

LANDFILL REQUIREMENTS FOR POULTRY PROCESSING & SLAUGHTER WASTE FINAL REPORT



**PREPARED FOR: INVESTMENT AGRICULTURE FOUNDATION
& MINISTRY OF ENVIRONMENT**



Investment
Agriculture
Foundation
of British Columbia



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& SYLVIS ENVIRONMENTAL**

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Disclaimer

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- Landfill Services
 - Land Reclamation
 - Corporate Management
 - Groundwater Hydrogeology
-

February 13th, 2007

PRJ 06041

Ms. Alisa Williams
Environmental Management Analyst
General Industrial Section, EMB
BC Ministry of Environment
PO Box 9342 Stn Provincial Government
Victoria, BC
V8W 9M1

Dear Alisa:

Re: Landfill Requirements for Poultry Processing and Slaughter Waste

We are pleased to submit three hard copies of our report titled *Landfill Requirements for Poultry Processing and Slaughter Waste*.

I hope that the report provides a detailed summary of the technical requirements for disposal of slaughter and poultry processing wastes for both landfill disposal and for on-site burial. We thank you for allowing us to work with you on this project and look forward to working with you in the future.

Please contact me if you require more information or if you have any questions or concerns.

Yours truly,
SPERLING HANSEN ASSOCIATES

Dr. Tony Sperling, P.Eng.
President

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1 INTRODUCTION

1.1 Project Description

The *Environmental Management Act* (EMA) and the *Waste Discharge Regulation* (WDR) provide the requirements for managing industrial wastes in British Columbia. There are various tools available under the EMA for managing industrial wastes, including regulations, codes of practice, site specific permits and approvals, and other initiatives. Both poultry processing waste and slaughter industry waste are listed in Schedule 2 of the Waste Discharge Regulation and may be regulated by a code of practice. The permitting process for facilities that deal with this waste represents a large workload for the Ministry. Since both waste types share common characteristics and management issues, it was decided that a common code of practice could be developed in parallel.

The poultry processing industry produces waste from the processing of chickens, ducks, turkeys, pheasants and other domestic fowl or game. The slaughter industry produces wastes from the processing of cattle, swine, sheep, fallow deer and bison. These industries produce wastes that are typically liquid, semi-solid and solid waste that includes waste water, blood, feces, oil, grease, industrial cleaners, offal, feathers, hide, inedible materials, bones, carcasses and viscera. Generally these wastes are disposed of using a variety of methods including composting, incineration, gasification, land application and landfilling.

Prior to detection of bovine spongiform encephalopathy (BSE) in Canada's cattle herd, poultry and slaughter wastes were valued for their rendered by-products including meat and bone meal and tallow that could be used as feed supplements for cattle and other ruminants. Therefore, generators were paid by renderers to dispose of these materials, providing a supplemental income stream to their operations, and landfilling of poultry and slaughter waste prior to the emergence of BSE in cattle was an uncommon practice. Landfilling of these materials generally only occurred if a waste generator was far removed from a collection route or if on-site burial was not an option.

In June 2006 the British Columbia Ministry of Environment (MOE) issued a Request for Proposals (RFP) for developing the technical standards and requirements for disposing of poultry and slaughterhouse waste on-site and at landfills in British Columbia. The resulting report would answer a number of questions related to the regulatory, siting, design and operational requirements for landfilling poultry and slaughter wastes. A comprehensive list of the questions included in the Request for Proposals in Appendix A.

Sperling Hansen Associates (SHA) and SYLVIS Environmental were successful in obtaining the work requested in the RFP. A startup telephone conference meeting was held on August 3rd, 2006 between representatives of SHA, SYLVIS, MOE and the BC Investment Agriculture Foundation (IAFBC). Through discussions between MOE and the IAFBC it was determined that the project would be completed through the IAFBC rather than through MOE. As a result of the initial phone meeting slight changes in scope were discussed. Essentially, hours were adjusted to account for the amount of background information that was available through MOE and to allow for review of specified risk material (SRM) background information from the Canadian Food Inspection Agency (CFIA). Following the initial start-up teleconference SHA submitted an Overview Report on September 15th outlining the work that had been completed and issues for discussion between SHA, SYLVIS and the Steering Committee that would allow the project to proceed in the

desired direction. A review meeting was then held on September 22nd to discuss the issues identified in the Overview Report and any other concerns the Steering Committee had. A Draft Report was submitted on October 16th, and a teleconference was held on October 31st with the Steering Committee to review the draft. A Final Draft report was submitted on November 7th, and comments were provided by the Steering Committee on November 28th.

This Final Report aims to address the technical requirements for disposing slaughter and poultry waste within landfills and on-site via burial. It also outlines a process for selecting the desirable technical requirements for the quantity of waste desired to be disposed and the desired location of the disposal site. The technical requirements and process selection have been based upon a detailed background review, which is also presented in this report. Any follow up work required is also presented in order to ensure that the disposal of this waste has minimal to no impact upon the environment.

2 BACKGROUND REVIEW

A background review has been conducted to identify the current practices with regards to poultry processing and slaughter waste disposal within BC, throughout Canada and internationally. The review focused on two main areas, disposing this waste within landfills, and disposing this waste on-site via burial. There was little information available on the disposal of this waste within landfills, suggesting it is not a common practice and that more research is required in this area. As on-site burial of mortalities is a more common practice than disposal of slaughter waste in landfills, there are more regulations and guidelines available. As such, these regulations and guidelines have also been reviewed as the burial of mortalities is similar in nature to the burial of slaughter wastes. The regulatory aspect has been presented in this chapter, whilst a comparison of the technical aspects is considered in Chapter 3. A summary of the characteristics of poultry and slaughter waste is also presented within this chapter.

2.1 Canadian Jurisdictional Review

In all Canadian jurisdictions surveyed except Alberta, Saskatchewan and Ontario, slaughter and poultry processing wastes are not mentioned specifically in landfilling regulations and guidelines. No landfill design criteria specific to the handling of slaughter wastes (such as requirements for liners or leachate collection systems) were discovered in the review; however, some specific management requirements were found and these are covered in the sections that follow. The technical requirements for landfills in general that were found as part of this review are outline in Chapter 3 of this report.

Throughout Canada, rendering has been the standard method of disposing of slaughter and poultry processing wastes, with preferred alternatives to rendering being incineration and on-site burial. Landfilling has historically been a disposal option used for small quantities of these wastes and in emergency situations. Thus, most jurisdictions have not developed specific regulations or guidelines for the landfilling of these wastes.

In several jurisdictions surveyed (New Brunswick, Nova Scotia and Ontario) municipal bylaws regulate the disposal of slaughter wastes in landfills. Provincial legislation contains general criteria for design and management of landfills that accept municipal solid waste, and it is left up to individual municipalities to decide whether they will accept these wastes in the landfills within their jurisdiction. Municipalities may also have their own landfill design and management criteria for accepting slaughter waste.

2.1.1 Canadian Food Inspection Agency Requirements

Landfill Disposal

If slaughter waste that contains specified risk material (SRM) is disposed of off-site within a landfill, then it is governed by Canadian Food Inspection Agency (CFIA) requirements. The CFIA classifies the landfilling of SRM as a method of permanent containment of the abnormal prion, and that no reduction of the infectivity of this prion will occur within the landfill [1]. The CFIA has recently conducted a risk

assessment of disposal of SRM to an engineered landfill, and has determined that this presents a negligible risk of transmission of BSE to domestic ruminants [1].

Under proposed CFIA requirements [2] the owner / operator of the landfill must submit an application for a permit form to the local CFIA district office. Documentation required in the permit application includes relevant municipal and provincial licenses (i.e. Operating Certificate), detailed site plan, operating procedures and the results of any recent analysis or verifications relevant to containment of SRM. Following receipt of this information a CFIA Inspector will then conduct a site inspection and review the permit application.

The documentation supplied during the application and the observations made during the site inspection will be used to determine if the landfill meets the requirements of the CFIA. The components that will be assessed include separation, signage, operation, liner, landfill cap, drainage layer, groundwater protection, surface water management, leachate control system, cover material, equipment, integrity breaches and records. If there are any discrepancies between the requirements and the actual conditions at the landfill, a corrective action plan must be written by the applicant to address these and will be verified by a follow up inspection.

If all requirements are met, then a permit will be issued for one year. These permits will be issued annually for landfills that provide on-going compliance monitoring. Compliance monitoring will be conducted at least once during the time that the permit is valid by a CFIA inspector.

The CFIA currently does not have standards for Natural Control Landfills (i.e. non-engineered landfills that do not rely on leachate containment/collection/disposal systems) accepting SRM. A risk assessment is proposed to be conducted on Natural Control landfills in the near future.

Onsite Burial

If SRM material is disposed on-site where the slaughtering occurs, then the proposed CFIA requirements do not apply [3], but the disposal is governed by municipal and provincial requirements for landfilling of this waste. The CFIA also conducted a risk assessment [1] on disposal of SRM via on-farm burial (burial of mortalities), and has determined that this presents a negligible to very low risk of transmission of BSE to domestic ruminants, assuming that there will be some forms of improper burial that do not meet provincial guidelines.

2.1.2 Alberta

Landfill Disposal

Alberta's *Code of Practice for Landfills* [4] contains the only apparent reference to landfilling of slaughter and poultry processing wastes in that province's legislation. Dead animals and animal parts can be disposed of in Class II and Class III landfills (both of which require lining to acceptable standards and a leachate collection system) provided that they are immediately covered with soil. The *Destruction and Disposal of Dead Animals Regulation* [5] outlines that livestock and poultry mortalities can be disposed of in Class I or Class II landfills. No further landfilling guidelines were found.

Onsite Burial

Disposal on-site of mortalities in Alberta that have not died from infectious or reportable disease is regulated under the *Destruction and Disposal of Dead Animals Regulation*. This regulation outlines burial requirements for on-site disposal. Alberta Agriculture, Food and Rural Development have published a document that outlines the technical requirements for on-site burial of livestock or poultry mortalities, titled *Livestock Mortality Burial Techniques* [6]. This document is based on the requirements outlined under the *Destruction and Disposal of Dead Animals Regulation*.

2.1.3 Saskatchewan

Landfill Disposal

Discussion with Saskatchewan Environment staff revealed that slaughter and poultry processing wastes are prohibited at landfills except by special permit from Saskatchewan Environment and permits are only issued for landfills that meet site-specific design criteria as determined by a qualified professional. Individual municipalities can accept these wastes under permit only. The Saskatchewan Environment fact sheet, *Slaughterhouse Wastes at a Landfill* [7], outlines the recommended landfilling methods for slaughterhouse wastes if a permit has been obtained. The fact sheets suggests that landfilling is considered less desirable than either rendering or incineration for the disposal of slaughter wastes, preferred only to on-site burial.

Onsite Burial

A fact sheet, titled *Farm Fact – Managing Livestock Mortalities* [8] published by Saskatchewan Agriculture and Food, outlines burial techniques for on-site disposal of livestock mortalities. The fact sheet references *The Health Hazard Regulation*, *The Environmental Management and Protection Act*, *The Agricultural Operations Act* and, *The Agricultural Operations Regulations* with regards to the disposal of livestock mortalities.

2.1.4 Manitoba

Landfill Disposal

No regulations or guidelines specific to the landfilling of slaughter and poultry processing wastes in Manitoba were located during this review.

Onsite Burial

In Manitoba, the *Livestock Manure and Mortalities Management Regulation* [9] outlines the requirements for on-site burial of livestock mortalities. Manitoba Agriculture, Food and Rural Initiatives has also prepared some short fact sheets for the disposal of mortalities via burial [10,11].

2.1.5 Ontario

Landfill Disposal

In discussions with Kevin Joynes, Dead Animal Disposal Advisor with the Food Inspection Branch of Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), he indicated that Ontario does not

have any technical standards for the landfilling of slaughter or poultry processing wastes at this time. Landfilling as a disposal method for slaughter wastes has not been common in Ontario as most slaughter and poultry processing waste is currently rendered and most landfills have been reluctant to accept slaughter waste. Landfilling has been used primarily for emergency disposal of dead stock or slaughter wastes. Some municipalities within the province have enacted bylaws regulating the disposal of slaughter waste in local landfills. Landfill disposal of slaughter wastes has been treated as burial with the same cover requirements as on-site burial although in practice the coverage requirements do not appear to be met routinely in landfills. Landfilling of this waste is becoming a more appealing solution in some areas of the province.

Onsite Burial

The *Meat Inspection Act* [12] governs the disposal of waste from abattoirs, while the *Dead Animal Disposal Act* [13] governs the disposal of on-farm livestock mortalities. Both acts allow on-site burial as a disposal method provided the cover requirements are met. A fact sheet prepared by the Ministry of Agriculture, Food and Rural Affairs (OMAFRA), titled *Proper Burial Techniques for Small Farm Animals and Poultry Mortalities Under 25kg* [14], presents some guidelines for the on-site burial of dead livestock and poultry. The burial rate guidelines developed in this document were adapted from guidelines prepared by the Missouri Department of Natural Resources. Upon discussions with Hugh Fraser, P.Eng, an Agricultural Engineer with OMAFRA, it was found that the Ontario fact sheet is currently being updated and a new version will be released in early 2007. It was also found that currently in Ontario the onsite burial of slaughter waste is looked upon as the second least favored form of disposal ahead only of natural disposal. At present the authorities in Ontario are only approving onsite burial as a last resort, and recommend composting as a better solution.

2.1.6 Quebec

Landfill Disposal

In the Province of Quebec, slaughter and poultry processing wastes are not permitted to be disposed of in municipal landfills at this time and it is unlikely that these wastes will ever be accepted in municipal landfills. Most slaughter waste currently is rendered. Farmers who slaughter small numbers of animals can bury the wastes on site.

Onsite Burial

There are no specific standards for on farm burial however, at the discretion of provincial Ministry of Fisheries and Foods staff, on site burial sites can require an engineering report from a qualified professional that outlines site specific burial requirements based on the site's soil and groundwater characteristics. Because of the new CFIA requirements for the handling of SRM waste, costs to haul slaughter house wastes to rendering plants have been passed on to the slaughter plants which is increasing the amount of on-farm burial. Because of the risks to the environment with this practice when it is uncontrolled, the province is anticipating developing on-site burial standards within the next five to ten years.

2.1.7 New Brunswick

Landfill Disposal

In this jurisdiction, landfill disposal of slaughter waste is not regulated provincially although landfill design and management is regulated. The province is divided into Solid Waste Commissions, each of which is responsible for the landfills in its region. Staff from the Fredericton Solid Waste Commission indicated that their landfills do not accept any slaughter or poultry processing waste or deadstock except by special permission on an emergency basis. This appears to be the situation throughout New Brunswick.

Onsite Burial

The legislation or technical standards for on-site burial of slaughter wastes or mortalities could not be found for New Brunswick during this review.

2.1.8 Nova Scotia and Prince Edward Island

Landfill Disposal

Upon discussions with Andrew Cameron, Manager of Regional Services for the Nova Scotia Department of Agriculture it was found that in Nova Scotia the burial of organic material within landfills is prohibited. Currently slaughter waste is sent to two main rendering plants. No regulations or guidelines specific to the landfilling of slaughter and poultry processing wastes in Prince Edward Island were located during this review.

Onsite Burial

In Prince Edward Island, burial on farms is not permitted. Currently there are no regulations for the disposal of slaughter waste onsite in Nova Scotia. Discussions with Nova Scotia Ministry of Agriculture staff revealed that there is unregulated disposal of mortalities on-site in small amounts.

2.2 International Review

2.2.1 European Union

Landfill Disposal

The disposal of slaughter waste in the European Union (EU) is regulated by Regulation (EC) No. 1774/2002 [15]. The regulation provides disposal options for slaughter wastes (referred to as “animal by-products” (ABP) in the regulation), based on the separation of the materials into three categories. The categories reflect the potential risks for the animal by-products to transmit transmissible spongiform encephalopathies (TSE), including BSE.

Category 1 materials pose the most risk to spreading TSEs. Included under Category 1 ABPs are:

- animals suspected of being infected with TSEs;
- animals killed as part of TSE eradication protocols; and

- specified risk material.

Landfilling is a disposal option for Category 1 ABPs, provided that Category 1 materials are first incinerated or processed using methods approved under Regulation 1774/2002. Most pertinent to the disposal of slaughterhouse and processing wastes are Category 3 materials which include:

- parts of slaughtered animals fit, but not intended for, human consumption;
- parts of slaughtered animals that are unfit for human consumption and do not exhibit signs of communicable diseases that pose a threat to human or animal health;
- hides, skins, hoofs and horns and feathers of animals that have undergone a post-mortem inspection; and
- blood obtained from animals other than ruminants that are slaughtered in a slaughterhouse and have undergone a post-mortem inspection.

These Category 3 ABPs may be disposed of in a landfill after undergoing an approved processing method or as ash resulting from an approved incineration or co-incineration method.

Landfilling requirements in the EU are regulated by the Council Directive 1999/31/EC [16]. Directive 1999/31/EC provides technical standards and monitoring requirements. The monitoring requirements are implemented to ensure wastes have been properly disposed of based on their classification in a manner that is protective of the environment and in compliance with the landfill permit. The directive outlines the frequency of operational and after-care monitoring requirements including meteorological, water, leachate, gas, groundwater and topographical monitoring. Many of these requirements serve as general guidelines; the frequency of monitoring may vary depending on a number of site-specific factors including morphology of the landfill waste, composition of the waste (e.g. organic matter content), fluctuation in groundwater level and groundwater velocity. The specific monitoring programs for each site are prepared in the site operating permit based upon the general monitoring requirements set out in the directive.

The standards and requirements stipulated in this regulation are dependent on the types of wastes to be accepted in the landfill. Accepted wastes for landfill are classified as:

- hazardous;
- non-hazardous; or
- inert waste.

Hazardous wastes are defined in Article 1(4) and elucidated in Annex I – III under Council Directive 91/689/EEC [17]. Included under the definition of hazardous wastes are the primary products of slaughterhouse waste, ash and animal fats and waxes. Thus the landfilling of these wastes are subject to the requirements for hazardous wastes under Directive 1999/31/EC.

2.2.2 United States - Texas

Texas was selected over the USEPA technical requirements for landfills as their guidelines made specific reference to slaughter waste disposal. The Texas technical requirements are very similar to those presented in the *USEPA Subtitle D Part 258 – Criteria for Municipal Solid Waste Landfills* [18].

Landfill Disposal

Landfill authorization, permitting and operating criteria are regulated by the Texas Commission on Environmental Quality under the Title 30 Texas Administrative Code [19]. Slaughterhouse waste is designated as a “Special Waste” under Section 330.171 (c) of the code and may be landfilled in any Type I or Type IAE landfill that is permitted to receive them and as long as specific cover requirements are met. Type I landfills are the standard classification of landfills in Texas. Type I landfills are subject to technical standards and requirements based on the following criteria:

- permitting requirements;
- operational standards;
- analytical QA/QC standards;
- surface water drainage;
- liner system design and operation;
- landfill gas management;
- groundwater monitoring and corrective action;
- closure and post-closure requirements and corrective action cost estimates; and
- location restrictions.

Type IAE landfills are equivalent to Type I landfills, but may qualify for an “arid exemption” provided the landfill:

- accepts less than 20 tons of authorized waste per day;
- does not cause contamination of groundwater;
- serves a community with no other waste management alternative; and
- is in a region that receives less than 25 inches of rain per year based on the 30 year average of the nearest precipitation monitoring station.

A Type IAE landfill is subject to all of the criteria outlined for Type I landfills above, except it is exempt from liner system design and operation, and groundwater monitoring and corrective action monitoring requirements.

2.2.3 United Kingdom

Onsite Burial

In the United Kingdom onsite burial is regulated under the *Animal By-Products Order* [20]. This order outlines some brief requirements for on-site burial, and highlights it as a less preferred disposal option that should be used for isolated areas or where other disposal methods are not available. The Ministry of Agriculture, Fisheries and Food has produced a guidance document titled *Guidance Note on the Disposal of Animal by Products and Catering Waste* [21], that outlines suitable technical guidelines in detail for the burial of this type of waste based upon other environmental legislation including *The Water Resources Act*, *The Control of Pollution Act* and the *Groundwater Directive* to name a few.

2.3 British Columbia Review

2.3.1 BC Overview

Within BC, a slaughterhouse or poultry processing facility must be federally licensed if it plans to sell meat inter-provincially or internationally. Facilities that are federally licensed are inspected by the CFIA as they are subject to the health and sanitation requirements of the federal government.

For slaughterhouses or poultry processing facilities that plan to sell their product within BC only, they are required to obtain a provincial license. Facilities that are provincially licensed are required to abide by the regulations and standards set by the province in which they are located. Within BC, the Ministry of Environment has the authority to authorize slaughterhouse and poultry processing operations under the *Environmental Management Act – Waste Discharge Regulation* [22] (EMA). Under the EMA, any slaughterhouse that processes more than 1,500 tonnes of red meat per year or any poultry processing plant that processes more than 130 tonnes of live weight poultry per year requires authorization (by permit, approval, order, regulation or waste management plan) for any discharge to the environment. It should be noted that these threshold amounts may change. Separate authorization (by permit, approval, order, regulation or waste management plan) for discharge to a system already permitted for such a purpose (i.e. municipal sewage treatment plant) is not required.

However, under the EMA, any waste that is burnt, incinerated, composted or landfilled requires authorization (by permit, approval, order, regulation or waste management plan).

The Ministry of Environment (under the EMA) and the GVRD (under Bylaw No. 937 [23]) are responsible for managing the air quality within BC. The GVRD is responsible for the air quality within its boundaries, and throughout the rest of the province the MOE is responsible. At present the MOE or GVRD do not have quantitative odour standards in place, and hence odour complaints are handled individually.

The *BC Organic Matter Recycling Regulation* (OMRR) [24] lists poultry carcasses, including offal, viscera and carcasses from deaths due to “federally reported diseases” and poultry manure as acceptable organic material for composting.

The use of a landfill for the discharge of slaughterhouse or poultry processing waste requires specific authorization regardless of amount processed. Industrial non-hazardous landfills may be eligible for authorization by a code of practice, which is currently under review by the Ministry. No specific

permits have been issued in BC solely for discharge of solid waste from slaughterhouse or poultry processing operations. Typically these wastes are handled at rendering facilities.

2.3.2 Landfill Criteria for Municipal Solid Waste

The *Landfill Criteria for Municipal Solid Waste* [25] was implemented in 1993. The document provides the guidelines for siting, designing, operating and monitoring landfills in British Columbia. Key definitions from the Criteria include the following:

- “free liquid” means any quantity of a liquid which is separated from a solid when subjected to the Free Liquid Test Procedure described in Part 3 of Schedule 4 of B.C. Reg 63 / 88 (Hazardous Waste Regulation) [26].
- “leachate” means any liquid and suspended materials which it contains, which has percolated through or drained from a municipal solid waste disposal facility.
- “liner” means a continuous layer of synthetic material or natural clay or earth materials, placed beneath and at the sides of a landfill and intended to restrict the downward or lateral escape of waste or leachate or in some cases to restrict the upward movement of ground water into the landfill.
- “municipal solid waste” (MSW) means “municipal solid waste” as defined in the Waste Management Act.
- “putrescible” refers to organic matter which has the potential to decompose with the formation of malodorous byproducts.
- “sewage” means effluent from a municipal sewerage system.

The Criteria specify the requirements for three types of landfills, Sanitary Landfills, Modified Sanitary Landfills and Selected Waste Landfills. The aim of the Criteria, as stated in the document, is to set Sanitary Landfills as the goal for all MSW landfills, but recognize that for some types of wastes and areas in the Province Modified Sanitary Landfills and Selected Waste Landfills might be appropriate. There are no separate criteria for Modified Sanitary Landfills and Selected Waste Landfills, only exemptions from the requirements for Sanitary Landfills. The definitions for the types of landfills are below:

- *Sanitary Landfills* are facilities that serve populations of more than 5,000 people and are generally required to comply with all requirements of the Landfill Criteria.
- *Modified Sanitary Landfills* are facilities that serve fewer than 5,000 people where bigger regional, cooperative disposal systems are not feasible. These sites are subject to some of the criteria but may be exempted from others.
- *Selected Waste Landfills* are facilities that accept selected types of refuse, not including putrescible waste. The selected types of refuse may include demolition, land clearing, construction and solid industrial wastes (such as foundry sands, but excluding special wastes). These wastes may also include materials that are not feasibly recyclable. These sites are subject to some of the criteria but may be exempted from others.

There are two further landfill types in the Criteria worth considering, Natural Control and Engineered landfills. Natural Control Landfills are those that do not rely on engineering leachate containment, collection and disposal systems. The requirement for a landfill to be Engineered depends on the capabilities of the natural soils to restrict off-site impacts. Generally all other design and siting requirements of the Criteria are the same for all landfills but exemptions and exceptions may be given depending on the specifics of the site.

The Landfill Criteria lists the following materials as prohibited, unless approved by the Manager:

- Special Wastes other than those specifically authorized in the Special Waste Regulation;
- Bulk liquids and semisolid sludge which contain free liquid;
- Liquid of semisolid wastes including septage, black water, sewage treatment sludge, etc.
- Automobiles, white goods, other large metallic objects and tires (except in the case of Selected Waste Landfills approved by the Manager where recycling options are not available or feasible);
- Biomedical waste as defined in the document *Guidelines for the Management of Biomedical Waste in Canada*; and
- Dead animals and slaughter house, fish hatchery and farming wastes or cannery wastes and byproducts.

The Criteria states the following with respect to disposal of prohibited wastes:

Burial of these wastes in dedicated locations (i.e. avoiding co-disposal) at a landfill site may be approved only if there is no other viable alternative such as treatment / disposal, recycling, reprocessing or composting. Viability of alternative is to be determined by the Manager. For those cases in which the dedicated disposal of otherwise prohibited wastes is approved, the specific on-site location of the disposal shall be recorded to allow ready access to the waste should corrective or further action pertaining to the management of these wastes be required by the Ministry at some time in the future.

In the past landfills in BC were authorized under specific permits. While there may still be permits in place, the MOE have essentially phased out permits and replaced them with site specific Operational Certificates (OC's). An OC provides the specific details and exemptions for each site, as a supplement to the Landfill Criteria. Through an OC sites may have more or less constraints than are required of the Landfill Criteria. The OC is developed from the Region's Solid Waste Management Plan which is signed off by the Minister and can be amended by the Minister. OC's are also partly based on the design and operational requirements specified by Qualified Professionals in approved Design and Operating Plans.

2.3.3 On-Site Burial

Slaughter and Poultry Waste

On-site landfilling is currently regulated under the *Environmental Management Act - Waste Discharge Regulation*. At present a permit issued by MOE is required for the disposal of this material on-site.

On-farm Mortalities

Requirements for on-site burial of mortalities in an agricultural setting are outlined in the *Agriculture Waste Control Regulation* [27] under the *Environmental Management Act*. Other legislation that pertains to dead stock burial includes the *Forest and Range Practices Act* [28]. The Ministry of Agriculture, Food and Fisheries has published a fact sheet for the disposal on large animals titled *Large Animal Disposal – On Farm Burial Option: South Coast Region of BC* [29]. The BC fact sheet outlines the technical guidelines for on-site disposal of mortalities, and has been based on a lot of the technical information from the Alberta and Ontario guidelines. This fact sheet is reviewed further in Section 3.2 of this report.

2.4 Waste Characteristics

2.4.1 Physical Properties

Poultry

Poultry offal consists of the solid waste generated when poultry are slaughtered. It includes guts, feet, heads and feathers. The waste stream may also include bones, skin and fat if the chicken is cut up and or deboned at the processing plant. The guts, feet, heads and feathers are removed at once during initial slaughter. If the chickens are cut up or deboned, this waste is generated in a separate area of the slaughter plant but in general would be mixed with the slaughter waste. Poultry offal is estimated to have a moisture content of 65 to 86% moisture and a bulk density of 250 to 300 kg per cubic meter of waste, and a Nitrogen concentration estimated at 5% (dry basis) [30-32].

Livestock

Livestock slaughter waste consists of the solid waste generated when livestock are slaughtered and processed. Because there is much variability in how slaughter plants operate, there is considerable variability in the waste stream from them. During slaughter the waste generated includes heads, feet, tails, blood, paunch (rumen) and paunch manure (undigested feed remaining in the rumen) and other parts of the intestines. Hides are normally sold separately so do not enter the waste stream although they may be included on occasion. Blood and paunch manure should be separated from the waste stream and recycled appropriately. An example of some slaughter waste that would typically be disposed of at a landfill or on-site is shown in the pictures below.

If carcass processing is done in the plant, an additional waste stream is generated. This includes trimmings (meat and fat), small bones and fat and may include large leg and hip bones if these are not otherwise processed for pet food. This waste stream is sometimes kept separate in the plant (in barrels or bins) but would ultimately end up blended with the slaughter waste for disposal.

Slaughter waste is estimated to have a moisture content varying from 45 to 65% but averaging 50%, and a bulk density of 400 to 700 kg per cubic meter, varying with the composition of the waste. Nitrogen concentration is estimated at 2 to 4 % (dry basis). No information was found on the characteristics of

the two different waste streams (with and without carcass processing). Rendered slaughter waste yields on average 25% fat and 25% protein with the remainder lost as moisture.

2.4.2 Contaminants of Concern

Pathogens

Pathogens of concern found in wastes from slaughterhouses and poultry processing facilities include salmonella species and campylobacter, and in addition to this protozoa cryptosporidia and giardia, and bacteria E. Coli O157:H7 can be found in livestock slaughterhouse waste [33]. No incidences of water borne disease outbreaks of any of these organisms have been traced to movement of the organisms through soil to groundwater and from there to surface water [33]. Disease outbreaks of some of these organisms have been linked to surface runoff of livestock manure into surface drinking water sources [33].



Slaughter waste stockpiled for composting



Slaughter waste stored in barrels

Although no disease outbreak has been traced to leaching of pathogenic organisms through soil, there is evidence that these organisms can move through the soil with soil moisture [33]. In general, however, the soil is a very unfriendly medium for pathogenic organisms and pathogen survival in soil is low. Microorganisms typically become trapped in soil particles and soil environmental factors such as dryness, pH, predator soil microorganisms and lack of percolation water lead to microbe death. However, under saturated conditions in coarse textured soils or soils with many macro pores, microorganisms can move through the soil with soil water. One study with E.Coli demonstrated that in

clay soil, E.Coli numbers dropped from 10^6 to less than 10 within the top 2 cm of soil. In a sandy soil, E.Coli organisms were recovered as deep as 15 cm in significant numbers demonstrating that there is greater risk of movement of pathogens to groundwater in coarse textured soils than clay or fine-textured soils [33].

Although this information does not specifically apply to slaughter wastes, it can be inferred that the risk of leaching of pathogenic organisms from landfilled livestock or poultry slaughter wastes will be minimal if the soil underlying the landfill is fine textured, preferably of clay and if there is no movement of water through the landfill which could cause leachate unless that leachate is collected and handled appropriately.

Other Contaminants

As slaughter waste is organic material, it will naturally decompose, and any moisture contained within the waste and introduced via rainfall or groundwater will have potential contamination issues. Characteristics of the leachate that may have an environmental impact include Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), Nitrogen and Chloride [34]. Besides from the direct impact that high concentrations of these characteristics can have on water supply, including reducing available oxygen levels (impact of high BOD) which can result in fish kill, and eutrophication caused by an increased nutrient load (due to high TDS and Nitrogen), they can also have indirect impacts. If degradable organic carbon is introduced directly into groundwater, then the bacteria in the soil, if under reducing conditions, can degrade the carbon resulting in high levels of ferrous iron going into solution. That ferrous iron can then be spontaneously precipitated once the groundwater is aerated, i.e. after it discharges into an open well or stream. This results in staining of the water and high iron levels making the water unsuitable for drinking and aquatic life.

2.4.3 Potential Waste Quantities

Poultry

Typically, the slaughter of poultry generates 26.5% waste, and for a typical broiler of 1.95 kg, solid waste generated per bird would be approximately 0.51 kg.

Livestock

Table 2-1 contains estimates of slaughter and carcass waste for various livestock species. The table shows that in all cases almost half of the live weight of the animal is disposed of as waste in some form. SRM is a small portion of the waste stream in comparison to the non-SRM material.

Table 2-1: Typical weight distribution of waste from slaughtered and processed livestock

Livestock species	Average live weight (kg)	Slaughter waste		Carcass or processing waste (kg)	Total waste (kg)
		SRM (kg)	Non-SRM (kg)		
Cattle (under 30 months)	630	13	211	94	318
Cattle (over 30 months)	604	40	236	81	357
Bison	410	0	152	58	210
Pork	100	0	22	23	45
Sheep/lambs	55	0	13	9	22

Adapted from [35]

Table 2-2 presents a summary of 40 slaughter houses located within BC that process cattle along with other animals, and their typical waste generation rates. It should be noted that this does not represent all the slaughterhouse facilities within BC. Aside from the cattle processing plants, there are dedicated pork processing plants located in the Fraser Valley, Vancouver Island and the North Thompson-Okanagan area. Also there are numerous poultry processing plants located in the Fraser Valley, one on Vancouver Island and two in the North Thompson-Okanagan area.

In total the 40 facilities listed in Table 2-2 produce 11,122 tonnes of waste per year, and have a weekly maximum waste generation total of 704 tonnes. The table also shows that on average each slaughter house produces up to 278 tonnes / year, or an average maximum of 17.6 tonnes / week, of waste that could potentially be land filled. The largest plant produces just over 2,000 tonnes / year of waste, whilst the smallest waste output is just 1.1 tonnes / year. The highest maximum weekly waste output reported was 177 tonnes / week, whilst the smallest was 1 tonne / week. All of the facilities presented slaughter cattle, while just over half also slaughter sheep and pork, a quarter also slaughter goats and bison, only one plant also processed poultry and six of the plants also processed other animals. This data shows that the waste output from slaughter houses across BC is variable from facility to facility, not only in quantity but also in species type.

2.5 Engineered Landfill Liner Lifespan

Typically, MSW landfills under anaerobic conditions experience temperatures of 30 to 40°C at the base of the fill. At an operating temperature of 35°C for example, Rowe et al [36] suggests that the service life of a geomembrane will be in the order of 130 years. Temperatures up to 60°C can occur in landfills where large volumes of water are added to create optimal conditions for biological activity, known as bioreactor landfills. Rowe et al [36] also suggests that the increased temperatures could reduce the membrane service life to as little as 15 years under worst case scenarios. It is expected that for a landfill that receives slaughter waste (up to 10% of the incoming MSW quantities) the lifespan of the liner system will not be greatly reduced if it's reduced at all.

Table 2-2: Selected BC Slaughter House Locations & Waste Generation Rates

Facility Location	Waste (tonnes/year)	Maximum Waste (tonnes/week)	Species Slaughtered						
			Cattle	Sheep/Lamb	Pork	Poultry	Goats	Bison	Other
Cariboo RD	10.2	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Cariboo RD	14.3	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Cariboo RD	151.6	13	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Cariboo RD	8.4	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Cariboo RD	265.1	15	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cariboo RD	54.8	1.8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Columbia-Shuswap RD	247.5	18	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Columbia-Shuswap RD	463.8	28.9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Cowichan Valley RD	60	3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>				
Cowichan Valley RD	8.8	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
Cowichan Valley RD	51.2	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Cowichan Valley RD	294.6	8	<input checked="" type="checkbox"/>						
Fraser Valley RD	1283	36	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fraser Valley RD	2047.6	177.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Fraser Valley RD	353	15.6	<input checked="" type="checkbox"/>						
Greater Vancouver RD	1518	49.9	<input checked="" type="checkbox"/>						
Greater Vancouver RD	900.6	21	<input checked="" type="checkbox"/>						
Greater Vancouver RD	1205	83.6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Peace River RD	572.5	60	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RD of Bulkley-Nechako	115.4	7	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>				
RD of Bulkley-Nechako	71	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
RD of Central Kootenay	59.9	13	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
RD of Central Okanagan	48.8	5	<input checked="" type="checkbox"/>						
RD of Central Okanagan	27.6	2	<input checked="" type="checkbox"/>						
RD of Comox-Strathcona	163.6	16	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
RD of East Kootenay	1.1	-	<input checked="" type="checkbox"/>						
RD of Fraser-Fort George	19	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
RD of Fraser-Fort George	48.2	5	<input checked="" type="checkbox"/>						
RD of Fraser-Fort George	69.2	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
RD of Nanaimo	25	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
RD of Nanaimo	55.1	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
RD of Nanaimo	18.3	1	<input checked="" type="checkbox"/>						
RD of North Okanagan	1.6	2	<input checked="" type="checkbox"/>						
RD of North Okanagan	230.8	13	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
RD of Okanagan-Similkameen	34.5	4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
RD of Okanagan-Similkameen	137.8	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Thompson-Nicola RD	309.6	20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Thompson-Nicola RD	154.8	34.3	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>	
Thompson-Nicola RD	20.6	6.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
TOTAL	11,121.9	703.8	40	25	24	1	11	11	6
AVERAGE	278.0	17.6							

3 EXISTING TECHNICAL REQUIREMENTS

This section looks at the existing technical requirements for disposal of slaughter and poultry processing waste in two sections; disposal in Commingled landfills and on-site disposal via burial.

3.1 Commingled Landfills

3.1.1 Base Liner System

British Columbia

Under the Landfill Criteria, for Natural Control landfills there must be a minimum 2 m thick layer of low permeability soil with hydraulic conductivity of 1×10^{-6} cm/s or less (silt or clay) below each waste cell. Lesser thickness, or no layer, of low permeability soil may be approved depending on the leachate generation potential, the unsaturated depth, soil permeability and soil leachate renovation capability.

For Engineered landfills, a minimum 1 m thick compacted soil liner with a hydraulic conductivity of 1×10^{-7} cm/s or less is required. Other liners which provide the same degree of containment are acceptable equivalents. Liners with a lower hydraulic conductivity may also be approved depending on the leachate generation potential, the unsaturated depth, soil permeability and soil leachate renovation capability. The liner system is to have an appropriate grade so that leachate head buildup is not greater than 0.3m at any time.

CFIA Engineered Landfill

The recent draft assessment of engineered landfills by the CFIA identified some requirements for the base liner system. It indicated that the liner may be constructed of natural clay, engineered clay compacted soil, rock, geomembranes (industry approved plastic sheeting or high density polyethylene) or a combination of the above such that the hydraulic conductivity of the liner system is less than 1×10^{-7} cm/s. It specifies minimum bottom slopes of 2 percent for controlling slopes and 0.5 percent for other slopes for the liner system.

Alberta

Class II landfills must have landfill liners with the exception of new or laterally expanding Small Class II landfills. New or laterally expanding Small Class II landfills may be situated in a location where

- there is a 5 m thick layer of clayey deposit having a hydraulic conductivity less than 1×10^{-6} cm/s beneath the waste or below original grade; and
- there is another 5 m thick layer of geologic material with a hydraulic conductivity less than 1×10^{-6} cm/s beneath the clay layer, or a layer with a material with a similar seepage rate (under 0.3 m head).

For Class II landfills, liners must meet a performance standard with respect to the hydraulic conductivity. If a clay liner is used, it must be compacted, have a minimum of 1 m in thickness and have a hydraulic conductivity of 1×10^{-7} cm/s, or be of greater thickness and have an equivalent advective flow performance. Composite liners must consist of a minimum 0.6 m thick compacted clay

liner and a geomembrane placed directly on the clay layer. The clay layer may be thicker but the overall performance must be equivalent to a hydraulic conductivity of 1×10^{-7} cm/s.

European Union

Under EU regulation, the base and sides of a hazardous landfill must consist of a mineral layer that has a hydraulic conductivity less than or equal to 1.0×10^{-7} cm/s, and must be greater than 5 meters in thickness. Further to the geological barrier, an artificial bottom sealing liner and drainage layer of greater than or equal to 0.5 m is recommended. These recommendations may be reduced accordingly, following an assessment of local meteorological conditions and the potential for the waste contained in the landfill to generate leachate.

United States – Texas

Liner systems for Type I landfills must be designed sufficiently to ensure the concentrations of the constituents do not exceed specified limits. To achieve this a composite liner may be installed that consists of a 30 mil geomembrane liner (60 mil if the geomembrane liner is composed of high density polyethylene) and 2 ft of re-compacted soil with a hydraulic conductivity of less than 1.0×10^{-7} cm/s. Alternative liner designs may be acceptable if it can be demonstrated through computer modelling that the concentrations of the constituents specified will not be exceeded. Type 1AE landfills can qualify for exemption from these liner requirements based on the factors mentioned in Section 2.2.2.

3.1.2 Leachate Collection

British Columbia

A Natural Control landfill typically does not have a leachate collection system. The natural attenuation of the underlying soils is meant to provide adequate retention and biological treatment of the leachate generated. The minimum specifications for leachate collection systems for Engineered landfills are a 0.3m thick sand drainage layer with a hydraulic conductivity of 1×10^{-2} cm/s or greater. An acceptable alternative to that are synthetic drainage nets with similar hydraulic conductivity. The leachate collection system must also be designed to prevent plugging due to precipitation of leachate constituents.

CFIA Engineered Landfill

A leachate collection and removal system is required. This system is to be hydraulically separate from the landfills storm water system. The leachate collection system must be able to:

- function all year;
- be able to monitor flow;
- have adequate storage capacity; and
- be accessible for inspection and monitoring.

Alberta

Class II landfills must have leachate collection systems with the exception of new or laterally expanding Small Class II landfills.

European Union

It must be demonstrated that water and leachate can be sufficiently managed to prevent any deleterious effects to the surrounding environment. A leachate collection system is required .

United States – Texas

For Type 1 landfills leachate-collection and associated leachate-removal systems shall be:

- constructed of materials that are chemically resistant to the leachate expected to be generated;
- of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and by any equipment used at the landfill; and
- designed and operated to function through the scheduled closure and post-closure care period of the landfill considering specific engineering factors

Type 1AE landfills can qualify for exemption from these leachate collection requirements based on the factors mentioned in Section 2.2.2.

3.1.3 Closure System

British Columbia

Under the Landfill Criteria, final cover must consist of a minimum 1m thick compacted soil with a permeability less than 1×10^{-5} cm/s, plus a 0.15m thick topsoil layer with approved vegetation established. Soils with higher permeability may be approved depending on the leachate generation potential of the site. Final cover should be slopes between 4% and 33% with appropriate run-on/run/off and erosion controls. Final cover is to be installed within 90 days of landfill closure or on any areas of the landfill that will not receive any more waste within the next year.

CFIA Engineered Landfill

The CFIA guidelines state that a soil barrier or a composite barrier with a geomembrane be placed over the landfill to limit infiltration into the landfill. If only soil is used then a minimum 60 cm thick layer of compacted natural or amended soil is required. If a composite geomembrane is used as well as the soil, the soil layer can be reduced. The saturated hydraulic conductivity of the closure system must be less than 1×10^{-7} cm/s. The guidelines also outline that it is typical for landfills to have a drainage layer consisting of a minimum 30 cm of compacted sand and a top vegetation / soil layer consisting of a minimum of 60 cm of soil graded at a slope between 3 – 5 % with vegetation or an armoured surface in addition to the closure system with the specified hydraulic conductivity.

Alberta

The regulations state that a final cover layer shall be installed to minimize infiltration and erosion. The final cover system shall include a soil barrier layer that is 0.6m thick with a maximum permeability of 1

$\times 10^{-5}$ cm/s, or alternative material can be used that achieves equivalent protection. On top of the barrier layer, subsoil and topsoil shall be placed depending on the desired end use for the site. If the site is to be used for pasture or recreational uses the 0.2m of topsoil and 0.35m of subsoil is required, or if the site is to be cultivated or used for forestry then 0.2m of topsoil and 0.8m of subsoil is required. The final topography of the cover system shall prevent pooling of water and have a grade between 5% and 30%. Closure should be completed within 180 days after capacity is reached.

European Union

Recommended surface sealing for landfills containing hazardous wastes include the use of an artificial sealing liner, an impermeable mineral layer, and drainage layer greater than 0.5 m and a top soil cover greater than 1 m in thickness. However, these recommendations for surface sealing may be reduced, following an assessment of local meteorological conditions and the potential for the waste contained in the landfill to generate leachate. A landfill gas collection and utilization system is required for landfills that accept biodegradable waste.

United States – Texas

For landfills receiving waste after October 9, 1993, two options for final cover exist under Texas regulations depending on whether the base of the landfill is lined or unlined (i.e. Type 1 or Type 1AE landfills). For landfills that have a synthetic bottom liner (Type 1), the final cover shall consist of a synthetic membrane of equal or less permeability than the synthetic bottom liner, covered by a minimum of 18 inches of clay-rich soil with a permeability of less than 1.0×10^{-5} cm/s. The minimum thickness of the synthetic membrane should be 20 mil, or 60 mil if it is composed of high density polyethylene.

For unlined landfills (Type 1AE) the clay rich soil cover layer shall be a minimum 18 inches thick with a permeability equal or less than the bottom liner (constructed or natural). The permeability of the cover layer is to be a minimum of 1×10^{-5} cm/sec.

3.1.4 Operational Requirements

British Columbia

Under the Landfill Criteria slaughter waste requires specific approval from the Manager in order to be disposed of within a landfill. If slaughter waste is disposed of in a landfill then the area where it is placed must be recorded for future reference. There is no other specific reference to the requirements for the disposal of slaughter waste. The guidelines outline that other waste is to be spread in layers less than 0.6m thick, and that daily cover is required at Sanitary Landfills at the end of each day, unless the landfill is continuously operated, then 0.15m of cover is required at a frequency approved by the Manager. When intermediate cover is required, it is to be applied on areas that will not receive additional waste within 30 days. The cover requirements for Modified Sanitary and Selected Waste Landfills are to be determined by the Manager. Typically, incoming slaughter and poultry waste in B.C. is treated as a controlled waste. It is typically disposed of under special requests and special operational procedures are prescribed at the time of disposal.

CFIA Engineered Landfill

Under the CFIA recommendations, landfill staff trained in SRM containment operating procedures must be present during all hours when SRM is received and handled at the landfill. The landfill also has to be secure to prevent unauthorized access. Operating and maintenance manuals are to be readily accessible to operating staff at the landfill. Cover material should be stockpiled or available above the working face prior to a vehicle arriving to dispose of the SRM at a specified location at the landfill. SRM should be covered immediately after tipping. Equipment that handles SRM must be designated for use as SRM equipment or be cleaned on-site via pressure washing to be remove all organic material prior to alternate use. If the vehicle is to leave the site, it must be visibly clean of any SRM material.

Alberta

Under Alberta's code of practice specific operational procedures are to be established for each landfill to ensure that operations are consistent with the landfill design, with special consideration for slaughter wastes. At a minimum, waste must be immediately covered with 15cm of soil or an alternative approved cover material.

European Union

It is unclear whether there are any special operation requirements for the handling and disposal of slaughter waste under European Union guidelines.

United States – Texas

Under Texas regulations, Type I or Type IAE landfills can receive slaughter waste provided the slaughter waste is covered with at least 3 ft of other landfill waste or 2 ft of earthen material immediately upon receipt.

Saskatchewan

The fact sheet prepared for Saskatchewan was the most detailed information found relating to landfill operation for slaughter waste disposal. It outlined the following guidelines:

- Slaughter wastes should be landfilled in a separate pit on the landfill site which is not accessible to the public.
- When waste is deposited into the pit, it must be covered with soil immediately to discourage pests. Lime may also be used to reduce pest attraction.
- When filled, the pit must be compacted and capped.
- Special permission may be granted for the deposit of slaughter wastes at the landfill face provided that daily covering of the waste occurs and that waste is accepted after normal operating hours of the landfill.

3.1.5 Buffers

British Columbia

The siting of new landfills requires a detailed site location investigation which assesses the Siting Criteria as outlined in the Landfill Criteria. The Siting Criteria gives some guidelines for buffer distances, including:

- Minimum 15m to 50m between landfill and property boundary
- Minimum 300m between landfill and other facilities
- 8km between landfill and airports unless bird control measures implemented
- Minimum 100m between landfill and nearest surface water
- Minimum 100m between landfill and unstable area
- Protective measures required if sited in a 200 year floodplain

The Landfill Criteria also identifies that the detailed site investigation should also address issues related to water contamination, air pollution, wildlife conflicts, transportation and social and economic factors.

For Natural Control landfills, the bottommost waste cell is to be 1.2 m above the seasonal high water table. Greater or lesser depths may be approved or required depending on the soils.

CFIA Engineered Landfill

For Engineered landfills, the seasonal high groundwater level shall be maintained a minimum of 500mm below the liner at its lowest point. Also, groundwater lowering systems shall be used to ensure that there is positive drainage of the groundwater away from the landfill area.

Alberta

There are no specific buffer guidelines presented in the Alberta Code of Practice. However, prior to the construction of a landfill an investigation shall be completed by a professional engineer or geologist to assess conditions at the site. It is assumed that during this time the siting conditions and buffer considerations would be taken into account.

European Union

General requirements for siting a landfill are applied to all classes of landfills. It must be demonstrated that the landfill will be located in consideration of neighbouring land uses (e.g. residential and recreational areas), local geological and hydrological conditions and the protection of the environment. Furthermore, it must be demonstrated that water and leachate can be sufficiently managed to prevent any deleterious effects to the surrounding environment.

United States – Texas

Permitting requires the description of surrounding land adjacent to the proposed landfill site to ensure compatibility. This includes an assessment of the land uses within a mile radius of the proposed landfill (i.e. describe and quantify residential, commercial and other uses), as well as a description of anticipated growth patterns within a 5 mile radius of the landfill. An assessment of environmental conditions at the site include a description of groundwater quality, geography, seismic activity, an inventory of endangered and threatened species, and characterization of floodplains and wetlands.

3.2 Onsite Disposal

As previously mentioned, there was limited published information found during the review of current technical requirements for on-site burial of slaughter and poultry waste. The literature search was broadened to look at the on-site burial of livestock mortalities, a subject on which a few provincial bodies have published technical fact sheets. Of most relevance to this project were the fact sheets published by B.C., Alberta and Ontario. The following section presents a summary of the technical requirements outlined in these fact sheets.

In an attempt to gain an understanding of where the technical requirements presented in these fact sheets were sourced, the authors were contacted. It was found that in the case of the B.C. fact sheet, the requirements were taken from an unknown source and also the Alberta and Ontario fact sheets. For the Alberta and Ontario fact sheets the requirements were sourced from a fact sheet published by the Missouri Department of Natural Resources (MDNR). Upon contacting MDNR staff, it was unconfirmed where these technical requirements were originally sourced from, and hence the scientific basis of all of these fact sheets is unknown.

The applicability, on a scientific basis, of the technical requirements presented in these fact sheets to the disposal of slaughter waste on-site is also unknown at this stage. In Chapters 4 and 5 of this report, SHA used the information presented below as a starting point for developing the on-site disposal technical guidelines. As there was no reliable scientific data published on this form of disposal, the final technical recommendations made in this report were based upon SHA's expertise and experience, as the scientific basis of the fact sheets presented is unknown.

3.2.1 Depth to Groundwater & Soil Type

British Columbia

The *Large Animal Disposal – On Farm Burial Option: South Coast Region of BC* fact sheet outlines that potential groundwater contamination can be assessed by looking at the soil type, soil depth and depth to groundwater for a selected burial pit location. Potential for groundwater contamination is estimated based on the following table.

Based on the matrix presented in Table 3.1, groundwater contamination is rated as follows: N/A = Not allowed, 1 = High potential for contamination – do not bury, 2 = Moderate potential for contamination – not recommended, select better site, 3 = Low potential – location suitable for burial from ground water protection perspective, 4 = Very Low potential - location suitable for burial from ground water protection perspective.

The fact sheet also states that burial of large animals or large volumes of animals over unconfined aquifers, such as the Abbotsford – Sumas or Hoppington Aquifers is not recommended.

Table 3-1: B.C. ground water contamination potential based on soil type and depth to watertable

Soil Type	Depth to Watertable from Bottom of Pit			
	<1 m	1-5 m	5-15 m	>15 m
Soil Depth <1m	N/A	1	1	1
Muck or peat soils	N/A	2	3	3
Sand with fast natural drainage	N/A	1	1	2
Sandy Loam with moderate natural drainage	N/A	1	2	3
Clay Loam with slow natural drainage	N/A	2	3	4
Clay with very slow natural drainage	N/A	3	4	4

Alberta

Under the *Destruction and Disposal of Dead Animals Regulations* the bottom of the burial pit is to be at least one meter above the seasonal high water table. The fact sheet titled *Livestock Mortality Burial Techniques* prepared by Alberta Agriculture, Food and Rural Development outlines some more specific recommendations for groundwater buffer depths based upon Alberta's Environmental Farm Plan (EFP). It presents a simplified method for determining groundwater contamination potential based on the EFP as follows:

- Groundwater contamination potential can either be high, moderate or low.
- There are no ideal conditions to reduce groundwater contamination.
- Areas with thin soil cover over a bedrock layer should be avoided.
- Use the table below to determine groundwater contamination potential.
- Contamination potential is then calculated, Contamination Potential = (A+B+C) / 3.
- If result is a fraction round up.
- Contamination Potential 1 = High, 2 = Moderate, 3 = Low.

Table 3-2: Alberta simplified method of determining groundwater contamination potential

Soil Group (Rating A)	Sub Surface Soil Texture (Rating B)	Depth to Aquifer (Rating C)
Brown = 3	Coarse textured Soils = 1	<8m = 1
Dark Brown = 2	Medium Textured Soils = 2	8 to 30m = 2
Black = 1	Fine Textured Soil = 3	>30m = 3
Gray = 1		

Ontario

The fact sheet prepared by the Ontario Ministry of Agriculture, Food and Rural Affairs outlines techniques for determining the groundwater contamination potential using a simplified method adopted from *Ontario's Environmental Farm Plan* (EFP), prepared by the Ontario Farm Environmental Coalition. The following table gives a summary of the procedure, which is where the Alberta procedure was adapted from.

Table 3-3: Ontario simplified method of determining ground water contamination potential

Soil Type (Natural Drainage)	Depth to Groundwater			
	<1 m	1-5 m	5-15 m	>15 m
Bedrock within 1m	1	1	1	1
Muck	1	-	-	-
Sand (Fast)	1	1	1	2
Sandy Loam (Moderate)	1	1	2	3
Clay Loam (Slow)	1	2	3	4
Clay (Very Slow)	1	3	4	4

Based on the matrix above, groundwater contamination is rated as follows: 1 = High, 2 = Moderate, 3 = Low, 4 = Very Low.

3.2.2 Waste Disposal Rate and Spacing

British Columbia

The fact sheet outlines that burial sites should be well distributed around the property, and that no more than one large animal carcass should be placed in each burial site. Mortality burial rates should not exceed 700 kg/Ha/yr, and a burial site should not be re-used within 3 years. Burial pits should be spaced a minimum of 30m apart from each other. Upon speaking with the author of this fact sheet, it was established that the waste disposal rate was adopted from an unknown source and not calculated based on the Nitrogen loading rates as previously believed.

Alberta

Under the Regulations, the weight of dead animals in a pit can't exceed 2,500 kg unless there has been multiple animal deaths due to extreme circumstances, then they may be buried in a farm pit subject to the approval of and in accordance with a veterinary inspector appointed under the *Livestock Disease Act*. The fact sheet presents recommended burial rates based on the groundwater contamination potential calculated via the Environmental Farm Plan method, as outlined in the table below.

Table 3-4: Alberta recommended burial rates

Groundwater Contamination Potential	Max Mortalities Buried (kg/Ha/yr)	Pit Spacing¹
High	0	N/A
Moderate	2500	100m
Low	5000	70m

1. Based on maximum of 2,500 kg per burial site

The fact sheet also outlines that farmers should not use more than 10% of their land for burial in any one year, and therefore burial sites should only be used once every ten years.

Ontario

The fact sheet presents burial rates based on the Environmental Farm Plan, according to the potential groundwater contamination at the site, as outlined in the table below. It should be noted that burial of mortalities is not recommended in soils that have a high groundwater contamination potential.

Table 3-5: Ontario recommended burial rates

Groundwater Contamination Potential	Max Mortalities Buried (kg/Ha/yr)
High	0
Moderate	1,000
Low	3,000
Very low	5,000

The fact sheet also outlines that farmers should not use more than 10% of their land for burial in any one year, and therefore burial sites should only be used once every ten years. It also recommends that more smaller burial sites that are well spaced are better than fewer, larger sites spaced closer together. They recommend that each burial site has no more than 500 kg of mortalities in them, and that they be spaced no closer than 15 m apart.

3.2.3 Trench & Cover Specifications

British Columbia

The fact sheet outlines that a pit needs to be 1.2 to 1.5m below the original ground level, and that at least 1.0m of cover be packed over the mortalities and this cover be at least 0.3m above original ground level. High carbon material such as saw dust can be used to line the pits that have a moderate groundwater contamination potential to reduce the pollution potential. Also, if pits are lined with 15cm of this material it may increase the decomposition process and help contain leachate. It is also suggested that agricultural or hydrated lime can be used to reduce odours and scavaging.

Alberta

A dead animal is to be covered within 48 hours of its death with a minimum of one meter of compacted soil or a wooden or metal lid to exclude scavengers if quicklime is added to control flies and odour. The fact sheet outlines some recommendations for burial:

- The burial trench should be 1.0 to 1.2m below original ground level.
- To keep mortality weight in hole less than 2,500kg, holes should be no more than 1.2m deep, 4.3m long and 1m wide. Generally 0.22m³ per 100 kg of mortality is required.
- Mortalities can either be covered with a minimum 0.6m of compacted soil, which also includes 0.3m of soil crowned over the hole, or

- Mortalities can be covered using 0.15m of soil between burial intervals with the addition of 0.5kg of quick lime for every 10 kg of mortalities. The hole is then to be capped with a 13mm thick, 1.2 x 2.4m piece of plywood, secured on the edges with soil. The lid can then be removed each time mortalities are added. This hole should be filled within a few days.

Ontario

The *Dead Animal Disposal Act* governs that the waste is covered with at least 60 cm of soil within 48 hours of burial. The fact sheet outlines some additional requirements for burial that are in essence the same as the Alberta requirements.

3.2.4 Environmental Buffers

British Columbia

Under the *Agriculture Waste Control Regulation*, burial sites must be located at least 30m away from any source of water used for domestic purposes. The *Forest and Range Practices Act* requires that burial sites are not within 100m of any stream or community watershed. The fact sheet recommends that burial sites be located more than 40m from well or at least 30m from any source of surface water used for domestic purposes. It also states that this buffer be increased for burial sites with a high groundwater contamination potential.

Alberta

Under the *Destruction and Disposal of Dead Animals Regulations* a burial pit must be:

- At least 100m from wells or other domestic water intakes, streams, creeks, ponds, springs and high water marks;
- At least 25m from the edge of a coulee, major cut or embankment;
- At least 100m from any residence;
- At least 300m from a primary highway;
- At least 100m from a secondary highway;
- At least 50m from any other road allowance.

The fact sheet also provides for buffer distances to wells based on the potential groundwater contamination, as presented in the table below:

Table 3-6: Alberta recommended buffer distances between burial sites and wells

Groundwater Contamination Potential	Drilled or Dug Wells
High	N/A
Moderate	150m
Low	100m

Ontario

The fact sheet outlines some recommended buffer distances for burial sites:

- Distance to open top catch basins, ponds used for watering livestock or poultry, and natural watercourses should be at least 50m.
- Try to keep burial sites 15m from drainage tiles.
- Keep 15m from property boundaries.
- Keep 100m from neighbouring homes.
- Keep out of view.

The fact sheet also provides for buffer distances to wells based on the potential groundwater contamination, as presented in the table below:

Table 3-7: Ontario recommended buffer distances between burial sites and wells

Groundwater Contamination Potential	Drilled or Dug Wells
High	100m
Moderate	75m
Low	50m
Very Low	30m ¹

1. Minimum to be consistent with Ontario Water Resources Act regulations for water wells.

The fact sheet also identifies that improper burial techniques can result in surface water contamination. It is recommended that burial sites should be kept at sites that are relatively flat with less than a 0.5% slope.

4 RECOMMENDED LANDFILL & ON-SITE DISPOSAL METHOD SELECTION PROCESS

4.1 Overview of Process

The impacts of leachate upon groundwater and the surrounding environment is one of the key considerations when dealing with disposal of slaughter and poultry waste, and hence it has been considered as a key factor for determining what technical requirements apply to landfills that want to dispose of slaughter and poultry wastes. The generation of landfill leachate is the result of precipitation infiltrating through the soil cover into the underlying refuse layer and from contained moisture in the waste being squeezed out from the overlying weight. The volume and strength of leachate generated is dependent on a number of principal factors; with the most relevant being climate (including precipitation), the surface area of the cells, the type of cover being incorporated over the waste and the type of waste being disposed.

Considering this two matrixes have been developed by SHA; one for disposal in a Commingled Landfill (Table 4.1) and one for On-site Disposal via burial (Table 4.2). These matrixes have been developed in order to determine the applicable technical standards for landfills and on-site burial across a range of disposal scenarios. Both matrixes are based on the two main variable factors that have the potential to impact leachate generation and quality at a landfill or on-site disposal site; annual precipitation and volume of slaughter waste disposed. The annual precipitation at a site influences the volume of leachate generated, whilst the volume of waste disposed impacts the strength and volume of leachate produced. The estimation of these two factors for the two different scenarios is discussed in the following sections. Based on the potential impact of leachate at the site influenced by these two factors an appropriate landfill or on-site disposal technical requirement has been recommended in order to minimize the impact of this waste disposal on the environment.

4.2 Commingled Landfill Disposal

4.2.1 Landfill Technical Requirements Matrix

A Decision Tree has also been prepared and is shown in Figure 4-1. The Decision Tree aims to help guide decision makers whether to accept slaughter waste based on the applicable technical standards outlined in this report that they must meet.

If a landfill operator wants to allow the disposal of slaughter or poultry waste at their landfill, then they would consult the following Landfill Technical Requirements Matrix (Table 4-1) to determine the technical standards they must meet. This matrix is applicable for private, municipal and regional landfill facilities. Based on the annual rainfall at the site and the desired slaughter and poultry disposal rate as a percentage of the current incoming MSW stream, a landfill operator can determine what technical standards they must meet. Four technical landfill categories have been established as outline below, and the technical guidelines for these landfills are presented in the Chapter 5 of this report.

Natural Control Landfill

If the desired waste disposal volumes and annual rainfall indicate that a natural control landfill can be used for disposal of this waste, then the technical requirements for a natural control landfill must be achieved as outlined in Chapter 5 as a minimum. If these requirements can't be met at the site then the waste should not be disposed at the site and an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Natural Control Landfill with Enhanced Technical Requirements

If the desired waste disposal volumes and annual rainfall indicate a natural control landfill with enhanced technical requirements is required, then the technical requirements for this type of landfill must be achieved as outlined in the following chapter as a minimum. Certain aspects of the landfill requirements have been increased for this scenario of waste disposal to provide for the required environmental protection. If these requirements can't be met at the site then the waste should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Engineered Landfill

If the desired waste disposal volumes and annual rainfall indicate that an engineered landfill can be used for disposal of this waste, then the technical requirements for an engineered landfill as outline in the following chapter must be achieved as a minimum. If these requirements can't be met at the site then the waste should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Engineered Landfill with Waste Pre-Treatment

If the desired waste disposal volumes and annual rainfall indicate that an engineered landfill with waste pre-treatment can be used for disposal of this waste, then the technical requirements for an engineered landfill with waste pre-treatment as outline in the following chapter must be achieved as a minimum. If these requirements can't be met at the site then the waste should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Alternative Disposal

If the desired waste disposal volumes and annual rainfall indicate that alternative disposal is appropriate to dispose of this waste then the waste should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

**FIGURE 4-1
DECISION TREE FOR THE DISPOSAL OF SLAUGHTER WASTE IN LANDFILLS**

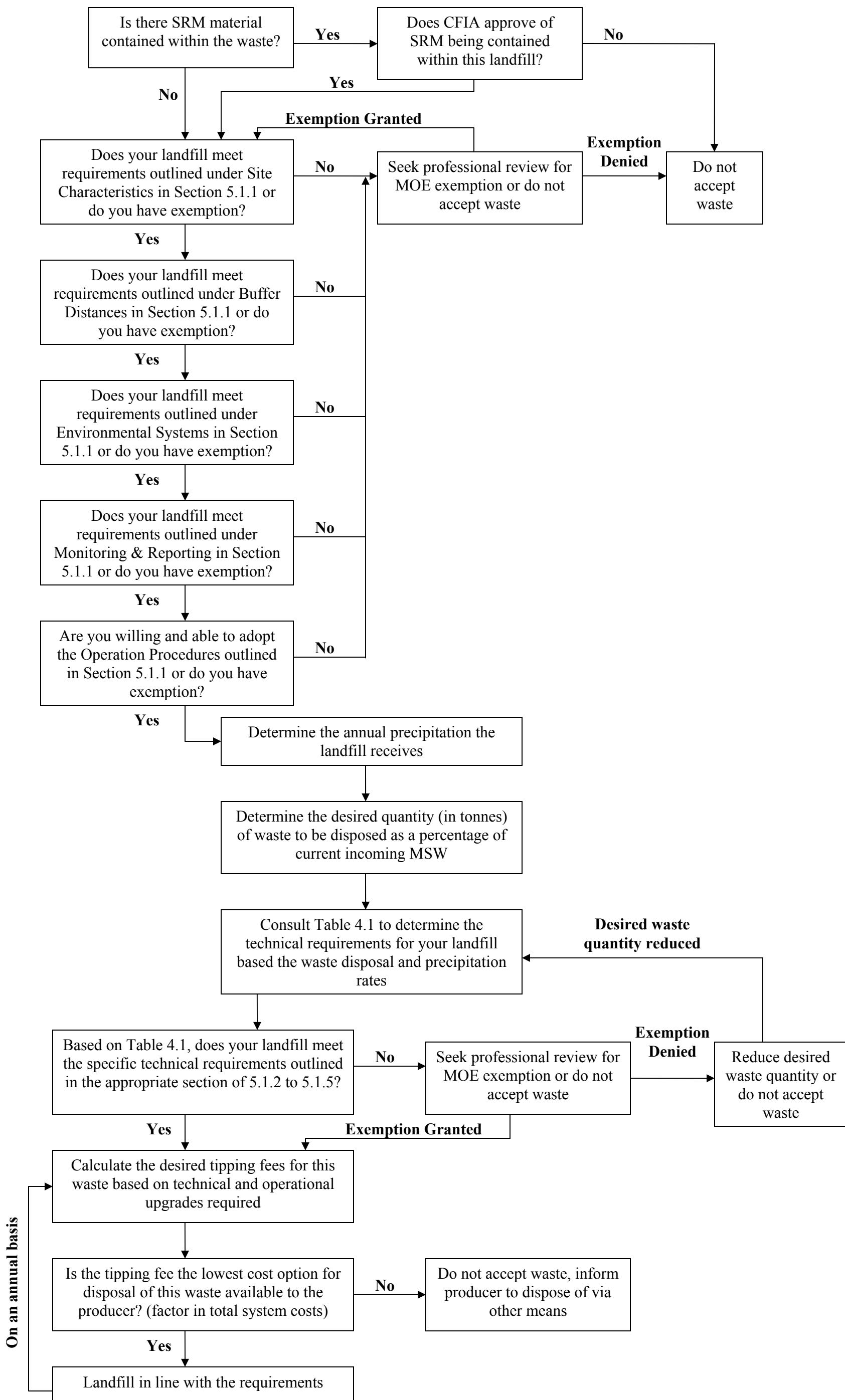


Table 4-1: Commingled Landfill Technical Selection Matrix for Poultry Processing & Slaughter Waste Disposal

		Slaughter & Poultry Waste Disposal Volumes (% of Incoming MSW Stream)			
		<2%	2% - 5%	5-10%	>10%
Rainfall (mm/yr)	0-400	Natural Control Landfill	Natural Control with Enhanced Technical Requirements	Engineered Landfill	Engineered Landfill with Waste Pre-Treatment
	400-1000	Natural Control with Enhanced Technical Requirements	Engineered Landfill	Engineered Landfill	Engineered Landfill with Waste Pre-Treatment
	>1000	Engineered Landfill	Engineered Landfill	Engineered Landfill with Waste Pre-Treatment	Alternative Disposal

1. Waste can be disposed in the identified landfills described above if they meet the technical requirements outlined within Chapter 5 of this report.

4.2.2 Justification of Selected Matrix Parameters

Rainfall

Based on SHA's 12 years of experience at more than 150 landfills in British Columbia, we have analyzed various landfill sites to determine their leachate generation potential based upon the average annual precipitation received at the site. The relationship for numerous sites across B.C. is presented in Figure 4-2. The figure shows the estimated water surplus at a particular site compared to the recorded average annual precipitation. The water surplus gives an indication of water that is available for leachate production after evaporation and evapo-transpiration have been taken into account. The water surplus has been calculated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The model accepts weather, soil, and design data and uses solution techniques that account for the effects of surface storage, snowmelt, frozen soil, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through soil, geomembrane, or composite liners to calculate the water balance for a site.

Based on SHA's experience at the landfills presented, landfills have been ranked as having either low (blue), moderate (green) or high leachate (red) generation potentials. Based on these observations a water surplus range was selected that covered each of these scenarios as shown on the figure. A trend line was then established, and from this the precipitation ranges that related to each of these groups was estimated. This resulted in the three annual precipitation ranges shown in the matrix:

- <400 mm/year = Low leachate generation potential
- 400 to 1000 mm/year = Moderate leachate generation potential
- >1000mm/year = High leachate generation potential

Waste Disposal Rates

The waste disposal rates expressed as a percentage of current incoming MSW volumes has been estimated based upon SHA's experience with landfill operations. This parameter was set up as a percentage instead of a flat waste tonnage in order to prevent small landfills from receiving large quantities of this waste and hence resulting in potential leachate impacts. Four scenarios were considered based on the potential impact this volume of waste could have on leachate strength within a landfill, as outlined below:

- 2% of Incoming MSW Stream = Low leachate strength impact potential
- 2 to 5% of Incoming MSW Stream = Moderate leachate strength impact potential
- 5 to 10% of Incoming MSW Stream = High leachate strength impact potential
- >10% of Incoming MSW Stream = Extreme leachate strength impact potential

It should be noted that these factors have been estimated by SHA, and may require adjustment based upon actual practice and leachate impacts from disposing this waste. Refer to Chapter 7 for further work required in this area.

4.3 On-site Disposal

4.3.1 On-site Disposal Technical Requirements Matrix

A Decision Tree for on-site disposal has also been prepared and is shown in Figure 4-3. The Decision Tree aims to help guide waste producers who wish to dispose of waste on-site whether it is a feasible option based on the applicable technical standards outlined in this report that they must meet.

If a slaughter house or poultry processing plant operator wants to dispose of slaughter or poultry waste on-site where the waste was produced, then they would consult the following On-site Disposal Technical Requirements Matrix (Table 4-2).

Based on the annual rainfall at the site and the desired slaughter and poultry disposal rate expressed as kilograms per hectare per year, the operator can determine what technical standards they must meet, or if another form of disposal is required. Two on-site disposal categories have been established as outlined below, and the technical guidelines for these disposal methods are presented in the Chapter 5 of this report.

Unlined Burial

If the desired waste disposal volumes and annual rainfall indicate that unlined burial can be used for disposal of this waste, then the technical requirements for unlined burial must be achieved as outlined in Chapter 5 as a minimum. If these requirements can't be met at the site then the waste should not be disposed at the site and an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Unlined Burial with Enhanced Technical Requirements

If the desired waste disposal volumes and annual rainfall indicate that unlined burial with enhanced technical requirements is appropriate, then the technical requirements for this type of on-site disposal must be achieved as outlined in the following chapter as a minimum. Certain aspects of the unlined burial requirements have been increased for this scenario of waste disposal to provide for the required environmental protection. If these requirements can't be met at the site then the waste should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

Alternative Disposal

If the desired waste disposal volumes and annual rainfall indicate that it is not appropriate to dispose of this waste within any type of on-site facility then wastes should not be disposed of in the quantities proposed or an alternative disposal method should be sought. Alternatively the MOE may grant exemptions to certain criteria if a professional review of the site is conducted showing that exemption is warranted.

**FIGURE 4-3
DECISION TREE FOR THE DISPOSAL OF SLAUGHTER WASTE ON-SITE VIA BURIAL**

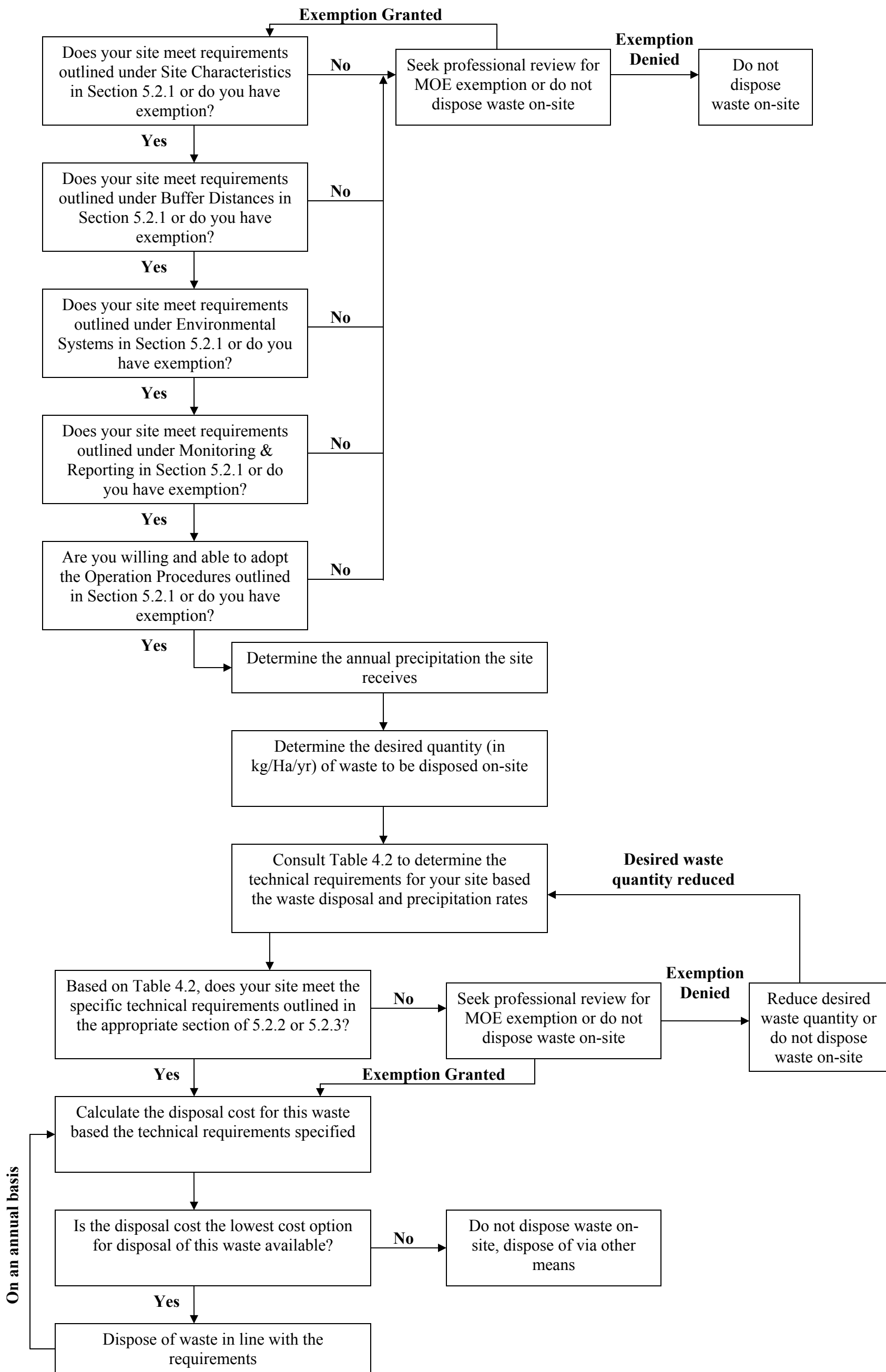


Table 4-2: On-site Disposal Technical Selection Matrix for Poultry Processing & Slaughter Waste Disposal

		Slaughter & Poultry Waste Disposal Volumes (kg/Ha/yr)			
		<1,250	1,250 – 2,500	2,500 – 5,000	>5,000
Rainfall (mm/yr)	0-400	Unlined Burial	Unlined Burial	Unlined Burial with Enhanced Technical Requirements	Alternative Disposal
	400-1000	Unlined Burial	Unlined Burial with Enhanced Technical Requirements	Unlined Burial with Enhanced Technical Requirements	Alternative Disposal
	>1000	Unlined Burial with Enhanced Technical Requirements	Alternative Disposal	Alternative Disposal	Alternative Disposal

1. Waste can be disposed via the methods identified above if they meet the technical requirements outlined within Chapter 5 of this report.

4.3.2 Justification of Selected Parameters

Rainfall

Based on SHA's 12 years of experience at more than 150 landfills in British Columbia, we have analyzed various landfill sites to determine their leachate generation potential based upon the average annual precipitation received at the site. The relationship for numerous sites across B.C. is presented in Figure 4-2. The figure shows the estimated water surplus at a particular site compared to the recorded average annual precipitation. The water surplus gives an indication of water that is available for leachate production after evaporation and evapo-transpiration have been taken into account. The water surplus has been calculated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The model accepts weather, soil, and design data and uses solution techniques that account for the effects of surface storage, snowmelt, frozen soil, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through soil, geomembrane, or composite liners to calculate the water balance for a site.

Based on SHA's experience at the landfills presented, landfills have been ranked as having either low (blue), moderate (green) or high leachate (red) generation potentials. Based on these observations a water surplus range was selected that covered each of these scenarios as shown on the figure. A trend line was then established, and from this the precipitation ranges that related to each of these groups was estimated. This resulted in the three annual precipitation ranges shown in the matrix:

- <400 mm/year = Low leachate generation potential
- 400 to 1000 mm/year = Moderate leachate generation potential
- >1000mm/year = High leachate generation potential

This data is also applicable to on-site burial methods, although the ranges may be somewhat affected. However, for the purpose of this project it has been assumed that leachate will be generated in the same manner within the on-site burial methods as it is within landfills.

Waste Disposal Rates

The waste disposal rates expressed as a kilogram per hectare per year have been adapted from the guidelines for mortality disposal within Canada presented in Section 3.2.2 of this report. The existing maximum value of 700 kg/Ha/yr recommended in the BC fact sheet prepared by the Ministry of Agriculture, Food and Fisheries is much lower than those recommended by other provinces, as it was prepared for the Fraser Valley area, which has a high groundwater table and high annual rainfall. As the technical requirements in this report take into account the rainfall and required depth to groundwater, the values presented in the Alberta and Manitoba fact sheets have been adapted to allow for disposal of a higher volume of waste on-site, considering that the increased technical standards outlined in this report will provide for environmental protection. The values presented in the Alberta and Ontario fact sheets correlate to a level of potential ground water contamination based on soil type and depth to groundwater. These waste disposal value ranges and hence potential ground water contamination values were adapted

to represent the potential impact this volume of waste could have on leachate strength within an on-site burial site, as outlined below:

- <1,000 kg/Ha/yr of waste disposed on-site = Low leachate strength impact potential
- 1,000-2,500 kg/Ha/yr of waste disposed on-site = Moderate leachate strength impact potential
- 2,500 kg/Ha/yr of waste disposed on-site = High leachate strength impact potential

Based on these waste disposal rates the different disposal options are presented. Under the technical requirements for each of these potential disposal options, the specific groundwater buffer distances and soil permeability requirements are outlined, similar to the requirements set out in the BC, Alberta and Ontario fact sheets in order to provide for protection of groundwater. The technical requirements are outlined in the following chapter.

Estimated Nitrogen Loading

SHA has estimated the nitrogen loading rate on the soil based on the above disposal rates. It was assumed that the nitrogen content of the waste was 5% by mass. This resulted in the following loading rates for the disposal options:

- <1,250 kg/Ha/yr Slaughter Waste = <62.5 kg/Ha/yr Nitrogen
- 1,250 – 2,500 kg/Ha/yr Slaughter Waste = 62.5 – 125 kg/Ha/yr Nitrogen
- 2,500 – 5,000 kg/Ha/yr Slaughter Waste = 125 – 250 kg/Ha/yr Nitrogen

For comparative purposes, typical annual lawn fertilizer rates are in the range of 97 kg/Ha [37], so the values stated above are not excessive when looked at from a per hectare basis.

Analysis of the potential Nitrogen (as Ammonia or Nitrate) concentration in the leachate produced over a hectare with the above loading rates gives the following results for the worst case precipitation scenario, 1,000 mm/yr:

- <1,250 kg/Ha/yr Slaughter Waste = <13 ppm Nitrogen
- 1,250 – 2,500 kg/Ha/yr Slaughter Waste = 13 to 25 ppm Nitrogen
- 2,500 – 5,000 kg/Ha/yr Slaughter Waste = 25 to 50 ppm Nitrogen

The following assumptions were made:

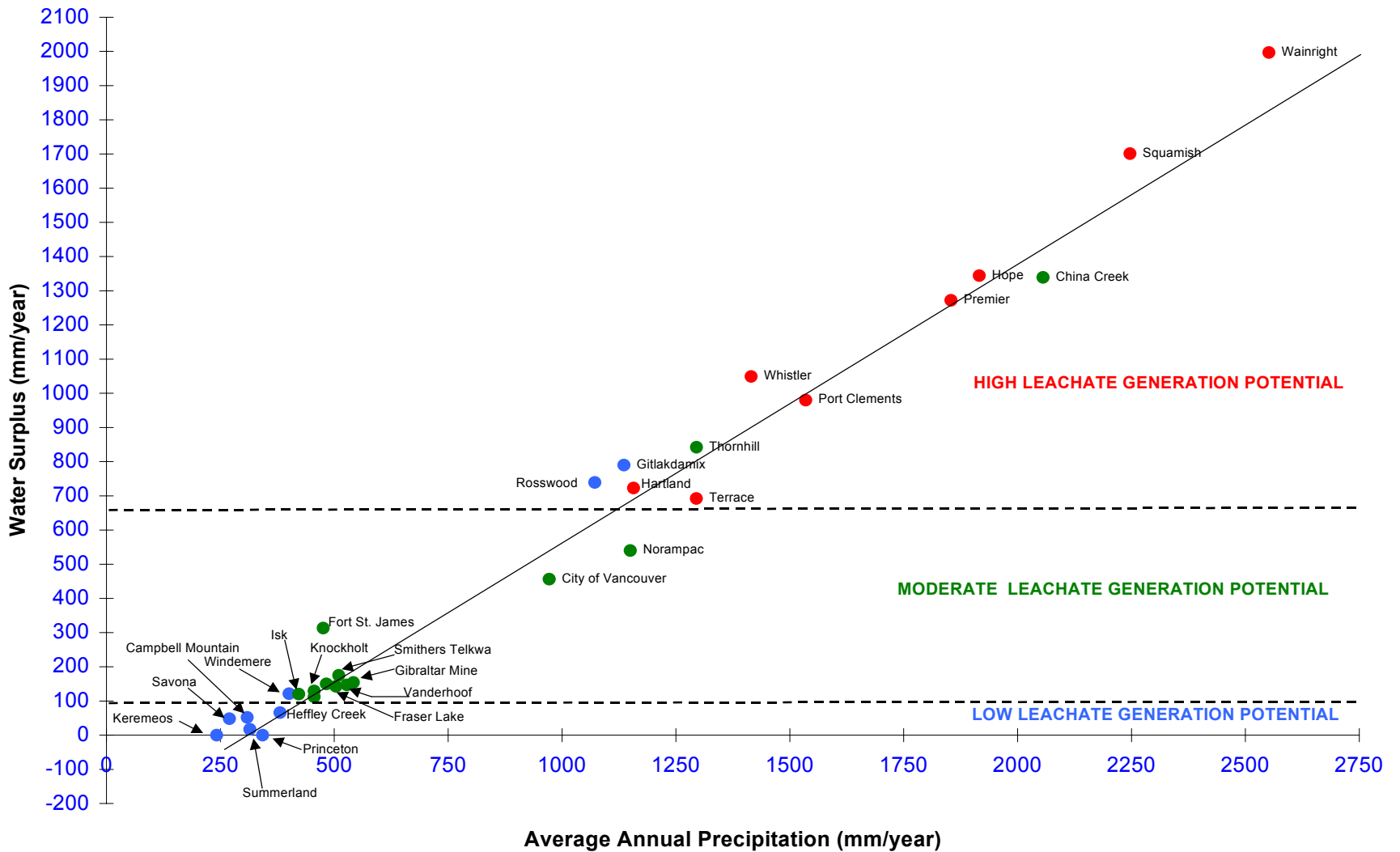
- All available Nitrogen would leach from the buried waste within 1 year
- 50% of the precipitation would infiltrate and produce leachate

The following water quality criteria apply in BC with regards to Nitrogen [38]:

- Drinking Water – Nitrate as Nitrogen (maximum) = 10 ppm
- Livestock Watering - Nitrate as Nitrogen (maximum) = 100 ppm
- Fresh Water Aquatic Life Nitrate as Nitrogen (maximum) = 200 ppm

- Fresh Water Aquatic Life Ammonia as Nitrogen (average value) = 10 ppm

The leachate strengths calculated are all above the drinking water criteria for nitrate and the fresh water aquatic life levels for ammonia. All concentrations calculated are below the livestock watering and fresh water aquatic life values for Nitrate. Considering that the waste will be buried as per the technical specifications outlined in the following chapter, it is likely that this leachate will have a long travel time before it reaches the groundwater table, resulting in further decomposition of the nitrogen and dilution in the groundwater. The nitrate values stated for livestock protection are probably most applicable in this scenario, and the highest projected concentration for the waste disposal scenarios is one half the regulatory limit of 100 ppm. Based on this it appears that the maximum discharge limits in Table 4-2 are reasonable, and that it is not appropriate at this time to dispose of waste in excess of these rates until further monitoring is conducted and more data documenting actual performance and nitrogen levels in the groundwater is compiled.



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**RELATIVE LEACHATE GENERATION
POTENTIAL AT B.C. LANDFILLS**

Figure
4-2

5 RECOMMENDED LANDFILL TECHNICAL REQUIREMENTS

5.1 Commingled Landfill Disposal Technical Requirements

5.1.1 General Technical Requirements

All landfills must meet the following general technical requirements in order to accept the specified quantity of slaughter and poultry processing waste. The specific requirements for each type of landfill are included in the following sections.

Site Characteristics

- Proven record of acceptable surface water, groundwater and air quality that is in compliance with applicable legislation and no formal complaints lodged with regard to these characteristics (applicable to existing landfills only).
- No current leachate breakout issues.

Buffers Distances

- Minimum 50m between landfill toe and property boundary.
- Minimum 300m between landfill and other facilities.
- Minimum 100m between landfill and nearest surface water.
- Minimum 100m between landfill and unstable area, ravine, steep bank or cliff.
- Not located within the 200 year floodplain.
- Meets any other buffer distances required in the Landfill Criteria.

Environmental Systems

- Surface water diversion systems to divert clean run-on and run-off away from the landfill.
- Bear fencing to prevent access to landfill from large predators.
- Security fencing to prevent unauthorized access to the landfill.
- Closure system to consist of minimum 1m thick low permeability soil with a minimum hydraulic conductivity of 1×10^{-6} cm/s (silt or clay) or equivalent of the base liner (whichever is lower). Minimum 0.15m topsoil layer on top of barrier layer required, as per the Landfill Criteria
- Closure system to be implemented in a phased approach once area has reached final contours as per the Landfill Criteria.

Operational Procedures

- Slaughter and poultry processing waste is to be weighed and recorded at the landfill scale upon entry to the site.

- ❑ Slaughter house and poultry processing wastes should be disposed of in a specific location away from the active face of the landfill to avoid disruption with MSW filling operations and to keep the waste away from areas used by the public.
- ❑ The waste should be disposed of in a trench or cell dug within the existing waste mass. The purpose of trenching in existing waste is to provide separation from native ground, to allow for some absorption / retention of moisture within the waste and to allow the waste to be efficiently covered. A long narrow trench is more efficient from an operations perspective than a cell that covers a large area. A trench with a smaller surface area will produce less leachate than a trench with a larger surface area as less water will be able to infiltrate into the waste.
 - **WARNING: Gas buildup within the trench is probable, and hence the trench should be treated as an unconfined space and only qualified people wearing the appropriate safety equipment should enter the trench under any circumstances.**
- ❑ The trench or cell should be prepared before the waste arrives. If a trench is to be used multiple times, i.e. it is to be left open, then an impermeable cover should be placed over the top (e.g. tarp) to prevent precipitation from infiltrating into the exposed waste. As a rule of thumb, based on a waste to cover ratio of 1:1, and a waste density of 0.5 tonnes/m³, each 1 tonne of waste disposed will require 4 m³ of trench capacity, not allowing for final cover to be placed.
- ❑ The trench should not be located in a low spot on the landfill surface. It must be ensured that surface run-off is not able to flow into the trench. A soil berm may be built around the trench to divert run-off if there are any issues.
- ❑ The outer edges of the trench or cell should be located at least 10 m from the existing or future completed outside slope of the landfill.
- ❑ Care should be taken not to dig the trench too deep and with side slopes that are too steep. In general excavation should be in accordance with Worker's Compensation Board guidelines.
- ❑ A 0.3 m layer of material with a high carbon content, such as wood chips should line the bottom of the trench. The purpose of the wood chip layer is to absorb moisture and prevent flow through preferential pathways caused by voids in the MSW.
- ❑ Waste shall be placed in maximum 0.6m thick lifts. The waste should be compacted using the back of an excavator bucket to ensure there are no large voids within the waste. Firm compaction is not required as this will promote leaching from the waste.
- ❑ Waste shall be placed immediately upon entering the site and should be covered with a minimum 0.5 m thick layer of low permeability silt or clay cover material.
- ❑ Lime may be utilized to neutralize potential pathogen and odour issues if required. Lime should not be used unless an odour or pathogen issue exists as it extends the time required for organic decomposition of the waste and can also impact leachate quality.
- ❑ Arrangements should be made between the waste generator and the landfill operator prior to the waste arriving on site. The disposal of this waste must be scheduled to allow for the landfill operator have a trench ready and operator present to assist in the disposal of this waste.

- If there are any issues related to pests and vectors at the site these should be dealt with prior to receiving this waste. If an issue develops then this waste should cease to be received until such issues are dealt with.

Environmental Monitoring

- A monitoring program as per the Landfill Criteria must be in place. This monitoring program should be based on the criteria outlined in *British Columbia Approved Water Quality Guidelines, 2006* [38] and *A Compendium of Working Water Quality Guidelines for British Columbia, 2006* [39], both published by the MOE.
- In addition to the standard monitoring parameters required under the Landfill Criteria, the following should also be monitored at the site based on the previously mentioned criteria:
 - Groundwater and Surface Water
 - BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms.
 - Landfill Gas
 - It should be ensured that landfill gas monitoring is taking place to assess gas concentrations within structures at the landfill and within close proximity to the landfill. Also, odour should be monitored to ensure it does not become an issue at or surrounding the site.

Reporting and Documenting

- The details of burial should be documented for reference and reporting purposes. As a minimum the following information should be documented:
 - Date and time of delivery.
 - Name of the waste generator and delivery company, if different.
 - Location of the waste disposal at the landfill and dimensions of the trench or cell.
 - Waste type (slaughter, poultry, types of animals or birds) and quantity (in volume and tonnes).
- All other reporting requirements in line with the Landfill Criteria should be followed.

5.1.2 Natural Control Landfill Specific Requirements

A Natural Control landfill must meet the following specific technical requirements in addition to the general technical requirements in order to accept the specified quantity of slaughter and poultry processing waste.

Site Characteristics

- Existing landfills must be in compliance with the requirements of the Landfill Criteria for a natural control landfill and have a current Operational Certificate.

Buffers Distances

- Minimum 4m between the seasonal high water table and the bottommost waste cell.

Environmental Systems

- Minimum 2m thick layer of low permeability soil with hydraulic conductivity of 1×10^{-6} cm/s (silt or clay) below each waste cell.
- Landfill gas venting or recovery system required if deemed necessary by the Landfill Criteria.

Operational Procedures

- The waste may be disposed of at the active face if it is received frozen and contained. If waste is not received in this form then it must be disposed of via the trench method detailed in the general requirements. Frozen material can also be disposed via the trench method. If disposed at the active face the waste should be placed and immediately covered with a minimum 0.5 m thick layer of refuse or low permeability silt or clay cover material.

5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements

A Natural Control landfill with enhanced technical requirements must meet the following specific technical requirements in addition to the general technical requirements in order to accept the specified quantity of slaughter and poultry processing waste.

Site Characteristics

- Existing landfills must be in compliance with the requirements of the Landfill Criteria for a natural control landfill and have a current Operational Certificate.

Buffers Distances

- Minimum 8m between the seasonal high water table and the bottommost waste cell.

Environmental Systems

- Minimum 5m thick layer of low permeability soil with hydraulic conductivity of 1×10^{-6} cm/s (silt or clay) below each waste cell.
- Landfill gas venting or recovery system must be installed at the site upon closure of each phase. The quantity of slaughter and poultry waste disposed at these types of landfills is likely to generate significant amounts of landfill gas. The Landfill Criteria calculations for landfill gas generation will most likely be an underestimate for these sites as the organic content of the waste disposed will be increased. A qualified professional should assess whether a passive or active gas system is required based on the quantities of waste disposed. If an active system is used it will reduce odour issues and also reduce greenhouse gas emissions from the site.

Operational Procedures

- The waste may be disposed of at the active face if it is received frozen and contained. If waste is not received in this form then it must be disposed of via the trench method detailed in the general requirements. Frozen material can also be disposed via the trench method. If disposed at the active face the waste should be placed and immediately covered with a minimum 0.5 m thick layer of refuse or low permeability silt or clay cover material. No more than 2% of the incoming

MSW stream of slaughter or poultry waste may be disposed of at the active face. Any quantity beyond this amount must be disposed of via the trench method.

5.1.4 Engineered Landfill Specific Requirements

An Engineered landfill must meet the following specific technical requirements in addition to the general technical requirements in order to accept the specified quantity of slaughter and poultry processing waste.

Site Characteristics

- Existing landfills must be in compliance with the requirements of the Landfill Criteria for an engineered landfill and have a current Operational Certificate.

Environmental Systems

- The site must have a leachate collection system that meets the Landfill Criteria requirements. The collection system must be fully operational and not be subject to clogging or blockages.
- The site must have a leachate treatment system in place that is successfully treating the existing flow, and capable of treating the projected future flow, of leachate ensuring that there is no impact upon the receiving environment. It must have the ability to treat BOD, COD, Chloride Nitrogen, Phosphorus and the associated pathogens generated by the slaughter and poultry waste as well as other contaminants typical of landfill leachate. The site must have a contingency plan to deal with leachate in the case of interruptions to or malfunction of the leachate treatment system.

A basic treatment system could consist of an aeration lagoon with a settling pond or alternatively a wetland system could be used. The leachate being discharged from this system should be monitored (outlined below) to ensure that it is meeting the applicable requirements. If the system is not adequately removing TSS, BOD, COD, Chloride, Nitrogen or Phosphorus then the settling pond could be upgraded to an activated sludge system, and a screening chamber and oil and grease separator could be installed. If pathogens are not being effectively removed, then disinfection via Chloride or Lime dosing should be added to the treatment system. As the requirements for leachate treatment vary greatly from site to site, a professional should be engaged to ensure the existing treatment system will be able to effectively treat the leachate generated and provide a design for any upgrades required.

- A minimum 1 m thick compacted soil base liner with a hydraulic conductivity of 1×10^{-7} cm/s or less is required. Other liners which provide the same degree of containment are acceptable equivalents. The liner system is to have an appropriate grade so that leachate head buildup is not greater than 0.3m at any time. The liner system must meet any other requirements as per the Landfill Criteria.
- Landfill gas venting or recovery system must be installed at the site upon closure of each phase. The quantity of slaughter and poultry waste disposed at these types of landfills is likely to generate significant amounts of landfill gas. The Landfill Criteria calculations for landfill gas generation will most likely be an underestimate for these sites as the organic content of the waste

disposed will be increased. A qualified professional should assess whether a passive or active gas system is required based on the quantities of waste disposed. If an active system is used it will reduce odour issues and also reduce greenhouse gas emissions from the site.

Operational Procedures

- The waste may be disposed of at the active face if it is received frozen and contained. If waste is not received in this form then it must be disposed of via the trench method detailed in the general requirements. Frozen material can also be disposed via the trench method. If disposed at the active face the waste should be placed and immediately covered with a minimum 0.5 m thick layer of refuse or low permeability silt or clay cover material. No more than 2% of the incoming MSW stream of slaughter or poultry waste may be disposed of at the active face. Any quantity beyond this amount must be disposed of via the trench method.

Environmental Monitoring

- In addition to the standard monitoring parameters required under the Landfill Criteria, the following should also be monitored at the site:
 - Leachate
 - The leachate being discharged from the treatment system should be monitored for BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms.

5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements

An Engineered landfill with waste pre-treatment must meet the following specific technical requirements in addition to the general technical requirements in order to accept the specified quantity of slaughter and poultry processing waste.

Site Characteristics

- Existing landfills must be in compliance with the requirements of the Landfill Criteria for an engineered landfill and have a current Operational Certificate.

Environmental Systems

- The site must have a leachate collection system that meets the Landfill Criteria requirements. The collection system must be fully operational and not be subject to clogging or blockages.
- The site must have a leachate treatment system in place that is successfully treating the existing flow, and capable of treating the projected future flow, of leachate ensuring that there is no impact upon the receiving environment. It must have the ability to treat BOD, COD, Nitrogen, Phosphorus and the associated pathogens generated by the slaughter and poultry waste as well as other contaminants typical of landfill leachate. The site must have a contingency plan to deal with leachate in the case of interruptions to or malfunction of the leachate treatment system.

A basic treatment system could consist of an aeration lagoon with a settling pond or alternatively a wetland system could be used. The leachate being discharged from this system should be monitored (outlined below) to ensure that it is meeting the applicable requirements. If the

system is not adequately removing TSS, BOD, COD, Chloride, Nitrogen or Phosphorus then the settling pond could be upgraded to an activated sludge system, and a screening chamber and oil and grease separator could be installed. If pathogens are not been effectively removed, then disinfection via Chloride or Lime dosing should be added to the treatment system. As the requirements for leachate treatment vary greatly from site to site, a professional should be engaged to ensure the existing treatment system will be able to effectively treat the leachate generated and provide a design for any upgrades required.

- A minimum 1 m thick compacted soil liner with a hydraulic conductivity of 1×10^{-7} cm/s or less is required. Other liners which provide the same degree of containment are acceptable equivalents. The liner system is to have an appropriate grade so that leachate head buildup is not greater than 0.3m at any time. The liner system must meet any other requirements as per the Landfill Criteria.
- Landfill gas venting or recovery system must be installed at the site upon closure of each phase. The quantity of slaughter and poultry waste been disposed at these types of landfills is likely to generate significant amounts of landfill gas. The Landfill Criteria calculations for landfill gas generation will most likely be an underestimate for these sites as the organic content of the waste disposed will be increased. A qualified professional should assess whether a passive or active gas system is required based on the quantities of waste disposed. If an active system is used it will reduce odour issues and also reduce greenhouse gas emissions from the site.

Operational Procedures

- Due to the high quantity of waste being disposed of in these landfills it is recommended that the waste be pre-treated before being disposed. The main issue with large quantities of this waste is its high moisture and organic content. These two factors will lead to stability issues within the landfill, which could have catastrophic environmental impacts if there were failures of the slopes. Also, there will be large amounts of landfill gas produced by the decomposition of this waste, which will result in large odour problems. Also, the leachate that will be generated from the landfill will be of a high volume and strength, meaning any leachate breakouts will have a significant impact on the surrounding environment and the leachate treatment facilities will be strained to provide adequate treatment. Any method of treatment that will reduce the moisture content and nutrient load of the waste is acceptable. A professional should be consulted to outline potential treatment options for a specific site. One such treatment method is composting.
- If the waste is composted, it can be done either at the landfill site and then disposed, or composted off-site and then transported and disposed within the landfill. A professional should be consulted to determine the level of composting required prior to treatment and to outline the treatment process.
- The composted material may be disposed of at the active face following normal refuse disposal procedures. Alternatively, if the material is of a relatively inert nature, it can be utilized as operational cover at the landfill in line with normal operating procedures.

- A dedicated lined cell may be constructed to receive the proposed quantities of composted slaughter and poultry waste. A specific site investigation and design should be carried out by a qualified professional to ensure there are no environmental impacts associated with the cell's development. The investigation will outline further guidelines with regards to maximum quantity of waste to be disposed, cover requirements, closure requirements etc. At a minimum the cell must meet the general requirements and the requirements for an engineered landfill outlined in this section.

Environmental Monitoring

- In addition to the standard monitoring parameters required under the Landfill Criteria, the following should also be monitored at the site:
 - Leachate
 - The leachate being discharged from the treatment system should be monitored for BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms.

5.2 On-site Disposal

5.2.1 General Technical Requirements

Site Characteristics

- Burial sites should be relatively flat with a slope less than 0.5%.
- Burial should not be located within areas with shallow bedrock depths.
- Burial sites should not be located in localized low spots to prevent run-off water from entering the trenches.
- A burial trench should never be re-used.

Buffer Distances

- Minimum 50m between trench and property boundary.
- Minimum 300m between trench and other facilities.
- Minimum 100m between trench and nearest surface water.
- Minimum 100m between trench and unstable area, ravine, steep bank or cliff.
- Not located within the 200 year floodplain.

Environmental Systems

- Surface water diversion systems to divert clean run-on and run-off away from the trench.
- Bear fencing to prevent access to trench from large predators.
- Closure system to consist of minimum 1m thick low permeability soil with hydraulic conductivity 1×10^{-6} cm/s (silt or clay). Closure system to extend 0.3m above native ground level to allow for settlement of the waste. The clay cover is to extend 0.5m beyond the trench edges at full thickness, and should be feathered out at 2H:1V (i.e. a slope of 20%) or flatter
- Closure system to be implemented in a phased approach once section of trench has reached capacity.

Operational Procedures

- Trench to be excavated to required width and length to accept waste. A long narrow trench is more efficient from an operations perspective than a cell that covers a large area. A trench with a smaller surface area will produce less leachate than a trench with a larger surface area as less water will be able to infiltrate into the waste.
- Trench to be 1.0 to 2m below native ground level and maximum of 2m wide. Care should be taken not to dig the trench too deep and with side slopes that are too steep. In general excavation should be in accordance with Worker's Compensation Board guidelines. As a rule of thumb, based on a waste to cover ratio of 1:1, and a waste density of 0.5 tonnes/m³, each 1 tonne of waste disposed will require 4m³ of trench capacity, not allowing for final cover to be placed.

- ❑ The trench should be prepared before the waste is generated. If a trench is to be used multiple times, i.e. it is to be left open, then an impermeable cover should be placed over the top (e.g. tarp) to prevent precipitation from entering the trench.
- ❑ The trench should be constructed progressively as required to minimize the amount of open trench. This will reduce issues associated with covering the trench, potential fall hazards, infiltration etc.
- ❑ Bright warning taping should be installed around the pit to warn others of its presence.
- ❑ The trench should not be located in a low spot relative to the local topography. It must be ensured that surface run-off is not able to flow into the trench. A soil berm may be built around the trench to divert run-off if there are any issues.
- ❑ Waste shall be placed in maximum 0.6m thick lifts. Firm compaction is not required as this will promote leaching from the waste.
- ❑ Waste should be immediately covered with the recommended 1m thick closure material (see above). If it is not possible to place the closure material immediately then at a minimum a 0.5 m thick layer of low permeability silt or clay cover material should be applied. This material can count towards the 1m thick final closure layer.
- ❑ A 0.3 m layer of material with a high carbon content, such as wood chips, should line the bottom of the trench. The purpose of the wood chip layer is to absorb moisture and aid in the decomposition of the waste.
- ❑ No more than 2,500 kg should be placed in one trench. Once the 2,500 kg limit has been reached a new trench should be started using the appropriate separation distances.
- ❑ Once the per hectare disposal limit has been reached (as outlined in Table 4.2), a new trench should be started on a new hectare of the property.
- ❑ No more than 10% or 1 acre (whichever is greater) of a site by area should be used for waste disposal within a year.
- ❑ Lime may be utilized to neutralize potential pathogen and odour issues if required. Lime should not be used unless an issue exists as it extends the time required for organic decomposition of the waste and may impact on leachate quality.
 - **WARNING: Gas buildup within the trench is probable, and hence the trench should be treated as an unconfined space and only qualified people wearing the appropriate safety equipment should enter the trench under any circumstances.**

Environmental Monitoring

- ❑ A qualified professional should be used to determine if groundwater monitoring is required at the site. This review should look at the depth to groundwater, groundwater flow regime and potential impacts of groundwater contamination. The review should aim to determine whether groundwater monitoring is required at the site based on the desired amount of waste to be

disposed and the existing groundwater conditions. The review should also determine the *minimum* quantity of wells required at the site, as well as their location.

- If a groundwater monitoring program is required, then the *minimum* requirements should be met at the site prior to waste disposal commencing. Also, any drinking water wells established at the site should be monitored as per below.
- An initial sample from the established wells should be taken prior to waste disposal to establish back ground concentrations for BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms.
- The wells established should be monitored on an annual basis for Nitrogen and Fecal Coliforms. The results should be compared to *A Compendium of Working Water Quality Guidelines for British Columbia, 2006* and *British Columbia Approved Water Quality Guidelines, 2006*, both published by the MOE.
- If results are above the criteria, then a follow up sample should be taken from the well(s) in excess and analyzed for BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms. If the results are still above the criteria and background levels, then the burial of waste should be ceased and another in depth professional review should be conducted to establish a detailed monitoring program for the site.
- Any surface water discharge from the site that passes through the waste disposal catchment should be sampled on an annual basis for Nitrogen and Fecal Coliforms. The results should be compared to *British Columbia Approved Water Quality Guidelines, 2006* [38] and *A Compendium of Working Water Quality Guidelines for British Columbia, 2006* [39], both published by the MOE. A background sample should be taken prior to waste disposal. If results are above the criteria then a follow sample should immediately be taken and tested for BOD, COD, TDS, Nitrogen, Chloride and fecal coliforms. If results for these parameters are above the criteria and background levels then a professional review is required and preparation of a surface water monitoring program may be required based on this.
- If there are any odour complaints received or excessive odour issues associated with the burial site, then lime should be used during future burial practices. Odour and gas monitoring at any nearby structures is recommended if odour issues are encountered.

Reporting and Documenting

- The details of burial should be documented for reference and reporting purposes. As a minimum the following information should be documented:
 - Date and time of disposal.
 - Location of the waste disposal and dimensions of the trench.
 - Waste type (slaughter, poultry, types of animals or birds) and quantity (in volume).
- An environmental monitoring report should be submitted every five years by the waste generator. This report should outline the results of the monitoring at the site over the previous

five years of operation (if any) and the total waste quantities disposed as well as the disposal locations.

5.2.2 *Unlined Burial*

Buffer Distances

- Trenches should be spaced a minimum of 30m apart from each other.
- Minimum 4m between the seasonal high water table and the bottommost waste cell.

Environmental Systems

- Minimum 2m thick layer of low permeability soil with hydraulic conductivity of 1×10^{-6} cm/s (silt or clay) below each waste trench.

5.2.3 *Unlined Burial with Enhanced Technical Requirements*

Buffer Distances

- Trenches should be spaced a minimum of 50m apart from each other.
- Minimum 8m between the seasonal high water table and the bottommost waste cell.

Environmental Systems

- Minimum 5m thick layer of low permeability soil with hydraulic conductivity of 1×10^{-6} cm/s (silt or clay) below each waste trench.

6 POTENTIAL FOR DISPOSAL WITHIN BC LANDFILLS

6.1 Summary of Landfill Survey

The Investment Agriculture Foundation (IAF) initiated a survey of numerous Regional Districts within British Columbia. The survey aimed to ascertain whether the existing landfills within the Regional District had legislative permission and the technical capabilities to receive slaughter waste and SRM. The survey was conducted by phone by a student of the Western College of Veterinary Medicine on behalf of the BC Ministry of Agriculture and Lands and IAF in August 2006, and follow up phone calls were made by SHA during the course of this project to gather more detailed information from selected landfill operators. A detailed summary of the survey results is presented in Appendix B. Below is a summary of the results found to date. As local governments are continually changing their solid waste management plans this information is only current to August 2006.

- 23 out of the 27 Regional Districts / Cities contacted have responded to the survey.
- 16 landfills were identified by Regional District staff as having the technical capability to receive Non-SRM slaughter waste.
- Of the 16 landfills identified to receive Non-SRM slaughter waste, 11 of these also had the technical capability to receive SRM slaughter waste according to Regional District staff.
- The majority of landfills were able to receive slaughter waste and mortalities under MOE legislation according to Regional District staff.
- There were similar numbers of landfills that could and could not receive slaughter waste under local bylaws according to Regional District staff.
- The majority of landfills were able to receive mortalities under local bylaws according to Regional District staff.
- The tipping fee for slaughter waste and mortalities ranged from being free to up to \$200/tonne.

6.2 Specific Opportunities to Accept Slaughter and Poultry Waste

The following is an overview of the specific issues associated with disposing this form of waste at a landfill as identified by a follow up telephone survey of specific landfill operators. The majority of landfill operators contacted are in the interior as this is where the majority of the waste is being generated.

Columbia Shuswap Regional District

Currently no landfills within the CSRD accept slaughter waste as it is classified as a prohibited material under the landfill criteria. Local bylaws also do not allow for the disposal of this waste within landfills. Animal waste material produced in the district is roughly equal to half the volume of MSW produced, so landfills do not have the capacity to deal with this entire waste stream. The CSRD would be willing to accept SRM, although landfills are unlined and do not meet CFIA requirements for engineered landfills.

Public consultation would be required in order for slaughter waste to be disposed of in the landfills within the Regional District. The CSRD is reviewing their Solid Waste Management Plan in 2007 and is willing to look into addressing this issue at that time. The capital costs associated with any potential upgrades required to facilities was a big concern, and the tipping fee for slaughter waste would reflect this. Salmon Arm is the most suitable landfill within the Regional District, as the depth to groundwater at the site is approximately 20m.

North Okanagan Regional District

The Armstrong-Spallumcheen landfill is currently allowed to collect non-renderable animal waste under local bylaws. The landfill is due to close in 2019. This waste is accepted at a cost of \$58 / tonne plus a \$70 / tonne special handling surcharge. The landfill has clay lined cells and a leachate collection and treatment system. The NORD may be willing to accept SRM at the landfill, although local bylaws would need to be re-written and community consultation would be required. The NORD is likely to continue to accept only non-renderable waste to promote other disposal options other than landfilling. The other landfills within the NORD are unable to accept slaughter waste due to local bylaws and lack of technical capability. One of the major concerns with accepting slaughter waste identified by the NORD was the operational difficulties and associated expenses with handling this waste.

Thompson – Nicola Regional District

Local bylaws do not disallow the disposal of slaughter waste at landfills within the TNRD, however, none of the landfills owned by the TNRD have the technical capability to handle this waste. The TNRD is currently amending their Solid Waste Management Plan to prohibit slaughter waste being disposed of in landfills. They are receiving lobbying from the local agricultural industry against this. The TNRD uses the area fill method of landfilling, and disposing of slaughter waste via this method is not practical. The TNRD would support other disposal methods for slaughter waste over disposal within landfills.

Cariboo Regional District

There are no CRD bylaws that prohibit the disposal of slaughter waste at landfills. Their solid waste management plan would need to be amended to allow for the disposal of large quantities of slaughter waste. Any additional operational procedures or technical improvements to landfills required to receive this waste would have to be paid for by the industry, not the general public. It is unclear whether the 100 Mile House landfill has the technical capability to receive slaughter waste or SRM material at this stage.

Regional District of Kootenay Boundary

There are three natural control regional landfills within the RDKB; Grand Forks, McKelvey Creek and Green Wood. All of these landfills meet the requirements for natural control landfills under the Landfill Criteria. These landfills have minor offsite leachate impacts, although all are monitored. The Regional District currently requires special agreement of their Board in order to accept slaughter waste that is generated outside of the Regional District. They are willing to accept slaughter waste as long as it is generated within the Regional District. They were not familiar with the CFIA requirements for landfilling of SRM, and would need further information before accepting SRM due to the operational challenges potentially proposed.

Regional District of East Kootenay

The RDEK currently operates two large sub-regional natural control landfills that may have the technical requirements to receive slaughter waste; Central and Columbia Valley. Both of these landfills are unable to accept slaughter waste due to Operational Certificate restrictions. In order to accept this waste they would need to get permission from the board, who is supportive of the ranching community, before going through the process to amend their Operational Certificates. There are no large scale slaughter facilities within the region. Due to operational issues associated with landfilling this waste and reduced lifespans of existing landfills if this waste were to be accepted, the Regional District would prefer to see this waste be disposed of via another method.

Regional District of Central Kootenay

The RDCK operates the Creston landfill, which is a natural control landfill. At present they accept small amounts of slaughter waste at the site, and treat it as if it were a mortality. Regional District staff believe they will be accepting more slaughter waste at the landfill as a new slaughter house is planned for the area. At the moment the tipping fee for carcasses is \$65 / tonne, but this will increase if different operational procedures or technical upgrades are required for the disposal of this waste. Regional District staff identified the high moisture content and free liquids associated with this waste as a major issue and believed a separate area to dispose of this waste was a good idea, similar to the separate area required for asbestos disposal.

Regional District of the Central Okanagan & City of Kelowna

The Regional District of the Central Okanagan operates the Westside landfill, and the City of Kelowna operates the Glenmore landfill. The Regional District and the City try to adopt similar practices with regards to landfill operations and what is and is not accepted at their landfills. The Westside landfill is a natural control landfill, while the Glenmore landfill is a natural control landfill with some lined sections. There is a bylaw that does not allow for the disposal of slaughter waste at landfills. Currently they accept butcher waste in the MSW waste stream that is double bagged and frozen. The main issues perceived at the Glenmore landfill are operational requirements and vector control, as the landfill is not fully fenced. At the moment small quantities of mortalities are accepted, with the tipping fee set at \$55 per tonne for less than 100 kg, or \$200 per carcass for anything over 100 kg. It was suggested that operating staff and management would resist accepting slaughter waste at the landfills due to operational issues, although more discussion was required.

City of Chilliwack

The City of Chilliwack, located in the Fraser Valley Regional District, operates the Bailey landfill. Some sections of the landfill are natural control with perimeter leachate systems, while some sections are lined. At present the landfill accepts this form of waste when instructed to do so and follow the burial instructions provided on a case by case basis. Burial of a large amount of poultry waste was previously required, which was disposed of in an enclosed clay cell with lime added. A local bylaw does not allow for the disposal of carcasses, offal or viscera at the landfill. Issues perceived by the City are odours, leachate and operation requirements. If slaughter waste was to be accepted at the landfill the decision would have to be made by Council.

Wastech Services

The Cache Creek landfill has the technical capability to accept slaughter waste and SRM. At present there is nothing in the sites operating Certificate that excludes acceptance of this type of waste, although at present they do not typically accept it due to odour issues. If the landfill were to accept this waste then they would be required to seek approval from the Village of Cache Creek, the MoE and the TNRD, as they are limited by what the TNRD SWMP allows to be disposed of within landfills within the Regional District. The landfill is reaching capacity and is likely to close within the next 4 to 10 years.

Highland Valley Copper

Highland Valley Copper is proposing to construct a landfill at its existing mine site outside of Logan Lake. This landfill is still in the Environmental Assessment stage. It will have the technical capability and capacity to accept slaughter waste and SRM. If the landfill were to accept this waste then they would be required to seek approval from the District of Logan Lake, the MoE and the TNRD, as they are limited by what the TNRD SWMP allows to be disposed of within landfills within the Regional District.

6.3 Identified Issues Associated with Landfilling Slaughter and Poultry Waste

Discussion held with landfill operators highlighted a few major issues that may inhibit the disposal of this waste within landfills, such as:

- Majority of landfill operators would prefer to see this waste disposed of by another more sustainable method in line with the three R's – Reduce, Reuse, Recycle. They do not believe that landfilling of this waste is the most appropriate form of disposal, but agree that in some cases this may be the “least cost” form of disposal.
- The general feeling was that landfill operators did not want this waste in their landfill consuming the limited capacities they have and that it is an industrial waste that should be dealt with by the industry and not “downloaded” to the Regional Districts and municipalities.
- There are operating difficulties associated with landfilling this waste that landfill operators do not want to have to deal with. As this waste can't be disposed of at the active face along with the rest of the waste special operating procedures will have to be implemented. This will require extra training of landfill staff, and possibly hiring of specific landfill staff to handle this waste. All operators contacted indicated that they would increase tipping fees for this waste to cover any additional expenses required. The increase in tipping fees could be significant if only a small amount of this waste is received as there is an economy of scales with landfill operations.
- Landfill operators were concerned that once this waste was placed in a certain area within a landfill, that are could not be reused for waste disposal or anything else if so desired in the future.
- Some landfill operators did not wish to expose their staff to this waste.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The technical recommendations and processes outlined in this report are based upon SHA and SYLVIS' background review and knowledge of landfilling within British Columbia. The approach presented is aimed to give all interested parties technical information for the disposal of slaughter and poultry waste either within commingled MSW landfills or via burial on-site where the waste is produced. The technical requirements presented are aimed to minimize the impact on the receiving environment if waste is disposed of via the methods presented. As there is limited information available on the effect this waste has in landfills and on-site burial, a conservative approach has been adopted. If more information were to become available through the monitoring of sites that accept this waste in line with these guidelines, then these requirements may be able to be reduced.

7.2 Additional Work Recommended

The following additional work is recommended to be conducted in order to assure that the disposal of slaughter and poultry wastes within landfills and on-site has minimal to no impact on the environment. This work is outside the scope of this original project.

1. Monitoring and discussions should be held with landfill operators once they start to accept slaughter and poultry processing waste based on the guidelines outlined in this report. Practical feedback should be obtained to ensure the requirements in this report are adequate to prevent an impact upon the environment from the disposal of this waste, and to ensure that operating procedures are practical. There is limited data on this form of waste disposal at present but there is an opportunity to gather information to confirm that this method of disposal has minimal environmental impact if conducted in line with these guidelines.
2. Feedback on the volumes of waste to be accepted at landfills as outlined in Section 4.2.2 of this report should be obtained to ensure that volumes are manageable.
3. The disposal of waste on-site as per the recommendations outlined in this report should be monitored to ensure that there is minimal to no impact upon the environment. More information should be gathered with regard to the impact that the disposal this type of waste has upon the receiving environment. There is limited data on this at present but there is an opportunity to gather information to confirm that this method of disposal has minimal environmental impact if conducted in line with these guidelines.
4. A list of professionals qualified in landfill engineering, hydro-geology and water quality should be established to be provided to waste producers who wish to dispose of their waste on-site. This will help ensure that they get the correct advice when assessing their site for potential waste disposal.
5. These guidelines should be regularly reviewed as landfilling technology is evolving and better and more efficient means of landfilling of this waste may present themselves in the near future.

8 LIMITATIONS

This report has been prepared by Sperling Hansen Associates (SHA) on behalf of the Investment Agriculture Foundation (IAF) and the British Columbia Ministry of Environment (MOE) and in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions in British Columbia, subject to the time limits and financial and physical constraints applicable to the services.

The report, which specifically includes all tables and figures, is based on engineering analysis by SHA staff of data researched and compiled during the course of the project. Except where specifically stated to the contrary, the information on which this study is based has been obtained from external sources including the MOE and IAF. This external information has not been independently verified or otherwise examined by Sperling Hansen Associates to determine its accuracy and completeness. Sperling Hansen Associates has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The report is intended solely for the use of the MOE and IAF. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Sperling Hansen Associates does not accept any responsibility for other uses of the material contained herein nor for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. Copying of this intellectual property for other purposes is not permitted.

The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to Sperling Hansen Associates during the course of this project. Should additional new data become available in the future, Sperling Hansen Associates should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

Report prepared by:



Scott Ferraro
Environmental Engineer

Report reviewed by:



Dr. Tony Sperling, P.Eng.
President

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APPENDICES

APPENDIX A
RFP TECHNICAL QUESTIONS AND ANSWERS

RFP TECHNICAL QUESTIONS AND ANSWERS

For all landfills accepting liquid, semi-solid and solid poultry processing and slaughter wastes:

- 1. Is there evidence to confirm that the liquid waste of the poultry processing and slaughter should not be accepted at commercial, regional/municipal or other types of landfills? Would this apply to semi-solid waste and if it doesn't apply, why?**

Liquid waste or other waste with very high moisture contents or significant amounts of free liquids should not be disposed of at commingled landfills without prior detailed investigation of the site. The disposal of this type of waste will create large impacts on leachate volumes and strength and hence a site by site analysis would be required for disposal of this waste.

- 2. Should this waste be disposed of in a separate cell of the landfill and should it be covered immediately? If so, what cover (e.g. soil or garbage) and how much of it would be appropriate?**

Refer Section 5.1.1 General Technical Requirements, Operation Procedures.

- 3. Are there concerns for dumping this type of material in freezing conditions? If so, what requirements would be needed in these conditions?**

If this waste is to be disposed on on-site during winter months, then the trench will have to be pre-dug in the fall. It must be ensured that the trench is adequately covered with an impermeable cover to prevent precipitation from entering. It also must be ensured that adequate low permeability cover can also be placed to reduce odour and infiltration issues. If this waste can't be properly buried during winter months, it should be stored frozen for disposal when the ground thaws.

- 4. What process or steps should be taken for landfills accepting this type of waste?**

Refer Section 5.1 Commingled Landfill Disposal Technical Requirements.

- 5. What would be the requirements for small on-site landfills and under which conditions should a small on-site landfill be considered or should not be considered?**

Refer Section 4.3 Onsite Disposal and Section 5.2 Onsite Disposal.

For municipal or regional landfills accepting liquid, semi-solid and solid poultry processing and slaughter wastes:

- 6. Would the ministry's "Landfill Criteria for Municipal Solid Waste 1993" (<http://www.env.gov.bc.ca/epd/epdpa/mpp/lcmsw.html>) be sufficient when landfilling this type of waste? If not, what updates would be required to landfill this type of waste.**

From a regulatory perspective, the Landfill Criteria is sufficient for the disposal of slaughter and poultry wastes at municipal and regional landfills. Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements for more detail on the technical requirements for these landfills.

For all non-municipal or regional landfills accepting liquid, semi-solid and solid poultry processing and slaughter wastes:

7. What types of landfills would be best suited to accept this type of waste and why?

Refer to Section 4.2 Commingled Landfill Disposal and Section 5.1 Commingled Landfill Disposal Technical Requirements.

8. What site requirements, if any, would be best suited to landfill this type of waste when considering:

- a. Minimum buffer distances to residential areas, urban areas, airports, recreation areas, industrial areas, agricultural operations and sensitive/endangered/threatened ecological sites,**

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Buffer Distances, Section 5.1.2 Natural Control Landfill Specific Requirements – Buffer Distances and Section 5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements – Buffer Distances.

- b. Surface water,**

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Buffer Distances, Section 5.1.2 Natural Control Landfill Specific Requirements – Buffer Distances and Section 5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements – Buffer Distances.

- c. Groundwater, and**

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Buffer Distances, Section 5.1.2 Natural Control Landfill Specific Requirements – Buffer Distances and Section 5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements – Buffer Distances.

- d. Flooding, subsidence, landslides, avalanches or fault areas on or near the site?**

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Buffer Distances, Section 5.1.2 Natural Control Landfill Specific Requirements – Buffer Distances and Section 5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements – Buffer Distances.

9. Would current leachate management and water control requirements be acceptable for this type of waste or would specific requirements be used when protecting and monitoring surface and groundwater quality?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Environmental Monitoring, Section 5.1.4 Engineered Landfill Specific Requirements – Environmental Systems and Environmental Monitoring and Section 5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements – Environmental Systems and Environmental Monitoring.

10. Would current leachate and contaminated water collection and treatment requirements deal with this type of waste? If not, what modifications would need to be made?

Refer to Section 5.1.4 Engineered Landfill Specific Requirements – Environmental Systems and Section 5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements – Environmental Systems.

11. What monitoring requirements, sampling parameters or monitoring frequency for surface water and ground water monitoring stations would apply?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Environmental Monitoring, Section 5.1.4 Engineered Landfill Specific Requirements – Environmental Monitoring and Section 5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements – Environmental Monitoring.

12. What geological barrier is best suited for landfills accepting this type of waste and why? What landfill base, drainage layer, gas drainage layer, sides and topsoil cover would be required to ensure permeability and thickness requirements are met to protect the soil, surface water and groundwater?

Refer Section 5.1 Commingled Landfill Disposal Technical Requirements.

13. If no geological barrier meets the requirements for this type of waste, what engineered system would be sufficient for this type of waste (i.e. what artificial sealing liners, drainage layers, gas drainage layers, impermeable layers and top soil covers would meet these requirements)?

Refer Section 5.1 Commingled Landfill Disposal Technical Requirements.

14. Would this type of waste require different landfill gas management due to its biodegradability?

Refer Section 5.1.2 Natural Control Landfill Specific Requirements – Environmental Systems, Section 5.1.3 Natural Control Landfill with Enhanced Technical Requirements Specific Requirements – Environmental Systems, Section 5.1.4 Engineered Landfill Specific Requirements – Environmental Systems and Section 5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements – Environmental Systems

15. What additional measures would be taken to minimize nuisances and hazards arising from landfills accepting poultry processing and slaughter wastes (e.g. how would one minimize emissions of odour and dust, minimize wildlife attraction, limit access, prevent litter and establish vector controls)?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements.

16. Would there be different requirements for the placement of this waste in the landfill to ensure stability of mass and its structure to avoid settlement that may damage the barrier?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Operational Procedures.

17. What critical parameters should be tested for in landfill leachate from this type of waste?

Refer to Section 5.1.4 Engineered Landfill Specific Requirements – Environmental Monitoring and Section 5.1.5 Engineered Landfill with Waste Pre-Treatment Specific Requirements – Environmental Monitoring.

18. Will different batch leaching, percolation and/or pH dependence tests be required for landfills accepting this type of waste?

No. As the amount of slaughter/poultry waste entering the landfill will be controlled by the amount of MSW entering the landfill, it is envisioned that there will not be such a dramatic increase in the moisture content within the landfill to require such tests.

19. Would there be different requirements for a landfill’s operations plan if accepting this type of waste (e.g. different plans for emergency response to fires, releases, medical concerns, and different remediation programs if the surface quality or groundwater quality is impacted)?

The requirements under the Landfill Criteria would be sufficient.

20. Would this type of waste require different compaction and intermediate cover (such as lime applications to discourage vermin etc) to ensure environmental and human protection?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Operational Procedures.

21. Would the closure requirements be different with this type of waste i.e. the final slope, cover, re-vegetation, the minimization of water runoff and erosion, etc?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Environmental Systems.

22. Would these types of landfills have different post-closure monitoring and if so, what would it be and why?

The post closure monitoring would be as per the Landfill Criteria, but would also include the parameters listed in Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements – Environmental Monitoring.

23. Would different signage, access and secure controls, fire control, and litter controls be required for this type of waste?

Refer to Section 5.1 Commingled Landfill Disposal Technical Requirements.

APPENDIX B
LANDFILL SURVEY RESULTS

LANDFILL SURVEY RESULTS

REGIONAL DISTRICT	CONTACT	REQUIRED CAPACITY (culls/slaughter wastes/mortalities in tonnes/year)	LANDFILL	LANDFILL LOCATION	LEGISLATIVE PERMISSION		TECHNICAL CAPABILITY		FEES (per tonne)	COMMENTS
					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				

VANCOUVER ISLAND – COAST

1. Alberni – Clayoquot	Drew Hadfield, Manager, Environmental Services 250-720-2714 (direct) drew.hadfield@acrd.bc.ca www.acrd.bc.ca	95/0/28 Total: 123	Alberni Valley	Port Alberni						June 9, 2006 – called and LMOM. July 28, 2006 – called, out of office, will call next week. July 31, 2006 – called, out of office. August 1, 2006 – out of office. August 8, 2006 – out; e-mailed questions.
			West Coast	(between Ucluelet and Tofino)						
2. Capital	Alan Summers, Manager, Solid Waste 250-360-3080 www.crd.bc.ca	254/0/25 Total: 279	Hartland	Victoria	Yes	Yes	Yes	Yes		See appendix, CRD Hartland Landfill Operating Policy and Procedure.
3. Central Coast	Joy MacKay, Administrator 250-799-5291 www.centralcoastbc.com	3/0/2 Total: 5	Thorsen Creek	Bella Coola	Yes	Yes	Yes	No	\$13/carcass	Consultation would be required for disposal of large quantities of non-SRM waste. The site lacks requisite liner to deal with SRM waste.
4. Comox – Strathcona	Marcy, Manager, Communications 250-334-6037 www.rdcs.bc.ca	617/228/181 Total: 1026	Campbell River Regional	Campbell River	Yes	Yes	No	No	\$150 (\$350 if outside r.d.)	Currently the landfill disposes of non-slaughter mortalities such as hunting by-product, roadkill and pets, they also accept some waste from seafood processing. These are only minimal quantities, heaviest volumes are during hunting season. There is no technical capability to deal with SRM's.
			Pidgeon Lake	Cumberland	Yes	Yes	No	No		
	brose@rdcs.bc.ca		Tahsis	Tahsis	Yes	Yes	No	No	N/A	July 28, 2006 – out of office July 31, 2006 – out of office. August 1, 2006 – out of office. August 8, 2006 – e-mailed. Very small landfill, very rarely RCMP may dispose of 'nuisance' bears that have been destroyed, may also be some fish waste that is disposed of as household waste. No commercial slaughter or livestock to be dealt with in the region.
			Zeballos	Zeballos	Yes	Yes	No	No	N/A	Zeballos is also very small landfill.

REGIONAL DISTRICT	CONTACT	REQUIRED CAPACITY (culls/slaughter wastes/mortalities in tonnes/year)	LANDFILL	LANDFILL LOCATION	LEGISLATIVE PERMISSION		TECHNICAL CAPABILITY		FEES (per tonne)	COMMENTS
					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
5. Cowichan Valley	Bob McDonald, Manager, Solid Waste Reduction Program 250-746-2630 www.cvrld.bc.ca	859/602/256 Total: 1717	N/A	N/A	N/A	N/A	N/A	\$80	Cowichan Valley contains receiving facilities for disposal to Cache Creek—they do not have their own municipal landfill. There are currently two private composting facilities operating within regional district, will take some animal wastes, however, can not take large volume due to capacity. Rendering facility will take any animal waste except sheep. Significant animal agriculture in region, most carcasses are dealt with on farm.	
6. Mount Waddington	Greg Fletcher, Administrator 250-956-3161 www.rdmw.bc.ca	See under Comox-Strathcona	Seven Mile	Port McNeil (approx. 11 km away)	Yes	Yes	No	\$30	Cost is currently under review. Accept small amount of animal carcasses to service local small animal veterinarians, however do not have need to accept large animals or large amount of carcass waste. Should the need arise, they would be unable to accept large amounts of animal waste as they do not have the capacity. Former permit to dispose of solid waste has been replaced by operating certificate.	
7. Nanaimo	Carey McIver, Manager, Solid Waste 250-390-6539 www.rdn.bc.ca	270/115/82 Total: 467	Cedar Road Regional	Nanaimo	Yes	Yes	Yes	\$190	Local government bylaw accepts carcasses and slaughterhouse waste if designated as controlled waste; special waste is not permitted; landfill is lined and leachate from collection system enters sewer system. Do not have the capacity to handle large amounts of animal waste. Occasionally accept single carcasses if necessary but no physical capacity for larger loads.	
8. Powell River	Frances Ladret, Administrator 604-483-3231 administration@powellriverrd.bc.ca www.powellriverrd.bc.ca	1/0/1 Total: 2	None	N/A	No	No	No	N/A	This RD exports residual solid waste to the Cache Creek landfill under contract with GVRD. Contract does not allow animal carcasses to be sent. 2 local vets have arrangements to send carcasses to a site on Vancouver Island, few local farmers likely dispose of carcasses on-site. Currently there is NO way to dispose of animal waste on site, and animals waste can NOT be shipped to Cache Creek, strong public opposition is expected to local landfill proposal.	

LOWER MAINLAND – SOUTHWEST

9. Fraser Valley	Tara Friesen City of Chilliwack 604 793 2701	8175/4881/2409 Total: 15,465	Bailey	Chilliwack	Yes	Yes	Yes – in certain sections	N/A	The City of Chilliwack, located in the Fraser Valley Regional District, operates the Bailey landfill. Some sections of the landfill are natural control with perimeter leachate systems, while some sections are lined. At present the landfill accepts this form of waste when instructed to do so and follow the burial instructions provided on a case by case basis. Burial of a large amount of poultry waste was previously required, which was disposed of in an enclosed clay cell with lime added. A local bylaw does not allow for the disposal of carcasses, offal or viscera at the landfill. Issues perceived by the City are odours, leachate and operation requirements. If slaughter waste was to be accepted at the landfill the decision would have to be made by Council.
					No	No			
			Hope	Hope					
			Minnie's Pit	Mission					
			North Bend	North Bend					

REGIONAL DISTRICT	CONTACT	REQUIRED CAPACITY (culls/slaughter wastes/mortalities in tonnes/year)	LANDFILL	LANDFILL LOCATION	LEGISLATIVE PERMISSION		TECHNICAL CAPABILITY		FEES (per tonne)	COMMENTS
					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
10. Greater Vancouver		2094/2739/646 Total: 5479								June 19, 2006 – Reception advised must contact individual landfills.
11. Sunshine Coast	Manager, Landfills, Cathy Kenny 604-885-2261 (reception) cathy.kenny@scrd.bc.ca www.scrd.bc.ca	0/0/0 Total: 0	Pender Harbour	Pender Harbour						June 19, 2006 – Spoke to Susan Hunt, CAO, she will have Cathy Kenny (landfill manager) call back. August 8, 2006 – e-mailed.
12. Squamish – Lilloet	Jerry Cheshuk Coordinator, waste reduction 604-894-6371 (ext 238) jcheshuk@slrd.bc.ca www.slrd.bc.ca	8/0/14 Total: 22	Sechelt Lilloet	Sechelt Lilloet	Yes	?? – contact was unsure of current reg's, advised to contact MOE	\$25 per carcass for residents, \$35 per carcass for non-residents (for animals larger than cat or dog); \$5 per carcass (residents), \$5.85 per carcass (non-residents) for carcasses smaller than cat/dog)		There is also a landfill in Squamish operated by the District of Squamish. Lilloet landfill does take animal carcasses, all animals are placed in designated pit within landfill, immediately covered with lime and 2 feet of material cover. Five carcasses at once is maximum number for disposal without prior approval from SLRD. The lifespan of the landfill is based on 3 phases: Phase 1: 227000 m3 to be reached by 2044 Phase 2: 216000 m3 to be reached by 2084 Phase 3: 144000 m3 to be reached by 2099 Contact expects some concern voiced within community if disposal of large amounts of slaughter waste, would likely have to go through public consult.	

REGIONAL DISTRICT	CONTACT	REQUIRED CAPACITY (culls/slaughter wastes/mortalities in tonnes/year)	LANDFILL	LANDFILL LOCATION	LEGISLATIVE PERMISSION		TECHNICAL CAPABILITY		FEES (per tonne)	COMMENTS
					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
13. Central Okanagan	Carol Suhan Coordinator, Waste Reduction 250-469-6259 (direct) www.regionaldistrict.com	272/108/72 Total: 452	Glenmore	Kelowna	No	Yes	Yes		\$200/tonne for carcasses weighing over 100kg; \$55/tonne for carcasses weighing under 100kg.	Operated by City of Kelowna, not Central Okanagan regional district, however, both sites attempt to coordinate prices and policy.
			Westside	Westbank	No	Yes	Yes		\$200/tonne for carcasses weighing over 100kg; \$55/tonne for carcasses weighing under 100kg.	Operated by Central Okanagan Regional District. Both sites have separate landfill area with liming and immediate cover when mortalities are received. Neither site accepts commercial slaughter waste, both accept mortalities and waste from butchers. Carcasses are covered and buried immediately.
14. Columbia – Shuswap	Doug Dymond Manager, Works Services 250-832-8194 www.csr.bc.ca	962/574/273 Total: 1809	Golden	Golden	No	No	No	No	N/A	Currently any animal waste is classified as prohibited material, therefore slaughter waste and mortalities cannot be disposed of in regional district landfills. Current animal waste material produced in regional district would comprise 50-60% of total waste stream, therefore landfills do not have the physical capacity to dispose of animal waste in region either. There are currently commercial slaughterhouses operating within regional district, waste may be handled by Greenwave (also handles animal waste for TNRD.) Should MOE require SRM disposal, landfill would be willing, however they currently have no isolated cells set-up, and leachate is all handled by natural attenuation. Tipping fees for non-animal waste is \$60/tonne.
			Revelstoke	Revelstoke	No	No	No	No	N/A	
			Salmon Arm	Salmon Arm	No	No	No	No	N/A	
			Sicamous	Sicamous	No	No	No	No	N/A	
			Skimikin	Tappen	No	No	No	No	N/A	
					No	No			N/A	

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					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
15. North Okanagan	Nicole Kohnert, Manager, Solid Waste 250-550-3741 www.nord.ca	1791/0/515 Total: 2306	Armstrong-Spallumcheen	Spallumcheen	Yes	Yes	Yes		\$58/tonne plus \$70/tonne for special handling	Bylaw allows only Armstrong-Spallumcheen to collect non-renderable animal waste. Landfill has life expectancy until 2019. Currently accept wild game and SPCA kills. Armstrong-Spallumcheen has technical capacity (clay-lined cells) to take SRM's, however bylaws would need to be re-written to allow SRM wastes to be disposed of at this site.
					Yes	Yes				
					Yes	Yes	No			
					No	No				
			Cherryville	Cherryville	Yes	Yes	No			
					No	No				
			Greater Vernon	Vernon	Yes	Yes	No			
					No	No				
			Lumby	Lumby	Yes	Yes	No			
					No	No				
16. Okanagan – Similkameen	Don Hamilton Manager, Public Works 250-490-4103 dhamilton@rdos.bc.ca www.rdos.bc.ca	768/242/246 Total: 1256	Campbell Mountain	Penticton	No (with exception, see comments)	Yes	Yes		Minimum charge \$10; carcasses \$90/tonne	Slaughterhouse, fish hatchery and cannery wastes and by-products are designated prohibited waste by OSRD, they may only be disposed of if specifically authorized by regional district and regional waste manager of MOE. Mortalities are designated controlled waste which may require special handling. Currently the site has the capability of dealing with limited number of non SRM or SRM carcasses. Lifespan of landfill depends on site, 30-50 years.
					No (with exception, see comments)	Yes				
			Keremeos	Keremeos	No (with exception, see comments)	Yes	Yes		Minimum charge \$10; carcasses \$90/tonne	
					No (with exception, see comments)	Yes				
			Okanagan Falls	Okanagan Falls	No (with exception, see comments)	Yes	Yes		Minimum charge \$10; carcasses \$90/tonne	
					No (with exception, see comments)	Yes				

REGIONAL DISTRICT	CONTACT	REQUIRED CAPACITY (culls/slaughter wastes/mortalities in tonnes/year)	LANDFILL	LANDFILL LOCATION	LEGISLATIVE PERMISSION		TECHNICAL CAPABILITY		FEES (per tonne)	COMMENTS
					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
			Oliver	Oliver	No (with exception, see comments)	Yes	Yes	Minimum charge \$10; carcasses \$90/tonne		
					No (with exception, see comments)	Yes				
17. Thompson – Nicola	Don May, Manager, Environmental Health Services 250-377-7057 www.tnrd.bc.ca	4026/842/1117 Total: 5985	Barriere	Barriere	Yes	Yes	No	Based on volume. See www.tnrd.bc.ca for details.	Though MOE regulations allow disposal of animal wastes, and regional bylaws do not disallow disposal of animal wastes, none of the landfills in the tnrd have the technical capability to handle carcasses. The 'solid waste management plan' states that landfill criteria must be adhered to, and these criteria do not allow for disposal of animal wastes. There is very rare disposal of individual carcasses by the tnrd, in these situations, cost of disposal is very high and carcasses are disposed of in individual pits on an as-needed basis. Should there be an emergency, however, it would be technically possible to create isolated cells in the landfills to allow for disposal of carcasses. There is concern about the capacity for redevelopment of any given area of the landfill after it has been used for disposal of animal wastes, as public currently has access to entire landfill area for private dumping.	
					Yes	Yes				
			Chase	Chase	Yes	Yes	No			
					Yes	Yes				
			Clearwater	Clearwater	Yes	Yes	No			
					Yes	Yes				
			Heffley Creek	Heffley Creek	Yes	Yes	No		Heffley has an isolated area for disposal of animal wastes, but currently that unit is not operational due to problems with high ground water.	
					Yes	Yes				
			Lower Nicola	Merritt	Yes	Yes	No			
					Yes	Yes				

KOOTENAY

18. Central Kootenay	Reinhard Trautmann Supervisor, Services and Waste Management 250-352-8161 (reception) www.rdck.bc.ca	546/85/169 Total: 800	Canex	Salmo	N/A	Yes	No		Landfills in CKRD receive occasional mortality from local CO's, may receive some pets or hunting byproduct if bagged as household waste. There is no commercial slaughter waste received at any landfills in CKRD. Only landfills accept carcasses, transfer stations do not accept any animal waste materials.
					N/A	Yes			

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					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
			Creston	Creston	N/A	Yes	No	\$65/tonne or \$20/m3	Creston landfill is the only landfill in regional district that currently receives small volume of mortalities from dairy farms in regional district. They are buried immediately upon arrival at the landfill.	
					N/A	Yes				
			Nakusp	Nakusp	N/A	Yes	No			
					N/A	Yes				
			Ootischenia	Castlegar	N/A	Yes	No			
					N/A	Yes				
19. East Kootenay	Eric Sharpe, Manager, Engineering and Environmental services 250-489-2791 (reception) www.rdek.bc.ca	928/2/235 Total: 1165	Central Sub-Region	Cranbrook	No	Yes	No	\$25/carcass	Operating certificate does not allow slaughter waste. Landfills do currently accept mortalities and rendered byproduct from butchers. Mortalities and rendered waste is disposed of in separate slit trench which operates by natural attenuation, therefore no leachate collection and no technical capability to deal with SRM's.	
					No	Yes				
			Columbia Valley Sub-Region	Windermere	No	Yes	No			
					No	Yes				
20. Kootenay Boundary	Raymond Gaudart, Director, Environmental Services 250-368-0232 (direct) www.rdkb.com	551/0/149 Total: 700	Christina Lake	Christina Lake					July 17, 2006 – LMOM, will be out of office until Tuesday p.m. July 19, 2006 – Returned call July 21, 2006 – LMOM August 1, 2006 - out	
			Grand Forks Regional	Grand Forks						
			Greenwood Regional	Greenwood						
			McKelvey Creek Regional	Trail						
			Rock Creek	Rock Creek						

CARIBOO

21. Cariboo	Mitch Minchau, Supervisor, Environmental Services	4436/494/1205 Total: 6135	Big Lake	Big Lake	Yes	Yes	?	No charge	CRD landfill sites are permitted by MOE to accept typical municipal refuse, which can include a minor component of, slaughter waste and mortalities. There are no CRD bylaws prohibiting slaughter waste or mortalities, as up to know, it has not been a problem or issue. If it
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					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				
	250-392-3351 (reception) mminchau@cariboord.bc.ca www.cariboord.bc.ca				?	?				becomes a problem prohibiting bylaws can be created. Contact did not know about city bylaws, advised to contact city directly. The ability of sites to technically deal with non-specific risk and specified risk materials would have to be determined by MOE and CFIA. At this time there are no tipping fees at rural sites, however they are considering charging the slaughter industry for use of one site in the region. Volume of material to be disposed at each site will determine capacity. There is always the potential for opposition to the disposal of slaughter waste, especially if large volumes are involved or its special risk material. The Solid Waste Management Plan would have to be amended and public consultation process would apply. Operational procedures could occur, but the industry, and not the general tax payer would have to pay for them.
Cochin Lake	Cochin Lake	Yes	Yes	?			No charge			
Gibraltar Mines		Yes	Yes	?			No charge			
Mahood	Near Mahood Provincial Park	Yes	Yes	?			No charge			
Nazko	Nazko	Yes	Yes	?			No charge			
Nehemiah Valley	Nehemiah Valley	Yes	Yes	?			No charge			
Nimpo Lake	Nimpo Lake	Yes	Yes	?			No charge			
100 Mile House	100 Mile House	Yes	Yes	?			No charge			
Puntzi Mountain	Puntzi Mountain	Yes	Yes	?			No charge			
Quesnel	Quesnel	Yes	Yes	?			No charge			
Sheridan Lake	Sheridan Lake	Yes	Yes	?			No charge			
Tatla Lake	Tatla Lake	Yes	Yes	?			No charge			
Watch Lake	Watch Lake	Yes	Yes	?			No charge			
Wells	Wells	Yes	Yes	?			No charge			
22. Fraser – Fort George	Jim Martin, Manager, Operations 250-960-4483 (direct line) www.rdffg.bc.ca	1024/383/281 Total: 1688	Foothills Boulevard Regional	Prince George	Yes	Yes	Yes	No	\$42	
			Mackenzie Regional	Mackenzie	Yes	Yes	No			
					No	No				

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					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE	MOE				
					Bylaw	Bylaw				

NORTH COAST

23. Kitimat – Stikine	Roger Tooms Manager, Works and Services 250-615-6100 www.rdks.bc.ca	73/0/19 Total: 92	Aiyansh (First Nations)	Nass Valley	Yes	No	N/A	Though bylaws and MOE regulations do allow disposal of animal waste at these sites, technical capability and willingness to dispose of large volumes of animal waste does not exist. Landfills do take roadkill, hunting byproduct, some fish waste and deceased pets, there has never been need to take slaughter waste. Farm waste is disposed of on-farm, it would be possible for landfills to take occasional animal mort., however there is no technical capability or willingness to take consistent larger volumes of waste. Conditions are different for each landfill. None of regional district landfills have leachate collection system. Was advised to contact Terrace, Kitimat and Stewart municipalities, they operate landfills independent of regional district, Terrace and Kitimat landfills are the largest in the regional district. Was advised to contact Fraser MacKenzie or Eric Pierce (MOE) regarding permitting/regulations for disposal of animal wastes at ksrld landfills. Regional district is in the process of developing two sub-regional landfills. Cost is by volume, there is no fee schedule in place for large volumes of animal waste.
			Hazelton	Hazelton	Yes	No	N/A	
			Iskut	Iskut	Yes	No	N/A	
			Kitwanga	Kitwanga	Yes	No	N/A	
			Rosswood	Rosswood	Yes	No	N/A	
			Thornhill	Terrace	Yes	No	N/A	
24. Skeena – Queen Charlotte	N/A	See under Kitimat-Stikine	Port Clement	Queen Charlotte Islands	N/A	N/A	N/A	

NECHAKO

25. Bulkley – Nechako	Janine Dougal, Director, Environmental Services 250-692-3195 (reception) www.rdbn.bc.ca	2537/98/717 Total: 3352	Fort Fraser	Fort Fraser	No	Yes	No	0	There is one commercial slaughter facility in the Bulkley-Nechako regional district (this does not include small operations who may butcher for hunters). "Country Locker," slaughterhouse sends all wastes to Clearview landfill. Clearview has capacity to manage all of Country Lockers slaughter wastes, however, should volume increase, landfill has the right to refuse additional volume. Landfill not permitted to take 'hazardous waste' so if slaughter house waste is designated 'hazardous waste' under new SRM reg.'s then Clearview will be unable to take slaughterhouse waste. Currently the municipality operates landfills with no tipping fee.		
					N/A	N/A					
			Fraser Lake	Fraser Lake	No	Yes	No	0			
					N/A	N/A					
			Granisle	Granisle	No	Yes	No	0			
					N/A	N/A					
			Knockholt	Houston	No	Yes	Yes	No		0	Knockholt is the only landfill in rd that has technical capability to collect leachate. Currently, leachate is being collected but not treated.
					N/A	N/A					
			Vanderhoof	Vanderhoof	N/A	N/A	N/A	0		Vanderhoof landfill is closed, no longer operational	
					N/A	N/A					
			Clearview	Between Vanderhoof and	Yes	Yes	Yes	0		Clearview is now operating, currently accepting 8-10 thousand tones of animal waste per year. Operates with unlined clay soils, underlying	

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					Slaughter Wastes	Mortalities	Non-SRM	SRM		
					MOE Bylaw	MOE Bylaw				
					Yes	Yes				
				Ft. St. James	Yes	Yes				glacial till has low permeability and very deep water table, therefore natural capacity for leachate to collect at one end of landfill. Current plan is to monitor leachate for next several years, does not currently have isolated cells, therefore not currently engineered for SRM management.

PEACE RIVER

26. Northern Rockies	N/A	See under Peace River	C.F. Wright Farms	Fort Nelson						
			Fort Nelson	Fort Nelson						
27. Peace River	Shannon Anderson, Director, Field Services 250-784-3200 www.peaceriverrd.bc.ca	4748/770/1267 Total: 6785	Chetwynd	Chetwynd	Yes	Yes	\$90/tonne, or \$75 per carcass			None of landfills in rd are capable of taking liquid waste, only permitted for solid waste. Currently take some roadkill and small amounts of solid slaughter waste, do not have the technical capability to take liquid waste or large amounts of solid animal waste. Would seek direction from board and have to amend license and technical capabilities to deal with large amounts of animal waste. All four regional landfills combined take only 60000-65000 tonnes waste per year. Animal carcasses from large animals/livestock are considered restricted waste, therefore higher fees apply.
			Bessborough	Dawson Creek	Yes	Yes				
			Fort St. John	Fort St. John	Yes	Yes				
			Rose Prairie	Rural site 40 minutes from Ft. St. John	Yes	No				