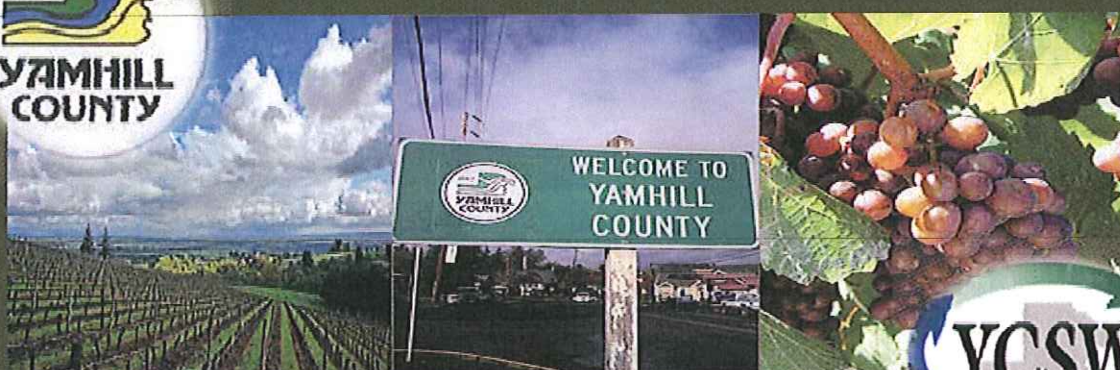
Final Report
Analysis of Waste Disposal / Management Alternatives
for Yamhill County, Oregon
October 2nd, 2009



By
Zia Engineering & Environmental Consultants, LLC

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Final Report on Waste Disposal / Management Alternatives for Yamhill County, Oregon

1.0 Introduction

1.1 Background

Riverbend Landfill in Yamhill County is operated by Waste Management, Inc. and receives refuse not only from Yamhill County but from other jurisdictions in the western and coastal portions of Oregon. The County has two franchised waste service providers – Newberg Garbage and Recycling Service and Western Oregon Waste. There are 10 incorporated municipalities in Yamhill County and the County's population is about 97,000 (U.S. Census Bureau 2007 estimate). Presently about 150,000 tons of waste per year from Yamhill County are being disposed at Riverbend Landfill. It is anticipated this amount could increase to 200,000 tons per year by 2015.

The agreement between the County and Waste Management for operation of the landfill ends on September 30, 2014 and it is unknown at this time whether Riverbend Landfill's application for expansion of operations will be approved. To prudently plan for the future, the County's Board of Commissioners desires to assess the feasibility of pursuing other waste disposal / management methods and their related impacts. It is understood such methods could involve existing landfills in Oregon and Washington or non–landfill technologies such as waste–to–energy conversion. In this regard, the County retained Zia Engineering and Environmental Consultants, LLC (Zia, prime contractor) and HDR Engineering, Inc. (HDR, subcontractor) to examine such methods and prepare a report for the Commissioners.

1.2 Purpose

The purpose of this report and the interaction process associated with it (see Section 1.3 below) is to analyze alternative waste disposal / management options available to Yamhill County. The consultant's scope of work calls for data, information, perspectives, and conclusions to be developed, but does not request a specific, recommended course of action. Rather, the Zia / HDR analysis will be used by the County Commissioners in reaching a decision about whether or not to expand Riverbend Landfill.

1.3 Approach

The County's existing Solid Waste Advisory Committee (SWAC) was used to assist staff and the Commissioners review consultant work products and to function as a focal point for stakeholder comments. Five meetings / presentations were conducted with SWAC in 2009 – June 17, July 1, July 15, August 5, and September 30.

To facilitate decision – making on future waste disposal / management directions it was deemed important to provide a common, basic level of understanding for all involved parties on solid waste management in Yamhill County prior to introducing new technical information / analysis. The factors relevant for such an understanding are contained in Section 2 below.

Zia Engineering subcontracted with HDR Engineering, Inc. to provide expertise on the operations and status of disposal / management technologies that do not involve landfilling. HDR has an ongoing project with the City of Los Angeles Bureau of Sanitation that is the most recent industry examination of such technologies Zia could identify. Due to the limited budget and timeframe for the Yamhill County project it was decided to use existing HDR research as found in the document dated April 27, 2009 and titled "City of Los Angeles – Alternative Technology – Technical Analysis of Vendor Proposals" as well as previous work performed by HDR on this topic for the City of Los Angeles and other clients. The research is recent enough that is does not require updating for purposes of determining the state – of – the – art in this evolving field.

2.0 Context of Analysis

2.1 State Statutes

ORS (Oregon Revised Statutes) 459.015 – 2 (a) established waste management priorities in the following order:

- First, to reduce the amount of solid waste generated;
- Second, to reuse material;
- Third, to recycle material that cannot be reused;
- Fourth, to compost material that cannot be reused or recycled;

- Fifth, to recover energy from solid waste that cannot be reused, recycled, or composted;

- Sixth, to dispose of remaining solid waste by landfilling or other method approved by the Department of Environmental Quality.

ORS 459.015 – 2 also has other relevant priorities in additional subsections as follows:

- (c) Primary responsibility for provision of solid waste management programs rests with cities, counties, and metropolitan service districts;

- (e) Promote research, surveys and demonstration projects to encourage material or energy recovery;

- (j) Provide authority for counties to establish a coordinated program for solid waste management, to regulate solid waste management and to license or franchise the providing of service in the field of solid waste management;

- (k) Encourage utilization of the capabilities and expertise of private industry;

- (m) Promote application of material or energy recovery systems.

ORS 459.017 – 1 (b) emphasizes that local government units have primary responsibility for solid waste management planning.

2.2 Current Roles and Responsibilities

Riverbend Landfill is operated by Waste Management. There are two franchised waste service providers in the County – Newberg Garbage and Recycling Service and Western Oregon Waste. The tipping fee at the landfill for Yamhill County garbage is $ 28 / ton. The County has one full – time staff person dedicated to solid waste in the Department of Planning and Development. The County's most recent recovery rate as documented by the Department of Environmental Quality (see Appendix A) is nearly 37 % (2007). The official 2008 recovery rate is being calculated based on discussions between the County and DEQ.

The County's current ability to direct the flow of waste is virtually non–existent since there is no flow control policy in place. Presently the destination of disposed waste is determined by the two franchised service providers and the economic / logistical considerations they take into account. Further examination of this issue was not part of Zia's scope of work. However, it is clear that directing the flow of waste necessarily entails a major policy initiative and more direct involvement by the County in the solid waste system.

The County receives revenue from Riverbend Landfill based on the current contractual agreement in the form of host fees, as portrayed in the table below.

Table 1: 2008 Host Fees Paid to Yamhill County	
Annual License Fee (fixed fee)	$256,645
Restricted Host Fee (per ton)	$421,481
Beneficial Host Fee (% of revenue)	$120,113
Unrestricted Host Fee (% of revenue)	$3,115
Total Fees paid in 2008	**$801,354**

2.3 Sources and Quantities of Waste Disposed at Riverbend Landfill

Table 2: Riverbend 2008 Regional Waste Tons

County	Waste Tons	% of Tons
Clackamas	59,674	9%
Clatsop	35,974	6%
Columbia	27,799	4%
Lincoln	19,892	3%
Marion	2,767	0%
Multnomah	2,482	0%
Polk	1,943	0%
Washington	217,821	34%
Yamhill	215,296	34%
Other Counties	20	0%
Contaminated Soil (ADC)	43,908	7%
Tires	4,746	1%
Clean – up Materials	331	0%
Total Regional Tons	**632,653**	**100%**

Note – ADC = alternative daily cover for landfill operation

Figure 1:
Sources of Waste Sent to Riverbend Landfill

The table and map presented above clearly demonstrate the regional impact of present and future waste disposal operations at Riverbend Landfill.

3.0 Description of Waste Disposal / Management Alternatives

Two sets of alternatives to Riverbend Landfill have been assessed, as discussed in the sections below.

3.1 Landfills

The first broad category of alternatives involves export of waste to another local or regional landfill in Oregon and Washington. Four landfills are in this category:

- Coffin Butte Landfill, Corvallis / Benton County, OR – owned and operated by Allied / Republic Waste

- Wasco County Landfill, The Dalles / Wasco County, OR – owned and operated by Waste Connections

- Columbia Ridge Landfill, Arlington / Gilliam County, OR – owned and operated by Waste Management

- Roosevelt Regional Landfill, Roosevelt / Klickitat County, WA – owned and operated by Allied / Republic Waste

3.2 Non – landfill Technologies

The second broad set of alternatives involves non – landfill biological, chemical, or thermal waste conversion technologies. As identified by HDR those technologies are:

- Advanced Thermal Recycling (also referred to as Mass Burn or Waste – to – Energy incineration)

- Gasification (also referred to as Plasma Arc)

- Anaerobic Digestion

- Aerobic Digestion / Composting

- Thermal Depolymerization

- Hydrolysis
- Pyrolysis
- Refuse – Derived Fuel (also referred to as RDF)

Appendix B contains detailed descriptions of the non – landfill waste disposal / management technologies.

4.0 Assessment of Alternatives

4.1 Landfills

Concerns have been formally expressed to the County and consultant by Waste Management (see Appendix E), Waste Connections (see Appendix F), and Waste Not of Yamhill County (see Appendices G and H) about various aspects of the original analysis done by J. R. Miller and Associates regarding the financial impacts of closing Riverbend Landfill. To address these concerns Zia Engineering performed further calculations in an effort to clarify those impacts. The calculations are presented below; Appendix D contains more extensive details supporting the calculations.

The following series of tables summarize the disposal components for each alternative landfill and the impact on the collection rates under each alternative. Transfer station build and operational costs are estimated for Western Oregon Waste (WOW) whereas the costs for Newberg Garbage & Recycling (NG&R) are actual amounts. For Alternatives 2, 3, and 4, an additional $1,350,000 is estimated to purchase and install a waste compactor at each company's transfer facility for more economical and efficient transport of refuse to the three more distant landfills. Tonnage amounts for each transfer station are based on the current amount reported by the two waste service firms. An additional 10,400 tons of waste currently being self – hauled to Riverbend Landfill would be delivered to the transfer station in McMinnville, thereby increasing the tonnage amount handled by WOW to 50,010 over the current 36,610 tons of waste collected on route.

Transport of waste – by – rail was not considered in the cost analysis due to the high costs and low volumes of waste at each facility. The details of the waste – by – rail cost analysis are included in the Appendix D of this report.

Table 3: Landfill Alternative #1

Coffin Butte located north of Corvallis, Oregon

Distance from McMinnville: 38 miles

Alternative #1 – Coffin Butte Landfill			
Waste Source		**WOW**	**NG&R**
Tons to be disposed at Coffin Butte		50,010	54,545
Transfer Station Capital Cost per Ton	A	$10.98	$7.44
Transfer Station Operational Cost per Ton	B	$21.90	$19.25
Waste Transport Cost per Ton	C	$13.41	$15.50
Transfer & Transport Cost per Ton (**A+B+C**)	D	**$46.30**	**$42.19**
Landfill Tip Fee Low	E	$28.00	$28.00
Landfill Tip Fee High	F	$44.00	$44.00
Landfill Tip Fee Median (**E+F/2**)	G	$36.00	$36.00
Total Cost per Ton: Low (**D+E**)	H	$74.30	$70.19
Total Cost per Ton: High (**D+F**)	I	$90.30	$86.19
Current Disposal Cost	J	$27.00	$61.56
▲ per Ton (**D+G-J**)	K	**$55.30**	**$16.63**
Increased Cost per Year (**Waste Tons per Source x K**)	L	**$2,765,426**	**$907,178**

Since each collection company would have to negotiate the specific terms and conditions of a disposal contract with the landfill owner / operator, a range of disposal costs is used to estimate the system costs. For this analysis, the rate impact assumes the transfer and transport amounts from above (Item D) plus the median cost of disposal (Item G). Set – out weight for the 32 gallon cart was estimated at 24 pounds or 104 pounds per month (24 x 4.33 weeks) and the 96 gallon cart is estimated at 60 pounds per set – out or 260 pounds per month (60 x 4.33 weeks). Commercial containers are estimated at 125 pounds per cubic yard. The assumed monthly weight for a 2 – cubic yard dumpster collected weekly is 1,083 pounds and the 3 – cubic yard dumpster has an estimated monthly weight of 1,624 pounds.

Table 4:
Alternative #1 Impact on Collection Rates in Yamhill County

	WOW	WOW	NG&R	NG&R
Residential	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
32 gallon cart	$17.90	$16.51	$18.04	$12.84
Rate Increase	$3.35	$3.35	$1.01	$1.01
Alt #1 32 gallon rate	$21.25	$19.86	$19.05	$13.85
96 gallon cart	$29.83	$27.52	$24.38	$20.50
Rate Increase	$8.35	$8.35	$2.51	$2.51
Alt #1 96 gallon rate	$38.18	$35.87	$26.89	$23.01
Commercial	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
2 yard x collected weekly	$189.53	$176.63	$128.55	$125.61
Rate Increase	$34.80	$34.80	$10.47	$10.47
Alt #1 2 YD Rate	$224.33	$211.43	$139.02	$136.08
3 yard x collected weekly	$249.68	$234.56	$183.17	$178.93
Rate Increase	$52.20	$52.20	$15.70	$15.70
Alt #1 3 YD Rate	$301.88	$286.76	$198.87	$194.63

Table 5: Landfill Alternative #2

Wasco County Landfill located south of The Dalles, Oregon
Distance from McMinnville: 140 miles
Assumes all waste is compacted at transfer station prior to transport

Alternative #2 – Wasco County Landfill			
Waste Source		**WOW**	**NG&R**
Tons to be disposed at Wasco County		50,010	54,545
Transfer Station Capital Cost per Ton	A	$18.19	$14.65
Transfer Station Operational Cost per Ton	B	$21.90	$19.25
Waste Transport Cost per Ton	C	$26.81	$25.59
Transfer & Transport Cost per Ton (A+B+C)	D	**$66.90**	**$59.49**
Landfill Tip Fee Low	E	$25.00	$25.00
Landfill Tip Fee High	F	$33.00	$33.00
Landfill Tip Fee Median (E+F/2)	G	$29.00	$29.00
Total Cost per Ton: Low (D+E)	H	$91.90	$84.49
Total Cost per Ton: High (D+F)	I	$99.90	$92.49
Current Disposal Cost	J	$27.00	$61.56
▲ per Ton (D+G-J)	K	**$68.90**	**$26.63**
Increased Cost per Year (**Waste Tons per Source x K**)	L	**$3,445,629**	**$1,469,037**

Table 6: Alternative #2 Impact on Collection Rates in Yamhill County				
	WOW	WOW	NG&R	NG&R
Residential	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
32 gallon cart	$17.90	$16.51	$18.04	$12.84
Rate Increase	$4.18	$4.18	$1.63	$1.63
Alt #1 32 gallon rate	$22.08	$20.69	$19.67	$14.47
96 gallon cart	$29.83	$27.52	$24.38	$20.50
Rate Increase	$10.41	$10.41	$4.07	$4.07
Alt #1 96 gallon rate	$40.24	$37.93	$28.45	$24.57
Commercial	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
2 yard x collected weekly	$189.53	$176.63	$128.55	$125.61
Rate Increase	$43.36	$43.36	$16.95	$16.95
Alt #2 2 YD Rate	$232.89	$219.99	$145.50	$142.56
3 yard x collected weekly	$249.68	$234.56	$183.17	$178.93
Rate Increase	$65.04	$65.04	$25.43	$25.43
Alt #2 3 YD Rate	$314.72	$299.60	$208.60	$204.36

Table 7: Landfill Alternative #3

Columbia Ridge Landfill located south of Arlington, Oregon

Distance from McMinnville: 184 miles

Assumes all waste is compacted at transfer station prior to transport

Alternative #3 – Columbia Ridge Landfill			
Waste Source		**WOW**	**NG&R**
Tons to be disposed at Columbia Ridge		50,010	54,545
Transfer Station Capital Cost per Ton	A	$18.19	$14.65
Transfer Station Operational Cost per Ton	B	$21.90	$19.25
Waste Transport Cost per Ton	C	$32.73	$30.33
Transfer & Transport Cost per Ton (**A+B+C**)	D	**$72.82**	**$64.23**
Landfill Tip Fee Low	E	$22.00	$22.00
Landfill Tip Fee High	F	$33.00	$33.00
Landfill Tip Fee Median (**E+F/2**)	G	$27.50	$27.50
Total Cost per Ton: Low (**D+E**)	H	$94.82	$86.23
Total Cost per Ton: High (**D+F**)	I	$105.82	$97.23
Current Disposal Cost	J	$27.00	$61.56
▲ per Ton (**D+G-J**)	K	**$73.32**	**$30.17**
Increased Cost per Year (**Waste Tons per Source x K**)	L	**$3,666,766**	**$1,645,571**

Table 8: Alternative #3 Impact on Collection Rates in Yamhill County				
	WOW	WOW	NG&R	NG&R
Residential	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
32 gallon cart	$17.90	$16.51	$18.04	$12.84
Rate Increase	$4.45	$4.45	$1.83	$1.83
Alt #1 32 gallon rate	$22.35	$20.96	$19.87	$14.67
96 gallon cart	$29.83	$27.52	$24.38	$20.50
Rate Increase	$11.07	$11.07	$4.56	$4.56
Alt #1 96 gallon rate	$40.90	$38.59	$28.94	$25.06
Commercial	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
2 yard x collected weekly	$189.53	$176.63	$128.55	$125.61
Rate Increase	$46.15	$46.15	$18.99	$18.99
Alt #3 2 YD Rate	$235.68	$222.78	$147.54	$144.60
3 yard x collected weekly	$249.68	$234.56	$183.17	$178.93
Rate Increase	$69.22	$69.22	$28.48	$28.48
Alt #3 3 YD Rate	$318.90	$303.78	$211.65	$207.41

Table 9: Landfill Alternative #4

Regional Disposal Landfill located north of Roosevelt, Washington

Distance from McMinnville: 177 miles

Assumes all waste is compacted at transfer station prior to transport

Alternative #4 – Regional Disposal Landfill			
Waste Source		**WOW**	**NG&R**
Tons to be disposed at Regional Disposal		50,010	54,545
Transfer Station Capital Cost per Ton	A	$18.19	$14.65
Transfer Station Operational Cost per Ton	B	$21.90	$19.25
Waste Transport Cost per Ton	C	$32.74	$30.29
Transfer & Transport Cost per Ton (**A+B+C**)	D	**$72.83**	**$64.19**
Landfill Tip Fee Low	E	$23.00	$23.00
Landfill Tip Fee High	F	$34.00	$34.00
Landfill Tip Fee Median (**E+F/2**)	G	$28.50	$28.50
Total Cost per Ton: Low (**D+E**)	H	$95.83	$87.19
Total Cost per Ton: High (**D+F**)	I	$106.83	$98.19
Current Disposal Cost	J	$27.00	$61.56
▲ per Ton (**D+G-J**)	K	**$74.33**	**$31.13**
Increased Cost per Year (**Waste Tons per Source x K**)	L	**$3,717,386**	**$1,697,781**

Table 10: Alternative #4 Impact on Collection Rates in Yamhill County				
	WOW	**WOW**	**NG&R**	**NG&R**
Residential	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
32 gallon cart	$17.90	$16.51	$18.04	$12.84
Rate Increase	$4.51	$4.51	$1.89	$1.89
Alt #1 32 gallon rate	$22.41	$21.02	$19.93	$14.73
96 gallon cart	$29.83	$27.52	$24.38	$20.50
Rate Increase	$11.23	$11.23	$4.70	$4.70
Alt #1 96 gallon ate	$41.06	$38.75	$29.08	$25.20
Commercial	**McMinnville**	**Yamhill**	**Newberg**	**Yamhill**
2 yard x collected weekly	$189.53	$176.63	$128.55	$125.61
Rate Increase	$46.78	$46.78	$19.59	$19.59
Alt #4 2 YD Rate	$236.31	$223.41	$148.14	$145.20
3 yard x collected weekly	$249.68	$234.56	$183.17	$178.93
Rate Increase	$70.17	$70.17	$29.38	$29.38
Alt #4 3 YD Rate	$319.85	$304.73	$212.55	$208.31

4.2 Non – landfill Technologies

At the August 5, 2009 SWAC meeting the detailed technology descriptions from Appendix B were offered and a presentation made which elaborated further on the status of these technologies based on site visits conducted by HDR personnel in several countries. That presentation is found in Appendix C. Considering the content of this presentation and the previously referenced work being performed by HDR for the City of Los Angeles, the technologies were divided into three general groups to indicate their developmental stage at this point in time. Those three groups are:

- ***Experimental*** – the technology does not have a proven track record of performance either in the United States and / or elsewhere in handling even small quantities of mixed waste on a regular basis; it is still in the "laboratory" or "test tube" level of development.

- ***Emerging*** – the technology is being used at particular locations either in the United States and / or elsewhere with limited to moderate amounts of mixed waste and / or pre – processed selected waste streams.

- ***Commercial*** – the technology is being widely used either in the United States and / or elsewhere to dispose of or convert into a useful product (or products) large quantities of mixed waste and / or pre – processed selected waste streams.

The developmental stage of the technologies is characterized as follows:

- Advanced Thermal Recycling (also referred to as Mass Burn or Waste – to – Energy incineration) – commercial

- Gasification (also referred to as Plasma Arc) – emerging

- Anaerobic Digestion – emerging

- Aerobic Digestion / Composting – commercial

- Thermal Depolymerization – experimental

- Hydrolysis – experimental

- Pyrolysis – experimental

- Refuse – Derived Fuel (also referred to as RDF) – commercial

5.0 Conclusions

5.1 Are There Alternatives to Riverbend Landfill?

The simple answer to this key questions is "yes…but". As Sections 3 and 4 of this report have demonstrated, there are other operating landfills in the region that could be viable alternatives to Riverbend, however there are varying cost impacts associated with each one. They would all be more expensive than using Riverbend Landfill given the necessary transfer capacity development and transport distance, costs which inevitably are reflected in rates charged residential and commercial customers.

Of the eight non–landfill technologies identified there are three that are in a commercial developmental stage and two in an emerging developmental stage (refer to Section 4.2 above). It must also be noted that refuse – derived fuel is actually a product derived from a materials processing sequence that ultimately requires a market to realize its full utilization as a waste management technology. Without a market, RDF processing becomes a size reduction technique for trash that would still need to be landfilled. As well, the two forms of composting – anaerobic and aerobic – are focused on organic materials such as food and green waste and not designed for the entire municipal solid waste stream.

Thus the one alternative operating at a fully commercial level and capable of handling the broad municipal solid waste stream is waste – to – energy (WTE). Even if a WTE facility were chosen as an option – setting aside the critical questions of who would pay for it and how, where it would be located in the County, who would own it, who would operate it, and so on – it would take several years before such a facility came to fruition, necessitating continued use of Riverbend or some other disposal capacity. And the costs for such a facility or any other alternative – both capital and operating – would depend heavily on whether only Yamhill County waste were going to it or whether somehow the 600,000 plus tons now taken annually by Riverbend Landfill were directed to it. Finally, it does not make sense, nor would it happen in the real world, that tonnage transported out of the County would be brought back after several years for a WTE plant or other non – landfill technology that had evolved to a commercially viable scale.

5.2 Policy Objectives and County Decision – making

Ultimately a decision about the future of the Riverbend Landfill does not revolve around technology options but instead policy objectives and directions. The technologies of landfilling, transfer stations, long – haul transport of garbage, and WTE facilities are established. As HDR's research has shown, there are several promising other non – landfill waste disposal / management technologies that are in various stages of development, some moving ahead faster and more productively than others. Still, it is difficult to predict when and in what form they will be able to handle 150,000 to 200,000 tons of municipal solid waste per year, much less 600,000 to 700,000 tons per year. The resolution to that issue requires more expenditures of time and money by public and private sector entities involved with solid waste management, not only in Northwestern Oregon but across the nation.

It should be noted that there is a WTE facility in Brooks / Marion County. However, that facility is presently operating at capacity – approximately 183,000 tons per year – and could only take more tonnage with the addition of a new boiler. Such a boiler would expand capacity by about 90,000 tons per year; this is far less than the quantity of disposed waste being generated within Yamhill County. Marion County is considering installation of a new boiler but as of now has not made a final decision.

Continued operation of Riverbend Landfill maintains the status quo and gives the County some measure of control / influence over solid waste management through a revised contractual arrangement with Waste Management along with the franchise agreements between the County and two service companies.

For whatever set of reasons, the County may decide not to enter into a revised contractual arrangement with Waste Management for operation of Riverbend Landfill. That decision will actually reduce the amount of County control / influence over solid waste management because the County does not exercise flow control authority. A plausible scenario at that point is that WOW and N G & R will enter into discussions with one or more of the landfills noted in Section 3.1. They would be trying to secure a long – term disposal agreement in order to spread costs out over several years, thus controlling their own cash flow requirements and the impact on rate payers as well. The County would not be a party to those discussions. In addition, the revenue to the County from host fees at Riverbend Landfill (see Section 2.2) would cease.

Further, in considering the implementation feasibility of one of the non – landfill disposal / management technologies, the County's position in the solid waste management system would have to increase dramatically for the County to be the "change agent" pushing for development of a specific technology. That increased role would be in the form of flow control authority so it can guarantee tonnage, augmented staff expertise, and a robust financing protocol (or several) to fund a project. And still, the County could obviously only theoretically exercise flow control over waste generated within the County, not the tonnage from outside the County now flowing to Riverbend Landfill. At no point in the course of this analysis has the consultant been advised by the County that it is interested in taking on such a role.

In reality, it is not the developmental status of the non – landfill disposal / management technologies that is the pivotal factor. Even if all the technologies were commercially operational this would not resolve the basic and open question: "How does an alternative technology to replace Riverbend Landfill get implemented in Yamhill County? Who, or what, will be the change agent or mechanism for determining the most appropriate technology and then siting, funding, constructing, and operating it, especially if the County is not in a position to do all this?"

Between the two clearly opposite courses of action described above – keep Riverbend Landfill open or close it – there is a potential "third way" that entails the County more actively pursuing the statutory authority it has (see Section 2.1) in partnership and combining resources with Waste Management, WOW, and N G & R. This is termed the "balanced compromise strategy" and is outlined in the next section. The balanced compromise strategy addresses the issue of what mechanism could there be for introducing an alternative waste disposal / management technology into Yamhill County.

5.3 The Balanced Compromise Strategy

- Houston – based Waste Management has launched thinkgreen.com, an interactive Web site to further educate the public about the business of handling the nearly five pounds of waste that the average citizen produces each day. David Steiner, CEO of Waste Management, said "Our goal is to not only be a waste collection and disposal company, but an industry leader that invests resources in the development of environmentally smart ways to manage waste."

  Waste Age, January 28, 2008

- Houston – based Waste Management has opened a $ 10 million, 65,000 square foot construction and demolition (C & D) debris recycling center in Washington County, Oregon. The facility contains such environmentally friendly features as a translucent roof for natural lighting and reduced energy consumption, and a system that collects rainwater from the roof and stores it for later on – site use. "This is a significant investment for Waste Management and a reflection of our commitment to advancing sustainability in Oregon," said Dean Kattler, Vice President of Waste Management's Northwest Market Area. "Recovering debris from C & D sites and then putting it back to work in the community synchs up with our broader company strategies to use traditional waste in innovative, sustainable ways."

Waste Age, July 1, 2009; see also Appendix I of this report

- ***"Garbage Never Smelled So Sweet – InEnTec of Bend Has Partnered with Waste Management, Inc. to Build Its Trash–to–Gas Machines at Landfills Across the Country", by Andrew Moore, Bend Bulletin, June 7, 2009 (see Appendix J of this report)***

  "InEnTec's join venture with Waste Management envisions...building InEnTec's Plasma Enhanced Melters at many of the more than 180 landfills Waste Management operates throughout the country."

  "...the goal is to eventually process municipal waste. To be economically efficient PEM units for municipal waste would need to process 125 tons of garbage a day."

  "Surma [Jeff Surma, a founder of InEnTec] said the deal with Waste Management is the next step in InEnTec's evolution. Surma said he didn't want to sell InEnTec but instead partner with a company that has the resources to scale up the technology."

- Houston – based Waste Management and Valero Energy Corporpation have invested in Terrabon, a company that converts biomass into fuel. According to a press release, Waste Management's and Valero's investments "will be used by Terrabon to advance the scalability of its technology."

  "We see waste as a resource to be recovered in a way that protects and enhances the environment, and this investment in Terrabon, together with Waste Management's other renewable energy initiatives, will help move Waste Management toward meeting two of its sustainability goals: doubling its renewable energy production and investing in emerging technologies for managing waste," said Carl Rush, Vice President of Organic Growth at Waste Management, in a press release.

  Waste Age, August 26, 2009

It is important to formulate a balanced, compromise position and avoid getting trapped in the "either / or", "lose / lose" framework of either continuing with Riverbend Landfill or closing it. The consultant encourages the County, its private sector partners, citizens, and businesses to examine the elements of the solid waste situation in Yamhill County with a positive and creative perspective. In so doing the involved parties can take advantage of a unique confluence of circumstances that, combined together, constitute an excellent opportunity for proactive leadership in the solid waste field. This positive and creative perspective consists of the following viewpoints and elements:

- The resources of Waste Management, and the company's clear corporate commitment to waste diversion and alternative, non–landfill disposal / management technologies (see news items above) are powerful tools the County can harness in pursuit of a policy objective that moves away from reliance on landfill disposal, which is the least desirable management approach in the State of Oregon's waste management hierarchy (see Section 2.1).

- Oregon statutes as cited in Section 2.1 give counties wide latitude in promoting an action agenda that emphasizes materials and energy recovery from waste.

- Whether intentional or not, the fact is that through its agreement with Riverbend Landfill the County is already playing a regional role in solid waste management, and thus its decision regarding the landfill will have regional implications, either positively or negatively.

- The 600,000 to 700,000 tons of trash per year that are handled at Riverbend, including the County's own refuse, offer the basis for spreading investment costs for an alternative technology across a wide rate base.

- There are concerned citizens and interest groups in the County who care strongly about the quality of life in Yamhill County and who, if provided the opportunity, could choose to make the long – term commitment and contribution to a constructive partnership with the County, Waste Management, WOW, and N G & R that is necessary for development of an alternative to Riverbend Landfill.

- However, since the County is not in a position to fully or even partially fund such development on its own it is precisely the continued landfill operation that will produce the revenue, and provide the raw material for, an alternative technology. The paradox is that the landfill operation, if placed within a more comprehensive policy initiative or framework stressing materials / energy recovery, will finance its own replacement.

- The County can have reliable local disposal capacity at reasonable rates and begin creating one or more alternatives to landfill disposal at the same time.

- The County could strive to reach agreement with Waste Management to phase out the landfill through a development sequence that replaces it with one or more conversion technologies.

- If for whatever reason one or more waste conversion technologies do not prove viable the landfill could be closed and transfer / transport of waste out of Yamhill County and / or other options pursued.

- Carrying out the balanced compromise strategy over the course of several years would be facilitated through ongoing monitoring by SWAC and / or another support / advisory group.

Appendix A

2007 DEQ Materials Recovery Report for Yamhill County

State of Oregon Department of Environmental

2007 DEQ MATERIALS RECOVERY REPORT
YAMHILL COUNTY

CALCULATED RECOVERY RATE: 30.7%
2% CREDITS: 6.0%
TOTAL RECOVERY RATE: 36.7%

GOAL (2009): 45%

In 2007, YAMHILL COUNTY disposed of131,051 tons of waste and recovered 58,027 tons of waste.

Year	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007
Calculated	34.8%	31.2%	44.4%	49.2%	54.4%	42.3%	50.2%	44.6%	39.6%	**30.7%**
Credits*	-	0.0%	4.0%	4.0%	4.0%	6.0%	6.0%	6.0%	6.0%	**6.0%**
Total	34.8%	31.2%	48.4%	53.2%	58.4%	48.3%	56.2%	50.6%	45.6%	**36.7%**

* Credits were not available prior to 1997

PER CAPITA WASTE DISPOSAL FOR WASTESHED (Pounds per Person):
The average per capita waste *disposed in Oregon* during 2007 was 1,743 pounds. YAMHILL COUNTY's per capita waste disposal was 2,794 pounds. As shown in the following table, per-capita waste disposal in YAMHILL COUNTY has increased 82% since 2002 (5-year change) and increased 68% since 1997 (10-year change).

PER CAPITA WASTE RECOVERY FOR WASTESHED (Pounds per Person):
The average per capita waste *recovered in Oregon* during 2007 was 1,313 pounds. YAMHILL COUNTY's per capita waste recovery was 1,237 pounds. As shown in the following table, per-capita waste recovery in YAMHILL COUNTY has decreased 32% since 2002 (5-year change) and increased 128% since 1997 (10-year change).

PER CAPITA WASTE GENERATION FOR WASTESHED (Pounds per Person):
Waste generation is the sum of disposal and recovery. It is a rough measure of the total discards in a wasteshed. In 2001, the Oregon Legislature established waste generation goals for the State. These goals are: a) no increase in per capita waste generation in 2005 and all subsequent years, and b) no increase in total waste generation in 2009 and subsequent years.

The average per capita waste *generation in Oregon* during 2007 was 3,005 pounds. YAMHILL COUNTY's per capita waste generation was 4,031 pounds. As shown in the following table, per-capita waste generation in YAMHILL COUNTY has increased 20% since 2002 (5-year change) and increased 83% since 1997 (10-year change).

	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007
PER-CAPITA DISPOSED*	1,241	1,659	1,558	1,493	1,533	1,508	1,583	1,699	2,163	**2,794**
PER-CAPITA RECOVERED*	663	752	1,242	1,447	1,832	1,106	1,594	1,370	1,416	**1,237**
PER-CAPITA GENERATED*	1,904	2,411	2,800	2,940	3,365	2,614	3,177	3,068	3,579	**4,031**

*Pounds per person per year.

REGIONAL TECHNICAL ASSISTANCE CONTACT:
Contact Cathie Davidson at (503) 378-5089 for assistance in identifying ways to help reduce waste generation and disposal through waste prevention, reuse, recycling, and composting.

SURVEY COORDINATOR:
Contact Mary Lou Perry in Portland at (503) 229-5731, or toll free in Oregon at 1-800-452-4011, for more information on the survey.

NOTE: DEQ routinely updates recovery rates for prior years as we receive new information. These are the current corrected figures for all years.

Appendix B

Detailed Descriptions of Non – landfill Technologies

Management Alternative # 1 – Advanced Thermal Recycling

A. Description

Advanced thermal recycling refers to a modern waste-to-energy technology with advanced environmental controls and by-product recovery. This type of facility uses the combustion of carbon-based materials to produce energy. Inorganic materials are contained in the ash residue. Exhaust gas is treated in emission control systems before being released into the atmosphere.

B. Process

Waste is first shredded, then conveyed or loaded into feed hoppers and moved into a furnace. Complete combustion of the carbon-based material in the feedstock is accomplished in an oxygen rich atmosphere with high air-to-fuel ratios. Inorganic (non-combustible) materials are converted to ash. The hot flue gas is composed primarily of carbon dioxide and water, and the gas flows through a boiler, where steam is produced. Steam may be used directly, or for driving a steam turbine generator to produce electricity. Cooled exhaust gas flows through emissions control systems before being directed through stacks into the atmosphere. Common by-products for controlling the air quality of plant emissions include gypsum and hydrochloric acid. The fly ash and bottom ash are often mixed, and the resulting ash is processed to remove metals and metal oxides. After treatment, the remaining ash is typically disposed in landfills or reused as landfill cover, or it can be processed for other beneficial uses, such as road base.

C. Wastestream or "Feedstock"

Municipal Solid Waste (MSW) is used as the feedstock for advanced thermal recycling.

D. Capacity Range

Typically these facilities are designed to process between 500 and 2,000 tons per day.

E. Developmental Stage

Commercial development of this technology is mature in the United States although its use is limited to facilities initially developed in the 1970's through 1980's and has been further limited to technical upgrades, primarily in the emission control systems since then. The first waste-to-energy (WTE) plant in the United States was established in 1975, and 87 plants are now in operation throughout 29 states. Development of the technology is more mature overseas, and advanced thermal recycling is the primary method of managing and reducing municipal solid waste in Japan and parts of Europe.

Management Alternative # 1 – Advanced Thermal Recycling continued

F. End Product(s) and Markets

End products can include steam, electricity, bottom ash (rock or cement feedstock), iron, steel, non-ferrous metal, and metal oxides. In some countries bottom ash is used as a construction material. Many plants also produce hydrochloric acid and gypsum.

G. Residuals Requiring Disposal

Primarily fly ash. Bottom ash may require disposal where there are no markets or other beneficial uses available, or where regulatory restrictions prohibit their use in other products.

H. Example Companies/Locations

- Commerce, CA Refuse-to-Energy Facility and Southeast Resource Recovery Facility (SERRF) in Long Beach, CA
- Marion County Resource Recovery Facility in Brooks, OR
- Numerous facilities in Germany, Spain and France

Management Alternative # 2 – Gasification

A. Description

Thermal conversion of solid waste includes a number of technologies that are used both for volume reduction and energy recovery. Thermal processing is used to convert solid waste into gaseous, liquid, and solid conversion products. Gasification systems use thermal conversion to convert waste into a synthetic gas (or "syngas") which can then be sold as combustible fuel gas or converted to electricity. In gasification systems, the solid waste is subjected to high temperatures in converter units where the heat breaks the organic materials contained in the waste down to a gaseous state. The gases are then compressed and used as fuel for an industrial facility, a gas-fired turbine, or internal combustion engine / electrical generating facility.

B. Process

The waste entering the system is typically screened for removal of obviously inappropriate materials (such as large appliances or metal items), then ground for size reduction and fed to the converter units. Within the converter units, applied heat breaks the materials down to individual molecules (the resultant synthetic or "syngas"). This gas is further processed and cleaned, then either sold to a local gas company or large industrial user, or combusted in engines or turbines to generate electricity.

C. Wastestream or "Feedstock"

The feedstock can be unprocessed Municipal Solid Waste (MSW), or refuse-derived fuel (RDF) from processed waste. Feedstocks for some gasification facilities (particularly in Japan) include high Btu materials, typically consisting of elevated quantities of plastics and / or tires.

D. Capacity Range

Typically these facilities are designed to process between 100 and 500 tons per day.

E. Developmental Stage

This is an emerging technology with low reliability in North America, where the first demonstration plants are now coming online. Over the last ten years, most experience with gasification systems using MSW as feedstock has been overseas.

F. End Product(s) and Markets

Products include ferrous metal (recovered through initial screening and magnetic separation of the feedstock), electricity or fuel (from syngas), sulfur (agricultural grade), and aggregate (for construction industry or cement manufacturing).

Management Alternative # 2 – Gasification continued

G. Residuals Requiring Disposal

Heavy metals and other contaminants recovered from the gas cleaning equipment will need to be disposed of properly.

H. Example Companies/Locations

- Canada (combined with other technologies such as plasma arc)
- Various locations in Japan

Management Alternative # 3 – Anaerobic Digestion

A. Description

This technology relies on controlled decomposition of organic material by microbes. The decomposition occurs within a vessel, or digester. The process produces biogas for heating and power generation, and a semi-solid residual material (or "digestate") that can be used as compost feedstock. The content of organic materials in a digester can vary. A low-solids digester can contain less than 10% organic matter by weight as compared to a high-solids digester, which can contain as much as 40% organic material by weight.

B. Process

Material is typically screened, shredded, or otherwise processed for contaminant removal, then directed into tanks, where microbes digest the organics in the absence of oxygen and produce biogas, which is collected off the top of the tank. The semi-solid digestate, comprised of less digestible material, is collected and used as compost feedstock in an aerobic composting operation. The biogas may also be converted into liquefied natural gas (LNG) fuel. An advantage of the anaerobic digestion process is the ability to recover energy in the form of natural gas from the organic portion of the wastestream.

C. Wastestream or "Feedstock"

Food waste and / or other organic materials found in municipal solid waste can be used as feedstock for anaerobic digesters.

D. Capacity Range

Typically, these facilities are designed to handle between 50 and 200 tons of organic feedstock per day, although some larger facilities in Europe have been developed that are capable of processing up to 500 tons per day.

E. Developmental Stage

This is an emerging technology in the United States, but becoming a mature technology in Europe, with over ten years of commercial experience at some facilities.

F. End Product(s) and Markets

Products include biogas for heating and power production, and digestate for compost feedstock. Biogas usually contains approximately half methane (natural gas) and half carbon dioxide with trace amounts of other constituents (hydrogen, nitrogen, hydrogen sulfide, and volatile organic compounds). Markets include utility companies, large industrial gas or steam users, truck fleets and composting operations.

Management Alternative # 3 – Anaerobic Digestion continued

The digestate can be used as a soil supplement or mixed with compost. Digestate markets include agricultural growers.

G. Residuals Requiring Disposal

Contaminants sorted out of feedstock will need to be disposed of properly. Digestate will also require proper disposal if no composting markets exist.

H. Example Companies/Locations

- DRANCO, Belgium
- Valorga, France and Spain
- Arrow Bio, Israel and Australia
- Bekon, Germany

Management Alternative # 4 – Aerobic Digestion / Composting

A. Description

This technology relies on the controlled decomposition of organic material by microbes, a technique more commonly known as composting. The decomposition occurs similar to other composting technologies, in a covered windrow or enclosed bunker. The process occurs in an oxygen rich environment so it does not produce biogas. The process does produce an organic residual compost-type material. The composted municipal solid waste (MSW) material may contain broken glass and small particles of film plastic, so its use is typically limited to commercial applications.

B. Process

Material is usually screened, shredded or otherwise processed for contaminant removal, then directed into an enclosed bunker or vessel which maintains an oxygen rich environment, allowing aerobic microbes to digest the organics in the presence of oxygen. During this process, no biogas is produced. Rather, air which has passed through the compost is typically collected and treated in a bio-filter to remove objectionable odors. The post-compost material is screened to remove excessive film plastics, glass, and other undesirable material. However, complete removal of these materials is usually not feasible.

C. Wastestream or "Feedstock"

Food waste and / or other organic materials such as green or yard waste found in municipal solid waste can be used as feedstock for aerobic digestion (composting).

D. Capacity Range

Typically, these facilities are designed to handle between 50 and 200 tons of organic feedstock per day, although some larger facilities in Europe have been developed that are capable of processing up to 500 tons per day.

E. Developmental Stage

This technology in the United States is considered to be in a transition phase between emerging and commercial but is a mature technology in Europe, with over ten years of commercial experience at some facilities.

F. End Product(s) and Markets

Products include a low quality compost material. Markets include commercial applications that accept compost with some glass and film plastic contamination.

Management Alternative # 4 – Aerobic Digestion / Composting continued

G. Residuals Requiring Disposal

Contaminants sorted out of feedstock will need to be disposed of properly. Some compost materials containing elevated levels of undesirable materials (glass and film plastic) may also require proper disposal if no commercial composting markets exist.

H. Example Companies/Locations

- Valorga facility in Spain
- Z Best facility in San Jose, CA
- Yellowstone facility, WY
- Bedminster, Sevier County, TN
- Conporec, France
- Herhof, Germany
- Engineered Compost Systems, WA

Management Alternative # 5 – Thermal Depolymerization

A. Description

Thermal Depolymerization is a type of chemical processing technology that involves a thermal conversion process encompassing several complex steps to refine the resultant product.

B. Process

Feedstock is funneled into a grinder and mixed with water to create a slurry that is pumped into the first-stage reactor, where heat and pressure partially break apart long molecular chains. The resulting mixture is dehydrated using a flash vessel where the pressure is dropped dramatically, thereby liberating some of the water, which returns back upstream to preheat the flow into the first-stage reactor. In the second-stage reactor, the remaining organic material is subjected to more intense heat, continuing the breakup of molecular chains. The resulting hot vapor then goes into vertical distillation tanks which separate the materials into gases, light oils, heavy oils, water, and solid carbon. The gases are burned on-site to assist in the heating and to power the process, and the water is discharged to a municipal wastewater treatment plant. The oils and carbon are stored in tanks for distribution and sale.

C. Wastestream or "Feedstock"

The process converts organic materials (fats, bones, greases, feathers and other organic wastes) into renewable diesel, fertilizers, and specialty chemicals. One initial pilot plant has been dedicated to agricultural materials (primarily poultry wastes). While marketing information reports the facility could accept municipal solid waste, no continuous operation using MSW as a feedstock has been reported.

D. Capacity Range

The capacity range is unknown at this time. This technology is an emerging technology and there is not enough available information on its performance at a commercial scale.

E. Developmental Stage

Commercial interest exists for using this technology to process shredder residue, scrap tires, and municipal solid waste. Testing on shredder residue, on behalf of the Vehicle Recycling Partnership (research arm of the major auto manufacturers), has reportedly been performed.

During the fourth quarter of 1999, a pilot plant was commissioned at the Naval Business Center in Philadelphia, PA. Initial testing was performed on animal waste streams (i.e., animal fats, manure, and turkey offal) to provide operating procedures and parameters as well as insight into system adjustment and response. Additional mixed agricultural wastes, municipal wastes, mixed plastics and tires have been processed in the pilot facility over the last few years, and several process improvements have been made to various unit operations that make up the technology.

F. End Product(s) and Markets

The process is designed to produce different quality fuels from a variety of organic feedstocks. The fuel is reportedly similar to diesel oil or an unblended low-sulfur fuel oil. The first applications of the technology were fuels for use in boilers for heating and turbines for electrical power generation.

Other products could include metals (extracted from the feedstock), electricity and heat.

In addition, the mineral residual from natural organic waste has the potential for fertilizer applications.

G. Residuals Requiring Disposal

It is unclear what residuals require disposal, however char (carbon) and unmarketable chemicals are likely to require disposal if markets do not exist for their consumption.

H. Example Companies/Locations

Changing World Technologies (CWT) pilot plants in Philadelphia, Pennsylvania, and Carthage, Missouri (currently non-operational since March 2009, after CWT filed for bankruptcy).

Energy Visions (KDV Pressureless Catalytic Depolymerization Technology)

Management Alternative # 6 – Hydrolysis

A. Description

Hydrolysis is a chemical decomposition process that breaks down cellulose (potentially obtained from municipal solid waste as a feedstock) to produce ethanol or other compounds. There are different types of hydrolysis, including enzymatic and concentrated acid hydrolysis. As this technology cannot process the entire waste stream, it would likely be combined with other technologies that produce a high-cellulose byproduct and minimize potential process interferences and contaminants from other waste stream components.

B. Process

Hydrolysis uses material and energy inputs to separate cellulose and hemicelluloses from cellulose-rich organic material (biomass), and convert them to sugars. The sugars are then fermented, producing liquids which are purified into products. This hydrolysis process (namely, the process of breaking down cellulose into sugars) can use acids or enzymes.

The disadvantages of hydrolysis include that it may be prohibitively expensive if used in a project where paper or cellulose materials are separated from the mixed waste, unless it is coupled to one or more other technologies. Also, the environmental risks of hydrolysis are not well defined. In addition to the environmental risks of any associated technology, there would be some emissions risks related to methane emissions or issues dealing with potential chemical spills. Another disadvantage is that this process would be able to address only a portion of the cellulose-related fraction of the waste stream (paper and cardboard). It might be possible to site a facility in conjunction with another technology such as autoclaving, as a use for the cellulose product, or a materials recovery facility (MRF) where lower-value paper products would be used as the feedstock for hydrolysis.

C. Wastestream or "Feedstock"

Hydrolysis uses cellulose-rich organic material as a feedstock. Research using municipal solid waste as the primary feedstock is on-going.

Management Alternative # 6 – Hydrolysis continued

D. Capacity Range

The capacity range is unknown at this time because this technology is an emerging technology and has not been developed at a commercial scale (see Section E below).

E. Developmental Stage

Few pilot-scale hydrolysis facilities have been completed as compared to other emerging technologies. The economics have not been well developed for this technology, and projects have generally been small scale. The few demonstration projects and tests that have moved past the laboratory stage of development have focused on the use of corn stover and other biomass materials for ethanol production. Tests with mixed waste or even paper feedstock have been limited, and therefore cost information is limited. No known commercial facilities are in operation for mixed waste. The Blue Fire ethanol facility in Lancaster, CA anticipates using biomass and agricultural cellulose as the primary feedstock.

F. End Product(s) and Markets

Reportedly, marketable ethanol, methane, or other products could be produced. Byproducts of hydrolysis include metals, glass, and fuel products.

G. Residuals Requiring Disposal

It is expected that significant quantities of wastewater would be produced, which would need to be properly treated or discharged to a plant for treatment. Any byproducts for which there are no available markets would need to be disposed of properly.

H. Example Companies/Locations

- Arkenol
- BC International
- Blue Fire Ethanol (concentrated acid hydrolysis), Lancaster, CA

Management Alternative # 7 – Pyrolysis

A. Description

Pyrolysis is a thermal conversion process that uses high temperatures, in the absence of oxygen, to convert waste into a synthetic gas (syngas) and a solid carbon-based residue or "char" product.

B. Process

Municipal Solid Waste (MSW) is typically ground, dried to less than 10% moisture, and fed into the pyrolysis chamber through an air lock to keep air from entering the chamber. The resulting gas is combusted in a thermal oxidizer, and the resulting heat is used to generate steam in a boiler. The steam can either be used for heat or injected into a turbine to generate electricity. The exhaust from the boiler is treated by passing through a sophisticated air pollution control (APC) system.

C. Wastestream or "Feedstock"

MSW is used as the feedstock for pyrolysis.

D. Capacity Range

These facilities are initially being developed as pilot projects which are designed to process between 10 and 50 tons of feedstock per day.

E. Developmental Stage

This is an emerging technology with low current reliability in the United States. The International Environmental Solutions (IES) pilot plant located in Romoland, California, is currently performing test runs. The Plasco facility in Ontario, Canada, is a combined plasma arc / gasification facility and has operated at up to 50 tons per day.

F. End Product(s) and Markets

Products include electricity, char and gypsum. Anticipated markets include utility companies, carbon black manufacturers, asphalt paving companies, and agriculture operations.

G. Residuals Requiring Disposal

Inert material and residues from the APC system will need to be disposed of properly.

H. Example Companies/Locations

- IES (pilot plant, Romoland, CA)
- Balboa Pacific proposed pilot plant (San Diego)

Management Alternative # 7 – Pyrolysis continued

- Plasco (combined plasma arc / gasification facility, Ontario, Canada)
- GEM America located in Summit, New Jersey

Management Alternative # 8 – Refuse – Derived Fuel (RDF)

A. Description

Refuse-derived fuel (RDF) facilities can be used to address nearly the entire waste stream. The goal of this technology is to derive a highly refined fuel (uniform in size, moisture, ash content, and heating value) which can be used as a replacement for coal, wood or other fuels in a conventional solid fuel boiler or cement kiln. The fuel goes by various names but generally is categorized as a RDF. The complexity of an RDF facility can be quite high, increasing the potential for shut-downs. Costs for processing a mixed MSW and the physical characteristics of waste make these facilities expensive to build and operate. Depending on the level of processing, costs can be up to $100 per ton. In most cases, the fuel is used at the same facility where it is processed, although this does not have to be the case.

B. Process

The technology prepares municipal solid waste (MSW) by shredding, screening, and removing non-combustible materials prior to additional processing. RDF facilities can employ multiple shredding stages, large trommel screens or other types of screens for sizing, several stages of magnets, and possibly air separation and eddy current magnets. The product would have an average diameter of 4 to 8 inches, and have the grit and other low-combustible materials removed. However, some facilities perform minimal front-end processing, and their particle size range could be much wider, and metals and grit might or might not be removed, but these facilities would be categorized as something between RDF and mass burn. The RDF is blown or fed into a boiler for semi-suspension firing. Combustion is also completed on a traveling grate. Thermal recovery occurs in an integral boiler. Air pollution controls (APC) are similar to those for mass burn combustion.

RDF front-end processing can create challenges for the facility. Explosions can occur in the shredders, thus requiring, at a minimum, the primary shredders to be placed in explosion-resistant bunkers. Trash is very abrasive and hard on equipment, which causes wear and tear on components. RDF systems have been subject to high maintenance costs and extensive repairs to keep online. Normally processing occurs on one or two shifts with a third shift reserved for maintenance and surges. Therefore, processing systems need to be sized larger than the associated boilers, and storage capacity must be provided to keep the facility running smoothly.

C. Wastestream or "Feedstock"

RDF uses mixed MSW as a feedstock. Bulky objects must be removed from the MSW before processing and / or shredding, but the facility should be designed to address these objects. Recycling processes can also be built into an RDF facility; however, these "dirty" MRFs (material recovery facilities that sort recyclables out of mixed MSW) usually are limited in their productivity.

D. Capacity Range

Facilities can range in size from several hundred tons per day to more than 3,000 tons per day.

E. Developmental Stage

This technology is used in the U.S. and there are several examples of RDF plants in the U.S. that use varying degrees and types of pre-processing and RDF production.

F. End Product(s) and Markets

The benefits of RDF are that the fuel is a substitution for coal or wood in some coal-fired power plants or cement kilns. RDF can be stored and used as a fuel as needed as opposed to mass burn waste systems. Also the fuel can be transported to boilers or cement kilns in relatively distant locations.

Since RDF can be used as a substitution to coal in some power plants and cement works, it is viewed as a substitute for primary fossil fuels. As such, RDF can be viewed as providing environmental advantages when compared with the use of fossil fuels.

Markets are available for at least some of the byproducts, and these markets help to defray some of the costs of processing, but probably not all costs.

RDF facilities will have some air emissions directly from the processing as well as from the boiler. Fugitive particulates from process must be controlled. Because the fuel is derived from waste, the boiler operator would have to comply with the Municipal Solid Waste Maximum Achievable Emission Requirements, which they might not be willing to do or capable of doing. Therefore, the best arrangement is to have a dedicated boiler, gasifier, or other fuel user built specifically for this fuel, and usually that plant is located onsite and connected via a conveyor. Air pollution control devices to achieve these limits are well demonstrated. Additional metals recovery likely will occur after combustion.

Management Alternative # 8 – Refuse – Derived Fuel (RDF) continued

G. Residuals Requiring Disposal

Water will be required for the facility, and wastewater might be discharged. Odors could be an issue from the processing facility. The residue from the processing could be landfilled and could be used as landfill cover material in some cases. Ash from the boiler facility would also need to be landfilled after demonstrating compliance with the Toxicity Characteristic Leaching Procedure (TCLP).

H. Example Companies/Locations

- Germany, Austria, Belgium, France
- Approximately 40 plants operating in the US