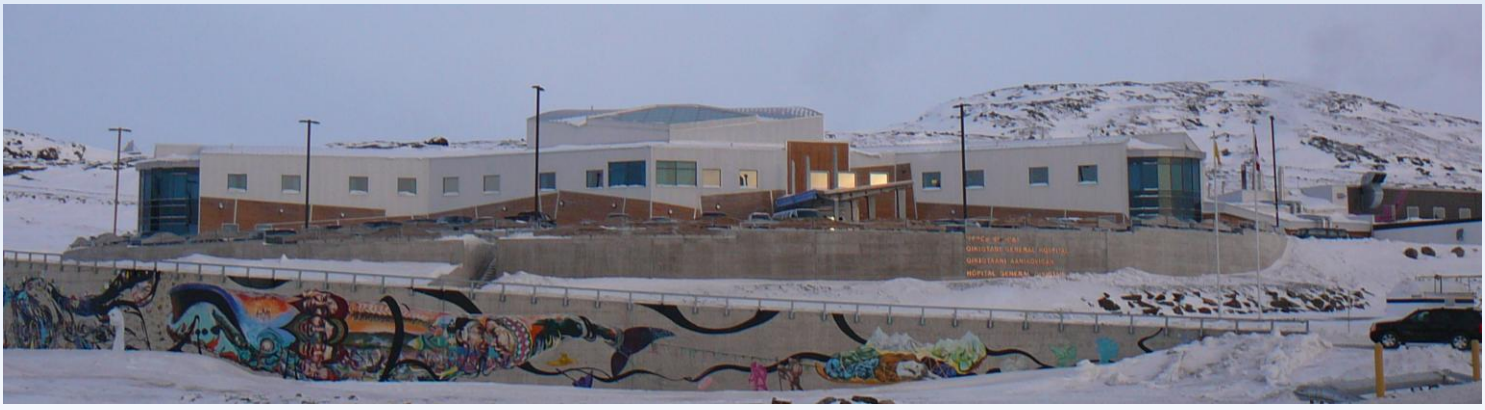
## Environmental Guideline for

# Biomedical and Pharmaceutical Waste




Department of Environment
Government of Nunavut

# GUIDELINE: BIOMEDICAL AND PHARMACEUTICAL WASTE

Original: March 2014

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under the authority of Section 2.2 of the *Environmental Protection Act.*

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with biomedical and pharmaceutical waste. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of biomedical and pharmaceutical waste.

Copies of this Guideline are available upon request from:

Department of Environment
Government of Nunavut
P.O. Box 1000, Station 1360, Iqaluit, NU, X0A 0H0
Electronic version of the Guideline is available at http://env.gov.nu.ca/programareas/environmentprotection

Cover Photos: E. Paquin (top and bottom left)

## Table of Contents


**Introduction** ..... 1
1.1 Definitions ..... 2
1.2 Roles and Responsibilities ..... 3
1.2.1 Generators and Owners of Biomedical and Pharmaceutical Waste ..... 3
1.2.2 Government of Nunavut ..... 4
1.2.3 Government of Canada ..... 5
1.2.4 Local Municipal Governments ..... 5
**Characteristics and Potential Effects of Biomedical and Pharmaceutical Waste** ..... 6
2.1 Biomedical Waste ..... 6
2.2 Pharmaceutical Waste ..... 6
**Waste Minimization and General Management Practices** ..... 7
3.1 Minimization and Reduction ..... 7
3.2 Segregation ..... 8
3.3 Packaging and Labeling ..... 8
3.3.1 Reusable Containers ..... 9
3.3.2 Single-use Containers ..... 9
3.4 Storage ..... 10
**Treatment and Disposal Practices and Technologies**
4.1 Steam Autoclaving ..... 11
4.2 Chemical Disinfection ..... 11
4.3 Incineration ..... 12
4.4 Open burning ..... 13
4.5 Local Landfill ..... 13
4.6 Sanitary Sewer ..... 13
4.7 Off-site Transportation ..... 13
4.8 Treatment and Disposal of Biomedical Waste According to Category ..... 15
4.9 Waste Sharps from the General Public ..... 15
4.10 Pharmaceutical Waste ..... 16
**Conclusion** ..... 17
**References** ..... 18


## Appendices


Appendix 1 Environmental Protection Act
Appendix 2 Government Contacts

## Introduction

For decades, authorities have recognized the occupational and public health risks and hazards associated with biomedical waste. More recently, researchers have begun to associate pharmaceutical waste in the environment with changes in antibiotic resistance, hormone levels and other chronic effects in non-target organisms. While biomedical waste typically represents only a small proportion of the total volume of waste generated by health care facilities, its infectious nature and aesthetics requires that biomedical waste receive specific handling and treatment prior to disposal. Unlike biomedical waste, pharmaceutical waste is generated not only by health care facilities but by a large proportion of the general public. A survey undertaken by Statistic Canada in 2008 shows that Canadian consumers tend to dispose much of their unused and expired pharmaceuticals in garbage, toilets and sinks. The management of pharmaceutical waste and the environmental and human health risks it represents is an emerging and growing area of research.

The *Environmental Guideline for Biomedical and Pharmaceutical Waste* (the Guideline) is intended to establish minimum standards and promote uniform practices for the proper management of biomedical and pharmaceutical waste in Nunavut. The Guideline provides information on the risks and hazards associated with these wastes and guidance on best management practices including segregation, packaging, labeling, storage, transportation, treatment and disposal.

The Guideline applies to, but is not limited to, the following types of facilities:

- Health care services including hospitals and community health care facilities;
- Home nursing services;
- Human clinical and wildlife testing laboratories;
- Medical and health care teaching institutions;
- Veterinary offices and clinics; and
- Pharmacies

The Guideline does not apply to waste controlled in accordance with the *Health of Animals Act (Canada),* formally the *Animal Disease Protection Act (Canada).* The Guideline also does not apply to biomedical and pharmaceutical waste generated in private homes, unless specifically referenced by the Guideline.

The Guideline is not an official statement of the law. It should be read in conjunction with the *Environmental Guideline for the General Management of Hazardous Waste.* For further information and guidance, the owner or person in charge, management or control of biomedical and pharmaceutical waste is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the management of the waste.

The *Environmental Protection Act* enables the Government of Nunavut to implement measures to preserve, protect and enhance the quality of the natural environment. Section 2.2 of the *Act* provides the Minister with authority to develop, coordinate, and administer the Guideline.

## 1.1 Definitions

| | |
|---|---|
| *Animal Waste* | Waste that consists of animal tissues; organs; body parts; carcasses; bedding; fluid blood and blood products; items saturated or dripping with blood; body fluids contaminated with blood and body fluids removed for diagnosis or removed during surgery, treatment or autopsy that contain anthrax, brucellosis, hantavirus, rabies or any other infectious substance. This excludes teeth, hair, nails, hooves and feathers. |
| *Biomedical Waste* | Any solid or liquid waste that may present a threat of infection to humans including human anatomical waste, animal waste, microbiology laboratory waste, human blood and body fluid waste, and waste sharps. |
| *Biomedical Waste Incinerator* | A device or structure specifically designed to incinerate biomedical waste for the purpose of reducing its volume or destroying infectious substances. |
| *Commissioner's Land* | Lands that have been transferred by Order-in-Council to the Government of Nunavut. This includes roadways and land subject to block land transfers. Most Commissioner's Land is located within municipalities. |
| *Contaminant* | Any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,<br>(a) endangers the health, safety or welfare of persons,<br>(b) interferes or is likely to interfere with normal enjoyment of life or property,<br>(c) endangers the health of animal life, or<br>(d) causes or is likely to cause damage to plant life or to property. |
| *Dangerous Good* | Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* in any of the classes listed in the Schedule provided in the *Transportation of Dangerous Goods Act*. |
| *Disinfection* | A process that kills most bacteria but rarely kills all viruses and spores. |
| *Environment* | The components of the Earth and includes<br>(a) air, land and water,<br>(b) all layers of the atmosphere,<br>(c) all organic and inorganic matter and living organisms, and<br>(d) the interacting natural systems that include components referred to in paragraphs (a) to (c) above. |
| *Hazardous Waste* | A contaminant that is a dangerous good and is no longer wanted or is unsuitable for its original intended purpose and is intended for storage, recycling, treatment or disposal. |
| *Human Anatomical Waste* | Waste that consists of human tissue, organs and body parts, but does not include teeth, hair and nails. |

| | |
|---|---|
| *Human Blood and Body Fluid Waste* | Waste that consists of human fluid blood and blood products, items saturated or dripping with blood, body fluids contaminated with blood, and body fluids removed for diagnosis during surgery, treatment or autopsy. This does not include urine or faeces. |
| *Infectious Substance* | A substance known or reasonably expected to contain viable microorganisms that can cause disease or death in humans or animals. |
| *Microbiology Laboratory Waste* | Waste that consists of laboratory cultures, stocks or specimens or microorganisms, live or attenuated vaccines, human or animal cell cultures and laboratory material that has come into contact with any of these. |
| *Open Burning* | Burning of waste with limited or no control of the burning process. For clarity, open burning includes burning on the open ground or using a burn box or unmodified or modified burn barrel. |
| *Pharmaceutical Waste* | Waste that consists of expired, unused, spilled or contaminated medical drugs, vaccines or sera that is no longer required and need to be disposed of. |
| *Sterilization* | A process that kills all microorganisms including bacteria, viruses, spores and fungi. |
| *Transport Authority* | The statute and regulations controlling the management of hazardous waste under that mode of transport. These include<br>(a) Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations; Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*.<br>(b) Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and<br>(c) Marine – *International Maritime Dangerous Goods Code* (IMDG). |
| *Waste Sharps* | Waste that consists of clinical and laboratory needles, syringes, blades or laboratory glass capable of causing punctures or cuts. |

## 1.2 Roles and Responsibilities

### 1.2.1 Generators and Owners of Biomedical and Pharmaceutical Waste

Generators, owners or persons in charge, management or control of biomedical and pharmaceutical waste, also referred to as the responsible party, are responsible for ensuring waste is properly and safely managed from the time it is produced to its final treatment and disposal. Contractors may manage unwanted biomedical and pharmaceutical waste on behalf of the responsible party. However, the responsible party remains responsible for ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not

comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the waste on behalf of the responsible party, the responsible party may also be charged.

The Canada Labour Code and Nunavut's *Safety Act* require all employers to maintain a safe workplace and ensure the safety and well being of workers. Organizations should take reasonable measures to reduce the risk of exposure to infection by establishing written procedures for the safe handling, storage, packaging, transport, treatment and disposal of biomedical waste that workers may come in contact with. These procedures should be reviewed and updated regularly. Training programs should also be offered to employees on safe work and emergency procedures (i.e. spills or other potential exposures) and on the use of engineering controls and personal protective equipment.

While these requirements do not apply to biomedical and pharmaceutical waste generated in a home health care setting unless specifically referenced by the Guideline, home owners are encouraged to comply with the Guideline's spirit and intent.

### 1.2.2 Government of Nunavut

**Department of Environment**

The Government of Nunavut's Environmental Protection Division is the key territorial agency responsible for ensuring owners or persons in charge, management or control of biomedical and pharmaceutical waste properly manage it. Authority is derived from the *Environmental Protection Act*, which prohibits the discharge of contaminants to the environment and enables the Minister to undertake actions to ensure appropriate management measures are in place. Although programs and services are applied primarily to activities taking place on Commissioner's and municipal lands and to Government of Nunavut undertakings, the *Environmental Protection Act* may be applied to the whole of the territory where other controlling legislation, standards and guidelines do not exist. A complete listing of relevant legislation and guidelines can be obtained by contacting the Department of Environment or by visiting the web site at http://env.gov.nu.ca/programareas/environmentprotection.

W**orkers' Safety and Compensation Commission**

The Workers' Safety and Compensation Commission is responsible for promoting and regulating worker and workplace health and safety in Nunavut. The Commission derives its authority from the *Workers' Compensation Act* and *Safety Act* which require an employer to maintain a safe workplace and ensure the safety and well being of workers. The Workplace Hazardous Materials Information System, or WHMIS, requires information be provided to workers on any hazardous substances they may encounter in the workplace, including microorganisms.

**Department of Health and Social Services**

The Department of Health and Social Services is a major generator of biomedical and pharmaceutical waste in Nunavut as well as having responsibilities to ensure protection of the health of the general public. The Office of the Chief Medical Officer of Health and Regional Environmental Health Officers should be consulted regarding specific legislated requirements under the *Public Health Act.*

**Department of Community and Government Services**

The Department of Community and Government Services is responsible under the *Commissioner's Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste and sewage disposal facilities in most Nunavut communities. Emergency planning responsibilities under the *Emergency Measures Act* include developing territorial emergency response plans, coordinating emergency operations at the territorial and regional levels and supporting community emergency response operations which may result from the release of infectious substances.

**Department of Economic Development and Transportation**

The Motor Vehicles Division of the Department of Economic Development and Transportation administers the *Transportation of Dangerous Goods Act* and is responsible for the safe transport of dangerous goods and hazardous waste by road. The Department is also responsible for driver licensing and various other vehicle and road safety matters under the *Motor Vehicles Act*.

### 1.2.3 Government of Canada

**Agriculture Canada**

The *Health of Animals Act* controls the management of infectious animal waste in Canada. Under the Act, which is administered by Agriculture Canada, a veterinary inspector may order any person having possession, care or custody of an animal that dies, or is suspected of dying, from an infectious or contagious disease to dispose of the carcass in a manner that the veterinary inspector specifies.

**Environment Canada**

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* (CEPA). Section 76 of CEPA requires the federal Ministers of Environment and of Health to establish a Priority Substances List identifying substances that are to be assessed on a priority basis to determine whether they are toxic (as defined under section 64 of CEPA) and pose a risk to the health of Canadians or to the environment. Environment Canada also regulates the interprovincial and international movement of hazardous waste under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* and is responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

### 1.2.4 Local Municipal Governments

Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal landfill sites and sewage disposal facilities. Unwanted biomedical and pharmaceutical waste may be deposited into these municipal facilities only with the consent of the local government.

# Characteristics and Potential Effects of Biomedical and Pharmaceutical Waste

## 2.1 Biomedical Waste

A wide variety of biomedical waste can be produced in health care facilities. While this waste represents only a small proportion of the total volume of waste generated, specific handling, treatment and disposal is required because of the risk of infection to patients, visitors, doctors, nurses and other medical, service and maintenance staff.

Three types of infection are most commonly transmitted through biomedical waste: hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). According to a study published by the Institute for Environment, Engineering, Economics and Applied Mathematics[1], among the 35 million health care workers worldwide, about 3 million are exposed each year to bloodborne pathogens including 2 million of those to HBV, 0.9 million to HCV and 170,000 to HIV.

Waste sharps present a physical hazard to health care and service workers as these objects can penetrate skin after having come in contact with infectious substances. In other cases, a high level of public sensitivity must also be displayed when managing certain types of biomedical waste due to the nature of the waste itself (i.e. human body parts).

Biomedical waste may also originate from wildlife. Viruses such as *Rhabodoviridae* (rabies) and *Bunyaviridae* (hantavirus) and bacteria such as *Bacillus anthracis* (anthrax) and *Brucella sp.* (brucellosis) can produce very serious diseases and may be transmitted from animals to humans.

## 2.2 Pharmaceutical Waste

Pharmaceutical drugs are comprised of a large class of organic chemicals that tend to be soluble in water. Municipal sewage treatment processes do not break down many of these compounds, which results in their release to the environment. Smaller amounts of pharmaceutical drugs are released to the environment in runoff from landfills when unwanted drugs are disposed of in household garbage.

There is considerable research being undertaken to identify the effects these chemicals are having on the environment at the very low concentrations at which they are being detected. While toxicity tests generally indicate that acute lethal effects are unlikely to occur, there is increasing concern over the potential for chronic or long-term effects. Antibiotic resistance in non-target receptors, or those organisms that the drug was not intended to be used on, is receiving much attention. Although not common, antibiotic resistant bacteria have already been identified in Lake Ontario by Environment Canada researchers[2]. Another emerging area of study deals with a group of chemicals known as endocrine disrupting compounds[3]. While pharmaceutical drugs are not the only source of these chemicals, endocrine disrupting compounds are increasingly being found in surface waters and are suspected to be responsible for declining sperm count, mobility and function in humans.

[1] Nikos E. Mastorakis, Carmen A. Bulucea, Tatiana A. Oprea, Cornelia A. Bulucea, Philippe Dondon. Environmental and Health Risks Associated with Biomedical Waste Management. Institute for Environment, Engineering, Economics and Applied Mathematics. ISBN: 978-960-474-253-0.
[2] Dr. Tom Edge. Aquatic Ecosystem Protection Research Division of Environment Canada.
[3] Endocrine disrupting compounds are chemicals that mimic hormones or disrupt hormone regulation. These compounds can be found in pesticides, detergents, cosmetics, plastics, pharmaceuticals and other personal care products.

# Waste Minimization and General Management Practices

> *Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created.*[4]

Good waste management begins with good planning. A written biomedical and pharmaceutical waste management plan that provides instructions on the safe handling and disposal of waste materials should be included in each health care facility's policy and procedures manual. This plan should be included in the orientation and in-house training that is provided to all staff and should describe procedures for:

- Minimizing the quantities of biomedical and pharmaceutical waste generated including ensuring these wastes are not mixed with general garbage.
- Segregating, packaging, labeling, storing, disinfecting, treating and disposing of infectious material, contaminated clothing, equipment and other waste;
- Record keeping;
- Infection control including the use of personal protective and other equipment;
- Responding to spills, leaks and other possible exposures;
- Investigating and documenting exposure incidences and other post-exposure follow-up; and
- Worker safety and training.

The waste management plan should be developed in consultation with the facility's Occupational Health and Safety Committee, or where a Committee has not been established, with the workers. It should be updated whenever a major change in procedure or technology is implemented. Copies of the plan should be posted in a location that is accessible to all employees and other workers.

## 3.1 Minimization and Reduction

The recommendations described in this section go beyond biomedical and pharmaceutical waste management and should be applied to all waste that is generated in health care facilities.

Comprehensive waste minimization and reduction principles should be reflected in a health care facility's policy and procedures manual. This source-reduction approach results in the avoidance of waste and reduces the overall cost of waste management practices. One way to achieve this is through periodic waste audits. Waste audits help to define sources, quantities and types of waste; identify aspects of waste management that require improvement; establish objectives and targets for waste reduction and increase employee knowledge of waste management practices. Using the audit results, procedures can then focus on the specific wastes and priorities identified through the audit.

Waste management should always be considered when planning the purchase or replacement of products and services. Where it is consistent with patient and worker safety, replacing single-use items with reusable products, or products that contain recycled materials, should be considered. Product substitution, reduced product packaging, using suppliers that are willing to take back waste and used materials, using containers composed of non-halogenated plastics and recovering materials that can be reused or recycled should each be considered[5]. Maintaining effective inventory controls to ensure

[4] Source – Canadian Council of Ministers of the Environment.

[5] An example of waste substitution and recovery is mercury in thermometers, other medical devices and dental amalgam. Refer to the *Environmental Guideline for Mercury-Containing Products and Waste Mercury* for additional information.

stored quantities of materials and supplies are completely used before purchasing additional items is another effective way to reduce waste and unnecessary costs.

As many purchased products as possible should bear the *EcoLogo*® mark. The EcoLogo Program is a third party environmental leadership standard setting and certification program. Founded by the Government of Canada and being part of the Underwriters' Laboratories (UL) Global Network, EcoLogo is North America's largest and most respected environmental leadership certification mark. It helps consumers to identify products that can help minimize the use of environmentally hazardous substances, maximize the use of recycled or recyclable materials and increase energy efficiency. A complete listing of EcoLogo-certified products is available for downloading at http://www.ecologo.org/en/.

## 3.2 Segregation

Biomedical and pharmaceutical waste typically represents only a small proportion of the total volume of waste generated by health care facilities. Special care should be taken to ensure biomedical and pharmaceutical waste does not become mixed with, or contaminate, general garbage. If this was to occur, the total waste stream may require special handling and treatment. Segregation also helps in the diversion of those materials that are recyclable.

Further segregation of biomedical and pharmaceutical waste into the following categories enables added cost effective packaging, labeling, treatment and disposal to occur:

- Human anatomical waste;
- Microbiology laboratory waste;
- Human blood and body fluid waste;
- Animal waste;
- Waste sharps; and
- Pharmaceutical waste.

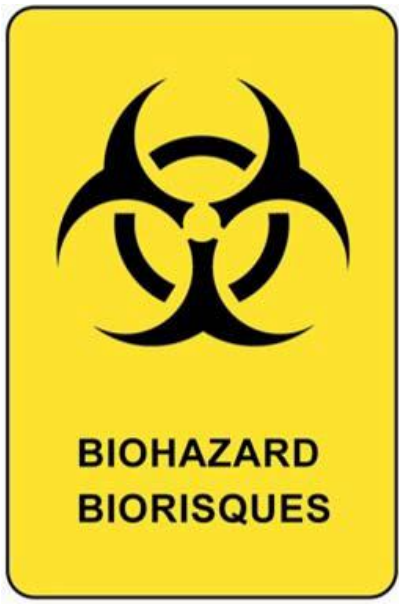
## 3.3 Packaging and Labeling

All biomedical and pharmaceutical waste must be safely and securely contained. When purchasing or selecting the type of packaging to be used, the following factors should be considered: the type of waste being contained; colour coding and labeling; transportation requirements; method of disposal and requirements of the disposal facility; and any other regulatory requirements.

Waste containers are classified as being either reusable or single-use. Each container must be capable of withstanding the weight of the waste without tearing, cracking, crushing, breaking or allowing the accidental release of the waste. Each must be color-coded and labeled according to the type of waste for which it is intended. Table 1 provides a summary of containment, labeling and temporary storage requirements for each waste category.

### 3.3.1 Reusable Containers

Reusable waste containers must be made of rigid plastic and able to withstand exposure to common cleaning agents. They must be labeled and colour-coded according to the type of waste for which they are intended. They should be inspected for holes or leaks each time they are emptied and replaced or repaired. Reusable containers should also be disinfected regularly to prevent odours or immediately following the leakage or spillage of waste within the container.




**Universal Biohazard Symbol**

### 3.3.2 Single-use Containers

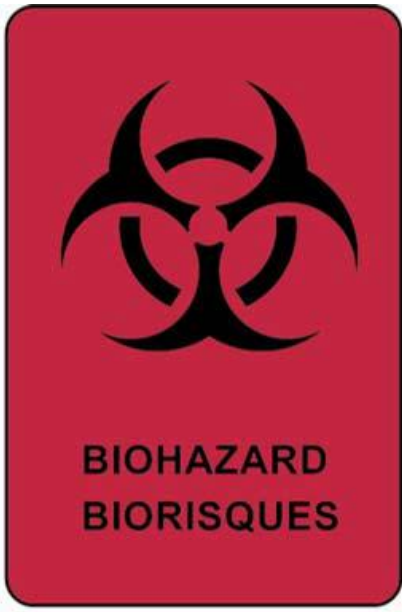
Single-use containers are generally classified as one of the following: sharps containers, plastic waste-holding bags or cardboard containers.

***Sharps Containers*** must be sturdy enough to resist puncture under normal conditions of use and handling. They must be colour-coded yellow or red, labeled with the universal biohazard label and have lids which can be tightly secured. It is also useful to users if sharps containers have a fill line; handles that permit the safe handling and movement of the containers; tight fitting lids that prevent unauthorized individuals from removing items from the container; a design that allows for stacking; and features that allow containers to be attached to medication and treatment carts.

The use of bleach bottles or other secondhand containers is discouraged. These containers are acceptable only if they are approved by the person responsible for the facility's biomedical waste management program.

***Plastic Waste-holding Bags*** must be sturdy enough to resist puncture or breakage under normal usage. They must be labeled and colour-coded according to the type of waste for which they are intended.

***Cardboard Containers*** must be rigid, closable, leak resistant and capable of being sealed. They must also be labeled and colour-coded according to the type of waste for which they are intended. If biomedical and pharmaceutical waste is shipped off-site in cardboard containers and not supplemented with an additional outer packaging meeting the requirements of the Transport Authority (i.e. *Transportation of Dangerous Goods Act*), then the cardboard container itself must meet the requirements of the Authority.




**Universal Anatomical Symbol**

## 3.4 Storage

Storage refers to the temporary maintenance of biomedical and pharmaceutical waste while awaiting treatment, transport or disposal. The long-term storage of waste is acceptable only under extraordinary circumstances. Ultimately, facilities will determine acceptable maximum storage times based upon storage capacity, rate of waste generation and availability of treatment or disposal options.

**Table 1. Acceptable Storage Container Type, Colour and Symbol**

| | Container Type | | | |
|---|---|---|---|---|
| **Waste Category** | **Single Use** | **Reusable** | **Container Colour** | **Symbol** |
| **Human Anatomical Waste** | Yes | No | Red | Anatomical |
| **Microbiology Laboratory Waste** | Yes | Yes | Yellow | Biohazard |
| **Human Blood and Body Fluid Waste** | Yes | Yes | Yellow | Biohazard |
| **Animal Waste** | Yes | No | Orange | Biohazard |
| **Waste Sharps** | Yes | Yes | Yellow or Red | Biohazard |
| **Pharmaceutical Waste** | Yes | Yes | NA | NA |

Human and animal anatomical waste must be stored at 4$^{o}$C or lower at all times. All other types of biomedical waste should be stored at 4$^{o}$C or lower if stored for more than four days. While the use of either commercial or domestic refrigeration and freezer units is acceptable, the units should be permanently marked to prevent their reuse as food storage appliances. If the facility generates only waste sharps (i.e. home care facilities), waste storage areas do not need to be refrigerated.

Untreated biomedical waste should not be compacted as containers may burst or leak and sharps may protrude through the containers. Compaction could also cause the release of infectious substances into the air.

Biomedical waste storage areas must be totally enclosed and separate from supply rooms, food preparation areas and other active work areas. It is unacceptable for biomedical waste and other materials to be placed together in the same storage area[6]. All storage areas must be lockable and have access restricted to authorized personnel only. Biohazard warning labels must be clearly displayed so as to identify these areas as containing biomedical waste.

Pharmaceutical waste should be stored in lockable cabinets separate from other pharmaceutical drugs and the cabinets clearly identified as containing pharmaceutical waste.

[6] Where operational constraints require storage areas to be used to store both general and biomedical waste, care must be taken to prevent the contamination of general waste by biomedical waste.

# Treatment and Disposal Practices and Technologies

Many different treatment and disposal practices and technologies have been developed to manage biomedical and pharmaceutical waste. The following section describes several of these practices and technologies and identifies acceptable management alternatives for each category of waste.

## 4.1 Steam Autoclaving

Steam autoclaving is acceptable for treating microbiology laboratory waste and human blood and body fluid waste. Waste sharps may also be treated using steam autoclaving however, the autoclaved sharps must also be either safely packaged, mechanically shredded or buried at a designated, approved location within the local landfill as part of the overall process due to their physical hazards (i.e. capable of puncturing skin).

Steam autoclaving relies on temperature and pressure to disinfect biomedical waste. Typical operating conditions required to achieve effective disinfection are a minimum temperature of 121$^{o}$C at a pressure of 105 kilopascals for more than 60 minutes.

Proper loading and operation of the autoclave is critical to the effectiveness of the disinfection process. Because waste is heated in the autoclave by both heat conduction and steam penetration, all air must be displaced from within containers holding the waste and good steam penetration must be achieved. For this reason, operators must never overload the equipment. Two separate small loads may be more effective in treating waste than a single large load. Some laboratory wastes, such as Petri dishes and syringes that are liable to melt and trap air or liquids, may require longer disinfection times. Consideration should also be given to the type of plastic bags used within the autoclave as some bags impede steam penetration while others melt.

## 4.2 Chemical Disinfection

Human blood and body fluid waste and waste sharps may be treated using chemical disinfection. Similar to steam autoclaving, further physical treatment of waste sharps through safe packaging, mechanical shredding or burial at a designated, approved location within the local landfill must be carried out due to the sharps' physical hazards.

Chemical disinfection uses a chemical agent to destroy infectious microorganisms within the waste, making it safe for handling. A solution of sodium hypochlorite is commonly used as the disinfectant, with the undiluted commercial product having a concentration of 5.25%. If a diluted solution of hypochlorite is used, it should be made up daily to ensure its effectiveness as a germicide is maintained.

Chemical disinfection is effective only when the chemical agent thoroughly penetrates the waste. Other factors that should be considered include the type of microorganism, level of contamination, type of chemical disinfectant used, concentration and quantity of disinfectant and the length of time the disinfectant is in contact with the waste.

## 4.3 Incineration

Biomedical waste incinerators are commonly used by medium and large health care facilities to dispose of anatomical and other biomedical waste. This is the only disposal technology capable of handling all components of the biomedical waste stream.

Biomedical incinerators are engineered to routinely achieve temperatures exceeding 1000°C and a holding time of at least one second. Combustible materials are converted at these high temperatures into non-combustible residues, typically achieving a 95% volume reduction and 75% weight reduction. Achieving these conditions will also minimize the release of dioxins and furans, which have drawn much attention in recent years because of their linkage to certain types of cancers, liver problems, impairment of the immune, endocrine and reproductive systems and effects on the fetal nervous system.

Air emission standards have been established on levels of air pollutants that can be released from incinerators. These standards are expressed as a concentration in the exhaust gases leaving the stack and are generally capable of being achieved using modern incineration technology and waste diversion practices. The following emission standards apply to all existing and new biomedical incinerators operating in Nunavut[7]. They have been adopted from the Canadian Council of Ministers of the Environment (CCME) *Guidelines for the Management of Biomedical Waste in Canada* and the CCME *Canada-Wide Standards for Dioxins and Furans and Mercury Emissions*.

**Table 2. Air Emission Standards for Biomedical Incinerators**

| Parameter | Numeric Standard | Monitoring Method |
|---|---|---|
| Dioxins and Furans | 80 pg I-TEQ/$Rm^3$ (a) | Annual stack test (b) |
| Mercury | 20 µg/$Rm^3$ (c) | Annual stack test (b) |
| Particulate Matter | 20 mg/$Rm^3$ (d) | Annual stack test (b) |
| Hydrogen Chloride | 75 mg/$Rm^3$ (e) | Continuous emissions monitor where charging capacity exceeds 200 kg/hour |
| Carbon Monoxide | 57 mg/$Rm^3$ (f) | Continuous emissions monitor where charging capacity exceeds 200 kg/hour |

a. International Toxicity Equivalents per Reference cubic meter (volume of air at 25°C and 101.3 kilopascals).
b. Monitoring requirements may be relaxed where it is demonstrated that best available pollution prevention and control techniques are being used, such as a plastics or mercury waste diversion program or where temperature in the burn chamber is monitored.
c. Micrograms per Reference cubic meter (volume of gas adjusted to 25°C and 101.3 kilopascals).
d. Milligrams per Reference cubic meter (volume of gas adjusted to 25°C and 101.3 kilopascals).
e. Equivalent to 50 parts per million dry volume.
f. Equivalent to 50 parts per million dry volume.

An incinerator's charging capacity should never be exceeded in order to ensure its proper functioning and operation. Two separate small loads, or charges, may be more effective in disposing of waste than a single large load. When incinerating waste with high moisture content, supplementary incinerator fuel may be required in order to achieve the necessary operating temperatures.

[7] Stack concentrations are corrected to 11% oxygen content for reporting purposes.

Bottom ash and other solid residue collected from an incinerator is suitable for burial at a local landfill where consent is first obtained from the landfill operator and where it meets the criteria set out in Table 1 of the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities.* Any bottom ash or residue not meeting the criteria is considered a hazardous waste. This hazardous waste is not suitable for landfilling and its management must comply with the *Environmental Guideline for the General Management of Hazardous Waste*.

### 4.4 Open Burning

Open burning includes burning waste directly on the ground or in burn boxes or burn barrels. This method does not achieve the temperatures or conditions needed for complete combustion of waste and should be avoided. The only exception to this prohibition is the open burning of infectious wildlife carcasses in remote locations, and where it is carried out under the direction of the Department of Environment or an Agriculture Canada veterinary inspector.

### 4.5 Local Landfill

A limited number of types of biomedical waste may be disposed of in local landfills, and only under specific conditions. Microbiology laboratory waste that has been treated by steam autoclaving and waste sharps that have been treated by either autoclaving or chemical disinfection may be buried at a designated, approved location within the landfill. The health care facility should prearrange with the landfill operator such details as the time of delivery and type and volume of waste so that the waste can immediately be covered with earth or other waste at the site. Following burial, the waste should never be allowed to be burned, disturbed or uncovered.

### 4.6 Sanitary Sewer

Similar to landfills, only a limited number of types of biomedical waste may be disposed of in a sanitary sewer. Treated and untreated fluid blood, suctioned fluids, excretions and secretions can be disposed of in a sanitary sewer where quantities are limited. Where these fluids are suspected of containing any of the exotic communicable diseases (ECDs) listed by Health and Welfare Canada, they must not be disposed of in a sanitary sewer but managed in consultation with the Canadian Laboratory Centre for Disease Control.

### 4.7 Off-site Transportation

Biomedical waste that is determined to be infectious[8] is classified as a Class 6.2 Infectious Substance for the purposes of transport. Infectious substances are further separated into two categories. Category A infectious substances are high risk infectious substances in a form that is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. Category B infectious substances are substances that do not meet the criteria for inclusion in Category A.

The handling, offering for transport and transport of biomedical waste must comply at all times with the requirements of the appropriate road, air or marine Transport Authority. Where biomedical waste is

[8] For the purposes of the *Transportation of Dangerous Goods Act*, an infectious substance is defined in Part 1 of the TDGA as "a substance known or reasonably believed to contain viable micro-organisms such as bacteria, viruses, rickettsia, parasites, fungi and other agents such as prions that are known or reasonably believed to cause disease in humans or animals and that are listed in Appendix 3 to Part 2, Classification, or that exhibit characteristics similar to a substance listed in Appendix 3".

transported by road, the *Transportation of Dangerous Goods Act* must be complied with. Transport by air must conform to the *International Air Transport Association* (IATA) *Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions,* while transport by marine must conform to the *International Marine Dangerous Goods Code*.

The *Transportation of Dangerous Goods Regulations* and *International Civil Aviation Organization Technical Instructions* establish the following classifications for transporting infectious substances by road and air:

| | |
|---|---|
| Shipping Name: | Infectious Substance, Affecting Humans<br>Classification: 6.2<br>Product Identification Number: UN2814<br>Packing Group: Category A |
| Shipping Name: | Infectious Substance, Affecting Animals only<br>Classification: 6.2<br>Product Identification Number: UN2900<br>Packing Group: Category A |
| Shipping Name: | Biological Substance<br>Classification: 6.2<br>Product Identification Number: UN3373<br>Packing Group: Category B |

Assignments to UN 2814, UN 2900 or UN3373 are based on the known medical history and symptoms of the infectious substance. If there is any doubt as to whether the substance falls within Category A or B, it must be transported as a Category A infectious substance.

Further assistance in classifying infectious substances in Canada may be obtained from the Director of Biohazard Containment and Safety, Canadian Food Inspection Agency. For transport by air, assistance on the classification of infectious substances may also be obtained by referring to the *Guidance Document: Infectious Substances - International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air*. This Guidance Document can be downloaded from http://www.icao.int/publications/Documents/guidance_doc_infectious_substances.pdf.

Outer containers used to transport biomedical waste must be colour-coded according to the type of waste they contain. Refer to section 3.4 *Storage* of the Guideline for additional information. The appropriate anatomical or biohazard label must also be affixed to the container in such a way as to be clearly visible and legible.

The *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* and the *Interprovincial Movement of Hazardous Waste Regulations* also require that consignments of Class 6.2 dangerous goods that are intended for disposal or recycling and transported in a quantity greater than five litres or five kilograms be accompanied by a waste manifest. An exception to this manifesting requirement is where the substance is either household in origin or returned directly to a manufacturer or supplier of the product for reprocessing, repackaging or resale for any reason, including that the substance is no longer usable for its original purpose or was purchased in surplus quantities.

Waste manifests are available from the Nunavut Department of Environment. Completion instructions have been included on the reverse side of each manifest. Further information on manifesting can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste* or Environment Canada's *User's Guide for the Hazardous Waste Manifest*.

In order to obtain a manifest, generators of biomedical and pharmaceutical waste must be registered with the Nunavut Department of Environment. A unique registration number is assigned to each registrant through the registration process, which enables completion of the manifest document. Copies of registration forms may be downloaded from the Department's web site at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment.

Biomedical and pharmaceutical waste may only be transported to facilities for disposal where those facilities have been registered with the appropriate territorial or provincial agency. In Nunavut, receivers of hazardous waste should be registered with the Department of Environment using forms that may be downloaded at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications. Registration enables the government to track the generation, transport and disposal of hazardous waste. It also provides assurance that the receiver has the necessary emergency and spill response capabilities should a spill or other accident occur. Additional information on the registration process can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste*.

Where a spill of a Class 6.2 infectious substance occurs, it must immediately be reported to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130 in accordance with the *Spill Contingency Planning and Reporting Regulations*.

### 4.8 Treatment and Disposal of Biomedical Waste According to Category

Table 3 identifies acceptable practices and technologies for treatment and disposal of each category of biomedical waste. Refer to Section 3 *Waste Minimization and General Management Practices* of the Guideline for specific advice on how to segregate, package, label and store biomedical waste prior to its treatment and disposal.

### 4.9 Waste Sharps from the General Public

Medical care is increasingly being administered in the home either by a health professional or by the resident themselves. These activities often generate waste sharps similar to those generated by health care facilities.

In the home health care setting, used needles, syringes and lancets should immediately be placed in a puncture resistant container that is secured with a tight fitting lid and clearly identified as containing waste sharps. Where commercial containers designed for this purpose are not available, an antifreeze container, bleach bottle or other thick opaque plastic container may be used. The container should only be filled ¾ full with waste sharps.

Local health care practitioners are encouraged to make arrangements with the resident to periodically pick up full containers and dispose of the waste sharps along with sharps that are generated at the health care facility. Where this option is not available, the resident should arrange with the local landfill

operator for a time when the waste sharps can be delivered to the landfill site and immediately covered with earth or other waste. Following burial, the waste should never be allowed to be burned, disturbed or uncovered.

**Table 3. Treatment and Disposal**

| | Waste Category | | | | | |
|---|---|---|---|---|---|---|
| | **Human Anatomical Waste** | **Microbiology Laboratory Waste** | **Human Blood and Body Fluid Waste** | **Animal Waste** | **Waste Sharps (a)** | **Pharmaceutical Waste (b)** |
| **Steam Autoclaving** | No | Yes | Yes | No | Yes (c) | No |
| **Chemical Disinfection** | No | No | Yes | No | Yes (c) | No |
| **Incineration** (d) | Yes | Yes | Yes | Yes | Yes | Yes |
| **Open Burning** | No | No | No | Yes (e) | No | No |
| **Local Landfill** | No | Yes (f) | No | No | Yes (g) | No |
| **Sanitary Sewer** | No | No | Yes (h) | No | No | No |
| **Off-site Transportation** (i) | Yes | Yes | Yes | Yes | Yes | Yes |

a. Refer to Section 4.9 for advice on the disposal of waste sharps for the general public.
b. Refer to Section 4.10 for advice on the disposal of pharmaceutical waste.
c. Steam autoclaving and chemical disinfection may be used on waste sharps where further treatment is part of the process (i.e. chemical decontamination coupled with mechanical shredding) or where the sharps are subsequently buried at a designated, approved location within the local landfill.
d. Only non-halogenated containers should be incinerated.
e. Following permission being obtained from the Wildlife Management Division of the Nunavut Department of Environment or an Agriculture Canada veterinary inspector.
f. Disposal in a local landfill may be used where microbiology laboratory waste is first treated by steam autoclaving and buried at a designated, approved location within the landfill.
g. Disposal in a local landfill may be used where waste sharps are first treated by either steam autoclaving or chemical disinfection and buried at a designated, approved location within the landfill.
h. Disposal in a sanitary sewer may be used where quantities of human blood and body fluid waste are limited.
i. Wastes must be transported in accordance with the appropriate Transport Authority to an approved treatment or disposal facility.

## 4.10 Pharmaceutical Waste

Canadian consumers tend to dispose a large part of their unused, expired and unwanted pharmaceutical waste in garbage, toilets and sinks. This practice is discouraged because of the negative impacts these chemicals are being shown to have on the environment. Although Nunavut does not currently have a formal territory-wide program for the disposal of pharmaceutical waste, consumers may return unwanted pharmaceuticals to community health centers. These wastes are then returned to the Qikiqtani General Hospital or a regional center for recording purposes and incineration.

## Conclusion

The improper management, treatment and disposal of biomedical and pharmaceutical waste can result in impacts on the environment as well as occupational and public health risks. While biomedical and pharmaceutical waste typically represents only a small proportion of the total volume of waste generated by health care facilities, its infectious nature and aesthetics require that it receive specific handling and treatment prior to transportation and disposal. Unlike biomedical waste, pharmaceutical waste is generated not only by medical facilities but by a large proportion of the general public.

The *Environmental Guideline for Biomedical and Pharmaceutical Waste* is an introduction to the management of these wastes. The Guideline provides information on the characteristics of biomedical and pharmaceutical waste, their effects on the environment and guidance on their proper treatment and disposal in a medical facility and homecare setting.

Familiarity with the Guideline does not replace the need for the generator or person in charge, management or control of biomedical and pharmaceutical waste to comply with all applicable federal and territorial legislation and municipal by-laws. The management of these wastes may also be controlled through permits and licenses issued by Nunavut's co-management boards, Aboriginal Affairs and Northern Development Canada and other regulatory agencies. These permits and licenses must be complied with at all times.

Contact your local health care facility for additional information on the management of biomedical and pharmaceutical waste, or to obtain a list of available guidelines, go to the Department of Environment web site or contact the Department at:

Environmental Protection Division
Department of Environment
Government of Nunavut
Inuksugait Plaza, P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0

Telephone: (867) 975-7729
Fax: (867) 975-7739
Email: EnvironmentalProtection@gov.nu.ca
Website: http://env.gov.nu.ca/programareas/environmentprotection

## References

Canadian Council of Ministers of the Environment. Canada-Wide Standards for Dioxins and Furans Emissions from Waste Incinerators and Coastal Pulp and Paper Boilers. 2001.
http://www.ccme.ca/assets/pdf/d_and_f_standard_e.pdf

Canadian Council of Ministers of the Environment. Canada-Wide Standards for Mercury Emissions from Base-Metal Smelters and Waste Incinerators. 2000.
http://www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf

Canadian Council of Ministers of the Environment. Guidelines for the Management of Biomedical Waste in Canada. CCME EPC-WM-42E. 1992.
http://www.ccme.ca/assets/pdf/pn_1060_e.pdf

Environment Canada. Pharmaceuticals and Personal Care Products in the Canadian Environment: Research and Policy Directions.
http://www.ec.gc.ca/inre-nwri/default.asp?lang=en&n=C00A589F-1

Health Canada. Pharmaceutical Disposal Programs for the Public: a Canadian Perspective. 2009.
http://www.enviroadvisory.com/pdf/Takeback.pdf

Government of the Northwest Territories, Department of Environment and Natural Resources. Guidelines for the Management of Biomedical Waste in the Northwest Territories. 2005.
www.enr.gov.nt.ca/_live/documents/content/biomedical_waste.pdf

Government of Nunavut Department of Environment. Environmental Guideline for the General Management of Hazardous Waste. 2010.
http://env.gov.nu.ca/node/82#Guideline Documents

Government of Nunavut, Department of Environment. Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities. 2011.
http://env.gov.nu.ca/node/82#Guideline Documents

Government of Ontario, Department of Environment. Guideline C-4: The Management of Biomedical Waste in Ontario. 2009.
http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079528.pdf

Government of Saskatchewan, Department of Health. Saskatchewan biomedical Waste Management Guidelines. 2008.
http://www.health.gov.sk.ca/biomedical-waste-management

Transport Canada. Transportation of Dangerous Goods Regulations.
http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm

# APPENDICES

# APPENDIX 1 - *ENVIRONMENTAL PROTECTION ACT*

The following are excerpts from the *Environmental Protection Act*

1. "Contaminant" means any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,
   (a) endangers the health, safety or welfare of persons,
   (b) interferes or is likely to interfere with normal enjoyment of life or property,
   (c) endangers the health of animal life, or
   (d) causes or is likely to cause damage to plant life or to property;

   "Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping;

   "Environment" means the components of the Earth and includes
   (a) air, land and water,
   (b) all layers of the atmosphere,
   (c) all organic and inorganic matter and living organisms, and
   (d) the interacting natural systems that include components referred to in paragraphs (a) to (c).

   "Inspector" means a person appointed under subsection 3(2) and includes the Chief Environmental Protection Officer.

2.2 The Minister may
   (a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
   (b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
   (c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;
   (d) collect, publish and distribute information relating to contaminants and to the preservation, protection or enhancement of the environment:

3. (1) The Minister shall appoint a Chief Environmental Protection Officer who shall administer and enforce this Act and the regulations.

   (2) The Chief Environmental Protection Officer may appoint inspectors and shall specify in the appointment the powers that may be exercised and the duties that may be performed by the inspector under this Act and regulations.

5. (1) Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.

   (3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that
   (a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
   (b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling house;
   (c) the contaminant was discharged from the exhaust system of a vehicle;

(d) the discharge of the contaminant resulted from the burning of leaves, foliage, wood, crops or stubble for domestic or agricultural purposes;
(e) the discharge of the contaminant resulted from burning for land clearing or land grading;
(f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
(g) the contaminant was discharged for the purposes of combating a forest fire;
(h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
(i) the contaminant is a pesticide classified and labelled as "domestic" under the *Pest Control Products Regulations* (Canada).

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity.

5.1. Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or license issued under this Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person in charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:
(a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
(b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
(c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge.

6. (1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or license issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or the person in charge, management or control of the contaminant to stop the discharge by the date named in the order.

7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.

(2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the measures that he or she considers necessary to repair or remedy an injury or damage to the environment that results from any discharge.

# APPENDIX 2 – GOVERNMENT CONTACTS

**Government of Nunavut**

Environmental Protection Division
Department of Environment
Inuksugait Plaza
P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-7729
Fax: (867) 975-7739

Office of Chief Medical Health Officer of Health
Department of Health and Social Services
P.O. Box 1000, Station 1000
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5774
Fax: (867) 975-5755

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free)
Fax: 1-866-979-8501

Motor Vehicles Division
Department of Economic Development and Transportation
P.O. Box 10
Gjoa Haven, Nunavut X0B 1J0
Telephone: (867) 360-4615
Fax: (867) 360-4619

Department of Community and Government Services (all Divisions)
P.O. Box 1000, Station 700
4th Floor, W.G. Brown Building
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5400 Fax: (867) 975-5305

**Government of Canada**

Aboriginal Affairs and Northern Development
P.O. Box 2200
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-4500 Fax: (867) 975-4560

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine
Fax: (204) 983-1734 Air

Biohazard Containment and Safety Division
Canadian Food Inspection Agency
159 Cleopatra Drive
Ottawa, Ontario K1A 0Y9
Telephone: (613) 221-7068
Fax: (613) 228-6129

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

Fisheries and Oceans Canada – Eastern Arctic Area
4th Floor - 630 Queen Elizabeth
P.O. Box 358
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 979-8000
Fax: (867) 979-8039