scenario #1: SHUT DOWN THE INCINERATOR



Scenario #2: UPGRADE THE INCINERATOR TO PROPOSED EMISSION STANDARDS



Scenario #3: TEST THE EXISTING INCINERATOR TO MEET CURRENT EMISSION STANDARDS



The Air Quality Division of the Minnesota Pollution Control Agency sent letters on April 2, 1992, to the following hospitals, notifying them that they had 180 days to demonstrate compliance with Minnesota Rules on incineration.

FACILITY	CITY
NAEVE HOSPITAL	ALBERT LEA
DOUGLAS COUNTY HOSPITAL	ALEXANDRIA
SAINT OLAF HOSPITAL	AUSTIN
NORTH COUNTRY REGIONAL HOSP.	BEMIDJI
SAINT JOSEPH MEDICAL CENTER	BRAINERD
SAINT FRANCIS MEDICAL CENTER	BRECKENRIDGE
FAIRVIEW RIDGES HOSPITAL	BURNSVILLE
HEALTHONE MERCY HOSPITAL	COON RAPIDS
ST LUKES HOSPITAL	DULUTH
ST MARYS MEDICAL CENTER	DULUTH
MILLER DWAN HOSP & MED CENTER	DULUTH
FAIRVIEW-SOUTHDALE HOSP	EDINA
RICE COUNTY DIST 1 HOSPITAL	FARIBAULT
LAKE REGION HOSPITAL	FERGUS FALLS
HEALTHONE UNITY HOSPITAL	FRIDLEY
GOLDEN VALLEY HEALTH CENTER	GOLDEN VALLEY
ITASCA MEDICAL CENTER & C&NC	GRAND RAPIDS
MESABI REGIONAL MEDICAL CENTER	HIBBING
IMMANUEL-ST JOSEPHS HOSP	MANKATO
ST JOHNS NORTHEAST COMM HOSP	MAPLEWOOD
ST MARYS HOSPITAL	MINNEAPOLIS
FAIRVIEW RIVERSIDE HOSPITAL	MINNEAPOLIS
MINNEAPOLIS CHILDREN'S MED.CTR	MINNEAPOLIS
ABBOTT NORTHWESTERN HOSPITAL	MINNEAPOLIS
HENNEPIN COUNTY MEDICAL CTR	MINNEAPOLIS
UNIV. OF MN. HOSPITAL & CLINIC	MINNEAPOLIS
METHODIST HOSPITAL	MINNEAPOLIS
METROPOLITAN/MT SINAI MED. CTR	MINNEAPOLIS
SAINT ANSGAR HOSPITAL	MOORHEAD
ST JOHN'S REGIONAL HEALTH CTR.	RED WING
NORTH MEMORIAL MEDICAL CENTER	ROBBINSDALE
ROCHESTER METHODIST HOSP	ROCHESTER
ST MARYS HOSPITAL	ROCHESTER
ST FRANCIS REGIONAL MED CTR	SHAKOPEE
DIVINE REDEEMER MEM HOSP	SO ST PAUL
ST CLOUD HOSPITAL	ST CLOUD
BETHESDA LUTHERAN HOSPITAL	ST PAUL
ST JOSEPHS HOSPITAL	ST PAUL
ST PAUL RAMSEY MEDICAL CENTER	ST PAUL
MIDWAY HOSPITAL	ST PAUL
CHILDREN'S HOSPITAL	ST PAUL
UNITED HOSPITAL & NH	ST PAUL
LAKEVIEW MEMORIAL HOSPITAL	STILLWATER
NORTHWEST MEDICAL CENTER	THIEF RIVER FALLS
RIDGEVIEW MEDICAL CENTER	WACONIA
RICE MEMORIAL HOSPITAL	WILLMAR
COMMUNITY MEMORIAL HOSPITAL	WINONA

The Air Quality Division of the Minnesota Pollution Control Agency sent letters on April 14, 1992, to the following hospitals, notifying them that they had 240 days to demonstrate compliance with Minnesota Rules on incineration.

FACILITY	CITY
RIVERWOOD HEALTH CARE CENTER	AITKIN
CLEARWATER CO MEMORIAL HOSP.	BAGLEY
UNITED HOSPITAL DISTRICT	BLUE EARTH
HEALTHONE BUFFALO HOSPITAL	BUFFALO
MEMORIAL HOSPITAL	CAMBRIDGE
CHISAGO HEALTH SERVICES	CHISAGO CITY
COMMUNITY MEM HOSP	CLOQUET
RIVERVIEW HOSPITAL & NSG HOME	CROOKSTON
CUYUNA REGIONAL MEDICAL CENTER	CROSBY
ST MARYS REGIONAL HEALTH CTR.	DETROIT LAKES
ELY BLOOMENSON COMM HOSP	ELY
FAIRMONT COMM HOSPITAL	FAIRMONT
S.SUB.MED.CTR & SANFORD MEM NH	FARMINGTON
DISTRICT MEMORIAL HOSPITAL	FOREST LAKE
FOSSTON MUN HOSPITAL & HOME	FOSSTON
GLENCOE AREA HEALTH CENTER	GLENCOE
HOLY TRINITY HOSPITAL	GRACEVILLE
KITTSON MEMORIAL HOSPITAL	HALLOCK
REGINA MEDICAL COMPLEX	HASTINGS
HUTCHINSON COMMUNITY HOSPITAL	HUTCHINSON
FALLS MEMORIAL HOSPITAL	INTERNATIONAL FALLS
LAKE CITY HOSPITAL	LAKE CITY
MEEKER CO MEM HOSP	LITCHFIELD
ST GABRIELS HOSPITAL	LITTLE FALLS
LUVERNE COMMUNITY HOSPITAL	LUVERNE
WEINER MEM MEDICAL CTR	MARSHALL
FAIRVIEW MILACA HOSPITAL	MILACA
SHRINERS HOSPITAL	MINNEAPOLIS
CHIPPEWA CO MONTEVIDEO HOSP	MONTEVIDEO
MONTICELLO BIG LAKE COMM HOSP	MONTICELLO
MERCY HOSPITAL + C+NC	MOOSE LAKE
KANABEC HOSPITAL	MORA
STEVENS CO MEMORIAL HOSP	MORRIS
QUEEN OF PEACE HOSPITAL	NEW PRAGUE
SIOUX VALLEY HOSP	NEW ULM
NORTHFIELD CITY HOSPITAL	NORTHFIELD
RENVILLE COUNTY HOSPITAL	OLIVIA
HEALTH ONE OWATONNA HOSPITAL	OWATONNA
ST JOSEPHS HOSPITAL	PARK RAPIDS
PIPESTONE COUNTY MEDICAL CNT	PIPESTONE
FAIRVIEW PRINCETON HOSPITAL	PRINCETON
REDWOOD FALLS MUN HOSP	REDWOOD FALLS
OLMSTED COMM HOSPITAL	ROCHESTER
ROSEAU AREA HOSPITAL	ROSEAU
ST MICHAELS HOSPITAL & NH	SAUK CENTRE
MURRAY COUNTY MEM HOSP	SLAYTON
COMMUNITY MEM HOSP + C+NC	SPRING VALLEY
GILLETTE CHILDREN'S HOSPITAL	ST PAUL
ST PETER COMM. HOSP. & H.C.C.	ST PETER
UNITED DISTRICT HOSP & HOME	STAPLES

TRACY MUNICIPAL HOSPITAL	TRACY
VIRGINIA REG MED CTR & NH	VIRGINIA
TRI-COUNTY HOSPITAL	WADENA
WARREN COMMUNITY HOSPITAL,INC.	WARREN
WASECA AREA MEMORIAL HOSP	WASECA
WHEATON COMMUNITY HOSPITAL	WHEATON
WINDOM AREA HOSPITAL	WINDOM
WORTHINGTON REGIONAL HOSP	WORTHINGTON

The Air Quality Division of the Minnesota Pollution Control Agency sent letters on April 14, 1992, to the following hospitals, notifying them that they had 300 days to demonstrate compliance with Minnesota Rules on incineration.

FACILITY	CITY
ADA MUNICIPAL HOSPITAL & C&NC	ADA
ARNOLD MEM HOSPITAL	ADRIAN
ALBANY AREA HOSPITAL	ALBANY
APPLETON MUNICIPAL HOSPITAL	APPLETON
ARLINGTON MUNICIPAL HOSPITAL	ARLINGTON
WHITE COMMUNITY HOSPITAL	AURORA
LAKEWOOD HEALTH CENTER	BAUDETTE
SWIFT COUNTY-BENSON HOSPITAL	BENSON
NORTHERN ITASCA HOSP DIST	BIGFORK
THE LUTH HOSP & HOME-CALEDONIA	CALEDONIA
CANBY COMMUNITY HEALTH SERV.	CANBY
CANNON FALLS COMM HOSPITAL	CANNON FALLS
COMFREY HOSPITAL	COMFREY
COOK COMMUNITY HOSP	COOK
JOHNSON MEMORIAL HOSP & HOME	DAWSON
COMM MEM HOSP & HOMESTEAD NH	DEER RIVER
GRANT CO HOSPITAL	ELBOW LAKE
EVELETH FITZGERALD COMM HOSP	EVELETH
GLACIAL RIDGE HOSPITAL	GLENWOOD
COOK CO NORTHSHORE HOSP & C&NC	GRAND MARAIS
MUNICIPAL HOSP & GRANITE MANOR	GRANITE FALLS
GREENBUSH COMMUNITY HOSPITAL	GREENBUSH
HARMONY COMMUNITY HOSPITAL	HARMONY
HENDRICKS COMM HOSP	HENDRICKS
HERON LAKE MUN HOSP & C&NC	HERON LAKE
DIVINE PROVIDENCE HOSP + HOME	IVANHOE
JACKSON MUNICIPAL HOSP	JACKSON
KARLSTAD MEMORIAL HOSP	KARLSTAD
LAKEFIELD MUNICIPAL HOSP	LAKEFIELD
MINNESOTA VALLEY MEM HOSP	LE SUEUR
LONG PRAIRIE MEM HOSP + C+NC	LONG PRAIRIE
MADELIA COMMUNITY HOSPITAL	MADELIA
MADISON HOSPITAL	MADISON
MAHNOMEN CO & VILLAGE HOSP	MAHNOMEN
MELROSE HOSP & PINE VILLA	MELROSE
MOUNTAIN LAKE COMM HOSP	MOUNTAIN LAKE
MILLE LACS HOSPITAL & HOME	ONAMIA
ORTONVILLE MUN HOSP	ORTONVILLE
PARKERS PRAIRIE DIST HOSP	PARKERS PRAIRIE
PAYNESVILLE COMMUNITY HOSP	PAYNESVILLE
PELICAN VALLEY HEALTH CENTER	PELICAN RAPIDS
PERHAM MEMORIAL HOSP & HOME	PERHAM
LAKESIDE MEDICAL CENTER	PINE CITY
RUSH CITY HOSPITAL	RUSH CITY
NORTH PINE AREA HOSPITAL DIST.	SANDSTONE
SLEEPY EYE MUNICIPAL HOSPITAL	SLEEPY EYE
TWEETEN/LUTHERAN HEALTH C. C.	SPRING GROVE
SPRINGFIELD COMMUNITY HOSP	SPRINGFIELD
WATONWAN MEMORIAL HOSPITAL	ST JAMES
MINNEWASKA DISTRICT HOSP	STARBUCK

TRIMONT COMMUNITY HOSP	TRIMONT
LAKEVIEW MEMORIAL HOSPITAL	TWO HARBORS
AL VADHEIM MEMORIAL HOSPITAL	TYLER
ST ELIZABETH HOSPITAL	WABASHA
WELLS HOSPITAL	WELLS
DR HENRY SCHMIDT MEM HOSP	WESTBROOK
ZUMBROTA COMMUNITY HOSPITAL	ZUMBROTA

APPENDIX D-1

MDH Memo to Generators
October, 1989

Appendix V

minnesota department of health
717 s.e. delaware st. p.o. box 9441 minneapolis 55440
(612) 623-5000

MEMORANDUM

DATE: October 16, 1989

TO: Potential Infectious Waste Generators and Other Interested Persons

FROM: Sheila Brunelle, Coordinator of Infectious Waste Control SB

SUBJECT: Infectious Waste Generator Management Plans

In May 1989, the Minnesota Legislature enacted the Infectious Waste Control Act (Minn. Stat. §§116.75-.83 {Minn. Supp. 1989}) (Attachment 1). The Act regulates infectious waste handling from generation through disposal for all generators. The Act covers any person who generates, treats, stores, transports, or disposes of infectious or pathological waste except infectious or pathological waste generated by households, farm operations or agricultural businesses. Person means an individual, partnership, association, public or private corporation, or other legal entity, the United States Government, an interstate body, the State, and an agency, department, or political subdivision of the State. The Minnesota Department of Health (MDH) will focus on the generators of the infectious waste and the Minnesota Pollution Control Agency (MPCA) will focus on transportation, storage and disposal of the waste.

The Act defines a generator as a person whose activities produce infectious waste, which is defined as laboratory waste, blood, regulated body fluids, sharps, and research animal waste that have not been decontaminated (see Attachment 1). The Act requires generators of infectious and pathological waste to submit a generator's waste management plan (plan) for each facility and the fee to the MDH by January 1, 1990, and every two years thereafter. The fee must accompany the plan and be payable to the Treasurer, State of Minnesota. Facility means a site where infectious waste is generated, stored, decontaminated, incinerated, or disposed.

This is how the MDH is implementing the law at this time. We are notifying potential generators of their new responsibility under the Act. We request that all recipients of this mailing reply, whether or not they meet the definition of generator. Individuals who are part of a group practice are not required to develop their own management plan but all facilities and/or groups that generate infectious or pathological waste, as defined by the Act, are required to submit a plan. Each hospital may submit a single plan if it addresses the total facility, including ancillary services such as home health care services, hospice, and ambulance services, if applicable. This is appropriate as long as all services are rendered at one site and under one business entity, which is accountable for the plan, its development and implementation. Clinics under one business entity shall submit one plan for each separate location, rather than each individual practitioner submitting a plan. Separate individual practices, located in the same building, each being a separate business entity, are considered individual generators and each must submit a plan. Nongenerators and generators who practice at a facility that is developing a single facility wide management plan need only complete the relevant sections of Attachment 2. Facilities required to develop a plan, should complete Attachment 2 and proceed to develop a management plan according to the general guidelines of Attachment 3.

The plans submitted by January 1, 1990, will be developed and reviewed under the requirements of the Act. More specific regulations will be developed before the second generator's management plan is due on January 1, 1992.

If you have questions on the preparation of the generator's management plan, please contact your professional or trade association first. If you have additional questions please direct them in writing to Sheila Brunelle, Coordinator of Infectious Waste Control, Minnesota Department of Health, 717 Southeast Delaware Street - P.O. Box 9441, Minneapolis, Minnesota, 55440. The very short time available precludes our being able to handle individual calls at this time. If you have questions regarding transportation, storage, decontamination or disposal of infectious waste please contact Julie Marien Ketchum at the MPCA, see Attachment 4.

Appendix D

Attachment 2

NOTE: This form must be returned to MDH

INFECTIOUS WASTE CONTROL SURVEY SHEET

Relevant areas of this attachment must be filled out and returned to MDH by all recipients of this mailing. Recipients will determine if they are generators or nongenerators of infectious and pathological waste.

Name _____
Facility name _____ Occupation _____
(if applicable) _____ Type of facility _____
Street _____ Number of employees _____
City, state, zip _____ Phone (___) _____

If you or the facility you represent is not a generator of infectious and/or pathological waste as defined in the ACT, please state why this is so.

_____

_____

_____

If you are a generator of infectious and/or pathological waste as defined in the Act, but the facility (or facilities) you are associated with is developing a plan that is covering the infectious and/or pathological waste you generate, please complete the following information.

Name of the facility _____
Address _____ Zip code _____
City, State _____ Phone (___) _____
Name of the person developing the plan for the facility _____

If more than one facility is involved, please list the above information for each facility on a separate page and attach it to this form.

If you qualify for exemption because you are a nongenerator or are part of a named group(s), you need only fill in the top portion, sign and date this page and return it to the following address.

Minnesota Department of Health
Infectious Waste Control
925 Southeast Delaware Street - P.O. Box 59040
Minneapolis, Minnesota 55459-0040

Date: _____ Signature: _____

If you, or the facility you represent, is a generator of infectious and/or pathological waste as defined by the Act, please complete the following page and submit a generator's management plan with appropriate fee.

What types of waste are generated by the facility? (check all that apply)

Infectious waste	Pathological waste (human tissues and body parts)
___ Laboratory waste	___ removed accidentally
___ Blood	___ removed surgically
___ Regulated body fluids	___ removed during autopsy
___ Sharps	
___ Research animal waste	

Identify the types of infectious and pathological wastes decontaminated, sewered and/or incinerated on-site, if applicable. (check all that apply)

	Decontaminated	Sewered	Incinerated
Pathological waste	___	___	___
Laboratory waste	___	___	___
Blood	___	___	___
Regulated body fluids	___	___	___
Sharps	___	___	___
Research animal waste	___	___	___

Identify the types of untreated infectious and pathological waste that are transported off-site for disposal. (check all that apply)

___ Pathological waste
___ Laboratory waste
___ Blood
___ Regulated body fluids
___ Sharps
___ Research animal waste

Summarize (by weight, volume, or number and capacity of containers) the following categorical amounts, processed by the facility from October 1, 1988, to September 30, 1989. If the calendar year 1988 time period is more convenient, please use that data and so note.

	Infectious Waste	Pathological Waste	Sharps
Generated (total)			
Decontaminated on site			
Sewered			
Stored on site (maximum at any one time)			
Incinerated on site			
Disposed of (transported off site)			

Please proceed to Attachment 3 and development of the management plan

1 Oct. 1987

Attachment 3

GENERAL GUIDELINES FOR DEVELOPING AN INFECTIOUS WASTE MANAGEMENT PLAN

Part I - General Information

1. In general, the following will be generators of infectious and/or pathologial waste and required to develop a management plan: hospitals, clinics, physicians, podiatrists, chiropractors, dentists, nursing homes, board and care facilities, certain laboratories (including clinical, medical research, pharmaceutical, etc.), funeral homes, veterinarians, blood banks, infirmaries (including those located in colleges, universities, technical institutes, correctional facilities, regional treatment centers, and military installations), hospices, ambulatory outpatient surgical centers, community health services, ambulance services, renal dialysis services and medical schools.

2. Physicians, Dentists, Podiatrists, Chiropractors and Veterinarians (practitioners), please note: Since mailing lists are not available identifying which practitioners are in which clinics, group practices, etc., practitioners are being contacted individually. This makes it critical that all practitioners complete Attachment 2 identifying the name of the facility (or facilities) that is (are) developing the plan covering any infectious or pathological waste they may be generating.

3. Any facility developing a plan covering practitioners that are not developing an individual plan should identify each practitioner that is being covered by the plan.

4. If the facility generates infectious and/or pathological waste but disposes of all the waste or decontaminates the waste on-site before it is transported elsewhere for disposal, a plan is still required since the facility is a generator of infectious and or pathological waste.

5. Colleges, Universities, and Technical Colleges that provide health services to students, which generate infectious waste as defined in the Act, or generate infectious waste in educational laboratories, are required to develop a plan.

6. Corporations that generate infectious waste in research laboratories or employee health services are required to develop a plan.

Part II - Content of an Infectious Waste Generator Management Plan

NOTE: Since the generator's management plan is being developed and reviewed pursuant to the Act, please use the Act (Attachment 1) for definitions and as a guide.

ALSO NOTE: Standards are being developed by the MPCA for off-site storage; transportation and disposal; and packaging and labeling of infectious waste. The MPCA is also developing standards for treatment of infectious waste.

1. Name, address and phone number of the facility (business entity).

2. Name of person in charge of the facility.

3. What activities, programs and locations at and associated with the facility generate infectious or pathological waste.
   - The plan needs to cover all relevant departments or areas under the central administration of the program.

4. Identify the types of infectious and pathological waste that the person or facility generates.

   NOTE: Infectious waste means laboratory waste, blood, regulated body fluids, sharps, and research animal waste that have not been decontaminated. Pathological waste means human tissue and body parts removed accidentally or during surgery or autopsy intended for disposal (excluding teeth).

5. Describe the facility's procedures for segregating untreated infectious waste from other waste material at its point of generation.
   - Identify how solid waste is segregated from infectious waste; and liquid waste, sharps and other infectious or pathological waste from each other.

   NOTE: Once segregated, the infectious waste must be maintained in separate packaging throughout collection, storage and transportation.

6. Describe the facility's procedures in regards to the packaging of liquids, sharps and other infectious or pathological waste, if applicable.

   NOTE: The proposed MPCA rules require that infectious waste should be packaged in a container or containers in a manner that prevents release of the waste material, such as: rigid; leak resistant; impervious to moisture; sealed to prevent leakage during transport; and has strength sufficient to prevent tearing or bursting under normal conditions of handling. In addition, sharps and sharps with residual fluid should be in packaging that is puncture resistant and spill proof.

   NOTE: Reusable containers that have been in contact with infectious waste may be reused as long as they are disinfected prior to reuse.

7. Describe the facility's procedures for labeling all bags, boxes, and other containers used to collect, transport, or store infectious waste.

NOTE: The above must be labeled with a biohazard symbol or with the words "Infectious Waste" written in letters no less than one inch in height.

8. Describe the facility's procedures for collecting the infectious waste from the point of generation to the central collection point, prior to its transport off-site or its treatment or incineration on-site.

9. Describe the facility's procedures for storage of infectious and pathological waste; at temporary and central collection points.
   - List length of time infectious and pathological waste is stored on-site, by type of infectious or pathological waste.
   - Describe the difference in storage time or requirements for infectious and pathological waste that is treated or incinerated on-site from the infectious and pathological waste that is transported off-site for disposal/incineration, if applicable.
   - Identify the procedures in-place to protect the storage area from vermin or access by unauthorized persons.
   - Identify special storage conditions (time, temperature, etc.), if applicable.
   - If the facility stores infectious or pathological waste for any other facility, the plan should identify the type of waste and the facility.

NOTE: Collected infectious and pathological waste must be stored in a specially designated area that is designed to prevent entry of vermin and that prevents access by unauthorized persons.

10. If the facility does any decontamination of infectious waste on-site, the plan should identify the method used for each type of infectious waste treated, including the estimated volume of each type of waste decontaminated, on a monthly basis.

11. If the facility sewers blood or other regulated body fluids (cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid), the plan should identify which body fluids are generally disposed of in this manner, and the estimated volume of each, on a monthly basis.
   - If this method of disposal is utilized, are there restrictions as to volume or type of fluid so disposed?
   - If fluids are sewered, the plan should identify if it is generally done at the point of generation or at a central site.

12. If the facility incinerates infectious or pathological waste on-site, a separate management plan on the incinerator needs to be developed according to the requirements of the Minnesota Pollution Control Agency. For purposes of the generator's management plan to be submitted to the MDH, the following information is requested.
   - Identify the type, and quantity of each type, of infectious and pathological waste that is generated on-site and incinerated on-site on a monthly average.
   - If the facility incinerates infectious and pathological waste for other facilities, the plan should identify each of these facilities, the type of infectious or pathological waste received from each, and an estimate of the quantity of each type of waste incinerated, on a monthly average.
   - Indicate the size and type of the incinerator and the frequency of operation.

13. If the facility has infectious or pathological waste transported off-site for disposal, the plan needs to identify the commercial transporter or transporters.
    - Identify by company name, address and phone number each commercial transporter utilized by the facility and the type of infectious and pathological waste handled by each.
    - If intermediate facilities/transporters are utilized between initial transporter and final disposal, the plan needs to identify each facility/transporter by name, address and phone number.
    - Identify any relevant procedures involved in pickup and transporting the waste.

14. If the facility has any infectious or pathological waste disposed of off-site, the plan needs to identify the type of facility utilized, the method of disposal, the name, address and phone number of the disposal facility/facilities, with an estimated monthly average of the type of infectious waste or pathological waste disposed of at each disposal facility.

    NOTE: The proposed MPCA rules require that transporters can not accept infectious waste from generators unless the generator has an Infectious Waste Generator Management Plan.

15. Describe the steps that will be taken by the generating facility to minimize the exposure of employees to infectious agents throughout the process of handling infectious and pathological wastes; and the name and phone number of the individual responsible for the management of the infectious waste and pathological waste at the facility.
    - If the facility has developed a handout on employee safety, this can be referenced and attached to the plan.
    - The facility should identify the procedures and training provided to comply with the relevant OSHA Employee Right-to Know, training, personal protective equipment, immunization, etc., requirements.

16. The plan should identify a contingency system that could be utilized if the present infectious and pathological waste disposal system breaks down or is unavailable.

17. A copy of the plan must be kept at the facility.

18. The plan should contain a list of all the physicians, dentists, chiropractors, podiatrists, and veterinarians covered by the plan, if applicable.

19. The completed plan should be signed and dated by the person responsible for the facility.

20. The completed plan must be submitted with the applicable fee to the MDH by January 1, 1990.
    - The fee for facilities of less than 25 employees is $40.00.
    - The fee for facilities of 25 employees or above is $225.00.
    - The check should be written to the Treasurer, State of Minnesota.
    - Both plan and fee should be submitted to:

Minnesota Department of Health
Infectious Waste Control
925 Southeast Delaware Street - P.O. Box 59040
Minneapolis, Minnesota 55459-0040

- An acknowledgement will be sent to generators submitting a plan and fee.

APPENDIX D-2

MDH Memo to Generators
October, 1991

Minnesota Department of Health
Division of Environmental Health
925 Delaware Street Southeast
P.O. Box 59040
Minneapolis, MN 55459-0040
(612) 627-5100

MEMORANDUM

DATE: October 16, 1991

TO: Infectious Waste Generators and Other Interested Persons

FROM: Sheila Brunelle, Coordinator of Infectious Waste Control

SUBJECT: Infectious Waste Generator Management Plans

In May 1989, the Minnesota Legislature enacted the Infectious Waste Control Act (Minn. Stat. §§ 116.75-.83). The Act regulates infectious and pathological waste handling from generation through disposal for all generators. The Act covers any person who generates, treats, stores, transports, or disposes of infectious or pathological waste except infectious or pathological waste generated by households, farm operations or agricultural businesses. Person means an individual, partnership, association, public or private corporation, or other legal entity, the United States Government, an interstate body, the State, and an agency, department, or political subdivision of the State. The Minnesota Department of Health (MDH) regulates the generators of the infectious waste and the Minnesota Pollution Control Agency (MPCA) regulates the transportation, off-site storage and disposal of the waste.

The Act defines a generator as a person whose activities produce infectious waste, which is defined as laboratory waste, blood, regulated body fluids, sharps, and research animal waste that have not been decontaminated. The Act requires a generator of infectious and pathological waste to submit an infectious waste generator management plan (plan) for each facility (or a common management plan for all generating facilities owned and operated by the generator) and the fee to the MDH by January 1, 1992, and at least every two years thereafter. A generator does not include a person who produces sharps as a result of administering medication to oneself nor an ambulance service licensed under § 144.802, an eligible board of health, community health board, or public health nursing agency in a county with a population of less than 40,000, or a program providing school health services under § 123.35, subd. 17. The fee(s) are facility specific and must accompany the plan and be payable to the Treasurer, State of Minnesota. Facility means a site where infectious waste is generated, stored, decontaminated, incinerated, or disposed.

The Act was amended in 1990 and 1991 and those amendments affect the 1992 management plans. Two areas that affect many generators are the fee changes (see fee schedule) and the option for a generator to submit a common management plan to cover all generating facilities. A generator may submit: 1) an addendum to the previous management plan(s), as long as he/she attaches the completed practitioner or facility list (green or yellow sheet) included in this mailing; or 2) completed 1992 Infectious Waste Generator Plan forms (blue sheets) included in this mailing. A generator who receives more than one mailing from MDH may combine the mailings and submit them in one plan if all facilities are part of one controlling entity. If a generator incinerates infectious waste on-site, the generator must attach a copy of the incineration management plan prepared for the MPCA with the generator's management plan. A copy of the generator's management plan must be kept at each facility.

A generator who fails to submit a plan, fee, or manage infectious waste in accordance with the Act is subject to the remedies and penalties specified in Minn. Stat. §§ 115.071 and 116.072.

The plans submitted by January 1, 1992, will be developed and reviewed under the requirements of the Act. The MDH anticipates completing the rulemaking process in early 1992 but not in time for the January 1, 1992 submittal date.

If you have questions on the preparation of a generator's management plan, please contact Infectious Waste Control at (612) 627-5112.

FEE SCHEDULE

The following fee schedule has been established for 1992 Infectious Waste Management Plans. Note: All checks are payable to the **Treasurer, State of Minnesota**, and **must be submitted with the Management Plan.**

Practitioner Office (2 or fewer licensees)	$ 40.00
Practitioner Office (3 or more licensees) a $20.00 fee for each additional practitioner, above two licensees (physician, dentist, chiropractor, podiatrist, veterinarian, certified nurse practitioner, certified nurse midwife or physician assistant, employed by, under contract to, or working at the generating facility) up to a maximum total of $225.00.	$ 60.00-$ 225.00
Laboratory (including corporate research & development) with fewer than 10 generating employees	$ 225.00
Laboratory (including corporate research & development) with 10 - 49 generating employees	$ 450.00
Laboratory (including corporate research & development) with 50 or more generating employees	$ 600.00
Hospital (fewer than 50 licensed beds)	$ 225.00
Hospital (50 - 299 licensed beds)	$ 450.00
Hospital (300 or more licensed beds)	$ 600.00
Long Term Health Care Facility (Nursing Homes, Board & Care, or Intermediate Care) with less than 25 licensed beds	$ 40.00
Long Term Health Care Facility (Nursing Homes, Board & Care, or Intermediate Care) with more than 24 licensed beds	$ 225.00
Licensed Home Care Agency (2 or fewer generating employees)	$ 40.00
Licensed Home Care Agency (3 or more generating employees) a $20.00 fee will be required for each generating employee, up to a maximum total of $225.00	$ 60.00-$ 225.00
Mortuary	$ 40.00
Health Care Facility other than a hospital, long term care facility, or laboratory	$ 225.00
Generating facility that is not a health care facility or agency (corporate occupational health clinic; college or university campus, including its research laboratories and student health services but excluding a hospital	$ 40.00
Community Health Board (in a county with a population over 40,000)	$ 225.00
Migrant Health Services, Inc	$ 225.00
A generating satellite facility utilized less than five hours per week, or 260 hours per year	$ 00.00
Federal facilities, the Bureau of Indian Affairs, and State agencies	$ 00.00

Minn. Stat. §116.79, subd. 3(b)

A person shall submit for each generating facility the following fee with the generator's management plan:

(1) for a generating facility that is a private practice office with two or fewer physicians, dentists, chiropractors, podiatrists, veterinarians, certified nurse practitioners, certified nurse midwives, or physician assistants, employed by, under contract to, or working at the generating facility, a fee of $40;

(2) for a generating facility that is a private practice office with three or more physicians, dentists, chiropractors, podiatrists, veterinarians, certified nurse practitioners, certified nurse midwives, or physician assistants, employed by, under contract to, or working at the generating facility, in addition to the fee for two practitioners as prescribed under clause (1), a fee of $20 for each additional practitioner, up to a maximum total fee of $225;

(3) for a generating facility that is a health facility or agency other than a hospital or laboratory described in clause (5) or (6), a fee of $225. Long-term health care facilities,including nursing homes, boarding care facilities, or intermediate care facilities, with less than 25 licensed beds shall have a fee of $40. A corporate research and development laboratory with fewer than ten generating employees is also included in this category;

(4) for a generating facility that is not a health facility or agency, a fee of $40. Included in this category are a corporate occupational health clinic; or a college or university campus, including its research laboratories, and student health service, but not including a hospital;

(5) for a generating facility that is a laboratory, including a corporate research and development laboratory, with ten to 49 generating employees, or a hospital with 50 to 299 licensed beds, a fee of $450;

(6) for a generating facility that is a laboratory, including a corporate research and development laboratory, with 50 or more generating employees or a hospital with 300 or more licensed beds, a fee of $600;

(7) the following persons shall pay a fee of $225 to cover the generation at all its facilities:

(i) a community health board; or

(ii) Migrant Health Services, Inc.;

(8) for a generator with a generating satellite facility or mobile facility, that is used for an average of less than five hours per week on an annual basis, no additional fee is required;

(9) for a licensed home care agency with no more than two generating employees, a fee of $40;

(10) for a licensed home care agency with more than two generating employees, a fee of $20 for each generating employee, up to a maximum fee of $225; and

(11) the fees are waived for the Bureau of Indian Affairs, federal facilities, and state agencies.

1992

GENERATOR'S INFECTIOUS WASTE MANAGEMENT PLAN

A person may prepare a common management plan for all generating facilities owned and operated by the person. If a single plan is prepared to cover multiple facilities, the plan must identify common policy and procedures for the facilities and any management procedures that are facility specific. The plan must identify each generating facility covered by the plan (Minn. Stat. § 116.79 subd. 1 [a]).

List all generating facilities covered by this plan.

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

List all nongenerating facilities owned and operated by the generator (i.e., billing offices, nonembalming mortuaries).

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Describe what activities, programs and locations at and associated with the facility generate infectious or pathological waste).

_____
_____
_____
_____
_____
_____
_____
_____

Person responsible for the management of infectious waste_____
Phone number (_____)_____-_____

The management plan must describe, to the extent the information is applicable to the facility (Minn. Stat. § 116.79, subd. 1 [b]):

The type of infectious waste and pathological waste that the person generates or handles (Minn. Stat. § 116.79, subd. 1 [b][1]);

1. **Type of waste generated: (check all that apply)**

[ ] Laboratory Waste
[ ] Blood
[ ] Regulated Body Fluids
[ ] Sharps
[ ] Research Animal Waste
[ ] Pathological Waste

The **segregation, packaging, labeling, collection, storage,** and transportation procedures for the infectious waste or pathological waste that will be followed. (Minn. Stat. § 116.79, subd. 1 [b][2])

2. **Segregation.** All untreated infectious waste must be segregated from other waste material at its point of generation and maintained in separate packaging throughout collection, storage, and transport.

Describe the facility's procedure for segregation:

3. **Packaging.** Infectious waste must be packaged, contained, and transported in a manner that prevents release of the waste material (Minn. Stat. § 116.78, subd. 1).
Sharps must be placed in puncture-resistant containers (Minn. Stat. § 116.78, subd. 4).

Describe the facility's procedure for packaging:

4. **Labeling.** All bags, boxes, and other containers used to collect, transport, or store infectious waste must be clearly labeled with a biohazard symbol or with the words "infectious waste" written in letters no less than one inch in height (Minn. Stat. § 116.78, subd. 2).

Describe the facility's procedure for labeling:

5. **Collection.** Containers which have been in direct contact with infectious waste must be disinfected prior to reuse.
Infectious waste may not be compacted or mixed with other waste materials prior to incineration or disposal. Compaction is acceptable only if it is part of an infectious waste system, approved by the commissioner of health or the commissioner of the pollution control agency, that is designed to prevent exposure during storage, transportation, and disposal (Minn. Stat. § 116.78, subd. 3 and subd. 7).

Describe the facility's procedure for the collection of infectious and pathological waste within the facility:

6. **Storage.** Infectious and pathological waste must be stored in a specially designated area that is designed to prevent the entry of vermin and that prevents access by unauthorized persons (Minn. Stat. § 116.78, subd. 6).

Describe the facility procedure for storing infectious and pathological waste:

7. **Decontamination and disposal on-site.** The management plan must identify any method of decontamination of infectious or pathological waste that takes place on-site (Minn. Stat. § 116.79, subd. 1 [b][3]).

Decontamination method:

The management plan must identify the method used for any on-site disposal (Minn. Stat. § 116.79, subd. 1 [b][3]).

Disposal method:

8. **Incineration on-site.** A person who incinerates on-site must submit an attachment to the generator's management plan detailing the incinerating operation (Minn. Stat. § 116.79 subd. 4 [a]).

Do you incinerate on-site? [ ] Yes [ ] No

If yes, attach a copy of the management plan submitted to the Minnesota Pollution Control Agency to this management plan.

9. **Transporters and off-site disposal.** The management plan must identify the transporters and disposal facilities that will be used for the infectious waste (Minn. Stat. § 116.79, subd. 1 [b][4]).

Complete the appropriate information:

[ ] Self transported [ ] Transported by another generator

[ ] Commercial transporter

Name_____

Address_____City_____State_____

Phone Number (___) ___ - ____ Contact Person_____

Other transporters or storage facilities

Name_____

Address_____City_____State_____

Phone Number (___) ___ - ____ Contact Person_____

Disposal facility

Name_____

Address_____City_____State_____

Phone Number (___) ___ - ____ Contact Person_____

Contingency system _____

10. **Training program.** The management plan must identify the steps that will be taken to minimize the exposure of employees to infectious agents throughout the process of disposing of infectious or pathological wastes (Minn. Stat. § 116.79, subd. 1 [b][5]).

Do you provide annual Employee Right-To-Know training? [ ] Yes [ ] No

Date last offered ___/___/___

Describe and/or attach relevant information:

_____

_____

_____

_____

_____

_____

_____

Quantity. To the extent applicable to the facility, management plans must be accompanied by a statement of the quantity of infectious and pathological waste generated, decontaminated, stored, incinerated, or disposed of at the facility during the **previous two-year period**. Quantities must be reported in **gallons or pounds**. (Minn. Stat. § 116.79, subd. 1 [d])

Complete the following information for each generating facility stating whether gallons or pounds:

	Infectious Waste	Pathological Waste	Sharps
Generated (total)	_____	_____	_____
Decontaminated on-site	_____	_____	_____
Disposed of (sewered)	_____	_____	_____
Stored on-site (maximum at any one time)	_____	_____	_____
Incinerated on-site	_____	_____	_____
Disposed of (transported off-site)	_____	_____	_____

_____ (____)_____-_____
Signature of person responsible for the facility(ies) Phone Number

_____ ____/____/____
Title Date

APPENDIX D-3

MPCA Annual Report Forms

Minnesota Pollution Control Agency

Infectious Waste Annual Report

On-Site Incineration

Facility Name _____	**Responsible Person/Title** _____
Address _____	**Telephone Number** _____
_____	**Air Quality Permit#** _____
_____	**Incinerator Size** _____

Time Period of Report: **From** _____ **To** _____

1. Report the amount of Infectious Waste incinerated over the previous year. This will be for the year following the end date reported on your Management Plan. This information must be reported in pounds. If you are able to separate out the amount of sharps from total infectious waste, please do so in space provided.

Infectious Waste _____ lbs.	Sharps _____ lbs.

* Please attach copy of one page of your incinerator operating log.

2. If you accept other generators infectious waste for incineration, please report the following information.

Name	Address	MDH ID Number	Amount of Infectious Waste /Sharps

Minnesota Pollution Control Agency

Infectious Waste Annual Report

Commercial Transporter

Company Name _____	**Responsible Person/Title** _____
Address _____	**Telephone Number** _____
_____	**CT Registration Number** _____
DOT Registration _____	**Number of Vehicles** _____

Time Period of Report: **From** _____ **To** _____

1. Report the amount of Infectious Waste transported over the previous year. This will be for the year following the end date reported on your Management Plan. This information must be reported in pounds. If you are able to separate out the amount of sharps from total infectious waste, please do so in space provided.

Infectious Waste _____ lbs. Sharps _____ lbs.

2. List all destination facilities utilized over the previous year.

Name	Address	Telephone	Facility Type	Permit/Approval	Amount of Waste

Infectious Waste Annual Report

Decontamination/Disposal Facility

Company Name _____	**Responsible Person/Title** _____
Address _____	**Telephone Number** _____
_____	**Type of Facility** _____
_____	**Permit/License** _____

Time Period of Report: **From** _____ **To** _____

1. Report the total amount of Infectious Waste decontaminated over the previous year. This will be for the year following the end date reported on your Management Plan. This information must be reported in pounds. If you are able to separate out the amount of sharps from total infectious waste, please do so in space provided.

Infectious Waste _____ lbs. Sharps _____ lbs.

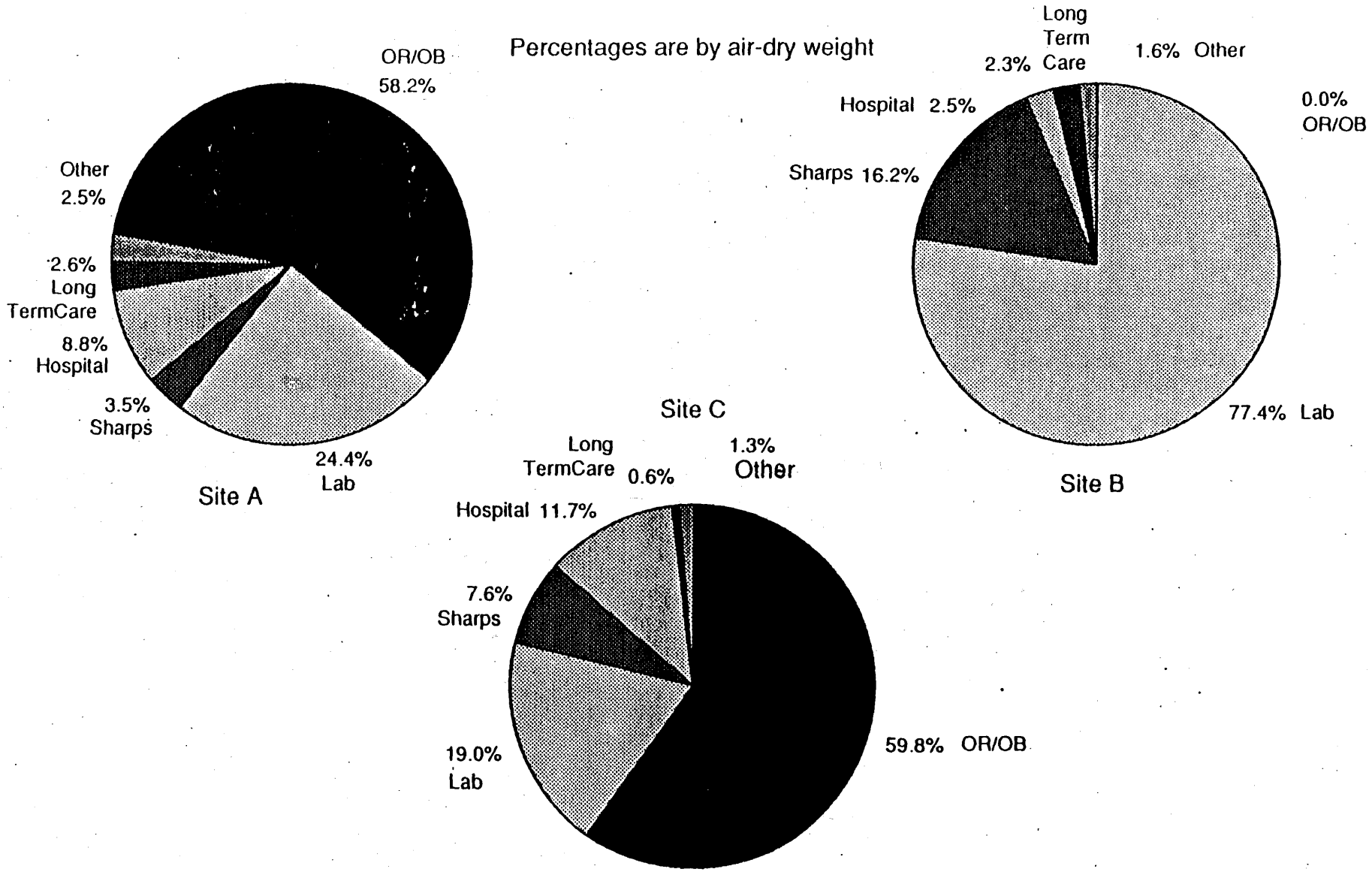
2. List all commercial transporters delivering infectious waste to your facility over the previous year.

Name	Address	Telephone	MN Registration Number	Amount of Waste

APPENDIX D-4

MPCA Waste Composition Pie Charts

source.delta



SOURCES OF HOSPITAL MEDICAL WASTE

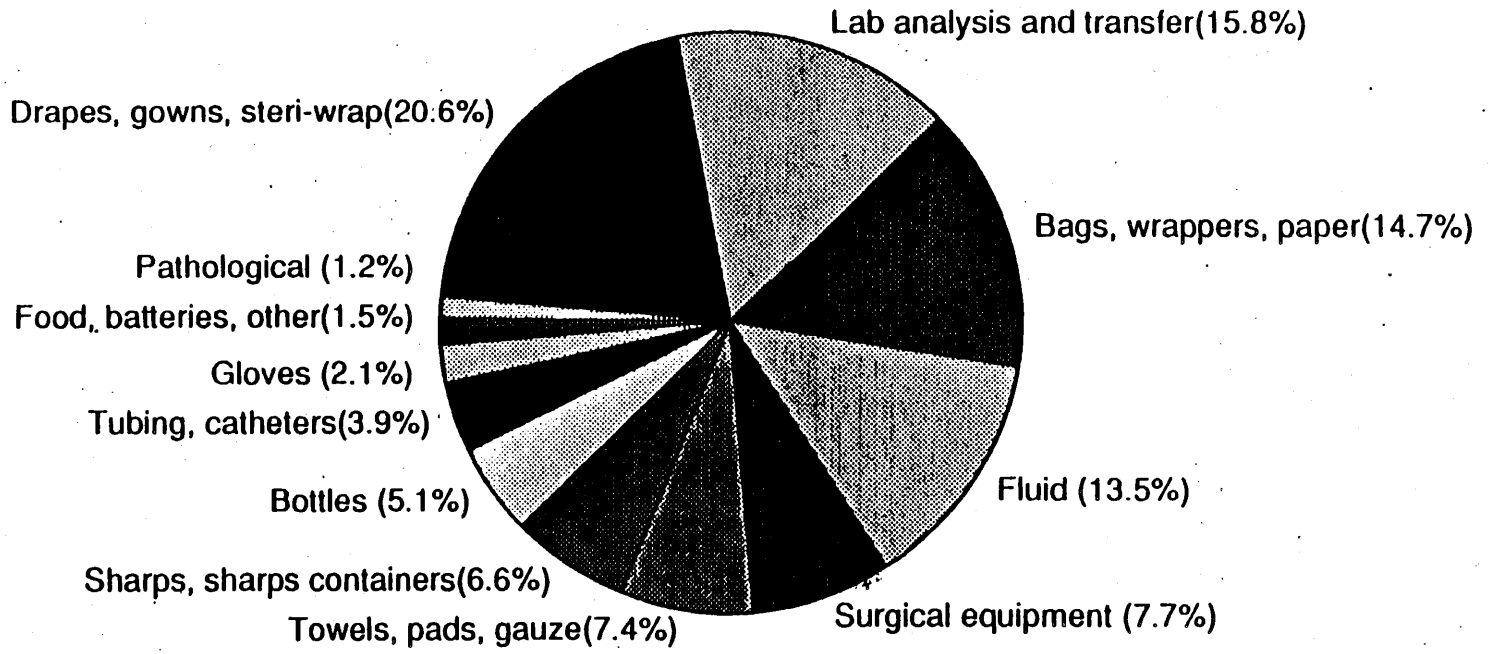
Figure III-8

item.delta

itemhosp.draw

These are items found in the waste stream of a hypothetical Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.

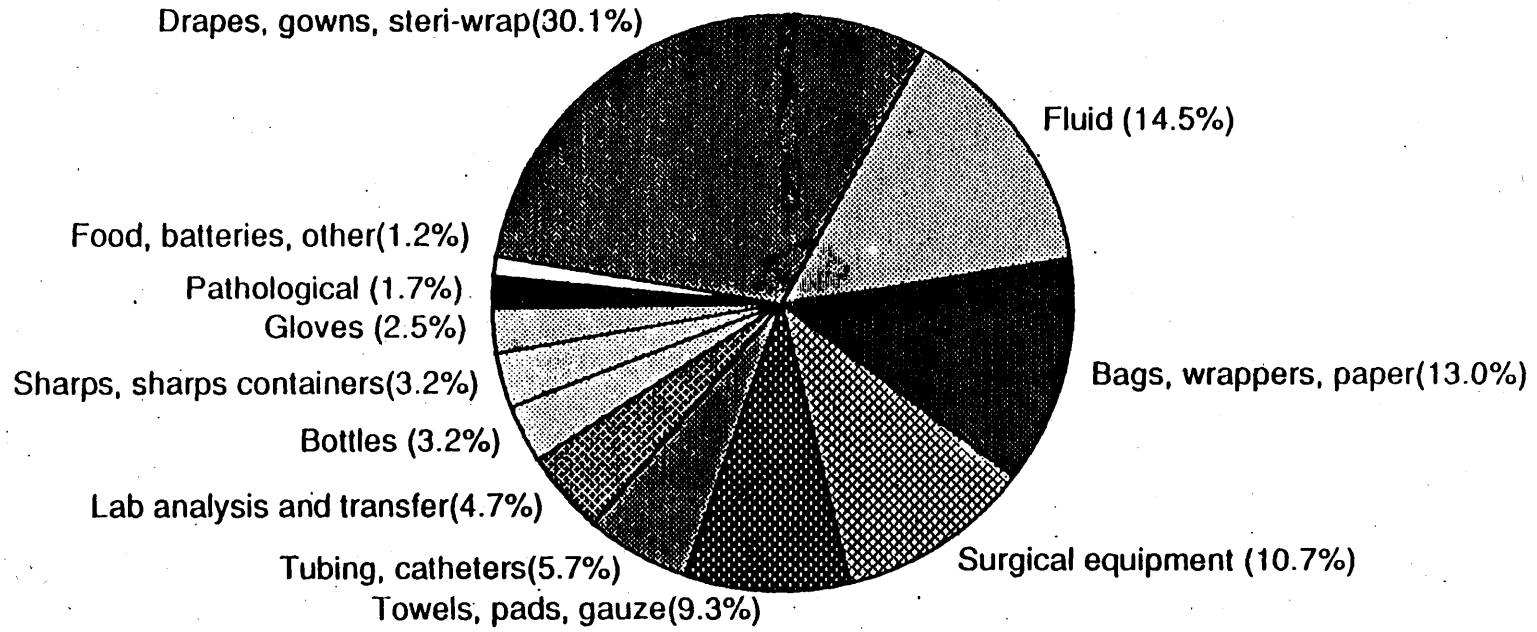
The waste stream is assumed to be composed of waste from only three sources: operating/delivery room (68%); laboratory (27%); and sharps containers (5%).



ITEMS FOUND IN TYPICAL HOSPITAL MEDICAL WASTE

Figure III-9

These are items found in the operating/delivery room waste stream from non-metropolitan hospitals.



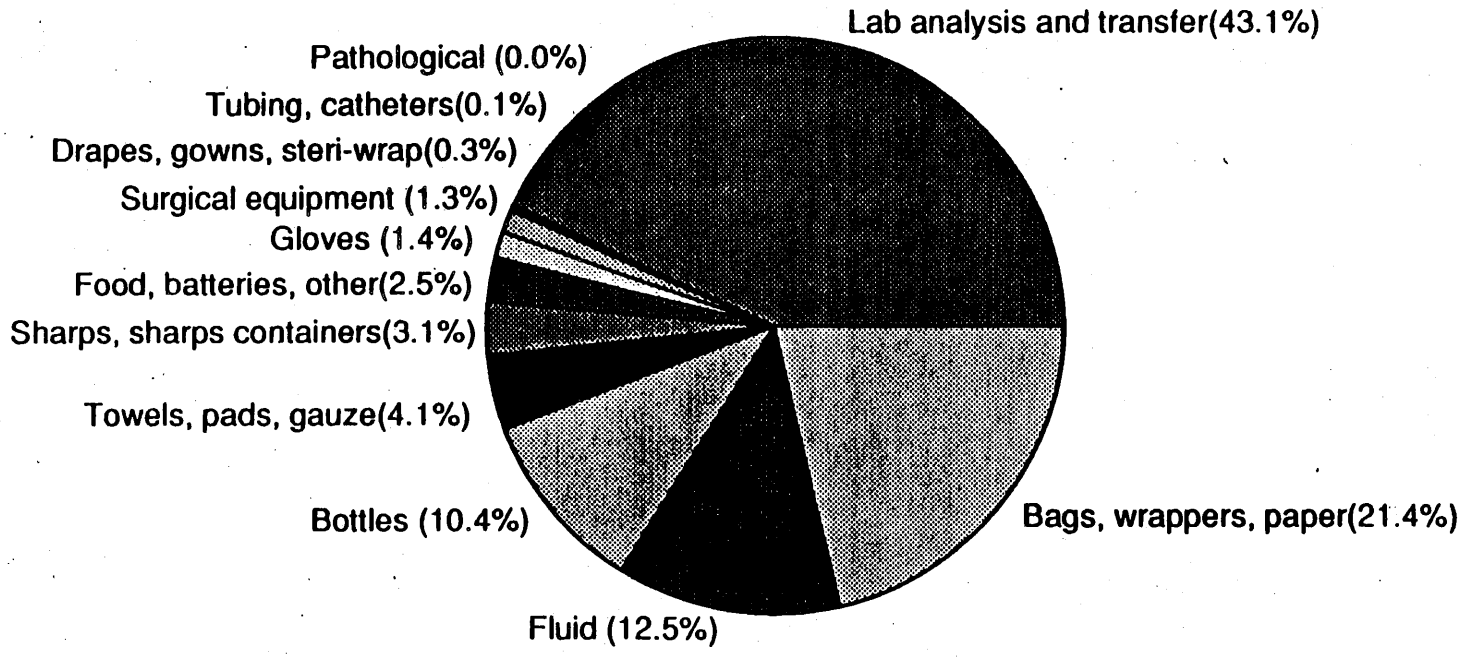
ITEMS FOUND IN HOSPITALOR/OB WASTE

Figure III-10

oritam draw

item.delta

These are items found in the laboratory waste stream from three Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.



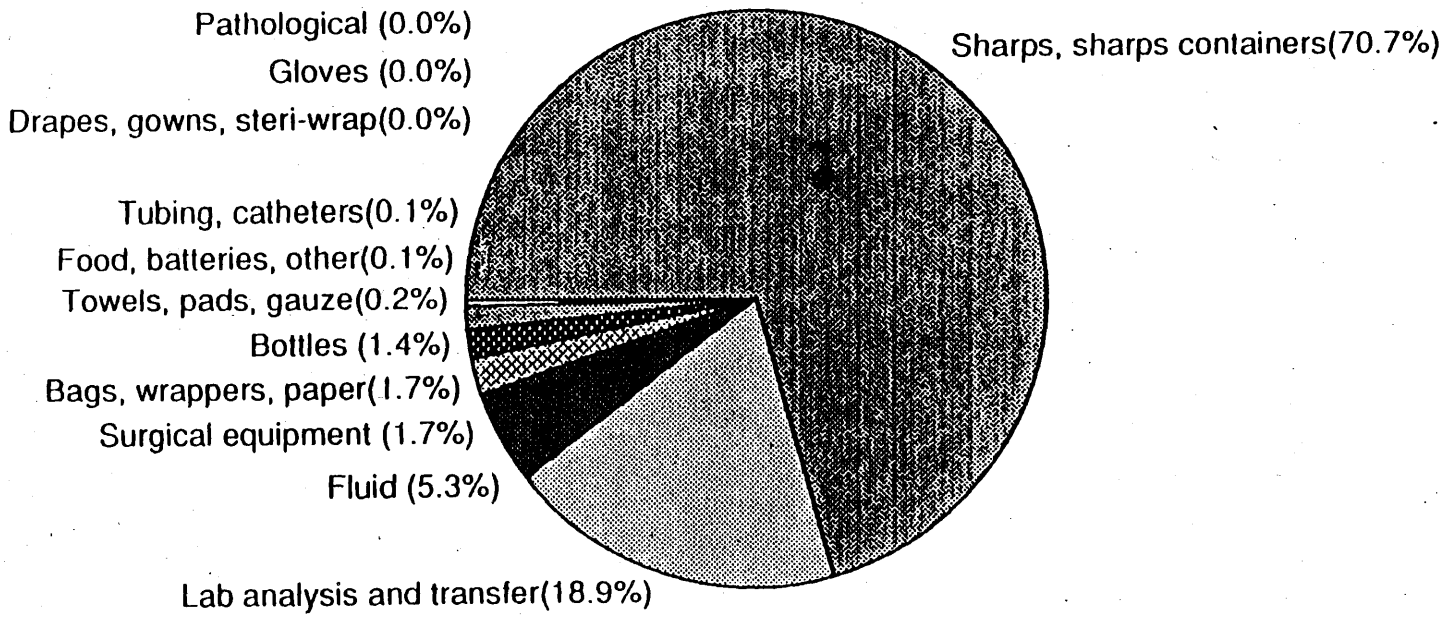
ITEMS FOUND IN HOSPITAL LABORATORY WASTE

Figure III-11

item.delta

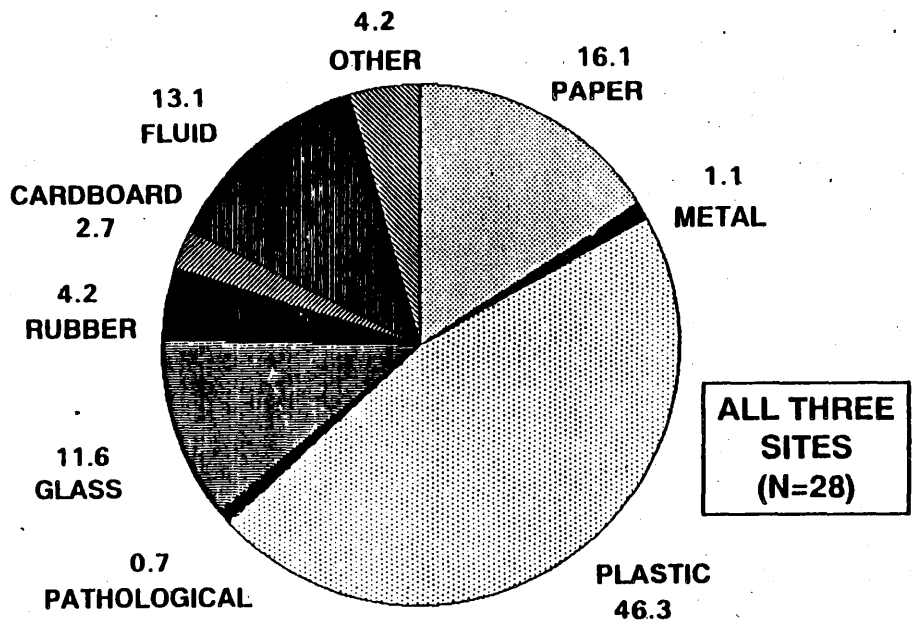
itemshrp.draw

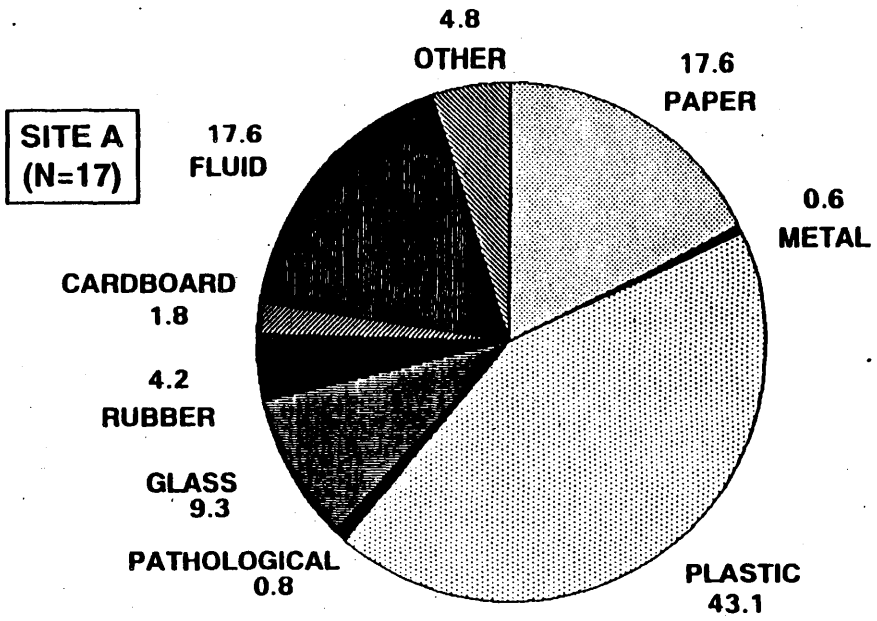
These are items found in the sharps containter waste stream from three Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.



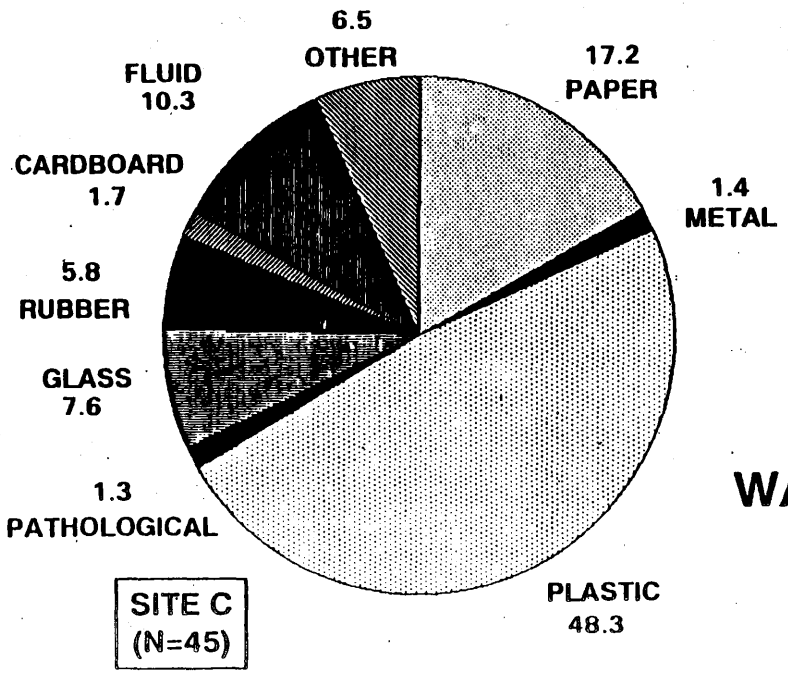
ITEMS FOUND IN HOSPITAL SHARPS CONTAINER WASTE

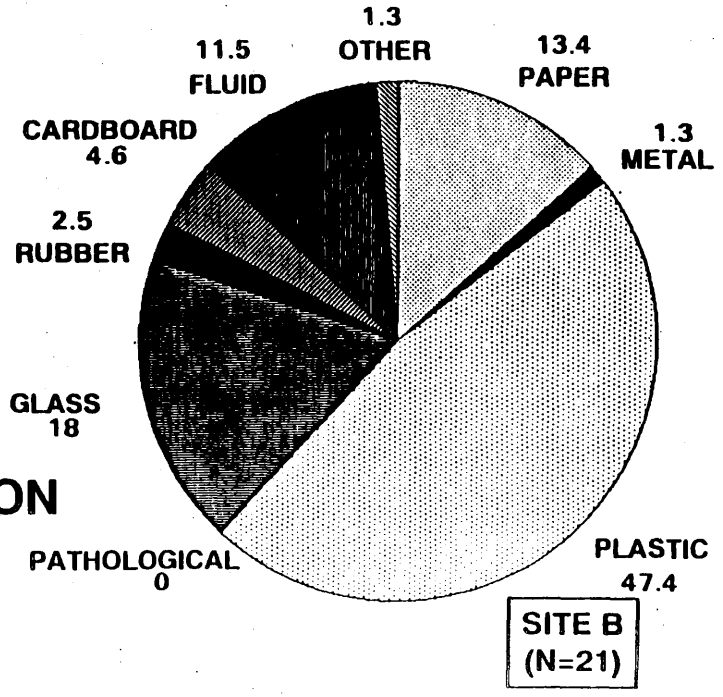
Figure III-12





MPCA STUDY 1990-91
(Percentages are by air-dry weight)

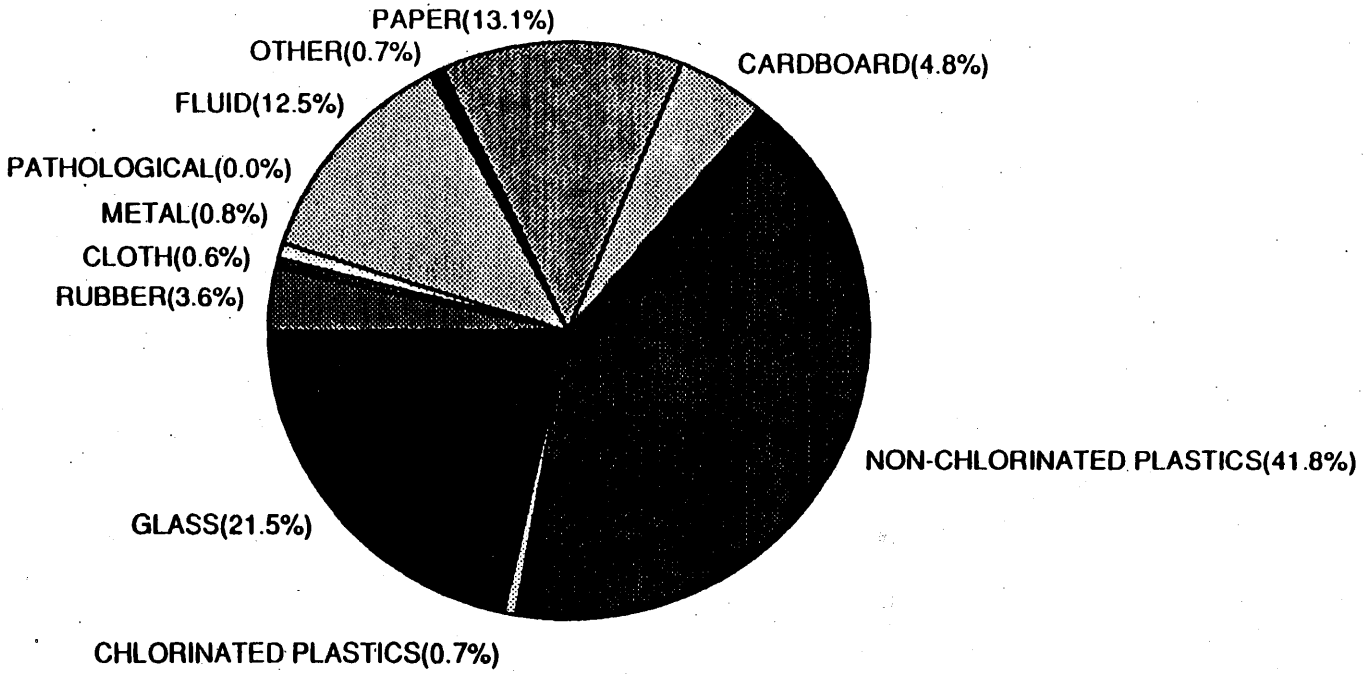




WASTE COMPOSITION TOTALS, BY SITE

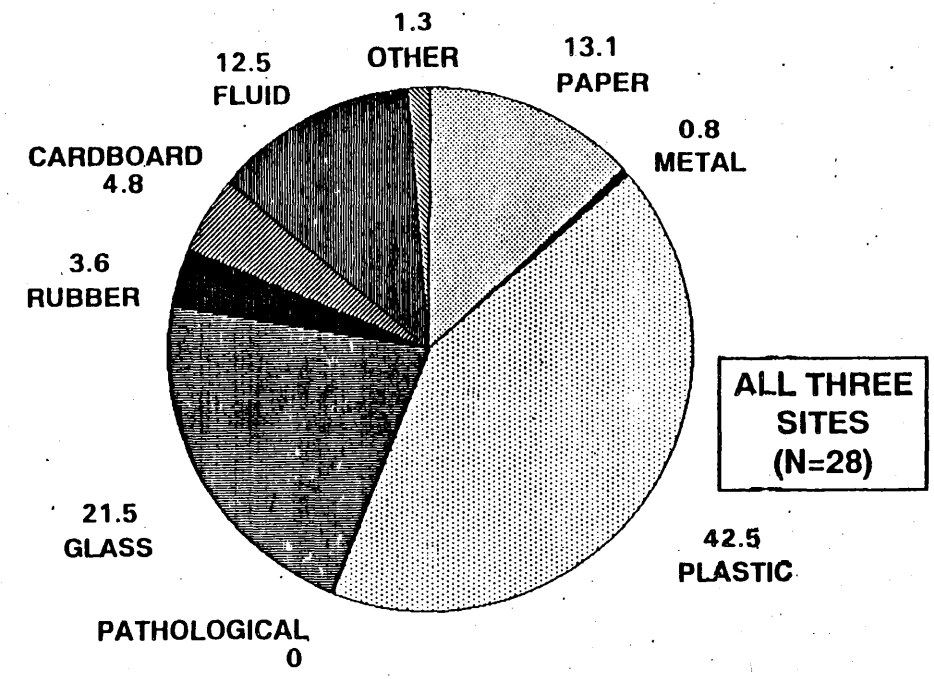
Figure III-13

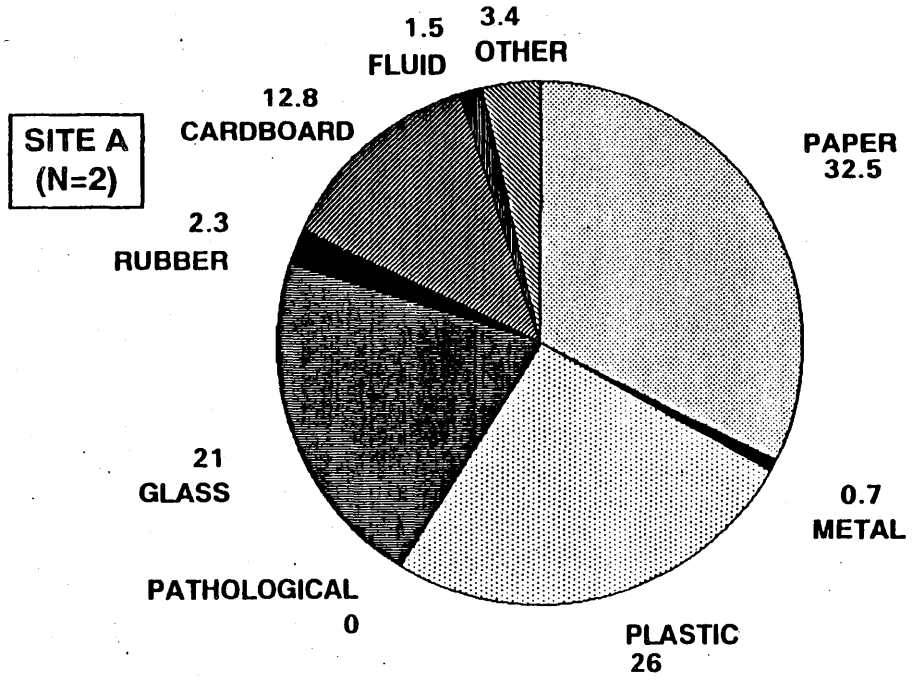
These are materials found in the laboratory waste stream from three Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.



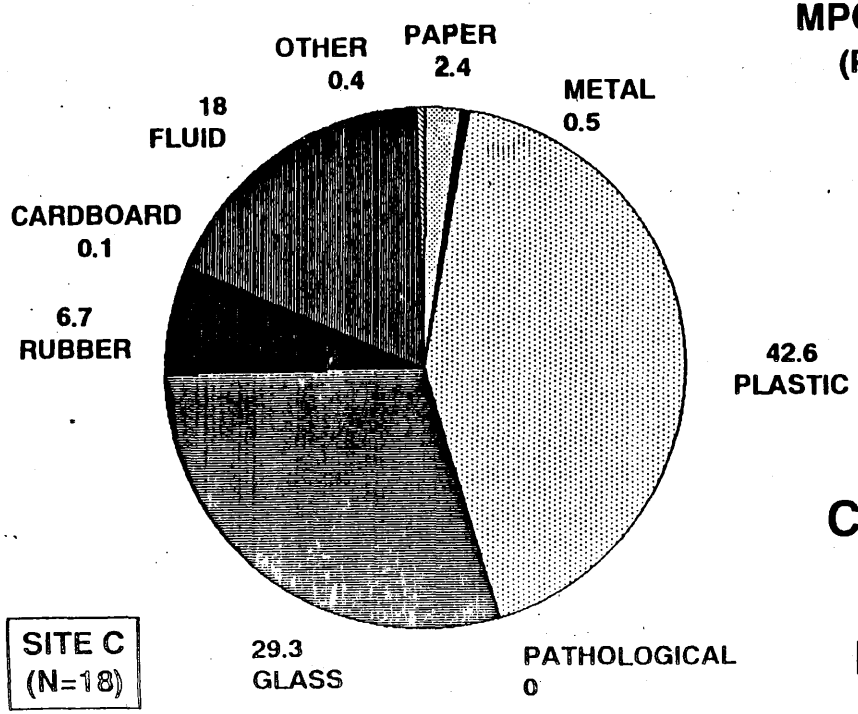
MATERIALS FOUND IN HOSPITAL LABORATORY WASTE

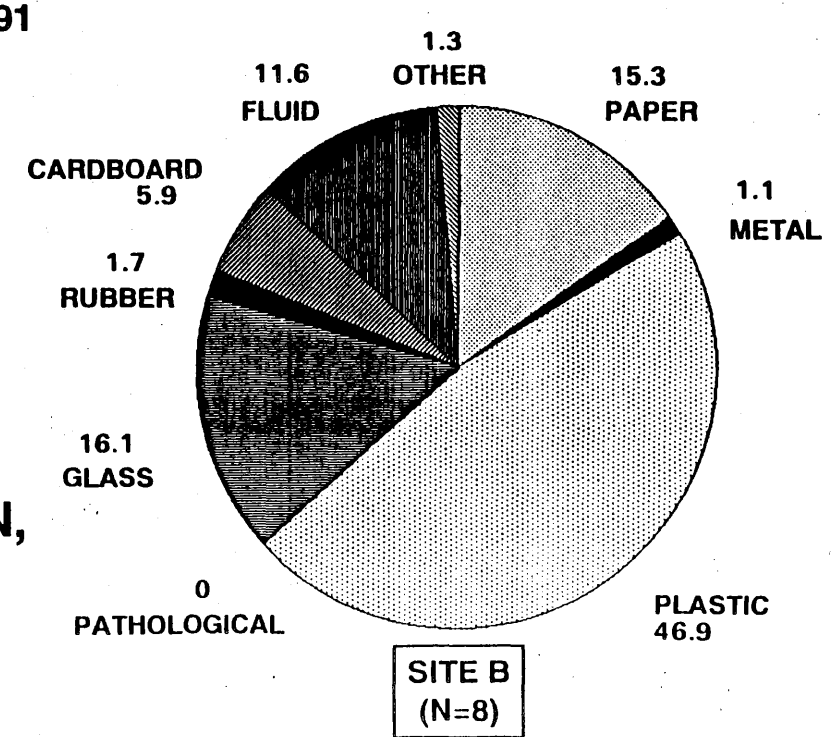
Figure III-14





MPCA STUDY 1990-91
(Percentages are by air-dry weight)



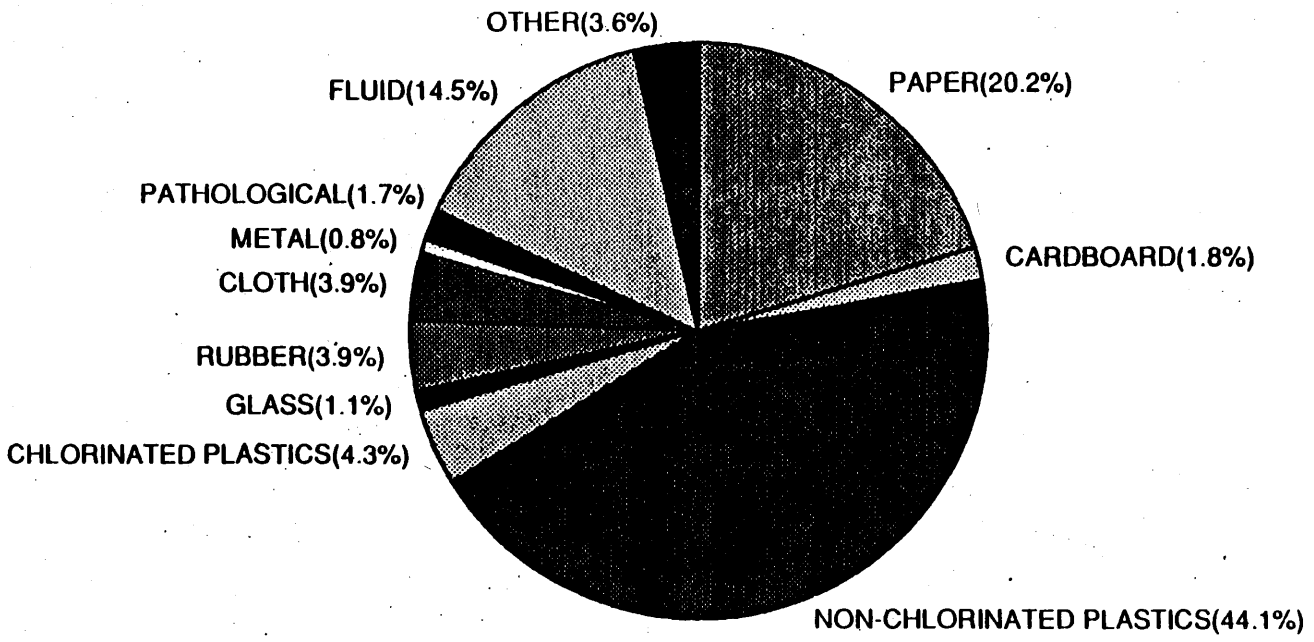


LAB WASTE COMPOSITION, BY SITE

Figure III-15

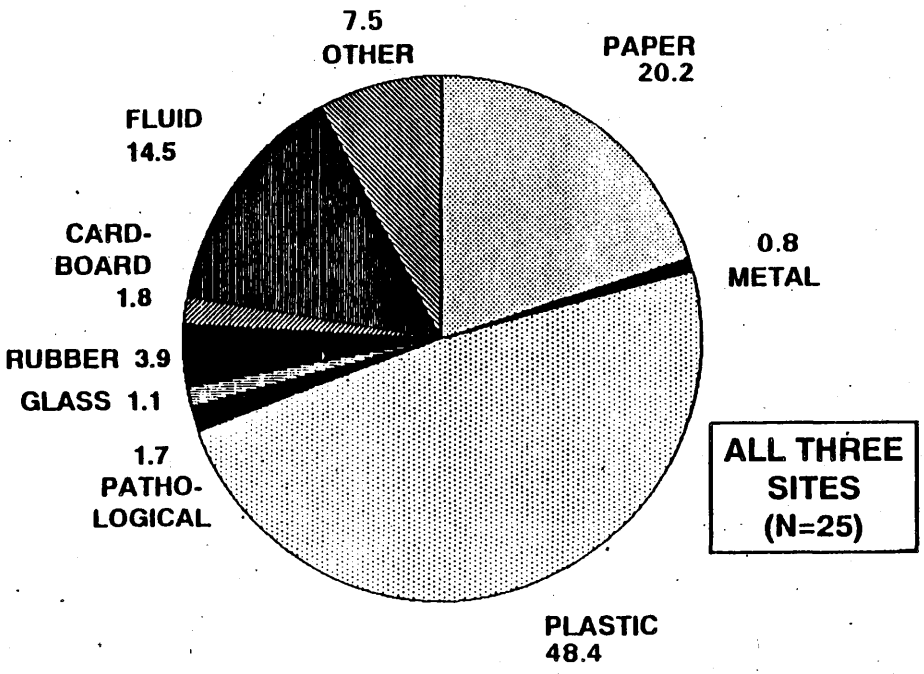
matlsourcesum.delta

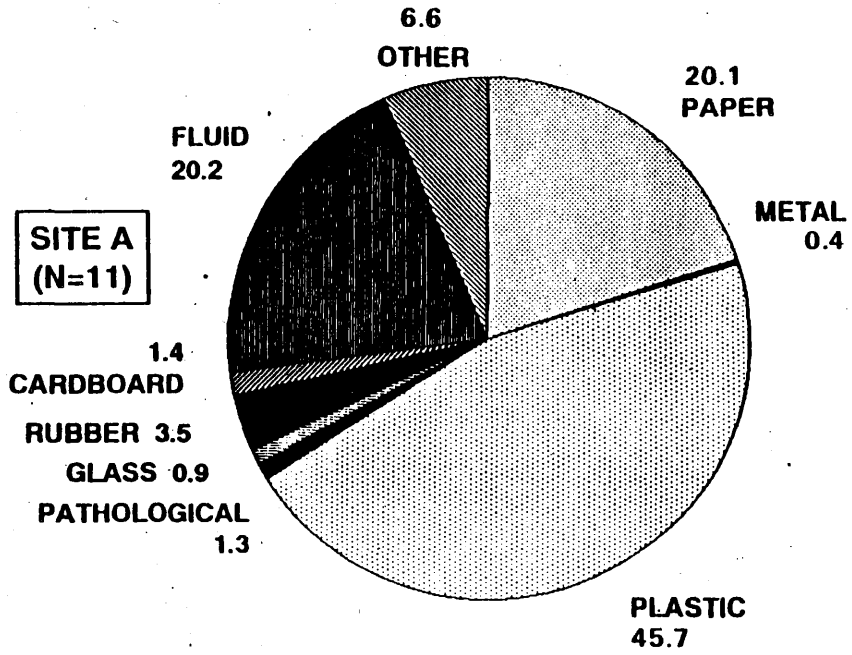
These are materials found in the operating/delivery room waste stream from three Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.



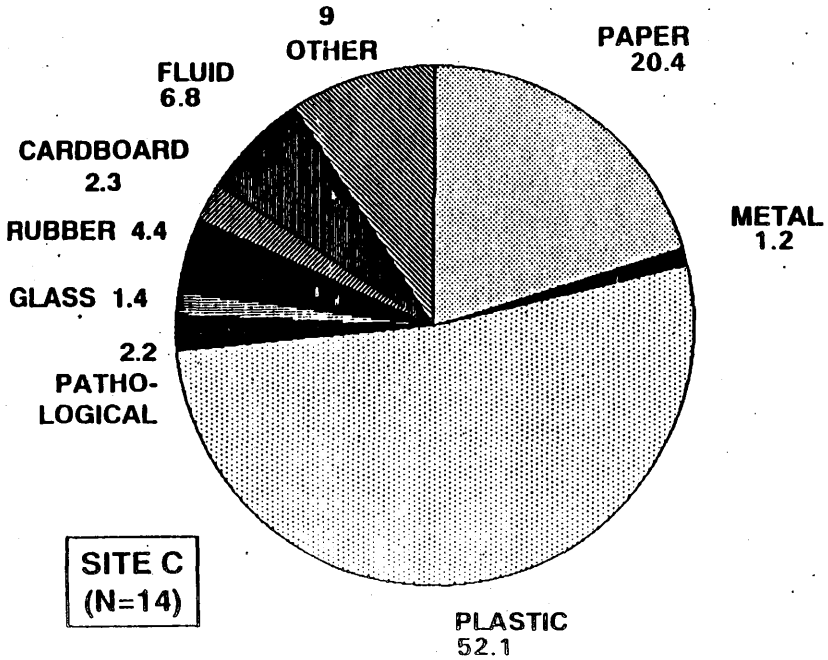
MATERIALS FOUND IN HOSPITAL OR/OB WASTE

Figure III-16





MPCA STUDY 1990-91
(Percentages are by air-dry weight)



(SITE B DID NOT ROUTINELY RED-BAG SURGICAL WASTE)

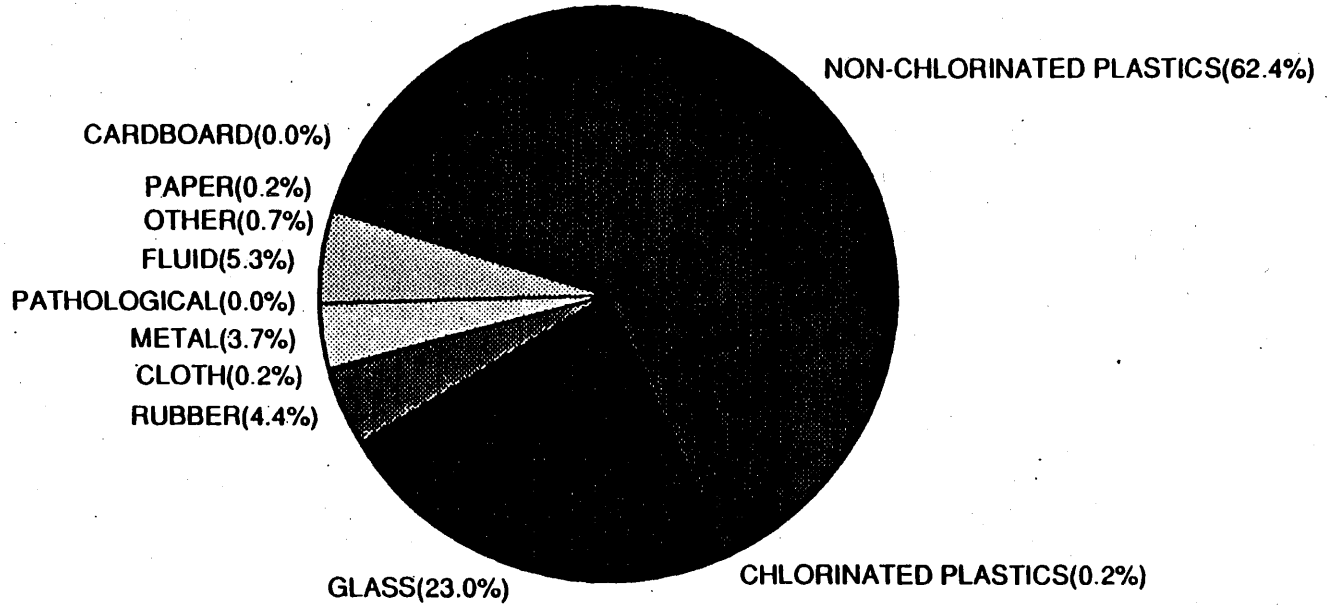
OR/OB WASTE COMPOSITION, BY SITE

SITE B (N=0)

Figure III-17

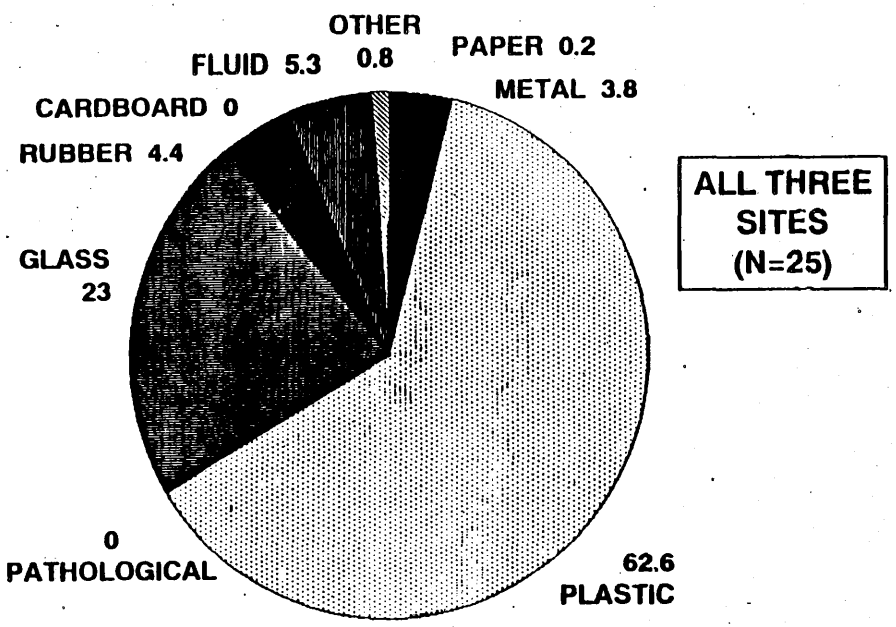
matlsourcesum.delta

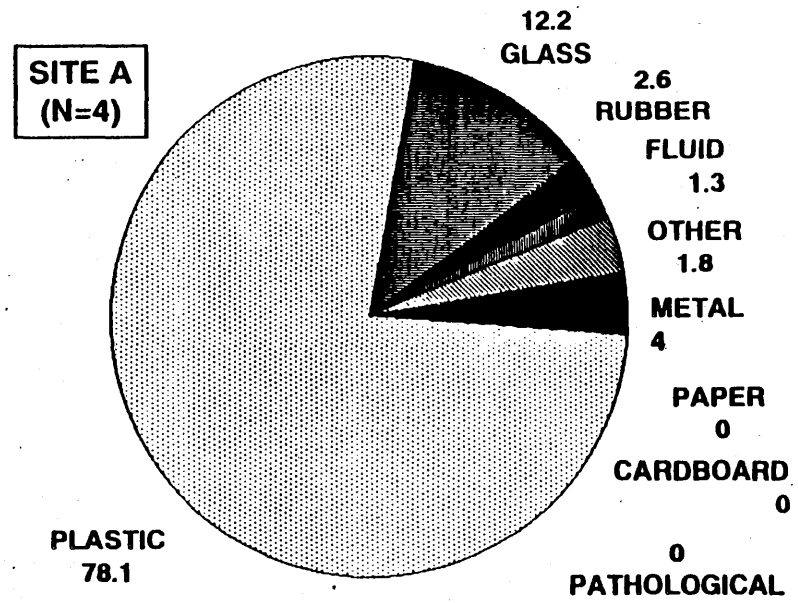
These are materials found in the sharps waste stream from three Minnesota non-metropolitan hospitals. The waste sort was conducted by the Minnesota Pollution Control Agency in the fall of 1990. Percentages are by air-dry weight.



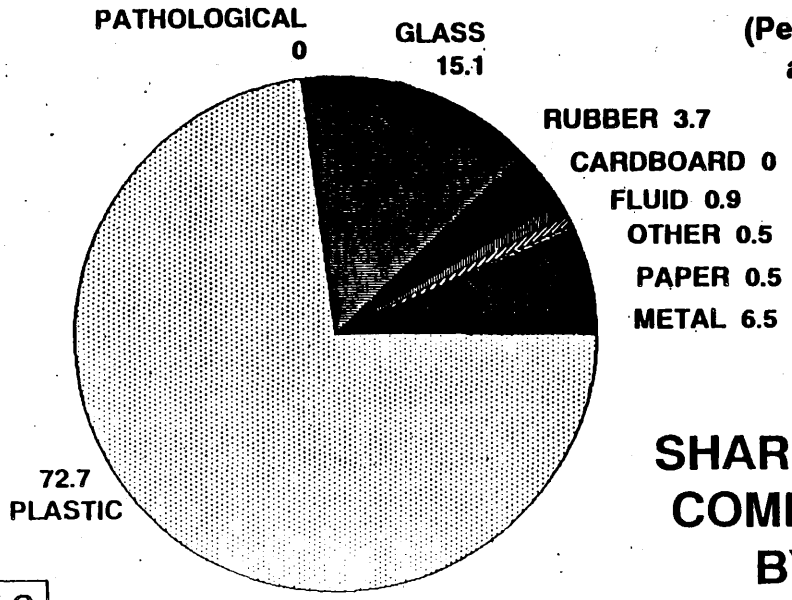
MATERIALS FOUND IN HOSPITAL SHARPS WASTE

Figure III-18



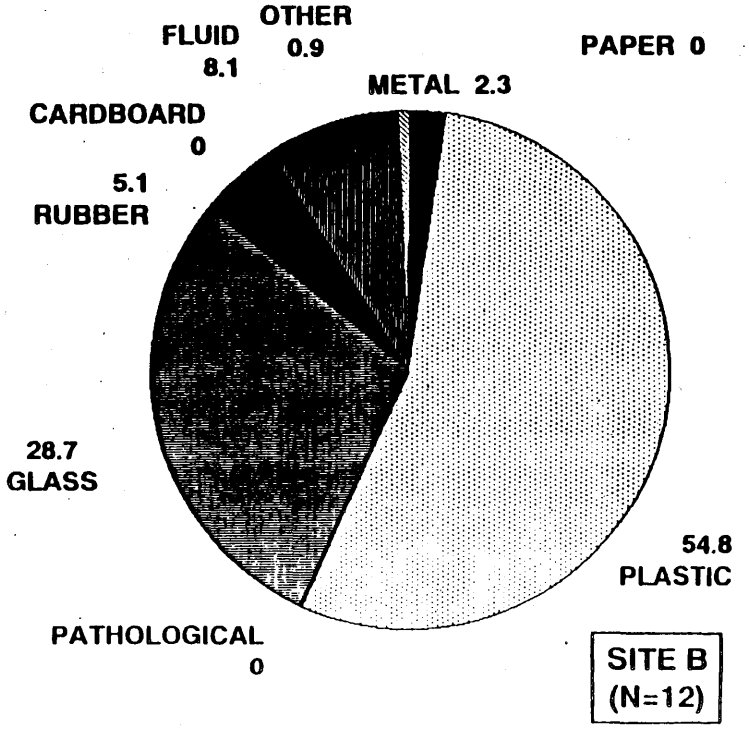


MPCA STUDY 1990-91
(Percentages are by air-dry weight)



SHARPS WASTE COMPOSITION, BY SITE

Figure III-19



APPENDIX P-1

CDC Guidelines

PB85-923404

GUIDELINE FOR HANDWASHING AND HOSPITAL ENVIRONMENTAL CONTROL, 1985

Supersedes Guideline for Hospital Environmental Control
Published in 1981

Revised by Julia S. Garner, R.N, M.N.

and

Martin S. Favero, Ph.D
Hospital Infections Program
Center for Infectious Diseaes
Centers for Disease Control
Public Health Service
U.S. Department of Health
and Human Services
Atlanta, Georgia

Contributions from the Hospital Infections Program,
Center for Infectious Diseases, Centers for Disease Control

James M. Hughes, M.D., Director

Roger L. Anderson, Ph.D.
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Donald C. Mackel, M.S., M.P.H.

PB85-923404

GUIDELINE FOR HANDWASHING AND HOSPITAL ENVIRONMENTAL CONTROL, 1985

Supersedes Guideline for Hospital Environmental Control
Published in 1981

Revised by Julia S. Garner, R.N, M.N.

and

Martin S. Favero, Ph.D
Hospital Infections Program
Center for Infectious Diseaes
Centers for Disease Control
Public Health Service
U.S. Department of Health
and Human Services
Atlanta, Georgia

Contributions from the Hospital Infections Program,
Center for Infectious Diseases, Centers for Disease Control

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Water used to prepare dialysis fluid should be sampled once a month; it should not contain a total viable microbial count greater than 200 colony-forming units (CFU)/ml. The dialysis fluid should be sampled once a month at the end of a dialysis treatment and should contain less than 2,000 CFU/ml. *Category II*

3. **Microbiologic sampling for specific problems**
   Microbiologic sampling, when indicated, should be an integral part of an epidemiologic investigation. *Category I*
4. **Sampling for manufacturer-associated contamination**
   a. Routine microbiologic sampling of patient-care objects purchased as sterile is not recommended. *Category I*
   b. If contamination of a commercial product sold as sterile is suspected, infection control personnel should be notified, suspect lot numbers should be recorded, and items from suspected lots should be segregated and quarantined. Appropriate microbiologic assays may be considered; however, the nearest district office of the FDA, local and state health departments, and CDC should be notified promptly. *Category I*

References

1. Eickhoff TC: Microbiologic sampling. Hospitals 44:86-87, 1970.
2. American Hospital Association Committee on Infections within Hospitals: Statement on microbiologic sampling in the hospital. Hospitals 48:125-126, 1974.
3. Haley RW, Shachtman RS: The emergence of infection surveillance and control programs in U.S. hospitals: An assessment, 1976. Am J Epidemiol 111:574-591, 1980.
4. Simmons BP, Wong ES: Guideline for prevention of nosocomial pneumonia. Infect Control 3:327-333, 1982.
5. Favero MS, Petersen NJ: Microbiologic guidelines for hemodialysis systems. Dialys Transpl 6:34-36, 1977.

Section 4: Infective waste

INTRODUCTION

There is no epidemiologic evidence to suggest that most hospital waste is any more infective than residential waste. Moreover, there is no epidemiologic evidence that hospital waste disposal practices have caused disease in the community. Therefore, identifying wastes for which special precautions are indicated is largely a matter of judgment about the relative risk of disease transmission. Aesthetic and emotional considerations may override the actual risk of disease transmission, particularly for pathology wastes.

Since a precise definition of infective waste that is based on the quantity and type of etiologic agents present is virtually impossible, the most practical approach to infective waste management is to identify those wastes that represent a sufficient potential risk of causing infection during handling and disposal and for which some special precautions appear prudent. Hospital wastes for which special precautions appear prudent include microbiology laboratory waste, pathology waste, and blood specimens or blood products. Moreover, the risk of either injury or infection from certain sharp items (e.g., needles and scalpel blades) contaminated with blood also needs to be considered when such items are disposed of. While any item that has had contact with blood, exudates, or secretions may be potentially infective, it is not normally considered practical or necessary to treat all such waste as infective. CDC has published general recommendations for handling infective waste from patients on isolation precautions.[1] Additional special precautions may be necessary for certain rare diseases or conditions such as Lassa fever.[2] The EPA has published a draft manual (Environmental Protection Agency. Office of Solid Waste and Emergency Response. Draft Manual for Infectious Waste Management, SW-957, 1982. Washington: 1982) that identifies and categorizes other specific types of waste that may be generated in some research-oriented hospitals. In addition to the above guidelines, local and state environmental regulations may also exist.

CONTROL MEASURES

Solid waste from the microbiology laboratory can be placed in steam-sterilizable bags or pans and steam-sterilized in the laboratory. Alternatively, it can be transported in sealed, impervious plastic bags to be burned in a hospital incinerator. A single bag is probably adequate if the bag is sturdy (not easily penetrated) and if the waste can be put in the bag without contaminating the outside of the bag; otherwise, double-bagging is indicated. All slides or tubes with small amounts of blood can be packed in sealed, impervious containers and sent for incineration or steam sterilization in the hospital. Exposure for up to 90 minutes at 250° F (121° C) in a steam sterilizer,

Volume 14 Number 3
June, 1986

depending on the size of the load and type container, may be necessary to assure an adequate sterilization cycle.[3,4] After steam sterilization, the residue can be safely handled and discarded with all other nonhazardous hospital solid waste. All containers with more than a few milliliters of blood remaining after laboratory procedures and/or bulk blood may be steam sterilized, or the contents may be carefully poured down a utility sink drain or toilet.

Waste from the pathology laboratory is customarily incinerated at the hospital. Although no national data are available, in one state 96% of the hospitals surveyed reported that they incinerate pathology waste.[5] Any hospital incinerator should be capable of burning, within applicable air pollution regulations, the actual waste materials to be destroyed. Improper incineration of waste with high moisture and low energy content, such as pathology waste, can lead to emission problems.

Disposables that can cause injury, such as scalpel blades and syringes with needles, should be placed in puncture-resistant containers. Ideally, such containers are located where these items are used. Syringes and needles can be placed intact directly into the rigid containers for safe storage until terminal treatment. To prevent needle-stick injuries, needles should not be recapped, purposely bent, or broken by hand. When some needle-cutting devices are used, blood may be aerosolized or spattered onto environmental surfaces; however, currently no data are available from controlled studies examining the effect, if any, of the use of these devices on the incidence of needle-transmissible infections.

It is often necessary to transport or store infective waste within the hospital prior to terminal treatment. This can be done safely if proper and commonsense procedures are used. The EPA draft manual mentioned above contains guidelines for the storage and transport, both on-site and off-site, of infective waste. For unique and specialized problems, this manual can be consulted.

RECOMMENDATIONS

1. **Identification of infective waste**
   a. Microbiology laboratory wastes, blood and blood products, pathology waste, and sharp items (especially needles) should be considered as potentially infective and handled and disposed of with special precautions. *Category II*
   b. Infective waste from patients on isolation precautions should be handled and disposed of according to the current edition of the *Guideline for Isolation Precautions in Hospitals*. (This recommendation is not categorized since the recommendations for isolation precautions are not categorized.)
2. **Handling, transport, and storage of infective waste**
   a. Personnel involved in the handling and disposal of infective waste should be informed of the potential health and safety hazards and trained in the appropriate handling and disposal methods. *Category II*
   b. If processing and/or disposal facilities are not available at the site of infective waste generation (i.e., laboratory, etc.) the waste may be safely transported in sealed impervious containers to another hospital area for appropriate treatment. *Category II*
   c. To minimize the potential risk for accidental transmission of disease or injury, infective waste awaiting terminal processing should be stored in an area accessible only to personnel involved in the disposal process. *Category III*
3. **Processing and disposal of infective waste**
   a. Infective waste, in general, should either be incinerated or should be autoclaved prior to disposal in a sanitary landfill. *Category III*
   b. Disposable syringes with needles, scalpel blades, and other sharp items capable of causing injury should be placed intact into puncture-resistant containers located as close to the area in which they were used as is practical. To prevent needle-stick injuries, needles should not be recapped, purposely bent, broken, or otherwise manipulated by hand. *Category I*
   c. Bulk blood, suctioned fluids, excretions, and secretions may be carefully poured down a drain connected to a sanitary sewer. Sanitary sewers may also be used for the disposal of other infectious wastes capable of being ground and flushed into the sewer. *Category II* (Special precautions may be necessary for certain rare diseases or conditions such as Lassa fever.[2])

References

1. Garner JS, Simmons BP: Guideline for isolation precautions in hospitals. Infect Control 4:245-325, 1983.
2. Centers for Disease Control: Viral hemorrhagic fever: Initial management of suspected and confirmed cases. MMWR (suppl) 32:275-405, 1983.
3. Rutala WA, Stiegel MM, Sarubbi FA: Decontamination of laboratory microbiological waste by steam sterilization. Appl Environ Microbiol 43:1311-1316, 1982.
4. Lauer JL, Battles DR, Vesley D: Decontaminating infectious laboratory waste by autoclaving. Appl Environ Microbiol 44:690-694, 1982.
5. Rutala WA, Sarubbi FA: Management of infectious waste from hospitals. Infect Control 4:198-203, 1983.

APPENIDIX P-2

MPCA Approval Process

Minnesota Pollution Control Agency

REVIEW PROCESS FOR METHODS OTHER THAN INCINERATION AND AUTOCLAVING FOR THE DECONTAMINATION OF INFECTIOUS WASTE

- Off-site Commercial Facilities -

STEP 1. TECHNOLOGY REVIEW

GWSW (Ground Water/Solid Waste Division)	EAO (Environmental Analysis Office)
Proposer submits information that demonstrates that the proposed method decontaminates the waste	General environmental review of the technology
If YES, can demonstrate decontamination of waste	If YES, there are no potentially significant environmental impacts associated with the technology

* issue Approval Letter for the TECHNOLOGY
(essentially technology is feasible)

STEP 2. SITE SPECIFIC PROPOSAL

Infectious Waste Management Plan
plus attached site specific information

GWSW	EAO
size of unit(s), throughput	site selection (area land use)
operating standards (time, temperature, etc.)	transportation usage including ADT volumes
proposed log	noise containment
proposed QA schedule	end product evaluation
list of unacceptable waste and methods to prevent entry into facility	odors, other nuisances
safety program (infectious agents, electromagnetic radiation, emissions)	
preventative maintenance schedule	
final disposal site (site has approved industrial waste mgmt. plan)	
end product description (size, weight, volume)	
containment of dust, aerosols, fumes, vapors through negative air systems, HEPA filtered air systems, or other systems	

If YES management plan and
site specific information is acceptable

* issue Approval Letter for DECONTAMINATION/DISPOSAL FACILITY

FACILITY CAN NOW OPERATE
(if all other local and county required permits have been issued)

The following information must be submitted with your DECONTAMINATION/DISPOSAL FACILITY Infectious Waste Management Plan:

1. The size of the unit(s) and estimated throughput.

2. Scheduled operating hours; including number of days per week and number of hours per day that the facility will be open to receive and process waste.

3. The type of containers used to deliver waste to the facility and how the waste is fed into the decontamination unit.

4. An example of an operating log that will include but is not limited to: operator name or ID, date, time, load size, and operating parameters (such as temperature, pressure, pH, concentration of Chlorine and time).

5. Proposed Quality Assurance schedule and reporting mechanism for the "Decontamination" process.

6. List of unacceptable waste and methods of preventing its entry into the facility.

7. Proposed safety program minimizing worker exposure to emissions, infectious agents, electromagnetic radiation, etc.

8. How the shredder/grinder is designed to prevent exposure to potentially infectious aerosols during scheduled and unscheduled maintenance.

9. A general description of the end product. (appearance, size, weight, volume, moisture content, etc.)

10. Final end product disposal site. Does the end product have any restrictions associated with it such as acceptability at landfills, solid waste processing facilities (RDF, MSW compost), or mass burn incinerators?

11. Does the end product have any recycling capability ? Who and how will end-poduct be transported to final disposal site ? Does the solid waste facility have an amended Industrial Waste Management Plan to accept this waste ?

In ADDITION, for review by the ENVIRONMENTAL ANALYSIS OFFICE, please submit the following information:

1. Describe site/project characteristics:

   - surrounding land resources (surface waters, local topography, etc.)
   - surrounding land uses (proximity to residences, other industries, etc.)
   - traffic flows

2. Will the project cause any potential environmental impacts in terms of:

   - noise
   - dust
   - odors
   - sanitary, industrial wastewater flows
   - contamination of surface or ground waters
   - surface water run-off problems
   - impacts due to high traffic flows, excessive vehicle emissions
   - stationary source air emissions
   - compatibility with existing land use plans
   - impact on infrastructure and public services
   - anticipated future project stages

APPENDIX P-3

Trace Chemotherapy Fact Sheet

Hazardous Waste from Health Care Providers

Hazardous waste is usually a small percentage of the wastes generated at medical centers; however, all generators are required to disclose, report annually, store properly, and use a licensed hazardous waste transporter and permitted hazardous waste facility for disposal of these wastes. This fact sheet is intended as a guide; **this is not an all-inclusive listing.**

Antineoplastic Wastes

DRUGS AND ANTINEOPLASTIC (chemotheraputic): There are seven antineoplastic agents defined by the EPA as hazardous waste (U-listed toxic). Because of the similar toxicities and pharmacological properties of antineoplastics, according to Minnesota Rules, **all antineoplastic wastes exhibit the characteristic of Minnesota toxicity and are considered hazardous.**

Trace contaminated waste materials include those materials containing residual or trace amounts of the drug. Examples of these are expired syringes and needles, empty vials, and ampules. If trace contaminated waste materials can be classified as empty as established in Minnesota Rules Chapter 7045.0127 Subp. 3, they are exempt from Minnesota Hazardous Waste Rules. The storage and disposal of sharps is regulated under the Minnesota Infectious Waste Control Act (1989) and Minnesota Solid Waste Rules pt. 7035 subps. .9100 to .9140. Contact the MPCA at (612) 296-7388 for additional information on infectious waste.

Bulk contaminated waste materials (MN01) are defined as any containers that are not empty. Any unused antineoplastic drugs or waste containers must be labeled, stored and disposed of as hazardous waste. **Do not sewer; do not dispose of as a municipal waste; do not incinerate at a medical waste incinerator.** This waste must be transported by a licensed Hazardous Waste Transporter and be disposed of at a permitted Hazardous Waste Facility.

Laboratory Wastes

Hazardous laboratory wastes include spent solvents, unused waste solvents, mercury, and discarded commercial chemical products. Some common laboratory wastes and their Hazardous Waste Numbers are listed below.

Alcohols (if not listed)	**D001**
Mercury	**D009**
Acetone	**F003**
Methanol	**F003**
Xylene	**F003**
Toluene	**F005**

Minnesota Pollution Control Agency

Hazardous Waste Division
520 Lafayette Road, St. Paul, Minnesota 55155

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APPENDIX S-1

3M Letter

OFFICE OF WASTE MANAGEMENT
1350 Energy Lane, St. Paul, MN 55108

State of Minnesota
OFFICE MEMORANDUM

DATE: July 16, 1992

TO: Sheila Brunelle, MDH

FROM: John Gilkeson
Hazardous & Problem Wastes
(612) 649-5745

RE: Item for inclusion in Strategy Subcommittee report

The following item from Dr. Stephens should be included in the strategy subcommittee report section on segregation practices for infectious waste.

It is the complete text of a letter to Dr. Stephens, and should be referenced as a personal communication from Mary Anne Maclean of 3M to William E. Stephens, M.D.

Thank you.

Dear Dr. Stephens:
recently (May28-June 1) held a meeting of 3M's Infection Control Research Panel, a group made up of Operating Room and Sterile Processing Managers from across the country. This particular meeting was attended by 35 panelists, 23 of whom manage Surgery in hospitals or Surgicenters.

We have spoken with our panel members about Medical Waste Management, among numerous other subjects, for the last two years and noticed an interesting difference during this session. Two years ago and last year we were hearing that most of the panelists hospitals had had waste consultants in and were implementing sorting programs to reduce the medical waste portion of their waste. This year we are hearing comments that some panelists were now red bagging everything in the operating room, after the case begins, including packaging. It was stated that a more stringent classification of "red bag" waste (everything) seems to be the safest course.

We didn't poll the panelists to quantify, but there was a general agreement about protecting the hospital by this type of waste classification. It would appear that nervousness about these regulations can override the common sense approach to waste sorting that we would all like to see.

I'm enclosing two articles, one by Dr. Rutala, that we consider definitive in terms of current medical Waste Management practices. It speaks very effectively to the issue of overly zealous red bagging.

It was a pleasure to meet you, and I hope to hear from you if we can be of any assistance in the future.

Regards,
Mary Anne

APPENDIX S-2

Disposing of Household Sharps Fact Sheet

Minnesota Pollution Control Agency

Disposing of household "sharps"

A fact sheet from the MPCA's Infectious Waste Management Program

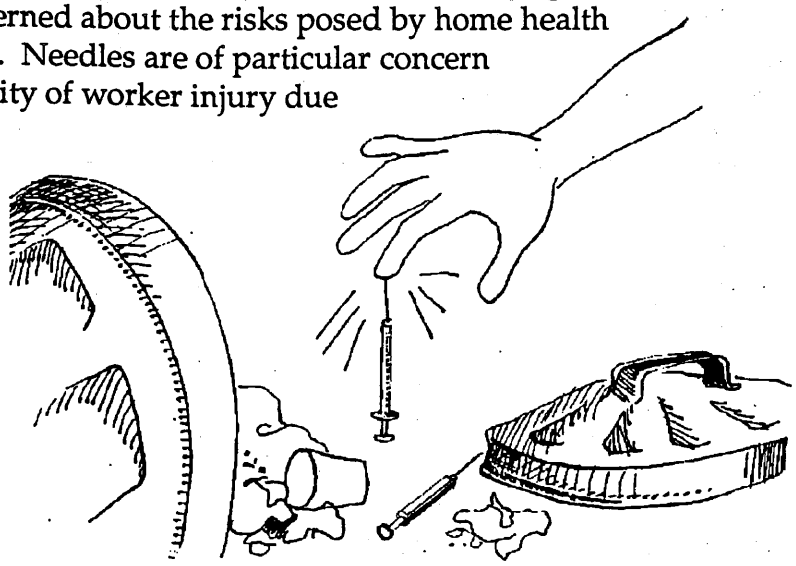
Households exempt from infectious waste regulation

The 1989 Minnesota Infectious Waste Control Act outlined management practices for infectious waste generated in medical facilities. However, it did not include infectious waste generated in homes, particularly "sharps," such as needles, syringes and lancets. Because self-administered home health care is exempt from state infectious waste laws and rules, it can be disposed of with solid waste. This fact sheet will outline some of the options for safely disposing of sharps generated in the home.

The problem with household sharps

Household sharps are very common in household garbage. The American Diabetes Association estimates that more than a billion needles alone are thrown out each year by diabetics who self-administer insulin. This high number of sharps in the garbage, along with a growing number of home health care patients, has attracted a great deal of attention in the waste management industry and environmental health profession.

Increasing numbers of garbage haulers and solid waste facility operators are aware of and concerned about the risks posed by home health care waste in the trash. Needles are of particular concern because of the possibility of worker injury due to puncture wounds and the fear of transmission of diseases, such as hepatitis and AIDS.



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Revised February 1992

Printed on recycled paper

How should household sharps be managed?

Even though household sharps can be managed as a solid waste, the Minnesota Pollution Control Agency (MPCA) encourages special management practices that will keep sharps from being randomly thrown into household garbage. These disposal methods will help protect workers at solid waste facilities, such as composting facilities, refuse-derived fuel plants, recycling facilities and landfills. Also, some local ordinances may prohibit household sharps from being disposed of with the regular household garbage. Here are a number of options to safely dispose of sharps generated in the home:

First, see if there are any household sharps collection or drop-off sites in your area:

1. Ask your doctor or local clinic if they have programs to accept household sharps from patients for disposal. One Twin Cities-area clinic offers sharps disposal through its pharmacies. Patients purchase a sharps container at a service cost. The patients receive instructions on how to use it and how to return the filled container to the clinic. The clinic then contracts with a registered infectious waste hauler for proper disposal of the containers.

2. A neighborhood pharmacy may also have a sharps collection program. Some nationwide chains and Minnesota pharmacy associations offer sharps disposal services.

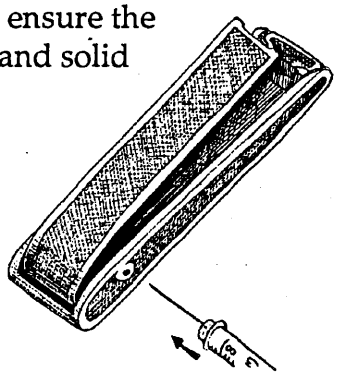
3. A local hospital may have an incinerator or other decontamination method on-site and may be willing to accept household sharps. Some hospitals, particularly in greater Minnesota, have indicated that collection programs could be organized through county health nursing departments or through special educational programs for diabetic patients.

4. Your county solid waste officer, health department or environmental services department may know if a local collection program is available for household sharps. Some areas have household sharps collections similar to household hazardous waste collections. Residents bring their sharps to a drop-off site after they have been properly packaged and labeled. The containers are then disposed of by the local government with the regular solid waste or hauled away by a registered infectious waste transporter.

5. Households may contract with a registered infectious waste hauler themselves. The MPCA has a list of licensed haulers. Some licensed disposal firms also offer mail-in sharps disposal programs through the U.S. Postal Service.

What if there are no collection or drop-off options available?

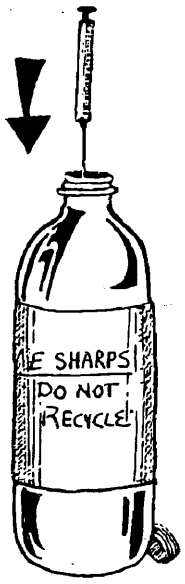
If household sharps must be disposed of with household garbage, individuals should follow these guidelines to ensure the safety of garbage haulers and solid waste facility workers:



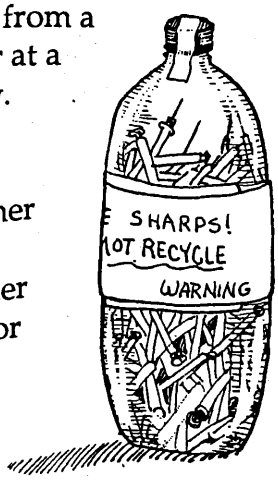
1. Individuals can use needle clippers or re-cap or re-sheathe their needles after use. This is helpful in

(continued)

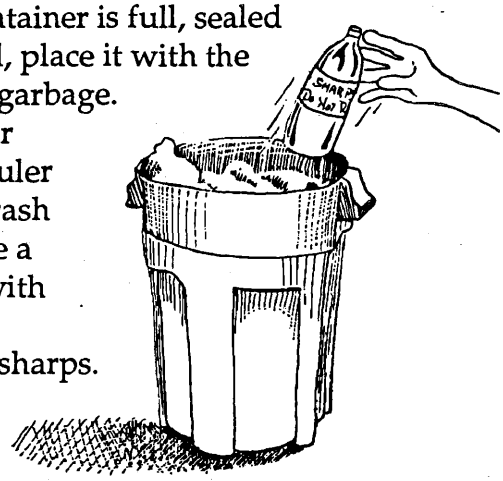
preventing "needle sticks" among solid waste workers. Even though re-capping needles is discouraged in the medical profession because of the potential for medical workers to stick themselves with contaminated needles, individuals who self-administer insulin or other medications are not at risk if they alone are using the needle.



2. Sharps should be placed in puncture-resistant containers with secure lids or caps. Useable containers include: coffee cans with reinforced or taped lids; commercial sharps containers; plastic detergent bottles with screw caps; or plastic pop bottles. A study performed in the state of Washington under a U.S. Environmental Protection Agency grant showed that two-liter plastic pop bottles actually withstood the solid waste disposal process and compaction better than other containers. The pop bottle's plastic resin made it pliable and rarely allowed sharps to puncture through the container in a garbage truck or during compaction at a landfill. Red containers are not recommended, because red usually indicates a regulated infectious waste from a medical facility and could cause alarm from a hauler or a worker at a solid waste facility.



3. Label the sharps container with either "Household" or "Home," plus either "Medical Waste" or "Sharps." For example, a sharps container may read "Household Medical Waste," or "Home Sharps." Also, if your area offers curb-side recycling, you should indicate that the container is not to be recycled by labeling it with either "Do Not Place With Recyclables," or "Do Not Recycle."



4. When a container is full, sealed and labeled, place it with the household garbage. Inform your garbage hauler that your trash will include a container with exempted household sharps. The hauler should let you know if the container should be bagged and placed with the other trash, or if it should be placed alongside or on top of the regular garbage. If you place your garbage in an area where rummaging may occur, conceal the container in a bag and place it in the rest of the garbage just prior to collection. Your hauler should be willing to work with you to arrange for the most efficient and safest way to handle household sharps.

For more information...

For more information on disposal of household sharps, contact the MPCA's Infectious Waste Management Program at (612) 296-7388, or toll-free at 1-800-652-9747, or contact the Minnesota Department of Health at (612) 627-5112.

APPENDIX R-1

MPCA Letter to SW Incineration Facilities

SP 7.6

Minnesota Pollution Control Agency
520 Lafayette Road, Saint Paul, Minnesota 55155
Telephone (612) 296-6300

Celebrate MINNESOTA 1990

March 30 , 1989

Mr. Dean Massett
City of Red Wing
P.O. Box 34
Red Wing, Minnesota 55066

Dear Mr. Massett:

We are aware that municipal incinerator facilities are accepting medical waste, knowingly or otherwise. This may be a more environmentally acceptable option than to have this waste randomly disposed of at landfills, or continued to be incinerated in outdated, unmaintained incineration facilities. Therefore, we are attempting to determine which municipal waste combustors in Minnesota are interested in accepting medical waste. Incinerating this waste is not without consequences, however. This letter is to inform you of some of the issues of concern that we see, and to encourage you to contact me if you are interested in pursuing the option of accepting medical waste for incineration.

Definition of Medical Waste:

First, it is important to understand what the medical waste stream is made up of. The content determines its importance to us from a regulatory and operational perspective.

Medical waste generators include hospitals, doctors' and dentists' offices, veterinary clinics, morticians, laboratories and the like. The waste stream consists mostly of paper and plastics, with a small amount of pathological waste (usually less than 10 percent by weight). Depending on housekeeping practices of the generators, the medical waste stream may or may not have kitchen and office wastes in the waste. The most often expressed concerns with this waste are focussed on the infectious, or redbag, portion of the wastes. Again, depending on housekeeping practices of medical waste generators, the redbag waste may have all of the medical waste contained in it, or it may be solely the items considered infectious by the infection control officier of the generator.

Consequences of Accepting the Waste for Incineration:

There is considerable interest by the generators in seeing medical waste incinerated. First, pathological waste is destroyed. Secondly, infectious agents are destroyed. Thirdly, because of the rapidly growing quanitity of waste, incineration cuts costs for disposal, as it reduces the volume of waste to be disposed of by 90 percent. Hospitals have a large demand for steam, thus incinerating their own wastes and recovering the heat can help reduce the cost of the steam. Lastly, the MPCA's solid waste rules prohibit the disposal of untreated infectious wastes in landfills, thus the MPCA also has an interest in providing capacity for the incineration of medical waste.

As stated earlier, incinerating the waste is not without consequences. Our concerns center around three issues: medical waste handling and storage practices, corrosion of incineration equipment, and ambient air quality impacts. I will address each concern, and suggest remedies that you might consider to mitigate these concerns.

The handling of medical waste has two components: worker safety and storage. Worker safety must be considered in collecting, transporting and finally incinerating the waste, and proper storage is important to prevent medical wastes' degradation.

It is vital that medical waste not be accepted by having it dumped on a tipping floor, or subjected to destructive handling processes prior to its introduction into the combustion chamber, thus risking worker exposure. Further, medical waste should not be stored in a waste pit for any length of time, as that storage would encourage decompostion of the waste. Municipal waste combustors need to protect the incoming waste from being compacted, crushed, or shredded. Ash needs to be given the same respect, as sharps (needles and glassware) often don't disintegrate in the combustion process.

These concerns can be addressed by developing handling policies and practices especially for this waste. The condition of waste in which it will be accepted can be limited. For example, the waste can be boxed, double-bagged, or be placed in reusable containers for transport. At the incinerator, storage of the waste can be avoided by not accepting the waste unless the incinerator is operating, introducing it directly into the combustion chamber and not the feed pit, emptying the waste feed chute entirely before shutting down a combustion chamber, and so on.

The second concern is that of equipment corrosion. Data shows hydrogen chloride emissions from the incineration of medical waste to be on average 40 pounds per ton of waste. This is compared to an average hydrogen chloride emission rate for municipal solid waste of 6 pounds per ton of waste incinerated. This is due to the fact that medical waste is mostly paper and plastics, and has a higher BTU content than municipal solid waste. Hydrogen chloride, better known as acid gases, is responsible for accelerated corrosion of metal. Thus, the decision to accept this waste must include the realization that your maintenance costs might increase to counteract the corrosion. The corrosion rates can be controlled by controlling the types of plastics used, limiting the amount of waste accepted, or using in-furnace types of control (for example, blowing lime into the combustion chamber). The second two options are likely the only ones implementable today for municipal waste incinerators.

The last concern that needs to be addressed is that of ambient air quality impacts. Without scrubbing devices, acid gas emission rates from a municipal waste combustor must be controlled through the input rate of the medical waste. The United States Environmental Protection Agency (USEPA) has indicated that there appears to be physical damage of metal at hydrogen chloride ambient concentration of 3 micrograms per cubic meter (3 ug/m 3). Our desire is to calculate acceptable medical waste input rates such that this ambient concentration is not exceeded. We will likely use dispersion modeling to calculate the maximum ambient air concentrations. Thus emissions would be controlled by strictly enforcing a maximum medical waste input rate.

We believe that incineration of medical waste at properly operated municipal waste incinerators makes good sense at this point. Some municipal waste incinerators have additional capacity and are looking for a source of revenue, while some solid waste districts are trying to figure out how to handle this waste stream within their own service areas. Regardless, today most of the municipal waste incinerators have better combustion conditions and pollution control devices than most community hospitals.

Some municipal waste incinerator owners have already contacted us about their desire to accept this waste. We are willing to prepare incinerators to take this waste, provided that the above concerns are recognized, and a complete proposal is prepared for amending the air emissions facility operating permit. Performance tests will be necessary to demonstrate compliance with air emission limits while incinerating this waste.

Should you have an interest in accepting medical waste, I would appreciate your contacting me to discuss this further. I can be reached at (612)296-7173.

Sincerely,

Lisa J. Thorvig

Lisa J. Thorvig, Chief
Regulatory Compliance Section
Division of Air Quality

LJT:cmbg1.3

cc: Lou Chamberlain, DAQ
Anne Jackson, DAQ
Art Dunn, GWSW/PD
Cliff Anderson, OPR
MPCA Regional Offices
DAQ File SP 7.6