REGIONAL DISTRICT OF NANAIMO

STAFF REPORT

TO:	Daniel Pearce A/General Manager, Transportation & Solid Waste Services	**DATE:**	May 21, 2015
		MEETING:	RSWAC, May 28, 2015
FROM:	Sharon Horsburgh Senior Solid Waste Planner	**FILE:**	5365-00

SUBJECT: An Overview of Multi Material Recycling Facility Technologies

RECOMMENDATION

That the Regional Solid Waste Advisory Committee (RSWAC) receive this report for information as part of the 2015 Solid Waste Management Plan Review Process.

PURPOSE

To provide background information on Multi-Material Recycling facilities that is intended to stimulate discussion on future options for consideration during the Solid Waste Management Plan Review Process.

BACKGROUND

Materials Recovery Facility Processes

Materials Recovery Facilities (MRFs) provide an intermediary or pretreatment approach involving the manual and mechanical separation of a Municipal Solid Waste (MSW) feedstock into recyclable and non-recyclable materials streams. There are two distinct types of MRF's which are typically referred to as "clean" or "dirty" MRF processes.

"Clean" MRFs

The most common type of MRF are "clean MFRs" that provide sorting and processing function for clean, dry, commingled recyclable materials (excluding putrescible and green wastes) derived from source separated collection programs.

"Dirty" MRF's

Dirty MRF's tend to handle single stream materials that require processes to provide a sorting function for mixed MSW feedstocks (including putrescible and organic wastes). Some dirty MRF's process residual waste exclusively to provide energy and fuel sources for other waste disposal treatments. Generally, dirty MRFs are tooled to exclusively recover dry recyclables, with the wet residue and non-recyclables destined for landfill or as feedstock for incinerators/advanced thermal treatment processes. According to research this type of system achieves at best 50 per cent recovery of material for recycling and the residual is either landfilled or used as fuel waste to energy facilities.

MRF processes involve a number of stages, including removal and processing of large bulky items, manual and automated sorting of recyclables, and organics screening. Bagged waste may be opened manually or mechanically using trommel screens with knives. Typical MRF equipment used to recover recyclables includes conveyors, screens, magnets and eddy current separators, shredders, crushers and bailers.

Collection Methods

Over the last 20 to 30 years the basic MRF, along with collection systems, has been rapidly changing. Collection systems have evolved from the multi-bin/truck-side sort method to dual-stream (termed commingled), to wet/dry collection systems where the wet fraction is organic waste such as food waste and yard waste; soiled paper, foil, plastic, and other materials; diapers and the dry fraction consisting of recyclables and non-recyclables.

Curbside collection options include: single stream collection (fully commingled); two stream collection (partially commingled); multi-stream collection (segregated); and Co-collection. This approach is essentially the simultaneous collection of two or more material streams (e.g., recyclables and garbage, or recyclables and organics) with one vehicle. Co-collection may provide improved efficiency over operating two (or more) collection vehicles on the same route. Single stream recycling is where all recyclable materials are collected co-mingled in a single container.

More recently, there has been a shift by some communities to move to automated collection which has led to single-stream processing. One disadvantage is that the high equipment costs of MRF's for the paper/container auto-sort machines, contaminated materials, and the reluctance by industry to change collection methods. In the Regional District of Nanaimo (RDN) we have a five year contract with Progressive Waste Solutions who purchased new split packer collection trucks at the beginning of the curbside collection contract. Examples of collection trucks are included in Appendix 1.

For curbside collection the level of commingling at the curb influences the types of material collected, types of trucks used, and the design of the processing facility. Decision makers must decide whether to invest more effort in the collection system (maximum source segregation/minimal sorting) or in processing (commingled collection/maximum processing). Collection costs are typically higher with more detailed material separation curbside, but processing costs can be lower. When material is commingled curbside, collection costs are lower, but processing costs can be higher. Collection and processing costs need to be combined to assess the most cost-effective system.

On Vancouver Island, single family recycling programs tend to offer curbside collection programs that source separate recyclables, garbage and increasingly food waste. Recyclable materials from these programs are shipped to clean MRFs, organics are sent to composting facilities, and residual in the form of garbage is landfilled.

Types of Material Recovery Facilities

There have been MRF's operating at a commercial scale in North America for a number of years. There are numerous clean MRFs located in the Lower Mainland. Green by Nature recently opened a state-of-the-art MRF facility to handle containers collected through Multi-Material BC (MMBC). In Nanaimo, there are three clean MRFs that process primarily source separated recyclables from the residential sector, multi-family and the Industrial, Commercial and Institutional (ICI) sector.

Many of the dirty MRF facilities are being modernized to handle "mixed waste". Advanced technology is employed to "break open the bag" and extract recyclables and this requires less manual labour. Newer modern facilities are safer and offer more efficient processes to recover material from the waste stream compared to their low-tech predecessors. Many of the innovations and improvements have evolved from the processing of source separated recyclables. These modern facilities are employed in a growing number of cities across the United States to extract recyclables left in the waste stream. Advanced technology designed to maximize recovery includes screening equipment, air separators, optical technology, magnets, eddy current separators and manual quality controls.

NextUse, owned by Belkorp Environmental Services Ltd., proposes to build a mixed waste processing facility in Coquitlam that would have the technological ability to employ the "break the bag" technique. This facility is awaiting licensing approval from Metro Vancouver under Bylaw 181. This would be the first MRF of its kind in British Columbia.

Single-stream MRFs for recycling have evolved and are the most common technology in North America. This MRF system is very convenient as it can handle a variety of collection methods. MRF's can range from low technology with mostly manual sorts to highly technological sort lines with almost no human hands touching the material. Advances in MRF technologies include; paper screening from containers, acceptance of eddy current magnets, and optical and near-infrared sorting units. Modern single-stream MRFs automatically sort by paper grade or container type/color/resin, with quality and speeds far greater than human sorters can achieve. Although these advanced sort units can be expensive, especially if used in tandem for multiple sorts, they are still less expensive per unit than the initial equipment used 20 years ago.

MRFs sorting through pure MSW are still utilized in several places. In this process, no MSW collection changes need to be made, but, on the processing side, dirty MRFs require lots of equipment and sorters to handle volume to reduce contamination. The dirty MRF requires good equipment, skilled operators, and extensive maintenance programs, plus an understanding of the end markets for the lower-quality sorted materials. One benefit of the dirty MRF is that the technology will most likely serve well in prepping material for waste to energy facilities.

Current Flow of Recyclables in the RDN

Annually the RDN receives approximately 50,000 metric tonnes of MSW. The RDN's 2012 Waste Composition Study indicated the types of materials being landfilled. To illustrate the volume of waste by category, please see Appendix 2. This will highlight the volume of materials that could potentially be recovered.

The RSWAC has identified a MRF as a potential option to manage the RDN's waste stream. The following points should be given consideration as part of any future research:

1. Currently, the RDN and the City of Nanaimo does not control ownership of curbside recyclable materials. This transfer of ownership is a result of the Provincial recycling regulation that requires printed paper and packaging to be managed by MMBC that is an industry stewardship program. Curbside collectors such as the City of Nanaimo and the Regional District, servicing single family housing have contracted with MMBC who pay the collector to collect on their behalf.
2. Six drop-off depots operating in the region are also contracted to MMBC to accept recyclables generated by the residential sector.
3. There is a strong vibrant private recycling industry that has evolved from a culture of source separation and a regulatory framework that has contributed to the Region's impressive high diversion rate.
4. The ICI waste stream is managed exclusively by the private sector hauling community and processing of recyclables is conducted by well-established clean MRFs that have emerged to handle source separated recyclables region wide.
5. To establish a MRF significant capital investment is required. In addition, it is necessary to have sufficient feedstock to support a facility.

General System Performance

The RDN's 2012 Waste Composition study information shows that approximately 30-35 per cent of the waste stream is potentially recyclable at MRFs (this excludes compostable material). The actual amount depends on whether there is a deposit-return system on various containers, which affects the amount of plastic and metal packaging available for recycling. The top recyclables categories in municipal waste streams in Canada (percentage of residential waste composition):

Recyclables %
Paper 7
Plastics 14
Glass 3
Metal 3
Beverage containers 1
Electronics 2
Household Hazardous Materials 2

The actual amount recycled, and therefore the amount of diversion depends on the type of collection system (curbside or depot), and materials collected. According to research, good curbside recycling programs should achieve 90 per cent participation or higher. Even when households participate they do not always recycle all material collected by the program, therefore participation must be multiplied by capture to estimate the proportion of the waste stream that will be recovered in a program. Experience has shown that capture varies by material, generally related to how complicated the recycling message is. In mature curbside programs, people understand that cans, bottles, and newspapers are recyclable; therefore capture of these can be as high as 80 or 90 per cent where good promotion and education programs exist and in communities with user pay systems, which encourage participation. Once new materials are added in an expanded collection program, people are often confused (e.g., different kinds of plastics and mixed paper).

The RDN's curbside recycling program is mature and sophisticated, achieving diversion rates of 25-30 per cent of the residential waste stream. Depot programs generally divert seven to 12 per cent. Deposit or return-to-retail systems typically recover more than 80 per cent of targeted beverage containers. Residual rates also vary depending on how materials are collected. "Typical" residual rates are five to seven per cent or less for curbside sorted materials, and 20 per cent for bag or cart collection systems, or where no curbside sort takes place. Wet/dry programs, where waste is collected in two streams, experience a combined 30 per cent residue rate in their wet and dry streams (because wet/dry programs usually direct non divertible materials into one stream or the other).

The recycling industry is vulnerable to global market conditions. When markets fail, recycling is an expensive way to process waste. Solutions to market vulnerability include structuring contracts to share market risk with either a recycling contractor, or directly with the market itself. It is preferable to guarantee rates to sign a long term contract, usually for five years. In such an arrangement, the early years will focus on establishing efficient collection and processing. Collection is the most expensive part, therefore attention would be on reducing collection costs. Current trends would indicate moves towards faster single stream collection with more expensive MRF's are more cost effective overall.

ALTERNATIVES

There are no alternatives for this report.

FINANCIAL IMPLICATIONS

This report is presented for information only therefore has no financial implications.

STRATEGIC PLAN IMPLICATIONS

This report was prepared to provide information to RSWC as part of the Regional District's Solid Waste Management Plan (SWMP) review process.

SUMMARY/CONCLUSIONS

This memorandum is intended to stimulate discussion by the RSWAC for the purposes of the RDN SWMP review and provides an overview of MRF technologies for future consideration.

A MRF is a mechanized sorting facility, which separates recyclables and organics from waste that would otherwise be landfilled. There are numerous MRFs in operation in the US and in Europe. Similar MRFs have been proposed in Metro Vancouver and one in Fraser Valley Regional District. However, it was recently announced that the latter has been discontinued due to public opposition. Currently there are three MRFs in Nanaimo that handle source separated recyclable materials. New programs will depend on future trends and global commodity markets.

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APPENDIX 1

Collection Systems

Dual Stream Collected In Split Packer System in RDN & RDN Split Packer - Commingled Recyclables

Front End Loaded

Single Stream - Automated CollectionSystem

Detailed Data by Waste Sector

Material Category	Residential		Commercial		Self-Haul		Totals	
	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)
Paper	1.2%	637	9.5%	5,049	1.8%	969	12.5%	6,655
Newsprint	0.1%	76	1.3%	690	0.3%	134	1.7%	900
Cardboard (recyclable)	0.2%	105	2.4%	1,271	0.3%	143	2.8%	1,519
Cardboard (waxed)	0.0%	0	0.0%	1	0.0%	0	0.0%	1
Cardboard (non-recyclable)	0.0%	0	0.2%	108	0.0%	0	0.2%	108
Boxboard / Cores	0.4%	191	1.3%	709	0.2%	128	1.9%	1,028
Office Paper	0.4%	198	2.5%	1,324	0.7%	368	3.5%	1,889
Magazines and Catalogues	0.0%	1	0.2%	106	0.1%	59	0.3%	166
Molded Paper Containers	0.0%	20	0.4%	237	0.0%	25	0.5%	282
Hardcover Books	0.0%	7	0.2%	91	0.2%	87	0.3%	186
Takeout Cups	0.1%	30	0.7%	360	0.0%	23	0.8%	413
Composite Can	0.0%	8	0.0%	21	0.0%	2	0.1%	31
Other Paper	0.0%	1	0.2%	130	0.0%	0	0.2%	131
Plastic	2.5%	1,313	8.3%	4,421	3.0%	1,599	13.8%	7,333
Bags - Retail (carry-out and grocery)	0.2%	124	0.2%	115	0.1%	44	0.5%	284
Bags - Packaging (film and overwrap)	0.9%	468	2.2%	1,173	0.2%	127	3.3%	1,768
Bags - Non Packaging (e.g. Ziploc bags)	0.2%	113	0.7%	379	0.1%	46	1.0%	538
Other Plastic Film (pallet wrap)	0.1%	27	0.9%	473	0.0%	0	0.9%	500
PETE #1	0.1%	71	0.2%	99	0.1%	33	0.4%	202
HDPE #2	0.1%	65	0.4%	235	0.1%	58	0.7%	357
PVC #3	0.0%	0	0.0%	7	0.0%	1	0.0%	8
LDPE #4	0.0%	0	0.0%	6	0.0%	0	0.0%	6
PP #5	0.1%	37	0.2%	131	0.1%	29	0.4%	198
PS #6	0.2%	98	0.8%	450	0.1%	45	1.1%	593
Mixed Resin #7	0.0%	25	0.4%	210	0.0%	25	0.5%	260
Other uncoded plastics	0.2%	104	0.7%	391	0.5%	291	1.5%	786
Durable plastic (non-packaging)	0.3%	180	1.4%	753	1.7%	901	3.4%	1,833
Compostable Organics	6.3%	3,301	26.0%	13,879	2.7%	1,453	34.9%	18,632
Food Waste	4.5%	2,381	17.6%	9,386	2.4%	1,297	24.5%	13,065
Yard and Garden	0.4%	223	4.7%	2,490	0.0%	12	5.1%	2,725
Compostable Paper	1.3%	696	3.7%	1,987	0.3%	141	5.3%	2,824
Tree Based Wood	0.0%	0	0.0%	16	0.0%	3	0.0%	19

APPENDIX 2

– Detailed Data by Waste Sector

Material Category	Residential		Commercial		Self-Haul		Totals	
	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)
Beverage Containers	0.2%	98	1.3%	681	0.2%	86	1.6%	866
Aseptic Containers (deposit)	0.0%	8	0.0%	19	0.0%	1	0.1%	29
Aseptic Containers (non-deposit)	0.0%	4	0.0%	9	0.0%	0	0.0%	14
Gable Top Containers (deposit)	0.0%	0	0.0%	8	0.0%	1	0.0%	9
Gable Top Containers (non-deposit)	0.0%	22	0.1%	59	0.0%	15	0.2%	96
Beverage Pouches (deposit)	0.0%	0	0.0%	11	0.0%	0	0.0%	11
Plastic Beverage Containers (deposit)	0.0%	6	0.2%	110	0.0%	18	0.3%	133
Plastic Beverage Containers (non-deposit)	0.0%	25	0.0%	25	0.0%	17	0.1%	67
Plastic Beverage (takeout cups)	0.0%	8	0.1%	72	0.0%	2	0.2%	82
Metal Beverage (deposit)	0.0%	9	0.1%	65	0.0%	4	0.1%	78
Metal Beverage (non-deposit)	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Glass Beverage Containers (deposit)	0.0%	16	0.6%	303	0.1%	28	0.7%	347
Glass Beverage Containers (non-deposit)	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Textiles	1.1%	576	2.0%	1,080	2.6%	1,380	5.7%	3,037
Clothing	0.1%	45	0.0%	16	0.1%	64	0.2%	126
Composite Textiles	0.1%	74	0.1%	37	0.3%	167	0.5%	278
Leather	0.0%	5	0.0%	12	0.1%	49	0.1%	66
Natural Fibre Textiles	0.7%	380	1.4%	727	1.3%	690	3.4%	1,798
Synthetic Textiles	0.1%	72	0.5%	288	0.8%	410	1.4%	770
Metals	0.5%	260	1.2%	656	0.7%	375	2.4%	1,291
Metal Packaging (food)	0.2%	120	0.4%	213	0.0%	25	0.7%	358
Aluminum Foil and Trays (packaging)	0.0%	10	0.0%	4	0.0%	0	0.0%	14
Aluminum Foil and Trays (non-packaging)	0.1%	79	0.2%	89	0.0%	12	0.3%	180
Non-consumables mixed metals (<0.5kg)	0.1%	51	0.3%	169	0.0%	25	0.5%	245
Non-consumables mixed metals (>0.5kg)	0.0%	0	0.3%	181	0.6%	313	0.9%	494
Glass	0.5%	275	1.1%	611	0.9%	500	2.6%	1,386
Glass Packaging (food)	0.4%	188	0.6%	299	0.3%	182	1.3%	669
Other Glass and Ceramics	0.2%	86	0.6%	313	0.6%	318	1.3%	717
Building Materials	0.7%	347	4.6%	2,438	5.6%	2,963	10.9%	5,748
Clean Wood	0.3%	145	1.0%	509	0.8%	403	2.0%	1,057
Treated or Painted Wood	0.2%	88	1.4%	759	0.0%	6	1.6%	853
Gypsum/drywall/plaster	0.0%	0	0.3%	186	1.2%	652	1.6%	838
Masonry/bricks	0.0%	0	0.2%	91	0.5%	241	0.6%	332
Asphalt products	0.0%	0	0.1%	52	0.0%	0	0.1%	52
Carpet & Underlay	0.0%	0	0.8%	437	1.9%	1,004	2.7%	1,441
Flooring (non-wood)	0.0%	0	0.0%	0	0.1%	54	0.1%	54
Other (fiberglass insulation)	0.2%	114	0.8%	404	1.1%	604	2.1%	1,122

Detailed Data by Waste Sector

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	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)	Waste Stream Percentage	Estimated Disposed (2012)
Electronics	0.3%	144	1.9%	997	0.3%	182	2.5%	1,323
Computers and Peripherals	0.0%	0	0.5%	274	0.0%	2	0.5%	276
Televisions and Audio Visual Equipment	0.1%	36	0.5%	257	0.1%	40	0.6%	333
Telephones and Telecommunications Equipment	0.0%	0	0.3%	137	0.0%	9	0.3%	146
Small Kitchen Appliances and Floor Care	0.1%	36	0.5%	243	0.2%	123	0.8%	402
Electronic Toys	0.0%	3	0.0%	3	0.0%	0	0.0%	6
Smoke and CO Detectors	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Other Electronics	0.1%	69	0.2%	83	0.0%	7	0.3%	160
Household Hazardous	0.3%	135	2.3%	1,220	0.3%	162	2.8%	1,516
Batteries	0.0%	13	0.1%	31	0.0%	1	0.1%	46
Medical/Biological	0.1%	42	0.7%	383	0.0%	0	0.8%	425
Stains/Preservatives	0.0%	0	0.0%	0	0.0%	10	0.0%	10
Latex Paint	0.0%	12	0.3%	163	0.2%	103	0.5%	278
Oil Based Paint	0.0%	0	0.1%	31	0.0%	0	0.1%	31
Aerosols	0.0%	24	0.1%	38	0.1%	35	0.2%	97
Solvents	0.0%	0	0.1%	34	0.0%	0	0.1%	34
Pesticides/Herbicides/Fungicides	0.0%	0	0.0%	3	0.0%	0	0.0%	3
Motor Oil	0.0%	3	0.0%	17	0.0%	0	0.0%	20
Oil Filters	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Anti-Freeze	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Pharmaceuticals	0.0%	1	0.0%	10	0.0%	13	0.0%	23
Other Petroleum Based Products	0.0%	0	0.0%	16	0.0%	0	0.0%	16
Mercury Containing Items	0.0%	0	0.0%	5	0.0%	0	0.0%	5
Other HHW	0.1%	39	0.9%	488	0.0%	0	1.0%	527
Household Hygiene	3.4%	1,829	3.1%	1,633	0.9%	470	7.4%	3,937
Diapers / Personal Hygiene	2.6%	1,394	2.2%	1,187	0.4%	205	5.2%	2,786
Pet Waste	0.8%	435	0.8%	446	0.5%	266	2.1%	1,146
Other	0.3%	169	1.1%	572	1.6%	859	3.0%	1,599
Cosmetics / Soaps	0.1%	61	0.1%	75	0.0%	26	0.3%	162
Fines	0.2%	102	0.5%	261	0.0%	7	0.7%	370
Furniture	0.0%	0	0.4%	196	1.5%	825	1.9%	1,021
Rubber/Tires	0.0%	6	0.1%	40	0.0%	0	0.1%	46
White Goods	0.0%	0	0.0%	0	0.0%	0	0.0%	0
Totals	17%	9,083	62%	33,239	21%	10,998	100%	53,319