Technical Guidance Document

for the

Slaughter and Poultry Processing Industries

October 2008

A Companion Document to the Code of Practice
for the
Slaughter and Poultry Processing Industries

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Limitation of Liability and User's Responsibility

The primary purpose of the Technical Guidance Document for the Slaughter and Poultry Processing Industries is to confirm the expectations of the British Columbia Ministry of Environment (MOE) with regard to the development of various designs, plans and assessments required by the *Code of Practice for the Slaughter and Poultry Processing Industries (Code).*

While every effort has been made by the authors and the MOE to ensure the accuracy and completeness of these materials, these materials should not be considered to be the final word in the areas of practice they cover. The qualified professional must use his/her own professional expertise and judgment to ensure that any designs, plans or reports prepared for clients in accordance with the *Code* meet the requirements of the *Code*, the Waste Discharge Regulation (WDR) and the *Environmental Management Act* (EMA).

GLOSSARY OF TERMS

AAFC	Agriculture and Agri-Food Canada
BCAC	British Columbia Agriculture Council
BOD/BOD_5	biochemical oxygen demand
BSE	bovine spongiform encephalopathy
CAEAL	Canadian Association for Environmental Analytical Laboratories
Code	Code of Practice for the Slaughter and Poultry Processing Industries
$CBOD_5$	carbonaceous biochemical oxygen demand
COD	chemical oxygen demand
CFIA	Canadian Food Inspection Agency
cm/s	centimetres per second
CNR	crop nutrient requirement
DAF	dissolved air floatation
EMA	*Environmental Management Act*
FOG	fat, oil and grease
GEM	Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills
ha	hectare
K	potassium
kg	kilogram
kg LWK	kilogram of live weight killed
kg/m^3	kilogram per cubic metre
L	litre
MAL	British Columbia Ministry of Agriculture and Lands
mg	milligram
mg/L	milligram per litre
mg/m^3	milligram per cubic metre
mm	millimetre
MOE	British Columbia Ministry of Environment
MSR	Municipal Sewage Regulation
NH_4N	ammonium nitrogen
NMRG	Nutrient Management Reference Guide
NTU	nephelometric turbidity unit
OMRR	Organic Matter Recycling Regulation
P	phosphorous
PVC	polyvinyl chloride
SBR	sequencing batch reactor
SRM	specified risk material
TKN	total Kjeldahl nitrogen
tonne	metric ton (1,000 kilograms)
TP	total phosphorous
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
VCP	vector control plan
WDR	Waste Discharge Regulation

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1. General

1.1. Purpose

The British Columbia Ministry of Environment (MOE) has provided these guidelines to confirm its expectations with regard to the development of key designs, plans and assessments required by the Code of Practice for the Slaughter and Poultry Processing Industries (hereafter referred to as the "*Code*"). These guidelines are designed primarily to provide the **qualified professional** with an understanding of MOE expectations for specific sections of the *Code* that require the advice of a qualified professional as a condition of authorization to discharge.

The appendices to this document include the *Code* and several key technical references. This guidance document may be considered by MOE staff when reviewing submissions prepared by qualified professionals. The guidelines may also be of assistance to facility owners by providing them with a better understanding of technical and other requirements of the *Code*. Three plain language "Factsheets" describing key *Code* requirements are also available from the MOE, as well as on the following website: http://www.env.gov.bc.ca/epd/industrial/regs/codes/slaughter/index.htm.

1.2. Background

The *Environmental Management Act* (EMA) and associated Waste Discharge Regulation (WDR) were brought into force by the Government of British Columbia on July 8, 2004. The EMA replaced the *Environment Management Act* and *Waste Management Act,* which had regulated waste discharges in British Columbia for decades. An important change brought forth in the EMA is a requirement that only industries, trades, businesses, operations and activities listed, or "prescribed", in the WDR are required to have an authorization (i.e., a permit or approval) to discharge wastes. Those not listed in the WDR, generally small low risk operations, do not require an authorization to discharge waste but are subject to a general prohibition in S. 6(4) of EMA against introducing waste into the environment so as to cause pollution.

The WDR also contains provisions to establish codes of practice, approved by the Minister of Environment, as a form of authorization for some designated industries, trades, businesses, operations and activities. This option provides for a general set of discharge standards for sectors which have common issues and requirements without development of a provincial regulation, which is subject to approval by Legislative Council (Cabinet). British Columbia slaughter and poultry processing industries were identified as suitable candidates for a common code of practice for waste disposal.

The *Code* was enacted by the Minister of Environment on July 4, 2007, after consultation with stakeholders and the general public. The *Code* was amended on December 6, 2007, to:

a) authorize the inclusion of domestic sewage in slaughter and poultry processing facility wastewater (for subsequent subsurface disposal or irrigation), if the sewage is incidental (toilets provided for employees) to the operation of the facility,

b) remove the requirement for submission of plans required by the *Code,* and

c) remove a redundant section in the *Code* which was causing confusion with registration requirements.

A copy of the *Code* (incorporating the December 6, 2007 amendment) can be found in Appendix 1 of these guidelines.

1.3. *Code* Overview

This section provides an overview of the *Code* that will be of particular interest to qualified professionals and facility owners. It is recommended that both facility owners and qualified professionals carry out a careful review of all provisions of the *Code* and the WDR to ensure that persons intending to discharge slaughter and poultry processing waste under the provisions of the *Code* are in full compliance with all applicable requirements.

To Whom Does this *Code* Apply?

This *Code* applies to facilities that are engaged in processing red-meat animals and poultry for human consumption **and** have a waste discharge to the environment. A facility is not required to register under the *Code* if that facility discharges all wastewater to a municipal sewerage system and all solid waste is utilized by a meat by-product processing industry (rendering) facility or disposed of to a municipal landfill (see decision flowchart on page 19).

Furthermore, a person who processes red-meat animals or poultry for **personal use and not for resale** is not required to register under this *Code.*

For the purposes of this *Code,* "processing" includes holding, killing, defeathering, deboning, eviscerating, chilling, cooking, packaging, curing, smoking and canning.

For the purposes of this *Code,* "poultry" includes domesticated chickens, turkeys, ducks, geese, guinea fowl, ratites, squab and pheasants; "red-meat animals" include cattle, swine, sheep, fallow deer, farmed game and farmed bison.

If an **existing** facility's discharge to the environment is authorized by a waste discharge permit, the facility may continue to operate under this permit or the permittee may choose to cancel the permit and register under the *Code*. There is no legal requirement for a facility owner to request cancellation of a permit and register under this *Code*. All new facilities, and those that may have been operating without a permit, must register if required by the *Code*. If a major amendment (i.e., more than a ten percent increase in the authorized discharge quantity) is required to an existing permit, it will not normally be granted but rather the permittee will be required to register under the *Code*.

In the case of mobile processing facilities, the owner of the land where a waste discharge occurs (termed a "docking station") is the person who is required to register under the *Code* and meet applicable requirements of the *Code*. Docking stations for mobile processing plants are categorized on the basis of production and wastewater

discharged in the same manner as processing facilities discussed later in this section and the land owners are required to register under the *Code* for the discharge(s) occurring (i.e., wastewater or landfilling solids). An owner of a mobile processing facility is not required to obtain a waste discharge authorization or register under the *Code* unless discharging to his/her own land.

The proponent of a very large facility must determine whether a proposed processing plant or planned expansion will trigger a review under the Reviewable Projects Regulation (B.C. Reg. 30/2005). This regulation requires a review under the *Environmental Assessment Act* for:

- new facilities with a waste discharge of 800 m^3/day or more,
- an increase of 30% or more from an existing facility of this size, or
- an expansion of an existing facility that will result in a discharge of 800 m^3/day or more and is an expansion of 30% or more.

Based upon the current number and size of the existing processing facilities in British Columbia, it is considered unlikely at this time that a review under the Reviewable Projects Regulation would be required.

Registration and Record-keeping is Required

Section 2 of the *Code* requires that a person register and provide specific information to the director. Additional registration information is required in accordance with the WDR (section 4(2)). Except for the situations discussed above (personal use/not for resale exception or facilities authorized by other enactments), this registration requirement applies to all slaughter and poultry processing operations, regardless of size, intending to discharge under the provisions of this *Code*. Either the owner of the land where the discharge occurs or his/her agent can register with the MOE.

All registration requirements, both *Code* and WDR, are included in a single registration form. The form is available from MOE offices or by e-mail from Victoria Administration, at PermitAdministration.VictoriaEPD@gov.bc.ca, or through the Ministry website at http://www.env.gov.bc.ca/epd/industrial/regs/codes/slaughter/index.htm.

A fee must be submitted with the registration form based on $100 per discharge (e.g., wastewater, solid waste or air emission).

Code-based registration and record-keeping requirements include the following:

1. Annual production expressed as tonnes (1 tonne =1,000 kg) of live weight killed per calendar year of red meat or poultry products. If information on live weight is not available, live weight can be estimated from carcass weight (see section 2.1.1) or site specific information.
2. Maximum daily volume of wastewater discharged expressed in cubic metres per day when the facility is discharging.
3. A list of plans that have been completed in accordance with *Code* requirements. Plans that may be included in this list are:

a) a nutrient management plan (*Code* section 8(3)),

b) a groundwater monitoring and assessment plan (*Code* section 10(2)(d)),

c) a vector control plan (*Code* section 12), or

d) a landfill closure plan (*Code* section 14(2)(b)), if completed at the time of registration. The *Code* specifies that a landfill closure plan, where required, be completed at least 3 months before the closure of the landfill and retained.

Note that a December 6, 2007 amendment to the *Code* requires that all plans required by the *Code* are to be completed and retained by the facility operator. **I**t should be noted that these plans and other records required by the *Code* must be retained for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer. Good record-keeping is essential.

The WDR requires that a Ministry of Environment director be notified in writing within 30 days of any change to registration information. This means, for example, if there is an increase in production or volume of wastewater discharged, Victoria Administration will need to be notified within 30 days of the change.

Who is a Qualified Professional?

A qualified professional, in relation to a duty or function under the *Code,* means an individual who:

a) is registered in British Columbia with a professional organization, is acting under that organization's code of ethics, and is subject to disciplinary action by that organization, and

b) through suitable education, experience, accreditation and knowledge, may reasonably be relied upon to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.

Examples of professional organizations which meet the criteria in (a) and with members who may have expertise in areas related to this *Code* include:

- the British Columbia Institute of Agrologists,
- the Association of Professional Engineers and Geoscientists of British Columbia,
- the British Columbia College of Applied Biology, and
- the Applied Science Technicians and Technologists of British Columbia.

When is a Qualified Professional Required?

In some cases the *Code* requires that a plan, design or assessment be prepared by a qualified professional. In other cases, such as the development of a vector control plan, preparation by a qualified professional is not required by the *Code*. However, in order to exercise appropriate due diligence, the facility owner must ensure that any information required by the *Code* is prepared by a person who through suitable education, experience, accreditation or knowledge may be reasonably relied upon to

provide this advice. In other words, preparation of a plan, report or assessment by a person not qualified to do the job could lead to liability issues for the facility owner if problems develop due in part to an ineffective plan or faulty information.

Categories of Slaughter and Poultry Processing Facilities Discharging Wastewater

To facilitate regulation of wastewater discharges, the *Code* identifies two categories of slaughter and poultry processing facilities based on production and wastewater discharged.

1. A ***category A facility*** discharges less than 5 cubic metres (5,000 litres or 1,100 imperial gallons) of wastewater per day ***and*** produces less than 60 tonnes (approximately 100 cows) of live weight killed (LWK) red meat per year. In the case of poultry processors, a ***category A facility*** is one that discharges less than 5 cubic metres of wastewater per day ***and*** produces less than 40 tonnes (approximately 18,000 to 20,000 birds) of LWK poultry per year.
2. A ***category B facility*** is one that has an annual production rate greater than that specified for category A *or* discharges 5 cubic metres or more of wastewater per day.

Code Requirements for the Discharge of Wastewater

Except for wastewater containing domestic sewage, wastewater discharge requirements for a person operating a category A facility are specified in section 5 of the *Code*. All facilities are subject to the EMA (section 6(4)), which prohibits any introduction of waste into the environment in such a manner or quantity that would cause pollution, as well as:

a) a prohibition against direct discharge to a watercourse (as defined) or groundwater,

b) mitigation of fugitive dust and odour, and

c) a requirement to keep records documenting wastewater discharge volumes and facility production rates. Note that these records are required to be kept for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

Category B facilities have two options for the discharge of wastewater (subsurface discharge or irrigation). Category B facilities discharging into the subsurface of the ground are subject to these same conditions as category A facilities, and must also meet the following additional requirements as set out in section 7 of the *Code*:

a) Wastewater discharged into the subsurface of the ground must not surface and must not cause the groundwater table to be raised to the surface;

b) Inspections of the discharge site must be carried out to ensure wastewater is not surfacing and that the groundwater table is not being raised to the surface;

c) Any subsurface disposal system associated with a category B facility discharging for the first time after September 30, 2007, must be **designed by a qualified professional** and installed in accordance with that design; and

d) Any category B facility that experiences wastewater surfacing or causes the groundwater table to be raised to the surface must cease discharge until such time as the discharge is carried out in accordance with a plan **designed by a qualified professional**.

The intent of section 7(5) of the *Code* is to authorize a person operating either a category A or a category B facility to discharge wastewater containing domestic sewage into the subsurface of the ground providing the domestic sewage is from the facility (i.e., employee washrooms), the discharge does not surface or cause the groundwater table to be raised to the surface, and that inspections are carried out to ensure that these surfacing conditions do not occur. The subsurface disposal system must be **designed by a qualified professional** and installed according to that design.

Fugitive Dust and Odour

The *Code* requires the control of associated fugitive dust and odours caused by:

a) the operation of category A and B facilities (sections 5(b) and 6(a)),

b) the operation of a landfill (section 11(2)), and

c) the operation of an incinerator (section 16(2)).

The main cause of fugitive dust associated with the slaughter and poultry processing industry is usually the entrainment of fine particulate matter into the air from unpaved roadways due to vehicular traffic transporting animals to the facility and waste products and by-products from the facility. Corrective action includes the provision of water sprays, use of acceptable dust suppression agents or paving of the road surface within the facility site as required. Some fugitive dust may also be generated from the animal holding areas and from improper storage of feathers. Site-specific controls are required to address these issues if they become significant.

The potential for odour generation is significant in view of the nature of the slaughter and poultry processing industry, which deals with live/organic raw materials and produces waste products or by-products which are potentially putrescible. Prevention of odours from developing in the first place is a very important strategy and attention to housekeeping and cleanliness through such activities as conducting regular floor and equipment cleaning (which is required for sanitation and health purposes) is effective. Minimizing the storage period and providing refrigeration as required for solid wastes and by-products until such time as these items can be removed for disposal or reuse are key elements in preventing odours.

Wastewater from slaughter and poultry processing facilities can also be a source of odour both from the treatment facility and from stagnant water that may collect in floor drains and other low points in the collection system. A properly designed and operated treatment system should not produce any significant odours, however, upsets or

malfunctions occur from time to time and corrective action should be immediately undertaken.

The effectiveness of prevention/control measures with regard to minimizing fugitive dust and odour can often be determined by the number and types of complaints received from the public. Accordingly, a complaint tracking system provides valuable information and should be implemented by the facility operator. Key elements of a complaint tracking system include:

- recording each complaint made to the processing facility or employee,
- record should contain information with regard to date and time of complaint, method by which complaint was made, nature of the complaint, action taken including follow up contact with the complainant (and if no action was taken, the reason why),
- although not a *Code*-based requirement, these records should be maintained for at least 10 years, and should be made available to an MOE officer within two days of a request.

Guidelines for control of fugitive dust and odour specifically related to wastewater treatment (section 2.2.1.4), solid waste disposal (section 3.9) and incineration (section 4.1.5) are discussed in the appropriate sections of these guidelines.

Code Requirements for the Use of Wastewater for Irrigation

Wastewater from both category A and B facilities must not be discharged on the ground where agricultural crops intended for human consumption are grown.

Category B facilities using wastewater for irrigation are subject to the same general conditions applicable to category A facilities (section 5), as well as the following additional requirements.

Wastewater discharged on the ground for the purpose of irrigation from a category B facility must meet the standards specified in section 8 (2) of the *Code*. Wastewater treatment will be required to meet these standards, as follows:

a) fat, oil and grease (FOG) not to exceed 10 mg/L

b) carbonaceous biochemical oxygen demand ($CBOD_5$) not to exceed 45 mg/L

c) total suspended solids (TSS) not to exceed 60 mg/L

d) total coliform organisms not to exceed 1,000 per 100 ml and total fecal organisms not to exceed 200 per 100 ml.

Wastewater from a category B facility **used by a farmer (as defined in the *Code*)** for surface irrigation of farmland is not required to meet these standards, but the wastewater must be applied at an agronomically sound rate and the volume of discharge must not exceed 100 cubic metres (22,000 Imperial gallons) annually.

An agronomically sound rate of wastewater application relative to nutrient application, is one where the application supplies all the nitrogen required by a crop being grown, but allows very little or none of the nutrients to penetrate into the groundwater or below the area where the nutrients are used by the crop.

Prior to the discharge of wastewater for irrigation purposes from a category B facility, in accordance with section 8(2), a nutrient management plan[1] (*Code* section 8(3)) must be **prepared by a qualified professional** and the facility operator must follow that plan to be in compliance with the *Code*. A nutrient management plan must include (*Code* section 8(4)):

a) a description of how the land is being used and how the public may access it, and

b) an analysis of the effect the wastewater discharge may have on the ground.

These guidelines (section 2.3.3.2) provide information for consideration by qualified professionals when preparing a nutrient management plan.

The intent of section 8(6) of the *Code* is to authorize the discharge of wastewater containing domestic sewage to the surface of the ground from category A and category B facilities, if:

a) the domestic sewage is from the facility,

b) the wastewater is not discharged on ground used to grow crops intended for human consumption,

c) the wastewater containing the sewage from category A or B facilities meets the quality requirements specified in section 8(2) of the *Code,* and

d) a nutrient management plan has been **designed by a qualified professional** and carried out in accordance with sections 8(3) and (4) of the *Code* for category A and B facilities.

Note: The *Code* section 8(5) exemption, which authorizes farmers to discharge to the land without meeting section 8(2) and 8(3) requirements, does not apply if the wastewater discharge contains domestic sewage.

Sampling and Analysis

Wastewater sampling and analysis is required only for category B facilities when using wastewater for irrigation purposes.

Section 9 of the *Code* specifies the time and frequency of wastewater sampling and provides direction on analytical methods, laboratory certification, as well as record-

[1] The core objectives of a Nutrient Management Plan are: a) to supply crops with nutrients at the appropriate rate, timing, and with the appropriate method to produce an economically optimal crop in terms of both yield and quality; and b) to minimize the risk of pollution by loss of nutrients via runoff, leaching, emissions to the air or other loss mechanisms.

keeping. Compliance with *Code*-based requirements for irrigation wastewater quality is determined by:

a) sampling and analyzing wastewater before the wastewater is discharged, and

b) sampling and analyzing wastewater quality every two weeks during the period when wastewater is being discharged.

Analysis of wastewater to determine compliance with section 8(2) of the *Code* must be carried out by a laboratory registered with the Canadian Association for Environmental Analytical Laboratories (CAEAL). Sampling and analysis must be in accordance with the latest version of the British Columbia Field Sampling Manual: 2003 For Continuous Monitors and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples (Field Sampling Manual) issued by the MOE.

Records of the sampling and analysis of wastewater used for irrigation must be kept for a period of at least 10 years by the person discharging the wastewater and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

Landfill Requirements

Part 4 the *Code* (sections 10 to 14) applies to the discharge and disposal of solid wastes. Division 1 of Part 4 is applicable to all slaughter and poultry processing facilities engaged in the activity of landfilling.

Section 10 (1) of the *Code* specifies the size, location, terrain and distance to ground/ surface water as well as other setback requirements for the discharge of solid wastes to the ground. A **qualified professional must evaluate the landfill and design a groundwater monitoring and assessment plan,** if:

a) any of the conditions in section 10 (1) cannot be met, or

b) the amount of solid waste exceeds 5,000 kg/ha/year, or

c) the landfill site has an average precipitation of more than 600 mm/year.

When evaluating a landfill, a qualified professional will need to determine if the landfill design and operation will provide, as a minimum, an equivalent degree of environmental protection as would be provided by conditions set out in section 10(1) of the *Code,* or alternatively show that this degree of environmental protection is not required.

Sections 3.3 to 3.7 of these guidelines provide information for consideration by qualified professionals when evaluating a landfill and designing a groundwater monitoring and assessment plan.

The *Code* requires the person operating the landfill to comply with the groundwater monitoring and assessment plan.

Note that only solid wastes originating from the associated slaughter and poultry processing facility such as feathers, hides, bones, carcasses and manure (incidental to processing) are to be landfilled. This solid waste cannot be mixed with any domestic or municipal refuse. Large quantities of manure (and contents of the rumen (or the paunch) should be separated and used beneficially rather than being landfilled.

Landfill Operation

Section 11 of the *Code* prescribes landfill operating procedures including frequency of intermediate cover and permeability of cover material. Solid waste disposed at a landfill must immediately be covered with:

a) at least 0.15 metres (approximately 6 inches) of low-permeability soil (permeability less than or equal to 1×10^{-6} cm/s), and

b) an impermeable cover (i.e., a tarpaulin) to prevent precipitation from entering the landfill.

Section 11 also requires that fugitive dust and odour be controlled at the landfill site (see guidelines section 3.9).

Section 12 of the *Code* requires the preparation of a vector control plan (VCP) which details measures to minimize vectors (i.e., birds, rodents or other organisms) from accessing the landfill and thereby potentially spreading harmful microorganisms. Section 3.8 of these guidelines provides information which may be useful in the preparation of a VCP.

Section 13 of the *Code* lists the types of records that must be maintained by the landfill operator. The person operating the landfill must keep records of:

a) the dates when solid waste was discharged to the landfill,

b) the location of the landfill, and

c) the types and quantities (by mass) of solid waste discharged to the landfill.

These records must be kept for a period of at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

Landfill Closure

Section 14 of the *Code* specifies the quantity and composition of final cover on a landfill site that is to be closed. The landfill must be closed by covering the completed landfill with at least 1 m of low-permeability (permeability less than or equal to 1×10^{-6} cm/s) soil that extends:

a) at least 0.3 m (approximately 12 inches) above ground level, and

b) at least 0.5 m (approximately 20 inches) beyond the edges of the landfill.

This section also requires that a person operating a landfill disposing of more than 5,000 kg/ha/year of solid waste notify the director (MOE) of the intended closure and complete and retain a landfill closure plan at least three months prior to the intended closure of a landfill. **This plan must be prepared by a qualified professional.** Section 3.10 of these guidelines provides useful information regarding the preparation of a closure plan. Once a landfill has been closed a person cannot discharge any more solid waste to that site.

Incineration of Waste

Division 2 of Part 4 of the *Code* (sections 15 through 19) lists requirements for location, loading rates, operation, emission quality, monitoring and record keeping for incinerators used to dispose of solid waste from slaughter and poultry processing facilities. The operation and maintenance of incinerators must be in accordance with the manufacturer's specifications and procedures in order to be in compliance with the *Code***.** Loading rates are limited to 400 kg/hour for continuous feed and 400 kg/load for batch feed incinerators.

Emission quality must meet an opacity standard of 10% averaged over six consecutive minutes and the total particulate matter concentration in the incinerator emission must not exceed 50 mg/m^3 at reference conditions as specified in the *Code*. Incinerator operators must ensure that appropriate measures are taken to control both fugitive dust and odour.

The *Code* requires that stack monitoring be carried out:

a) on the first day of incinerator operation, and

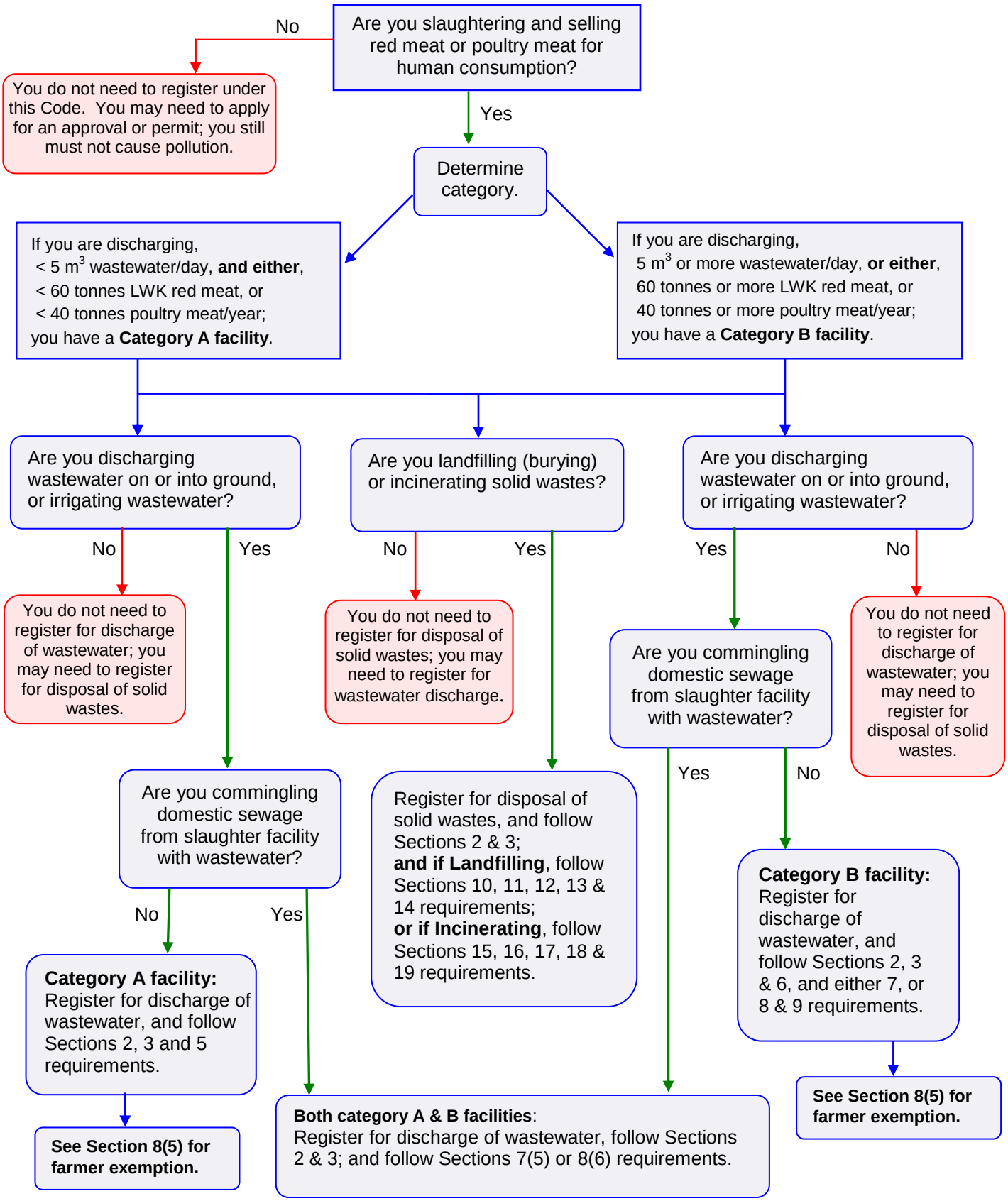
b) no later than one year later to ascertain compliance with the total particulate matter limit.

This means that the incinerator must also be designed so that appropriate stack sampling requirements as specified in the Field Sampling Manual are met. The *Code* also provides the director with the authority to require additional testing if he/she considers it necessary or advisable. Records of stack sampling results and incineration throughputs are to be maintained. The records are required to be kept for a period of at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

Section 4 of these guidelines provides additional information that should be considered by a facility operator when contemplating the establishment of an incinerator. These include other regulatory requirements, cumulative impacts, airshed management plans and applicable Canada-wide standards.

Figure 1. DECISION FLOWCHART

Do you need to register your slaughter facility under the Code of Practice for the Slaughter and Poultry Processing Industries?



2. Wastewater Disposal Guidelines

As part of the scoping process leading up to the development of the *Code*, an extensive review of the slaughter and poultry processing industries was undertaken for the MOE by Senes Consultants Ltd. The Senes report (Senes, 2007) has been used in the preparation of these guidelines and will be made available by the MOE upon request.

2.1. Determining the Category of a Slaughter or Poultry Processing Facility

The *Code* defines slaughter and poultry processing facilities as the following:

"category A facility" means a facility that

(a) discharges less than 5 cubic metres of wastewater per day, and

(b) is either

(i) an establishment where slaughter-industry processes are carried out, producing less than 60 tonnes live weight killed red meat per year, or

(ii) an establishment where poultry-processing industry processes are carried out, producing less than 40 tonnes live weight killed poultry per year;

"category B facility" means a facility that

(a) discharges 5 or more cubic metres of wastewater per day, or

(b) is either

(i) an establishment where slaughter-industry processes are carried out, producing 60 tonnes or more live weight killed red meat per year, or

(ii) an establishment where poultry-processing industry processes are carried out, producing 40 tonnes or more live weight killed poultry per year;

2.1.1. Determining Annual Production

Annual production is expressed as tonnes (1 tonne = 1,000 kg) of live weight killed red meat or poultry processed per calendar year. If information on live weight is not available, live weight can be estimated from carcass weight based on the following Table 1:

Table 1: Carcass Weights as Percentage of Live Weight (Van Kleeck)

Species	***Carcass Weight***
Cattle and Bison under 30 months	50 % of live weight
Cattle and Bison over 30 months	40 % of live weight
Hogs	55 % of live weight
Sheep and Goats	60 % of live weight
Poultry	74% of live weight

2.1.2. Determining Wastewater Volume

An accurate determination of the amount of wastewater (in cubic metres per day) discharged from slaughter and poultry processing facilities is essential. This information is:

- required for registration purposes (maximum amount of wastewater discharged),
- important to determine the facility category type,
- necessary to meet the record-keeping requirement for both category A and category B facilities, and
- essential for both treatment system design and operational purposes (i.e., irrigation application rates).

For an existing facility this can be determined by actual measurement of the wastewater discharged (section 2.1.2.2) with potential adjustments for any pollution prevention or wastewater reduction measures (section 2.1.2.1) and/or facility expansions that may be planned. For new or planned facilities, estimates of anticipated wastewater volume generated may be obtained from the literature, or from experience. Once operating, a more accurate measure may be obtained through actual measurements.

2.1.2.1. Pollution Prevention and Wastewater Flow Reduction

A key element in the design of a wastewater treatment and disposal system is to first give consideration to all reasonable means to reduce wastewater volume. This can usually be achieved through fairly simple and low-cost practices and techniques that are available to most slaughter and poultry processing facilities regardless of size. The cost associated with these practices and techniques may be more than offset by savings in capital and operating costs associated with end-of-pipe treatment.

It is recognized that some of the practices and techniques listed below, especially flow reduction techniques, may not be appropriate because of provincial or federal meat and poultry inspection requirements. Therefore all proposed pollution prevention and wastewater flow reduction measures must be subject to appropriate provincial or federal requirements.

Some examples (Senes, 2007) include:

- Maximizing the segregation of blood and water by designing suitable blood collection facilities.
- Reuse of relatively clean wastewater from cooling systems for washing livestock, if possible.
- Reuse of wastewater from slaughter floor, washbasins, knife and implement sterilizers and carcass washing for gut cutting and washing. Water may require screening to remove gross solids prior to reuse.

- Reuse of final rinse water from paunch and casing washing for other non-critical cleaning steps in the casings department.
- Reuse of cooling water from the singeing process for other purposes in the pig de-hairing area.
- Boiler condensate that is not returned to the boiler may be used as make-up water for the scalding process.
- Use of automated scalding chambers rather than scalding tanks for de-hairing.
- Installation of automated controls to supply wash spray water to viscera section only when required.
- Setting and maintaining minimum water flow rates for viscera table wash sprays.
- Replacing single-skinned knife sterilizers with more efficient sterilizers (i.e., water jacket sterilizers).
- Use of automated control systems to operate flow of water at knife sterilization and hand wash stations.
- Use of dry dumping techniques for the processing of cattle paunches and pig stomachs instead of wet dumping techniques.
- Use of water sprays on splitting saws to remove bone dust to reduce water required for carcass washing.
- Separation of high strength effluent streams, such as effluent from the meat by-product area and wastewater from paunch washing and treating them separately if possible.
- Installation of on/off controls for cooling water on breaking saws. This will ensure that water is supplied only when the saw is operated.
- Use of low pressure water sprays for carcass washing to avoid removing fat from the surface.
- Use of water with a temperature of less than 30º C for carcass washing to reduce fat removal from the surface.
- Use of air chillers for carcass cooling in poultry plants to reduce water use.

Maximizing the separation of blood from wastewater is an **essential** pollution prevention step as it will significantly reduce the wastewater $CBOD_5$ concentration and therefore help facilitate the use of primary treatment works by smaller processing operations. Blood may be used beneficially, for example, provided to meat by-product processing establishments if that option is available.

2.1.2.2. Wastewater Volume Calculation

Following an assessment of pollution prevention measures available and the measures either installed or planned, an accurate estimate of wastewater volume from the processing facility is necessary. Various options are available to determine the volume of wastewater generated, such as measurement of flow rate. The selection of appropriate flow monitoring equipment or techniques will depend upon

the site-specific details associated with each facility and wastewater treatment system. Surrogate parameters such as water consumption rates or the number of wastewater pumping cycles (converted to m^3/day as required by the *Code*) may provide adequate information. In very small facilities it may be possible to capture the wastewater in a container of known volume to obtain a measurement of the total discharge.

Flow Rate Measurement

Where wastewater flow rate measurement is used, the Field Sampling Manual should be consulted as part of the equipment selection process. The flow measuring device will generally depend on whether the wastewater flow is in an open channel or closed channel. Open channel measurement devices include weirs and flumes. Venturi flow meters and electromagnetic flow meters are the most commonly used flow measurement devices for wastewater applications in closed channels. Flow measurement should be undertaken at a location such that it is representative of the actual discharge to the environment (ideally at a point just prior to discharge).

Conducting regular inspections and maintenance of flow measurement equipment is important especially for slaughter and poultry processing facility wastewaters since fouling due to grease and solids accumulation is a significant concern. Therefore, it is important to follow the manufacturer's recommendations with regard to maintenance and calibration requirements for these flow measurement devices and to regularly review the use of surrogate parameters to validate their adequacy. The **qualified professional** should also provide the facility operator with a maintenance and operating schedule for this equipment.

Estimating Wastewater Volume

For estimating wastewater volume, the following jurisdictional scan of wastewater generated in meat processing facilities conducted by Johns (1993) shows that the amount of wastewater per unit production varies from 0.8 L/kg LWK to a maximum of 16.7 L/kg LWK. The findings of the scan are summarized in Table 2 as follows:

Table 2: Wastewater Generated per Unit Production

Country	Wastewater Generated (L/kg LWK)
USA	4.2 to 16.7
U.K.	5 to 15
Europe	5 to 10
Hungary	2 to 3.8
Germany	0.8 to 6.2

In 2002, the U.S. Environmental Protection Agency summarized data from a detailed survey and site sampling programs. The following tables show median and average wastewater volumes generated per unit production for slaughter and poultry processing facilities by size and type.

Table 3: Median Wastewater Volumes per Unit Production at Slaughterhouse Operations

Size of facility	Process Wastewater Generated (L/kg LWK)
> 60 tonnes LWK and <= 300 tonnes LWK per year, or have a maximum wastewater flow volume > 5 m^3 per day and < 50 m^3 day	8.5
all operations not captured by definition above	7.3

Table 4: Average Wastewater Volumes per Unit Production at Poultry Processing Operations

Type of facility	Process Wastewater Generated (L/kg LWK)
Chicken	12.3
Broiler	25

Table 5: Median Wastewater Volumes per Unit Production at Poultry Processing Operations

Size of Facility	Process Wastewater Generated (L/kg LWK)
(> 60 tonnes LWK and <= 300 tonnes LWK per year or have a maximum wastewater flow volume > 5 m^3 per day and < 50 m^3 day)	14.8
(all operations not captured by definition above)	13

The above wastewater flow values taken from the literature are a useful reference but it is important that the facility owner or qualified professional carefully review site-specific circumstances, as flow estimates may vary considerably based upon the type of animals being processed, the type of processing being undertaken and the degree of water conservation being practiced.

2.2. Subsurface Wastewater Disposal Systems

Subsurface disposal of wastewater for larger facilities may not be feasible in all cases due to the extensive tile field area required. However, if the qualified professional has determined that subsurface disposal (through drain fields or exfiltration basins) is feasible, then it is recommended that the wastewater treatment system for these larger facilities consist of pre-treatment (screening, catch basin/grease traps, dissolved air floatation, flow equalization), primary treatment and secondary treatment (biological treatment). Larger facilities may need to meet more stringent effluent quality than the minimum values as stated in section 2.2.1.1., in view of the greater potential for environmental impact and to be consistent with MOE expectations. Thus, the installation of both pre-treatment, primary treatment and secondary treatment should ensure that the effluent quality as detailed in section 2.2.1.1. is easily achieved, although because of reduced treatment capability for FOG, the FOG limit (10 mg/L) will likely be achieved with a smaller safety margin than the $CBOD_5$ and TSS limits.

As discussed in detail in the *Code* overview section 1.3, an amendment to the *Code* allows for the inclusion of domestic sewage from both category A and B facilities in the wastewater discharged to subsurface disposal systems, so long as:

a) it is incidental to the facility's operation,

b) wastewater discharged into the subsurface of the ground from a category A and B facilities must not surface and must not cause the groundwater table to be raised to the surface,

c) a person discharging wastewater into the subsurface of the ground must conduct inspections to ensure compliance with (b), and

d) the subsurface disposal system (drain field and treatment works) **for both category A and B facilities is designed by a qualified professional** and installed according to that design.

2.2.1. Wastewater Quality, Treatment and Disposal

Senes recommends that septic tanks (primary treatment) not be used as the only treatment of slaughter and poultry processing facility wastewater, regardless of the facility size, primarily because of the potentially very high content of fats, oil and grease (FOG) in the wastewater. The concern is that septic tanks by themselves will not provide adequate treatment to allow for long term disposal through drain/tile fields. For example, the following Table 6 (Senes, 7-5) provides septic system removal efficiencies for several domestic sewage components:

Table 6: Septic Tank Removal Efficiencies

Parameter	Removal efficiency of a septic system
$CBOD_5$	15% to 40%
TSS	25% to 45%
Fecal coliform	0%
Oil and grease	0% to 47%

The use of septic tank/tile field systems, combined with effective pre-treatment, may be acceptable as a treatment and disposal option for smaller operations in British Columbia. The use of primary treatment works for slaughter and poultry processing facility wastewater requires effective pre-treatment and/or pollution prevention measures to significantly reduce the concentrations of 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), solids and FOG, such that wastewater entering as influent to the primary treatment works is similar in quality to that of domestic sewage. The effluent quality in these situations will benefit from septic tanks and tile fields being conservatively sized and designed for the expected flows and loadings. Inspection and maintenance programs are an important element for all treatment facilities but especially important with regard to the application of primary treatment works/tile field systems used to treat wastewater from slaughter and poultry processing facilities.

2.2.1.1. Wastewater Quality Target for Subsurface Discharge of Treated Wastewater

In order to meet MOE expectations, the design of effluent treatment facilities treating wastewater for subsurface disposal via drainage/tile fields should target for a minimum effluent quality of:

- 10 mg/L or less FOG
- 130 mg/L or less $CBOD_5$
- 130 mg/L or less TSS

These targets represent a minimum level of wastewater quality and are based upon the quality expected from a properly functioning septic tank treating domestic sewage. This minimum effluent quality should ensure that subsurface disposal fields perform reasonably well over time. A higher degree of wastewater treatment will reduce the size of the drainage field required and may also help extend the life of the field. A higher degree of treatment may also allow for the use of exfiltration basins.

2.2.1.2. Wastewater Treatment

Various options are available to the qualified professional with regard to the design of a subsurface wastewater disposal system capable of meeting the quality requirements in section 2.2.1.1. Regardless of the treatment system selected to treat wastewater for subsurface disposal, the qualified professional should consider implementing effective pre-treatment technologies to reduce the loading of solids, $CBOD_5$, and FOG to primary or secondary treatment works.

A. Pre-Treatment

Pre-treatment technologies consist of screening as an initial step to remove solids and semi-solids for subsequent by-product recovery or landfilling. Solids and blood from the processing facility should be separated, and diverted to rendering (meat by-product processing) establishments where feasible. Screening can be accomplished using static, rotary drum, brushed or vibratory units with appropriate mesh sizes.

The 10 mg/L FOG target for subsurface disposal requires the implementation of an efficient method to reduce this component following screening. As discussed in section 2.2.1.2., primary treatment is not considered to be an effective treatment by itself in reducing this component to the required target, and therefore FOG reduction by pre-treatment (following screening) is crucial. Although the FOG concentration will be reduced in a secondary treatment process, good practice suggests that FOG reduction should also be considered at the pre-treatment stage, even when using secondary treatment. It is likely that a basic grease trap/ skimming mechanism will not be sufficient for the wastewaters associated with most processing facilities and dissolved air floatation (DAF) should be considered. However, DAF systems sized for smaller processing facilities with low wastewater flow rates may not be readily available. The use of flocculants in conjunction with DAF systems may also be required where needed to increase efficiency.

The need for increased efficiency compared to the chemical cost should be assessed. Flow equalization systems (tanks and pumps) may be necessary for some treatment options and require a cost/benefit analysis.

B. Primary Treatment

As discussed earlier, the use of a primary treatment works/tile field system requires that suitable pre-treatment options be installed so that wastewater similar in quality to domestic sewage is provided as influent to the primary treatment works. Parameters of concern are $CBOD_5$, TSS and particularly FOG. If the primary treatment works are properly (i.e., conservatively) sized and maintained, the resulting effluent should meet the minimum target quality needed to ensure reasonably long term effective operation of (conservatively-sized) drainage fields.

A comparison of slaughter processing wastewater, poultry processing wastewater and domestic sewage (Senes, A-10) is shown in Table 7, as follows:

Table 7: Comparison of Slaughter and Poultry Processing Wastewater and Domestic Sewage.

Parameter	Slaughterhouse Operations	Poultry Processing Operations	Domestic Sewage
CBOD (mg/L)	7,237	1,662	200
TSS (mg/L)	1,153	760	200
TKN (mg/L)	306	54	30
TP (mg/L)	35	12	6
Oil & Grease (mg/L)	146	665	10

Modifications to the treatment system to enhance performance may include the installation of influent and effluent baffles to prevent short circuiting, use of two chamber tanks, and the installation of additional grease removal traps. An effluent filter installed in the discharge from the primary treatment works will further minimize the potential for carry over into the drainage field.

Increasing the capacity of the primary treatment works by 50% to 100% over that normally provided for domestic sewage may also be considered by the qualified professional in order to provide for an additional margin of safety.

Good access must be provided to allow for regular cleaning of the effluent filter/grease trap and inspection for solids build up. The solids removal frequency is expected to be more frequent for primary treatment works treating wastewater from slaughter and poultry processing facilities than would normally be expected for septic tanks used to treat domestic sewage. A routine inspection schedule should be developed by the **qualified professional** based upon anticipated solids and FOG accumulation rates.

C. Secondary Treatment

A number of technology options exist for secondary treatment, and due to cost and complexity, may be appropriate only for larger facilities. Secondary treatment options for slaughter and poultry processing wastewater include anaerobic and facultative lagoons, anaerobic sequencing batch reactors and aerobic sequencing batch reactors (Senes, 2007). These treatment options are discussed in detail in section 2.3.2.2. (wastewater used for irrigation). If treatment ponds or lagoons are being considered, the **qualified professional** will need to consider land availability for treatment/storage facilities, ambient temperature range and rainfall, suitability of the soil, as well as capital and operating costs, in order to develop a treatment option that will consistently exceed the effluent quality described in section 2.2.1.1. Treatment technologies employed should minimize the nitrification process, thereby reducing the risk of nitrate contamination of ground and surface waters (Senes, 2007).

There is no single pre-treatment/primary treatment/secondary treatment system that is applicable for every processing facility. Consequently, the facility owner is expected to rely upon a **qualified professional** to consider site-specific factors to determine the most appropriate treatment system.

2.2.1.3. Subsurface Disposal System Design

The design of subsurface systems for disposing of treated slaughter and poultry processing wastewater discharged from primary treatment works should be consistent with the Municipal Sewage Regulation (MSR) (B.C. Reg. 129/99) in order to meet minimum MOE expectations for FOG concentrations (10 mg/L or less), for $CBOD_5$ concentrations (130 mg/L or less) and TSS concentrations (130 mg/L or less).

Specifically, Tables 2 and 4 of Schedule 4 (Standards for Discharges into Ground), for typical septic tank effluents (class “D”) are applicable. Subsurface systems used for slaughter and poultry processing wastewater receiving secondary treatment

should incorporate design criteria for secondary effluents (class “C”) listed in Tables 2, 3 and 4 of Schedule 4, which can be found in the Appendix 2 of these guidelines.

Any deviation from the requirements as specified in Schedule 4 of the MSR should be supported by a technical rationale indicating how the design will provide for an equivalent degree of functionality and environmental protection to that required by the MSR. These guidelines contain key requirements specified by the *Code*, as well as design considerations taken from the MSR with regard to subsurface disposal. However, the **qualified professional** should ultimately ensure that site-specific subsurface disposal design meets best management practices and prevents pollution of both surface and groundwater.

Key requirements of the *Code* and design considerations from the MSR or based upon MOE expectations are as follows:

1. The *Code* requires that a subsurface wastewater disposal system associated with a category B facility that discharges wastewater into the ground for the first time after September 30, 2007, **be designed by a qualified professional** and be installed according to that design (*Code* section 7(3)).

2. The *Code* requires that a subsurface discharge from a category B facility that discharged prior to September 30, 2007, and which has caused surfacing of wastewater or has caused the groundwater table to reach the surface must cease discharge. **The subsurface discharge can only resume if the subsequent discharge is carried out in accordance with a plan designed by a qualified professional** (*Code* section 7(4)).

3. The *Code* prohibits the discharge of wastewater to the subsurface of the ground from a category B facility if the wastewater surfaces, and the *Code* also prohibits a discharge which results in the groundwater table being raised to the surface (*Code* section 7(1)). *Code* 7(1) requirements also apply to category A facilities if the wastewater from these facilities contains domestic sewage.

4. Subsurface field location and design should provide for a subsurface travel time of 10 days as a minimum (subsurface travel time is the time required for effluent to travel from the bottom of the disposal trench to the point where the effluent reaches the property line, or is intercepted by a water well).

5. If exfiltration basins are used to dispose of effluent that has received secondary treatment, the exfiltration basins must be located at least 300 metres from a drinking water source, unless additional treatment is provided. Table H in Schedule 7 of the MSR specifies additional setback requirements (Table H can be found in the appendices to this report). Furthermore, at least two exfiltration basins must be provided, with each basin capable of accepting all of the effluent under annual average rainfall conditions.

6. The land area set aside for effluent disposal should be adequate to provide for application rates as detailed in Schedule 4 (Tables 2, 3 and 4) of the MSR for effluent class “D” or “C” as appropriate.

7. The **qualified professional** should determine if there is a need for filtration equipment to prevent solids from carrying over to the disposal field. It should be noted that for secondary effluent (class "C") rates greater than 37 cubic metres per day (m^3/day) (or 8,139 Imperial gallons per day), the MSR requires installation of filters complete with monitoring controls that signal an alarm when filtration begins to malfunction.

8. The **qualified professional** should note that for secondary effluent (class "C") discharge rates greater than 37 m^3/day, if the soils are well drained (percolation rate <5 min/25 mm) and if the depth to groundwater, including any groundwater mounding effect, is greater than 1.0 metre below the bottom of the drainage trench, the MSR authorizes the qualified professional to design the ground disposal system with deeper, narrower trenches and the drainage pipe length may be reduced to a value equal to the product of pipe length (in Table 4 of Schedule 4 of the MSR) and a factor of $1/H^{0.5}$ or 0.8 (whichever factor is greater), where H is the drainage trench depth below pipe invert in metres.

9. Percolation rates greater than 20 min/25 mm require construction of the drainage field to be supervised by a **qualified professional** to ensure that construction has been carried out in a manner that has not reduced the trench wall permeability unless, for discharges less than 37 m^3/day only, the native undisturbed permeable soil depth exceeds 1.35 metres. In these cases, (percolation rates greater than 20 min/25 mm) the bed hydraulics should be confirmed by a hydrogeological assessment.

10. Generally, percolation rates less than 2 min/25 mm are considered to be too fast for adequate renovation of wastewater. If these conditions exist, the **qualified professional** should conduct the necessary hydrogeological assessments to determine if all relevant groundwater quality criteria will be met (nitrate and fecal coliform are the main substances of interest). If groundwater will be adversely impacted, other means of treatment and/or disposal should be investigated.

11. Minimum drain field setbacks from sensitive features should be in accordance with those set out in Table H of Schedule 7 of the MSR (Table H can be found in the appendices to this report).

12. Subsurface fields and a surrounding buffer strip (at least as wide as the distance prescribed in row 2, Table H of Schedule 7 (MSR) - see appendices) should be kept free of building or hard surfacing of any kind and should not be put to uses which may cause damage to the system or interfere with its operation.

13. A pressure distribution system should be used for drainage pipes fed by a dosing siphon or pump.

14. Drainage pipes should be provided in two fields with a third undeveloped field retained as a standby area. Drain fields should normally be constructed with trenches on 3 metre on-centre spacing. A qualified professional may determine that the performance of the drain field is not adversely altered by varying the

minimum spacing, however an on-centre spacing of less than 2 metres is not generally considered to be acceptable. In the case where less than 3 metre on-centre spacing is used, the standby area should be doubled. Except where the **qualified professional** determines reductions in drainage pipe length are acceptable, each of the two developed fields should have at least the length of drainage pipe indicated in MSR Table 4 of Schedule 4 (see appendices).

15. In certain areas of the province as detailed in Schedule 5 of the MSR (see appendices), there is a concern with the amount of total nitrogen in discharges of effluent into ground. Accordingly, the **qualified professional** should ensure that the total nitrogen concentration in the treated effluent does not exceed 10 mg/L in these areas.

2.2.1.4. Wastewater Treatment Fugitive Dust and Odour Control

General measures for control of fugitive dust and odour are discussed in section 1.3 of these guidelines.

Overloaded or poorly maintained primary treatment works/tile field systems may result in the surfacing of wastewater, thereby creating odours. Should this happen, the *Code* requires that a category B facility may only resume discharging into the subsurface of the ground in accordance with a **plan designed by a qualified professional**. Although the *Code* is not prescriptive with regard to measures required for category A facilities, the surfacing of wastewater (and resulting odour) requires corrective action, which may include the renovation of the tile field and/or pumping of the treatment tank.

Larger operations (category B facilities) that have installed secondary treatment (biological) systems may experience odour problems associated with certain treatment stages (especially anaerobic lagoons). Aerobic and facultative lagoons generally do not produce odours. However, odours can result from anaerobic lagoons mainly due to overloading, lack of a contiguous ‘scum’ surface layer, or an improper pH. Control strategies are available to address each of these issues and include increasing anaerobic capacity or installing a synthetic or natural cover (especially for new ponds).

2.3. Irrigation with Wastewater

Treated wastewater from slaughter and poultry processing facilities which is used for irrigation purposes is considered to be beneficial reuse. Irrigation systems can be used to apply treated water during the growing season and may also provide an indirect benefit of frost protection in the spring and fall, and crop cooling during the hotter summer months.

Accordingly, the *Code* (section 8) makes provision for the use of treated wastewater from category B facilities for irrigation purposes. Wastewater from category B facilities (whether containing domestic sewage or not) and wastewater from category A facilities containing domestic sewage may not be used for irrigation of agricultural crops intended

for human consumption. A nutrient management plan must **be prepared by a qualified professional** when wastewater from a category B facility or wastewater containing domestic sewage from a category A facility is intended to be used for irrigation. This plan must include a description of public use of the land, an analysis of the effect of the wastewater on the ground and must be carried out as designed. Section 2.3.3.2. of these guidelines provides information for consideration by **qualified professionals** when developing this plan.

Wastewater from category B facilities and wastewater from category A facilities containing domestic sewage used for irrigation purposes is required to meet minimum quality standards for several parameters. These standards and other applicable requirements are outlined in this section.

A category B facility operator who is also a farmer (as defined) using wastewater (not containing domestic sewage) for irrigation is not subject to the wastewater quality requirements of section 8 of the *Code* if the discharge does not exceed 100 m³/year and is applied at an agronomically sound rate.

2.3.1. Wastewater Quality

The *Code* (sections 8(2) and 8(6)) requires that wastewater from category B facilities and wastewater containing domestic sewage from category A facilities used for irrigation purposes meet all of the following standards prior to being applied to the ground:

a) Not to exceed 10 mg/L for fat, oil and grease (FOG),

b) Not to exceed a carbonaceous biochemical oxygen (CBOD) demand concentration of 45 mg/L,

c) Not to exceed 60 mg/L for total suspended solids (TSS), and

d) Total coliform organisms not to exceed 1,000/100 ml of wastewater and fecal coliform organisms not to exceed 200/100 ml of wastewater.

These standards are consistent with the MSR-based standards for the use of reclaimed water (effluent from a sewage facility that is suitable for a direct designated water use or controlled use) for irrigation purposes on ground with restricted public access following treatment by a lagoon system. Additional disinfection requirements to reduce fecal coliform concentration may apply in situations where there is frequent worker contact with reclaimed water (MSR). If lagoon treatment is not employed, then the MSR requires that the TSS concentration meet a level less than or equal to 45 mg/L. It is expected that the majority of irrigation applications will be to ground with restricted public use. However, irrigation of areas allowing unrestricted public access such as parks, playgrounds and golf courses requires that the wastewater exceed the quality required by the *Code* in order to be consistent with the MSR. The MSR and the companion document, British Columbia Code of Practice for the Use of Reclaimed Water*,* are considered to be good reference material for the design and application of wastewater irrigation systems utilizing treated wastewater from slaughter and poultry processing facilities.

The MSR requires that reclaimed water used to irrigate areas with unrestricted public access meet effluent quality standards (as running mean values) as follows:

a) pH = 6 – 9,

b) less than or equal to 10 mg/L for BOD_5 (may require use of non-toxic flocculants),

c) less than or equal to 2 NTU for turbidity (this can usually be achieved by 60-day storage or filtration after secondary treatment), and

d) less than or equal to 2.2/100 ml for fecal coliform organisms (requires a chlorine residual of 0.5 mg/L unless the requirement is waived by a director).

These MSR effluent quality standards are considered to be target values for the use of treated slaughter and poultry processing facility wastewater for irrigation of areas allowing unrestricted public access (such as golf courses and parks). Other restrictions may also apply. Any variation from these MSR effluent quality limits used by a **qualified professional** in the design of a wastewater irrigation system for use on lands allowing for unrestricted public access should be supported by a documented rationale indicating that this design offers an equivalent degree of protection to public health.

2.3.2. Design Elements Associated with Achieving or Exceeding Wastewater Standards Specified by the *Code*

The degree of treatment provided to wastewater used for irrigation purposes is determined by the effluent conditions as set in the *Code* (as a minimum) and the type of public access to land used for irrigation purposes as described in section 2.3.1. In order to meet the effluent standards required by the *Code,* wastewater from category B facilities and wastewater containing domestic sewage from category A facilities must receive secondary treatment (primary treatment works will not provide adequate treatment to allow the treated wastewater to be used for irrigation). The treatment system design should be based upon a consideration of the various stages of treatment described in this section or equivalent alternatives. Many of the considerations given to wastewater disposal through subsurface means (especially pre-treatment and pollution prevention measures) apply also to the use of wastewater from slaughter and poultry processing facilities for irrigation purposes. Pre-treatment and pollution prevention measures are discussed in Sections 2.2.1.2. and 2.1.2.1. respectively and pre-treatment is also discussed in the following section.

2.3.2.1. Pre-treatment and Primary Treatment

See previous section 2.2.1.2. A and B of these guidelines for guidance on the selection of pre-treatment and primary treatment technologies.

2.3.2.2. Secondary (Biological) Treatment

Biological or secondary treatment will be required following pre-treatment and primary treatment in order to meet *Code* requirements. The treatment method

ultimately selected by the **qualified professional** will depend upon the effluent quality required (restricted or unrestricted public access), volume of wastewater, land availability, ambient temperature range, rainfall and cost. All secondary treatment systems reduce the concentrations of suspended solids and soluble and colloidal organics, which remain in the wastewater following pre-treatment, and when properly designed and operated, these systems should result in wastewater meeting or exceeding *Code* standards. Subsequent storage lagoons provide additional solids removal and, if sufficient storage capacity is provided (usually a minimum 30 days since the last addition of wastewater), may also reduce total and fecal coliform concentrations enough to meet *Code* requirements. Storage lagoons must also be suitably sized to retain treated wastewater during periods when it cannot be used for irrigation purposes.

Detailed information describing secondary treatment systems is included in the Senes report. A summary of that information is provided in this section of the guidelines. If the **qualified professional** is considering the use of secondary treatment for slaughter and poultry processing wastewater, the Senes report may provide useful information.

Lagoon Systems

For processing facilities with wastewater flow rates within the range of 5 to 50 m^3/day, a two lagoon treatment system with subsequent storage of treated wastewater is often a favoured option. Advantages include low energy requirements, low mechanical complexity, relatively low capital and operating costs if land is available, and effective treatment of wastewater. Disadvantages include the significant land requirements if land is at a premium, the adverse impact of cool temperatures on treatment efficiency and potential odour generation (especially from anaerobic lagoons).

The two lagoon treatment system when applied to wastewater from slaughter and poultry processing facilities most frequently consists of an anaerobic lagoon followed by a facultative lagoon and storage lagoon.

Anaerobic lagoons are relatively deep, between 3 to 5 metres, with a detention time of 5 to10 days. Typical loading rates are between 0.24 to 0.32 kg/m^3 of $CBOD_5$ with a pH range of 7.0 to 8.5. Although anaerobic wastewater processes are very temperature sensitive, with an optimal efficiency occurring at 35 º C, anaerobic digestion does occur at temperatures in the range of 5 to 20 ºC; however, at significantly reduced reaction rates. A cover on the lagoon surface, either formed naturally by wastewater “scum” or provided by an engineered barrier, will tend to retard heat loss (thereby increasing microbial reaction rates) and reduce the emission of odorous compounds (hydrogen sulphide). Surface area loading rates can therefore be increased and lagoon volumes reduced. The “scum” generally consists of fat, oil and grease and is best left undisturbed by introducing effluent through a submerged inlet. Synthetic floating or biogas inflated covers can be used to prevent odours from escaping the lagoon surface, while simultaneously trapping biogas for possible collection and use as a fuel source.

Anaerobic lagoons are the most commonly used anaerobic process units for the treatment of slaughter and poultry processing industry wastewaters in the USA. Anaerobic lagoons provide flow equalization, thereby reducing the variation in daily flows to subsequent treatment processes.

A facultative lagoon is the second stage of biological treatment in the anaerobic/ facultative two lagoon system. Wastewater treatment and stabilization in a facultative lagoon is carried out in three zones by aerobic (surface), facultative (intermediate) and anaerobic (bottom) bacteria.

Facultative lagoons can be designed to be operated as continuous discharge or as fill and draw systems for seasonal or annual discharge. Facultative lagoons vary in depth from 2 to 3 metres. Loading rates for facultative lagoons vary from 22 kg/ha/day to 67 kg/ha/day $CBOD_5$ with a hydraulic retention time of 4 - 200 days (recommended 180 days) and a solids retention time of 100 days. Properly functioning facultative lagoons provide good odour control because odorous compounds are usually oxidized by the upper aerobic layer before they reach the atmosphere.

Instead of using a facultative lagoon, another option is the use of an aerated lagoon following an anaerobic lagoon. Biomass aeration and mixing in the aerated lagoon are achieved by using diffused air systems or floating mechanical aerators. Aerated lagoons operated without recycling solids, may use a large, shallow, earthen basin in place of a more conventional clarifier for removal of suspended solids. Typically, these clarification basins are also used for the storage and stabilization of suspended solids. Because of problems created by carry over of suspended solids to subsequent treatment processes, and the inability to achieve secondary effluent quality standards, the energy intensive, aerated lagoon system is considered to have limited application in the treatment of wastewaters from slaughter and poultry processing operations.

Aerobic treatment will increase the conversion of ammonia and organic nitrogen to nitrate, which is not necessary or desirable when wastewater is to be used for irrigation. Nitrates are mobile and have a greater potential to impact ground and surface water drinking water sources. Ammonia and organic nitrogen found in wastewaters from slaughter and poultry processing facilities are readily available to plants and nitrification is not required prior to irrigation.

Alternatives to Lagoon Treatment Systems

Limited land availability, low ambient temperatures and odour sensitivity are factors that can lead to consideration of non-lagoon options. Some alternatives to lagoon treatment systems considered by Senes are as follows:

a) Anaerobic

High rate anaerobic technologies are available that maintain a long solids retention time in a reactor having a relatively short hydraulic retention time. Reactor configurations which have been used are:

- Anaerobic contact process reactors

- Upflow anaerobic sludge blanket reactors
- Anaerobic sequencing batch reactors
- Anaerobic filters

An anaerobic sequencing batch reactor may be considered as a treatment option for processing facilities with a wastewater flow range between 5 and 50 m^3/day. With this option, the completely mixed and heated anaerobic reactor is operated as a fill and draw system. Biomass is retained in the system without the need for an external clarifier. The reactor size is increased to compensate for the reduced reaction times. An anaerobic sequencing batch reactor offers a significant reduction in capital cost and operational complexity compared to an anaerobic contact process reactor, which utilizes an external clarifier in a manner similar to the activated sludge process in an aerobic treatment plant.

The anaerobic contact process (which is similar to the aerobic activated sludge process) is not used extensively because of its high cost but is considered by Senes to be a potentially viable option for processing facilities with wastewater flows of greater than 50 m^3/day.

The upflow anaerobic sludge blanket reactor, because of its complexity and the need to generate an anaerobic sludge matrix, is not considered suitable for application to slaughter and poultry processing wastewaters in British Columbia (Senes, 2007).

For those sites where there is insufficient land for anaerobic lagoons, an anaerobic filter may be an appropriate alternative. The anaerobic filter is a cylindrical tank or column filled with various types of synthetic media.

b) Aerobic

An aerobic sequencing batch reactor (SBR) may be considered as a treatment option for processing plants producing wastewater in the 5 to 50 m^3/day range and also for large plants producing more than 50 m^3/day. The SBR is one of many activated sludge process options that could be used for the slaughter and poultry processing industry but the SBR offers the simplest configuration and operational system. The system can be designed with two reactor vessels for large processing facilities or one vessel for smaller facilities. The use of a single reactor vessel will require storage of pre-treated or primary treated wastewater while a batch of wastewater is being processed by the single SBR.

Two other non-lagoon aerobic treatment options were considered by Senes to be potentially viable for the slaughter and poultry processing industry. They are both aerobic attached growth processes which are commonly used in the treatment of domestic sewage. The first option is a trickling filter. This option requires primary treatment to remove settleable solids and FOG in order to prevent plugging of the filter media. Secondary clarification is also necessary. Senes suggests that lower energy requirements may make trickling filters an attractive alternative to activated sludge processes.

Mass-transfer limitations limit the ability of trickling filters to treat high strength wastewaters, and for a single-stage or roughing trickling filters, the $CBOD_5$ removal efficiency is typically 50 to 75%. To successfully treat high strength wastewaters, a two or three stage trickling filter system is necessary with a clarifier after each stage. This configuration can achieve $CBOD_5$ removal efficiency as great as 95%.

The second attached growth process is the rotating biological contactor. This process, like the trickling filter, uses an attached film of microorganisms to metabolize the organic matter in the wastewater. In this technology, the media is a series of rotating closely spaced disks of polystyrene or polyvinyl chloride (PVC). The rate of rotation controls oxygen diffusion into the microbial film and provides the sheer force necessary for continual biomass sloughing. As with trickling filters, mass transfer may limit the ability of this technology to treat the high strength wastewater produced by the slaughter and poultry processing industry.

Senes identified typical hydraulic and organic loading rate design values for secondary treatment systems using rotating biological contactors to be 0.08 to 0.16 $m^3/m^2/day$, and 9.6 to 16.8 g total $BOD_5/m^2/day$, respectively, with effluent BOD_5 concentrations ranging from 15 to 30 mg/L.

The major advantages of rotating biological contactors are relatively low installation costs and resistance to shock loads. The major disadvantage is the need to enclose them, especially in cold climates, in order to maintain high removal efficiencies and to control odour. Their use in the treatment of high strength wastewater, such as that from the slaughter and poultry processing industry, is considered to be somewhat limited.

2.3.2.3. Disinfection

The need to disinfect treated effluent prior to discharge should be determined through a site-specific assessment conducted by a **qualified professional**. If storage lagoons are provided, a 30-day period since the last addition of wastewater may be sufficient to meet the total and fecal coliform standards for application to the ground where there is restricted public access. Application of treated effluent to the ground where there is unrestricted public access will likely require the provision of disinfection equipment (chlorination, ultraviolet irradiation or ozonation). Analysis of the effluent prior to discharge will ultimately determine the need to disinfect.

2.3.3. Developing an Irrigation System for the Disposal of Treated Wastewater

Once suitable land and land uses have been identified and appropriate treatment options have been selected, planning for treated wastewater storage and application to the ground should occur. The British Columbia Code of Practice for the Use of Reclaimed Water is a very useful resource and also cites additional references which can be used in the design and operation of irrigation systems.

2.3.3.1. Treated Wastewater Storage

For irrigation purposes, the treated wastewater storage facility must be large enough to contain the average daily wastewater volume produced outside the normal irrigation season and also account for precipitation and evaporation that occurs during the storage period. It may be prudent to consider providing additional treated wastewater storage capacity to deal with emergency situations where effluent that cannot meet discharge standards can be diverted (temporarily) rather than shutting down the processing facility.

Suitable signage and fencing are required to advise the public and workers that treated wastewater is being used for irrigation purposes and to control access. Signs should be posted at both the wastewater storage reservoir and application areas. Fencing is required to control access to the storage reservoir and to application areas that are considered to be 'restricted public access areas'. The British Columbia Code of Practice for the Use of Reclaimed Water provides additional details.

The normal irrigation season is that period when treated wastewater which has been held in storage can be used. It is defined as the time when irrigation is required because of a climatic moisture deficit during the growing season. The normal irrigation season can be estimated from the length of the normal growing season, climatic trends, the annual climatic moisture deficit, and knowledge of irrigation periods in British Columbia. The reference Guide to Irrigation System Design with Reclaimed Water (British Columbia Ministry of Agriculture, Food and Fisheries, now known as the Ministry of Agriculture and Lands (MAL)) provides information regarding the normal growing season, climatic moisture deficit, and estimated normal irrigation period for various regions in British Columbia.

The storage facility may also be required to provide an allowance for the accumulation of additional wastewater due to reduced irrigation requirements in wet weather. However, the Guide to Irrigation System Design with Reclaimed Water suggests that if the average seasonal irrigation requirements are used to determine the irrigation area, then this is not normally necessary. Also, the British Columbia Code of Practice for the Use of Reclaimed Water recommends that, if the land base is not sufficient to accommodate the average seasonal irrigation requirements, a cumulative capacity of five years of wet weather for a five-year return period should be added to storage volume.

In addition, the number of available days for irrigation needs to be reduced to provide time for harvesting of crops or, if wastewater quality is suitable for unrestricted public access, the time available for irrigation will be affected by the type of land use and associated public access.

The British Columbia Code of Practice for the Use of Reclaimed Water states that normal seasonal storage capacity needs to be available for periods when wastewater production exceeds use. The design should therefore provide for the normal 25-year wet-year cycle for the irrigation season, plus 20 days as a safety factor. Storage calculations should factor in evaporation from, and precipitation into, the storage lagoon system.

The design of storage facilities for domestic sewage requires planning for emergency storage if an option for emergency disposal is not available. Unlike sewage collection systems, a processing facility can cease operations thereby stopping the flow of wastewater. Consequently emergency storage over and above seasonal storage and wet weather storage will not be required in situations where plant shutdown is the preferred option.

2.3.3.2. Objectives of a Nutrient Management Plan

A nutrient management plan is an essential component in the overall development of a wastewater irrigation system and is required by the *Code* (section 8(3)). The British Columbia Agricultural Council (BCAC), in conjunction with Agriculture and Agri-Food Canada (AAFC) and the British Columbia Ministry of Agriculture and Lands (MAL), have produced a useful guide (Nutrient Management Reference Guide or NMRG), which has been used in the development of this guidance document. Note that the nutrient management plan is not required to be submitted but must be retained for a period of at least 10 years and be made available for inspection by an officer (as defined in the EMA) within 2 days of a request by that officer.

Generally the core objectives of nutrient management planning according to the NMRG are:

a) to supply crops with nutrients at the appropriate rate, timing, and using an appropriate method to produce an economically optimal crop in terms of both yield and quality, and

b) to minimize the risk of pollution by loss of nutrients via runoff, leaching, emissions to the air (aerosol drift) or other loss mechanisms.

The *Code* requires that the nutrient management plan also describe public access to the land being irrigated and provide an analysis of the effect that the wastewater has on the ground (*Code* section 8(4)(a) and (b)).

Consequently, the “nutrient management plan” should address more than just nutrient application, uptake and removal/loss, although these are important components of the plan.

The plan should address the land use, buffer areas and type of public access planned for the area to be irrigated. The type of public access, i.e., restricted or unrestricted, determines the quality of wastewater that can be applied. A list of restricted and unrestricted public access uses (only irrigation-based uses are applicable) is provided in schedule 2 of the MSR (an excerpt of schedule 2 is in the appendices to this report). The plan should detail the measures taken to ensure that wastewater treatment will provide the quality of wastewater required for the type of public access. The plan should also describe all signage and protective works needed to ensure public health and safety (as discussed in section 2.3.3.3.).

The plan should also describe how the volume of wastewater produced by the processing facility can be safely stored and applied to the ground during the time available for irrigation. All provisions for wet weather and emergency storage should also be described (section 2.3.3.1.).

Furthermore, the plan should describe how the treatment and application of wastewater will address potential environmental, human health and safety risks (as detailed in section 2.3.3.3. Step 1). The British Columbia Code of Practice for the Use of Reclaimed Water and the MSR will provide useful information in this regard. Although the plan is a 'nutrient management plan', all relevant components of the wastewater in addition to nutrients (i.e., metals, bacteria, protozoans and viruses) should also be addressed in order to meet MOE expectations.

A significant amount of work regarding nutrient management planning has been carried out in British Columbia under the auspices of the Environmental Farm Plan Program (www.bcac.bc.ca/efp_documents.htm). The Nutrient Management Reference Guide (NMRG), introduced at the beginning of this section, was prepared as a subcomponent of the Environmental Farm Planning Process.

Although nutrient management in the context of the Environmental Farm Planning Process primarily involves the application of manure for soil augmentation and fertilization, many of the planning techniques and procedures found in the NMRG are applicable to the development of a nutrient management plan for the use of slaughter and poultry processing facility wastewater.

Determining the nutrient concentrations in wastewater associated with slaughter and poultry processing facilities is an essential component of a nutrient management plan and can be estimated using production-based reference values, or can be measured at existing operations. The range of nutrient concentrations found in red meat and poultry processing operations wastewater is presented in section 2.3.3.3. Step 2.

It is important to note that it is the intent of the *Code* that slaughter and poultry processing wastewater from category A and B facilities not be used for the irrigation of crops intended for human consumption. Consequently irrigation using treated wastewater from these facilities will be generally limited to land growing forage crops unless a higher standard of wastewater quality is achieved (i.e., irrigation of land allowing unrestricted public access, such as parks or golf courses). Nutrient management planning guidelines proposed in this guidance document are based on the NMRG and it is recommended that **qualified professionals** refer to these guidelines, the NMRG and other relevant sources to develop a plan that will meet nutrient management objectives for the site to be irrigated.

2.3.3.3. The Nutrient Management Planning Process

Step1. Assess Environmental, Human Health and Safety Risk

As a minimum, the following site, terrain and access characteristics should be determined and evaluated when developing a nutrient management plan:

a) distance to surface water

b) minimum depth to groundwater

c) distance to wells or other sources used for potable water (setback distance usually required to be >30 m) or irrigation and any unused or closed well sites

d) distance to property boundaries, residences, hotels, restaurants, schools, churches or other places of worship, public parks, public highways or any other public or private facilities that may be impacted by wastewater used for irrigation

e) land use compatibility with any land use plans, zoning or bylaws

f) evidence of public access to, or use of, the property in question (and provision for signage and fencing)

g) likelihood of frequent worker contact with treated wastewater

h) determination of the period or periods when physical and climatic conditions allow irrigation to occur. The reference Guide to Irrigation System Design with Reclaimed Water provides information on the normal growing season, climatic moisture deficit, and estimated normal irrigation period for various regions in British Columbia. Periods when frozen ground or saturated soil conditions would allow wastewater and eroded soil to flow directly onto adjacent property or adversely impact ground or surface water must also be determined.

i) evidence or documentation of unstable or potentially unstable terrain and identification of any potential impact if a failure were to occur

j) evidence of any unique environmental sensitivity that may exist in the proximity of the site. This would include sensitive aquifers such as those found near Abbotsford, Langley, Prince George, Duncan, Grand Forks, Merritt, Osoyoos and Chilliwack. In addition, watercourses or lakes that are threatened or particularly sensitive to nutrient addition or bacterial contamination should be carefully assessed for potential impacts.

Step 2. Obtain Data Needed for Development of a Nutrient Management Plan

A. Determine Wastewater Volume and Nutrient Concentration

Determine (through estimation or measurement) the annual volume and nutrient concentration of wastewater that will be used for irrigation purposes. As discussed in section 2.3.3.1., the determination of wastewater volumes depends upon many factors, such as allowances for precipitation or evaporation which may impact uncovered storage reservoirs. With regard to determining the nutrient concentration in wastewater, Senes presented a range of nutrient concentrations in slaughter and poultry processing wastewater for Canadian processing facilities in Table 8.

Table 8: Nutrient Concentration in Slaughter and Poultry Processing Wastewater from Canadian Facilities.

Parameter	TKN (mg/L)	NH_4N (mg/L)	Total P (mg/L)	TSS (mg/L)
Canada	90 - 593	19 - 169	20 - 80	736 - 2,099

(From Senes 3-1)

The **qualified professional** may consider obtaining wastewater concentrations for additional macro or micro nutrients if they are considered to be relevant to site-specific conditions.

When designing proposed irrigation operations the **qualified professional** should consider using an "upper limit" estimate for nutrient concentrations and wastewater volumes if any environmentally sensitive situation exists at or near the irrigation site. Subsequent sampling of the wastewater discharge can then be used over time to refine the wastewater nutrient loading calculation. For application purposes an analysis (average concentration) is required for the following nutrients:

- Total nitrogen (N or TKN)
- Ammonium nitrogen (NH_4-N)
- Total phosphorus (P)
- Total potassium (K)
- Micronutrients as necessary

B. Determine Soil Nutrient Reserves and Anticipated Crop Nutrient Uptake

Soil nutrient reserves are determined by obtaining representative samples of soil from sites to be irrigated. **Qualified professionals** developing a nutrient management plan should refer to the NMRG document "Factsheet No. 1 (Soil Sampling for Nutrient Management 631.500-1)" for guidance on timing of sampling, obtaining representative samples, sampling equipment, sampling depth and sample handling.

Samples should be analyzed, as a minimum, for:

- available phosphorus (P)
- available potassium (K)
- nitrate-nitrogen (NO_3-N)

and, for spring samples in the interior region of British Columbia,

- ammonia-nitrogen (NH_4-N)

The laboratory analytical methods that must be used for these samples are also detailed in Factsheet No. 1. A list of British Columbia laboratories that are able to do agricultural soil analysis is contained in the NMRG document "Factsheet No. 7 (British Columbia Agricultural Testing Laboratories 631.500-7)".

Note that soil nutrient levels will vary from year to year and a nutrient management plan should normally specify that annual testing will be undertaken prior to each year's irrigation season so that a **qualified professional** can determine if the previous season's assessment of the wastewater application program is still applicable. The annual review should consider potential reduction (or augmentation) in sampling intensity based on site variability and other factors.

At this stage a suitable crop(s) should have been selected. For each crop grown and removed from the irrigated land, the anticipated crop yield must be determined. Where accurate records have been kept it is best to determine yield based on historical yields. As yields fluctuate from year to year, it is recommended to take the average of the previous three to five year period. If property records are not available, local historical yield averages may be available from a British Columbia Regional Agrologist (MAL) or from other local experts.

In order to determine the crop nutrient uptake, crop samples should either be analyzed or estimated for crop protein, phosphorus, potassium and moisture. The NMRG document "Factsheet No.2 (Forage Crop Sampling for Nutrient Management 631.500-2)" provides guidance on sample collection. This factsheet also provides guidance on calculating the irrigation site's dry yield, which is used to estimate the crop's requirement for N, P and K. Information on the average N, P and K content of all major crops is also available from the web site http://npk.nrcs.usda.gov/.

Step 3. Calculate Crop Nutrient Requirement

For the purposes of this planning process, "Crop Nutrient Requirement" (CNR) is defined as "the amount of nutrient that is biologically necessary for a crop (assuming all other related requirements are met) to produce an economically optimal and environmentally sustainable yield" (British Columbia Agriculture Council *et al.*). The CNR is considered equivalent to the amount of nutrient that would be harvested from the above ground biomass of the plant, based on the desired nutrient concentration in the plant tissue. The BCAC document also has useful information with regard to the CNR for forage and other crops. Note that CNR may be different from the crop nutrient uptake (Step 2) in that the CNR is related to optimal growth and is not necessarily equal to the nutrient concentrations determined through estimation or analyzed in crop samples. In fact, the nutrients in wastewater may provide the necessary 'top up' for optimal growth.

In addition to determining the amount of land required based on seasonal crop water requirements and nutrient uptake, an allowance for some leaching (use of more wastewater than calculated for plant use) must be incorporated to ensure that salt build-up in the soil does not occur.

Irrigation can be accomplished through the use of sprinklers, drip/trickle systems or subsurface drip irrigation systems. The type of system selected and the spacing and operating pressure of nozzles are important components for minimizing aerosol drift and ponding and to address specific topography and plant requirements (British Columbia Code of Practice for the Use of Reclaimed Water).

Step 4. Calculate Land Required for Irrigation Purposes (based upon the wastewater production rate)

The actual surface area available for irrigation is determined by taking into account environmental and human health risks identified in Step 1. The plan must detail how all environmental and human health risks are addressed in a manner which will prevent pollution or other impacts. This would normally involve, but is not limited to, a combination of appropriate buffer zones, barriers and timing of wastewater application. Potential stability issues should also be addressed by a **qualified professional** and any resulting restrictions to the application of wastewater must be considered when determining available surface area and rates of application. The appropriate wastewater application rate (i.e., 16.5 mm/hr for sandy loam soil) can be determined from the NMRG (see appendices for NMRG table 1), which provides maximum water application rates based upon soil texture and type of cultivation. The amount of land required can then be calculated taking into account the appropriate wastewater application rate, the wastewater production rate and other 'adjustment'

factors such as precipitation rates, evapotranspiration and restrictions due to public access.

Step 5. Calculate the Volume of Wastewater that can be Applied to Replace Nutrients Removed Through Crop Harvest.

Calculate the timing and wastewater application rates based on the application period as determined earlier.

Determine the method of irrigation to be used. Since irrigation of food crops using wastewater from category B facilities and wastewater containing domestic sewage from category A facilities is prohibited by the *Code*, irrigation options would likely be limited to various sprinkler irrigation systems.

This step must re-confirm that the discharge of wastewater, when applied in accordance with the nutrient management plan, will not cause pollution through bacterial contamination or other factors. This assessment should also ensure that sufficient leaching does occur to prevent an unacceptable salt build-up in soil.

The **qualified professional** should also address the agronomic soundness of a nutrient management plan, including whether some nutrients are being supplied adequately while others may be applied in excess. If so, the nutrient management plan must propose a strategy to avoid long term accumulation of nutrients, particularly phosphorus and potassium. Because of this challenge, the qualified professional may have to give priority to a specific nutrient to target for optimization in the nutrient management plan.

The NMRG "Factsheet No. 4 (Phosphorus Considerations in Nutrient Management 631.500-4)" and "Factsheet No. 5 (Potassium Considerations in Nutrient Management 631.500-5)" address the management of excess phosphorus and potassium in soils. Adding wastewater to soil already high in phosphorus could lead to pollution of sensitive receiving environments. Build-up of excess potassium could lead to unacceptable concentrations in animal forage which can adversely affect animal health. The **qualified professional** should address these conditions if they exist. Factsheets No. 4 and 5 provide guidance in this area.

Step 6. Provide Feedback to Wastewater Disposal and Storage Design

Ensure adequate storage of wastewater is available to accommodate normal irrigation requirements and unusual or emergency conditions. If the proposed irrigation area is insufficient for normal wastewater disposal needs, additional ground may be needed or alternate disposal methods for wastewater may have to be considered.

Step 7. Ongoing Sampling and Analysis

Section 2.3.3.3. Step 2 provides guidance on yearly sampling and analysis needed to support the development of a nutrient management plan. There may be factors that require wastewater nutrient levels to be sampled and analyzed more often than once a year, such as changes to the slaughter operation, or the amount of animals being slaughtered. Sampling of treated wastewater should be at a location which best

represents discharge quality and should occur as often as necessary to reasonably reflect fluctuations in wastewater nutrient concentrations.

In addition, the *Code* (section 9(1)) requires ongoing sampling and analysis to monitor compliance with wastewater irrigation quality standards set out in section 8(2) of the *Code*. Sampling of treated wastewater used for irrigation should be carried out prior to discharge, and every two weeks during the period when wastewater is being discharged. Analysis must show that *Code*-based standards are met before discharge begins.

Parameters to be sampled must include:

- Fat, oil and grease (FOG)
- Carbonaceous biochemical oxygen demand ($CBOD_5$)
- Total suspended solids (TSS)
- Total fecal coliform
- Total coliform

Sampling required by the *Code* is to be in accordance with the latest version of the Field Sampling Manual and analyses must be carried out by a laboratory registered with the Canadian Association for Environmental Analytical Laboratories (CAEAL) http://www.caeal.ca/.

Sampling results must be retained for at least 10 years, and must be made available for inspection by an officer (as defined in the EMA) within two days of a request by the officer.

3. Solid Waste Discharge and Disposal Guidelines

3.1. Introduction to Landfilling

As part of the process leading up to the development of the *Code*, an extensive technical review of solid waste landfilling practices associated with the slaughter and poultry processing industries was undertaken by Sperling Hansen Associates and Sylvis Environmental (Sperling). This report (Sperling, 2007) has been used extensively in the preparation of these guidelines.

Solid waste from slaughter and poultry processing facilities includes feathers, hides, bones, carcasses, manure (incidental to processing) and other non-liquid wastes[2]. No solid waste from domestic or municipal sources is allowed to be mixed in with solid waste originating from slaughter and processing facilities for landfilling under the *Code.*

The high moisture and organic content often associated with solid waste produced by slaughter and poultry processing facilities makes it a difficult material to landfill in large quantities. This moisture content results in the generation of leachate which is higher in volume and strength when compared to leachate produced by municipal refuse. This high moisture content can also lead to landfill instability if special care is not taken. As well, the high organic content of this waste has the potential to generate gas (and resulting odour issues) when landfilled.

Because of these concerns, precautions should be taken to ensure leachate is minimized or not generated if landfilling untreated solid waste (especially from larger slaughter and poultry processing facilities). Other options of dealing with solid waste (rendering, composting and incineration) should be investigated as well.

Some areas of British Columbia are served by rendering establishments (referred to in the WDR as the meat by-product processing industry). Reference to the National Renderers Association website: http://www.renderers.org/, provides contact information for member companies so that a facility owner can determine if any of these companies provide service (i.e., collection) to a particular area. Rendering establishments produce useful products from slaughter and poultry processing waste and therefore are considered to be a preferred method to deal with solid waste. Any costs associated with this option should be carefully weighed against the cost and potential liability of developing and operating an acceptable on-site landfill or composting facility.

Another disposal option that should be investigated prior to the development of an on-site landfill is the potential for using existing municipal solid waste landfills. Solid waste from slaughter and poultry processing facilities is considered to be an industrial waste and therefore may not be accepted at all municipal solid waste landfills. However, some municipal solid waste landfills in British Columbia presently accept small amounts of slaughter and poultry processing waste. In other cases, there is a possibility that

[2] It is not intended that other non-liquid wastes, such as rags or plastic containers be landfilled with slaughter waste.

some regional authorities may not favourably consider a request to accept this waste (Sperling, 2007). It should be noted that landfilling of slaughter and poultry processing waste at existing municipal solid waste landfills may require an amendment to the regional solid waste management plan and/or operational certificate, and the chance of success is not guaranteed. As well, there will likely be tipping fees associated with the disposal of slaughter and poultry processing facility solid waste at municipal landfills based upon tonnage and type of waste. A processing facility operator considering the use of a municipal solid waste landfill should first contact the local municipal or regional government to determine if this option is available.

Specified Risk Materials

As a result of the emergence of bovine spongiform encephalopathy (BSE) in cattle, the disposal of specified risk material (SRM) is regulated by the Canadian Food Inspection Agency (CFIA). Detailed information concerning SRM can be obtained from the CFIA website: http://www.inspection.gc.ca/english/anima/heasan/disemala/bseesb/enhren/enhrene.shtml. **The qualified professional** should ensure that all current enactments and requirements of municipal, regional, provincial and federal agencies with respect to SRM disposal, have been addressed (including the Agricultural Land Commission, see Appendix 4).

SRM's include the skull, brain, trigeminal ganglia (nerves attached to the brain), eyes, tonsils, spinal cord and dorsal root ganglia (nerves attached to the spinal cord) of cattle aged 30 months or older and the distal ileum (portion of the small intestine) of cattle of all ages. The CFIA controls the collection, treatment, transport, disposal, destruction or alternate use of SRMs. Risk assessments conducted by the CFIA have indicated that proper on-site disposal of SRMs pose a negligible risk for possible further infection.

Composting of SRMs prior to landfill to reduce volume may be considered. However, it is recommended that SRMs be composted separately to other non-SRM compost. The CFIA currently recommends that if on-site composting of SRMs is practiced as an alternative to landfilling, the composted material should not be applied to land directly grazed by domestic ruminants for at least 5 years. This recommendation may change over time as further research is carried out. It should be noted that composting of red meat and poultry processing wastes, as well as other organic wastes is strictly regulated by the British Columbia Organic Matter Recycling Regulation (B.C. Reg. 18/2002) (OMRR), which is discussed in further detail in section 3.6. As with the rendering option, the costs and benefits associated with acceptable composting operations should be carefully weighed against the cost of developing and operating an on-site landfill for untreated solid waste.

3.2. *Code* Requirements for Landfills Receiving Solid Waste

Definitions (for the purposes of these guidelines):

- The 200-year flood plain means land where the chance of a flood occurring in any given year is at least one in two hundred. Information on floodplain mapping in British Columbia can be obtained from the following website: http://www.env.gov.bc.ca/wsd/data_searches/fpm/reports/index.html.

- A landfill means a landfill, burial site or trench for the final disposal of solid waste.

- Unstable or potentially unstable terrain includes land subject to subsidence, landslides, avalanches or geological faults.

General Siting Requirements

A facility operator **disposing of 5,000 or less kg/ha/year of solid waste on land that receives an average total annual precipitation of 600 mm or less** is authorized to landfill this waste so long as siting conditions in section 10 (1) of the *Code* are met.

Approximately 5,000 kg of solid waste would be generated by the slaughter and processing of either, 15 cattle, 25 bison, 110 hogs, 225 sheep or 9,800 chickens.

It is important to note that if any of the section 10 (1) siting conditions cannot be achieved, and the facility owner still wishes to pursue a landfilling option for the disposal of solid waste, section 10 (3) of the *Code* requires that he/she **retain a qualified professional** to evaluate the landfill and to design a groundwater monitoring and assessment plan (see section 3.7 of these guidelines).

A qualified professional, after evaluating the potential site-specific impacts as a result of not being able to meet these siting conditions should, where necessary, propose more protective design or operational measures (enhancement measures) that will provide an equivalent degree of environmental or human health and safety protection as provided by the conditions set out in section 10 (1). Alternatively, the **qualified professional** should provide a technical rationale which would indicate that such a degree of environmental protection is not required.

Siting requirements specified in section 10 (1) of the *Code* require that the landfill:

- Must not be more than 2 metres wide (this reduces the exposure of the solid waste to precipitation)

- Must be located on a site that has a slope of less than 0.5% (this is a relatively flat site rising only 6 inches in 100 feet which reduces the difficulty in dealing with surface water runoff)

- Must be located at least 1 metre below ground level (this helps reduce the exposure of the solid waste to wind and allows for the application of adequate cover without significantly increasing natural elevations)

- Must be located within a property so that there is at least 50 metres between the property line and the boundary of the landfill (which allows for some attenuation of any leachate that may be produced)

- Must be located so that there is at least 4 metres between the seasonal high water table beneath the landfill and the bottom of the landfill (groundwater records may be available from local well drilling companies or the MOE [Water Stewardship Division] which can be used to estimate seasonal high water tables)

- Must not be located within 100 metres of the nearest surface water

- Must not be located within the 200-year flood plain
- Must not be located within 100 metres of unstable or potentially unstable terrain
- Must not be located within 30 metres of another landfill, either closed or currently in use (minimizes the 'additive' effects of similar landfills [burial sites or trenches] in close proximity)
- Must not be located within 300 metres of a residence, hotel, restaurant, school, church, public park, water supply well, or water supply intake (this minimizes the risk of impacting sensitive receptors).

Operational Requirements

- *Code* sections 11 (1) and 11 (2) require that solid waste discharged to a landfill (of any size) be covered immediately after disposal with at least 0.15 metres (6 inches) of low-permeability soil and an impermeable cover to prevent precipitation from entering the landfill. Typically, the impermeable cover consists of a tarpaulin placed in such a manner as to prevent water from entering the landfill. Low permeability soil is defined by the *Code* to be soil with hydraulic conductivity of 1 x 10^{-6} cm/s (e.g., clay). Soil with less hydraulic conductivity (i.e., 1 x 10^{-7} cm/s) would also be acceptable. The primary purpose of applying cover immediately upon discharge is to ensure that the waste is not disturbed or removed by small vectors such as birds or rats and also to reduce odour. Note that in order to prevent larger animals (such as bears) from disturbing or removing the solid waste, the installation of fencing may be required (see Appendix 5 for detailed information on fencing).
- *Code* section 11 (2) requires a person operating a landfill (of any size) for the disposal of solid waste from slaughter and poultry processing facilities to take measures to control fugitive dust and odour caused by the operation of the landfill. Section 1.3 and 3.9 of these guidelines addresses the control of fugitive dust and odour at landfill sites.
- *Code* section 13 requires that detailed records regarding the landfill be kept for a period of at least 10 years. These records include the dates of disposal of solid waste, the location of the landfill and the types and quantities (by mass) of solid waste disposed. These records are to be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.
- *Code* sections 12 and 14 detailing vector control and closure requirements are applicable to landfills of all sizes and must be followed. See sections 3.8 and 3.10 for additional information on these requirements.

3.3. Additional Technical Recommendations for Landfill Siting and Operation

In addition to *Code*-based **requirements** for the siting and operation of a landfill listed above, Sperling made a number of general technical **recommendations** which may be

of value to a qualified professional or a facility owner currently operating a landfill or, planning to develop a landfill. These recommendations are that:

a) surface water diversion systems be designed and installed in such a manner as to prevent water from entering the trench. A soil berm may be built around the trench if required;

b) the disposal trench be prepared/excavated to the required width (maximum 2 metres) and length to accept waste. A long narrow trench is considered to be operationally more efficient than a cell which covers a large area. The amount of water that can potentially enter the landfill from precipitation and produce leachate is directly proportional to the landfill's surface area. Consequently, the surface area should be minimized;

c) the trench be constructed progressively as required in order to minimize the amount of open trenching. This will reduce problems associated with covering the trench, potential falling hazards, infiltration, etc.;

d) waste be placed in maximum 0.6 metre (2 feet) thick lifts. Firm compaction is not required as this will promote leaching from the waste;

e) a 0.3 metre (1 foot) layer of material with high carbon content, such as wood chips, be placed in the bottom of the trench. The purpose of this layer is to absorb moisture and aid in the decomposition of the waste;

f) disposal sites not to be located in localized low spots in order to prevent surface runoff water from entering the trench;

g) once the 'per hectare' disposal limit (not to exceed 5,000 kg/year) has been reached, a new trench be started on a previously unused portion of the landfill site (maintaining the *Code*-required separation distance);

h) a burial trench should never be re-used;

i) electrified bear fencing be installed where required in certain parts of British Columbia to prevent access by large scavenging animals (see Appendix 5);

j) lime can be utilized to neutralize potential pathogen and odour issues if required. Lime should not be used unless there is a significant concern as it extends the time required for organic decomposition and may adversely impact leachate quality;

k) the maximum amount of waste to be discharged to a single disposal trench not exceed 2,500 kg;

l) the minimum thickness of low-permeability cover material to be applied immediately upon disposal be 0.5 metres; and

m) no more than 10% or 0.4 ha (whichever is greater) of the site be used for waste disposal is a single year.

In addition to the above technical recommendations provided by Sperling, the following general operational recommendations should also be considered:

a) security fencing be installed where required to prevent unauthorized access (see Appendix 5),

b) if solid waste is to be disposed of during winter months when the ground is frozen, it may be advisable that the trench be constructed in the fall. In addition, the operator should ensure that the open trench is covered with an impermeable cover to prevent precipitation from entering the landfill. The operator should also ensure that an adequate supply of low-permeability cover material is available so that waste can be immediately covered in order to reduce odour, infiltration and vector access. If winter conditions prevent this level of operation, the operator may consider freezing and securely storing the waste until the ground thaws enough to allow for disposal.

3.4. Special Design Elements for Large Volume Disposal

The *Code* requires that a person proposing to establish a landfill for the disposal of more than 5,000 kg/ha/year of solid waste from slaughter and poultry processing facilities ensure that:

a) the **evaluation of a landfill be undertaken by a qualified professional,**

b) if the landfill is constructed, **a qualified professional must also design a groundwater monitoring and assessment plan.** (Section 3.7. provides guidelines for the development of a groundwater monitoring and assessment plan), and

c) the person complies with the groundwater monitoring and assessment plan.

The potential for adverse impacts due to leachate generation (strength and volume), odours, vectors and site instability increases with larger amounts of waste. The siting requirements set in the *Code* (section 10 (1)) are based on technical information and experience which, if followed, are considered to be adequate to prevent pollution from landfills disposing of less than or equal to 5,000 kg/ha/year.

The evaluation and subsequent design of a landfill disposing of an amount of solid waste in excess of 5,000 kg/ha/year must account for these increased potential adverse impacts and install additional protective measures as required in order to provide a similar level of environmental or human health and safety protection to that offered by the *Code* for smaller landfills.

A key to this evaluation is to determine whether there is any need for additional or modified design/operational elements (enhancement measures). The **qualified professional is not bound by the *Code*-based siting requirements for smaller landfills.** However, the qualified professional must ultimately be satisfied that the natural attenuation of the underlying soils (with or without enhancement measures) will provide for adequate retention and biological treatment of leachate. If this is not the case, then the technical and economic feasibility of installing an engineered landfill with leachate capture and treatment systems may be considered. However, it should be

noted that Sperling suggests that the risk for adverse impacts is sufficiently greater for landfills exceeding a disposal rate of 5,000 kg/ha/year, and the report recommends in this case that facility owners choose alternate means of solid waste disposal. Consequently, it is incumbent on the **qualified professional** to apply extraordinary care when evaluating a landfill with an intended disposal rate in excess of 5,000 kg/ha/year.

The initial step in the evaluation of such a landfill is to incorporate all feasible conventional design and operational measures (as discussed in section 3.2.).

Once all appropriate and feasible conventional design aspects and operational measures have been applied to the site, the **qualified professional** should consider developing an estimate of the leachate generation rate and evaluate whether these protective measures are sufficient to ensure that appropriate groundwater water quality guidelines can be met or whether enhancement measures are required. Determination of groundwater quality at the property boundary is an important consideration. However, the groundwater quality at other sensitive locations may be important as well. The British Columbia Approved Water Quality Guidelines 2006 and the Compendium of Working Water Quality Guidelines for British Columbia 2006 are useful references with regard to numerical water quality guidelines. Key elements used in the evaluation by a qualified professional should include: distance to domestic water sources, depth to groundwater, groundwater flow regime, soil types, hydraulic conductivity and potential impacts of groundwater contamination.

If enhancement measures are required, the **qualified professional** may wish to evaluate whether composting (in accordance with the OMRR) prior to landfilling is feasible and will provide the required degree of environmental protection. If composting is not a practicable option then the qualified professional may wish to consider whether enhancement measures applied to 'natural control' landfills will provide adequate protection. Some enhancement measures proposed by Sperling include:

- maintaining a minimum of 8 metres separation between the seasonal high water table and the bottommost waste cell,
- placing cells (trenches) a minimum of 50 metres apart,
- ensuring there is a minimum 5 metres of low permeability soil (1×10^{-6} cm/s or less) below each waste cell (trench).

Some additional enhancement measures that may be considered are limiting the amount of waste disposed to a single trench, increasing the minimum thickness of low-permeability cover material applied immediately upon discharge and limiting the area of the landfill that can be used in a single year (as discussed in section 3.3.).

If a **qualified professional** determines that a natural control landfill with an enhanced level of protection provides for an inadequate level of environmental protection, the feasibility of an engineered landfill (discussed earlier) could be considered. However, the cost, features (leachate collection and treatment, impermeable liner, gas venting systems) and complexity of such systems will likely mean that engineered landfills are not practicable for the disposal of solid waste from the slaughter and poultry processing industry.

3.5. Special Design Elements for High Rainfall Areas

The *Code* requires that a person proposing to establish a landfill for slaughter and poultry processing solid waste in an area with an average annual precipitation of more than 600 mm ensure that:

a) an **evaluation of a landfill is undertaken by a qualified professional**,

b) if the landfill is constructed, **a qualified professional must also design a groundwater monitoring and assessment plan.** Section 3.7 provides guidelines for the development of a groundwater monitoring and assessment plan, and

c) the person complies with the groundwater monitoring and assessment plan.

As with large volume landfills (section 3.4) **the qualified professional is not bound by the *Code* section 10 (1) siting requirements** that apply to landfills located in areas receiving equal to or less than an average annual precipitation rate of 600 mm.

A useful source for precipitation information is the University of British Columbia's Climate BC web version program http://www.genetics.forestry.ubc.ca/cfgc/climate-models.html. Use of this program requires only the entry of the latitude and longitude for the site in question for the program to display the average total annual precipitation for that location.

Sperling recommends a number of potential design and operational enhancements that could be applied to facilitate development of an environmentally acceptable landfill in areas with average annual precipitation exceeding 600 mm. **Qualified professionals** considering landfill sites in these areas should review detailed information in this report.

Sperling further recommends alternate means of waste disposal (to landfilling) when waste volumes exceed 1,250 kg/ha/year in areas receiving more than an annual average of 1,000 mm of precipitation. A **qualified professional** considering the development of a landfill in an area receiving this amount of precipitation may consider enhancement measures including pre-treatment by composting and/or an engineered landfill as described in section 3.4. As well, it is important to ensure that any landfill operated under these conditions is subject to increased monitoring and rigorous operational requirements.

Because of the high potential for leachate production in areas experiencing annual average precipitation rates greater than 1,000 mm, the **qualified professional** should carefully evaluate distance to domestic water sources, depth to groundwater, groundwater flow regime, soil types, hydraulic conductivity and potential impacts of groundwater contamination to ensure that pollution will not occur.

3.6. Composting **(Under the Organic Matter Recycling Regulation *B.C. Reg. 18/2002*)**

Composting of solid waste from slaughter and poultry processing facilities may be considered either as an alternative to landfilling or as a form of pre-treatment prior to landfilling. In all cases, composting must be carried out in accordance with the requirements of the Organic Matter Recycling Regulation (OMRR) (British Columbia).

The OMRR considers poultry carcasses from domestic fowls such as chickens, turkeys, ducks or geese, including offal and viscera, as well as red meat waste, which includes carcasses of red-meat animals such as cattle, swine, sheep, fallow deer, farmed game and farmed bison, to be suitable for composting.

Composting in accordance with the OMRR means the controlled biological decomposition of organic matter which produces a stabilized earthy matter having the structure and properties of humus. The OMRR applies to the construction and operation or composting facilities as well as to the production, storage, sale and use of compost. Any person considering the composting of waste from slaughter and poultry processing facilities is advised to review the OMRR before proceeding. Note that certain provisions under the OMRR **require the involvement of a qualified professional**.

3.7. Preparing a Groundwater Monitoring and Assessment Plan

As discussed previously, the *Code* (Section 10 (2)) requires that a person proposing to construct a landfill:

a) for disposal of more than 5,000 kg/ha/year, or

b) in an area with an average precipitation of more than 600 mm/year, or

c) where any of the requirements in section 10 (1) of the *Code* cannot be met,

must ensure that **a qualified professional evaluates the landfill and, if deemed necessary, designs a groundwater monitoring and assessment plan** (*Plan*).

This section provides guidelines that may be useful to qualified professionals in the design of a *Plan.* Note that the *Plan* does not need to be submitted (to the MOE), however, it must be retained for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

The British Columbia Ministry of Environment publication, "Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills (GEM)" is a key reference document that should be reviewed by **qualified professionals** when developing a *Plan* as required by section 10 (2) of the *Code*.

The guidelines in this section are based upon the GEM and highlight the following important components that may be considered for inclusion in a *Plan*.

1. Detailed Site Investigation

It is recommended that a **qualified professional** carry out a hydrogeological investigation of the landfill site to define the hydrogeology and microgeology of the site. This investigation would likely be carried out when determining the initial suitability of the site. At least one groundwater sample would normally be collected from each lithological zone. Information from this investigation is useful to determine the appropriate location and number of suitable monitoring wells. A groundwater monitoring network should consist of a sufficient number of wells (typically 50 mm diameter PVC pipe equipped with a screen) installed at appropriate locations and depths, to yield samples that represent the quality of both ambient groundwater and leachate which

may have passed under or through the disposal area. Since the monitoring program is expected to operate over the life of the landfill and into the post-closure period, it is important to consider anticipated site development as well as any predicted changes in groundwater flow.

The goal of the monitoring program is to determine if there is a significant increase in contaminants over background levels and to ensure compliance with water quality guidelines (British Columbia Approved Water Quality Guidelines 2006 and the Compendium of Working Water Quality Guidelines for British Columbia 2006). Therefore, the selection and location of monitoring wells is very important.

2. Monitoring Period

A *Plan* is expected to provide for sampling during the operational phase of the landfill, and should also include appropriate provisions to conduct some sampling prior to landfilling at the site, as well as during the post-closure period. The post-closure period should be defined by the **qualified professional** based on site-specific information. Ideally, pre-start-up monitoring should be carried out for a minimum of one year prior to the commencement of landfilling.

3. Numbers and Location of Monitoring Wells

In order to effectively detect and evaluate potential or existing groundwater contamination, monitoring wells should be located at the following locations:

a) a minimum of one upgradient well to determine background water quality and groundwater elevation,

b) a minimum of one well immediately adjacent to and at the downgradient edge of the landfilled area, with the well screen intercepting the water table to enable sampling of “raw” leachate, and

c) an array of monitoring wells (usually three or more) situated downgradient of the landfill and perpendicular to groundwater flow in the horizontal plane to detect and determine the extent and concentration of any leachate plumes. Additional wells further downgradient from the landfill may be needed if a leachate plume is detected. Downgradient water quality at the property boundary is of particular importance.

Hydrogeological investigations (as discussed previously) will ultimately determine the number and location of groundwater monitoring wells. In order to facilitate early contaminant detection, monitoring wells should be located to sample groundwater from the uppermost aquifer at the closest practicable distance from the site boundary encompassing all possible routes to detect leachate migration.

It is recommended that any domestic drinking water sources within reasonable proximity (300 metres) to the landfill site be monitored prior to landfill start-up, and at least annually thereafter, to provide assurance to nearby residents that drinking water quality guidelines are being met.

4. Monitoring Frequency and Parameters

Groundwater monitoring wells should normally be sampled at a minimum frequency of four times per year, preferably starting one year in advance of the start of landfill operations. Consideration should be given to monitoring the following parameters:

Field tests

- pH, redox potential (Eh), dissolved oxygen, specific conductance
- groundwater elevation
- landfill site inspection documenting, preferably using photographs and GPS, location of seeps or any other areas of concern

Laboratory tests

- pH, specific conductance
- total dissolved solids
- total solids (to determine if sampling contamination has occurred)
- $CBOD_5$
- COD
- ammonia
- total Kjeldahl nitrogen (TKN)
- nitrate
- chloride
- fecal coliform
- metals

Analysis must be carried out by a laboratory registered with the Canadian Association for Environmental Analytical Laboratories (CAEAL) http://www.caeal.ca/.

5. Monitoring Well Construction, Decommissioning and Sampling Procedures

It is important that the *Plan* address the construction and sampling protocols associated with the development, operation and closure of monitoring wells by describing how well construction, sampling and closure procedures will ensure that the samples are representative of groundwater quality and the system is protective of the groundwater resource. The Field Sampling Manual, GEM and the British Columbia Groundwater Protection Regulation (B.C. Reg. 299/2004) are excellent references in this regard. The *Plan* should describe applicable sampling procedures and provide the qualifications of personnel who will be sampling the wells.

The *Plan* should also include a quality assurance and quality control program. The quality assurance component should require that an appropriate number of blind replicates, blind references, spiked samples and blank samples be taken. Laboratory quality control can be assured by the use of a laboratory registered with CAEAL.

6. Monitoring Assessment

The *Plan* should describe the elements to be contained in an annual monitoring and assessment report. The first report would normally be prepared one year after the landfill start-up. The assessment should determine if there has been any significant change in groundwater quality resulting from the landfilling operation and should compare groundwater quality to the appropriate water quality guidelines.

The *Plan* should set out a protocol in which notification is provided to the MOE if the sampling results or annual review and assessment suggest there may be an impact or potential impact on the environment, public health, or safety.

All data and other records must be retained for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

3.8. Preparing a Vector Control Plan

A vector, as defined in this *Code,* means an organism that is capable of transmitting a pathogen from one facility, waste source, product or organism to another facility, waste source, product or organism. Vector organisms include, but are not limited to, flies and other insects, rodents, bears and birds.

Section 12 of the *Code* requires that a person intending to operate a landfill complete and retain a "Vector Control Plan" (VCP) setting out how the person intends to control vectors at the landfill. The *Code* does not require that this VCP be prepared by a qualified professional, but the landfill operator should ensure he/she exercises reasonable due diligence. There is no requirement to submit the VCP (to the MOE) however, it must be retained for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

In most locations in British Columbia there is a potential for impact from all the vectors described above and consequently measures to reduce access by these animals, organisms and insects should be included in the VCP.

A VCP should also provide measures to prevent large wildlife (i.e., bears) from gaining access to the solid waste if the site is located in or near their habitat. Electric fencing has proven to be a useful measure in reducing bear access to municipal landfills and should be considered for slaughter and poultry processing waste landfills where required. See Appendix 5 for detailed information on the design, construction and maintenance of electric fencing.

Application of immediate cover in accordance with the *Code* (as a minimum), or as may be recommended by a qualified person, is considered to be a crucial step in the control of vectors. In most municipal solid waste landfills, soil cover material is also compacted which increases the protection from vector access. However, compaction of slaughter and poultry processing facility waste in a trench is not recommended since it promotes the generation of leachate, and therefore, this additional measure of protection from vectors is not available.

The VCP should include an ongoing assessment protocol which is designed to regularly evaluate the effectiveness of immediate and final covering with soil, as well as detailing other operational measures which may be used as required to prevent or reduce access by vectors.

The VCP should provide a prioritized list of available additional measures that could be taken if the assessment indicates that additional control measures are required. Some additional measures which could be considered include application of a thicker or denser immediate soil cover, reduction in the size of the landfill exposed area, elimination of standing water near the site, use of repellents, insecticides or rodenticides and pre-treatment by composting.

The VCP should provide for a mechanism to notify the MOE if the assessment and implementation of additional measures indicate there is a significant vector or wildlife access problem.

3.9. Fugitive Dust and Odour Control for Landfilling Operations

General measures for control of fugitive dust and odour are discussed in section 1.3. of these guidelines.

The potential to generate odour from a landfill operation is significant due to the semi-solid nature of some components of the solid waste stream, as well as its putrescibility. Accordingly, proper attention given to housekeeping, as well as the application of suitable cover material immediately after disposal (*Code* requirement section 11(1)), are important considerations. Housekeeping measures include the use of transport vehicles that provide for adequate containment (water tight with secure lid) and taking care during the unloading process to ensure that no solid waste is discharged beyond the disposal trench. The transport vehicles (and/or totes) require regular cleaning in order to prevent them from becoming a source of odour. In the event that odours are noticed at the landfill, the application of lime (sparingly) can provide some control.

Composting, if undertaken prior to landfilling as discussed previously (in section 3.6.), may be a potential source of odour. Accordingly, the OMRR requires that **an odour management plan be developed by a qualified professional for new composting facilities** which stipulates how air contaminants from the composting facility will be discharged in a manner that does not cause pollution. These measures are site-specific, rely upon the experience of **qualified professionals** and may include the use of biofilters and negative pressure containment facilities.

3.10. Landfill Closure

3.10.1. General Requirements

Upon closure of the landfill, section 14 of the *Code* requires:

a) that the landfill be covered with low-permeability soil (hydraulic conductivity of 1×10^{-6} cm/s) to a thickness of at least 1 metre such that it extends at least

0.3 metres above the ground surface and at least 0.5 metres beyond the landfill site, and

b) for landfills receiving more than 5,000 kg/ha/year of solid waste, the director (MOE) be notified of the intended closure and that a **landfill closure plan prepared by a qualified professional** be completed and retained. Both of these duties are required to be undertaken at least three months prior to the closure of the landfill. The landfill closure plan may be amended by the director and if so, the landfill operator is required to comply with the plan as amended. The landfill closure plan is required to be retained for at least 10 years and be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

3.10.2. Preparation of a Landfill Closure Plan

The landfill closure plan should document in sufficient detail the measures to be taken in order to satisfy legislated requirements, and to provide for adequate environmental and human health protection for a post-closure period, as defined by the **qualified professional**.

The key elements in a landfill closure plan are as follows:

1. A groundwater monitoring program. This program should consider groundwater monitoring that occurred during landfill operation and provide a rationale for any longer term monitoring proposed. Important groundwater monitoring considerations to be included in a landfill closure plan include:
    - the location of long term monitoring wells,
    - information concerning responsibility for long term maintenance and sampling of wells,
    - duration and frequency of sampling,
    - parameters to be sampled,
    - a reporting schedule, and
    - a mechanism to address any adverse impacts that may be discovered.
2. A description of the anticipated final land use and whether this use is consistent with local zoning.
3. An estimate of the total mass of solid waste discharged to the landfill site. Note that records of landfill use (including the quantity of solid waste disposed) are required to be kept (*Code* section 13).
4. A description of the final cover layer(s) and the methods and practices to be taken to install these layers. Note that the thicknesses and dimensions specified in the *Code* are minimum requirements for the low permeability cover layer only. Additional subsoil or topsoil layers may be recommended by a qualified professional in order to promote the growth of vegetation.

5. A description of the measurement techniques to be used to verify that the thickness and other dimensional requirements, as specified in the *Code,* have been achieved and that grading has been conducted in such a manner as to prevent the ponding of surface waters.
6. A description of the vegetation that is to be planted or expected to become established naturally.
7. Provision for erosion protection, maintenance of cover and vegetation/soil amendments, as required.
8. Measures required to prevent the run on/run off of surface waters.
9. An inspection schedule.
10. Corrective action to be taken in the event that the groundwater water quality deteriorates.
11. Record keeping and reporting requirements.

4. Incineration Guidelines

Division 2 (Part 4) of the *Code* sets out standards and conditions for the incineration of waste from slaughter and poultry processing facilities. Only solid waste produced by slaughter or poultry processing industries (see *Code* definitions) is allowed to be incinerated in accordance with the *Code.* Wastes from other sources cannot be mixed with this solid waste prior to incineration. Those slaughtering for personal use are exempt from the requirements of the *Code*.

A person contemplating use of an incinerator for the disposal of SRM should contact the Canadian Food Inspection Agency to determine any additional requirements to those specified in the *Code*.

4.1. *Code* Requirements

4.1.1. Siting

Section 15 of the *Code* requires that an incinerator:

a) must not be located within 500 metres of a residence (other than a residence of the person operating the facility), and

b) must not be located within 1,000 metres of an existing business (other), school, hospital or continuing care facility.

4.1.2. Operational

Section 16 (1) of the *Code* requires that an incinerator, including all equipment that is an integral part of the incinerator or is used to operate the incinerator, must be installed, operated and maintained in accordance with the manufacturer's specifications and recommended procedures.

Section 17 of the *Code* requires that the loading rate for continuous feed incinerators not exceed 400 kg/hr and for batch feed incinerators not to exceed 400 kg/load. In order to ensure that the loading rate does not exceed these limits, the waste must be weighed prior to loading.

4.1.3. Emission Limits

The following emission limits are not to be exceeded (*Code* section 18):

a) total particulate matter of not more than 50 mg/m^3 at the reference conditions of dry gas at 25º C and 101.3 kPa, corrected to 11% oxygen, and

b) total opacity of not more than 10% averaged over 6 consecutive minutes.

4.1.4. Stack Monitoring and Record Keeping

Section 19 (1) of the *Code* requires that a person operating an incinerator conduct stack monitoring on the first day of operation and again no later than one year after the first stack sample. The director may require that additional stack monitoring be undertaken if he/she considers it to be necessary or advisable.

Stack sampling facilities must be constructed and stack monitoring must be conducted in accordance with the Field Sampling Manual.

The person operating the incinerator must keep records of stack monitoring results as well as the quantities of waste disposed of in the incinerator. These records must be kept for 10 years and must be made available for inspection by an officer (as defined in the EMA) within two days of a request by that officer.

4.1.5. Fugitive Dust and Odour Control

General measures for the control of fugitive dust and odour are discussed in section 1.3. of these guidelines.

Fugitive dust sources associated with incinerator operations include waste storage prior to incineration, and activities associated with charging the incinerator.

Use of interlocking blocks, concrete enclosures, fences or tree planting may be useful techniques to reduce the entrainment of fine particulate matter at incinerator sites due to wind activity.

The potential to generate fugitive odour is significant due to the semi-solid nature of some components of the solid waste stream, as well as its putrescibility. Good housekeeping is needed to minimize odour generation. Stockpiling of waste at the incinerator site should be minimized and, if required, the waste storage facility may be kept under negative pressure and the vents equipped with odour scrubbing equipment. Other odour control measures include refrigeration of stored waste at the processing facility (or incinerator site), use of transport vehicles that provide for adequate containment (water tight with secure lid) and taking care during the unloading process to ensure that no solid waste is discharged to the ground or other locations where it could decompose. The transport vehicles (and/or totes) require a regular cleaning and maintenance program to prevent them from becoming a source of odour.

4.2. General Guidelines

As part of the process leading up to the development of the *Code,* an extensive review of the air emission requirements and technical standards associated with the incineration of waste from the slaughter and poultry processing industries was undertaken by Levelton Consultants Ltd. Some of the operational and monitoring recommendations contained in their report have been incorporated into the *Code.* However, some additional recommendations that are considered to be best

management practices (not already contained in these guidelines) and which may be of interest to a facility owner contemplating the incineration of solid waste are as follows:

- reduce the animal carcass size and parts of the animal carcass prior to incineration,
- duct the air from the installation and pre-combustion equipment to combustion chambers,
- install alarms and interlock combustion temperatures to charging mechanisms,
- ensure that a buffer zone of 250 metres is maintained around the incinerator,
- measure the temperature of the gas stream exiting the primary and secondary combustion chambers, and
- conduct regular olfactory and visual measurements of the emissions from the incinerator.

When considering the installation of incineration facilities, perhaps as an alternative to landfilling, the facility operator should first determine if there are any existing local or airshed quality issues which may be impacted by the operation of the proposed incinerator.

The *Code* sets out emission standards (section 18), as well as operating, siting, monitoring and record-keeping requirements. However, there may be site-specific situations that exist due to a current or developing air quality problem, airshed management plan, local bylaw or regulation that could result in more stringent conditions being required for incinerators used to dispose of solid waste from slaughter and poultry processing facilities.

Metro Vancouver, formerly known as the Greater Vancouver Regional District, has the delegated authority under the *Environmental Management Act* (section 31) to manage air emissions within their jurisdiction. If a proposed slaughter and poultry processing waste incinerator is to be located within Metro Vancouver, the facility operator should first contact Metro Vancouver authorities to determine if the operation of the incinerator may be subject to additional requirements contained in applicable Metro Vancouver air quality management bylaws. The *Code* is considered to be a 'baseline' regulatory instrument applicable for the entire province. However, enhancements are possible through the exercise of appropriate bylaws.

Air quality concerns in British Columbia include exposure to:

- particulate matter and/or ozone at concentrations that could lead to detrimental impacts on human health and ecosystem effects,
- impairment of visibility, and
- odorous emissions.

Emissions from incinerators produce both fine particulates and greenhouse gases. Fine particulates (<2.5 microns) are presently considered to be the type of air pollution of most concern in British Columbia (British Columbia Ministry of Environment Slaughter

and Poultry Industries Policy Intentions Paper for Consultation). The Government of British Columbia is also committed to a significant reduction of greenhouse gases. See the MOE Air Protection website for additional information regarding air quality issues and priorities in British Columbia.

"Airshed planning" is one of the most commonly used approaches in British Columbia to address complex air quality management issues. This level of planning often results from community concern with regard to local air pollution and is intended to provide a multi-stakeholder process for coordinating activities in an airshed. A person considering incineration of slaughter and poultry processing waste should first contact local authorities, as well as the MOE, to determine if an airshed management plan is in place or being developed.

In those areas currently in an airshed planning process, should *Code*-based requirements be considered insufficient to meet the requirements of an airshed management plan, or if it is determined that the incinerator's contribution to an airshed may lead to unacceptable cumulative impacts, it would be prudent for the proponent to consider other options. These options could include utilizing other disposal methods (such as landfilling), installing improved emissions treatment equipment, or relocating to a less sensitive area.

In addition, the MOE has committed to a target of achieving or maintaining Canada Wide Standards for PM 2.5 (particulate matter less than 2.5 microns in diameter) and ozone in all monitored British Columbia communities by 2010. To achieve this target, new establishments may be required to meet more stringent specified air emission requirements based on:

- specific air quality concerns within an airshed where an airshed plan is being developed or implemented, or
- whether the location is within an airshed falling under the "keeping clean areas clean" commitment in the Canada Wide Standards agreement.

A proactive, cooperative and public approach to ensuring airshed quality is recommended in order to gain local support for any incineration project being contemplated.

Although the *Code* does not require the involvement of **qualified professionals** with regard to the use of incineration for the disposal of solid waste from the slaughter and poultry processing industries, the facility operator should consider engaging qualified persons in view of the complex and technical nature of the incineration process.

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5. APPENDICES

Appendix 1.

Code of Practice for the Slaughter and Poultry Processing Industries (B.C. Reg. 406/2007) (includes amendments up to December 6, 2007).

NOTE: THIS APPENDIX PROVIDES A COPY CODE OF PRACTICE FOR THE CONVENIENCE OF THE GUIDELINE USER. THE USER SHOULD NOT ASSUME THIS COPY IS CURRENT AND MUST CONTACT THE MINISTRY OF ENVIRONMENT TO DETERMINE IF AMENDMENTS HAVE OCCURRED.

B.C. Reg. 246/2007
M176/2007

Deposited July 4, 2007
sections 1 and 3 to 19 effective June 30, 2007;
section 2 effective September 30, 2007

Environmental Management Act

Code of Practice for the Slaughter and Poultry Processing Industries

[includes amendments up to B.C. Reg. 406/2007, December 6, 2007}

Contents

PART 1 – DEFINITIONS

Definitions

1 In this regulation:

"200-year flood plain" means land where the chance of a flood occurring in any given year is at least one in two hundred;

"Act" means the *Environmental Management Act*;

"agronomically sound rate", relative to nutrient application, means a rate of application that supplies all the nitrogen required by a crop being grown, but allows very little or none of the nutrients to penetrate into the groundwater or below the area where the nutrients are used by the crop;

"category A facility" means a facility that

(a) discharges less than 5 cubic metres of wastewater per day, and

(b) is either

(i) an establishment where slaughter-industry processes are carried out, producing less than 60 tonnes live weight killed red meat per year, or

(ii) an establishment where poultry-processing industry processes are carried out, producing less than 40 tonnes live weight killed poultry per year;

"category B facility" means a facility that

(a) discharges 5 or more cubic metres of wastewater per day, or

(b) is either

(i) an establishment where slaughter-industry processes are carried out, producing 60 tonnes or more live weight killed red meat per year, or

(ii) an establishment where poultry-processing industry processes are carried out, producing 40 tonnes or more live weight killed poultry per year;

"domestic sewage" has the same meaning as in the Sewerage System Regulation, B.C. Reg. 326/2004;

"farmer" means a person who operates a farm on land classified as a farm under the *Assessment Act*;

"incinerator" means an incinerator used to dispose of solid waste;

"landfill" means a landfill, burial site or trench for the final disposal of solid waste, and does not include a landfill for the discharge of any waste that contains or is mixed with domestic or municipal refuse;

"low-permeability soil" means soil with hydraulic conductivity of 1×10^{-6} cm/s;

"poultry processing industry" has the same meaning as in Schedule 2 to the Waste Discharge Regulation;

"slaughter industry" has the same meaning as in Schedule 2 to the Waste Discharge Regulation;

"processing waste" means wastewater and solid waste;

"qualified professional", in relation to a duty or function under this code, means an individual who

(a) is registered in British Columbia with a professional organization, is acting under that organization's code of ethics, and is subject to disciplinary action by that organization, and

(b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function;

"solid waste" includes feathers, hides, bones, carcasses, manure and other non-liquid wastes produced by the slaughter industry or the poultry processing industry;

"vector" means an organism that is capable of transmitting a pathogen from one facility, waste source, product or organism to another facility, waste source, product or organism;

"wastewater" means processing water which may contain blood, fat, oil, grease, industrial cleaners and other liquid wastes produced by the slaughter industry or the poultry processing industry;

"watercourse" means a place that perennially or intermittently contains surface water, including

(a) a lake, river, creek, canal, spring, ravine, swamp, saltwater marsh or bog, and

(b) a drainage ditch leading into anything referred to in paragraph (a);

"Waste Discharge Regulation" means the Waste Discharge Regulation, B.C. Reg. 320/2004.

[am. B.C. Reg. 406/2007, s. 1.]

PART 2 – GENERAL

Registration information

2 (1) Subject to subsection (2), a person must register under section 4 of the Waste Discharge Regulation for the purposes of an exemption under that section in relation to this code, and must include, with the other information required under section 4 (2) of that regulation, the following information:

(a) the annual production, in tonnes of live weight killed per calendar year, of red meat and of poultry products by the person's facility;

(b) the maximum amount of wastewater discharged from the person's facility, in cubic metres per day;

(c) Repealed. [am. B.C. Reg. 406/2007, s. 2.]

(d) a list of the following information or plans that have been completed as required under this code:

(i) a nutrient management plan under section 8 (3);

(ii) a groundwater monitoring and assessment plan under section 10 (2) (d);

(iii) a vector control plan under section 12;

(iv) a landfill closure plan under section 14 (2) (b).

(2) A person engaged in the slaughter industry or the poultry processing industry is not required to register under section 4 of the Waste Discharge Regulation for the purposes of an exemption under that section in relation to this code if the products the person produces from either of those industries are for the person's personal use and not for resale.

[am. B.C. Reg. 406/2007, s. 2.]

Records and plans

3 Records required to be kept under this code and plans referred to in section 2 (1) (d) must be

(a) retained for at least 10 years, and

(b) made available for inspection by an officer within 2 days of a request by the officer to inspect those records.

Exception

4 A person engaged in the slaughter industry or the poultry processing industry is required to comply with neither Part 3 nor 4 if the products the person produces from either of those industries are for the person's personal use and not for resale.

PART 3 – DISCHARGE OF WASTEWATER

Discharge by category A facilities

5 A person operating a category A facility

(a) must not discharge wastewater directly into groundwater or into a watercourse,

(b) must take measures to control fugitive dust and odour caused by the operation of the category A facility, and

(c) must keep records of the following information:

(i) the amount of wastewater discharged, in cubic metres per day, from the category A facility for any period during which there is a discharge;

(ii) production volumes of red meat or poultry, in tonnes of live weight killed per year.

Discharge by category B facilities

6 A person operating a category B facility

(a) must comply with section 5, and

(b) must ensure that a discharge of wastewater from the category B facility is carried out in accordance with either section 7 or 8, as applicable.

Subsurface discharge of wastewater

7 (1) Wastewater discharged into the subsurface of the ground from a category B facility must not surface and must not cause the groundwater table to be raised to the surface.

(2) A person discharging wastewater under subsection (1) must conduct inspections of the discharge site to ensure compliance with that subsection.

(3) The subsurface wastewater disposal system of a category B facility that discharges wastewater into the subsurface of the ground for the first time after September 30, 2007, must be designed by a qualified professional and installed according to that design.

(4) A category B facility that has discharged wastewater contrary to subsection (1) may resume discharging wastewater into the subsurface of the ground if the discharge is carried out in accordance with a plan designed by a qualified professional.

(5) A person operating either a category A facility or a category B facility may discharge wastewater containing domestic sewage into the subsurface of the ground if

(a) the domestic sewage source is from the facility,

(b) the discharge complies with subsection (1),

(c) the person complies with subsection (2), and

(d) the subsurface disposal system is designed by a qualified professional and installed according to that design.

[am. B.C. Reg. 406/2007, s. 3.]

Wastewater irrigation

8 (1) Wastewater must not be discharged on ground with agricultural crops intended for human consumption.

(2) Except for wastewater discharged by a farmer under subsection (5), wastewater discharged from a category B facility onto the surface of the ground to irrigate that ground must meet all of the following conditions:

(a) it must not contain more than 10 mg per litre of fat, oil or grease;

(b) it must not exceed a carbonaceous biochemical oxygen demand concentration of 45 mg per litre;

(c) it must not contain more than 60 mg per litre of total suspended solids;

(d) it must not contain more than total coliform organisms of 1 000 per 100 ml of wastewater and total fecal organisms of 200 per 100 ml of wastewater.

(3) A person intending to discharge wastewater from a category B facility under subsection (2) must ensure that

(a) a qualified professional designs a nutrient management plan for the beneficial use of treated wastewater for irrigation, and

(b) the nutrient management plan referred to in paragraph (a) is carried out as designed.

(4) A plan referred to in subsection (3) (a) must include

(a) a description of the public access to and use of the ground, and

(b) an analysis of the effect on the ground of the wastewater discharged on it from the category B facility.

(5) Wastewater discharged by a farmer onto the surface of the farmland to irrigate that land

(a) must be discharged at an agronomically sound rate, and

(b) must not exceed 100 cubic metres annually.

(6) A person operating either a category A facility or a category B facility may discharge wastewater containing domestic sewage onto the surface of the ground if

(a) the domestic sewage source is from the facility,

(b) the discharge complies with subsections (1) and (2), and

(c) the person complies with subsection (3) and (4).

[am. B.C. Reg. 406/2007, s. 4.]

Sampling and analysis

9 (1) To ensure compliance with section 8 (2), a person discharging wastewater from a category B facility under that section must ensure that sampling and analysis of the wastewater are carried out

(a) before the wastewater is discharged, and

(b) every two weeks during the period when the wastewater is being discharged.

(2) The sampling and analysis required under subsection (1) must be carried out

(a) in accordance with the requirements of the latest version of the Field Sampling Manual issued by the ministry, and

(b) by a laboratory registered with the Canadian Association for Environmental Analytical Laboratories.

(3) A person referred to in subsection (1) must keep records of the results of the sampling and analysis carried out under this section.

PART 4 – DISCHARGE AND DISPOSAL OF SOLID WASTES

Division 1 – Landfills

Landfill site

10 (1) Subject to subsection (3), a landfill

(a) must not be more than 2 m wide,

(b) must be located

(i) on a site that has a slope of less than 0.5%,

(ii) at least 1 m below ground level,

(iii) within a property so that there is at least 50 m between the property line and the boundary of the landfill, and

(iv) so that there is at least 4 m between the seasonal high water table beneath the landfill and the bottom of the landfill, and

(c) must not be located within

(i) 100 m of the nearest surface water,

(ii) the 200-year flood plain,

(iii) 100 m of unstable or potentially unstable terrain,

(iv) 30 m of another landfill, either closed or currently in use, or

(v) 300 m of a residence, hotel, restaurant, school, church, public park, water supply well, or water supply intake.

(2) A person proposing to establish a landfill

(a) for the disposal of more than 5 000 kg/ha/year of solid waste,

(b) in an area with an average precipitation of more than 600 mm/year, or

(c) that will not meet a requirement set out in subsection (1),

must ensure that

(d) a qualified professional evaluates the landfill and designs a groundwater monitoring and assessment plan, and

(e) Repealed. [B.C. Reg. 406/2007, s. 5.]

(f) the person complies with the plan referred to in paragraph (d).

(3) A landfill established under subsection (2) in compliance with a plan referred to in paragraph (d) of that subsection is not subject to the requirements of subsection (1). [am. B.C. Reg. 406/2007, s. 5.]

Landfill use

11 (1) Solid waste disposed of at a landfill must immediately after the disposal be covered with

(a) at least 0.15 m of low-permeability soil, and

(b) an impermeable cover to prevent precipitation from entering the landfill.

(2) A person operating a landfill must take measures to control fugitive dust and odour caused by the operation of the landfill.

Vector control plan

12 A person intending to begin operating a landfill must complete and retain a plan setting out how the person intends to control vectors at the landfill. [am. B.C. Reg. 406/2007, s. 6.]

Records of use

13 A person operating a landfill must keep records containing all of the following information:

(a) the dates of disposals of solid waste made at the landfill;

(b) the location of the landfill;

(c) the types and quantities, by mass, of solid wastes disposed of at the landfill.

Landfill closure

14 (1) A landfill must be closed by covering the landfill with at least 1 m of low-permeability soil that extends

(a) at least 0.3 m above ground level, and

(b) at least 0.5 m beyond the landfill site.

(2) At least 3 months before the closure of a landfill referred to in section 10 (2) (a), the person operating the landfill must

(a) notify the director of the intended closure,

(b) complete and retain a landfill closure plan, prepared by a qualified professional, for the closure of the landfill, and

(c) comply with the plan referred to in paragraph (b), or, if the plan is amended under subsection (3), with the plan as amended.

(3) The director may amend a plan referred to in subsection (2) (b).

(4) A person must not deposit solid waste at a landfill that has been closed.

[am. B.C. Reg. 406/2007, s. 7.]

Division 2 – Incineration

Incinerator sites

15 An incinerator must not be located

(a) within 500 metres of a residence other than a residence of the person operating the facility, and

(b) within 1 000 metres of an existing

(i) other business,

(ii) school,

(iii) hospital, or

(iv) continuing care facility.

Operation of incinerators

16 (1) An incinerator, including all equipment that is an integral part of an incinerator or is used to operate an incinerator, must be installed, operated and maintained in accordance with the manufacturer's specifications and recommended procedures.

(2) A person operating an incinerator must take measures to control fugitive dust and odour caused by the operation of the incinerator.

Loading rates

17 The maximum loading rates for an incinerator are as follows:

(a) for a continuous feed incinerator, 400 kg/hour;

(b) for a batch feed incinerator, 400 kg/load.

Emission limits

18 An incinerator must not exceed the following emission limits:

(a) total particulate matter of not more than 50 mg/m^3 at reference conditions of dry gas at 25°C and 101.3 kPa, corrected to 11% O_2;

(b) total opacity of not more than 10% averaged over 6 consecutive minutes.

Stack monitoring and record keeping

19 (1) Subject to subsection (2), a person operating an incinerator must conduct stack monitoring

(a) on the first day of operation, and

(b) no later than one year after the day that stack monitoring was last conducted.

(2) Stack monitoring must be conducted in accordance with the Stationary Air Emissions Testing section in the latest version of the Field Sampling Manual issued by the ministry.

(3) The director may require testing in addition to the stack monitoring required under subsection (1) if the director considers this necessary or advisable in the circumstances.

(4) A person operating an incinerator must keep records

(a) of the results of the stack monitoring analysis conducted under this section, and

(b) of the quantities of solid waste disposed of by the incinerator.

[Provisions of the *Environmental Management Act*, S.B.C. 2003, c. 53, relevant to the enactment of this regulation: sections 22 and 138 (3) (h)]

Appendix 2.

Municipal Sewage Regulation (MSR) Tables and Schedules

This appendix contains MSR tables and schedules referenced in the guidelines. The user is encouraged to refer to the MSR for more detailed information. Tables and explanatory notes are taken from the MSR as written and may not be directly applicable to discharges from slaughter and poultry processing facilities.

Schedule 2. (excerpt)

1. Types of Unrestricted Public Access:

URBAN
- Parks (see restrictions in MSR schedule 2 explanatory note 6)
- Playgrounds
- Cemeteries
- Golf Courses (see restrictions in MSR schedule 2 explanatory note 6)
- Road Rights-of-Way
- School Grounds (see restrictions in MSR schedule 2 explanatory note 6)
- Residential Lawns
- Greenbelts
- Vehicle and Driveway Washing
- Landscaping around buildings
- Toilet flushing
- Outside landscape fountains
- Outside fire protection
- Street cleanings

AGRICULTURAL
- Aquaculture
- Food crops eaten raw
- Orchards and vineyards
- Pasture (no lag time for animal grazing)
- Frost protection, crop cooling and chemical spraying on crops eaten raw (see MSR schedule 2 explanatory note 17)
- Seed crops

RECREATIONAL
(See schedule 2 explanatory note 18 restrictions regarding use of disinfectants)
- Stream augmentation
- Impoundments for boating and fishing
- Snow making for skiing and snowboarding

2. Types of Restricted Public Access

AGRICULTURAL

- Commercially processed food crops (See MSR schedule 2 explanatory note 19) *Note that Code does not permit the use of using wastewater from category B facilities for irrigation of agricultural crops intended for human consumption*
- Fodder, fibre
- Pasture (see MSR schedule 2 explanatory note 20 regarding necessary non-irrigation periods prior to reuse by cattle)
- Silviculture
- Nurseries
- Sod farms
- Spring Frost Protection (See MSR schedule 2 explanatory note 17)
- Chemical spray
- Trickle/Drip Irrigation of Orchards. *Note that Code does not permit the use of using wastewater from category B facilities for irrigation of agricultural crops intended for human consumption*

URBAN/RECREATIONAL

(See schedule 2 explanatory note 18 restrictions regarding use of disinfectants)

- Landscape impoundments
- Landscape waterfalls
- Snow making not for skiing and snowboarding

CONSTRUCTION

- Soil compaction
- Dust control
- Aggregate washing
- Making concrete
- Equipment washdown

INDUSTRIAL

(See schedule 2 explanatory note 24 for restrictions)

- Cooling water
- Process water
- Stack scrubbing
- Boiler feed

ENVIRONMENTAL

(See schedule 2 explanatory note 18 restrictions regarding use of disinfectants)

- Wetlands (See schedule 2 explanatory note 25 for restrictions)

Schedule 4. Standards for Discharges into Ground

Table 1 - Effluent Class Definition

		Effluent Quality Parameters (maximum values)				
Effluent Class	Description	BOD_5 (mg/L)	TSS (mg/L)	Fecal Coliform (number of fecal coliform organisms/100 ml)	Turbidity (NTU)	Nitrogen (mg/L)
A	High quality secondary (drinking water well within 300 m)	10	10	Median – 2.2 Any sample-14	Avg. 2 Any sample-5	NO_3 (N) - 10 Total N-20
B	High quality secondary	10	10	*	N/A	N/A
C	Secondary	45	45**	N/A	N/A	N/A
D	Typical septic tank	N/A	N/A	N/A	N/A	N/A

N/A means not applicable

* A fecal coliform limit of 400/100mL applies to discharges designed to meet the requirements of Row 2 to Table 3.

** For lagoon systems, the maximum TSS level must not exceed 60 mg/L.

Table 2 - Requirements for Discharges (Maximum Daily Flow) less than 37 m^3/day*

	Effluent Class	Drainage Pipe Length**	Minimum unsaturated soil depth (m)***	Continuous Monitoring Required
Row 1	A****	Table 4	0.5	Yes
Row 2	B****	Table 4	0.5	Yes
Row 3	C	Table 4	0.75	No
Row 4	D	Table 4	0.75	No

* Flow calculations must be made by a qualified professional acting within the qualified professional's area of expertise.

** Use of chamber distribution systems with equivalent length are permissible. The bottom of the sidewall or "foot" of the chamber is considered to be the trench bottom.

*** Measured from the trench bottom to the highest water table including the groundwater mounding effect or restrictive layer where "groundwater mounding effect" means the vertical rise in the water table that occurs in response to a discharge.

**** The use of a drainfield in this category requires filtration to prevent solids from carrying over into the disposal field. Monitoring controls must be maintained to signal an alarm when filtration begins to malfunction.

Table 3 - Requirements for Discharges (Maximum Daily Flow) equal to or greater than 37m^3/day*

	Effluent Class	Drainage Pipe Length**	Minimum unsaturated soil depth (m)***	Maximum Percentage Reduction in Disposal Field Length	Continuous Monitoring Required
Row 1	A****	Table 4	0.5	40	Yes
Row 2	B****	Table 4	0.5	40	Yes
Row 3	C****	Table 4	1.0	0	No
Row 4	D	Table 4	1.0	0	No

* For flows equal to or greater than 37 m^3/day only, and if water conservation measures are employed and a restrictive covenant is placed on each property requiring that water conservation measures are continuously employed, actual maximum daily flow may be used to design treatment works and the disposal system. Notwithstanding schedule 6 flow monitoring requirements, if actual maximum daily flow is used, daily discharge volume monitoring is required.

** Use of chamber distribution systems with equivalent length are permissible. The bottom of the sidewall or "foot" of the chamber is considered to be the trench bottom.

*** Measured from the trench bottom to the highest water table including the groundwater mounding effect or restrictive layer where "groundwater mounding effect" means the vertical rise in the water table that occurs in response to a discharge.

**** The use of a drainfield in this category requires filtration to prevent solids from carrying over into the disposal field. Monitoring controls must be maintained to signal an alarm when filtration begins to malfunction.

Table 4-Minimum Drainage Pipe Length for each Field[1]

	Number of metres of drainage pipe for each 10 m^3/d of Maximum Daily Flow for percolation rates shown						
Percolation rate; Minutes/25 mm	2[2,3]	5[2]	10	15	20[4]	25[4]	30[4]
Effluent Class Prior to Application: A,B or C	50	75	100	110	120	135	150
Effluent Class Prior to Application: D	120	215	280	320	360	400	430

1. The drainage pipes must be provided in 2 fields with a third field being retained as a standby area. Drainfields must be constructed with trenches on 3 m on-centre spacing. If a qualified professional determines that the performance of the drainfield is not adversely altered by varying the spacing a minimum spacing of 2 m is permissible. In the case where less than 3 m on-centre spacing is used, the standby area must be doubled. Except if reductions in length are allowed, each of the 2 developed fields is to have at least the length of drainage pipe indicated in table 4 of schedule 4.

2. For discharges equal to or greater than 37 m^3/d only, if the soils are well drained and if the depth to groundwater including any groundwater mounding effect is grater than 1.0 m below the bottom of the drainage trench, a qualified professional may design the ground disposal system with deeper narrower trenches and the drainage pipe may be reduced to a value equal to the product of table 4 pipe length and a facot of $1/H^{0.5}$ or

0.8 (whichever is greater), where H is the drainage trench depth below invert in metres.

3. Percolation rates less than 2 minutes per 25 mm are too fast for adequate renovation and drainfields will not be permitted, unless hydrogeological studies show that local groundwater quality can be met at the property boundary. For discharges of less than 37 m^3/d only, use of AMERICAN SOCIETY OF TESTING MATERIALS C33 sand mounding or AMERICAN SOCIETY OF TESTING MATERIALS C33 sand-filled trenches to reduce percolation is permitted if class B or A effluent is discharged by pressure distribution.

4. Percolation rates more than 20 minutes per 25 mm require the construction to be supervised by a qualified professional and to have been carried out in a manner which has not reduced the trench wall permeability unless, for discharges less than 37 m^3/d only, the native undisturbed permeable soil depth exceeds 1.35 m.

Schedule 5.

Table 2 - Discharges into Ground

Column A-Name of Aquifer	Column B-Location	Column C-Total Nitrogen Limit mg/L*
Abbotsford-Sumas Aquifer	Abbotsford	10
Hopington	Langley	10
Langley/Brookswood	Langley	10
Lower Nechako River	Prince George	10
Lower Cowichen River	Duncan	10
Grand Forks	Grand Forks	10
Merritt	Merritt	10
Osoyoos West	Osoyoos	10
Osoyoos East	Osoyoos	10
**	Osoyoos Lake to Tuc-el Nuit Lake	10
Vedder River Fan	Chilliwack	10
**	Tuc-el Nuit Lake to Vaseux Lake	10
*A director may impose alternate requirements based on the recommendations of an environmental impact study conducted by the discharger.		

Schedule 7.

Table H - Minimum Setback Requirements

	Feature	Minimum Setback Distance	
		Maximum Daily Flow	
		Less than 37 m^3/d	Greater than or equal to 37 m^3/d
Row 1	Property boundary	3 m	6 m
Row 2	Building drain*	5 m	10 m
Row 3	Christina Lake	**	**
Row 4	Surface water	30 m	30 m
Row 5	Surface water within Okanagan basin	30 m	150 m
Row 6	Water well	60 m	90 m
Row 7	Water well within an unconfined aquifer	60 m***	300 m***

*The sewage treatment facility itself is to be considered as a building

**As determined by adherence to Christina Lake Official Community Plan

***Based on a hydrogeological assessment to determine the minimum distance required to protect water quality of the water well, distance from water well must be extended accordingly.

Appendix 3.

Excerpt from Nutrient Management Reference Guide

Table 1 - Maximum Water Application Rates by Soil Type[1] (NMRG page 31)

Soil Texture	Grass Sod Field (mm per hour)	Cultivated Field (mm per hour)
Sand	19.0	10.0
Loamy sand	16.5	9.0
Sandy loam	16.5	6.5
Loam	9.0	5.0
Silt loam	9.0	5.0
Clay loam	7.5	4.0
Clay	6.5	2.5
Organic soil (muck)	12.5	12.5

1. taken from *BC Sprinkler Irrigation Manual* for maximum irrigation water application rate

Appendix 4.

Agriculture Land Commission Information Bulletin

http://www.alc.gov.bc.ca/Information%20Bulletins/Red_Meat_Waste_info_sheet.pdf

Information Bulletin **Agricultural Land Commission** **Date: January 8, 2008**	**Slaughter plants and handling red meat waste in the ALR**

REGULATORY INTERPRETATIONS:

- The processing of farm products, if at least 50% of the farm product being stored, packed, prepared or processed is produced on the farm is permitted in the Agricultural Land Reserve (ALR). These activities are designated as farm uses and may be regulated but must not be prohibited by local government.

- Slaughter plants, where less than 50% of the farm product being stored, packed, prepared or processed is produced on the farm, are considered commercial/industrial plants and must be approved by the Agricultural Land Commission (ALC) through the application process. An application may not proceed unless authorized by a resolution of the local government if the application applies to land that is zoned to permit agricultural or farm uses, or requires an amendment to an official community plan or a zoning bylaw.

- Composting facilities in the ALR established in accordance with the Organic Matter Recycling Regulation (OMRR) are prohibited from using Specified Risk Material (SRM) as compost feedstock without the express written approval of the ALC.

- Spreading SRM-compost produced off the farm, or SRM-compost produced on the farm where the SRM compost feedstock is imported to the farm, is prohibited without the express written approval of the ALC.

- The ALC permits the use of non-SRM red meat waste as an acceptable feedstock for composting, and the land application of non-SRM compost on ALR land, provided the composting and use are consistent with BC Regulation 171/2002 *(Agricultural Land Reserve Use, Subdivision and Procedure Regulation)*.

  The following activities are designated as farm uses and may be regulated but must not be prohibited by local government:

Appendix 5.

Design, Construction and Maintenance of Electric Fencing

The following requirements for electric fencing are taken from a current authorization issued by the MOE for a municipal landfill with a significant potential for bear access. These requirements are very detailed and are included to provide an example of the elements that could be specified in a VCP to minimize bear access:

Design, Construction and Maintenance

Wherever required, electric fencing at the landfill site shall be designed, constructed, and maintained such that bears are prevented from penetrating the fence.

Fence Type

Fencing may be either high tensile smooth wire or fence fabric (e.g., mesh-wire, page-wire, chainlink or the like). The configuration of a high tensile smooth wire fence shall consist of a minimum of eight strands, with four energized strands alternating with four grounded strands as follows: the bottom strand shall be a grounded or (-) strand and shall not be more than 10 cm from the ground (soil) at any location; and thence starting from the bottom strand, the other seven strands shall be spaced 15 ± 2 cm, 15 ± 2 cm, 15 ± 2 cm, 20 ± 2 cm, 20 ± 2 cm, 20 ± 2 cm, and 25 ± 2 cm. Additional strands to this minimum configuration may be used.

A fence fabric may be used instead of high tensile smooth wire. The fence fabric shall: be a minimum of 1.22 metre high; be constructed of a minimum wire thickness of 11 gauge, and have a maximum mesh size of 15 cm. The bottom of the fabric shall not be more than 10 cm from the ground (soil) at any location. Any uncharged fence fabric must have a minimum of four strands of charged wires on an outrigger system, spaced as follows: the first strand shall not be higher than 25 cm from the ground; and each of the remaining three strands shall be spaced approximately 25 cm apart from adjacent charged strands.

Wire Tension

For a high tensile smooth wire fence construction, all strands shall be tightened to a minimum of 125 lbs tension at 20°C. The required tension is to be corrected for temperature by use of the following formula for 12-½ gauge high tensile steel wire:

$$Tension = 125 - 2.5(Temperature - 20)$$

where: *Tension* is in lbs force
Temperature is in °C

Post Spacing

Fence posts shall be spaced a maximum of 7.5 metres apart.

Grounding System

A grounding system shall be installed consisting of solid grounding rods (i.e., not pipe) with a minimum diameter of 16 mm (5/8 inch) that have a buried length of at least 2 metres. A minimum of three grounding rods (spaced at least 3 metres apart) shall be installed and connected to the energizer. Alternative energizer grounding systems (e.g., grounding plates, or a deep-driven grounding system) may be used

provided the grounding is equivalent to or better than three grounding rods. A grounding rod (or equivalent) shall be installed at least once every 450 metres along the fence and connected to the grounded wire stands or uncharged fence fabric. Additional grounding may be required for dry sites or if other conditions affect proper grounding.

Period of Operation

Electric fencing shall be fully operational during the period of April 1 to November 15 inclusive each year and at any other time of year when there is bear activity in the immediate surrounding area. If snow is present during this period, any electrified strands above the snow line shall be isolated from the remainder of the system and energized.

Minimum Voltage

Electric fencing shall be operated with a minimum voltage of 6,000 volts.

Gate(s)

Any access through electric fencing for vehicles, equipment and personnel shall consist of an electrified gate system that is closed during non-operating hours. The gate system shall be electrified to a minimum voltage of 6 000 volts at all times except when being opened or closed. Any gate that is open during operating hours shall be periodically checked by the attendant for bear activity during hours of operation. Gaps between the gate and the fence and ground, and between gate panels (for a double-hung gate) shall not exceed 10 cm.

Fence Inspections

The entire perimeter of the electric fencing shall be inspected at least once every seven days and the voltage of the fencing measured at several points along the fencing and at each gate using a proper electric fence voltmeter compatible with the brand of the fence charging unit. The results of voltage testing shall be recorded in a log book. Any results less than the minimum 6 000 volts shall be immediately investigated for the cause of the low voltage (e.g., low battery, litter, vegetation, loose or crossed wires, broken insulators, breaks in the grounding system, etc.). Corrective actions to restore proper voltage shall be immediately undertaken.

Signs of digging or other attempts by bears to penetrate electric fencing shall be recorded in a log book. Any penetrations through electric fencing by bears shall be immediately reported to the Conservation Officer Service (MOE).

In cases of low voltage or signs of penetration attempts, inspections shall be increased from once per week to once per day until proper voltage is fully restored and until there are no new signs of penetration attempts, respectively.

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