

# Health—Management of Healthcare Waste Materials at Alberta Health Services

## Summary

The purpose of our work was to determine whether Alberta Health Services has effective systems to manage its healthcare waste materials handling and disposal. For purposes of this report, the term “healthcare waste materials” includes biomedical and chemical waste as defined by AHS.<sup>1</sup>

## Why it is important to Albertans

The cost of healthcare waste materials management is not high in relation to AHS’s total annual budget of more than \$10 billion (see Appendix). However, the potential risks associated with healthcare waste materials are significant, including:

- human health risks such as infection or injury from direct contact with biomedical waste by patients, healthcare workers, visitors, cleaning staff, waste collectors, processors and recyclers.<sup>2,3</sup>
- environmental risks (ground, air and water contamination)—Healthcare waste materials may contain substances that are infectious, toxic, radioactive, flammable, explosive, corrosive or otherwise harmful if not safely disposed of.
- reputational risk—Healthcare waste incidents may raise fears, aesthetic concerns or loss of confidence in the healthcare system.

## What we found

We found weaknesses in AHS’s systems to manage healthcare waste materials. Our key findings include the following:

- AHS has not assigned responsibility for oversight of the management of healthcare waste materials at all AHS sites that generate these materials.
- AHS has not fully standardized healthcare waste management procedures across its sites.
- AHS does not have adequate controls to ensure waste disposal services have been performed before it approves vendor invoices for payment.
- AHS’s current agreements with contracted service providers do not provide adequate assurance that AHS’s service standards for healthcare waste materials management are being met.

<sup>1</sup> Biomedical waste materials include human anatomical waste (body parts), human blood and body fluids, cytotoxic waste (waste materials related to chemotherapy treatment), microbiological waste (laboratory cultures, vaccines) and used sharps (needles, blades and glass). Chemical waste is waste that contains one or a mixture of chemical compounds (e.g., solvents, reagents, chemical cleaning solutions, paints, fuels) and is classified as hazardous or non-hazardous.

<sup>2</sup> Canadian Council of Ministers of the Environment, 1992, *Guidelines for the Management of Biomedical Waste in Canada*. These Guidelines state “assuming proper healthcare waste disposal practices, the susceptible host population consists primarily of the waste haulers and handlers ... under normal waste disposal conditions, the general population is not exposed to healthcare waste.”

<sup>3</sup> World Health Organization, 1999, *Safe management of wastes from healthcare activities*. The WHO states that exposure to healthcare waste such as chemicals can cause or contribute to health effects including cuts, organ or nervous system damage, sterility, cancer, burns and rashes.

## What needs to be done

We made the following four recommendations to AHS:

<p><b>Recommendation—Oversight at AHS waste generating sites</b></p> <p>We recommend that Alberta Health Services establish systems for overseeing the management of healthcare waste materials at all AHS sites that generate these materials</p>
<p><b>Recommendation—Waste handling policies and procedures at AHS sites</b></p> <p>We recommend that Alberta Health Services improve the handling and disposal of healthcare waste materials at its sites by:</p> <ul style="list-style-type: none"> <li>• standardizing healthcare waste materials handling policies and procedures across sites</li> <li>• establishing processes to monitor and enforce facilities' compliance with healthcare waste materials handling policies and procedures</li> <li>• ensuring chemical waste hazards are remediated promptly</li> <li>• pursuing more opportunities to reduce, reuse and recycle materials that could enter the healthcare waste stream</li> </ul>
<p><b>Recommendation—Contract management for disposal of healthcare waste at AHS sites</b></p> <p>We recommend that Alberta Health Services take steps to improve its contract management processes for healthcare waste by:</p> <ul style="list-style-type: none"> <li>• requiring sites to verify services have been received before approving vendor invoices for payment</li> <li>• developing risk-focused systems to monitor healthcare waste management for purposes of controlling volumes and costs</li> </ul>
<p><b>Recommendation—Healthcare waste at contracted health service procedures</b></p> <p>We recommend that Alberta Health Services assess its risk related to healthcare waste produced by contracted health service providers and ensure contract provisions manage that risk</p>

## Audit objective and scope

We examined healthcare waste materials from the point where they enter the waste stream. We did not examine any of the processes that may be in place to ensure all appropriate items are actually placed into waste containers—such processes are part of infection control.

We did not examine systems for managing healthcare waste materials at facilities operated by contracted service providers. AHS focuses on providing healthcare services and uses its

agreements with contracted service providers to ensure such facilities comply with legislation for waste management. We reviewed the relevant provisions of AHS's contract with a major service provider to determine whether this contractual and regulatory framework adequately ensures AHS's standards for healthcare waste materials management are met.

We did not examine any aspect of healthcare waste materials that may be generated by other parties such as doctors' or dentists' offices.

## Findings and recommendations

### Oversight of healthcare waste materials management at sites operated by AHS

#### Background

AHS has a large number of sites throughout the province generating various types and volumes of healthcare waste materials. Environmental Services (ES) is a branch within AHS that currently has oversight responsibility for healthcare waste materials management at hospitals and other large sites operated by AHS. Healthcare waste materials pickup and disposal services are generally provided to AHS sites by a waste management vendor. AHS is currently developing requests for proposals for these services at its various sites throughout the province.

#### Recommendation: oversight at AHS waste generating sites

##### 1 RECOMMENDATION

We recommend that Alberta Health Services establish systems for overseeing the management of healthcare waste materials at all AHS sites that generate these materials

#### Criteria: the standards for our audit

AHS should understand the types and volumes of healthcare waste materials produced at AHS sites and should have a business unit within AHS responsible for overseeing management of this waste. This oversight should provide the basis for control and accountability regarding safety and legislative compliance for this aspect of AHS's operations.

#### Our audit findings

##### Key finding

AHS has not assigned responsibility for oversight of the management of healthcare waste materials at all AHS sites that generate these materials.

In addition to the sites that ES says it is currently responsible for, there are more than 400 other AHS-operated sites generating healthcare waste materials that are not subject to ES's supervision. In particular, for facilities variously described as "health centres", further work is required by AHS to obtain assurance these healthcare waste materials are being appropriately managed.

At an early stage in our audit work, ES staff provided us with a list of 129 sites they said ES was responsible for, including the names of the vendors engaged to dispose of healthcare waste materials at those sites. Included on this list were all AHS hospitals in the province, which produce the vast majority of the volume of such waste.

In response to our audit enquiries, ES staff worked for several months to verify all the other AHS-operated sites that may be generating healthcare waste materials. They also determined whether ES oversees the management of that waste and which vendor had been contracted to dispose of it. On October 25, 2011, ES confirmed that healthcare waste materials are produced at 573 of the 938 sites operated by AHS, plus 72 of the 112 sites operated by contracted service providers. This means that there are currently more than 400 AHS-operated sites and 72 contractor-operated sites producing healthcare waste materials that are not under ES's oversight responsibility.

ES explained to us that its roles and responsibilities in this area are evolving. For example, the type and number of sites ES is responsible for overseeing may change over time. ES informed us it is drafting a strategy proposing that ES be given responsibility for overseeing healthcare waste management at all AHS sites generating these materials. ES also told us that all such sites will be included in its planned requests for proposals from contractors to dispose of AHS's various waste streams. ES says it intends to add provision for contracted sites to have the option of harmonizing their waste management services with AHS's selected vendors on terms similar to those negotiated for AHS-operated sites.

## Implications and risks if recommendation not implemented

Without systems for oversight of the healthcare waste materials management at all AHS-operated sites that produce such waste, AHS does not have adequate assurance it has mitigated the risks related to handling, storage and disposal of this waste.

## Waste handling policies and procedures

### Background

AHS has a large number of sites throughout the province generating various types and volumes of healthcare waste materials. This creates a challenge in coordinating waste handling practices across sites.

## Recommendation: waste handling policies and procedures at AHS sites

### 2 RECOMMENDATION

We recommend that Alberta Health Services improve the handling and disposal of healthcare waste materials at its sites by:

- standardizing healthcare waste materials handling policies and procedures across sites
- establishing processes to monitor and enforce facilities' compliance with healthcare waste materials handling policies and procedures
- ensuring chemical waste hazards are remediated promptly
- pursuing more opportunities to reduce, reuse and recycle materials that could enter the healthcare waste stream

## Criteria: the standards for our audit

### Waste handling, storage and disposal

AHS should:

- have standard definitions for the various types of healthcare waste materials across all its sites
- have uniform, documented standards for proper collection, handling, storage, transportation and disposal methods for each category of healthcare waste materials
- have systems to properly segregate waste materials, where practicable, as they enter the healthcare waste stream
- have systems to ensure it complies with legislation applicable to healthcare waste materials

### Training

AHS should provide ongoing training to all staff members involved in healthcare waste generation and collection.

### Monitoring and oversight

AHS should:

- have systems to monitor healthcare waste management to obtain assurance that AHS sites are complying with its standards
- have systems to flag waste handling problems for follow-up and remedial action

## Our audit findings

### Key finding

AHS has not fully standardized healthcare waste management procedures across sites. As a result, potentially serious chemical waste hazards exist at some sites, and waste materials segregation could improve.

## Definitions and standards

In 2011, AHS's Environmental Services branch revised its definitions for the various types of healthcare waste materials and standards for the proper collection, handling, storage, transportation and disposal treatment methods to be used for each category of healthcare waste materials. It has also set up a document management system to distribute these policies and procedures to the sites. The definitions and standards are consistent with authoritative guidance, including that of the Canadian Standards Association, or CSA.<sup>4</sup> ES informed us these revised policies and procedures are being put into place at all major AHS-operated sites. However, at the time our audit concluded, some sites were still using procedures carried forward from the former regional health authorities, resulting in inconsistencies between sites and a risk that procedures at some sites may not fully meet the new standards.

## Chemical waste

Standards for safely handling hazardous materials have been set by the Canadian Centre for Occupational Health and Safety, including MSDS.<sup>5</sup> Reviews of seven southern Alberta sites, conducted by ES in April and May 2011, found several instances where various chemical waste hazards were present, including the following:

- Some chemicals were not properly labelled or, in some cases, were not labelled at all.
- Incompatible wastes were not properly segregated (some chemicals may react with

others and ignite or explode) or were not properly stored (some were stacked).

- Some chemicals requiring special handling may not have adequate precautions in place for handling (for example, picric acid can be highly explosive).
- In one case, gasoline fuels tanks were present in the chemical storage area.

Specialized training is required to deal with chemical waste safely. At the sites administered by ES, housekeeping personnel who handle chemical waste have WHMIS<sup>6</sup> training, but generally no TDG<sup>7</sup> training. The distinction is significant. WHMIS deals with how to handle chemicals and other hazardous materials during use, whereas TDG focuses on how to transport such materials.

WHMIS training for the housekeeping staff is only part of the solution for safe handling of these materials. It is essential that appropriate systems for labelling, segregating, storing and disposing of these materials be in place, either by making the generating areas responsible for transferring and storing chemicals before final disposal, or by having the waste contractor, who is trained in TDG, go directly to the generating areas to remove this waste.

<sup>4</sup> CSA Z317.10-09 (2009), *Handling of waste materials in healthcare facilities and veterinary healthcare facilities*.

<sup>5</sup> An MSDS, or Material Safety Data Sheet, is a document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with a chemical product. It is an essential starting point for a complete health and safety program. The supplier or manufacturer of the material prepares the MSDS. It contains much more information than a product label—it explains the hazards of the product, how to use and store the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure, and what to do if such incidents occur. (CCOHS website July 2011)

<sup>6</sup> WHMIS, the Workplace Hazardous Materials Information System, is Canada's national hazard communication standard. Key elements of the system are cautionary labelling of containers of WHMIS "controlled products," MSDSs, and worker education and training programs. Education is instruction in general information such as how WHMIS works and the hazards of controlled products. Training is instruction in site-specific information such as work and emergency procedures. Education and training are both important in understanding hazards.

<sup>7</sup> TDG stands for Transportation of Dangerous Goods. In Canada, the transportation of potentially hazardous materials is regulated under the federal *Transportation of Dangerous Goods Act and Regulations*, which are administered by Transport Canada. The legislation sets out criteria for classifying materials as dangerous goods and specifies how these materials must be packaged and shipped.

### Segregating biomedical and general waste

We did not find evidence of AHS staff putting healthcare waste materials into general waste.<sup>8</sup> Our discussions with ES and site managers indicated AHS healthcare workers are generally very aware of the need for proper handling of these materials and are conscientious in dealing with them properly.

However, it was less clear to us that some general waste is not going into healthcare waste. This is not a health or environmental hazard. Depending on volumes, such practices could result in significantly higher disposal costs because the cost of healthcare waste disposal is approximately 10 times the cost of general waste disposal. While the total costs of healthcare waste disposal may not justify an elaborate monitoring system, periodic checks or waste audits could be effective in maintaining staff awareness of this issue. At present, no formal program of monitoring is in place at AHS, other than site-specific initiatives that we observed to be ad hoc suggestions from the housekeeping staff to various generating areas.

### Recycling

It is generally accepted in the waste management sector that robust recycling programs help improve segregation of general and healthcare waste materials, thereby reducing costs and the organization's environmental footprint. We found that some beverage containers and paper/cardboard (for example, shredded confidential documents, baled cardboard) are recycled, but other materials such as glass and metals are generally not. Plastics are also not recycled, with the exception of a pilot project at one hospital in Edmonton and returnable/refundable containers collected by the staff at many sites. ES informed us it is starting a pilot program for enhanced recycling at selected Calgary sites.

Opportunities to recycle are continually emerging. For example, several companies now collect metals, the City of Edmonton is developing additional recycling and energy conversion capacity for handling plastics, and commercial "blue bin" recycling services are available to handle various materials.

### Training and supervision

We observed inconsistencies in waste handling at the two sites we visited, which may be the result of different procedures, training programs, supervision or combinations thereof. For example, while procedures were generally rigorous at the larger hospital, at the smaller hospital some biomedical waste bags were sitting on the floor rather than being secured in cardboard boxes, some waste bags were overfilled, some pails for sharps did not have required lids in place, and waste handling safety posters were not uniformly displayed. ES's recent onsite visits to seven southern Alberta facilities found similar inconsistencies.

In addition to their professional education and training, staff members at each site receive training on that site's procedures for handling healthcare waste materials. As part of its efforts to standardize healthcare waste handling procedures, ES is developing a training program and was expected to begin working with site managers on training delivery in January 2012. ES acknowledges the need for consistency and monitoring. A series of onsite visits around the province has been started and periodic waste audits may be requested in forthcoming requests for proposals for biomedical and hazardous waste disposal services.

<sup>8</sup> "General waste" is essentially ordinary garbage (for example, plastics).

### Implications and risks if recommendation not implemented

If appropriate procedures for handling healthcare waste materials are not applied at all sites generating this waste, health, reputational and financial risks may arise. Improperly stored chemicals may result in explosions, fires or toxic releases, and improperly segregated waste may lead to higher than necessary costs. Without adequate monitoring, AHS will not have assurance that standard procedures are in place and are complied with.

### Vendor management

#### Background

Two contractors, who have negotiated separate agreements with AHS facilities in different areas of the province, handle the substantial majority of AHS's biomedical waste. A third company has the contract for hazardous/chemical waste management. While there is some uniformity to pricing structures within regions, there are wide fluctuations in cost structure overall. These fluctuations primarily reflect higher costs of pickup at various locations and transport to final disposal sites.

The contractors generally supply the containers used for disposal. The contractors also provide labels to be applied by each site to filled containers before shipping. Most containers are single-use only, although some reusable containers are also in service.

According to ES's approved protocols, the basic disposal procedures are as follows:

1. The contractor's truck arrives on site.
2. Housekeeping staff members move full healthcare waste materials containers, bar-coded or labelled as appropriate, from designated storage areas to the loading area.
3. The driver is to provide the site a copy of the shipping manifest indicating the number of containers picked up.
4. Waste is to be transferred to the contractor's facility, weighed (if biomedical waste), and transported on larger trucks to the disposal facility.
5. For biomedical waste, the disposal facility is to process the waste and stamp a Destruction Certificate on the remaining copies of the manifest, of which notably the yellow copy is to be sent back to the originating site with the monthly billing. For chemical waste, the disposal facility is to sign a Destruction Certificate, which is to be submitted to the site with the monthly billing.

### Recommendation: contract management for disposal of healthcare waste materials at AHS sites

#### 3 RECOMMENDATION

We recommend that Alberta Health Services take steps to improve its contract management processes for healthcare waste materials by:

- requiring sites to verify services have been performed before approving vendor invoices for payment
- developing risk-focused systems to monitor healthcare waste management for purposes of controlling volumes and costs

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## Criteria: the standards for our audit

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### Procurement controls

AHS should have appropriate controls in place to ensure it has received goods and services purchased for healthcare waste management (such as disposal supplies and disposal charges), before approving vendor invoices for payment.

### Performance management

AHS should establish and monitor key performance measures for healthcare waste management (for example, volumes produced, amount recycled).

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## Our audit findings

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### Key finding

AHS does not have adequate controls to ensure waste disposal services have been performed before it approves vendor invoices for payment, and does not have systems to monitor waste volumes to help control costs.

### Procurement controls

Under the regional health authority structure, sites or regions were responsible for approving their own procurement costs. AHS has centralized this role. AHS's Environmental Services branch indicates that payment approval has recently been reassigned to individual sites, which are in the best position to confirm services have been performed. However, this alone will not reduce the risk of billing errors and overcharges going undetected.

The sites are not consistent in monitoring the amount of waste they send for disposal. With limited exceptions, the sites have no process to weigh the amount of waste shipped, which is the basis of the charge, and there is no consistently applied compensating control to agree the number of containers loaded to quantities on the manifest left by the driver, on even a sample basis, as a proxy for volumes shipped. Moreover, amounts shipped are not reconciled to amounts destroyed to ensure services have been performed and waste has not ended up in other than intended locations.

### Performance management

Waste volumes are not tracked by the sites. We found that ES had not tracked this information either, so no variance or trend analysis is being done on volumes. To estimate biomedical waste volumes and costs, we were directed to AHS's main contractor for biomedical waste management. ES had copies of monthly invoices for individual facilities, but no summary report from the contractor and no internal system to compile this information. For its part, the contractor was cooperative but could not provide us with more than selected regional monthly summaries (see Appendix). As a result, it was not reasonably possible for AHS or our Office to determine the actual annual volumes of healthcare waste materials processed, what they cost, or to analyze site volumes relative to other facilities of similar size.

Near the end of our audit, ES was evaluating creation of its own database to collect and analyze data on volumes and costs from all facilities, or including such a requirement in forthcoming request for proposal specifications of services to be provided by the vendor. ES also indicated it plans to develop key reports and indicators for ongoing monitoring and accountability.

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## Implications and risks if recommendation not implemented

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If the amount of waste shipped is not agreed to the amounts charged and the amounts certified as destroyed by the vendor, AHS may incur excess costs for services that have not been performed. If waste volumes are not monitored across sites and over time, AHS will lose the opportunity to use this information as a complementary control to assess the reasonableness of amounts billed by the supplier, and to compare waste volumes between facilities to identify anomalies, outliers and best practices.

## Contracted service providers

### Background

AHS delivers a significant portion of its healthcare services through contracted service providers such as Covenant Health. ES has confirmed that 72 of the 112 sites operated by contracted service providers generate healthcare waste materials.

ES informed us that “while AHS is responsible for the patients who receive care from a contracted service provider, AHS does not take responsibility for the service provider’s compliance with provincial laws such as environmental protection legislation or disposal of hazardous materials, or for the day-to-day enforcement of those laws. AHS is focused, by its legislation, on the provision of healthcare services, and it addresses legislative compliance through appropriate language in its agreements with service providers.”

The main focus and objective of AHS’s contracting activities is the delivery of healthcare services, and contract provisions around medical waste management are only one of many considerations in the contracting process. Any efforts by AHS to improve contract provisions for healthcare waste materials need to be viewed in the broader context of AHS’s contracting policies and practices.

### Recommendation: healthcare waste materials at contracted health service providers

#### 4 RECOMMENDATION

We recommend that Alberta Health Services assess its risk related to healthcare waste materials produced by contracted health service providers and ensure contract provisions manage that risk.

### Criteria: the standards for our audit

#### Service standards

AHS should have systems to ensure contracted service providers meet its requirements for management of healthcare waste materials.

### Our audit findings

#### Key finding

AHS’s current agreements with contracted service providers do not provide adequate assurance that AHS’s service standards for healthcare waste materials management are being met.

The standard terms of AHS’s agreements with contracted service providers require the contractor to warrant it has the skills, qualifications and experience necessary to ensure the performance and management of the services specified in the agreement. The standard agreement also requires a contracted service provider to comply with all laws applicable to its duties and obligations under the agreement, including occupational health and safety and environmental protection legislation. Contracted service providers must also ensure their programs, operations and services comply with written policies of AHS, provided the contractor has been notified of such policies.

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Applicable legislation does not reference, or provide direction comparable to, the authoritative guidance of the CSA standards on which ES has based its policies and procedures for the AHS sites it is responsible for.<sup>9</sup> For example, CSA standards and ES policies require biomedical waste to be secured and segregated in clean, refrigerated and locked storage areas until disposal, which are requirements not prescribed in legislation. The applicable legislation deals with:

- the definition of “biomedical waste”<sup>10</sup>
- disposal of “biomedical waste”<sup>11</sup>
- transportation of “dangerous goods”<sup>12</sup>
- workplace safety<sup>13</sup>

In general, if AHS intends to rely on legislative compliance provisions for assurance that contracted service providers will meet its service delivery standards, it needs to be sure that relevant legislation specifies such standards.<sup>14</sup> Where legislation alone does not achieve this purpose, as in the management of healthcare waste materials, it may be appropriate for AHS to advise its contracted service providers of the policies and standards it requires them to comply with.

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### Implications and risks if recommendation not implemented

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If AHS does not clearly specify the standards it expects contracted service providers to meet, healthcare waste materials may not be properly managed at all contracted sites that generate these materials.

<sup>9</sup> CSA Z317.10-09 (2009), *Handling of waste materials in healthcare facilities and veterinary healthcare facilities*.

<sup>10</sup> Under the *Waste Control Regulation* (AR 192/96) to the *Environmental Protection and Enhancement Act* (RSA 2000 cE-12), “biomedical waste” is defined as waste generated by:

- (i) human healthcare facilities,
  - (ii) medical research and teaching establishments,
  - (iii) clinical testing or research laboratories, and facilities involved in the production or testing of vaccines,
- and contains or may contain pathogenic agents that may cause disease in humans exposed to the waste. However, biomedical waste is not “hazardous waste” for purposes of disposal restrictions unless it meets the definition of hazardous waste due to its combustibility, toxicity, or chemical structure.

<sup>11</sup> The Environmental Code of Practice for Landfills under the *Environmental Protection and Enhancement Act*, requires all landfills in Alberta comply with the *Guidelines for the Management of Biomedical Waste in Canada*, published by the Canadian Council of Ministers of the Environment (CCME) in 1992. Those guidelines include requirements that:

- no human anatomical waste go to landfill,
- no human blood or body fluids go to landfill,
- microbiology laboratory waste can go to landfill if properly treated (steam autoclaved), and
- sharps can go to landfill if properly treated (steam autoclaved)

Healthcare waste materials meeting the definition of “hazardous waste” can only be accepted for disposal by the Swan Hills Treatment Centre or a Class 1 landfill.

<sup>12</sup> The *Dangerous Goods Transportation and Handling Act* (RSA 2000 cD-4) defines “dangerous goods” as a product, substance or organism that is:

- explosive, flammable, or liable to spontaneously combust,
- an oxidizing or corrosive substance,
- poisonous (toxic) or infectious,
- a nuclear substance within the meaning of the *Nuclear Safety and Control Act* (Canada), or
- otherwise considered by the Governor in Council under the *Transportation of Dangerous Goods Act, 1992* (Canada) to be dangerous to life, health, property or the environment when handled or transported.

The Act places various restrictions on the handling and transportation of “dangerous goods,” for example containment, labelling, travel routes and emergency response plans.

<sup>13</sup> Part 35, “Healthcare and Industries with Biological Hazards,” of the Occupational Health and Safety Code under the *Occupational Health and Safety Act* (RSA 2000 cO-2) requires employers to control a worker’s exposure to blood borne pathogens or other biohazardous material; establish policies and procedures dealing with storing, handling, using and disposing of biohazardous materials; ensure workers are informed of the health hazards associated with exposure to the biohazardous material; and ensure workers’ exposure to biohazardous materials is kept as low as reasonably practicable. The Code references more than 50 CSA standards, but CSA Z317.10-09 on the handling of waste materials in healthcare facilities is not one of them.

<sup>14</sup> The *Public Health Act*, s.66(2)(g), allows the Minister of Health to make regulations respecting the handling and disposal of biomedical waste, but no regulations have been enacted to date.

## Appendix—Estimated Biomedical Waste Volumes and Costs

Facility	Est kg/yr	Est \$/kg	Est cost/yr
U of A Hospital	420,000	\$1.08	\$453,600
Royal Alexandra Hospital	265,000	1.08	286,200
Grey Nuns Hospital	95,000	1.08	102,600
Misericordia Hospital	70,000	1.08	75,600
Edmonton General Hospital	35,000	1.08	37,800
Edmonton Renal	72,000	1.08	77,760
Edmonton Provincial Lab	84,000	1.08	90,720
Edmonton rural hospitals	24,000	1.08	25,920
Calgary urban hospitals	720,000	0.79	568,800
Calgary rural hospitals	90,000	0.96	86,400
Carewest	12,000	0.79	9,480
AHS south zone	180,000	1.73	311,400
AHS central zone	108,000	2.21	238,680
AHS north zone and others	198,000	1.36	269,280
<b>TOTAL</b>	<b>\$2,373,000</b>		<b>\$2,634,240</b>

### Sources

1. Based on Jan.1 to Dec. 31/09 volumes compiled by Environmental Services using vendor invoices.
2. Based on December 2010 volumes provided to the Auditor General by AHS's largest waste management vendor.
3. Estimate includes all other AHS sites that generate healthcare waste materials, based on average costs for similar sites.

