2 Waste Stream/Fuel Sources

This analysis addresses potential fuels for the Rock-Tenn Biomass/RDF Facility that could be produced at the NRG Newport Resource Recovery Facility (Newport Facility) and from a Construction and Demolition Waste (C&D) processing facility. The following sections address:

- The permitted capacity and historical RDF output from the Newport Facility;
- Expansion of the Newport Facility to provide RDF to Rock-Tenn along with the historical RDF for the Xcel combustion plants;
- A comparison of the municipal solid wastes (MSW) available from Ramsey and Washington Counties relative to the amount of RDF fuel required:
- C&D and industrial waste quantities available for processing into biomass fuel;
- The projected heating values of each of the fuels; and
- Brief descriptions of waste stream security approaches.

2.1 Newport Resource Recovery Facility Baseline Quantity

The Newport Facility is permitted to process 500,000 tons per year of municipal solid waste (MSW). More MSW can be received than 500,000 tons as occurred in 2002, when over 565,000 tons of MSW were received. Excess MSW over the 500,000 tons must be transferred out of the Newport Facility. Thus, at the top end, the Newport Facility could produce RDF from 500,000 tons of MSW per year. Based on the historical performance of the percent of RDF produced from MSW (87.7 percent), the high end "theoretical" potential for RDF production is approximately 438,500 tons of RDF per year.

The actual, historical performance of the Newport Facility is less than this "theoretical" potential tonnage. This is due to not having combustion capacity available for that amount of RDF and the fact that the amount of MSW received each year is typically less than 500,000 tons.

Foth & Van Dyke has represented the Ramsey/Washington Counties Resource Recovery Project Board (Project Board) in a consulting and engineering capacity since 1998, including the review of NRG's Monthly Operating Reports. Table 2-1 shows data from the monthly operating reports for the annual tonnage information related to MSW received, processed, refuse-derived fuel (RDF) produced for each year from 1998 through 2005 along with the averages. It should be noted that the MSW received is from all sources, not just from Ramsey and Washington Counties. NRG has MSW delivered from several other counties, including from as far away as southern Minnesota (Mankato area).

The year 2002 was an abnormal year in that Ramsey and Washington Counties were in the process of the Public Collection Study and almost all the waste haulers delivered all the waste

they collect in the two counties to the Newport Facility (565,548 tons were delivered in 2002). In all other years from 1998 to 2005, MSW received ranged from 409,762, up to a high of 444,523 tons. The average annual MSW delivered to the Newport Facility from 1998 to 2005 (not including 2002) is 430,711 tons. For purposes of this analysis, Foth & Van Dyke will use this tonnage as the Baseline Quantity.

Table 2-1 Total Deliveries Per Year - 1998 through 2005, with Average

Operating Parameter	Total Tons								
	1998	1999	2000	2001	2002	2003	2004	2005	Avg.[1]
MSW received	444,523	428,570	427,223	409,762	565,548	435,012	435,439	434,451	430,711
MSW processed	395,992	362,337	365,301	356,121	425,620	375,504	388,025	388,611	375,984
RDF produced	352,025	328,806	329,406	319,582	348,447	319,573	330,341	328,918	329,807
RDF to Red Wing	206,417	186,945	182,076	183,723	198,303	180,540	186,146	190,634	188,069
RDF to Wilmarth	145,608	141,859	147,327	135,862	150,142	138,706	144,197	138,285	141,692

[1]Averages do not include data from 2002.

Table 2-2 provides a breakdown of the average monthly deliveries from 1998 through 2005 (once again excluding 2002 from the calculations). These tonnages will be used as the Baseline Seasonal Fluctuations of MSW and the RDF produced for purposes of this analysis.

Table 2-2 Average Monthly Deliveries from 1998 through 2005 (tons)[1]

Operating Parameter	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
MSW received	29,372	27,175	32,496	36,961	39,836	40,773	37,906	39,647	37,888	38,300	36,107	34,250
MSW processed	25,773	24,138	28,740	33,129	35,065	34,572	33,608	34,877	32,497	31,948	31,696	29,941
RDF produced	21,378	20,930	24,816	29,712	31,636	29,578	29,986	31,259	28,104	27,501	27,737	27,171
RDF to Red Wing	15,088	10,915	12,620	17,211	18,498	16,900	16,396	17,744	17,218	16,363	13,740	15,377
RDF to Wilmarth	6,290	10,015	12,195	12,502	13,138	12,678	13,591	13,514	10,844	11,134	13,998	11,794

[1]Averages do not include data from 2002.

2.2 Newport Resource Recovery Facility Expansion Quantity

This analysis addresses MSW supply quantities that would be required to base load the Rock-Tenn energy needs. In addition, the analysis addresses the MSW supply needs to keep both current Xcel combustion plants in operation along with the Rock-Tenn combustion facility (assumed to be based on adding up to 100 ton per hour (tph) processing capacity at the Newport Facility or biomass from a C&D processing facility, or a combination of both). The following assumptions address these different scenarios.

As is covered in more detail in Section 4.1, the projected RDF demand to meet the energy needs of Rock-Tenn is approximately 45 tons per hour on an annual average basis. This equates to a total annual RDF demand of 394,200 tons. This is approximately 20 percent more than historically produced at Newport, but less than the 438,500 ton "theoretical" potential based on the permit.

As shown in Table 2-1, there has historically been approximately 430,000 tons (430,711) of MSW delivered to the Newport Facility each year, with an average RDF produced of approximately 330,000 tons (329,807). Of this RDF produced, an average of close to 190,000 tons was delivered to Red Wing (188,069) and close to 140,000 tons of RDF delivered to Wilmarth (141,692). Foth & Van Dyke discussions with NRG and Xcel officials indicate that each combustion plant can regularly handle approximately 190,000 tons of RDF per year (with some years handling upwards of 205,000 tons, but not regularly). Some of the RDF for Wilmarth is produced at NRG's Elk River Resource Recovery Facility. For purposes of this analysis, Foth & Van Dyke assumes that the Elk River Facility will continue to supply a portion (50,000 tons) of the annual RDF needs of Wilmarth. The Newport Facility at the Baseline Quantities will continue to provide the full needs of Red Wing at approximately 190,000 tons.

Combining the RDF needs of Rock-Tenn with the continuation of the RDF needs at Red Wing and Wilmarth brings the total RDF needs to 724,200 tons (394,200 tons to Rock-Tenn plus 190,000 tons to Red Wing plus 140,000 tons to Wilmarth).

An expansion of processing capacity at the Newport Facility is included in this analysis (Section 5). The assumption is that two processing lines will be installed that each has a "rated capacity" of 50 tons per hour. The Newport Facility currently has two processing lines—each rated at 50 tons per hour. Therefore, for purposes of this analysis, the processing capacity at the Newport Facility is projected to approximately double on an annual basis. The permitted processing capacity could expand to 1,000,000 tons per year.

If plant performance continued at the rate of producing 87.7 percent of RDF from the MSW processed, to produce 724,200 tons of RDF would require 825,770 tons of MSW to be processed. Not all the MSW received is typically processible. Some of it is typically "by-passed" to land disposal. If this by-passed waste percentage is approximately 5 to 7.5 percent (a reasonable range based on historical waste stream characteristics), the total MSW received tonnage would need to range from approximately 867,000 tons to over 890,000 tons per year. Table 2-3 provides a summary of these tonnages.

Table 2-3 Annual Tonnages of MSW/RDF Required

Scenario	MSW[1]	RDF
Base Load Rock-Tenn	486,000	394,200
Base Load Rock-Tenn, keeping both Xcel facilities	892,700	724,200

[1] Assumes 7.5 percent of MSW is by-passed and an RDF production efficiency of 87.7 percent.

Table 2-4 provides a Summary of Waste Management in Ramsey and Washington Counties for 2003 and 2004 (the most recent data available). The tons of MSW estimated to be available for processing from Ramsey and Washington Counties includes the total of the Processing and Land Disposal lines items. In 2003, this total was 525,906 tons and in 2004, this total was 524,035

tons. Based on these tonnages for Ramsey and Washington Counties, it is apparent that there would not be enough MSW to meet the needs projected in this analysis.

Table 2-4 Summary of Waste Management in Ramsey and Washington Counties, Per 2004 and 2003 SCORE/Certification Reports

2004

	Ramsey	Washington	TOTAL	
Recycling	**286,599**	**86,625**	**373,224**	
Residential (curbside and dropoff)	73,315	28,231	101,546	
Commercial/industrial/institutional	203,907	55,007	258,914	
Mechanical (Newport) and hand separated	9,377	3,387	12,764	
Processing (RDF as adjusted)	**197,160**	**73,510**	**270,670**	
Land Disposal	**225,516**	**27,849**	**253,365**	**→ 524,035**
Residuals and non-processible/excess (from Newport)	53,469	19,914	73,383	
Unprocessed MSW to MN landfills	20,676	3,616	24,292	
Unprocessed MSW to non-MN landfills	151,371	4,319	155,690	
Other Waste Management	**12,995**	**5,382**	**18,377**	
TOTAL	**722,270**	**193,366**	**915,636**	

2003

	Ramsey	Washington	TOTAL	
Recycling	**282,251**	**84,633**	**366,884**	
Residential (curbside and dropoff)	69,170	28,050	97,220	
Commercial/industrial/institutional	202,757	53,025	255,782	
Mechanical (Newport) and hand separated	10,324	3,558	13,882	
Processing (RDF as adjusted)	**192,056**	**70,931**	**262,987**	
Land Disposal	**228,487**	**34,432**	**262,919**	**→ 525,906**
Residuals and non-processible/excess (from Newport)	62,394	23,058	85,452	
Unprocessed MSW to MN landfills	25,620	4,725	30,345	
Unprocessed MSW to non-MN landfills	140,473	6,649	147,122	
Other Waste Management	**13,243**	**5,314**	**18,557**	
TOTAL	**716,037**	**196,569**	**911,347**	

NOTES:

[1] Information provided for SCORE/Certification reports is only for MSW, related recycling, and management of certain problem materials (recycled portion included with recycling and the remainder under Other Waste Management). C&D and other separately managed waste streams, including yard waste, are excluded.

[2] "RDF as adjusted" refers to RDF plus adjustments needed for deliveries to Newport to equal waste managed from Newport; also included are very small quantities of MSW processed at NRG-Empire.

[3] "Other Waste Management" refers to items neither recycled nor processed at a MSW facility; these include the unrecycled portion of several problem materials (major appliances, used motor oil, oil filters, tires, lead acid batteries) and may also include the unrecycled portion of household hazardous waste.

[4] OEA's SCORE report may show slightly different numbers for "Other Waste Management" because their estimates may be based on updated population estimates from those used by the Counties at the time of report submittal.

There is considerable discussion about processing being conducted on a regional basis. That needs to occur for the expanded scenarios considered in this analysis to be successful. According to the Solid Waste Management Coordinating Board (SWMCB)[1], there were 898,762 tons of processible waste landfilled from the SWMCB counties in 2004. For the purposes of this analysis, an assumption is made that the MSW supply will be provided on a regional basis.

2.3 Industrial and/or C&D Wastes Potential Quantities

According to the SWMCB[2], in 2004 there were over 2.4 million tons of non-MSW landfilled at 12 facilities in the Greater Twin Cities Area (located in Dakota, McLeod, Scott, Sherburne, Washington, and Wright counties). Non-MSW consists of two major components – construction and demolition waste (C&D waste) and industrial waste. According to the report noted above, in 2004 there were approximately 1.36 million tons of C&D wastes landfilled and approximately 1.1 million tons of industrial waste landfilled. One of the critical notes in this report and SWMCB plans is that:

> "non-MSW should receive greater attention in regional planning efforts than it has in prior periods. In order to develop non-MSW policies and programs, however, it will be necessary to collect data, evaluate environmental impacts and regulatory issues, and identify best management practices. For this reason, collection and analysis of better data on non-MSW is a major focus of SWMCB work in this area."

In some locations in the United States, C&D wastes are being processed to remove readily recyclable materials, with much of the remaining materials processed into a material that is used as an alternative landfill cover (ADC). Unfortunately, some of the landfills that have used this product have found that gypsum in wall board found in C&D wastes contains sulfates and when subjected to the anaerobic environment of a sanitary landfill, hydrogen sulfide gas is generated. Odors associated with the hydrogen gas are causing C&D processors to develop other uses for the processed C&D. One such potential use for a fraction of the processed C&D wastes is to produce a biomass based boiler fuel. This is currently being developed at a C&D processing facility in Des Moines, Iowa.

Depending on the composition of a specific C&D waste stream, approximately 40 percent to well over 50 percent of the C&D wastes may be recoverable as a biomass fuel. This is obviously highly dependent on the composition of the specific C&D wastes and how the processing facility is designed. Additionally, other materials could be recovered from the C&D waste stream, most notably, ferrous and non-ferrous metals and an aggregate from chunks of concrete and brick. Developing more detailed information on the composition of specific SWMCB area C&D wastes would be beneficial for determining the quantity of biomass that could be recovered in their market. In addition, other important characteristics for the C&D waste as a fuel source and

[1] "Annual Results Report 2004." Solid Waste Management Coordinating Board. Approved May 25, 2005. page 21.
[2] Ibid. page 25.

overall economics will need to be developed. It is highly recommended that additional information on composition and other characteristics (Proximate and Ultimate analyses) be developed. For purposes of this analysis, Foth & Van Dyke will use data from other sources or preliminary planning estimates.

As noted, SWMCB data indicates that there were approximately 1.3 million tons of C&D wastes along with 1.1 million tons of industrial waste landfilled in 2004 at 12 different facilities. Presumably not all of the C&D wastes would be considered processible, and possibly a smaller percentage of the industrial wastes would be processible into biomass fuel. For purposes of this preliminary planning process, Foth & Van Dyke will assume that a nominal 1,000 ton per day facility be used (250,000 tons per year). This would basically consist of three 50 ton per hour processing lines or two 75 ton per hour processing lines operating at approximately 85 percent availability for a single shift per day for 250 days per year. Operating more days would decrease daily throughput. Operating more hours per day could reduce the hourly throughput required. There could be many variations to this basic design that need to be considered further prior to proceeding. Such a facility could be located at an existing C&D waste and industrial waste landfill such that loads with the most recoverable wastes could be processed and other non-processible loads simply diverted directly to the landfill. For example, loads consisting primarily of drywall or shingles could be by-passed direct to the landfill.

C&D waste generation varies on a seasonal basis. Foth & Van Dyke obtained some historical data from one of the area's C&D waste landfill operators. In reviewing the data for monthly deliveries over a nine-year period, Table 2-5 was developed that provides the average percentage of C&D waste potentially delivered each month of the year. The percentages are then applied to the annual tonnage for the assumed processing facility of 250,000 tons per year. In addition, a preliminary projection for biomass fuel recovery is provided based on a 50 percent recovery rate. The 50 percent biomass recovery rate is based upon data available to Foth & Van Dyke from the Des Moines, Iowa C&D waste stream and actual processing facility operating data.

Table 2-5 Seasonal C&D Waste Variations

Month	Percentage	Projected C&D Tonnage	Tons Per Hour[1]	Projected Biomass Fuel at 50 %
January	4.6	11,381	65	5,691
February	4.6	11,611	73	5,805
March	6.0	14,896	85	7,448
April	7.7	19,374	115	9,687
May	9.3	23,317	132	11,658
June	9.9	24,661	147	12,331
July	10.8	26,891	153	13,445
August	11.2	27,986	167	13,993
September	10.3	25,788	154	12,894
October	11.3	28,157	160	14,078
November	8.0	20,075	120	10,037
December	6.3	15,863	90	7,932
Total	100.0	250,000	122	125,000

[1]Based on a single, 8-hour shift per day, 5 days per week.

2.4 Heating Values

The heating value of RDF produced from MSW is reported by NRG to range from 5,700 to 5,800 Btu per pound.

Foth & Van Dyke obtained a laboratory report on the chemical analysis of the biomass fuel produced at a C&D processing facility in Des Moines, Iowa. According to that laboratory analysis of a sample conducted on February 2, 2006, the Btu content was 6,435 per pound. With this as the only readily available data point for the heating value of this type of biomass, Foth & Van Dyke developed an estimate of the Btu content using composition percentages from C&D Waste Composition data from the Des Moines area and Btu values for materials from the *Integrated Solid Waste Management Engineering Principles and Management Issues*[3]. That process resulted in an estimated Btu value of 6,470 per pound (close to the laboratory data point).

For purposes of this analysis, the heating value for the C&D biomass fuel is assumed to be 6,200 to 6,400 Btu per pound. Additional analysis of potential C&D-based biomass fuel specific to the SWMCB planning area will be needed.

2.5 Waste Stream Security Approaches

To meet the RDF needs of just Rock-Tenn is projected to require approximately 20 percent more RDF annually than has historically been produced at the Newport Facility. To meet the needs of Rock-Tenn and continue the Xcel combustion facilities in Red Wing and Wilmarth is projected to require 120 percent more RDF than has historically been produced at the Newport Facility. To produce this RDF requires more MSW than is currently available from Ramsey and Washington Counties and would therefore require a more regional approach to waste stream supply.

The new power plant at Rock-Tenn and the processing facility expansion require extensive capital investments. Assuring an adequate waste supply in order to produce a reliable fuel supply will be very important for project financing. Without a secured source of fuel, the power plant at Rock-Tenn may not be financed.

Since the *Carbone v. Clarkstown* and other waste management court decisions in 1993 and 1994, Ramsey and Washington counties have pursued environmental goals such as waste processing as a market participant. This has been difficult for the Counties, as the solid waste industry in the east-metro area is primarily private and is a fairly complex, dynamic marketplace. The Counties' tools have primarily been economic, related to the tipping fee set at the Newport Facility and the use of the Counties Environmental Charge to raise funds to support processing and other solid waste management programs.

[3] Tchobanoglous, George, Hilary Theisen, and Samuel Vigil. 1993. *Integrated Solid Waste Management Engineering Principles and Management Issues.* McGraw-Hill Series in Water Resources and Environmental Engineering.

2.5.1 Merchant Plant Approach

This potential RDF and Biomass facility for Rock-Tenn is occurring at a point in time when the Counties desire to reduce their role in assuring the waste supply for processing. Ramsey and Washington Counties both have policies in their Solid Waste Master Plan that support processing of waste and support a transition to a "merchant" facility after 2007. The merchant facility approach was first proposed by NRG, the current owner of the Newport Facility, as a means to continue processing wastes after their contract with the Project Board expires in July 2007. The merchant plant approach was subsequently endorsed by the SWMCB and included in the Counties' Solid Waste Master Plans with the policy that the Counties would monitor the market during the interim period to gauge the success of a merchant plant approach.

One of the keys for merchant plant feasibility is the ability of NRG to secure sufficient waste delivery from haulers at a tipping fee competitive with current market rates. The waste processing and disposal market in Ramsey and Washington Counties is very complex. There are many stakeholders involved. Changes in the market place constantly result in different actions by the stakeholders. Factors that have been shown to affect the amount of waste delivered to the Newport Facility include:

- The amount of the tipping fee. In August 2005, the Counties lowered the tipping fee from $39 per ton to $34 per ton. Immediately the previous downward trend in waste deliveries was stabilized.

- The County Environmental Charge (CEC) made the cost of waste management more visible, which resulted in behavior changes. Generators have reduced the amount of waste that requires disposal and waste haulers manage some waste streams in alternative facilities to manage the amount of taxes their customers pay.

- The State of Minnesota Processing Payment was eliminated in 2005. This payment had been supporting the processing of MSW and without it, there is less incentive for waste haulers to deliver MSW to the Newport Facility.

- Use of out-of-state landfills (especially in Wisconsin) has increased as the disposal destination for MSW produced in Minnesota. Hauling companies have not only expanded landfills in Wisconsin, but have also added transfer station capacity in the metro area to be able to cost effectively haul MSW longer distances. In an analysis completed in 2005, Foth & Van Dyke determined that the potential price differential to dispose of MSW in private landfills in western Wisconsin could be $9 per ton and in some instances, the price differential may be more (i.e., the total price for some hauling companies to dispose of portions of their tonnage is under $30 per ton compared to the Newport Facility tipping fee of $39 at that time). These disposal prices work against processing via a merchant plant approach.

- Current technology interest in the solid waste industry is toward the use of bioreactor landfills wherein moisture is added to landfills and the liquids re-circulated in order to

more rapidly decompose the organic fraction of the wastes. This helps to stabilize the landfilled wastes in a much shorter time frame. Bioreactor landfills are expected to cost less than RDF processing and combustion.

Ramsey and Washington Counties understanding of the merchant plant approach is that NRG would arrange directly with waste haulers for waste delivery at a contract price that is above the current tipping fee, but below the current cost of processing. The early tipping fee prices quoted were $55 to $60 per ton. At the time of this report, it is very unclear whether a merchant plant approach at these tipping fees could be implemented or whether the Counties would still need to actively support processing in some manner, whether by providing financial support or more actively controlling the collection marketplace.

2.5.2 Economic Approaches to Waste Assurance

Competitive Tipping Fees – Ramsey and Washington Counties have historically set the tipping fee at the Newport Facility at a lower rate than the full cost in order to assure that an adequate supply of waste is delivered. Up until 2003, the Counties used service charges on property taxes to collect the necessary funds to make up the difference in processing costs. The last few years, the Counties have used the County Environmental Charge (CEC) collected by waste haulers on their bills to collect the necessary funds. Thus, both Counties are familiar with this approach to assuring a waste supply. Depending on the scope of future processing needs and the demand for RDF, this mechanism may need to be expanded and used in more of the counties in the region to supply the required quantity of MSW.

Zero Tipping Fee – This is a concept that the Counties have analyzed in previous planning activities. Setting the tipping fee actually charged to waste haulers at zero is possible, but requires that all the funds to pay for processing be collected on the CEC. The haulers' portion of their bills would only apply to the cost of waste collection and transportation. The Counties would pay the cost of processing directly rather than it being partially paid by the haulers and partially paid by the Counties from the CEC.

In setting the tipping fee at zero, the Counties and the processor would face issues such as determining which counties in the region the wastes delivered originated from so that the costs are properly assessed back to the proper county. A zero tipping fee would obviously be attractive to all local haulers and therefore the facility may receive more wastes than can be processed. Consequently, the Counties would need to maintain or even increase their level of involvement in waste delivery monitoring and control. This is counter to the current county goals to reduce involvement. Nevertheless, this approach could result in an adequate supply of waste to meet the RDF demands of both Rock-Tenn and the existing Xcel combustion plants.

2.5.3 Public Collection

There are three methods for the Counties to implement collection of solid wastes for public collection. These include:

- Purchasing trucks and hiring employees to handle all or at least a portion of solid waste collection.

- Implementing Organized Collection under the authority granted in Minn. Stat. 115A.94.

- Implementing Public Collection under the authority granted in Minn. Stat. Chaps. 145A, 400, and 473.

The third method was the selected approach during Public Collection Study conducted by the Counties in 2001 through 2002 with the other two thought to not be as favorable for the Counties. This study provided an extensive review of the methods and potential advantages and disadvantages of such an endeavor. The final report[4] was developed in 2002. While the report noted that waste haulers oppose this approach, it also noted this approach provides the best solution to meet the Counties' environmental goals. Thus, Public Collection provides another potential option to consider for waste assurance for meeting processing goals.

[4] "Final Report: Study on Public Collection." April 2002. Prepared by Ramsey and Washington Counties. 49 pages plus appendices.