



# Slaughterhouse Waste and Specified Risk Material (SRM) Management Study

Final Report for Vancouver Island

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## Executive Summary

The purpose of this study is to identify acceptable solutions for disposal of Specified Risk Material (SRM) and other slaughterhouse waste on Vancouver Island. SRM is the tissue that potentially contains the infective agent, known as a prion, which causes Bovine Spongiform Encephalopathy (BSE) or Mad Cow Disease. SRM is specifically defined in the federal regulations. It is mainly associated with the nervous system and includes the brain and spinal cord; it represents less than 10% of the waste from red meat abattoirs. The Canadian Food Inspection Agency (CFIA) has established a number of acceptable methods of disposing of SRM that will either permanently contain or destroy prions that may be present in slaughterhouse waste.

Currently, SRM is not separated at slaughterhouses on Vancouver Island. Because it is mixed in with non-SRM, it is all deemed to be SRM. This material is collected by West Coast Reduction from the abattoirs once a week for a fee of approximately \$0.125 per pound. It is shipped to a depot near Abbotsford where it is mixed with other material from B.C. and then hauled to a rendering plant in Calgary. Tallow is removed in the rendering process and the remaining material, still deemed to be SRM, is taken to Coronation, Alberta where it is land filled.

Until February 2009, the industry felt this method of disposal of slaughterhouse waste was generally acceptable. It was relatively inexpensive and simple for the plants that generate the waste. A significant increase in tipping fees was announced in early February 2009. This increase may change the industry's views of the service.

The goal of this study was to identify an alternative option or contingency plan that could be implemented if West Coast Reduction's service was no longer available or deemed to be too expensive to the industry.

Several similar studies have been done throughout B.C. over the past two years. These studies have evaluated virtually all of the options for disposal of SRM. These studies and the relevant policies and regulations were reviewed to establish the conditions that would need to be met to develop a site-specific disposal option, or options, for Vancouver Island.

Some options were eliminated because the volumes of waste available on Vancouver Island are not sufficient to justify large capital-intensive plants<sup>1</sup>. The remaining options were evaluated based on cost to the producer, ability to fit within the regulatory and policy limitations, environmental factors, and other relevant conditions.

This process resulted in recommendations to consider two sites with several potential options at those sites including:

- Incineration of SRM and rendering of non-SRM (modified status quo option at West Coast Reduction's Island Processing Inc. plant in Nanaimo), and
- Composting of non-SRM combined with landfilling, incineration, or composting of SRM at the Comox Valley Regional District's Waste Management Centre near Cumberland. Gasification is also a potential option at this site. There are plans, at the conceptual stage, to

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<sup>1</sup> "Economic Assessment of Combustion Technologies for Specified Risk Material Disposal in British Columbia", Stantec Consulting Ltd., December 2008 evaluated several combustion scenarios. The smallest involved slaughterhouse waste (SRM) volumes of 25 tonnes per day. The largest was 120 tonnes per day. Total Vancouver Island slaughterhouse waste is only 550 tonnes or about 1.50 tonnes per day. Stantec concluded that costs decrease as the size of the combustion unit increases.

develop additional composting capacity adjacent to the landfill that will allow the Regional District to divert organic waste from the landfill. It is early in the planning process, so it is believed that an incinerator (or other acceptable technology) could be incorporated into the plan. All of this is subject to approval from a number of agencies, including the Regional District board.

It is also recommended that local governments on Vancouver Island apply to the Canada-British Columbia Specified Risk Material (SRM) Management Program for funding to cover costs associated with obtaining CFIA approval to dispose of SRM at their landfills. This would ensure that there are approved disposal options for slaughterhouse waste available in the absence of other options.

## **Purpose**

The objective of this project is to identify site-specific solutions on Vancouver Island using Canadian Food Inspection Agency (CFIA) approved options for managing slaughterhouse waste and specified risk material (SRM).

## **Key Findings**

### ***Volume***

The volume of material shipped as SRM, from Vancouver Island, is estimated at 1800 tonnes. As noted below, SRM is not separated from non-SRM at the source so everything currently shipped is treated as SRM. If it was separated at source, the actual volume of specified risk material (SRM) generated at slaughterhouses on Vancouver Island is estimated at 38 tonnes per year. This amount is believed to be declining because the value of cull cows on Vancouver Island is so low that most producers dispose of them on farm.

### ***Current Practices***

The current practice for disposal of slaughterhouse waste from red meat plants on Vancouver Island is to ship mixed SRM and non-SRM to West Coast Reduction's rendering plant in Calgary, via the Abbotsford transfer station.

## **Options Investigated and Considered**

There are a number of disposal methods for SRM that are acceptable to the CFIA. All of these have been studied in other areas. All of these were considered but many were eliminated early on for a variety of reasons described in detail in the section entitled "General Disposal Options". Many of these are clearly only feasible with large volumes of material. In some cases, operating or capital costs are obvious limiting factors. In other cases, regulation or local government policy is a limiting factor. But generally, the options for approved methods of disposal of SRM on Vancouver Island are limited by the combination of:

- Small volumes of material
- Several plants,
- Spread over a wide area,
- Separated by water, and
- The complexity and cost of developing a central site(s) and moving the material to that site(s).

Detailed cost comparisons were completed for the following “shortlisted” options:

1. Status quo - collection of mixed SRM and non-SRM material by West Coast Reduction, transportation to Calgary, rendering, and landfilling in Alberta.
2. Modified status quo – separation of SRM and non-SRM at source, collection by WCR to Island Processing in Nanaimo where the SRM would be incinerated. Non-SRM would be transported to Calgary, rendered and landfilled in Alberta
3. Composting of non-SRM at the Comox Valley Waste Management Centre (CVWMC) combined with either:
  - a. Landfilling SRM at the adjacent Pidgeon Lake Landfill, or
  - b. Incineration of SRM at CVWMC, or
  - c. Composting of SRM at CVWMC, followed by a beneficial use or incineration or landfilling, of the composted SRM.

## Conclusions and Recommendations

The current system in which West Coast Reduction collects, transports and disposes of mixed SRM and non-SRM was generally acceptable to the industry on Vancouver Island. Some red meat abattoirs consider this option to be very simple and would not want to operate without it. At worst, it is considered to be a tolerable and viable option for the abattoir. Recent collection fee increases may change these opinions for some operators. The current cost of disposal to slaughterhouses using this system is about \$0.125 cents per pound.

An incinerator could be added at the West Coast Reduction plant (Island Processing Inc.) in Nanaimo for disposal of SRM. This would allow WCR to ship only non-SRM off island which fits with their plans to transport separated streams of SRM and non-SRM to Calgary from the Fraser Valley. It would be a modification of the existing system rather than an alternative. Recommendation of this is subject confirmation that a small scale incinerator can meet the Ministry of Environment’s emission standards at an acceptable cost. There would likely be some challenges installing an incinerator at the Nanaimo location – mainly with local government approvals.

A potential alternative to the status quo could be developed at the Comox Valley Waste Management Center near Cumberland. Plans are underway to replace the existing landfill which is expected to be full by 2015. The new plans include an expanded compost facility and the potential to add incineration, possibly even gasification. It is early enough in the planning process to alter the plans to allow an acceptable means of disposal for SRM and other slaughterhouse waste. The Regional District staff believe that this can fit into the plans. However, it would need the approval of the Regional District Board and the CFIA. The estimated cost of disposal to the slaughterhouses for the options considered at this site range from \$.188 for composting non-SRM and landfilling SRM to \$.208 per pound for composting non-SRM and incinerating SRM. These costs, presumably, could be reduced if government contributed to the capital costs of the new facilities. Some local government policy changes may also be necessary to allow waste from outside the Regional District to be received and disposed of at this site.

## Introduction

The objective of this project is to identify site-specific solutions on Vancouver Island using Canadian Food Inspection Agency (CFIA) approved options for managing slaughterhouse waste and specified risk material (SRM).

Bovine Spongiform Encephalopathy (BSE), or Mad Cow Disease, was first diagnosed in Canada, in 1987, in a cow that had been imported from the United Kingdom. This, essentially, led to a ban on cattle imports from and exports to the European Union. Since that time, the Canadian government has adopted a number of measures to control and eradicate BSE in Canada. Most of this has occurred in since 2003 when the first domestic case of BSE was discovered.

It should be noted that there are two main reasons for government to pursue control and eradication of BSE:

- 1) The health concerns associated with the human versions of transmissible spongiform encephalopathies (TSEs) discussed below, and;
- 2) The potential for trade conflict which would negatively impact export of Canadian cattle products.

The measures taken to date, and the awareness of the related health issues, significantly reduce the risks and concerns associated with human health and TSEs. However, given that 60% of Canadian cattle production is exported, the potential loss of export markets is an issue facing the Canadian cattle industry. Canadian exports of cattle and beef products were worth approximately \$4.5 billion in 2002, 80% destined for the American market - more than 70% of all beef exports and almost 100% of all cattle exports.<sup>2</sup>

### ***BSE - the Disease***

BSE is one of several transmissible spongiform encephalopathies (TSEs) - slowly progressive, neurodegenerative, disorders affecting humans and animals. Known TSEs include:

- Creutzfeldt-Jakob disease (CJD), Kuru, Gerstmann-Straussler-Scheinker (GSS), and Fatal Familial Insomnia (FFI) in humans
- Scrapie in sheep and goats;
- Transmissible mink encephalopathy (TME) in mink;
- Chronic wasting disease (CWD) of deer and elk; and
- Bovine Spongiform Encephalopathy (BSE) in cattle

While BSE is a cattle disease, the human disease called variant Creutzfeldt-Jacob Disease (vCJD) has been associated with the consumption of products derived from BSE-infected cattle<sup>3</sup>.

A large amount of research has been done to determine how BSE is transmitted. It is now commonly, and globally, accepted that the disease may be transmitted when infected material is fed to susceptible species. In the past, this could occur with the feeding of contaminated meat and bone

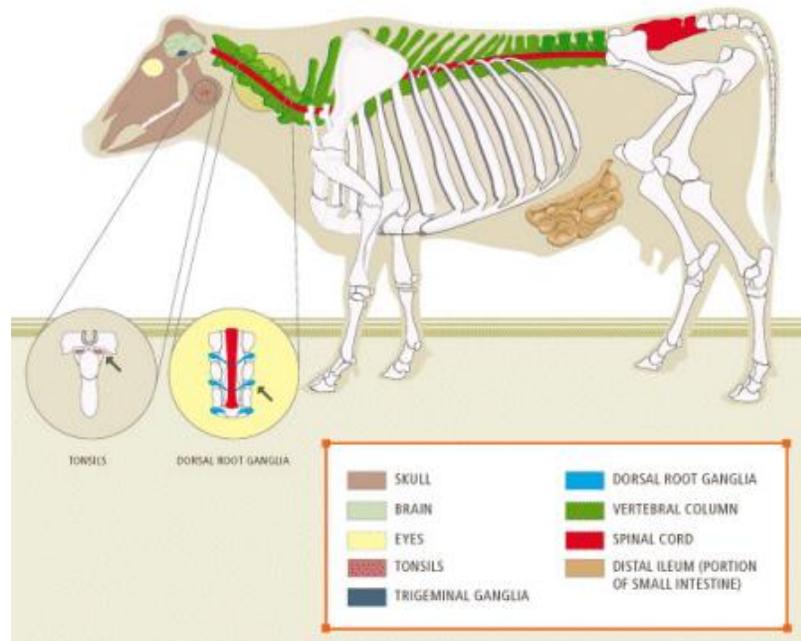
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<sup>2</sup> "Mad Cow Disease and Canada's cattle industry", Parliamentary Information and Research Service, Library of Parliament - July 2005.

<sup>3</sup> From: <http://www.inspection.gc.ca/english/anima/heasan/man/bseesb/1e.shtml>

meal (MBM) as an ingredient in feed rations. Research has verified that there are specific tissues, in BSE-infected cattle, that contain the agent, referred to as the abnormal prion that transmits the disease<sup>4</sup>. Those tissues have been designated as Specified Risk Material, or SRM, which is currently defined as 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.

**Figure 1 SRM material in cattle<sup>5</sup>**



The protein linked to BSE is heat resistant and resistant to other normal pathogen inactivation processes. Removal of SRM is internationally recognized as the most effective public health measure in preventing the transmission of BSE.

**Table 1. Illustration of the infectivity dose of SRM<sup>6</sup>:**

<b>Scientific Steering Committee Estimate of Cattle Infectivity Dose (ID) 50</b>		
<b>Tissue</b>	<b>Cattle infectivity dose (ID)50 per BSE case</b>	<b>Percentage of total infective load per bovine</b>
Brain	5000	64.1%
Spinal cord	2000	25.6%
Trigeminal ganglia	200	2.6%
Dorsal Root ganglia	300	3.8%
Ileum	260	3.3%
Eyes	3	0.04%
Tonsils	1	0.01%

<sup>4</sup> <http://www.inspection.gc.ca/english/anima/heasan/man/bseesb/1e.shtml>

<sup>5</sup> Source: CFIA

<sup>6</sup> Source: CFIA

Significant scientific research has now demonstrated that the inclusion of BSE infected MBM in prepared feeds, is the primary vehicle for infection. Accordingly, BSE infectivity has been recorded in the above tissues, to varying degrees, which if fed to susceptible species could result in the transmission of the infective prion. The brain carries the greatest risk but eyes and tonsils, with low infectivity ratings, are considered to carry some risk and are classified as SRM.

It is worth noting that BSE is not considered a contagious disease. It has gained prominence because of the human health risks and economic impact. As little as a milligram of infected brain material ingested orally by susceptible cattle can result in BSE infection<sup>7</sup>.

Based on this research, the government of Canada has amended the *Food and Drug Regulations* and the *Health of Animals Regulations* to prevent SRM from entering the human and animal food supply. The regulations now prohibit meat and bone meal containing SRM from being fed to any livestock or used in fertilizers.

## Industry Overview

### *Livestock Production on Vancouver Island*

The livestock industry on Vancouver Island is shifting from a commodity-based industry to a niche market industry. It is becoming more challenging to economically produce livestock on high valued land found on the island. The 2006 Census indicates significant declines in livestock numbers compared to 2001. This overall decline is expected to continue however, and the remaining producers will likely be producing high quality, value-added meat products targeted at consumers who are willing to pay premium prices to support local producers.

**Cattle and Calves:** the 2006 Census reports 738 farms with a total of 27,253 head of cattle and calves on Vancouver Island. This is down from 32,654 head on 849 farms in 2001.

In 2006, the island beef herd was reported as 4656 cows on 489 farms (down from 5946 cows on 538 farms in 2001). This equates to an average herd size of less than 10 beef cows per farm.

The island dairy herd was 7911 cows on 90 farms in 2006. This was down from 8558 cows on 130 farms - an 8% reduction in cow numbers in a 30+ percent drop in dairy farm numbers.

**Pork:** the 2006 Census reports 2814 pigs on 169 farms - an average of just over 16 pigs per farm. These numbers have declined from 3387 pigs on 238 farms in 2001 - a 17% drop in numbers over five years.

**Sheep:** in 2006, the total sheep and lamb numbers were reported at 14,521 on 461 farms. This was down from 17,636 on 502 farms in 2001 - a drop of over 17%. The number of ewes declined from 6917 to 6241 over that five year period.

**Goats:** Goat numbers in 2006 were 1949 down marginally from 2114 - a decline of 8%.

**Bison:** bison numbers were fairly stable with 91 reported in 2006 on 4 farms and 88 reported in 2001 on 4 farms.

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<sup>7</sup> CFIA: <http://www.inspection.gc.ca/english/anima/heasan/man/bseesb/1e.shtml#m1.1>

**Poultry:** the total number of broilers, roasters and Cornish Game Hens in 2006 was 482,768 on 342 farms. This was down from 846,784 - a drop of 43% in five years. Total production, live weight, was reported at 6,239,569 kgs compared to 10,604,428 kgs in 2001.

The turkey numbers reported in the 2006 Census are highly suspect. There is no indication on the ground that turkey production has increased by the reported amount. A review of turkey production by electoral area within the Regional Districts on Vancouver Island indicates production is close to what it was in 2001. Nevertheless, reported turkey numbers increased from 12,689 in 2001 to 20,531 in 2006 - the only commodity to increase significantly - by 62%. The reported live weight of turkeys produced in 2006 was 641,089 kgs, a huge increase of 449% over the 142,647 kgs produced on Vancouver Island in 2001.

### ***Vancouver Island Slaughter Industry***

The Vancouver Island slaughter industry consists of a number of relatively small plants, spread over a fairly large area, and in some cases separated by water, so ferry traffic is required from plant to plant. These factors make it difficult and expensive to develop one disposal option that works for all plants. Appendix 1 includes a list of licensed abattoirs and a map showing their location.

According to the BC Center for Disease Control, there were seven fully licensed red meat plants and six fully licensed poultry plants on Vancouver Island and the Gulf Islands as of November 5, 2008. Only one of these plants, Westholme Meat Packers near Duncan, is licensed for both red meat and poultry.

There are two more plants, classified as transitional "Class C" - both red meat (Plecas in Nanaimo and Alf Braun in Duncan). These plants are required to have a business plan in place, by December 31, 2009, that will commit them to meet all licensing requirements.

#### **Licensed Red Meat Plants**

All plants are relatively small by federal industry standards. The average weekly slaughter of beef animals for the whole island is only about 50 head<sup>8</sup>. Weekly beef slaughter at licensed plants is likely less because some of this is slaughtered on-farm for personal consumption.

The plants are also spread out over a fairly large area. Gunter Bros. Meats, in Courtenay, processes most of the red meat north of Nanaimo. They do custom cutting, as do the two abattoirs in Nanaimo.

Hidden Valley Processing, in Duncan, does red meat slaughter as well as custom cutting and wrapping. Braun's Butchers also service the Duncan area. Westholme Meats only processes their own animals. Cole Creek Farm, in Metchosin, concentrates on sheep - no beef slaughter. Two of the licensed red meat plants are on Gulf Islands - one on Gabriola Island, and the other on Saturna Island.

#### **Licensed Poultry Plants**

The poultry plants are also relatively small by federal standards, processing about 600,000 birds annually. They are spread over the southern/central area of the island with two small operations in

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<sup>8</sup> BC Centre for Disease Control (BCCDC) estimates 1117 tonnes total beef slaughter which equates to about 50 head per week.

the Comox Valley, one each in Port Alberni, Qualicum, Westholme, and the largest - Farmhouse Poultry - in Cowichan Bay.

## Waste Generation

### Waste Generation – Livestock Categories

Table 2 illustrates the average volume (kgs) and percentage of meat (carcass) and waste generated when an animal is slaughtered and processed. Live weights vary but the waste percentage is consistent.

**Table 2. Waste percentages and weight<sup>9</sup>**

All percentages are from **LIVEWEIGHT**

Livestock	Live weight (kg)	From Live weight (kg)				From Carcass (kg)		Total waste (kg)
		Carcass	Hide	Waste		Meat	Waste	
				SRM	Non-SRM			
Cattle UTM	630	380	26	13	211	286	94	318
	100%	60%	4%	2%	34%	45%	15%	50%
Cattle OTM	604	303	25	40	236	222	81	357
	100%	50%	4%	7%	39%	37%	13%	59%
Bison	410	230	28		152	172	58	210
	100%	56%	7%		37%	42%	14%	51%
Pork	100	78			22	55	23	45
	100%	78%			22%	55%	23%	45%
Sheep/lamb	55	34	8		13	25	9	22
	100%	62%	14%		24%	45%	16%	40%
Poultry	3	2.25			0.75	2.25	0	0.75
	100%	75%			25%	75%	0%	25%

Cattle UTM – under 30 months of age. Cattle OTM – over 30 months of age.

The actual volume of slaughterhouse waste and SRM generated on Vancouver Island was not available for this study. An initial estimate was provided at the outset of the project but the source of the information was not identified and the person who generated the report was not available to verify the information. Other estimates were found but the reported volumes were inconsistent from one source to the next. West Coast Reduction (WCR) has stated that they haul 1800 tonnes per year off the island. This is mixed ruminant waste including butcher shop waste but it is all deemed to be SRM because it contains slaughterhouse SRM.

Total waste was estimated using the 2006 Census livestock populations for the different species of livestock, and estimating the portion of the annual population that would be slaughtered based on typical production models for Vancouver Island. These numbers are shown in Table 3 below.

<sup>9</sup> R. Van Kleeck – Investment Agriculture Foundation (note: live weight of cattle UTM is based on feedlot stock, which are on average slightly heavier than cattle OTM)

**Table 3. Livestock Waste Summary for Vancouver Island, Powell River and Sunshine Coast.**

All weights are in TONNES												
Category	sub-category	Total Weight of livestock	Total Vancouver Island Slaughter liveweight	Total slaughter at registered abattoirs - liveweight	Farm slaughter - liveweight	Non SRM Slaughter waste	Process waste	Slaughter SRM waste	Total slaughter & process waste	Farm Mortality	Total of ALL waste	Total SRM
Cattle UTM	Steers over 1yr	626	486			165	73	10		19		28
	Heifers - slaughter	338	262			89	39	5		10		15
	Calves under 1 yr	1,307	65			22	10	1		39		41
Cattle OTM	Beef cows	2,188	66			26	9	5		70		74
	Dairy cows	3,829	230			90	30	16		261		277
	Bulls/other	267	8			3	1	1	Cattle	9		9
<b>Sub Total - cattle</b>		<b>8,555</b>	<b>1,117</b>	<b>1,076</b>	<b>41</b>	<b>395</b>	<b>161</b>	<b>38</b>	<b>594</b>	<b>408</b>	<b>1,001</b>	<b>445</b>
Sheep	Ewes	339	34			8	5			17		
	Lambs	429	300			72	48			21		
Bison		82	16			6	2			2		
Deer		32	6			2	1		Other	2		
Goats		97	19			5	3		Ruminants	5		
<b>Sub Total - other ruminants</b>		<b>980</b>	<b>377</b>	<b>271</b>	<b>105</b>	<b>93</b>	<b>60</b>	<b>0</b>	<b>152</b>	<b>47</b>	<b>200</b>	<b>0</b>
<b>Total ALL ruminants</b>		<b>9,535</b>	<b>1,493</b>	<b>1,347</b>	<b>146</b>	<b>487</b>	<b>221</b>	<b>38</b>	<b>746</b>	<b>455</b>	<b>1,201</b>	<b>445</b>
Pigs	Breeding sows	47	12			3	3					
	Grower/finishers	158	379			83	87			16		
Chicken	Broilers	302	1,388			347				272		
	Layers	216	216			54				87		
Turkey		20	68			17			Non-	16		
Other poultry		29	58			15			Ruminants	3		
<b>Sub-total - non-ruminant</b>		<b>771</b>	<b>2,122</b>	<b>2,076</b>	<b>46</b>	<b>519</b>	<b>90</b>	<b>0</b>	<b>608</b>	<b>395</b>	<b>1,003</b>	<b>0</b>
<b>TOTAL ALL LIVESTOCK</b>		<b>10,306</b>	<b>3,615</b>	<b>3,423</b>	<b>192</b>	<b>1,006</b>	<b>311</b>	<b>38</b>	<b>1,355</b>	<b>850</b>	<b>2,204</b>	<b>445</b>

A detailed breakdown of livestock waste generation is shown in Appendix 3. The slaughter weights and waste generation are calculated using local knowledge and a spreadsheet which simulated/estimated annual slaughter based on livestock production statistics from the 2006 Census. The results were consistent with industry information and with the BCCDC slaughter statistics. They are based on the following assumptions:

- Total Vancouver Island slaughter live weight was estimated using the number of livestock, within each category, expected to be slaughtered annually based on average age at slaughter, multiplied by the average weight at slaughter. In the case of broilers, the slaughter live weight is 4.5 times higher than the total reported weight of birds to adjust for the number of cycles raised each year.
- The waste generation figures are based on the slaughter live weight multiplied by the percentages given in Table 2.
- The slaughter waste estimates represent everything slaughtered on Vancouver Island, including on-farm slaughter for personal use.
- Farm mortality is estimated based on local knowledge and industry norms. It does show that the bulk (90%) of the likely SRM generated on the island is disposed of on-farm.

It is interesting to note that 20.2% of all waste is SRM (due to the fact that farm mortalities are taken at their full animal weight) but only 1.7% of the total waste is SRM generated by the slaughter industry.

The waste generation streams are complicated and difficult to precisely define. This report is mainly focused on the SRM portion of the waste, but it is necessary to understand the overall livestock/meat waste streams to effectively explain the disposal of SRM.

Vancouver Island produces about 5% of the total meat consumed. The amount of beef (and other meat products) brought on to the island is considerable. Most of it is processed before it arrives but a large proportion is in the form of sides, quarters and primal cuts for cutting and wrapping locally. This bulk “imported” meat generates additional processing waste, most of which is collected by WCR, mixed with slaughter waste and shipped to the Calgary rendering plant. It is safe to assume that none of this “imported” beef contains SRM material, so the figures in Table 3 cover all SRM generated on Vancouver Island.

## Sources and Disposal of Waste

Livestock slaughter and processing waste and dead stock are generated from three primary sources:

- Farms – primarily dead stock (which makes up a considerable portion of total waste and SRM waste) but also a small portion of slaughter waste, and
- Abattoirs – the main generators of slaughter SRM waste, plus a considerable amount of non-SRM waste, and
- Processors, butchers and grocers – who generate “process” waste, not all of which is derived from Vancouver Island livestock.

The disposal of this waste is carried out in various ways. While the quantity of waste which goes to landfill, burial or composting is difficult to estimate, that which goes to rendering is more easily quantified.

West Coast Reduction (WCR) is the only major rendering company operating on Vancouver Island. Their waste collection service, especially SRM, is monitored by CFIA. WCR indicate they collect a total of 1800 tonnes from the following sources:

Slaughterhouse waste from red meat plants	550 tonnes
Poultry slaughter waste, dead stock (all species)	150 tonnes
Process meat waste from butchers, processors, grocers	1100 tonnes

Most poultry slaughter waste is composted but WCR collects a small amount, along with some poultry dead stock and a very small amount of other dead stock as noted above.

In view of the difficulty in quantifying buried or composted waste, the disposal options for the generators described above are likely to be:

- Farms
  - Composting – dead stock (primarily but not exclusively non-ruminant) and some slaughter waste. Composting is mostly done on-farm.
  - Burial – dead stock (primarily but not exclusively ruminant – particularly beef and dairy). Burial tends to be exclusively on-farm. Some non-SRM material may be landfilled.
  - Rendering – some farms, particularly poultry may use WCR for disposal of dead stock.
  - **Estimated amount - approximately 850 tonnes.**

- Abattoirs
  - Rendering - red meat (including beef) abattoirs do not separate SRM and non-SRM waste streams. Because of the controls on the handling, transportation and disposal of SRM, WCR collects from all the abattoirs which generate beef waste. All waste, including non-SRM and non-beef is mixed so it is all regarded as SRM material for the purposes of handling and transporting by WCR. The 700 tonnes includes red meat and poultry waste as opposed to the 550 tonnes noted elsewhere which is just red meat waste.
    - **Estimated amount - approximately 700 tonnes.**
  - Composting – mainly used by poultry abattoirs. No SRM is disposed of in this way due to regulatory restrictions.
  - Landfill – small amounts are disposed to landfill.
    - **Estimated amount composted and landfilled - approximately 655 tonnes.**
- Processors, butchers, and grocers
  - Rendering – most, but not all meat wastes are rendered, particularly red meat. A large amount of this waste is from carcasses “imported” to Vancouver Island.
    - **Estimated amount - approximately 1100 tonnes.**
  - Composting – difficult to quantify
  - Landfill – difficult to quantify

The total of all waste streams discussed above is approximately 3305 tonnes, which includes 2205 tonnes of total livestock waste tissue generated by Vancouver Island livestock, plus the approximate 1100 tonnes going to WCR from processors and grocers. Composted and land-filled processor wastes are not quantified, and are beyond the scope of this project.

## *Current Practice*

### **Red Meat Plants**

Most of the slaughterhouse waste (both SRM and non-SRM) from the red meat plants on Vancouver Island is disposed of using the services of West Coast Reduction as described below. SRM is not separated. SRM and non-SRM are mixed at all of the larger plants on Vancouver Island. The exceptions to this are on Gabriola and Saturna Islands, and the Metchosin plant which does not currently process beef. WCR’s system does not easily allow collection of separated materials. Significant alterations would be needed to allow collection of both separately.

The smaller plants, on the Gulf Islands, landfill or compost their waste on-site. In both cases, the volume is low and the plants have an adequate land base to dispose of the waste appropriately. The Metchosin plant uses the Hartland landfill in the Capital Regional District.

### **Poultry Plants**

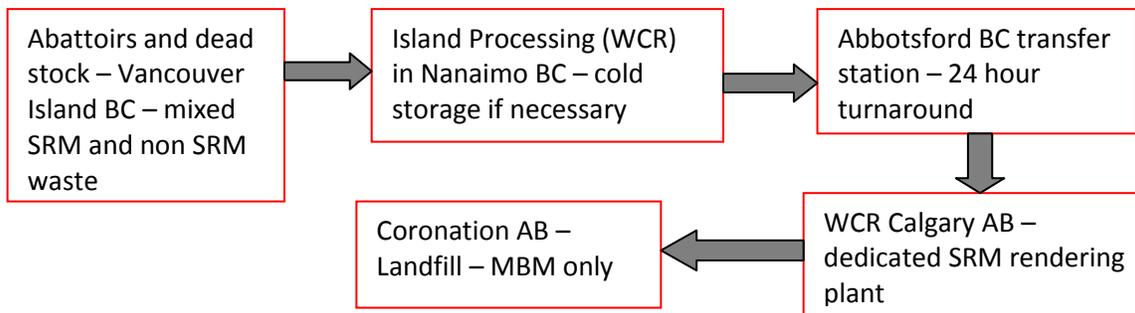
Most slaughterhouse waste from poultry plants on Vancouver Island is composted. A small quantity goes to WCR for rendering and a small amount is likely landfilled, on site, at smaller plants.

## West Coast Reduction

West Coast Reduction (WCR) is a major player in the animal and carcass waste handling and processing, not only on Vancouver Island, but in BC, Alberta and Saskatchewan. Their head office is in Vancouver, and they have rendering plants in each of the three Western provinces.

Their processing plants handle a wide variety of waste materials, including poultry, swine, ruminant, fish and inedible oil wastes. With the 2003 BSE discovery in Canada, WCR designated its plants ruminant and non-ruminant to minimize the impact on its markets for rendered finished products. Separate processing is now a regulatory requirement. Its BC plants were designated non-ruminant. All ruminant waste is transported to Calgary, where there are separate plants to handle the SRM and non-SRM ruminant waste streams. By taking these steps, the industry has significantly reduced the chances of cross-contamination of SRM with non-SRM waste, and ruminant with non-ruminant waste.

**Figure 1 WCR Collection Process:**



In this system, the volume of slaughter and dead stock waste generated on Vancouver Island, including Powell River and Sunshine Coast, is not sufficient to warrant separation of SRM from non-SRM. The logistics of handling small volumes of separated material and the risks of cross-contamination are not worth the effort. As such, all animal wastes are mixed, and treated as SRM for the purposes of permitting, transporting and rendering.

WCR currently charges \$188 per bin for SRM waste, regardless of the quantity in that bin. Bins generally hold around 2000 lbs (but as much as 2200 lbs) of mixed waste. Based on this, the average costs used in the industry are \$0.125 per pound<sup>10</sup> (\$.275/kg) to collect SRM from Vancouver Island plants. If the customer fills bins completely, they can reduce their average costs slightly, and conversely if they do not, they will increase them. The collection fee for non-SRM is \$.075 per pound (\$.165/kg). Given that the material is mixed, it is all deemed to be SRM, so the charges for those generating SRM are \$0.125 per pound. Tallow is the only product WCR can sell from rendered SRM material.

WCR collects about 1800 tonnes (2000 tons) of slaughter and processing waste annually from Vancouver Island. The waste is collected once a week from abattoirs, butcher shops, supermarkets, etc., and transported to the WCR plant at Nanaimo - Island Processing Co (IPC). Island Processing is a fish waste reduction plant. IPC does not process any other material. It does however provide separate transfer facilities for accumulation and cold storage of small volumes of mixed ruminant

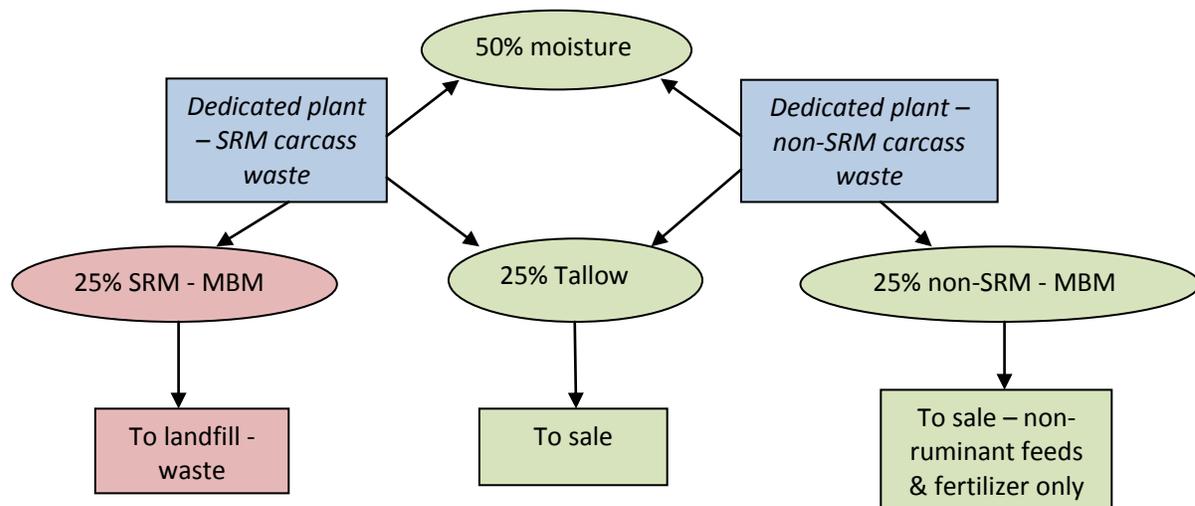
<sup>10</sup> The figure of \$0.125 has been derived from estimates of the likely range of 'per pound' costs depending on how much material the abattoirs get into a bin.

waste transferred to Abbotsford. Cold storage is occasionally required in the Nanaimo plant when loads need to be amalgamated to create a viable load for shipment to the mainland.

Once a large enough load is available, it is transported to a government-owned transfer station, operated by WCR, near Abbotsford. Since there is no cold storage available at this site, loads are normally amalgamated and moved to Calgary within 24 hours.

In Calgary, a dedicated SRM plant renders the waste from Abbotsford. Tallow derived from SRM is not distinguished from tallow derived from non-SRM removed material, providing it contains less than 0.15 % insoluble impurities - the maximum allowable level at which there is negligible risk of BSE infectivity. During the rendering process, half the weight of raw material is lost in the form of moisture, 25% is tallow or oil, and the remaining 25% is protein meal in the form of MBM. The infective prion is not destroyed in the rendering process so this MBM is still deemed to be SRM and is landfilled at an approved site near Coronation, Alberta.

**Figure 2 Products from rendering ruminant material and their end use and disposal**



Processing SRM and non-SRM in separate plants, or separate lines, is costly. Having two lines in Calgary has enabled WCR to achieve this requirement. They are currently building a new plant which will be dedicated to processing non-SRM. The existing plant will then be used to process SRM.

West Coast Reduction's Vancouver plant handles poultry, fish, and swine wastes, as well as oils. No ruminant waste is allowed in this plant.

In the long run, the process of handling and transporting waste from Vancouver Island and the rest of BC to Calgary may not be sustainable. It works, and is acceptable to most waste generators but economics and environmental considerations will ultimately determine its sustainability.

WCR and others have been involved in the process to determine the best long term options for SRM handling and disposal. Numerous studies have been completed throughout BC.

It makes sense to reduce the volume of SRM by rendering before final disposal. However, building a dedicated ruminant plant in BC is considered uneconomic due to volume. Rendering plants generally

need to process 50,000 to 60,000 lbs of raw material per hour to be viable<sup>11</sup>. Approximately 36,000 tons is collected annually in BC - about 25% of the breakeven volume.

Small scale rendering has not been considered in any of the BC studies on SRM disposal. It is a means of reduction which produces tallow as a by-product. A suitable disposal option would still be needed for the remaining product. If there was an opportunity to render, it is suggested that WCR would capitalize on the opportunity as this is their core business.

## Regulatory Overview

### Relevant Federal Regulations

The following CFIA regulations are relevant to this project:

- Feeds Act
- Fertilizers Act
- Health of Animals Act
- Meat Inspection Act

CFIA regulations prohibit the feeding of meat and bone meal to cattle, sheep and other ruminants. However, SRM-removed MBM can be fed to non-ruminant livestock, and used in fertilizers.

The Government of Canada has amended the *Food and Drug Regulations* and the *Health of Animals Regulations* to prevent SRM from entering the human food supply. The regulations establish a definition for SRM (provided earlier) and prohibit the sale or import for sale of food products containing SRM under the *Food and Drug Regulations* from countries that are not BSE-free. Amendments to the *Health of Animals Regulations* require the removal of SRM from carcasses and prohibit the use and export of SRM in food for human consumption.

### ***Food and Drug Regulations***

Amendments to the Food and Drug Regulations prevent potentially harmful cattle tissues from the human food supply.

### ***Health of Animals Act and Health of Animals Regulations***

The Act and Regulations were put in place to prevent the introduction of animal diseases into Canada, to prevent the spread within Canada of diseases that either affect human health or could have a significant economic effect on the Canadian livestock industry, and to provide for the humane treatment of animals during transport.

The "*Certain Ruminants and Their Products Importation Prohibition Regulations*" was extended, as of December 15, 2008, until June 30, 2009, to prohibit importation of certain animal products and by-products from the United States because they may come with an unacceptable risk of carrying BSE.

The regulation prohibits importation of: meat or meat products from cattle, bison and buffalo, (Sub-family Bovinae); meat or meat products from goats or sheep age 12 months or older; animal food containing ingredients derived from ruminants; fertilizer, excluding manure, containing ingredients from ruminants; and specified risk material. The intent of this regulation is to assist in the

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<sup>11</sup> Comment from WCR in respect to large commercial plants

prevention of additional cases of BSE in Canada and minimize the risk of transmission of BSE to the human food supply<sup>12</sup>.

The definitions of: prohibited material for feeding to ruminants; feed labelling; and record keeping requirements are detailed in Part XIV of the *Health of Animals Regulations*.

### ***Enhanced Feed Ban<sup>13</sup>***

The enabling legislation for the Enhanced Feed Ban includes amendments to:

- Section 5 of the Feed Act;
- Subsection 5(1) of the Fertilizers Act;
- Subsection 64(1) of the Health of Animals Act; and
- Section 20 of the Meat Inspection Act.

As of July 12, 2007, there were new regulations for handling, transporting and disposing of SRM. Under the enhanced regulations, owners or operators of waste management facilities who choose to accept SRM in any form must apply for a permit from the CFIA. Permits will only be issued after the facility's disposal procedures are assessed by a CFIA inspector and meet all requirements. Disposal procedures must prove to either destroy, or permanently contain, all SRM waste. In addition to new disposal regulations, a separate permit is required to transport SRM in any form, including cattle carcasses containing SRM. Slaughterhouses will have to properly identify SRM prior to pickup for waste disposal. Waste management facilities will be advised not to accept cattle parts, in any form, from anyone who does not possess a permit. The duration of the permit depends on the frequency of business. Permits for commercial operations to frequently handle SRM may be valid for up to one year. Other permits, for isolated SRM disposal needs, may be valid for periods of 30-90 days.

The enabling legislation for specified risk material (SRM) removal is both the *Food and Drug Regulations* and the *Health of Animals Regulations*.

### ***CFIA Permitting***

CFIA has permitting procedures for collection, transportation, processing, construction, receipt, use or export of SRM. This includes procedures for:

- Landfilling of SRM - the owner/operator of the landfill must submit an application for a permit to the local CFIA district office. The permit application requirements include: relevant municipal and provincial licenses (i.e. operating certificate); detailed site plan; operating procedures and the results of any recent analysis or verifications relevant to containment of SRM. Following receipt of this information a CFIA Inspector will then conduct a site inspection and review the permit application.

<sup>12</sup> Canada Gazette, Vol. 142, No. 26 - December 24, 2008

<sup>13</sup> [www.inspection.gc.ca/english/anima/heasan/disemala/bseesb/enhren/art/wasdece.shtml](http://www.inspection.gc.ca/english/anima/heasan/disemala/bseesb/enhren/art/wasdece.shtml)

- Transportation of SRM requires a permit from the point of removal or, on initial transportation of bovine carcasses containing SRM, to the point of final disposal. Permits and control measures are **not** required for SRM or bovine carcasses containing SRM if they are not removed from the premises of origin. Permitting requirements include bilingual signage and cleaning procedures for containers and vehicles. An application must be completed and the CFIA will inspect the “conveyance” vehicle and container to be used. The application must be accompanied by all relevant provincial agricultural, environmental or public health permits pertaining to the transportation of dead stock and slaughter waste. SRM must be stained and operating procedures must be followed to ensure that the SRM is transported in a manner that minimizes vector attraction. Operators transporting SRM must retain records, on information pertinent to SRM transportation, for up to 10 years. Permits are typically valid for 90 days to one year; operators transporting SRM more than once per week typically are permitted for one year. All operations may be subject to random inspections to ensure regulatory compliance.
- Mass composting of SRM - permit requirements described in more detail below.
- Rendering - permit requirements for rendering are somewhat irrelevant in B.C. because there are no ruminant rendering plants. Rendering is discussed in more detail elsewhere in this report. It is worth noting that WCR needs permits for the transfer station at Abbotsford, and vehicles for moving and disposing of SRM.

## ***BC Regulations***

### ***Environmental Management Act (EMA) - Waste Discharge Regulation***

The Environmental Management Act specifically prohibits the introduction of waste into the environment “in such a manner or quantity as to cause pollution”. Disposal of slaughter waste in B.C. is regulated under the Environmental Management Act Waste Discharge Regulation. A permit from the B.C. Ministry of Environment is required for disposal of this material in a landfill. If the landfill is owned by a local government, they have the authority to accept or decline the waste material.

### ***Slaughter and Poultry Processing Industries Code of Practice***

The Ministry of Environment has established a “code of practice” that addresses discharges to the environment from the slaughter and poultry processing industries under provisions of the Environmental Management Act. Solid waste, collected by a rendering company, is not considered a discharge to the environment so operators using this means of disposal are not required to register under this code. Those who slaughter livestock or poultry, strictly for their own consumption, are exempt from the provisions of the code and are not required to register. There are a number of requirements associated with landfilling slaughterhouse waste including (among others):

- Dust and odour must be controlled
- Every time new material is added to the landfill it must be covered with at least 0.15 m (6”) of low permeability soil.
- Between uses, the landfill must be covered with an impermeable cover that will keep out rain and snow and vectors

- Records must be kept of where the landfill is located, the dates that solid wastes were added to it, and the types and quantities of solid waste added.
- A landfill must be closed by covering it with at least one meter of low permeability soil and no more material can be added after it has been closed.

There are additional requirements for landfills located in high precipitation areas (areas with an average precipitation of more than 600 mm per year) - this applies to all of Vancouver Island. In these areas, the landfill owner must engage a Qualified Professional to evaluate the landfill and design a groundwater monitoring and assessment plan. The owner is required to comply with that plan.

## Review of Disposal Options

Generally, there are two acceptable methods of disposal of SRM:

- 1) Containment, in a permitted and approved landfill, and
- 2) Destruction technologies that will eliminate the abnormal prion to the point that there is deemed to be negligible risk of infection.

### *Containment*

The CFIA has approved land filling and on-site burial as suitable methods for long-term containment of SRM. Burial is a viable, and commonly used, option for farmers. The CFIA is generally satisfied that the SRM component of on-farm mortalities is suitably contained on the farm using current methods. On-site burial is not an option for the red meat slaughter houses on Vancouver Island. They do not have the land base, nor do they have suitable soils and drainage, to accommodate the volume. This inherently means that they must transport SRM from their site to another end disposal site. Basically, the least expensive landfill site they can use now is in Coronation, Alberta.

### *Destruction*

There are four technologies that are accepted and have been approved by CFIA for SRM destruction: incineration, gasification, alkaline hydrolysis, and thermal hydrolysis. The research indicates that these technologies are generally capital-intensive and probably complex enough that they would need to be managed as a separate entity. Most slaughterhouse operators specifically stated that they want to focus on their core business. They do not want the distraction of managing and operating a sideline business.

### *Rendering*

Rendering uses mechanical, chemical and thermal processes to convert livestock slaughter waste and whole carcasses into three main products - moisture, meat and bone meal (MBM), and tallow (or fat). The moisture is discarded, but the SRM removed MBM has value as a non-ruminant stock feed or fertilizer, and the tallow is used in the pharmaceutical, cosmetic and soap industries, and in animal feeds.

Rendering is **not accepted** by CFIA as a means of SRM destruction because it does not occur at a high enough temperature or pressure. As such, MBM containing SRM cannot be used in any animal feed or for fertilizer, and must be disposed of effectively by another means such as landfilling, burial

or incineration. MBM that does not contain SRM is currently still accepted as an animal feed additive, but for non-ruminants only.

Essentially, rendering is a step in the current disposal system. It is a reduction process during which some value is extracted in the form of tallow. The end disposal is containment in a landfill.

### **Advantages**

- Costs associated with disposal by collection and rendering are lower in comparison to other options (based on the average price of other options, not the lowest possible price).
- Rendering, while not destroying the abnormal prion, considerably reduces the volume of material for disposal. The end disposal site at Coronation is also approved, well known, and well monitored by CFIA and is considered to be a very low level risk site for disposal.
- WCR is a major player in the collection of waste for rendering, and has the necessary permitting in place.
- Beneficial by-products are generated during the rendering process

### **Disadvantages**

- Rendering is a means of reduction, not destruction; it does not destroy the BSE prion. The rendered product must be disposed of to an acceptable contained site.
- The long distances required to transport SRM and other ruminant material to Alberta, and the associated costs
- While rendering in itself is a beneficial operation, the sustainability of handling ruminant waste in BC using the current system (handling and transporting to Calgary) is questionable

### ***Options Considered***

Given that rendering is only a reduction option and, at best, would be part of a larger disposal system, no Vancouver Island options were considered. There is a small scale rendering plant near Port Hardy, however, that plant renders fish waste which is much easier and can be done on a small scale. The main limitation for rendering of SRM and other slaughterhouse waste option is economies of scale. If it was economical to construct a plant on Vancouver Island, West Coast Reduction would likely do so rather than haul material to Calgary.

### ***Composting***

Composting is a naturally occurring biological decomposition process in which bacteria, fungi and other microorganisms convert organic matter into a stabilized product. Carcass composting systems require a variety of ingredients or co-composting materials, including carbon sources (sawdust, straw, etc.) and bulking agents (shavings). Carbon sources and bulking agents are readily available on Vancouver Island.

The CFIA Science Directorate performed a risk assessment on composting. There is insufficient published scientific data to show that the abnormal prion is inactivated by the composting process. The risk assessment assumed that the abnormal prion would not be degraded during composting. The resulting risk assessment found that specified risk material (SRM) subjected to composting would present a very low to low risk of transmitting the BSE agent within the domestic ruminant population.

Under the CFIA's current working policy, only those methods posing no greater than a negligible risk of transmitting BSE to domestic ruminants are considered acceptable methods of disposal. However, in terms of SRM, the final compost will still be classified as SRM and thus will be subject to all regulatory and permitting requirements applicable to SRM.

Permits for final disposition of composted SRM will only be issued to pre-approved single sites that have negligible risk for exposure to domestic ruminants.

On-farm composting will not be controlled by the CFIA if it takes place on the same premises where the SRM is generated and if the product (compost) does not leave the premises of origin. The CFIA has advised the provincial ministries, which have regulatory authority over on-farm composting, that it is not recommended that compost, produced from SRM, be spread on land that will be directly grazed by domestic ruminants within 5 years.

### **Provincial Regulations**

Section 7.1 "Prohibited Wastes (M)" of the Landfill Criteria for Municipal Solid Waste (MSW)<sup>14</sup> states:

*The Co-disposal of the following wastes with the rest of the MSW is prohibited unless specifically approved by the manager:*

- *Hazardous Wastes other than those specifically authorized in the Hazardous Waste Regulation*
- *Bulk liquids and semisolid sludge's which contain free liquid;*
- *Liquid or semisolid wastes including septage, black water, sewage treatment sludge, etc.;*
- *Automobiles, white goods, other large metallic objects and tires (except in the case of Selected Waste Landfills approved by the Manager where recycling options are not available or feasible);*
- *Biomedical waste as defined in the document "Guidelines for the Management of Biomedical Waste in Canada" (CCME, February 1992); and*
- ***Dead animals and slaughter house, fish hatchery and farming wastes or cannery wastes and by-products.***

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

Discussions with Ministry of Environment staff indicate that the municipal landfills on Vancouver Island would be authorized to accept slaughterhouse waste if they choose to do so, i.e. the decision is a local government decision as opposed to a provincial Ministry decision.

### **Composting and the ALR:**

The BC Ministry of Environment amended the Organic Matter Recycling Regulation (OMRR) by adding red meat waste to the list of acceptable material for composting. This change was in

<sup>14</sup> <http://www.env.gov.bc.ca/epd/epdpa/mpp/lcmsw.html>

recognition of the Canadian Food Inspection Agency's enhanced animal health protection from BSE initiative.

OMRR makes no distinction between SRM and non-SRM. Under OMRR both can be composted.

The ALC reviewed the change to OMRR and determined that composting and the use of the composted material is permissible in the Agricultural Land Reserve if the composting of non-SRM met the requirements of the *Agricultural Land Reserve Use, Subdivision and Procedure Regulation*.

The ALC has concerns with composting SRM. When SRM is composted, the finished compost product is still considered by the CFIA to be SRM. If SRM are used as a feedstock in composting, in order to comply with the ALR regulation, some of the composted material must be used on the farm on which the composting took place. However, if compost produced using SRM is applied to land, the requirement of the CFIA is that the land on which the compost is applied should not be directly grazed by domestic ruminants for at least five years. The ALC views this restriction as contrary to the objectives of the Agricultural Land Commission Act to preserve agricultural land and encourage farming.

The ALC position regarding slaughter plants as an "on-farm processing" activity and the composting of red meat waste are as follows:

- If at least 50% of the farm product being stored, packed, prepared or processed is produced on the farm, then the processing of farm products is permitted as a farm use in the Agricultural Land Reserve (ALR).
- 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 ALC through the application process.
- Composting facilities in the ALR established in accordance with the OMRR are prohibited from using 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 the Agricultural Land Reserve Use, Subdivision and Procedure Regulation.

The ALC acknowledges that slaughter plants are necessary infrastructure for a healthy cattle industry and that proper handling of red meat waste is crucial.

The ALC will continue to work with proponents wishing to develop slaughter plants in the ALR, the cattle industry, local governments, the Ministry of Agriculture and Lands and other provincial ministries to review potential sites for slaughter plants and composting facilities.

### Advantages

- Composting produces a beneficial by-product
- It is a relatively simple low cost process – particularly if it is done on-site
- It is accepted by CFIA as a method to contain the SRM for final disposal

- It has a low environmental impact, and minimal energy input requirements, particularly in static pile or windrow formats
- In-vessel composting is desirable for containing leachate, and excluding vectors
- In-vessel composting results in a quick turnaround from input to output
- The nutrients remain on Vancouver Island.

#### Disadvantages

- It requires compliance with regulations, specifically environmental regulations and the ALR requirements discussed above
- It requires an acceptable facility which, in high rainfall areas, can be more costly than in other areas
- Composting does not destroy the abnormal prion and as such is subject to further disposal requirements
- The end product value is low unless used in an energy generating capacity such as incineration
- There is potential for contamination to the environment and possible ruminant intake if it is not handled correctly
- Composting only SRM involves a high proportion of bone material – particularly the skull – which may present problems if applying to land (on-site non-ruminant lands).

#### Options Considered

The potential to compost SRM at source at each of the red meat abattoirs was reviewed. The two plants on the Gulf Islands already use a combination of composting and landfilling to dispose of their waste. These plants have relatively small volumes and an adequate land base to use this method of disposal. Composting is not a final option for disposal of SRM so abattoirs would require a means of disposing of the composted SRM. These options could exist, as described below. The existing red meat plants on Vancouver Island do not currently compost SRM because (a) it is not part of their core business and (b) they are on ALR land and would not be allowed to apply it. At best, they would need to acquire permits and transport to another application or disposal site.

Composting could be an acceptable method of disposal of SRM subject to the following conditions:

- The composted SRM cannot be land applied to land that will be grazed by domestic ruminants within five years of application, and
- Approval would be needed from the Agricultural Land Commission to apply composted SRM on ALR lands, and
- Transportation, application and end use of composted SRM will require CFIA approval.

This limits the ability to use composting as part of a disposal option; however there are situations where compost could be used with a positive economic value. Examples include: potting mix for hedging and nursery products; soil amendments for sod farms, and; urban landscaping materials. If nothing else, composted SRM could be used as a landfill cover material. All of these uses would need the approval of CFIA and the CFIA would want to ensure compliance.

The limitations described above are the main reasons composting is not used by Vancouver Island abattoirs. However, it is a relatively simple process, and there are a number of facilities available. It is also believed that local government landfills could be convinced to accept SRM in this form, rather than the raw form. Composting is recommended as part of one of the alternatives for disposal of SRM on Vancouver Island later in this report.

## ***Landfilling***

Landfilling of specified risk material (SRM)—including bovine dead stock from which the SRM has not been removed, or SRM that has been subjected to intermediate processing (such as rendering or composting to decrease the volume)—is considered a permanent method of containment of the abnormal prion.

The CFIA Science Directorate performed a risk assessment on this method of disposal and determined that landfill and/or mass burial of SRM or carcasses from which the SRM has not been removed presented a negligible risk of bovine spongiform encephalopathy (BSE) transmission to domestic ruminants.

Landfilling of SRM requires the approval of CFIA. The owner of the landfill would be required to submit an application including a detailed site plan describing operating procedures and the results of analysis or verifications relevant to containment of SRM. The CFIA inspector would then conduct a site inspection and review the permit application. The CFIA indicates that none of the local governments on Vancouver Island have obtained approval to landfill SRM<sup>15</sup> – presumably because the small volumes of SRM - likely less than 1 tonne per week – do not justify the expense.

An engineered landfill is not limited in the quantity of SRM material they may receive, whereas a natural (non-engineered) landfill is limited by the CFIA to receive a maximum of 4,000 tonnes per year of slaughter waste / dead stock, of which a maximum of 2,000 tonnes per year can originate from over-thirty-month-old (OTM) cattle<sup>16</sup>.

## **Burial – On-Site or Non-Contiguous Property**

Farmers, abattoirs or dead-stock collectors who wish to bury SRM on-site are subject to one or more regulations, including *Environmental Management Act*, *Agricultural Waste Control Regulations* and *Code of Practice for Slaughter and Poultry Processing Industries*. Apart from complying with the various regulations, the problem for abattoirs is lack of appropriate area to conduct on-site burial.

Burial is permitted on a non-contiguous property, owned by the abattoir, but it is subject to the same permit requirements as a natural landfill. The amount of material that can be buried is limited (CFIA – “*BSE Manual of Procedures*”) to approximately 350 kg per week (equivalent to SRM from 7 mature bovine carcasses) or 18,200 kg per year (equivalent to approximately 30 mature bovine carcasses or SRM from 360 mature carcasses).

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<sup>15</sup> Conversation with Sam Elder, Inspection Manager, CFIA

<sup>16</sup> CFIA’s “*Bovine Spongiform Encephalopathy (BSE) Manual of Procedures*” at <http://www.inspection.gc.ca/english/anim/hasan/man/bseesb/bseesbe.shtml>

**Landfill/burial:****Advantages**

- Landfill/burial is accepted by CFIA as a permanent method of containment of the abnormal prion
- There is a negligible risk to human or animal health, or of the transmission of BSE to domestic ruminants
- It is a fairly simple method of disposal of SRM, with a relatively low cost compared to more sophisticated methods and technologies

**Disadvantages**

- The permitting and regulatory requirements are a deterrent to landfills accepting SRM waste
- There is considerable public opposition to existing landfills receiving animal waste in general, and SRM waste in particular
- Constructing a dedicated animal waste landfill is unlikely due to public opposition, high costs, high water tables, insufficient volumes, and extensive regulatory and permitting requirements
- The BSE prion is contained but not eliminated so continued monitoring is required to ensure compliance with regulations
- Landfilling or on-site burial of SRM can create odour and vector control problems
- Land for burial may be limiting for some operations

**Options Considered**

Burial or on-site landfilling is theoretically a permissible option. It is used on the farm but beyond the farm gate it is regulated by the “Code of Practice for the Slaughter and Poultry Processing Industries” under the *Environmental Management Act of BC*. A review of the code indicates it is highly unlikely that any of the island plants would have suitable sites for burial of the volumes of material generated. Certainly, none of the operators mentioned this as an option they would consider.

The potential to use any of the municipal landfill sites on Vancouver Island was considered with the results described below:

**Landfills on Vancouver Island:**

Hartland Landfill, in the Saanich area, serves the Capital Regional District. Hartland accepts animal waste from one of the red meat plants on the south island. This is all non-SRM as this plant does not slaughter cattle. They also accept dead-stock and bovine non-SRM, but would not be allowed to accept SRM as they do not have the required permit.

Cowichan does not have a landfill; solid waste is trucked to Cache Creek.

Nanaimo accepts slaughter waste and dead stock but does not encourage it. It is considered as controlled waste and charged a higher tipping fee of \$200 per tonne.

Port Alberni does not take any slaughter waste or dead stock.

The Comox Valley Regional District and Strathcona Regional District have a fee structure for controlled waste including animal waste but do not receive it in any large quantities. The total volume of “carcasses” landfilled in 2007 was 29 tonnes<sup>17</sup>.

There are private landfills on Vancouver Island. Elk Falls mill (owned by Calalyst Paper) in Campbell River, for example, has a private landfill but they are only permitted by the BC Ministry of the Environment (MoE) to landfill waste from their mill. Discussions with MoE staff indicate that they would be reluctant to approve landfilling of SRM on private sites. These sites are normally approved for specific types of waste.

**Table 1. Regional District Landfill Facilities:**

No.	Regional District	Name of facility	Address of facility	Controlled waste cost/tonne	Accept SRM?
1	Capital	Hartland Landfill & recycling Area	1 Hartland Avenue, Victoria (West Saanich)	\$150.00	No permit
2	Cowichan Valley	Bings Creek Solid Waste Mgt Complex	3900 Drinkwater Road, Duncan (North Cowichan)	Not accepted - Waste to Cache Creek	No permit
3	Nanaimo	Cedar Regional Landfill	1105 Cedar Road, Nanaimo	\$200.00	No permit
4	Comox Valley	Comox Valley Waste Mgt Centre	Bevan Road, Cumberland	\$150.00	No permit
5	Strathcona	Campbell River Waste Mgt Centre	6700 Argonaut Road, Campbell River	\$150.00	No permit
6	Alberni/Clayoquot	Alberni Valley Landfill West Coast Landfill	Landfill Road, Port Alberni	Not accepted	No permit

It is somewhat difficult to identify exactly why these municipal landfills do not accept SRM for a number of reasons. First, most are working with solid waste management plans that were developed before specified risk materials were defined so the SRM terminology is not used in the plans. If a specific policy was written, after the plans were adopted, that policy does not appear online or within the plan. Several of the local governments had vacant waste management positions at the level needed to answer questions about policy in this area at the time the study was written.

The limitations preventing the use of landfills as a disposal option for SRM on Vancouver Island are as follows:

- Local government policy or the lack of will to change policy to allow landfilling of SRM.
- Boundaries between Regional Districts. RDs are reluctant to receive waste generated outside of their boundaries and generally impose much higher fees for external waste. There is some movement to erase these boundaries.
- Generally, local governments are trying to reduce the volume of waste and especially the volume of organic material going to their landfills.
- CFIA permit would be required to accept SRM at any of these landfills. There was no indication, from CFIA that this would be a major hurdle.

<sup>17</sup> CVRD/SRD Centralized Composting Facility Conceptual Design Report, Prepared for Comox Valley Regional District by CH2M HILL, September, 2008

- Perception - It is suggested that SRM that has been composted or processed may be far more acceptable for landfilling. It is still SRM but is in a form which may be perceived to be safer and cleaner to handle.

Despite all of these opposing factors, landfilling of SRM could happen reasonably easily if there was a political will to obtain the appropriate permits from CFIA. The landfilling option is considered as part of site-specific options to dispose of SRM at the Comox Valley Waste Management Center. It is also recommended that local governments obtain approval from CFIA to landfill SRM; this would provide an approved option for disposal in the absence of other options or if there was a disruption in the current service.

## ***Incineration***

The CFIA Science Directorate performed a risk assessment on this method of destruction and determined that SRM incineration presents a negligible risk of transmission of bovine spongiform encephalopathy (BSE) to domestic ruminants.

Based on the conclusion of this risk assessment, output from approved incinerators is not regulated by SRM controls-provided that it can be demonstrated that the ash produced does not contain amino acids.

The incineration of SRM in any form in a primary chamber at a temperature of 850°C or above, for at least 15 minutes and until all organic matter has been reduced to ash, is approved by the CFIA as an acceptable method of destroying the abnormal prion.

For SRM that has been reduced to a size of 50 mm diameter or less, incineration in a primary chamber at 900°C or above, for at least 2 seconds and until all organic matter has been reduced to ash, is approved by the CFIA as an acceptable method of destroying the abnormal prion.

Dr. Thomas Dickinson of Thompson Rivers University conducted "*An Assessment of Enhanced Incineration as an Alternative Technology for the Disposal of Slaughterhouse Waste*". The assessment was based on a test burn at Rodear Meats in October 2005. The report indicates that there are a number of concerns related to incineration of small volumes of SRM and/or waste. His general conclusion was that "if enhanced incinerators can be located in suitable, environmentally resilient sites, that technology may provide a suitable, affordable, alternative for the disposal of slaughterhouse waste".

Incineration reduces waste by approximately 90% - 93% and provided the incineration is conducted correctly, will produce ash which is considered prion-free. The temperatures required to achieve a non-SRM ash output are outlined above. If the correct burn is achieved, there would be no requirement for CFIA approval or permitting in the disposal of the ash to landfill, or as a soil amendment. If, however, the correct burn is not achieved, output material (ash) would still be classed as SRM, and would require further permits for disposal off site.

Recent work at Rodear Meats indicates that fuel costs are higher than expected and emissions standards may be difficult to achieve<sup>18</sup> especially when incinerating high moisture, and/or large, portions of waste. The results may be better incinerating SRM only. In addition, local governments have met considerable public resistance when individuals have applied for approval to install incinerators in rural areas on Vancouver Island.

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<sup>18</sup> Personal conversation with Dave Fernie, Rodear Meats.

### Advantages

- Incineration at the correct temperature is accepted by CFIA as a means of prion destruction. As such, there are no further regulatory requirements in the disposal of the ash
- Though still undergoing trials in BC, incineration is an accepted technology for waste disposal, with the benefit of energy generation
- The volume of waste is reduced by 90 to 93%
- Other waste streams may also be processed through an incinerator either for disposal, or to generate energy in the form of heat or power.

### Disadvantages

- Raw SRM is likely to have a negative energy value due to the high moisture content
- Considerable resistance to incinerators by the public. There were, historically, at least two incinerators on local government lands in the Cowichan Valley. These were closed down and dismantled because they could not meet emission standards and there was no political will to keep them open. Applications for rezoning to accommodate pet incinerators have met very significant resistance from public in the Comox Valley Regional District.
- Stringent emission controls which have, so far, proven difficult to attain at test sites
- Requirement for high temperatures (850° to 900°C) in order to destroy the abnormal prion. This may be difficult to attain, particularly if higher volumes or large pieces (carcasses) of SRM are fed into the system.

### Options Considered

The red meat plant sites were evaluated to determine if there was an appropriate buffer around them to accommodate an incinerator. The only plant that may have enough buffer area (500 m from the nearest residence) is Westholme Meats. This may be an option for incineration if the emissions standards can be met, and if CFIA approval can be obtained. Assuming incineration cannot be accommodated at the source, then permitted transportation of SRM to an alternate site would be required. The east coast of Vancouver Island, from Campbell River to Sooke, was reviewed using Google Earth to identify accessible sites with appropriate buffers. Two credible alternate sites were identified: WCR's Island Processing Inc site at Nanaimo and the Comox Valley Waste Management Centre at the CVRD's landfill site near Cumberland. Both of these are described in more detail in the business case analysis below.

### Gasification

Gasification is a proven method of destruction of the BSE prion because it is capable of meeting the CFIA requirements of temperature of 850°C or above for at least 15 minutes and until all organic matter has been reduced to ash.

### Advantages

- Gasification at the correct temperature is accepted by CFIA as a means of prion destruction. As such, there are no further regulatory requirements to dispose of the ash
- Gasification is an accepted technology with the benefit of energy generation

- The volume of waste is reduced by 90 to 93%
- Other waste streams may also be processed.

### Disadvantages

- Capital costs are high
- Raw SRM is likely to have a negative energy value due to high moisture content. Some gasification plants handle this material better than others
- Waste disposal is not part of the core business of the plant owners. They are in the business of energy production. Tipping fees would likely have to be significant to cover the added costs associated with obtaining the appropriate approvals to receive material, dispose of ash and any other related costs.
- Gasification operators tend to be under close scrutiny from the public and may be reluctant to accept material that could create conflict and public-relations problems which are costly to address.

### Options Considered

Based on previous studies on SRM disposal in B.C., it is clear that there is not enough volume of SRM on Vancouver Island to justify a dedicated plant for SRM alone. Options include disposal at existing plants or development of a new gasification plant which would accommodate disposal of the small volume of SRM as part of a larger waste disposal system.

The existing gasification facilities on Vancouver Island are at pulp mills. These plants would be capable of reaching and maintaining the temperatures needed to destroy the prion<sup>19</sup>. The plants best suited to this are in Powell River and Port Alberni. However, there are several significant hurdles to overcome before SRM could be accepted at these sites:

- Current permits do not allow these plants to accept this waste. Amending these permits requires the company go through a public process. Companies are understandably reluctant to do this because of public opposition to incineration of certain types of waste.
- There is no will to amend permits within the companies because of the process above and the cost of amendment.
- Waste disposal is not the core business of the companies. If they become involved in incineration, they would need to set tipping fees at a level that would recover all of their costs including the costs of the public process.

In late February 2009, the mills described above announced a number of layoffs and some have closed indefinitely. This uncertainty, combined with the challenges of permit amendment noted above, led to the conclusion that these plants could not be counted upon as a disposal option for SRM. If the mills re-open, and stability returns to this sector, perhaps high-level discussions between corporate management and the Ministry could lead to use of these facilities for disposal of waste streams such as SRM.

Given the state of the pulp and paper industry, it was initially assumed that there was little, if any, chance that new gasification facilities would be planned for Vancouver Island. However, in late

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<sup>19</sup> Based on telephone discussion with Brian Houle of Catalyst Paper in Campbell River.

February 2009, a proposal was introduced to build a gasification plant near Cumberland. This proposal is in the early stages, and is considered further and discussed in the business case analysis for the Comox Valley Waste Management Center.

### ***Alkaline Hydrolysis***

The CFIA Science Directorate performed a risk assessment on alkaline hydrolysis of SRM and determined that this method of destruction, using specific operating parameters, presents a negligible risk of transmission of bovine spongiform encephalopathy (BSE) to domestic ruminants.

Based on the conclusion of this risk assessment, output products from approved alkaline hydrolysis units are not subject to further SRM regulatory controls. Depending on their form and intended use, output products remain subject to all other relevant federal legislation as well as all relevant provincial and municipal regulatory requirements.

CFIA-approved alkaline hydrolysis of SRM requires processing SRM at a temperature of 150°C and a pressure of at least 400 kPa in a hydroxide solution calculated on a mass per mass basis equal or greater than 9% of the SRM input material, which corresponds to 15 % sodium hydroxide (NaOH) or 19.3 % potassium hydroxide (KOH), for a period of not less than 180 minutes per cycle, in an enclosed pressure vessel that is suitable for the purpose required.

#### **Advantages**

- It is an acceptable method of prion destruction under the correct conditions.
- Beneficial by-products are produced.
- Alkaline Hydrolysis produces cleaner emissions than incineration, and is more likely to be accepted by the public over landfilling or incineration.
- More suited to small scale application than some other methods.

#### **Disadvantages**

- It is a relatively expensive technology, with a high knowledge requirement.
- Though tested in Europe, more work on this method is needed in Canada.
- It generates a fairly high level of effluent, with a high pH value

#### ***Options Considered***

Five alkaline hydrolysis digesters were evaluated by Ference Weicker & Company in the report entitled "*Specified Risk Material Containment and Destruction Options and Evaluations for the Fraser Valley*". Four of these digesters had capacities of 3000 pounds (1370 kgs) per cycle or less. The other had a capacity of 10,000 pounds per cycle - much larger than what is needed for the volume of SRM on Vancouver Island. Capital costs for the four smaller units were less than \$100,000. Two of these units were mobile. These were considered first, however the cost of moving a mobile unit between plants to process small volumes of SRM is prohibitive. Further investigation indicates that these smaller units have not been proven to destroy the prion because they do not reach the required temperature of 150° C. Further testing is needed to determine if the prion is destroyed at their lower operating temperatures - about 93° C. Until that is done, the hydrolysate effluent from these units would be deemed to be SRM and would need to be disposed of as SRM. This form of SRM would be alkaline and could contain valuable nutrients. There is considerable uncertainty for this option at approximately the same cost as composting and incineration. Accordingly, it has not

been considered as a viable alternative for disposal of SRM on Vancouver Island.

### ***Thermal Hydrolysis***

The CFIA Science Directorate performed a risk assessment on thermal hydrolysis of SRM and determined that, using specific operating parameters, the resulting material discharged at the end of this process presents a negligible risk of transmission of bovine spongiform encephalopathy (BSE) to domestic ruminants. Therefore, thermal hydrolysis is an acceptable method of permanent destruction of abnormal prions that may be present in SRM and is approved by the CFIA as a destruction method.

Based on the conclusion of this risk assessment, output products from approved thermal hydrolysis installations are not subject to further SRM regulatory controls. Depending on their form and intended use, output products remain subject to all other relevant federal legislation as well as all relevant provincial and municipal regulatory requirements.

CFIA-approved thermal hydrolysis of SRM requires operation at 180°C and 1200 kPa for a period of not less than 40 minutes per cycle in an enclosed pressure vessel that is suitable for the purpose required.

#### **Advantages**

- Accepted by CFIA as a method of BSE prion destruction, with a negligible risk of transmission of BSE.
- Output from thermal hydrolysis is not subject to further SRM control measures.
- Odour and pollution-free process.
- Can process many waste streams in a short space of time, producing beneficial by-products.

#### **Disadvantages**

- Expensive technology which requires considerable volume to make it worthwhile.
- Not suited to smaller applications where capital and operational experience will be limiting.

### ***Options Considered***

According to the Ference Weicker & Company report noted above, the capital cost of a complete thermal hydrolysis system is in the order of \$25 million. This system is capable of processing 100 tonnes of waste per day. This is clearly not a realistic option for stand-alone processing of the island's SRM. Thermal hydrolysis is not considered a viable option for disposal of SRM at this time, as no known facilities exist or are being proposed on Vancouver Island for any type of organic matter.

### ***On farm Disposal and the Role of Livestock Producers***

The regulations related to BSE have been changed to protect international trade of livestock between Canada and other countries.

BSE is a reportable disease in Canada. If an animal displays symptoms of BSE, the owner is legally required to report it to CFIA or face a fine of up to \$250,000 for not reporting. The objective of the regulations related to BSE is to control and eradicate the disease. Livestock producers have more to

lose than anyone. It is critical to the industry to ensure that SRM is properly managed and disposed of to protect and maintain the credibility of the industry with respect to trade agreements.

Discussions with livestock producer groups<sup>20</sup> and individual farmers on Vancouver Island indicate that virtually all of the on-farm dairy mortalities are either buried or composted on the farm. Because of the low market value, very few dairy animals, especially those over 30 months of age, are shipped to the auction or the slaughterhouse. Mortalities from beef operations are either composted or buried. Cull beef cows generally have a higher value so some of those are processed at red meat abattoirs.

Burial is an acceptable means of disposal for SRM provided that it does not pollute groundwater and that the material is not accessible for consumption by susceptible species. This is not likely to occur if carcasses are buried properly; however, some farmers may be challenged to find places on the farm dry enough for burial.

Currently accepted research indicates that environmental transmission of BSE is not possible<sup>21</sup>. Winter water tables on Vancouver Island are high and there are few, if any, places where livestock could be buried without being saturated by high water. Decomposing carcasses could create environmental concerns but transmission of BSE via groundwater is unlikely.

Discussions with livestock producers, producers groups and environmental farm planners indicate that the vast majority of bovine animals aged 30 months or over die on the farm. Therefore, most of the specified risk material generated by the industry is disposed of on the farm by burial or composting. Discussions with CFIA staff indicate that on-farm disposal of SRM waste is accepted by CFIA as an effective method of bio-containment of the disease.

While it is accepted that there may be short cuts taken by some farmers, CFIA believes that farmers are becoming educated on the BSE threat and the risks to the livestock industry, and are being more responsible in their disposal and containment.

As a further incentive to farmers to monitor the health of their cattle herds, and to assist CFIA in BSE eradication, a program is available to test cattle for the disease. If the farmer or his/her veterinarian suspects an animal is showing BSE-like symptoms, the CFIA will help fund brain tissue tests once the animal has died or been destroyed. The payment to the farmer is set at \$75 per sample (per animal), with the CFIA also reimbursing the veterinarian to a maximum of \$100 per sample<sup>22</sup>.

Appendix 3 shows a breakdown of livestock numbers on Vancouver Island, along with a calculation of likely slaughter numbers, slaughter waste and on-farm mortalities. It supports the assumption that most of the SRM on Vancouver Island is generated by on-farm mortalities. It is important to note that the figures are best estimates only, since there are no accurate statistics on the subject.

It is also worth noting that the figures generated for likely slaughter waste are for livestock produced and slaughtered on Vancouver Island. Generation of slaughter and processing waste is further complicated by the fact that carcasses are brought on to Vancouver Island and processed. Thus the waste collected by WCR, and probably some which finds its way to the landfills or

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<sup>20</sup> *Island Milk Producers Association and Cattle Farmers of Vancouver Island*

<sup>21</sup> "Mad cow disease and Canada's cattle industry" Parliamentary information and research service, Library of Parliament - July 2005.

<sup>22</sup> See: [CFIA/ACIA 5372 Producer/Veterinarian Agreement Form](#) or the CFIA - BSE manual of procedures

composting facilities, is not all derived from local livestock.

## Financial Assessment of Options

### Cost Comparisons

Table 2 outlines the costs associated with various disposal options. The cost estimates are based on the assumption that existing landfills or mass composting facilities could be used for disposal so no new capital is required. The costs include only those that flow back to the generators of livestock waste - primarily the slaughter industry. Furthermore, costs are based on island-wide solutions, using total waste for the sector, rather than solutions for individual sites.

**Table 2. Cost Comparisons<sup>23</sup>**

<i>Method of disposal</i>	WCR	Landfill - existing	Compost - on site	Mass compost - existing site	Incinerate	Alkaline hydrolysis	Gasification - existing plant	Thermal hydrolysis	Gasification - new plant
<i>Type of cost</i>	All material	All material	On-site	Off site	All material	All material	All material	All material	All material
Capital costs	0	0	\$10-120/t	0	\$108,230	\$139-183,000	0	\$25,000,000	\$4,400,000
Amortized 10/25 years @ 6%	n/a	n/a	\$14-163/t	n/a	\$147,000	\$189-249,000	n/a	\$48,900,000	\$8,605,000
Capital costs/tonne (range)	0	0	\$89	0	\$11-27	\$14-45	0	n/a	n/a
Transport costs/tonne	0	\$40-150	0	\$40-150	\$40-150	\$40-150	\$60-225	n/a	n/a
Tipping fees/tonne	\$188-362	\$150-300	0	\$65-300	0	0	\$200-400	n/a	n/a
Operating costs/tonne	n/a	n/a	\$21-108	n/a	\$150-350	\$352	n/a	n/a	\$130
Variable costs/tonne (range)	\$188-362	\$190-450	\$21-108	\$105-450	\$190-500	\$392-502	\$260-625	n/a	\$130
Total costs/tonne (range)	\$188-362	\$190-450	\$110-197	\$105-450	\$201-527	\$406-547	\$260-625	n/a	n/a
<i>Summary</i>									
Average capital costs per tonne	\$0	\$0	\$89	\$0	\$20	\$30	\$0	n/a	n/a
Average variable costs per tonne	\$275	\$320	\$65	\$278	\$345	\$447	\$442	n/a	n/a
Average total costs per tonne	\$275	\$320	\$154	\$278	\$365	\$477	\$442	n/a	n/a
Average total costs per pound	\$0.13	\$0.15	\$0.07	\$0.13	\$0.17	\$0.22	\$0.20	n/a	n/a

Note: See Appendix 8 for explanation of cost ranges. WCR tipping fees based on \$188 per bin – 2200 lbs when full, and 1140 lbs when only around half full. Weights are dependent on abattoir output. Average price assumed to be \$0.125/lb.

Variable costs are estimated based on local conditions. Transport costs are estimated assuming contract hauling with a local company. Investment in dedicated equipment for transport of material would substantially increase the capital costs above.

A range of prices has been used to reflect: the varying distance between the slaughter plants and the disposal site/option; the variations in quantities of waste produced, and; other costs variations such as increased tipping fees for waste generated outside of the RD where the site is located. Capital costs are also assumed to vary greatly depending on the equipment used, site factors, engineering, costs of obtaining approvals, and other costs involved in setup.

On-site composting, incineration and alkaline hydrolysis options are amortized over ten years. Gasification and thermal hydrolysis are amortized over 25 years.

The summary section uses the mid-range price for comparison sake. Costs for specific options could vary considerably.

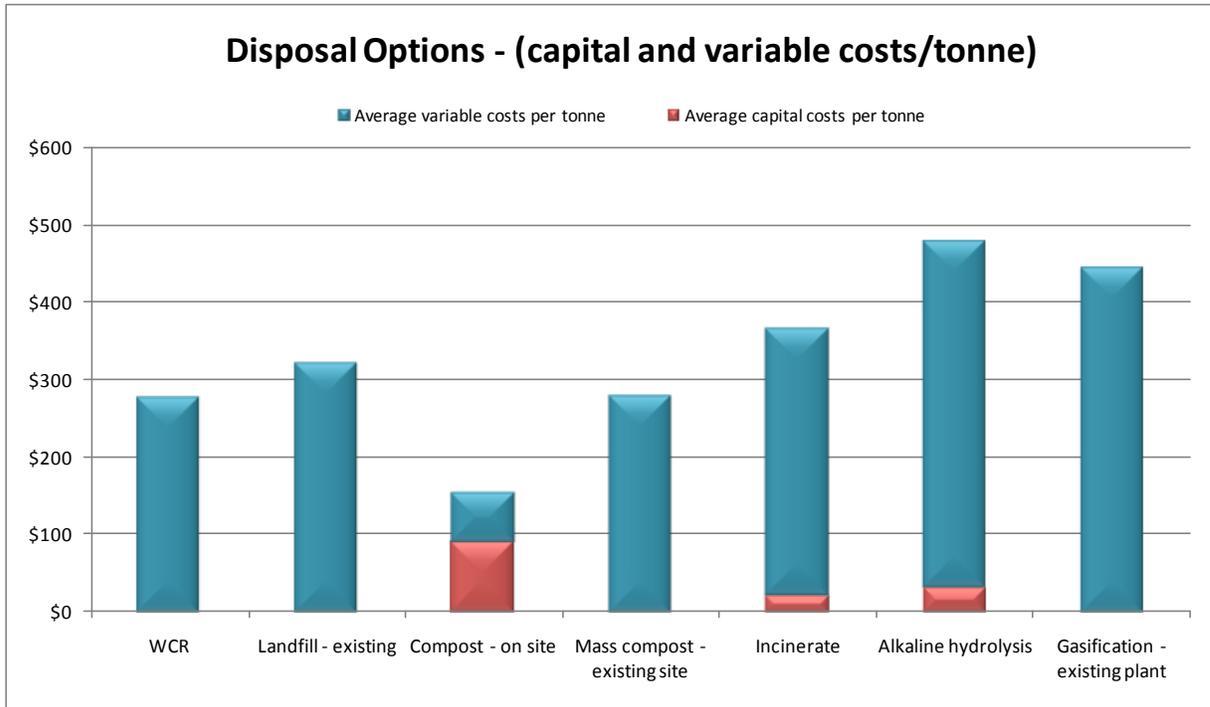
New thermal hydrolysis and gasification plants are included for the sake of interest. Final costs per tonne have not been calculated due to the very high capital costs and volumes required<sup>24</sup>. The

<sup>23</sup> The capital and variable (operating) costs are based on previous studies by *Ference Weicker & Company (SRM Containment and Destruction Options and Evaluations for the Fraser Valley)* and *Sylvis Environmental (North Okanagan/Thompson Slaughterhouse Waste Disposal Options)*, with minor adjustments for Vancouver Island transport costs and tipping fees.

<sup>24</sup> Stantec reports capital costs of over \$4.4 million for a gasification plant that will incinerate 8211 tonnes per year. Ference Weicker notes a \$25 million thermal hydrolysis system with a capacity of 100 tonnes per day. At

average cost per tonne will be highly dependent on the total volume of waste processed and the specific technology used.

**Figure 3 Chart showing total costs, broken down into capital and variable portions<sup>25</sup>:**



This chart gives a graphic illustration of the difference in the average total costs per tonne from Table 2. On-site composting appears to be the most cost-effective option but it is a storage option which would need to be followed by incineration, landfilling or, possibly, restricted methods of land application.

### Comparison of Preferred Options

Table 3 and Figure 4 show the disposal costs for the preferred options or option combinations.

this scale, these plants would provide an economic option; however total slaughter waste on Vancouver Island represents about 20% of the smallest option.

<sup>25</sup> Values for Figure 4 and Table 3 are derived from the figures in Table 2. Capital and transport cost figures in Table 3 for landfilling SRM, incineration of SRM, and alkaline hydrolysis of SRM have been increased to reflect possible substantially lower volumes of material.

**Table 3. Cost Comparison - Preferred Options and Combinations:**

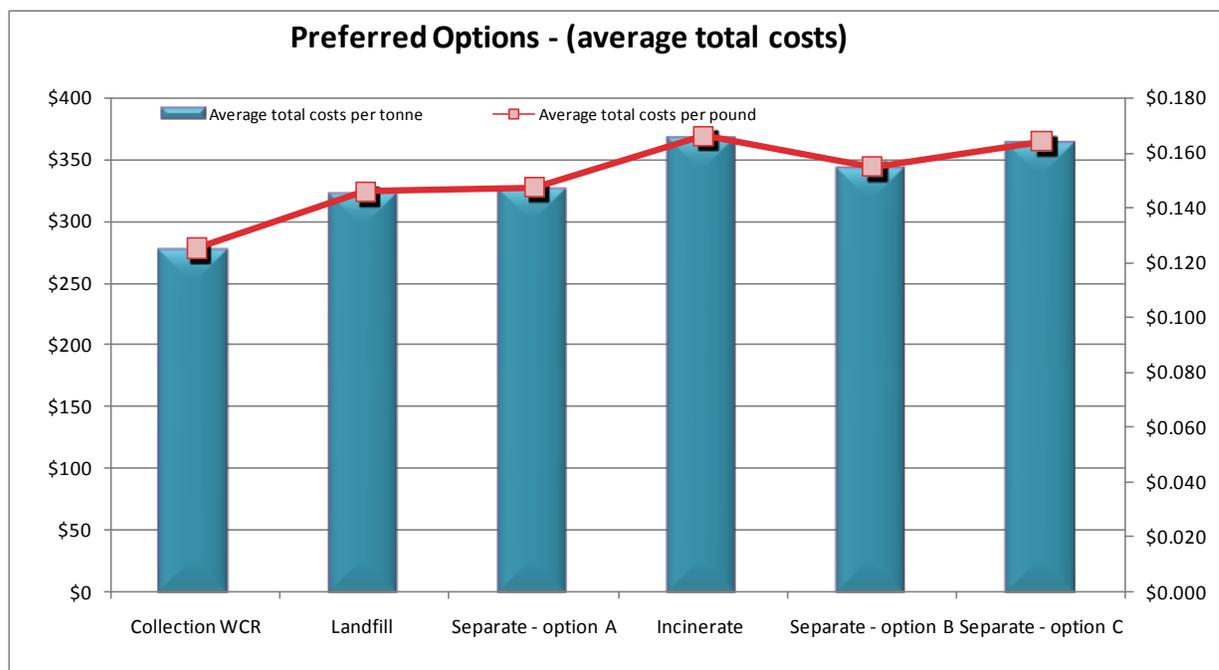
Method or methods of disposal	Collection WCR	Landfill	Separation of SRM - option A		Incinerate	Separation of SRM - option B		Separation of SRM - option C	
	All material	All material	Landfill SRM	Mass compost non-SRM	All material	Incinerate SRM	Mass compost non-SRM	Alkaline hydrolysis SRM	Mass compost non-SRM
<i>Type of cost</i>									
<b>Capital costs/tonne (range)</b>	\$0	\$0	\$0	\$0	\$11-27	\$55-397	\$0	\$65-455	\$0
<b>Transport costs/tonne</b>	\$0	\$40-150	\$40-2280	\$40-150	\$40-150	\$40-2280	\$40-150	\$40-2280	\$40-150
<b>Tipping fees/tonne</b>	\$188-362	\$150-300	\$150-300	\$65-245	0		\$65-245	0	\$65-245
<b>Operating costs/tonne</b>	n/a	n/a	n/a	n/a	\$150-350	\$150-350	n/a	\$352-704	n/a
<b>Variable costs/tonne (range)</b>	\$188-362	\$190-450	\$190-2580	\$105-395	\$190-500	\$190-2630	\$105-395	\$392-2984	\$105-395
<b>Total costs per tonne (range)</b>	\$188-362	\$190-450	\$190-2580	\$105-395	\$201-527	\$240-3027	\$105-395	\$457-3439	\$105-395
<i>Summary</i>									
<b>Average capital per tonne</b>	\$0	\$0	\$0	\$0	\$20	\$226	\$0	\$260	\$0
<b>Average variable costs/tonne</b>	\$275	\$320	\$1,385	\$250	\$345	\$1,410	\$250	\$1,688	\$250
<b>Average total costs per tonne</b>	\$275	\$320	\$324	\$324	\$365	\$340	\$340	\$360	\$360
<b>Average total costs per pound</b>	\$0.125	\$0.145	\$0.147	\$0.147	\$0.166	\$0.155	\$0.155	\$0.164	\$0.164

Note: See Appendix 8 for explanation of cost ranges.

WCR charges a fixed rate per bin (approximately one (1) tonne) regardless of the volume in the bin. Some customers maximize the amount they put in the bins where others do not have enough volume to fill one bin per week so there is a variation in cost per pound.

The average total cost per pound shown above is based on midrange variable costs. Therefore, the lowest cost option is not necessarily the best. For a specific option, all of the costs may be at the low end of the range. This could clearly make that option the preferred choice for the nearest abattoir, whereas more distant plants may be faced with costs at the upper end of the range.

The costs associated with the preferred options are graphically illustrated in Figure 4.

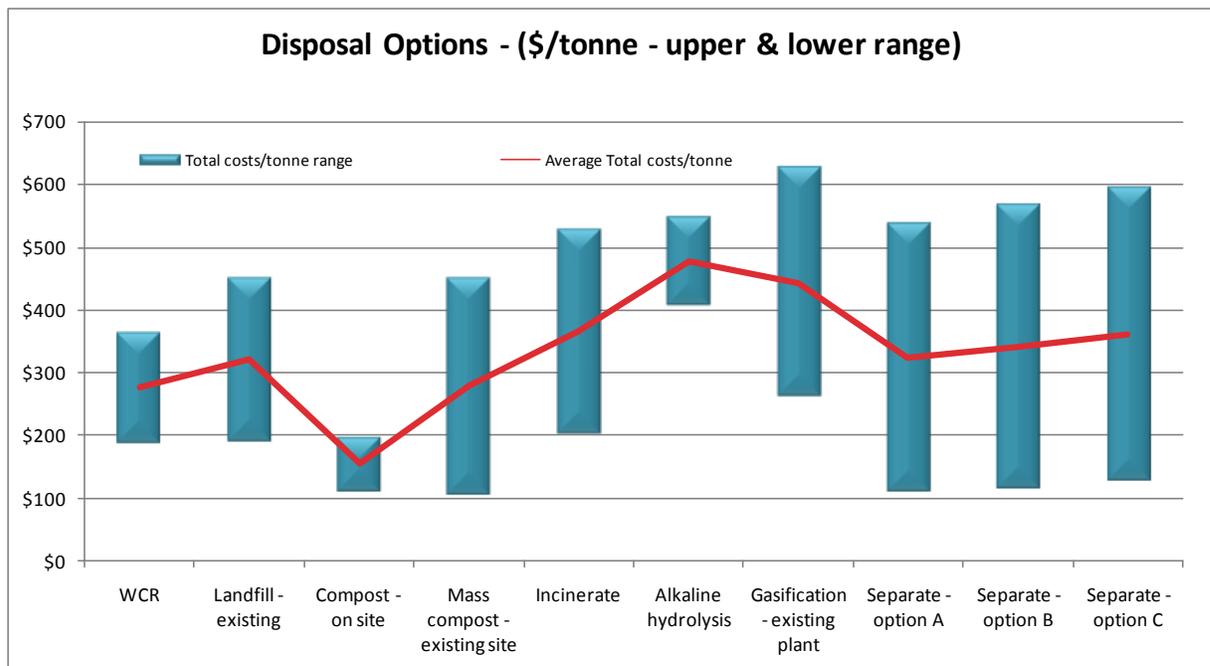
**Figure 4 Average Total Costs for Preferred Options**

Based strictly on the cost to the waste generator, the options would be ranked as follows:

- 1) West Coast Reduction collection: Cost \$275 per tonne (\$0.125 per pound) – the status quo being the least expensive option currently available.
- 2) Off-site Landfilling of mixed material: Cost \$320 per tonne (\$.145 per pound) - landfilling all material is not a preferred option for policy makers and regulators.
- 3) Separation with Landfilling of SRM and Composting of Non-SRM (Option A): Cost \$324 per tonne (\$.147 per pound) - more appealing to policy makers and regulators. SRM is still going to landfill but non-SRM is converted to a valuable product and material is not transported long distances.
- 4) Separation with Incineration of SRM and Composting of Non-SRM (Option B): Cost \$340 per tonne (\$.155 per pound) – SRM is destroyed and Non-SRM is converted to a valuable product. If an acceptable site can be found for incineration, this is likely a preferred option overall despite the cost being slightly higher than for 2 and 3 above. It destroys the prion, and offers benefits from the composted non-SRM.
- 5) Separation with Alkaline Hydrolysis of SRM, and Composting of Non-SRM (Option C): Cost \$360 per tonne (\$.164 per pound) – SRM is destroyed (assuming technology will pass CFIA tests) and Non-SRM is converted to a valuable product. This is a preferred option if an acceptable site can be found and the technology is shown to destroy the prion.
- 6) Incineration of all Mixed Material: Cost \$365 per tonne (\$.166 per pound) – SRM is destroyed. Based on the experience with the incinerator at Rodear Meats, it is quite challenging to incinerate all material because of the mass/bulk of the stomach material. Incineration of SRM alone, apparently, is not an issue. Furthermore, by incinerating all material, the beneficial re-use associated with composting is lost. Vancouver Island abattoir operators have stated that separation at source is not a major cost or inconvenience. Hauling separated materials to two different disposal sites would probably make the separation options listed above more expensive than incinerating mixed material. Ultimately, the incinerator and landfill or compost facility should be located at the same site.

None of the alternatives to the status quo can be eliminated on cost alone. The preferred alternative should be based on consideration of the conditions described above including environmental factors and the issue of destruction versus containment. Government support in favour of a specific option could also have an impact on the final outcome.

Figure 5 compares the range and average cost of the most feasible options for Vancouver Island.

**Figure 5 Cost Ranges and Averages**

A more detailed analysis will be required to accurately establish the final cost for any specific option selected and, unlike the status quo system of WCR collection, it is likely there will be variation in disposal costs between producers. Variables such as site, machinery size, machinery options, fuel used, accessories needed, truck hire versus truck purchase, distance from plants, tipping fees, land ownership, location, and jurisdiction will affect final costs.

More detailed cost analyses are presented in Appendix 4 to Appendix 8.

## Site-Specific Options

### *Conditions Affecting Site-Specific Options*

**Cost:** the variable costs and fixed costs associated with various disposal options are clearly important. In particular, SRM producers would prefer an option that has:

- Only variable costs attached to it, preferably low variable costs.
- Minimal capital cost, if any, and
- The operators have some control over costs.

**Regulations:** the regulations described above along with local zoning, codes of practice, and other policy impacts, significantly limit the options for disposal on Vancouver Island. Examples of note are the 500 m buffer required between an incinerator and the nearest residence and the collective policy and regulation designed to keep organic waste out of landfills.

**Turnkey operation:** SRM generators do not want to take time away from their core business to manage waste. They would rather use a simple service that requires no additional investment in management time or capital and, ultimately, reduces or eliminates their risk, especially risks

associated with handling wastes after they leave the premises. The simplicity of dealing with West Coast Reduction is clearly one of the main advantages of the current system.

**Simplicity:** the preferred option should be as simple as possible. This relates to the turnkey operation discussion above. Some SRM generators have admitted that separating SRM and non-SRM would be relatively simple. However, the simplicity must continue beyond the back door. It is doubtful that any of them would want to deal with multiple complex systems unless there was a significant advantage in dealing with SRM separately.

**Credibility:** the option chosen must be at a site, and with an operator, that is trustworthy and will be around for the long term. This is based on the assumption that the preferred option will be accessible to more than one SRM generating operation and possibly other organic waste generators.

**Scale:** the volume produced at individual plants on Vancouver Island cannot, by itself, support large-scale organic treatment processes.

**Destruction, not containment:** ultimately, an option that will result in destruction of the prion should be identified.

**Economic and environmental sustainability:** the current system essentially involves hauling SRM a long distance, processing it to remove a relatively small amount of tallow (albeit reducing the volume in the process), and then landfilling it. The prion is not destroyed in this process. It is hard to imagine that such a system of disposal is either environmentally, or economically, sustainable in the long term.

**Widespread benefit:** if possible, the preferred option will provide benefit to more than just the SRM generator. For example, nitrogen fertilizer is far more expensive on Vancouver Island than it is in Alberta. Yet, the current disposal system ships nitrogen, that could be used in a composting process and converted to valuable fertilizer, back to Alberta. An option that converts this portion of the waste, the non-SRM, into a product with a local value is more likely to survive the test of time.

There are a number of technologies that have been tested as a means of disposing or containing SRM and/or the abnormal prion. These have been discussed above. Studies have been conducted on each of these. Most of them require very large volumes of organic material to be viable. That volume of organic material is not available on Vancouver Island. Accordingly, these options were only considered to the point where they were clearly not viable for the industry.

## *Specific Sites or Disposal Options*

### **Status Quo - Current System**

All red meat abattoirs on Vancouver Island are shipping unseparated waste directly to West Coast Reduction using West Coast's trucks and bins, which are permitted for transport of SRM. This system is simple and effective. There is no guarantee that this option will be available indefinitely but it has been in place for many years. It offers the following advantages:

- a. Relatively low cost (\$0.125 per pound) and it is all variable cost. There are no fixed costs to the abattoirs and it fits with their existing infrastructure.
- b. Each abattoir generates a relatively small volume of SRM waste on a regular basis. They do not generate enough waste to justify investment in capital for the purpose of waste disposal.

- c. Any movement of SRM from the source requires CFIA approval of totes and transport vehicles. If the abattoirs take on this role, they will need to invest in the vehicles and containers, and obtain the necessary approvals for transport.
- d. The existing disposal and transport system (using West Coast Reduction) has all of the approvals in place through to the end disposal site.
- e. WCR picks up regularly, and often enough, that the plants do not have to invest in excess storage capacity and refrigeration.
- f. It allows the slaughter plant operators to focus on their core business and not be distracted by the sideline of managing waste.

## ***Alternatives***

After a thorough review of the potential disposal sites and options, two preferred alternatives were selected that fit with most of the criteria above. These were evaluated as follows:

- 1) Modified status quo - this suggested option involves installing an incinerator at the site of West Coast Reduction's Island Processing plant in Nanaimo. This would accommodate a system where SRM is disposed of on the Island and non-SRM continues to be rendered in Calgary.
- 2) Comox Valley Waste Management Centre - although it is at the conceptual planning stage, this option would allow composting of non-SRM from throughout the Island, combined with one of the following options for disposal of SRM:
  - a. Composting followed by an approved, and preferably beneficial, use of the composted SRM, or
  - b. Incineration, possibly even gasification, or
  - c. Landfilling.

In addition to the above, if local governments were to obtain approval from the CFIA, to dispose of SRM at municipal landfills on Vancouver Island, there would be an approved option for disposal if the existing service is disrupted or discontinued.

## **Modified Status Quo**

As noted above, this option is based on installing an incinerator at the Nanaimo site of West Coast Reduction's Island Processing plant. West Coast Reduction would also need to retrofit their trucks to allow hauling of SRM and non-SRM in separated containers. These changes would allow West Coast Reduction to transport only non-SRM off island. This will fit with their proposed changes to the disposal system on the mainland, which will result in transport of separated SRM and non-SRM to Calgary from other areas in BC.

The cost to the industry for this option is estimated at \$.135 per pound as shown in Table 4, compared to \$0.125 per pound for the status quo. Government support for the capital cost of the incinerator could potentially reduce the cost to the industry to current levels.

This is based on the assumption that the Inciner8 Model A2600 (AF) incinerator being tested at Rodear Meats can meet the emissions testing requirements and CFIA requirements for destruction of the prion. There are other potential options for installation of equipment on this site. For example, if composted SRM were permitted to be disposed of at the Nanaimo landfill, an in-vessel

composting system at this site would allow local disposal of SRM and transport of non-SRM to Calgary for rendering.

**Advantages:**

- If the cost of this option can be reduced to match current tipping fees, it will be beneficial to all users.
- The waste generators will have a viable disposal option, and WCR will receive greater value from the product it ships to Calgary.
- SRM will be disposed of closer to source.
- WCR is permitted for transport of SRM; no new transport permitting would be required from CFIA.
- This site is located in an industrial area with no residential neighbours. It also has access to natural gas as an energy source for incineration.
- WCR may also be able to incinerate other organic wastes.

**Disadvantage:** the purpose of this report was to identify an alternative to the status quo. This option is essentially linked to the status quo. If WCR discontinues service to Vancouver Island this option could disappear.

This option could result in a minor increase in employment on Vancouver Island. The operating costs for the incinerator include one part-time person. Restoring some certainty to the livestock industry, for the long-term, could also help to reverse the trend in declining production.

**Business Case Analysis for Modified Status Quo Option (WCR)**

<b>SRM</b>	
<b>Capital costs (\$)*</b>	<b>Incineration</b>
Incineration equipment (Inciner8 model A2600(AF))	78,900
Civil, building and preparatory work	4,250
CFIA permitting requirements	0
Engineering costs (15% of unit capital cost)	11,835
Tractor, vehicle, mixing or grinding machinery	93,000
<b>Total capital costs</b>	<b>\$187,985</b>
Annual amortization (10 years, no interest)	\$18,799
Operating costs per annum (SRM only)	\$62,054
<b>Cost per annum - capital and operating costs</b>	<b>\$80,853</b>
SRM Volume (tonnes)	38
Cost per tonne	\$2,128
<b>Cost per pound</b>	<b>\$0.967</b>
<b>NON-SRM</b>	
<b>Capital costs (\$)*</b>	<b>Rendering**</b>
Transport modification - separate SRM	25,000
Civil & engineering work - included in capital cost	0
Mixing or grinding machinery	0
<b>Total Capital costs</b>	<b>\$25,000</b>
Annual amortization (10 years, no interest)	\$2,500
Operating costs per annum (non-SRM)	\$80,955
<b>Cost per annum - capital and operating costs</b>	<b>\$83,455</b>
Amount of non-SRM (tonnes)	514
Cost per tonne	\$162
<b>Cost per pound</b>	<b>\$0.074</b>
<b>ALL MATERIAL</b>	
	<b>Incinerate &amp; render</b>
Combined cost per annum - SRM & non-SRM	<b>\$164,308</b>
Amount of material combined (tonnes)	552
Cost per tonne	\$298
<b>Combined average cost per pound</b>	<b>\$0.135</b>

\* Costs do not include taxes. Capital costs do not include interest.

\*\*Assumes modification of transport, not dedicated transport.

Zoning: this site is zoned Industrial and all surrounding lands are also Industrial. There is no indication as to whether or not incinerators are allowed in this zoning.

Ministry of Environment requirements: approval of the incineration unit. Based on the work at Rodear Meats, it is assumed that emissions would be the main challenge. Emission standards may be achievable if only SRM is incinerated.

CFIA requirements: the equipment would need to be approved by the CFIA as a disposal option. If it does not meet their requirements, then CFIA approval will be needed to transport and dispose of the new form of SRM generated on-site i.e. as compost, ash, or other residue.

This option would be subject to approval and cooperation by West Coast Reduction. WCR has indicated a willingness to cooperate, however there would be significant detail to negotiate a long-term agreement.

### **Comox Valley Waste Management Centre**

The Comox Valley Waste Management Centre belongs to the Comox Valley Regional District. The site, at Pidgeon Lake near Cumberland, includes an existing municipal landfill and a biosolids composting facility. It has an appropriate buffer from residential and other land uses. Conceptual plans are being developed to add additional composting capacity that would redirect organic waste from the landfill<sup>26</sup>. A second option has also been proposed for this site which would result in a large-scale gasification facility to produce energy and other beneficial by-products. This planning process is in the early stages, however staff believe there is potential to accommodate a number of disposal options for slaughterhouse waste as follows:

#### 1) SRM

- a. Composting followed by landfilling or beneficial reuse (subject to approval of the CFIA), or
- b. Incineration, which could include gasification in the future, or
- c. Landfilling on-site.

#### 2) Non-SRM

- a. Composting, or
- b. Gasification for the purpose of generating beneficial by-products including energy.

The cost to the industry for these options is estimated to range from \$.188 to \$.208 per pound as shown in Table 5, compared to \$0.125 per pound for the status quo. Even with government support for the capital cost of the SRM facility (incinerator or compost facility) and the portion of the compost facility attributable to non-SRM, the cost to the industry would be about \$.160 per pound for both of the non-landfill options.

There are a number of unanswered questions with this site/option that need to be addressed:

- Most local governments have limitations or restrictions with respect to accepting solid waste from outside of their boundaries. This option may be limited to waste originating in the Comox Valley. There is some movement towards relaxation of this and staff feels that boundaries will be erased in the future in the interests of supporting large-scale efficient waste disposal options. Based on current policy, waste generated outside the area would pay at least double the tipping fees paid by locals.
- This option is at the conceptual stage. The current landfill needs to be replaced by 2015 so something must be done fairly quickly. The end result will undoubtedly meet the disposal requirements of the CFIA. The question is what the facility will look like. Options range from an expansion of the existing compost facility to a large-scale gasification plant. It was suggested that an integrated resource management use would improve the chances that funding could be obtained to develop this option.
- Any form of this option recommended would be subject to approval by local politicians.

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<sup>26</sup> Personal conversation with staff at the Comox Valley Regional District.

**Table 4. Business Case Analysis for Comox Valley Waste Management Centre (CVWMC) Options**

<b>SRM</b>			
<b>Capital costs (\$)*</b>	<b>Incineration</b>	<b>Composting</b>	<b>Landfill</b>
Inciner8 model A2600(AF) & equipment	78,900	0	0
Enclosed channel Composting System	0	72,000	0
Cell within existing landfill	0	0	25,000
Civil, building and preparatory work	4,250	8,000	0
Use of landfill – amendment	0	0	15,000
CFIA permitting requirements	7,500	7,500	7,500
Engineering costs (15% of unit capital cost)	11,835	32,700	3,750
Tractor, vehicle, mixing or grinding machinery	93,000	138,000	
<b>Total capital costs</b>	<b>\$195,485</b>	<b>\$258,200</b>	<b>\$51,250</b>
Annual amortization (10 years, no interest)	\$19,549	\$25,820	\$5,125
Operating costs per annum (SRM only)	\$62,054	\$48,610	\$52,630
<b>Cost per annum - capital and operating costs</b>	<b>\$81,603</b>	<b>\$74,430</b>	<b>\$57,755</b>
Amount of SRM (tonnes)	38	38	38
Cost per tonne	\$2,147	\$1,959	\$1,520
Cost per pound	\$0.976	\$0.890	\$0.691
<b>NON-SRM</b>			
<b>Capital costs (\$)*</b>	<b>Composting</b>	<b>Composting</b>	<b>Composting</b>
Share of new composting facility	272,633	272,633	272,633
Environmental impact assessment	0	0	0
Civil & engineering work - included in capital cost	0	0	0
Mixing or grinding machinery	150,000	150,000	150,000
<b>Total Capital costs</b>	<b>\$422,633</b>	<b>\$422,633</b>	<b>\$422,633</b>
Annual amortization (10 years, no interest)	\$42,263	\$42,263	\$42,263
Operating costs per annum (non-SRM)	\$128,500	\$128,500	\$128,500
<b>Cost per annum - capital and operating costs</b>	<b>\$170,763</b>	<b>\$170,763</b>	<b>\$170,763</b>
Amount of non-SRM (tonnes)	514	514	514
Cost per tonne	\$332	\$332	\$332
Cost per pound	\$0.151	\$0.151	\$0.151
<b>ALL MATERIAL</b> n	<b>Incinerate &amp; compost</b>	<b>Compost &amp; compost</b>	<b>Landfill &amp; compost</b>
Combined cost per annum - SRM & non-SRM	<b>\$252,366</b>	<b>\$245,193</b>	<b>\$228,518</b>
Amount of material combined (tonnes)	552	552	552
Cost per tonne	\$457	\$444	\$414
<b>Cost per pound</b>	<b>\$0.208</b>	<b>\$0.202</b>	<b>\$0.188</b>

\*All costs exclude taxes. Capital costs exclude interest - assumes full funding

Note: the cost per pound in Table 5 above are specific to this site as opposed to the costs shown in Table 3 which are average costs associated with various options at an undetermined site.

Advantages: This option has the potential to satisfy all of the conditions described above. Given that this option would be developed and controlled by local government, it represents a credible long-term solution to the slaughterhouse waste issue on Vancouver Island. Waste management is the

core business in this option. Waste would be handled by trained and experienced personnel and would be monitored appropriately.

Disadvantages: the cost of disposal for slaughterhouses from areas outside the Regional District may be higher than those close to the facility.

Challenges: An incinerator at this site could beneficially use biogas from the landfill, however, this would be technically challenging. If SRM is composted, there could be several alternatives for beneficial reuse of composted SRM however, an approved and credible process will need to be developed to ensure the material is safely disposed of or used.

Employment opportunities: development of this option will very likely lead to increased local employment. The extent of employment increase will depend on the option chosen.

Zoning: this site is appropriately zoned for the proposed use. However, there may still be considerable discussion amongst local politicians about which option is best suited to the area and the location.

Ministry of Environment requirements: this option is being developed to deal with municipal solid waste from the Regional Districts of the Comox Valley and Strathcona. As such, MoE requirements will be met as part of the process.

CFIA requirements: CFIA approval will be needed: to transport SRM to the site; for the incinerator or any other processing equipment or process to be used at the site, and; for final disposal of SRM. If the SRM is composted and the intent is to beneficially reuse composted SRM, then further transportation and final use of compost and SRM will require permitting.

Final financing and cost estimates have not been determined. The figures per pound above, indicate a fairly high cost to develop the facilities, but do not necessarily indicate the cost to the producer (abattoir or farmer) for the use of this disposal method. With total or partial capital funding from Government, the producer contribution towards operating costs could be reduced. Furthermore, average operating costs have been used in this analysis. Actual costs may be lower if more efficient systems are used. These factors may bring costs to producers within the range of the current disposal method with West Coast Reduction.

The Business Case Analysis assumes all non-SRM will be composted at the CVRD facility, the cost of which is likely to be \$0.15 per pound (slightly higher than the previous financial analysis of \$0.13). Predictably, for SRM, the lowest cost is shown to be associated with landfilling. The high cost of composting SRM is associated with the need for dedicated equipment (preferably in-vessel) combined with the need to further dispose of the SRM compost.

It has previously been stated that Regional District landfills are reluctant to handle the raw SRM waste for burial, but it is possible, and, in the case of Comox Valley, will require further discussion at a higher level. It may be that the option of landfilling will be temporary while an alternate permanent solution is developed and tested.

Incineration of SRM, combined with composting of non-SRM, appears to be the most likely solution, but will depend on further satisfactory testing for both technologies. While those technologies are being tested, the industry can continue to use West Coast Reduction, or, in their absence, the landfilling/compost combination.

### **Landfilling at Municipal Landfills**

As noted elsewhere, the main reason that SRM is not disposed of at municipal landfills is the lack of approval by the CFIA. Local governments are trying to reduce the volume of waste going to landfill and there are challenges with management and perception related to disposal of SRM. However, if, as least one local government would obtain approval from the CFIA, there would be an acceptable option for disposal of SRM if the existing service was no longer available or disrupted.

### **On-Site Incineration at Westholme Meats**

Preliminary discussions with Norm Quist at Westholme Meats indicate that they would consider installing an incinerator at their operation if West Coast Reduction's services were not available. It is believed that there is a suitable buffer around the plant to accommodate an incinerator. However, because this is on private land, it is unlikely that it would be available for other users or other generators of SRM. Also, these discussions took place without the knowledge that the incinerator currently being tested may not achieve the emissions standards. If that is the case, incineration would not be an option at Westholme.

## Conclusions and Recommendations

Specified Risk Material (SRM) is the portion of slaughterhouse waste that could contain the infective agent that causes “Mad Cow Disease” or BSE. Control and eradication of BSE is a very important human health and international trade goal for Canada. However, it creates some very significant challenges for disposal of material that is deemed to be SRM. SRM is perceived, by some, to be “toxic waste” when in reality, the purpose of the disposal regulations is to ensure that it is not ingested by ruminant animals. The total volume of SRM generated by slaughterhouses on Vancouver Island is estimated to be 38 tonnes per year.

Many studies have been completed on the subject of SRM and slaughter waste disposal for other areas of B.C. This study has used much of that information rather than reinventing it. However, solutions that will work for the slaughter industry on Vancouver Island must recognize some of the unique conditions that the industry operates within. First, the industry is relatively small compared to other areas. It is also spread out which inherently leads to small volumes of slaughter waste, hauled significant distances on a weekly basis. Acceptable disposal options are limited by the wet climate and the effect it has on potential landfill sites. Ferry transportation complicates and adds cost for distant disposal options.

The purpose of this study was to identify site-specific, practical alternatives for disposal of slaughterhouse waste on Vancouver Island. The true challenge is to find acceptable options for disposal of slaughterhouse waste from red meat plants, particularly for SRM. There are several available options for disposal of non-SRM. Poultry plants, for example, which do not generate SRM, generally compost their waste.

Abattoirs on Vancouver Island are generally content with the current system of disposal. West Coast Reduction’s disposal service serves the industry reasonably well. However, recent increases in collection rates have moved the costs closer to other alternatives.

**Impact of the issue on the livestock industry.** Livestock production on Vancouver Island is economically challenging. High input costs, especially feed, combined with high land prices are pushing livestock production off island. The industry is shrinking. Increasing waste disposal charges at the abattoir further reduce the margins in the industry. This will have an impact on the Island’s food security and land use within the ALR. A suitable disposal option will have a widespread impact; it is not just a farmer/abattoir issue.

This study was done in late December through February. The short time frame did not allow all of the site-specific questions to be answered. Winter vacations and people in new positions have left some gaps in information. New information arose, late in the study, which impacted the alternatives being considered:

- A 66% increase in WCR’s collection fees announced on February 11, 2009
- News that the pilot incinerator at Williams Lake may not achieve emissions standards, and
- An indefinite closure of the Catalyst Paper facility at Elk Falls near Campbell River

**Specific Sites/Options:** Two credible sites were identified with several potential options at those sites:

- Installing an **incinerator at West Coast Reduction’s Island Processing Plant**. This option was described as “modified status quo” because it is not really an alternative to the current

system but it may allow improvements to the current system. The incinerator could be used to dispose of SRM so that WCR could transport only non-SRM off island for rendering in Calgary. If incineration cannot be proven elsewhere, a small composting facility at this location may also improve the current system. That option would require an acceptable and use for the composted SRM.

- Developing an **acceptable disposal option at the CVRD's Comox Valley Waste Management Centre** near Cumberland. The exact disposal option is not defined at this point because plans for this facility are in the conceptual stage. This alternative is suggested because the local government is receptive to it and it fits within the proposed concept. The end result will be a combination of composting of non-SRM and either landfilling, composting, or incineration of SRM. Gasification of all material is also a potential option. At this point, any of these options could be accommodated and they could all be adjusted to ensure that they are approved by the CFIA.

Both of these options will allow disposal of SRM and non-SRM on one single route which ensures minimal transportation and permitting costs.

Government support, in the form of a contribution towards capital costs, would help to reduce the cost of waste disposal for abattoirs and farmers.

It is also recommended that local governments on Vancouver Island apply to the Canada-British Columbia Specified Risk Material (SRM) Management Program for funding to cover costs associated with obtaining CFIA approval to dispose of SRM at their landfills. This would ensure that there are approved disposal options for slaughterhouse waste available in the absence of other options.

It is suggested that provision of waste disposal services at a competitive rate would serve the interests of protecting human health and protecting food security and would help the industry remain competitive on Vancouver Island.

The **main recommendations** that flows out of this study are:

- 1) To begin discussions with the Comox Valley Regional District to further develop the concept of adding an incinerator or dedicated SRM composting facility at the Comox Valley Waste Management Centre near Cumberland. Given that there is considerable uncertainty with the emissions from the smaller scale incinerator in the interior, a pilot project for a larger scale incinerator that would deal with multiple waste streams could be considered at this location.
- 2) For local governments to obtain approval from the CFIA to dispose of SRM in at least one municipal landfill on Vancouver Island. There is potential funding assistance (Canada-British Columbia Specified Risk Material (SRM) Management Program) to cover the costs of obtaining an approval and, if one landfill was approved for disposal, there would be an acceptable option available to the industry if the current service is disrupted or no longer available.

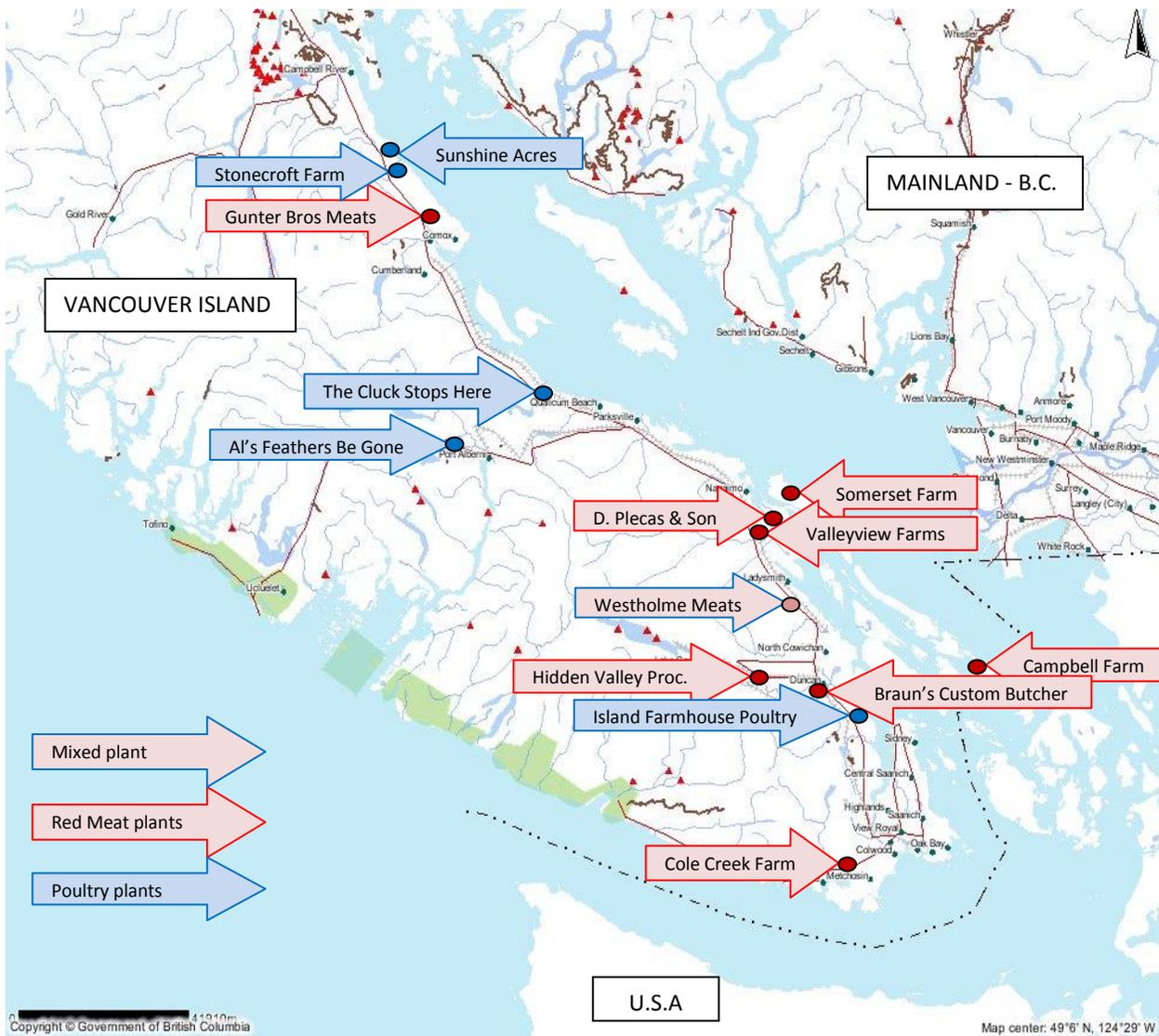
## Appendices

### *Appendix 1 - List and Map of Licensed Meat Plants on Vancouver Island*

#### **PROVINCIALY LICENSED MEAT PLANTS - VANCOUVER ISLAND, GULF ISLANDS AND POWELL RIVER**

<b>No.</b>	<b>Name</b>	<b>Business name</b>	<b>Operation</b>	<b>Telephone</b>	<b>Address</b>
1	Michael Peterson	<b>Cole Creek Farm Ltd</b>	Red Meat Class A	250-478-4850	755 Winfall Road Metchosin, V9B 5B4
2	George Gomerich	<b>Valleyview Farms</b>	Red Meat Class A	250-753-1753	2322 Gomerich Road Nanaimo, V9X 1R9
3	Norm Quist	<b>Westholme Meat Packers</b>	Red Meat & Poultry Class A	250-246-9500	7824 Westholme Road Westholme, V0R 1K0
4	Lyle Young	<b>Island Farmhouse Poultry Ltd</b>	Poultry Class A	250-746-6163	1615 Koksilah Road Cowichan Bay, V0R 1N1
5	Dennis & Harry Gunter	<b>Gunter Bros. Meat Co. Ltd</b>	Red Meat Class A	250-334-2960	6200 Ledingham Road Courtenay, V9J 1M5
6	Lori Gillis	<b>The Cluck Stops Here</b>	Poultry Class A	250-752-3082	1229 Walz Road Qualicum, V9K 2S8
7	Alistair Harley	<b>Al's Feathers Be Gone</b>	Poultry Class A	250-723-8307	6795 Swanson Road Port Alberni, V9Y 8L7
8	Mark Cardin	<b>Hidden Valley Processing</b>	Red Meat Class A	250-746-7235	6010 Cowichan Lake Rd Duncan, V9L 6H7
9	Kathy Beaton	<b>Stonecroft Farm</b>	Poultry Class A	250-337-5789	2165 Kelland Road Black Creek, V9J 1G4
10	Gordon Peters	<b>Sunshine Acres Poultry</b>	Poultry Class A	250-897-8008	8486 Island Highway Black Creek, V9J 1M3
11	Jacques Campbell	<b>Campbell Farm</b>	Red Meat Class A	250-539-2470	Box 9, 102 Quarry Saturna Island, V0N 2Y0
12	Eric Boulton	<b>Somerset Farm</b>	Red Meat Class A	250-247-9202	2585 North Road Gabriola, V0R 1X7
13	Rod Plecas	<b>D. Plecas &amp; Son</b>	Red Meat Class C	250-754-2238	2100 Plecas Road Nanaimo, V9X 1R9
14	Alfred Braun	<b>Braun's Custom Butcher Shop</b>	Red Meat Class C	250-746-6507	3901 Rowe Road Duncan, V9L 6T1

Map showing location of licensed abattoirs (Vancouver Island and Gulf Islands):



**Appendix 2 - Abattoir/Processor Questionnaire**

- 1 BUSINESS NAME.....
- .....
- 2 CONTACT NAME.....
- .....
- 3 ADDRESS.....
- .....
- TELEPHONE.....
- EMAIL.....

4 CARCASS GENERATION PER ANNUM:

	Beef UTM	Beef OTM	Veal	Pigs	Lamb & sheep	Bison
kg's/annum						
head/annum						
waste/annum						
SRM waste						

	Deer	Goats	Chickens	Turkeys	Other poultry
kg's/annum					
head/annum					
waste/annum					
SRM waste					

- 5 CURRENT WASTE DISPOSAL METHOD.....
- .....
- 6 CURRENT WASTE DISPOSAL COST PER POUND.....
- .....
- 7 WOULD YOU WANT TO CHANGE YOUR CURRENT WASTE DISPOSAL METHOD?
- .....
- WHY?.....
- .....
- 8 DO YOU SEPARATE SRM?.....
- .....
- IF NOT, COULD YOU DO SO?.....
- .....
- 9 DO YOU EXPECT PRODUCTION TO INCREASE OR DECREASE IN NEXT 5 YEARS?
- .....
- IF SO, BY WHAT %?.....
- .....
- 10 ANY OTHER COMMENTS.....
- .....

## Appendix 3 - Detailed Estimates of Livestock Production and Waste Generated

LIVESTOCK NUMBERS & WASTE GENERATION - VANCOUVER ISLAND\*, POWELL RIVER\*\* AND SUNSHINE COAST^

		NOTE: projections of waste generation are best estimates only						Figures are livestock numbers			All weights are in TONNES								
Livestock numbers are for 2006 (stats canada figures)	Region	CAPITAL	COWICHAN	NANAIMO	ALBERNI & CLAYOQUOT	COMOX	PR** & COAST^	GROSS TOTAL	Off island live sales	NET TOTAL	Total Weight of livestock	Total VI* Slaughter liveweight	Non SRM Slaughter waste	Process waste	Slaughter SRM waste	Total slaughter & process waste	Farm Mortality	Total of ALL waste	Total SRM
Category	sub-category																		
<b>Cattle UTM</b>	Steers over 1yr	166	458	326	36	349	56	1,391		1,391	626	<b>486</b>	165	73	10		19		<b>28</b>
	Heifers - slaughter	92	338	214	16	185		845		845	338	<b>262</b>	89	39	5		10		<b>15</b>
	Calves under 1 yr	1,211	2,449	974	357	2,212	264	7,467		7,467	1,307	<b>65</b>	22	10	1		39		<b>41</b>
<b>Cattle OTM</b>	Beef cows	908	1,146	947	343	972	340	4,656	279	4,377	2,188	<b>66</b>	26	9	5		70		<b>74</b>
	Dairy cows	498	3,632	456	401	2,917	7	7,911	949	6,962	3,829	<b>230</b>	90	30	16		261		<b>277</b>
	Bulls/other	84	108	95	27	96	27	437	26	411	267	<b>8</b>	3	1	1	Cattle	9		<b>9</b>
<b>Sub Total - cattle</b>								<b>22,707</b>	<b>1,255</b>	<b>21,452</b>	<b>8,555</b>	<b>1,117</b>	<b>395</b>	<b>161</b>	<b>38</b>	<b>594</b>	<b>408</b>	<b>1,001</b>	<b>445</b>
<b>Sheep</b>	Ewes	3,226	996	755		942	250	6,169		6,169	339	<b>34</b>	8	5			17		
	Lambs	4,338	1,175	799	151	1,040	300	7,803		7,803	429	<b>300</b>	72	48			21		
<b>Bison</b>								200		200	82	<b>16</b>	6	2			2		
<b>Deer</b>			268					648		648	32	<b>6</b>	2	1			2		
<b>Goats</b>		394	1,021	149				1,942		1,942	97	<b>19</b>	5	3		Other Ruminant	5		
<b>Sub Total - other ruminants</b>								<b>16,762</b>	<b>0</b>	<b>16,762</b>	<b>980</b>	<b>377</b>	<b>93</b>	<b>60</b>	<b>0</b>	<b>152</b>	<b>47</b>	<b>200</b>	<b>0</b>
<b>Total ALL ruminants</b>								<b>39,469</b>	<b>1,255</b>	<b>38,214</b>	<b>9,535</b>	<b>1,493</b>	<b>487</b>	<b>221</b>	<b>38</b>	<b>746</b>	<b>455</b>	<b>1,201</b>	<b>445</b>
<b>Pigs</b>	Breeding sows	54	87	43		127		311		311	47	12	3	3			2		
	Grower/finishers	127	540	159		752		1,578		1,578	158	<b>379</b>	83	87			16		
<b>Chicken</b>	Broilers	320,784	82,449	67,699	898	9,164	1,774	482,768	362,076	120,692	302	<b>1,388</b>	347				272		
	Layers	98,474	154,758	24,860		8,286	2,200	288,578	216,434	72,145	216	<b>216</b>	54				87		
<b>Turkey</b>		504	9,278	494		802	100	11,178	8,384	2,795	20	<b>68</b>	17				16		
<b>Other poultry</b>		839	5,756	2,102	152	893		9,742		9,742	29	<b>58</b>	15			Non-ruminants	3		
<b>Sub-total - non-ruminant</b>								<b>794,155</b>	<b>586,893</b>	<b>207,262</b>	<b>771</b>	<b>2,122</b>	<b>519</b>	<b>90</b>	<b>0</b>	<b>608</b>	<b>395</b>	<b>1,003</b>	<b>0</b>
<b>TOTAL ALL LIVESTOCK</b>								<b>833,624</b>	<b>588,148</b>	<b>245,476</b>	<b>10,306</b>	<b>3,615</b>	<b>1,006</b>	<b>311</b>	<b>38</b>	<b>1,355</b>	<b>850</b>	<b>2,204</b>	<b>445</b>

## Appendix 4 - Detailed Cost Estimates for Inciner8 Incinerator

### Inciner8 Model A2600(HF) incinerator capital and operating costs

#### Incinerator Operating Assumptions

Burn rate (kilograms per hour)	250
Operational hours per day	18
Pre-heat hours per day	1
Number of days per week in operation	6
<b>Tonnes of waste incinerated per year</b>	<b>1400</b>

#### Capital Costs

Item	Detail	Cost
A2600(HF) Incinerator	Purchase price	\$60,750
	Spare parts	\$3,200
	Transport to Vancouver Island	\$2,500
	Installation cost	\$1,250
	Import duty	\$6,700
Fuel tank		\$4,500
Drum handling tractor		\$18,000
Site preparation costs	Cement pad	\$3,000
Power	Install electrical power connection	\$1,250
<b>Sub-Total</b>		<b>\$101,150</b>
PST		\$7,081
<b>Total Capital Costs</b>		<b>\$108,231</b>

#### Annual Incineration Costs

Item	Detail	Cost
Incinerator fuel	11 litres per hour @ 75% efficiency = 87,000 litres of furnace oil @ \$1.40 per litre	\$121,800
Labour	4 hours per day (1 hour first load, 1 hour second load, 2 hours unload ash) @ \$25 per hour	\$31,200
Ash hauling costs	98 tonnes @ \$220 per tonne	\$21,560
Ash landfill tipping fees	\$65 per tonne	\$5,880
Incinerator repairs	5% of capital cost	\$3,040
Emission monitoring	Annual cost	\$5,000
Tractor repairs	10% of capital cost	\$1,800
Tractor fuel	624 hours per year @ 6 litres of diesel fuel per hour @ \$1.40 per litre	\$5,240
Electricity	1186 kW per year	\$90
Amortized capital costs	10 years @ 7%	\$15,080
<b>Total Annual costs</b>		<b>\$210,690</b>
<b>Cost per tonne</b>		<b>\$150</b>
<b>Cost per pound</b>		<b>\$0.07</b>

Source: Ference Weicker & Company: SRM Containment and Destruction Options and Evaluations for the Fraser Valley

#### TRANSPORT COST CALCULATIONS (for waste on Vancouver Island)

- Transport costs based on \$85 per hour round trip
- Cost per tonne ranges from a high of approximately 2 tonnes of waste on a 3.5 hour journey, or a low of approximately 4 tonnes of waste on a 2 hour journey
- Length of journey depends on location on Vancouver Island
- Assumes transport to a fairly central location on the Island. If the destination is not central, this range of costs may vary
- Transport for SRM assumes extra cost for separate handling, and permitting

## Appendix 5 - Detailed Cost Estimates for Small Scale Alkaline Hydrolysis Digesters

### Alkaline Hydrolysis - Capital and Running Costs

Running Cost Estimates for Operation of Alkaline Hydrolysis Tissue Digester with 900 Kilogram (2,000 Pound) Capacity

Item	Per Tonne	Per Pound
Steam, water, electricity	\$22	\$0.01
Chemicals (NaOH, KOH)	\$44	\$0.02
Personnel (4 hours/day for 2 cycles)	\$88	\$0.04
Sanitary sewer costs	\$154	\$0.07
Maintenance and repair	\$44	\$0.02
<b>Total</b>	<b>\$352</b>	<b>\$0.16</b>

Capital Cost Estimates for BioLiquidator Alkaline Hydrolysis Digesters

Item	Description	Cost
<b>Stationary Unit Models</b>		
S-2500	Digests 230 – 1130 kilograms (500 – 2500 pounds) in a single cycle	\$69,500
S-3500	Digests 340 – 1370 kilograms (750 – 3000 pounds) in a single cycle	\$81,500
<b>Mobile Unit Models</b>		
M-2500	Digests 230 – 1130 kilograms (500 – 2500 pounds) in a single cycle	\$87,500
M-3500	Digests 340 – 1370 kilograms (750 – 3000 pounds) in a single cycle	\$91,500

Assuming all slaughter house waste will be processed, 2 of either of the above units would be required

Capital costs therefore will vary according to the summary of costs	<b>From</b>		<b>\$139,000</b>
	<b>To</b>		<b>\$183,000</b>

Volume of Hydrolyzate and Total Effluent Produced Per Cycle from the Alkaline Hydrolysis Process

Unit Capacity (kilograms/pounds)	Hydrolyzate* (litres)	Total Effluent** (litres)
230/500	606	1,212
680/1,500	1,666	3,635
910/2,000	2,196	4,392
1,800/4,000	4,733	9,466
3,630/8,000	9,466	18,931
4,540/10,000	11,927	23,853

\* Undiluted effluent produced per cycle.

\*\* Includes hydrolyzate, cooling water, rinse water, and coflush.

Source: Ference Weicker & Co.: SRM Containment and Destruction Options and Evaluations for the Fraser Valley

### TRANSPORT COST CALCULATIONS (for waste on Vancouver Island)

- Transport costs based on \$85 per hour round trip
- Cost per tonne ranges from a high of approximately 2 tonnes of waste on a 3.5 hour journey, or a low of approximately 4 tonnes of waste on a 2 hour journey
- Length of journey depends on location on Vancouver Island
- Assumes transport to a fairly central location on the Island. If the destination is not central, this range of costs may vary
- Transport for SRM assumes extra cost for separate handling, and permitting

## ***Appendix 6 - Detailed Cost Estimates for Composting System***

### **Transform Enclosed Channel composting system**

<b>Capital costs:</b>	<b>Cap. Costs</b>	<b>O&amp;M Costs</b>	<b>O&amp;M Total</b>
Compost Housing Facility (2 m x 40 m)	\$80,000		
Turner, mixer/feeder	\$138,000		
Engineering Costs (15% of above)	\$32,700		
Infrastructure costs			
Other costs and transport	\$7,500		
<b>Total Capital Costs</b>	<b>\$258,200</b>		
<b>Operating and maintenance costs:</b>			
<b>LABOUR COSTS</b>			
Base Labour (Heavy Equipment Operator)		\$4,750	
Base Labour		\$10,500	
Benefits		\$3,250	
Backfill (vacation, sick, WCB, training)		\$4,000	
<b>Total Labour Cost</b>			<b>\$22,500</b>
<b>EQUIPMENT COSTS</b>			
Chipper Rental		\$6,500	
Vibrating Screen Rental		\$3,500	
Loader use		\$6,500	
<b>Total Equipment Cost</b>			<b>\$16,500</b>
<b>VEHICLE COSTS</b>			
Collection Vehicle Lease			
Maintenance		\$1,000	
Fuel		\$1,000	
<b>Total Vehicle Cost</b>			<b>\$2,000</b>
<b>FACILITY OPERATION COSTS</b>			
Electrical Consumption		\$1,600	
Water Consumption		\$10	
Facility Maintenance		\$6,000	
<b>Total Operation Costs</b>			<b>\$7,610</b>
<b>Total Annual O &amp; M Costs</b>			<b>\$48,610</b>

*Source: Cost estimates for capital are based on discussions with Transform Compost. Operating costs are prorated based on a University of Toronto composting cost study.*

## **Appendix 7 - Capital Costs – Comox Valley Waste Management Centre Composting Facility**

### **Capital costs - composting facility - Comox Valley Regional District**

<b>Cost centre</b>	<b>Cost</b>	<b>Initial design tonnage</b>	<b>non-SRM waste tonnage</b>	<b>Proportion of total</b>
Sitework	240,773			
Receiving and mixing building	629,439			
Primary composting tunnel	919,583			
Biofilter	131,879			
Secondary composting system	1,091,384			
Curing, storage and sales pads	71,100			
Weigh scale	140,000			
Fencing and miscellaneous	863,500			
Sub-contractor overhead and margin	409,000			
<b>Total construction costs</b>	<b>\$ 4,496,658</b>			
Contingency	1,573,830			
Consultant and sub-contractor fees	1,031,748			
<b>Probable total costs</b>	<b>\$ 7,102,236</b>	13,390	514	3.8%
<b>Share of costs for slaughter house waste</b>				<b>\$ 272,633</b>

Source: **CH2M HILL** - Centralized Composting Facility Preliminary Evaluation study for CVRD

## Appendix 8 - Detailed Cost Estimates for Various Disposal Options

### Landfill and Compost Combination versus Landfill Only

#### Summary of Costs - Mixed Options

figures in tonnes or per tonne unless otherwise stated

Option	Minimum usage Minimum price	Minimum usage Maximum price	Maximum usage Minimum price	Maximum usage Maximum price
<b>Landfill SRM and Compost non-SRM</b>				
<b>SRM</b>				
Total mass of SRM (and/or deadstock) <sup>1</sup>	38	38	265	265
Separate collection and transport to landfill <sup>2</sup>	\$40	\$2,280	\$40	\$2,280
Existing Landfill tipping fee <sup>3</sup>	\$150	\$300	\$150	\$300
<b>Total \$ cost</b>	<b>\$7,220</b>	<b>\$98,040</b>	<b>\$50,350</b>	<b>\$683,700</b>
Total cost per tonne	\$190	\$2,580	\$190	\$2,580
Total cost per pound	\$0.09	\$1.17	\$0.09	\$1.17
<b>Non-SRM</b>				
Total mass of non-SRM <sup>4</sup>	514	514	1317	1317
Separate collection & transport to compost facility <sup>5</sup>	\$40	\$150	\$40	\$150
Compost tipping fee <sup>6</sup>	\$65	\$245	\$65	\$245
<b>Total \$ cost</b>	<b>\$53,970</b>	<b>\$203,030</b>	<b>\$138,285</b>	<b>\$520,215</b>
Total cost per tonne	\$105	\$395	\$105	\$395
Total cost per pound	\$0.05	\$0.18	\$0.05	\$0.18
<b>Total of SRM and non-SRM</b>				
Total mass of all waste	552	552	1582	1582
<b>Total \$ cost</b>	<b>\$61,190</b>	<b>\$301,070</b>	<b>\$188,635</b>	<b>\$1,203,915</b>
Total cost per tonne	\$110.85	\$545.42	\$119.24	\$761.01
<b>Total cost per pound</b>	<b>\$0.050</b>	<b>\$0.248</b>	<b>\$0.054</b>	<b>\$0.346</b>

Option	Minimum usage Maximum price	Maximum usage Minimum price
<b>Landfill all</b>		
<b>Mixed SRM</b>		
Total mass of mixed waste material	552	1400
Collection and transport to landfill	\$150	\$40
Tipping fee	\$300	\$150
<b>Total \$ cost</b>	<b>\$248,400</b>	<b>\$266,000</b>
Total cost per tonne	\$450	\$190
<b>Total cost per pound</b>	<b>0.205</b>	<b>0.086</b>

<sup>1</sup> Low figure is slaughter SRM. High figure includes 50% of ruminant mortalities.

<sup>2</sup> Transport cost \$85/hr. Low end cost assumes 4.25 tonnes in 2 hours.

High end cost assumes 0.15 tonnes in 4 hours (based on estimate of low SRM per week).

<sup>3</sup> Based on current fee, and double that for waste from outside the RD area.

<sup>4</sup> Low figure is WCR collections less SRM. High figure is all slaughter waste less SRM.

<sup>5</sup> See explanation at foot of Appendix 4 & 5.

<sup>6</sup> Indication from composters based on type of material and operating costs.

**Incinerate and Compost Combination versus Incineration Only****Summary of Costs - Mixed Options**

figures in tonnes or per tonne unless otherwise stated

Option (per tonne unless stated)	Minimum usage	Minimum usage	Maximum usage	Maximum usage
<b>Incinerate SRM and Compost non-SRM</b>	Minimum price	Maximum price	Minimum price	Maximum price
<b>SRM</b>				
Total mass of SRM (and/or deadstock)	38	38	265	265
Separate collection and transport to incinerator	\$40	\$2,280	\$40	\$2,280
Incinerator capital cost <sup>7</sup>	\$55	\$397	\$55	\$397
Cost of incineration <sup>8</sup>	\$150	\$350	\$150	\$350
<b>Total \$ cost</b>	<b>\$9,310</b>	<b>\$115,026</b>	<b>\$65,050</b>	<b>\$802,155</b>
<b>Total cost per tonne</b>	<b>\$245</b>	<b>\$3,027</b>	<b>\$245</b>	<b>\$3,027</b>
<b>Total cost per pound</b>	<b>\$0.11</b>	<b>\$1.38</b>	<b>\$0.11</b>	<b>\$1.38</b>
<b>Non-SRM</b>				
Total mass of non-SRM	514	514	1317	1317
Separate collection & transport to compost facility	\$40	\$150	\$40	\$150
Compost tipping fee	\$65	\$245	\$65	\$245
<b>Total \$ cost</b>	<b>\$53,970</b>	<b>\$203,030</b>	<b>\$138,285</b>	<b>\$520,215</b>
<b>Total cost per tonne</b>	<b>\$105</b>	<b>\$395</b>	<b>\$105</b>	<b>\$395</b>
<b>Total cost per pound</b>	<b>\$0.05</b>	<b>\$0.18</b>	<b>\$0.05</b>	<b>\$0.18</b>
<b>Total of SRM and non-SRM</b>				
Total mass of all waste	552	552	1582	1582
<b>Total \$ cost</b>	<b>\$63,280</b>	<b>\$318,056</b>	<b>\$203,335</b>	<b>\$1,322,370</b>
<b>Total cost per tonne</b>	<b>\$114.64</b>	<b>\$576.19</b>	<b>\$128.53</b>	<b>\$835.88</b>
<b>Total cost per pound</b>	<b>\$0.052</b>	<b>\$0.262</b>	<b>\$0.058</b>	<b>\$0.380</b>

Option	Minimum usage	Maximum usage
<b>Incinerate all</b>	Maximum price	Minimum price
<b>Mixed SRM</b>		
Total mass of mixed waste material <sup>9</sup>	552	1400
Collection and transport to incinerator	\$150	\$40
Incinerator capital cost	\$27	\$11
Cost of incineration	\$350	\$150
<b>Total \$ cost</b>	<b>\$290,700</b>	<b>\$280,700</b>
<b>Total cost per tonne</b>	<b>\$527</b>	<b>\$201</b>
<b>Total cost per pound</b>	<b>\$0.239</b>	<b>\$0.091</b>

<sup>7</sup> Based on annual cost of \$14,700 divided by minimum & maximum SRM figures.

<sup>8</sup> Based on preliminary estimates from current incinerator tests (Rodear Meats).

<sup>9</sup> Low figure for WCR collection. High figure for maximum through an A2600 incinerator.

**Compost SRM and non-SRM separately versus Mixed Composting****Summary of Costs - Mixed Options**

figures in tonnes or per tonne unless otherwise stated

Option (per tonne unless stated)	Minimum usage	Minimum usage	Maximum usage	Maximum usage
<b>Compost (separate) SRM and Compost non-SRM</b>	Minimum price	Maximum price	Minimum price	Maximum price
<b>SRM</b>				
Total mass of SRM (and/or deadstock)	38	38	265	265
Separate collection and transport to composter	\$40	\$2,280	\$40	\$2,280
Composter capital cost <sup>10</sup>	\$467	\$1,402	\$67	\$201
Compost tipping fee <sup>11</sup>	\$65	\$300	\$65	\$300
Total \$ cost	\$21,736	\$151,316	\$45,580	\$736,965
Total cost per tonne	\$572	\$3,982	\$172	\$2,781
Total cost per pound	\$0.26	\$1.81	\$0.08	\$1.26
<b>Non-SRM</b>				
Total mass of non-SRM	514	514	1317	1317
Separate collection & transport to compost facility	\$40	\$150	\$40	\$150
Compost tipping fee	\$65	\$245	\$65	\$245
Total \$ cost	\$53,970	\$203,030	\$138,285	\$520,215
Total cost per tonne	\$105	\$395	\$105	\$395
Total cost per pound	\$0.05	\$0.18	\$0.05	\$0.18
<b>Total of SRM and non-SRM</b>				
Total mass of all waste	552	552	1582	1582
Total \$ cost	\$75,706	\$354,346	\$183,865	\$1,257,180
Total cost per tonne	\$137.15	\$641.93	\$116.22	\$794.68
<b>Total cost per pound</b>	<b>\$0.062</b>	<b>\$0.292</b>	<b>\$0.053</b>	<b>\$0.361</b>

Option	Minimum usage	Maximum usage
<b>Compost all</b>	Maximum price	Minimum price
<b>Mixed SRM</b>		
Total mass of mixed waste material	552	1400
Collection and transport to composter	\$150	\$40
Composter capital cost <sup>12</sup>	\$77	\$30
Cost of composting <sup>11</sup>	\$300	\$65
Total \$ cost	\$290,904	\$189,000
Total cost per tonne	\$527	\$135
<b>Total cost per pound</b>	<b>\$0.240</b>	<b>\$0.061</b>

<sup>10</sup> Based on \$533000 for in-vessel (spread over 10 years) to one third of that for a less advanced system (windrow or static pile). SRM weight range used.

<sup>11</sup> Slightly higher top figure due to nature of the material (SRM).

<sup>12</sup> Based on capital cost in Business Case Analysis for non-SRM (\$422,633) over 10 years. Weight range used as per <sup>9</sup> above.