

Commentary: Solid Waste as It Impacts Community Sustainability in Alaska

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For many people, the state of Alaska symbolizes pristine nature—clean air, clean water, and a clean environment. The aurora borealis, Denali National Park, Mt. McKinley (the tallest mountain in North America), and abundant wildlife all symbolize the unique beauty of Alaska. The magnificent and mostly untouched nature of the far north fascinates people from all over the world who visit, including scientists who travel there to study the impacts of climate change, which are especially pronounced in such northern latitudes. Large areas of spruce forests are dying because of the abnormal spread of the bark beetle, glaciers are receding, and sea ice in the Arctic Ocean is shrinking.

Solid waste disposal presents another challenge. Alaska's population is approximately 650,000, and Alaska's largest cities, Anchorage, Fairbanks, and Juneau, along with more than 200 rural communities, deal with large quantities of solid waste. At first glance it appears that an awareness of separating garbage and recycling has not penetrated deeply into Alaskan society. However, after a closer look, circumstances unique to Alaska create challenges for basic waste disposal (and recycling) that are not experienced in the Lower 48 U.S. states or in countries such as Japan where space is limited and recycling is critical.

In Alaska, programs available to separate recyclables from the waste stream, such as polyethylene terephthalate (PET) and plastic bottles, aluminum cans, glass bottles, cardboard, and paper products, are often minimal and varying. This is especially true for rural communities that have even less access to recycling outlets and services than do larger cities. Similarly, Alaska has

little industry, therefore most recyclable materials generated in Anchorage, for example, must be shipped by barge to far-away markets in Washington and Oregon. With the exception of glass, newsprint, and organic waste, which are used in local manufacture of new products, materials including office and mixed paper, cardboard, steel and aluminum cans, scrap metals and plastics are backhauled by barge companies to the Lower 48, often at a discounted rate. Due to this circumstance, the profit margin of these materials is dictated by freight costs and current market value (price per pound) once they arrive on the West Coast.

Per capita waste generation in Alaska adds yet another challenge. The *Cold Regions Utilities Monograph* lists waste generation at 5 lbs/person/day (2.3 kg/person/day) based on a study of communities connected by road in central Alaska (Smith, 1996, pp. 16–14). It is generally accepted that the rate of disposal in Alaska is higher than the national average of 4 lbs/person/day (U.S. Environmental Protection Agency, 1995, p. 3–5), while some speculate the Alaska rate to be as high as 6 to 7 lbs/person/day. This current situation does not lend itself to a sense of crisis now but might become a big problem in the near future, especially for larger rural communities.

More than 50% of Alaskan communities are not connected to a main road system (Alaska Department of Commerce, Community and Economic Development [ADCCED], n.d.). Many of them are small, remote villages that operate their own landfills, where waste is typically hauled by truck, snow machine or four-wheeler to an unlined open dump facility. Such facilities are referred to as Class III Municipal Solid Waste Landfill (MSWLF). Class III is a design standard unique to Alaska (allowed by federal exemption) that classifies landfills according to the Alaska solid waste regulations. This regulation is summarized below:

[A] Class III MSWLF is a landfill that is not connected by road to a Class I MSWLF or, if connected by road, is located more than 50 miles from a Class I MSWLF, and that accepts, for disposal, less than five tons daily of municipal solid waste, based on annual average. (Alaska Department of Environmental Conservation, 2002)

Table 1. *Comparison of Municipal Solid Waste (MSW) Generation*

2004 Data	Reported MSW generated (tons/yr)	MSW recycled (tons/yr)	MSW waste to energy ³ (tons/yr)	MSW landfilled (tons/yr)
Alaska ¹	—	100,516	37,574	1,194,098
U.S. total ¹	509,155,516	110,383,615	28,860,545	248,611,301
Japan ²	50,590,000	9,400,000	39,140,000	8,090,000

¹From “The State of Garbage, 15th Nationwide Survey of Municipal Solid Waste Management in the United States,” by P. Simmons, N. Goldstein, S. M. Kaufman, N. J. Themelis, & J. Thompson Jr., 2006, p. 31. Copyright 2006 by *BioCycle* and the Earth Engineering Center of Columbia University.

²From *State of discharge and treatment of municipal solid waste in FY 2004* (pp. 2–6). Copyright 2004 by Ministry of the Environment, Government of Japan.

³“MSW waste to energy” refers to solid waste disposed by incineration.

Table 1 shows data on municipal solid waste (MSW) generation for Japan, the United States, and Alaska in 2004. Since the state of Alaska did not respond to the 2006 State of Garbage in America survey sponsored by *BioCycle* and the Earth

Engineering Center of Columbia University, the MSW generated is an estimate based on a per capita projection.

As a whole, 64% of MSW is deposited in landfills in the United States, while in the state of Alaska 90% of MSW ends up in landfills. This means that a large portion of solid wastes produced in the state is buried. The United States as a whole recycles 28.5% of its MSW, while the state of Alaska recycles just 7.5%. This may be because the state of Alaska and local municipalities have not enacted laws mandating recycling. Due to these and other challenges, rural and urban communities generally depend on local voluntary recycling efforts.

A look at how Japan addresses solid waste disposal may offer valuable insight for improvement of solid waste disposal in Alaska. In contrast to Alaska, Japan is a small island country less than 2.5 times the size of California with a population of approximately 127 million. Since land available for living (and landfill) is limited, Japan relies on strict laws to encourage citizens to recycle whatever is possible. In Table 2, MSW waste to energy indicates that the percentage of disposal by incineration of solid waste is much higher than disposal by landfill. High-performance incinerators are used (for nonrecyclable materials) to reduce waste volume. This technology maintains a high temperature (over 900 °C) that belches no dioxin and is used by many communities throughout Japan.

Table 2. Comparison of MSW Disposal in Alaska, United States, and Japan

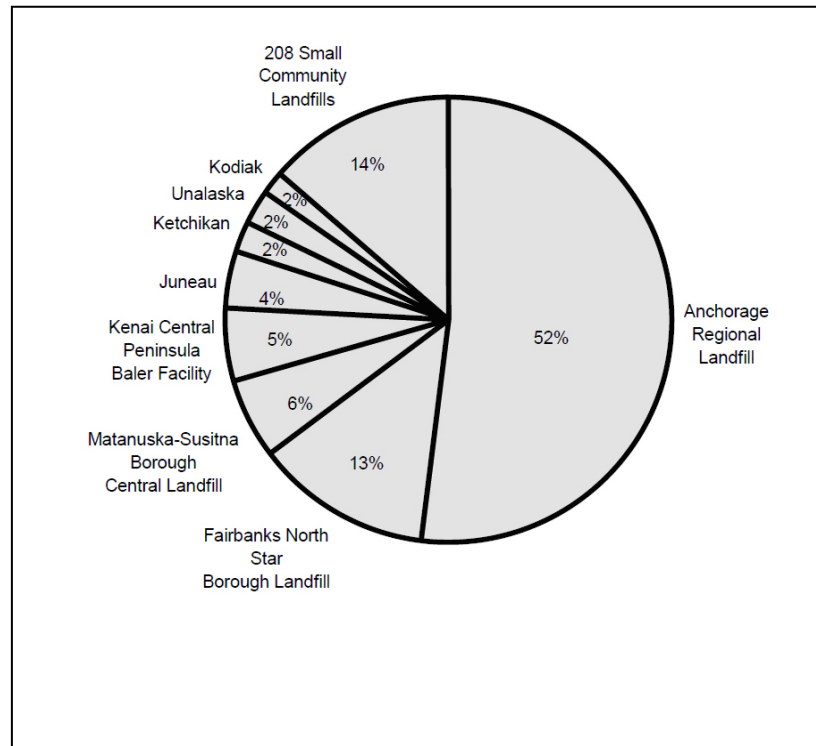
2004 Data	Population (2004)	Reported MSW generated (tons/yr)	Estimated MSW generated (tons/yr)	Estimated MSW generated per capita (tons/yr)	MSW recycled (%)	MSW waste to energy (%)	MSW landfilled (%)
Alaska ¹	655,435	—	1,332,188	2.0	7.5%	2.8%	89.6%
U. S. total ¹	293,101,881	509,155,516	387,855,461	1.3	28.5%	7.4%	64.1%
Japan ²	127,687,000	50,590,000	—	0.396	17.6%	77.5%	16%

¹From “The State of Garbage, 15th Nationwide Survey of Municipal Solid Waste Management in the United States,” by P. Simmons, N. Goldstein, S. M. Kaufman, N. J. Themelis, & J. Thompson Jr., 2006, p. 30. Copyright 2006 by *BioCycle* and the Earth Engineering Center of Columbia University.

²From *State of discharge and treatment of municipal solid waste in FY 2004* (pp. 2–6). Copyright 2004 by Ministry of the Environment, Government of Japan.

High-performance incinerators might provide a solution for solid waste disposal and related environmental problems in Alaska. Such technology may be especially beneficial for rural communities, where living areas for people are in fact restricted. While Alaska appears “vast” and “wide open,” rural communities experience limitations similar to urban ones regarding land use. Lands surrounding a rural village that are adequate for landfill development are private, public (state and federal), or Alaska Native corporation–owned lands, or lands held by the village or regional tribal government. Varying layers of ownership bring equally varying and competing uses. For example, most lands that are suitable for landfill development are often areas that are equally suitable for housing development. Traditional subsistence harvest of fish, game, and wild berries and natural resource development are other examples of land use needs. Given these circumstances, it will become increasingly difficult and costly for communities to identify and obtain new sites suitable for large-scale public works projects like landfill development.

Figure 1. Percentage of solid waste in Alaska by community.



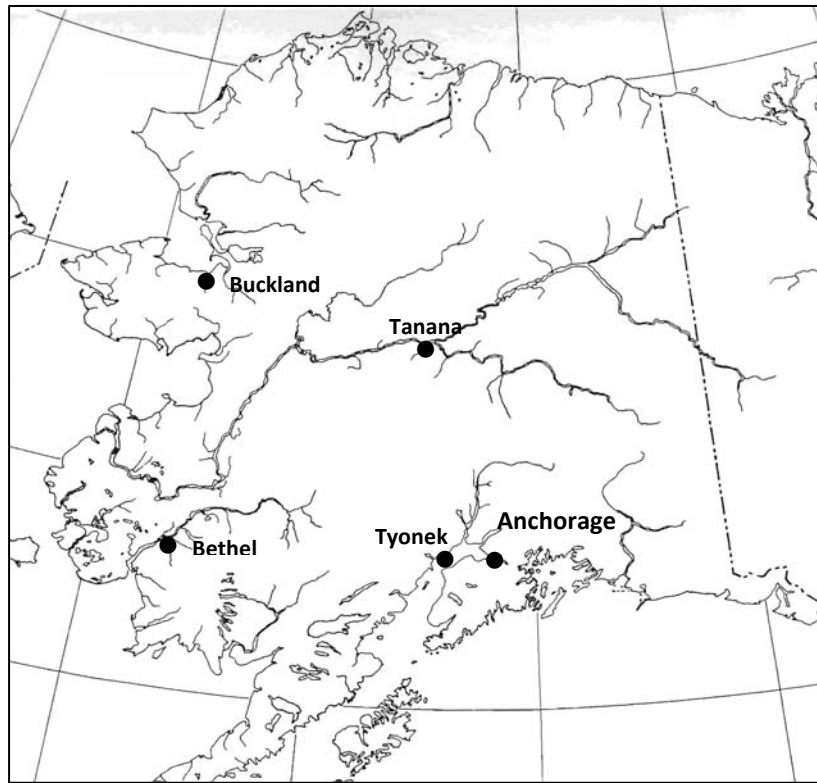
From *Alaska Solid Waste Regionalization Report*, p. 62. Copyright 1999 by the Alaska Chapter of the Solid Waste Association of North America.

The percentage of solid waste produced by communities in Alaska is illustrated in Figure 1. It should be noted that about 52% of the solid waste generated in the state is collected in the Anchorage Regional Landfill (ARL) and the second largest share is about 14%, generated collectively by about 208 small rural communities.

During fall 2007 five communities were selected to visit. Their selection was intended only to provide a broad overview of the Alaska situation. Based on the data above, local community practices of solid waste disposal and residents' awareness toward them were reviewed. The communities visited include the municipality of Anchorage and Matanuska-Susitna (Mat-Su) Valley in south-central Alaska, a highly urbanized region. In addition to Anchorage, we visited four rural communities off of the road system. The first community was Tyonek, an Athabascan village located across Cook Inlet from Anchorage. In interior Alaska, we visited Tanana, an Athabascan village located along the Yukon River, where the residents live a relatively simple subsistence lifestyle. On the northwest coast of Alaska we visited the village of Buckland, a mostly Inupiaq Eskimo community. The residents live a subsistence lifestyle of fishing and hunting caribou. In fall 2008 we visited Bethel in southwest Alaska. Figure 2 shows the location of the communities visited.¹

¹General information about these and other Alaskan communities can be found in the Alaska Department of Commerce, Community, and Economic Development's database at http://www.dced.state.ak.us/dca/commdb/CF_COMDB.htm

Figure 2. Communities visited. (Note: Map not drawn to scale.)



Anchorage

Driving north from Anchorage along the Glenn Highway for 20 minutes, we find the ARL (see Figure 3) on Hiland Road, which is a disposal site for solid waste for about 300,000 people in Anchorage and Eagle River. This 275-acre (1,112,885.52 m²) Class I MSWLF has been in operation since 1987 after Anchorage's Merrill Field Landfill was closed. A Class I site is a lined facility that receives a daily average of 20 tons or more of municipal solid waste (Alaska Department of Environmental Conservation, 2002).



Figure 3. The Anchorage landfill.

Most of Anchorage and Eagle River solid wastes end up at the ARL. Disposal fees for pickup trucks (5 cubic yards or less) are \$15 per load (Municipality of Anchorage, Alaska, 2008a). On weekends many loaded privately owned vehicles line up to dispose of trash, while commercial waste haulers also dispose of trash in this facility. Several recycling containers receive newspaper, cardboard, aluminum cans, and other



Figure 4. Recycling drop-off center at the ARL.

recyclable items right inside the gate (see Figure 4). While very few people appeared to be using them during our visit, these containers receive on average 12 tons of glass per month plus significant tonnage of cardboard, newsprint, mixed paper, and aluminum cans (Fisher, 2008). Obtaining permission to tour the facility, we took a closer look at the landfill and saw a large number of seagulls and ravens eating the garbage. Liquid waste, or leachate, oozed from refuse in the landfill, which is captured by the liner system and pumped up to lagoons and treated (Municipality of Anchorage, Alaska, 2008b). The leachate is then transported to the Point Woronzof Wastewater Treatment Facility in Anchorage, where it undergoes further treatment and is then discharged into Cook Inlet.

Tyonek

At the Tyonek Native Corporation office in Anchorage we were given a briefing on the village and landfill and received permission for our visit. The flight to Tyonek from Anchorage is about 30 minutes; the village is located 45 miles due west across Cook Inlet.

Tyonek has a population of 199 people (2006 estimated population). The Beluga Coal Field is nearby and produces coal and natural gas. About 10 miles north of the village sits the largest coal deposit in Alaska; plans for the Chuitna Coal Project are moving forward. Significant problems, however, remain to be resolved, of which environmental pollution mitigation is one of the more urgent.

Tyonek's approximately 90 homes and facilities are served by a piped water system (Alaska Community Database Community Information Summaries [ACDCIS], 2008a). The sewage water from each family is chemically and biologically treated in the lagoon and released into the ground. The landfill is located about 3 miles from the community in a forested area. Residents bring their own garbage and throw it away (see Figure 5). The unseparated garbage is then covered by a thin layer of soil. A device called a burn box unit (see Figure 6) is placed there to burn combustible solid waste. "This waste minimization technique reduces municipal solid waste required for burial by 25 percent" (Kenai Peninsula Borough, 2008). While many rural communities rely on this method to reduce solid waste, low-temperature burns (300 °C) produce dioxins (Kitano, 2001). Noncombustible items such as metals and glass, as well as wastes with moisture content (wet wastes), tend to reduce burn efficiency (Alaska Energy Authority and Alaska Department of Environmental Conservation, 2004, p. 9). Low-temperature burning can cause serious emissions problems. Along with dioxins, volatile organic compounds, polycyclic aromatic hydrocarbons, and



Figure 5. Tyonek landfill.



Figure 6. Burn box unit in Tyonek.

particulates are likely released into the surrounding area (U.S. Environmental Protection Agency, 2008a). Additional concerns regarding burn boxes in village settings involve use in areas where high groundwater levels or proximity to tundra ponds jeopardize limited village water supplies.

Tanana

Tanana is located in interior Alaska about 2 miles west of the junction of the Tanana and Yukon rivers, 130 air miles west of Fairbanks (ACDCIS, 2008b). It has a population of 258 (2007 ADCCED certified population).

Late fall had already come to Tanana when we visited. It was chilly, and the smoke from wood stoves wisped through the air. The community has “a project to use propane from the North Slope for heating, hot water, electricity and more” in the future (B. Ketzler, personal communication, September 13, 2007).



Figure 7. Tanana landfill.

The Tanana village officials took us to the landfill (see Figure 7), which is located about 2 miles from the village. The landfill, permitted under Alaska Department of Environmental Conservation regulations, is typical of those in rural Alaskan communities off the road system. All sorts of unseparated garbage are thrown



Figure 8. Vehicles sit in the Tanana landfill.

away together. According to village officials, the landfill had become 60% filled in 10 months. The garbage gives off a strong stench until it is covered with dirt. We observed a number of ravens gathered around the site, as this is a good feeding ground for them. Additional wastes included old snowmobiles, vehicles of all kinds, and refrigerators (see Figure 8).

Not far away is the village water supply. Water is derived from three wells near the Yukon River (ACDCIS, 2008b). Approximately half of the residents use honey buckets (a 5-gallon bucket used as a toilet inside the home) or outhouses for sewage disposal. The remaining homes are connected to a water/sewer system that takes the waste to a water treatment plant.

Buckland

The next community we visited was Buckland. Buckland is located 75 miles southeast of Kotzebue, which is 549 air miles northwest of Anchorage. Buckland, population 457 (2007 ADCCED certified population), is home to mostly Inupiaq Eskimos who practice a subsistence lifestyle of fishing and hunting caribou (KnowAlaska.com, 2008). Water is pumped from the Buckland River, treated in

the Washeteria building, and stored in a 100,000-gallon tank. Individuals dispose of refuse in Dumpsters, which are hauled to the landfill (ACDCIS, 2008c). As the landfill is near the river, which supplies water to people, there is a risk of contamination to the supply of drinking water. It is difficult to dig a hole to bury the solid waste because of permafrost. As a result, all kinds of garbage, cardboard, plastic goods, and even dead animals are piled up together on the ground (see Figure 9). There also is a risk of *E. coli* outbreaks in summer because of increases in air temperature by climate change and the proximity of the waste dump to drinking water sources. *Figure 9. Dead dog in Buckland landfill.*



According to Ted Jacobson, EPA tribal solid waste liaison and rural solid waste expert, “The big problem is that the waste stream has changed significantly in the last 50 years.” All kinds of trade goods now are barged or air freighted into rural communities. These goods come to the community and everything now requires more packaging. It is the packaging that goes in the landfill (see Figures 10 and 11).



Figure 10. Buckland landfill.



Figure 11. Residents clean up trash.

Bethel

We visited Bethel in September 2008. It is a Yupik village with a population of about 6,000. Bethel is located at the mouth of the Kuskokwim River, 40 miles inland from the Bering Sea. It lies in the Yukon Delta National Wildlife Refuge, 400 air miles west of Anchorage. Bethel serves as the regional center for 56 villages in the Yukon-Kuskokwim Delta. Food, fuel, transportation, medical care, and other services for the region are



Figure 12. Recycling Dumpsters.

provided. River travel is the primary means of local transportation in the summer, and it becomes a 150-mile ice road to surrounding villages in the winter. A barge service based in Bethel delivers goods to the Kuskokwim villages in the summer.

The city government operates a landfill, where residents are allowed free disposal of up to 4 cubic yards of trash per day, and a recycling center that accepts aluminum, plastics, copper, stainless steel, newspapers, and office paper. The recyclable materials are collected in Dumpsters located at the landfill (see Figure 12). Nonrecycled material is buried at the landfill.



Figure 13. Trash Dumpsters in Bethel.

The city government has placed Dumpsters in many neighborhoods for everyone to use (see Figure 13). Recycled materials are shipped to Seattle via the Kuskokwim River and oceangoing ships. The systematic solid waste disposal operations employed by the city of Bethel serve as a model for other rural communities in Alaska.

Funding for Solid Waste Improvements in Alaska

Figures from USDA Rural Development state that community solid waste increases in quantity at an annual rate that far exceeds the capacity of the immediate environment. Extrapolating this over the next hundreds of years if the present system and situations continue, the land will be polluted by solid waste and the soil contamination will contaminate groundwater; such conditions would affect the long-term sustainability of impacted communities.

The Solid Waste Grant Program administered by Alaska's Denali Commission provides one solution. This program accepts grant proposals (\$100,000 per applicant) to address local solid waste issues (see Table 3). Funding for this program was reduced considerably in 2008.

Table 3. *Eligible Applicants to the Solid Waste Grant Program (2007)*¹

Rural municipal governments (cities/boroughs with populations less than 6,000)
Tribal governments (IRAs or Traditional Councils)
501(3) nonprofit organizations

¹From *FY 2007 Request for Proposals*, Denali Commission Solid Waste Program.

Outreach, Planning and Education

The Rural Alaska Village Environmental Network (RAVEN) AmeriCorps program is among a variety of outreach programs in the state. RAVEN AmeriCorps is implemented by the Rural Alaska Community Action Program Inc. (RurAL CAP), a nonprofit organization. Through this program, locally recruited AmeriCorps members facilitate environmental cleanup, outreach, and education in their communities (RurAL CAP, 2008). The U.S. Environmental Protection Agency also funds locally based tribal environmental planners under the Indian General Assistance Program. These individuals work to address environmental issues to include implementation of solid and hazardous waste programs, dump-improvement projects, grant writing, and other community environmental needs (U.S. Environmental Protection Agency, 2008b).

Other innovative outreach programs and projects include Alaskans for Litter Prevention and Recycling (ALPAR), a privately funded nonprofit organization that supports community cleanup and recycling programs statewide (ALPAR, 2008a). The Solid Waste Alaska Network is a resource website that provides information about solid waste management planning, training, and outreach materials for Alaska Native communities (Solid Waste Alaska Network, 2008).

Responses by Alaska Communities

The Municipality of Anchorage Solid Waste Services (SWS), a trash hauler, provides a community recycling drop-off center at the ARL (see Figure 3) and is exploring two new sites in east Anchorage and in the community of Girdwood about 40 miles south of Anchorage. Anchorage Recycling Center, a privately owned recycling processing plant, provides similar bins at its facility in south Anchorage. There are 17 additional recycling drop-off sites located at various retailer parking lots, including the Anchorage supermarket chain Carrs/Safeway, Brown Jug liquor store, the Northway Mall, and several Anchorage School District school parking lots. Through these and other locations, residents of Anchorage are able to recycle aluminum cans, newspaper, glass, cardboard, mixed paper, office paper, magazines, metals, PET and HDPE plastic bottles and jugs, plastic bags and film, glass, yard waste, appliances, electronics waste, lead acid batteries, and various hazardous wastes. The Anchorage Recycling Center has been operating since 1978 and currently collects, processes, and recycles approximately 25,000 tons of materials annually. This material coupled with material that is recycled and shipped directly to markets in the Pacific Northwest by retailers and other recyclers results in a recycling rate for Anchorage of 16% (Fisher, 2008).

As for curbside pickup, SWS promotes an integrated trash and recycling collection program, implemented in fall 2008, for residents in the SWS trash collection area. This will have a volume-based variable rate “pay as you throw” fee structure (Municipality of Anchorage, Alaska, 2008c). Similarly, Alaska Waste, a private waste hauler, began offering curbside recycling in July 2008 to 17,000 additional homes, bringing the total to 35,000 in their service area (Alaska Waste, 2008). These services will enable residents to recycle, at the curbside, mixed paper, newspaper, cardboard, aluminum cans, steel cans, No. 1 PET plastic bottles and No. 2 HDPE plastic jugs.

The Anchorage School District began mixed-paper and cardboard recycling in all of its 95 schools and five administrative buildings during the 2008–09 school year (Municipality of Anchorage, Alaska, 2008d).

We visited a recycling center operated by the Matanuska-Susitna (Mat-Su) Valley Community for Recycling Solutions, in Wasilla, which is about a one-hour drive north of Anchorage. At this facility, plastic bags, newspapers, aluminum cans, PET bottles, and corrugated cardboard are sorted, and each type of solid waste gets pressed into bales (see Figure 14). The center encourages recycling activity by using volunteers as their core group and is aided by a grant from the Denali Commission (see Figure 15). They also operate a



Figure 14. A bale of cans for recycling.

booth at the Alaska State Fair in Palmer to carry out recycling outreach education and information activities.

On our tour of the facility, the executive director described the recycling program. We think the recycling of community solid waste will contribute to community sustainability. This program is an excellent example of solving a solid waste problem, but it is a small enterprise and available only in a limited area.



Figure 15. Valley Community for Recycling Solutions.

For rural communities off the road system, the Yukon River Inter-Tribal Watershed Council has been coordinating backhaul efforts of various solid and hazardous wastes out of communities along the Yukon River for the past three years (Yukon River Inter-Tribal Watershed Council, 2008). The council has worked with barge and air cargo companies to backhaul tons of materials, including waste oil, lead-acid batteries, vehicles, scrap metal, heavy equipment, electronic waste (computers), refrigerators, and freezers. The council looks to support other regions of the state to develop similar backhaul programs. Figure 16 shows a tote of batteries from Yukon River villages that will be backhauled.



Figure 16. This tote of batteries is ready for backhauling.

The ALPAR “Flying Cans” program is another program that has been serving the bush since the mid 1980s to backhaul aluminum cans from remote villages. This has been a very successful aluminum can recycling program, especially for rural communities off the road system that are served by air carrier companies. Over 20,000 lbs of aluminum cans were flown out and recycled from bush communities in 2007 alone (Fisher, 2008).

Concluding Comments/Recommendations

A recent editorial in the *Fairbanks (Alaska) Daily News* sums up the problem of solid waste disposal in the state (“Dealing with Deliveries,” 2008):

And in recent decades, the amount of trash in these villages has increased dramatically as more and more people have switched to a lifestyle that relies upon imported items for their sustenance. The advent of government programs designed to modernize villages has been a major contributor, too—modern facilities come with modern trash-producing features.

The problem for rural communities in Alaska can be summarized as suggesting that “the challenges to recycling large quantities of waste are complex including very low economies of scale, high cost of collection and transport and long distance from markets.” Further “the cost of landfilling is comparatively low in Alaska, which is the other mechanism that drives recycling rates, not to mention

that waste disposal is free for most rural communities” (Fisher, 2008). Given this circumstance, it is often difficult to compete with inexpensive waste disposal when attempting to implement a recycling program, especially in a rural community.

There is almost no doubt that continuing the present system of solid waste disposal in Alaska will cause harm to the environment. To avoid a crisis, it is necessary to consider a new way of thinking (a paradigm shift) regarding solid waste disposal in Alaska’s rural communities and to educate the Alaskan people, both in urban and rural areas, on the need for garbage recycling.

A large number of Alaska Native communities are concentrated in areas along the western coast and in the Yukon and Kuskokwim river basins. This means it should be possible to take advantage of the river systems for solid waste backhaul. If awareness of garbage separating and recycling penetrates deeply into the communities, and residents learn how to compact and package recyclable materials, it would be possible for shipping companies (barge or hovercraft) to pick up and backhaul substantial amounts of recyclable materials from each community before winter. This would of course extend the life span of landfills in those communities dramatically.

Along with recycling, there is a need to reduce the quantity of solid waste brought into rural Alaska. The bulk of trash coming in is from freight and air cargo shipments to the hub cities. Residents of the small communities then transport it home, and the excessive packaging materials end up in their landfills. Some suggestions for dealing with the solid waste issues are:

- When residents of small rural communities, such as Tyonek, Tanana, and Buckland, fly to the hub cities of Anchorage, Fairbanks, Bethel, Kotzebue, and Barrow to shop, they should remove any excess packaging from the goods they have purchased before bringing items home. This excess packaging material can be better disposed of in the landfills of the larger cities or processed for recycling.
- Anytime residents of the small rural communities fly to the larger cities they should consider backhauling their own excess packaging material in boxes or suitcases. The small air carriers allow each passenger a certain number of boxes or suitcases on outbound flights.
- Education about solid waste issues must continue in small rural communities to help residents learn to help mitigate the problem themselves instead of waiting for the state or local government to solve the problem.
- There should also be a community awareness campaign to dispose of plastic shopping bags properly instead of releasing them into open spaces. It is common to observe such bags blowing all over the landscape; one way to prevent this from happening is to ban their use in the villages and distribute reusable grocery bags. Plastic-bag litter has been an ongoing problem that many rural communities have been trying to deal with.

In summary, unlike Japan or the Lower 48 states, Alaska has few local industries for processing recyclable materials and turning them into new products. If not for backhauling of the standard recycled commodities to out-of-state markets provided at greatly reduced rates by shipping companies and Alaskans for Litter Prevention and Recycling, recycling in Anchorage and the Mat-Su Valley would likely not

exist at current levels, since rarely does the value of recyclable materials offset the true cost of barging these materials to the Lower 48 states. ALPAR's shipping subsidy also provides for a basic drop-off recycling system in southcentral Alaska and assists with the Flying Cans aluminum can recycling. However, challenges of getting these materials to markets affordably is an underlying problem for many Alaskan communities, making it difficult to increase recycling rates or even set up recycling programs in the first place. Due to these and other circumstances mentioned in this article this decentralized and often haphazard system of solid waste disposal and recycling throughout Alaska will continue to be a challenge for many communities.

Therefore to reduce the negative human and environmental health impacts of solid waste disposal, communities must rely in large part on themselves to initiate local waste disposal ordinances and practices that will reduce these impacts and increase recycling in their communities. Such recommended measures may include: (a) identifying and diverting hazardous wastes (electronics waste, lead acid batteries, liquid hazardous waste, and the like) from the waste stream; (b) selecting a location at the dump or elsewhere to store these materials safely for later removal; (c) restricting public access and exposure to the landfill by hiring a landfill operator/waste hauler who is properly trained in safety issues; (d) identifying burn practices and burn-box technologies that reduce toxic emissions and prevent smoke from blowing toward the community while burning trash; and (e) working with local retailers, shipping companies, and residents to reduce the volume of excess and unnecessary packaging materials from coming into the village in the first place as well as find new, cost effective ways to divert recyclables into the commodity market.

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