



PUBLIC WORKS DEPARTMENT

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DATE: October 23, 2014

TO: Mr. Michael Satre, Chair
Planning Commission

FROM: Samantha Stoughtenger, PE - Wastewater Utility Superintendent
Michele Elfers - Engineering Department

RE: Additional Biosolids Evaluation and Solid Waste Planning Documents

On October 27, 2014 the Engineering and Public Works Department will present a memorandum to the Assembly Committee of the Whole (COW) regarding the Biosolids Treatment and Disposal Evaluation, Phase II. This information is a response to a request by Assembly members for additional information regarding the project at the October 6 Assembly COW meeting. Also, the technical memorandum 4, 'Options for Combined Treatment and Disposal of MSW and Biosolids' has been completed and is being presented to the Assembly. These documents are included for review and discussion.



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2009 Radcliffe Road, Juneau, Alaska 99801

Phone: 907.586.0393 Fax: 907.789.1681

DATE: 27 October 2014

TO: Assembly Committee of the Whole

FROM: Samantha Stoughtenger, PE – Wastewater Utility Superintendent
Michele Elfers – Engineering Project Manager

RE: Biosolids Shipping and Alternatives Selection Process

This memorandum provides background information on shipping of the biosolids and clarifies the alternatives selection process from Phase I to Phase II for the biosolids evaluation.

Shipping History:

After the CBJ biosolids incinerator was decommissioned in 2010, the City and Borough of Juneau (CBJ) began landfilling the wastewater biosolids through a contract with Waste Management (WM); this temporary measure was employed while a long-term solution was sought. WM subcontracted biosolids transportation between Juneau and Seattle via barge with Alaska Marine Lines (AML) and from Seattle to Arlington, Oregon via rail with Union Pacific Railroads (UP) for the final disposal in the Columbia Ridge Landfill. At the time, shipping and landfilling appeared to be an acceptable and cost effective way to manage the problem on a short-term basis. Operationally, however, the shipping process was challenged from the start. The first real signs of trouble occurred in the summer 2012 when the turnaround time on the shipping containers was insufficient; as such, shipping stagnated and biosolids began accumulating at the facilities. The truly tenuous nature of shipping biosolids became more apparent by the week. Then, during the hot and sunny 2013 summer, the WM owned shipping containers created an even more problematic scenario where both AML and UP refused to transport the biosolids due to leakage, odor, potential contamination of other shipped products and transportation employee health concerns. Immediate action needed to be taken, CBJ purchased 60 specifically designed and constructed sealed biosolids-hauling containers and continued efforts to identify a long-term solution. In late 2013, AML became the only barge line in/out of Juneau. Then in early 2014, the original WM disposal contract expired, requiring CBJ to sign a new 5-year contract with WM. This new contract allows WM to walk away at any time with no consequences leaving CBJ in a perilous situation. If a long-term option is not implemented soon, CBJ could be left with no way to ship out the biosolids and no local alternative for disposal.

Alternatives Selection Process:

This section explains how the ten (10) treatment and (3) disposal alternatives developed in 2012/2013 under the Phase I TetraTech 'Biosolids Management System Alternatives Study and Matrix' were refined to the four (4) options examined in the 2014 CH2M Hill 'Biosolids Treatment and Disposal Evaluation – Phase II'.

In the Phase I study, CBJ worked with Tetra Tech to provide a general overview of 10 treatment processes and 3 disposal strategies. The goal was to understand the spectrum of treatment and disposal options that may be viable for Juneau. During the process of research and evaluation, the following two governing principles were established for further analysis and decision making:

- **Produce a Class A biosolid.** This refers to the United States Environmental Protection Agency (USEPA) classification for biosolids pathogen characteristics. A Class A product meets the most stringent pathogen standards, is considered safe for public use, and has the least disposal restrictions; for example it can be used as topsoil in residential gardens.
- **Reduce the volume of the biosolids.** Disposing of biosolids costs money. The more biosolids we have to dispose, the more expensive it is. Juneau has very little land that is of suitable size (multiple acres), flat, uplands, and in areas with compatible uses.

As scoping for the 2014 Phase II study began, the following governing principles were added to further define requirements of the long-term biosolids solution:

- **Allow for multiple end uses enabling ease of disposal.** Available disposal options include landfilling, monofilling, land applying (as a soil amendment), or burning (as a fuel source). Unfortunately, ground appropriate for a monofill or land application is limited, the landfill is nearing its capacity (within 20 years), and the market demand for a soil amendment product is uncertain.
- **Is classified as an established or innovative technology as defined by USEPA for system reliability.** An established technology is used at more than 25 facilities in the United States. An innovative technology may be established overseas but has some degree of initial, full-scale tested use in the United States.

Several of the Phase I study alternatives focused on the improvement to overall plant performance and subsequently required additional treatment processes to produce biosolids that could be handled and disposed locally. **Defining an improved biosolids treatment technology that allows for a long-term disposal solution is the key focus for this project.** As such, alternatives from the Phase I study were evaluated and the elimination rationale is described below:

Aerobic digestion could improve the overall treatment performance and reduce the quantity of biosolids produced but would only produce a Class B product (which has few to no local reuse options). With a low solids content, the end product makes handleability very difficult. To allow for local disposal, this treatment technology would require further treatment, and was therefore eliminated.

Composting was not carried forward into Phase II due to the uncertainty in market demand for the large volume of end-product and the consistent supply of significant quantities of buffering materials, such as wood chips or tires. Further, the process requires a large, flat, upland area of ground for operation and maintenance of the facility.

Anaerobic digestion is primarily a wastewater treatment process enhancement which was not advanced to the Phase II study. It has the capacity to produce Class A or Class B biosolids but would generally require additional treatment to make an end-product suitable for handling and disposal considerations. Additionally, its explosive byproduct generation poses a real public health and safety risk. However, it may produce biogas or other products that could be recycled as heat or fuel but typically requires a waste stream larger than the current CBJ volume and a significant capital infusion to operate as such.

Autothermal thermophilic aerobic digestion (ATAD) would alter the existing treatment process by the introduction of heat and aerobic digestion. Moderate amounts of biosolids would be produced from the ATAD process with low total solids content, requiring additional treatment to enable local disposal. This realization at the beginning of the Phase II study eliminated it from further consideration.

Supercritical water oxidation was not further analyzed as it is still in the research and development phase, considered embryonic technology as defined by the USEPA.

Lime stabilization produces a Class B biosolids which has few to no options for reuse locally. It produces more biosolids than the current status-quo operations. Additionally, lime is very caustic and working conditions can be hazardous.

Lime plus heat stabilization produces biosolids of significant quantities having low total solids content. Handling the biosolids and finding end disposal of this product would be difficult. Additionally, lime is very caustic and working conditions can be hazardous. Therefore, both lime stabilization and lime plus heat stabilization were eliminated from further study.

Various other vendors and interested parties have contacted CBJ with technology proposals (many embryonic and experimental) for wastewater and biosolids treatment. Each of these proposals has been evaluated by the consultants against the goals and governing principles of the project.

Consequently of the Phase I study alternatives, **incineration** and **heat drying** remain viable options with the **status-quo** for comparison. A fourth alternative, **heat drying with a furnace**, was proposed by CH2M Hill in Phase II as it met the goals and governing principles for the project. The CBJ project team added this final alternative to the study as it significantly reduced the end-product volume, allowed for energy recovery, minimized operation and maintenance costs, offered multiple disposal options, and presented a local solution to the biosolids treatment and disposal issue.



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TO: Mary Becker, Deputy Mayor
Chair, Assembly Committee of the Whole

DATE: 10/20/14

FROM: Rorie Watt, P.E., Director

SUBJECT: Solid Waste Planning

The Assembly has been interested in information regarding the potential joining of bio-solids disposal solutions with some type of garbage (municipal solid waste, MSW) incineration or alternative disposal. This memo reviews the technical aspects of co treatment and disposal as well as the history of solid waste planning in the CBJ.

Co Treatment and Disposal of Biosolids and MSW

The short answer as described in the attached Technical Memo #4 from CH2M Hill is that Juneau's waste stream, whether or not combined with our bio-solids, is not of sufficient quantity to make a co-incinerator economically feasible.

Adding the rest of SE Alaska into the waste stream still does not create enough waste to make such a system economically desirable.

It is true that other entities have pursued smaller waste destruction or waste to energy facilities, but they have only done so under one or more of the following conditions, none of which we experience:

- A. Experimental Programs
- B. Venture Capital
- C. Large Outside Grants
- D. High prevailing power rates
- E. Department of Defense Experimental Budgets
- F. Strict Land Use Regulations that prohibit or limit landfilling of MSW

It is critical that we make a decision about the disposal of biosolids. Our current method of taking biosolids and trucking them and loading into containers, barge shipping, rail shipping and out of state disposal is not sustainable. There are three reasons that solid waste planning should not delay decision making and implementation of a biosolids solution:

1. Heat Drying Is Compatible with Incineration

Even if an incinerator or other heat destruction technology were accessible at our scale, biosolids would have to be dewatered before they could be destroyed in that system. Therefore, heat drying, as proposed, is not out of sync with a MSW/Biosolids Incinerator.

2. Biosolids/MSW Co Treatment Timeline is 10-20 Years

Planning, funding, permitting, designing and constructing an MSW/Biosolids Incinerator is likely to take at least a decade, possibly two. By the time an incinerator could be financed, permitted and constructed, a biosolids heat dryer constructed today would have been used for at least half of its useful life and would be continued to be used to dry the watery biosolids.

3. Land Acquisition Adds Time and Money

The CH2MHill authors point out that an incinerator would require 10-15 acres of land in an industrial area. Identifying a parcel of industrial land that large, in and of itself, would be a very difficult, time consuming and expensive task.

Solid Waste Planning:

In the late 2000's the Assembly pursued a comprehensive solid waste management strategy. The goal was essentially to do something better than the dump. Solid waste planning experts were hired and reports and recommendations were produced in 2007 and 2008. A number of highly informative documents can be found at:

<http://www.juneau.org/pubworks/projects/SWMS/index.php>

I have attached the executive summary of the Solid Waste Strategy – it made twelve key recommendations about how Juneau could plan for the future. In 2010, for various reasons, the Assembly was unable to pursue the plan's two key components:

1. Securing the RCA Certificate for Refuse Collection
2. Implementing mandatory refuse collection

CBJ Solid waste planning ended in March 2010 when the Assembly voted to table the planning effort due to what seemed at the time insurmountable obstacles.

The landfill is privately owned by Waste Management. The garbage collection business is a franchise that is privately owned by Arrow Refuse. Both businesses are regulated by the State, not the City. The City currently has no control over the garbage, garbage is a business. However distasteful and potentially short sighted, Arrow Refuse and Waste Management are providing the public with the lowest cost garbage disposal option.

Juneau can be as dissatisfied as its wants to be with WM or Arrow for the current situation, but in the end, neither company gets to make the rules. They operate their businesses to generate profits for their owners and from a business perspective this makes sense. Juneau citizens provide garbage and money to the equation, and in contrast to the business approach, we also contribute philosophical goals of sustainability, aesthetics, and a desire for the smart use of resources. The executive summary of the Solid Waste Strategy states that

"... the issue before the Assembly was a fundamental policy call as to what the City should or should not be doing regarding solid waste. The City has long range solid waste goals. The

Assembly has passed resolutions and comprehensive plan policies regarding integrated solid waste management regarding recycling and there has been a fundamental disconnect with those goals and the City's ability to influence those goals, given that the landfill and the separate waste hauling service are both owned by private companies."

Recommendations:

We are in the midst of budgetary difficulties. While we are unsatisfied with the dump, it is unclear if we are sufficiently unsatisfied that we are willing to expend the funds or make the policy changes necessary to change the current garbage equation. I recommend that the Assembly do the following:

1. Study the previous planning effort. It is a detailed nuanced issue.
2. Continue solid waste planning only at such a time that Juneau is ready to:
 - a. Secure the RCA Certificate from Arrow
 - b. Provide revenue necessary to pay for the certificate
 - c. Set aside or purchase industrial land for an incineration facility
3. Solve the biosolids disposal problem now as step towards solving all of Juneau's waste disposal issues.

City and Borough of Juneau

Solid Waste Strategy

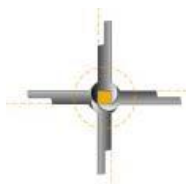
Executive Summary

February 2008

Prepared by

WIH RESOURCE GROUP
Environmental & Logistical Solutions™

In association with



**zia engineering
& environmental
consultants, llc.**



City and Borough of Juneau Solid Waste Strategy

Executive Summary

Background

In early 2007, the City and Borough of Juneau (CBJ) retained WIH Resource Group (WIH) to assist with conducting a long range solid waste management strategy and alternatives analysis. In order to achieve the City's objectives, the project work was performed in two phases. Phase one consists of information gathering and preliminary analysis and Phase Two work consists of identifying, analyzing and making recommendations on alternatives.

The final report provides a strategy for implementing environmentally prudent and cost-effective integrated solid waste management components to enhance or upgrade the CBJ's existing solid waste management and recycling systems. The strategy begins with an overview of the CBJ's existing solid waste management system and the subsequent sections of the strategy discuss individual solid waste programs in detail.

Some driving factors resulted in prompting the City to undertake this long-range solid waste management strategy and alternatives analysis. Specifically, in 2004 the private landfill operator ceased operations of its two incinerators (that had been operating for approximately 20 years) and returned to direct landfilling of the CBJ's solid waste. This forced the City to become more involved in solid waste and special waste management such as disposal of medical waste.

Since the closure of the incinerators, the landfill is growing and a mound of solid waste is visible from the adjacent highway and is generating interest from the public. Items of concern include the visual impact of the landfill mound as well as the long-term environmental effects of direct solid waste disposal near the wetlands of Lemon Creek. The incinerator closure has also meant that more birds have been attracted to the landfill, causing concern for aircraft safety, as the airport is located nearby. These visible solid waste issues were the impetus for the project. In addition, a large segment of the community continues to push for increased opportunities to recycle.

The data, information, analysis, conclusions, and recommendations in the Solid Waste Strategy consider the planning period from 2007 to 2030.

The original Request for Proposals (RFP) issued by the CBJ for a Solid Waste Management Strategy stated the Strategy should address methods of achieving Juneau's commitment to integrated solid waste management practices as expressed in the Comprehensive Plan and Assembly Resolution 1433 (March 19, 1990). Those practices are, in order of priority:

- Waste reduction,
- Recovery / recycling of resources,
- Recovery / recycling of heat or electricity from waste incineration,
- Treatment and processing of waste to reduce volume,
- Waste incineration, and,
- Landfilling in an environmentally sound manner

Given these priority objectives, two key questions were considered and contemplated by the WIH Resource Group Project Team, the SWWG and the CBJ staff throughout the course of the project as follows:

1. What is the future role and involvement of CBJ in solid waste management?
2. What form of "control" should the CBJ have over solid waste management and what is the rationale for this?

The central conclusion is that under present circumstances the CBJ has only marginal control and leverage in the present solid waste system and this is not consistent with having extensive public policy expectations, priorities, and objectives for solid waste management.

Solid Waste Strategy Planning Process

The WIH Project Team developed the Solid Waste Strategy by visiting Juneau on four separate trips and having discussions with public and private sector representatives about solid waste management conditions and needs. There was ongoing cooperation and coordination with the various representatives for the purposes of gathering data and sharing ideas. The information used in preparing the Solid Waste Strategy is the most accurate data that the WIH Project Team was able to obtain, either through published reports, interviews with personnel, or from records

kept by the appropriate governmental entity / department. Material, data, and comments have also been specifically provided by Arrow Refuse and Waste Management, Inc. as the local refuse collection and disposal service providers respectively for the CBJ and its citizens.

The WIH Project Team approached the analysis of the CBJ's solid waste management issues and alternatives from an integrated perspective. The various practices and operations that characterize how solid waste is handled in a given area are viewed as the related components of a solid waste management system. Consideration of individual elements is done within the framework of the whole program and involves examining how they are related and conflict with, or support, each other.

A Solid Waste Working Group (SWWG) was formed to provide feedback to the WIH Project Team and CBJ Staff and Assembly as to the contents of the Solid Waste Management Strategy as it was being developed. Four meetings of the SWWG were held. The SWWG consisted of eight members made up of residents from the community both in public roles, with the City and Borough of Juneau, as well as members from privately held companies and other citizens. The Project Manager for the CBJ recruited members of the SWWG.

With assistance from the City and Borough of Juneau (CBJ) staff, the CBJ's Solid Waste Working Group (SWWG), City contracted, non-contracted private service providers, and other key stakeholders, the WIH Resource Group Project Team gathered data to characterize how solid waste and recycling is managed within the CBJ including a list of programs, quantities collected, and planning-level cost estimates. The components of the current solid waste management system include:

- Solid waste collection
- Privately owned landfill
- Recycling drop off program
- Special waste management – Junked Vehicles
- Urban Bear Ordinance enforcement
- Household hazardous waste (HHW) management
- SE Conference (SEC) regional solid waste management efforts
- Public Education

The final report provided to the CBJ by WIH Resource Group provides the CBJ with recommendations for the long-term management of solid waste considering cost effectiveness, service to the community, and the ability to achieve the City's goals of integrated solid waste management. The analysis includes planning-level costs for various alternatives plus short-term (1-5 years), mid-term (5-10 years), and long-term (20-30-years) implementation recommendations.

Solid Waste Strategy Recommendations

The process for preparing the Solid Waste Management Strategy for the CBJ consists of a series of logically connected technical steps and feedback interactions involving the WIH Project Team, the SWWG, CBJ Staff and the CBJ Assembly.

The recommended solid waste management strategy is designed to build on the strengths of the present system by encouraging further development of the private refuse collection / disposal and recyclables processing / marketing operations but with CBJ providing more substantive program / policy guidance and contractual oversight.

The recommendations are intended to be considered, approved, and implemented as integrated package instead of on an item-by-item basis. This approach offers a comprehensive rather than a piecemeal strategy for addressing the CBJ's solid waste priorities. The recommendations are also intended to be consistent with the analysis regarding solid waste issues affecting the CBJ.

The core twelve recommendations of the Solid Waste Management Strategy that were developed by the WIH Project Team for the CBJ are to be implemented during the time frame 2008 to 2012. The specific twelve recommendations are as follows:

1. Continue to Use Waste Management (WM) Landfill for Disposal
2. Hire Solid Waste Coordinator
3. Adopt Policy on Universal Trash & Recycling Collection Service
4. Transfer Arrow Refuse RCA Certificate to CBJ

5. Form Contractual Partnerships Between CBJ, Arrow Refuse, & Waste Management
6. Secure Land for Multi – Purpose Materials Recovery Facility (MRF)
7. Design & Implement Fully Automated Residential Refuse Collection with Variable Rates
8. Design & Construct a Material Recovery Facility (MRF)
9. Design & Implement Promotion, Education, Outreach (PEO) Plan
10. Design & Implement Residential Recycling Collection Service
11. Design & Implement Commercial / Institutional Recycling Collection Service
12. Develop Recycling Standards for Designated Construction & Demolition Projects

Recommendations # 2 (Transfer Arrow Refuse RCA certificate to CBJ) and # 5 (Form a long – term contractual partnership between the CBJ, Arrow Refuse, and Waste Management, Inc. for a minimum period of 10 years) are the essential basis for the other recommendations and for the overall solid waste management strategy.

Once transfer of the Certificate of Public Convenience and Necessity from Arrow Refuse to the CBJ has been officially approved by the RCA then a contract for solid waste services can be established directly between CBJ and Arrow Refuse without involvement of the RCA. As part of the contract negotiation service rates would be determined.

Adoption of Solid Waste Strategy by CBJ Assembly

A special meeting of the City and Borough of Juneau Assembly (Special Assembly Meeting 2007-29) was held in the Assembly Chambers of the Municipal Building on November 29th, 2007. At the meeting, members of the WIH Resource Group Project Team, along with CBJ Staff, made presentations to the Assembly about the Solid Waste Strategy recommendations.

The WIH Project Team made a PowerPoint presentation and a distributed a modified implementation schedule to the “Final Draft of the Solid Waste Management Strategy for the City and Borough of Juneau,” dated November 30, 2007, by the WIH Resource Group, in association with Zia Engineering and Environmental Consultants. The Solid Waste Working

Group (SWWG) had reviewed the plan before it was presented to the public and the Assembly and outlined a modified Section 8.0, Table 7, and Implementation Schedule for review.

The CBJ Project Manager explained that the issue before the Assembly was a fundamental policy call as to what the city should or should not be doing regarding solid waste. The city has had long range solid waste goals. The Assembly has passed resolutions and comprehensive plan policies regarding integrated solid waste management regarding recycling and there has been a fundamental disconnect with those goals and the city's ability to influence those goals, given that the landfill and the separate waste hauling service are both owned by private companies.

After the presentation and a question and answer session, members expressed conceptual agreement with the direction recommended by this process, and said they looked forward to working with Waste Management and Arrow Refuse to move the CBJ forward.

Assembly Member Doll complimented the CBJ's Project Manager and the WIH Resource Group Project Team for the product of their work.

Acknowledgements

The WIH Resource Group Project Team would like to extend its appreciation to the following municipalities, agencies and companies that provided the WIH Project Team and the CBJ with critical information and key data throughout the project that assisted in the development of the Solid Waste Strategy for the CBJ.

A significant amount of time, effort, research and analysis went into the development of the CBJ's Solid Waste Strategy and the WIH Resource Group Project Team extends its sincere appreciation to those who participated in the project. The following participating parties are listed in alphabetical order.

- ADEC – Alaska Department of Environmental Conservation
- Advanced Combustion Services (ACS, Inc.)
- Alaska Electric Light and Power Company (AEL&P)
- Alaska Marine Lines
- Allied Waste Services
- Arrow Refuse
- Channel Construction, Inc.
- City and Borough of Juneau Alaska - Staff; Solid Waste Working Group; City Manager; Public Works Director; Assembly Members and the Mayor
- City of Ketchikan Public Works Department
- Idaho Waste Systems
- Northland Marine
- Philips Services (PSC) Burlington Environmental
- Regulatory Commission of Alaska (RCA)
- Southeast Conference
- Waste Connections
- Waste Management, Inc.

We apologize for any parties that may have been unintentionally omitted from this Acknowledgement.

Biosolids Treatment and Disposal Evaluation – Phase II

Options for Combined Treatment and Disposal of MSW and Biosolids

PREPARED FOR: City/Borough of Juneau (CBJ), Alaska

PREPARED BY: CH2M HILL

DATE: October 22, 2014

1.0 Introduction

The purpose of this technical memorandum (TM) is to provide a general summary of options for combined treatment of municipal solid waste (MSW) and sewage sludge (biosolids), with a focus on incineration and gasification thermal conversion technologies. Conversion technologies are methods of treating or converting MSW and biosolids into a more stable or useful form. Thermal conversion technologies are methods of converting MSW and biosolids into heat or energy. MSW and biosolids are the feedstock for the thermal conversion process.

2.0 Background

This section provides background on the generation and management of Juneau's MSW and CBJ's biosolids.

2.1 Municipal Solid Waste

MSW is refuse or garbage generated by residents or businesses in Juneau. The Capitol Landfill in Juneau is privately and jointly owned by Capitol Disposal Inc. and Waste Management, Inc. (WMI). Arrow Refuse, a subsidiary of Alaska Pacific Environmental Services, holds the exclusive rights for MSW collection in Juneau. MSW is hauled by Arrow Refuse or self-hauled by retail customers to the Capitol Landfill. MSW disposed in 2013 was 26,449 tons (Vance, 2014). Construction & demolition waste (C&D) disposed in 2013 was 4,585 tons (Vance, 2014). These totals do not include recyclables that were diverted at the Recycling Center. The remaining service life of the Capitol Landfill is estimated to be approximately 20 years (Vance, 2014).

2.2 Biosolids

Biosolids are generated at each of the three wastewater treatment plants (WWTP) in Juneau (Auke Bay WWTP, Mendenhall WWTP, and Juneau-Douglas WWTP) for a combined total of 6,993 wet tons in 2013 (CH2M HILL, 2014). The City/Borough of Juneau (CBJ) disposes of these biosolids via contract with WMI. In 2013, 12% of Juneau's biosolids were disposed at the Capitol Landfill in Juneau and 88% were shipped south and disposed at the Columbia Ridge Landfill in Oregon. Biosolids are dewatered to 14 - 16% by belt filter press at the Mendenhall and Juneau-Douglas WWTPs, but most of the biosolids are not digested before shipping. Future disposal of biosolids at the Capitol Landfill is not considered feasible because of volume, space and operational constraints, especially regarding odor generation (Vance, 2014). Shipping of biosolids to Oregon has also been problematic because of odors generated by the biosolids as this material decomposes during storage, shipping and transport. CBJ is evaluating local options for managing biosolids in Juneau.

3.0 Current Technologies to Treat MSW and Biosolids

There are very few technologies that can effectively co-treat MSW and biosolids. Brief descriptions of available conversion technologies are included below:

- Co-disposal means burial of biosolids together with MSW in a landfill.
- Co-composting is a conversion technology involving composting of biosolids and the organic portion of MSW under controlled conditions with a bulking agent like wood chips. The organic portion of MSW would be separated from the rest of the waste stream. If the right conditions are met during composting, then the finished compost can be certified for unlimited use.
- Co-digestion is a conversion technology involving anaerobic digestion of biosolids and the organic portion of MSW. Anaerobic digestion is the controlled breakdown of organic materials under anaerobic (no oxygen) conditions in a closed tank to yield bio-gas. Bio-gas can be used to generate heat or make electricity. The material left over after the digestion is called digestate, which also requires disposal.
- Incineration is a thermal conversion technology involving the combustion of biosolids and MSW to produce heat. The heat is typically converted to steam for power generation. Byproducts of incineration include flue gas (the combustion gasses) and ash. Mass-burn incineration involves direct combustion of the waste with little to no prior sorting, and is the most common form of incineration.
- Conventional gasification is a thermal conversion technology where biosolids and MSW (feedstock) is partially oxidized under air-starved conditions to produce synthesis gas (syngas). The syngas can be converted to energy or liquid fuels.
- Plasma arc gasification is a thermal conversion technology where biosolids and MSW (feedstock) is thermally decomposed to primary atoms under the intense heat of the plasma arc to produce syngas. The syngas can be converted to energy or liquid fuels.

Co-disposal is not feasible at the Capitol Landfill because of physical difficulties placing, compacting, and burying the biosolids. Co-composting is not feasible in Juneau because it requires lots of space (large areas of flat, uplands that are away from neighborhoods or commercial areas or incompatible use areas), and such space is not available in Juneau. Co-digestion will also require shipping or composting of the digestate (approximately 70 to 90% of the original feedstock), which is not considered feasible for Juneau because of the desire to avoid shipping of waste, and the lack of available space for composting as noted above.

Technologies like co-composting and co-digestion can treat the biosolids, but can only treat the organic part of the MSW. The remaining inorganic portion of the MSW (typically 60 to 70%) must still be managed via landfill or other process. Also, the high moisture content of the biosolids is detrimental to the thermal conversion of the combined organic waste. Driving out the 80% to 85% moisture from the biosolids takes significant energy which reduces thermal conversion efficiency. For large thermal conversion systems where the percentage biosolids to MSW is small (e.g., large mass burn incinerator operations in Europe and the eastern US), the addition of a small percentage of wet biosolids does not significantly impact system operations. However at Juneau where the percentage of biosolids is approaching 25% of the total waste mass, the efficiency of the thermal conversion system would be significantly decreased unless the biosolids were dried prior to thermal conversion.

CH2M HILL is not aware of any cities in the US with a waste generation rate similar to Juneau's where biosolids and MSW are being thermally co-treated. Juneau's relatively small volume of MSW is not sufficient to achieve the economy of scale necessary for an economically viable project. If the waste from all the other communities in Southeast Alaska (approximately 80 tons/day) were to be delivered to Juneau, the economy of scale would be more favorable but still falls short of the amount required to make the project economically viable using established thermal conversion technology, based on the cost and scale of other projects. Today in the U.S., the minimum volume for economic viability for a waste-to-energy mass-burn incinerator appears to range from 200 tons/day to 500 tons/day based on local conditions and situation. Juneau's tonnage is approximately 87 tons/day with MSW and biosolids combined.

It is not possible to estimate costs for thermal conversion technologies specific to Juneau without in-depth development of a design basis, followed by obtaining vendor quotes for equipment. Some cost information is available in the literature, but they vary widely and pose a high risk in using such numbers for CBJ's planning decisions. Relying on cost factors from the technical literature is not recommended because:

- Most available cost numbers are for systems much larger than Juneau, so costs of other facilities would need to be scaled to Juneau's tonnage. There are substantial fixed costs associated with thermal treatment, so scaling is not likely to be accurate.
- Cost factors from other projects will not be specific to Juneau's situation (i.e., location factors, site constraints, cost of fuel and utilities, etc.)
- Cost factors from other projects do not necessarily correspond to the co-treatment of biosolids and MSW, and certainly not in the ratios of biosolids to MSW that Juneau experiences.

The cost ranges provided in this TM are based on a literature review and CH2M HILL professional judgment.

The status of technology development is very important. There are no conventional or plasma arc gasification facilities operating on a commercial scale in the US. CH2M HILL strongly recommends that CBJ avoid these technologies because they are not established and the risk of system failure is too high.

A summary of conversion technologies that have been used to treat both MSW and biosolids is shown in Table 1 (next page). The remainder of this Technical Memorandum focuses on thermal conversion technologies.

4.0 Permitting, Siting, and Public Health Issues

A federal Title V air permit would be required for any thermal conversion facility. Also, a Minor Source Permit may be required under 18 Alaska Administrative Code (AAC) 50.502. Both permits will likely apply the standard operating permit conditions of 18 AAC 50.346. Incinerators are specifically regulated in 18 AAC 50.050 – Incinerator Emission Standards. Emissions are limited both by concentration and by weight per unit time. Incinerators have particulate matter (PM) limits that apply to MSW and biosolids.

The Mendenhall Valley area of Juneau has been designated by the EPA as “nonattainment” for PM-10, meaning that the air quality does not meet the ambient standard for small particulate matter with a diameter of 10 micrometers or less. However, through the implementation of a wood smoke control program and paving of unpaved roads, the PM-10 levels measured in the Mendenhall Valley have been about a third of the 24-hour standard since the year 2000. The Alaska Department of Environmental Conservation (ADEC) is currently in the process of downgrading Juneau’s PM-10 status to maintenance. The PM-10 nonattainment issues are not a factor in the ability to obtain a Title V operating permit.

With air pollution control systems, we believe the emissions from the existing facilities and a thermal conversion system should easily meet existing minor source limits or be below levels even requiring a Minor Source Permit. In that case, only the Title V Operating Permit would be required. However, obtaining a Title V Operating Permit is still a substantial undertaking and it would impact any other onsite emissions sources (such as emergency generators) as well.

A thermal conversion facility including access, waste pre-processing, and on-site power generation facilities would require a minimum of 10 to 15 acres of land. Such a facility would be fenced and self-contained, but would not be suitable for residential neighborhood due to traffic, noise, and odors associated with the incoming waste and operations. The facility should be located in an industrial area with a sufficient buffer to minimize complaints from neighbors.

It is expected that the primary public health and safety concern about operation of a thermal conversion facility would be related to air quality. A new thermal conversion system at Juneau’s scale would be required to have state-of-the-art air emission controls. A public relations effort, working closely with ADEC, would be recommended to address this and other health and safety issues if CBJ moves forward with this option.

TABLE 1

Technology	Description	Status	Pre-processing Required	End Product	Use or Disposal	ROM Capital Cost ¹	ROM O&M Cost ²	Biosolids type accepted
Co-disposal	Co-disposal of MSW and biosolids in a landfill	Established	Not required	Landfill	Landfill	Not feasible at Capitol LF due to biosolids placement problems and lack of space	Not feasible at Capitol LF due to biosolids placement problems and lack of space	80-85% moisture (no additional drying required)
Co-composting	Composting of biosolids and organic fraction of MSW	Established	Separation of organics, bulking, mixing	Compost	Compost	Not feasible due to lack of space	Not feasible due to lack of space	80-85% moisture (no additional drying required)
Co-digestion	Anaerobic digestion of biosolids and organic fraction of MSW	Established	Separation of organics, mixing	Digestate	Compost	Not feasible due to lack of space for composting digestate	Not feasible due to lack of space for composting digestate	80-85% moisture (no additional drying required)
The following are all classified as thermal conversion technologies								
Mass Burn Incineration	Combustion with oxygen to produce energy and flue gas	Established	Not required	Ash	Landfill	\$70M - \$200M	\$2.3M - \$3M	30 to 40% moisture (additional drying required)
Conventional Gasification ³	Partial oxidation to produce syn gas	Innovative - no commercial facilities in U.S.	Sorting	Ash	Landfill	\$60M - \$120M	\$2.5M - \$3M	30 to 40% moisture (additional drying required)
Plasma-arc gasification ³	Thermal decomposition under intense heat to produce syn gas	Innovative - no commercial facilities in U.S.	Sorting, shredding	Slag	Aggregate/ Landfill	\$50M - \$70M	\$2.5M - \$3M	30 to 40% moisture (additional drying required)

Notes

ROM - Rough order of magnitude

¹ References: EPA, 2012; Clark, 2010; SCS, 2009; World Bank, 1999; UK Government, 2013. \$20M has been added to each thermal conversion technology for heat drying of biosolids. Many sources note that costs are highly variable. Caution should be used when using these numbers for planning.

² References: SCS, 2009; Clark, 2010. Higher value for range from SCS, 2009 used for all technologies. \$1M has been added to each thermal conversion technology for heat drying of biosolids. Caution should be used when using these numbers for planning.

³ These innovative technologies are not recommended due to high risk of failure.

5.0 Facility Operation, Staffing, and Safety

Thermal conversion facilities can be highly complex and require trained professionals to operate and maintain. Whereas a biosolids incinerator burns only dewatered biosolids of a fairly consistent nature, an MSW/biosolids facility must have very careful and consistent mixing of the variable feedstock, which requires considerably more attention on the front end. Also, the higher operating efficiencies of today's thermal conversion facilities require more sophisticated controls, and the equipment has more sophisticated needs for maintenance. It is common for facility owners to have an operating agreement with the technology supplier for operation and maintenance of the system. Alternately, CBJ could hire or train employees to operate the facility with periodic support from the technology suppliers. Waste would be supplied via a collection contract, and ash would be transported to the landfill via contract. Electrical power generation facilities or heat-recovery facilities could be maintained under separate contract or by the local electrical utility. The coordination and planning activities associated with procuring and operating thermal conversion technologies are quite complex.

Strict health and safety procedures would be implemented inside the facility to protect workers. Process safety would be carefully evaluated during technology selection to ensure that the equipment was designed to prevent explosions, fires, uncontrolled emissions, or other hazards to the nearby community.

6.0 Risk Factors

Risk factors include: project cost overruns, technology failure or lack of performance, bankruptcy of technology provider(s), additional costs for disposal of residuals (e.g., ash), and increased costs from future tightening of regulations. These types of risks tend to be elevated when the technology is not established. Some of these risks can be addressed via careful drafting of the supply and operating agreements. Other risks can be addressed via waste screening and sorting. Specifically, procedures would be implemented to identify and remove dangerous wastes such as explosive gas cylinders and flammable or toxic waste to prevent damage of the facility or release of uncontrolled emissions in violation of operating permits.

7.0 Timeline for Implementation

Implementation timeline depends on contract arrangement and delivery approach. The initial planning tasks may take several years, and involve critical decisions such as selection of technology, securing funding, and site selection. These decisions usually require time-consuming political and public involvement.

Including technology selection, funding and site selection, the time required for project implementation could easily take 10 years or more.

Once funding has been secured and both site and technology have been selected, the timeline for permitting, design, and completion of construction would range from 5 to 8 years with the standard design, bid, and build delivery approach. The design-build approach can reduce the time to completion, but likely not less than 4 to 5 years.

8.0 Control of Waste Stream

There are at least two existing, contractual issues that would need to be resolved before CBJ could send MSW to a new thermal conversion system:

1. Arrow Refuse is the owner of the Regulatory Commission of Alaska (RCA) solid waste collection certificate for Juneau, giving them exclusive rights to waste collection and therefore disposal. One of the main recommendations from the 2008 Solid Waste Management Plan was that CBJ work to transfer this certificate from Arrow Refuse to CBJ. CBJ will be unable to direct waste disposal until transfer of this certificate is completed.

2. There is an existing contract between WMI and Arrow Refuse which stipulates that Arrow Refuse will take all MSW collected within Juneau to the Capitol Landfill for the duration of the contract. The expiration date on this contract is December 31, 2021. The disposal rates in this contract provide the basis for the RCA-regulated collection rates. This contract would have to be vacated or amended before CBJ could send the MSW to a thermal conversion system.

9.0 Recommendations

Based on our professional experience and research, the expected capital and operational costs for an established mass-burn incineration system with or without energy recovery are still likely too high to be feasible for current application in Juneau. The Capitol Landfill is expected to last another 20 years before it has to be closed, and it does not make economic sense to abandon landfilling of MSW while there is still remaining capacity at the Capitol Landfill. It might be possible to extend the remaining landfill even longer if additional controls could be imposed on the waste stream, but enacting such controls takes time, and CBJ lacks the necessary control of the waste stream that would be required to implement near-term changes to the current waste disposal.

New generations of thermal conversion technologies for MSW and biosolids like conventional gasification and plasma arc gasification are in commercial operation in a few facilities in Europe and Asia, in at least one demonstration scale project in Canada, and are progressing toward commercialization in the U.S.; however, these technologies still lack the necessary operating record in the U.S. to be seriously considered cost competitive viable alternatives for Juneau at this time. The implementation of these technologies in other countries has been based on two key conditions that make the facilities economically feasible: 1) extremely high costs for landfill disposal, primarily based on laws and regulations that preclude or severely restrict disposal of MSW in landfills, and 2) premium prices for renewable electricity generated by the thermal conversion facilities. In Juneau, neither of these conditions currently exist.

It is acknowledged that in approximately 20 years when the Capitol Landfill reaches capacity, there is expected to be no available space in Juneau for another landfill, so a different type of waste management solution will be required. Based on the progress of thermal conversion technologies in that past decade or so, it appears quite possible that some type of thermal conversion with energy recovery and volume reduction could be in Juneau's future.

CH2M HILL recommends that the CBJ start soon to carefully plan the transition from landfill to a different waste-management solution—possibly one that involves a thermal conversion system. At a minimum, the planning process will need to address the following objectives:

- Eventual transfer of the RCA collection certificate from Arrow Refuse to CBJ
- Funding strategies
- Siting study and securing of site
- Technology research and selection
- Permitting strategies
- Integration of energy recovery
- Location for ash disposal.

Regarding future ash disposal, with no space for a new landfill, it may make sense to reserve capacity at the Capitol Landfill now for future ash disposal, which would mean less time for landfilling of MSW at the existing Capitol Landfill.

In summary, we recommend that CBJ continue to pursue a course of prudent integrated solid waste management including capture of recyclables, landfilling of MSW, and thermal drying of biosolids with heat recovery at one of the Juneau WWTPs.

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