

Solid Waste Health and Environmental Considerations

Note: This document is "chapter 3" from the CCTHITA's Guide to closing Solid Waste Disposal Sites in Alaska Villages

Chapter 3: What are the Health and Environmental Considerations?

Running an open dump is the cheapest and easiest way to discard wastes in the short-run (but not in the long run!). So the main reasons why you might want to close your site aren't financial-- they're health and environmental. This Chapter looks at the health and environmental issues of open dumps. First, we talk about the problems that can occur, and then bring up some pretty inexpensive ways to address those problems.

A note about reading this Chapter!

This Chapter contains a lot of technical information that is explained using "Western science"—because we all know how much funding agencies and regulatory people like seeing numbers! If you are in a hurry, or are new to this way of thinking, the important information is bolded or contained in boxes and Figures. You can save the details for later-- or for someone else to chew on.

1. HEALTH IMPACTS OF OPEN DUMPS

Helped by a team of experts, Central Council of Tlingit and Haida Indian Tribes (CCTHITA) carried out a comprehensive health survey in the summer of 2000. Our purpose was to document health effects of unpermitted open dumps. Residents were questioned about symptoms of poor health, personal characteristics, and solid waste disposal practices.

The villages were chosen to represent four distinct regions of Alaska; the Northwest (NANA DOWL Region), the Yukon Delta (Calista Region), the Yukon Interior (Doyon Region), and the Southeast (Sea Alaska Region). Although each was off the road system, they were very different from each other and each had a unique solid waste disposal situation. Yet, the health expert was able to scientifically document the following conclusions for all villages:

- ❖ The health and environmental risks that people perceive with solid waste disposal substantially impact their subsistence practices.
- ❖ Slight but **significant increases in risks for symptoms of poor health** were found in:
 - ✓ People who visit the dumpsite frequently,
 - ✓ People who burn their trash close to their homes, and
 - ✓ People who are troubled by smoke or odors from the dumpsite (i.e. generally people living near the dump and those who are more sensitive).
- ❖ Residents have a high level of concern regarding negative health effects that open dumpsites might cause.

Open Dumps and Subsistence

One of the health impacts that you can consider is how your dump affects subsistence practices in your community. Tables 3-1a and 3-1b show the number of people in the four demonstration villages whose subsistence diets were affected by the risks they believed to be associated with their dumpsites. These people either changed the composition of their subsistence diets, or ate less subsistence foods. You probably already know that our traditional diets have been found to be very important in maintaining native health. In fact, we found that **in honeybucket villages, people who ate mostly subsistence foods instead of store-bought foods were 15 times less likely to experience diarrhea** (see box below). **Whether your community's traditional subsistence lifestyle is being affected by the dumpsite may be as important to your community's health, as whether or not there is significant contamination at your site.**

A word about "risk"

You should know that **proving that something causes a health symptom is almost impossible when using Western science.** You can only say that, number-wise, people who share a certain risk factor tend to develop a certain health symptom more often. That is, they develop it more often than people who don't share this factor-- and it is not due to chance. There is an "association" between the risk factor and the health symptom, but we don't know for certain that the risk factor *caused* the health symptom—which would be a "cause and effect" relationship. For example, a study might find that people who don't exercise are at risk for coughing more than people who do exercise. But in that study, all the people who didn't exercise also smoked. So it might be the smoking, and not the lack of exercise, that caused the coughing. For our open dump study results told here - the health expert used numbers to rule out smoking, gender, tobacco use, income level, or alcohol use as being the cause of health symptoms. But there may have been other factors she didn't know about.

For the demonstration villages, the subsistence activities of the villages depending most on subsistence foods were more impacted than the subsistence activities of villages that consume less subsistence foods. This means that if your village depends highly on subsistence foods, you should consider ways to reduce people's fears of dumpsite contamination. If you don't close your site, increasing site management should decrease the perceived and actual risks associated with subsistence activities. See Table 3-7 for suggestions. Also, read more details about risks to subsistence in the Environmental Impacts Section.

Possible Contaminants in Your Water and Soil

Table A-1 in Appendix A lists contaminants found in the water and soil near the open dumps of the demonstration villages. The last column in the Table lists possible health consequences that can result from ingestion, inhalation, or contact with these chemicals at high enough levels. **Arsenic, barium, chromium, lead, and diesel contaminants appear to**

be common at open dumps in Alaska. Much of the chromium, lead, and diesel is likely from batteries, and used oil leaking from scrapped snowmachines and other vehicles.

Table 3-1a

Percent of residents relying on a subsistence diet in four Alaska villages.

<i>Subsistence diet reliance</i>	Northwest village	YK Delta village	Yukon Interior	Southeast village	Combined (1,225 people)
<i>Less than half the time</i>	17	8	32	29	19.9
<i>Half the time</i>	24	20	42	44	29.0
<i>More than half the time</i>	58	72	26	27	51.1

Table 3-1b

Percent of residents in four Alaska villages whose subsistence activities are impacted by environmental concerns.

<i>Impact on subsistence</i>	Northwest village	YK Delta village	Yukon Interior	Southeast village	Combined (1,225 people)
<i>No impact</i>	28	21	47	51	36
<i>Some impact</i>	56	29	32	29	39
<i>Much impact</i>	15	46	21	20	25

Although it is almost certain that some contaminants have leached into soil and water around or beneath any unlined dump, it is important to know that not all of the contaminants in Table A-1 may be present. On the other hand, you may have additional contaminants that are not listed below. Read more about soil and water contamination in the Environmental Impacts Section of this Chapter.

Not a lot of water and soil sampling has been carried out at village dumps. It's not possible to give ranges of the level of contamination you might have. **Figure 3-1 lists some factors that increase the likelihood of significant contamination.** If your dump meets

Figure 3-1 Should We Worry About Water and Soil Contamination at Our Dump?

If any of these things happen:

People drink water from downstream of dump

People fish or gather berries near dump

People live near dump

Kids play near dump

Important plants or animals are near the dump

And you can check 2 or more of these factors:

- No liner or no continuous shallow permafrost under dump
- Dump is near surface water (less than 500 ft)
- Dump is less than 1,500 ft from drinking water
- Water flows from dump into surface water
- High ground water table (less than 15 ft)
- Soil under dump is sandy or gravelly (easy to pour water through)
- No wetlands between dump and area of concern

And you can check 1 or more of these factors:

- Honeybuckets are always or sometimes disposed at or next to dump
- Hazardous chemicals, like ethylene glycol, are dumped there
- Used oil is often dumped there
- A lot of snowmachines, used appliances, or machinery are dumped there without being drained and rinsed
- Batteries are, or were, dumped there regularly
- There is not much checking of what people dump

You Need to Worry About Water and Soil Contamination!

See Table 3-5 for actions you can take and "Seven Generations" for more information on risk assessment (for a copy of Seven Gen., call Bill Stokes, ADEC Compliance Assistance Office, 269- 7580)

many of these factors, you should seriously consider either improving your dump site, or closing it as soon as possible.

Something to watch for!

Contaminants in the water increase a lot during and just after big rain events and flooding - especially the first of the season. After a big rainstorm, lead was found at 5,000 ppb in water just downstream of a village dump on the Yukon River. That level is 1,000 times higher than what is considered safe to drink! **Do you have people who like to drink their water from traditional untreated sources, and these sources are downstream of your dump?** Make certain that they don't take the water after big rain or flooding events. You can test your water during these times for heavy metals, like lead and mercury, for about \$150. If you have reason to be concerned, you may be able to get ANTHC or another agency to fund the sampling. Water sampling can also be covered under IGAP monies. Your water operator, if you have one, may be able to help you as well. They are trained in sample taking and testing. If you decide to test your water, please send your test results to us. That way we can build up our information and let other tribes know of the risks their own dumps might be presenting.

Burning Wastes

Burning of typical household solid wastes, particularly plastics (e.g. plastic bags), can be hazardous to health. The smoke commonly contains dioxins, carbon monoxide, nitrous oxide, and carbon dioxide. These agents have been associated with respiratory complaints, dizziness, and headaches in the short-term, and cancer and heart disease in the long-term.

Recycle your batteries!

It's easy and can cost you nothing! The biggest thing you can do to reduce contamination potential is to get your batteries out of the dump. See Chapter 8.

Burnboxes or dump fires are set often, in 65 percent of the villages responding to our solid waste management (SWM) survey. Over one-half of the villages have dumpsites or burnboxes located closer than one-half mile from town, and smoke blows towards homes in 36 percent of these villages. Table 3-3 shows the number of residents taking part in the CCTHITA health study that were bothered by dump site odors - primarily smoke.

If you can easily smell the smoke from your dumpsite, landfill, or burnbox from any of the community homes-- and the smoke is dark at the source, stop burning, move your burnbox, or take plastics and hazardous wastes out of the "to-be-burned" waste pile. People living closer to their dump were 19 times more likely to have eye irritation, and

3 to 4 times more likely to have headaches or faintness, than people who live over a mile from the dump. People who were bothered by dump odors (generally people who live near the dump or who are more sensitive) were over 6 times more likely to experience faintness, and over 5 times more likely to have ear irritation than other people. They had increased risks for many other health symptoms as well (see Appendix B). If you can't stop burning because you don't have enough dump space, or animals are too much of a nuisance, you need to close your site and choose a different location or disposal method.

Table 3-3

Percent of residents concerned about dumpsite odors in four Alaska villages.

Concern About Dumpsite Odors	Northwest	YK Delta	Yukon Interior	Southeast ^a	Combined (1,225 people)
No concerns	30	37	80	48	39.1
Some concerns	41	49	10	32	39.2
Many concerns	29	13	10	20	21.5
Dump distance to homes ^a	2,200 ft	1,800 ft	1 1/2 mile	1 mile	

^a Estimated distance from dump of about one-half of the homes. Note each dump was burned with different frequency. See Chapter 8 to figure out how far a burnbox should be located from your community's homes.

If your dump or burnbox isn't close and upwind of homes, and you can keep out wastes that shouldn't be burned, *controlled* burning might be a good option. Burning can keep animals away and reduce the volume of wastes. If you maintain and use a burnbox correctly, the smoke can be much less toxic than smoke from an open burn. Using burnboxes instead of open burning reduces the risk of uncontrolled fires, and is much better for keeping animals away. See Chapter 8 for more about burnboxes and proper siting information.



Figure 3-2 Rusting and leaking oil drums.

Home Barrel Burning Because three of the dumps were not burned while the health expert was there, it was not possible to evaluate the increased health risks of open dump burning. But she could document the risk of home barrel burning. She found that people put themselves and their community at high risk while home barrel-, or home fire-, burning. It is not certain why, but **people who burned their own trash were almost 30 times more likely than other people to have developed rashes. They were 5 to 17 times more likely to feel faint, and almost 5 to 10 times more likely to develop numbness,** depending on how often they burned. Other symptoms that were found to be significantly higher include fever, sore throat, and cough.

You should know that if your dump is near homes, and it gets burned, these same types of risks are likely to be present if smoke or its odor is very noticeable in the village, and you do not separate out plastics and/or hazardous wastes. People can be less concerned about separating their trash if they're burning at home. They want to get rid of it so they don't need to haul it, or they want to burn as much as possible to keep their fires going. About 65 percent of the villages that responded to our SWM survey have households that use burn barrels. And burning at home means people are exposed to a greater concentration of hazardous constituents from the smoke. **If you discourage or control burning at your dump, make sure people don't burn their garbage at home instead.** It could create a bigger health problem than before.

Smoke on the Water - A Do-It-Yourself Study

Do you get your drinking water from a creek or river or do people store their water in open rain barrels? Does dark smoke from the dump or burnbox float over the water at least some of the time? The smoke could contaminate your drinking water when the ash particles settle. Although no studies have been carried out, people living near the dump in one village stated that the rainwater they store in open barrels tastes very different after a dump burn. The ash particles in dark smoke can contain toxic contaminants. So it makes sense that these particles can pollute the water when they settle.

Conduct a study on your own!

1. Right after, or during, burns ask people if their water tastes different from the day before the dump burn. But don't tell them why you are asking, and don't mention the dump burning. Just say you are conducting a taste test for a grant you are writing, or come up with your own excuse. Ask them something like, "Does the water taste different than two days ago?" Do this for three burns.
2. When the dump hasn't been burned for a while, ask them the same question at least once, and preferably 3 times. Again, don't mention why you are asking.
3. Look at the responses of people drinking water you think might be contaminated. Was there at least one person that noticed a definite difference in taste after all three burns? Did they find also *no* difference in taste when the dump *wasn't* burned? Then smoke from your dumpsite or burnbox might be contaminating the water. If most of these people found a definite difference in taste when the dump burned, and no difference when it didn't, the water is almost certainly contaminated.

Do you burn wastes?

There are some really important actions you can take to reduce your community's health risks from burning wastes:

- ✓ Use a burnbox or, if you can afford it, an incinerator
- ✓ If you use a burnbox, operate it so that it burns hot
- ✓ Burn only on days when the smoke goes away from the village
- ✓ Discourage or prohibit people, especially small children and the elderly, from going to the dump when wastes are burning.
- ✓ Limit burning to papers, cardboard, wood, and food wastes, especially if you don't have an incinerator or burnbox
- ✓ Don't burn hazardous wastes no matter what!
- ✓ Maintenance! With burnboxes, keep ashes from piling up and vents clear. Rust-proof the structure and look for and fix any structural damage.

Infectious Disease

One of the primary health risks of dumps is spreading diseases. Solid waste management affects whether disease can be transmitted in a lot of ways.

Honeybuckets If honeybuckets are still used in your community, you probably already know you're dealing with higher health risks than communities with completed tank haul or pipe systems. The health expert found that **people who used honeybuckets were 6.5 times more likely to have diarrhea than people with a water system.** Disease-causing organisms, like hepatitis viruses, can live in the honeybucket wastes. These organisms can be transmitted to other people if contact occurs. Skin rashes can also happen as a result of contact with contaminated water. The main ways contact can occur through solid waste management are:

- ✓ People with honeybuckets or slopbuckets throwing out their bags or emptying buckets at the dump
- ✓ Human wastes being tracked over to the dump site from a nearby honeybucket disposal site
- ✓ People discarding their garbage at the honeybucket site instead of the dump site
- ✓ Household pets allowed into the dump site or honeybucket site, or
- ✓ People drinking from, or swimming in, untreated water that is contaminated with dump runoff.

Community Education Alert!

Even when people know they shouldn't burn plastic, they may still be burning it unintentionally. We found in the health surveys that most people didn't realize the thin plastic shopping bags they were burning were considered plastic wastes.

Clinic Wastes Contact with disease organisms can occur also by accidentally touching unburned clinic wastes. Most of our village clinics now send their used needles to a hub city for proper disposal. But other clinic wastes, like gauze, bandages, and Kleenex can be infectious. Discarding them at the dumpsite makes transmitting diseases possible (but not certain) when people touch them. So it is very important to separate out these wastes and burn them each day.

Household Pets Household pets can transfer diseases from one person to another if your dump site, honeybucket disposal site, or sewage treatment pond, is unfenced. Make sure that pets cannot get into these places.

Concerned about your water?

You can test your river for "Fecal coliform" or "E. coli". The presence of these bacteria can indicate that the water is contaminated with disease organisms. If you have a water treatment operator, they can help test the water with their equipment. Otherwise, you can use a sterile container from your clinic and send the sample to a laboratory (about \$30). Call the lab for help in taking and sending the samples. One lab to try is Analytical Lab, Anchorage, 258-2155. Try testing your water a couple of times. The likeliest time for high contamination is during and just after big rain events and dump flooding, like Breakup.

Insects Insects, like everybody's favorite - mosquitoes- can also transfer disease organisms from wastes to humans. If you can - burn or compost (and tarp-cover) food wastes to help reduce insects, and if you can't, covering wastes with soil, woodchips, sawdust, tire chips, tarps, or other material will help a lot. Grade and fill-in the dump area so that there are no standing pools for insects to breed. Keep the area where people are allowed to dump their wastes as small as possible.

Animals Sick foxes can carry rabies. They don't eat, but they follow the healthy foxes to the dumps. It doesn't happen often, but they may infect a household pet. Fencing your dump is the best strategy to keep foxes and many rodents out. Keep a buffer zone free of trash between the fence and wastes.

Maintaining a fence if you have bears can be a nightmare! There may be no perfect solution. Some communities have been pretty successful with electric fences - but the voltage must be very high, and the fence can be difficult and expensive to maintain in

harsh weather or with an unpredictable electric output. Other communities have improved their bear problem by discarding all fish wastes in a separate secluded area, away from the dump. The household trash (excluding the plastics!) can be stored and burned in a burnbox. Villages are reporting that burnboxes can be an effective way to keep bears from the garbage. The City and Borough of Yakutat noticed a big reduction in dump bears after they cleared a buffer zone around their dump and confined the place where people dumped wastes (the "active face") to a very small area.

Getting Elders Involved

Dealing with mosquitoes and bears and where to place the fish wastes are ecology problems. When it comes to ecology, we all know there is no one like our elders for good knowledge. If you haven't already, perhaps try asking your community elders about the SWM problem you are trying to solve - they may be able to figure out the best solution!

Dump Scavenging, Waste Hauling, and Increased Health Risks

Not surprisingly, **the more someone visits the dump, the greater their health risk was found to be.** For example, they are between 4 to over 9 times more likely to feel faint, have vomiting, stomach pain, or headaches (see Appendix B). They are more likely to come into contact with disease pathogens. They are more likely to breathe toxic fumes from hazardous wastes. They, especially children, are more likely to burn themselves with battery acid that has leaked onto wastes, or into puddles. And they are more likely to have accidents. So cutting down on how often and how long people are at the dump can be a really effective way to reduce dump health risks.

Your village dump may be in such a bad state of repair and have so many health hazards that the best thing you can do is to keep people away from the dump. This means starting a collection program if you can afford it, or restricting dump open hours and enforcing anti-scavenging ordinances if you can't afford a collection program. A big problem is that our village dumps can be the most interesting place to play for our children, especially for tundra communities where the dumps might be on the only high ground. Keeping children out needs to be a major priority.

Site Accidents

Having an open dump often means that you are risking an accident happening. Accidents are especially likely if you don't manage your site much, or monitor what people are discarding, and how they are discarding it. In our survey, 16 percent of the responding tribes reported having at least one dump-related accident in the past 5 years. About one-half of the accidents were related to fire. In one instance, a child burned his foot during open burning of the dump.

Some accidents appear to be from carelessness. People don't realize how dangerous a dump can be. In one village, a man let a fire get out of control while burning a rabid dog. He is "lucky to be alive" because the fire spread to some nearby empty propane containers. One person walking through a dump stepped on a board with a rusty nail and had to get a tetanus shot immediately. Several snow machine accidents and blown-out tires have also been reported.



Figure 3-3a
Uncontrolled burning can be dangerous to dump visitors

Selawik Household Waste Collection Program

The Village of Selawik started a subsidized collection program. Visiting their dump presented great health risks to residents because honeybucket wastes were mixed in with regular wastes. During the summer, there was no way for people to turn around their Hondas without driving off the boardwalk and into scattered wastes. The dump edge kept moving closer to town. Another big problem was people setting the dump on fire. The dump is close to town and the toxic smoke could be smelled for a couple of days.

The village decided the solution was to start a mandatory collection program for all honeybucket and solid wastes. That way, people wouldn't need to go to the dump, and fires wouldn't be set. Also, with just the dump operator going to the dump, the honeybucket wastes could be dumped in a single spot and garbage could be placed back within the original dump borders. The operator is paid a good wage and provided with protective gear. The residents are happy with their collection program. The village hopes to phase in collection fees over the next 3 years, so the program will be self-supporting. Collection of aluminum cans for recycling will help subsidize part of the costs.

Summary of Health Risks

Does this seem like a lot of information? Tables 3-4 and 3-5 contain a brief summary of how diseases can be transmitted, and illnesses or injuries can occur, through solid waste management channels. Look at the Top Ten List and Table 3-7 in the last Section of this Chapter for suggestions on reducing risks. You can use the relative risks that are listed in Tables 3-4 and 3-5 to decide which problem to focus on. If, like most villages, you only have a couple of environmental staff (or like many villages, you are the only one!), it is best to tackle one or two problems at a time. Remember too, just because a risk is listed as being relatively high, it does not mean that it is happening (although it might be). It means there is a fairly good chance that it will happen if things aren't changed.

If you want some real numbers to use for education in your community, or to apply for grants to help reduce your health risks, look at Appendix B. The results of the health survey are shown in a pretty understandable format. The amounts by which people increase their risk of illness with different waste disposal factors are listed.



Figure 3-3a Hazardous wastes should be covered and stored off the ground. **Showing a funding agency that you have to store your oil and antifreeze drums on the school playground could be a good way to receive funding for a hazardous waste storage shed.**

Table 3-4
Potential solid waste management pathways for spread of infectious disease in Alaska villages.

Source	Typical relative risk ^a	Pathway
Honeybucket disposal- <i>humans tracking through wastes</i>	High Depending on degree of separation of solid wastes and honeybucket disposal areas, frequency of visits, and O & M procedures	Residents can track through wastes and get on shoes or clothing. Touching mouth, nose, other cavity, or open sores after touching shoes or clothing can spread disease. If hands are washed in shared basin, disease may spread. Disease organisms can be tracked onto floor, where children or pets play and contamination occurs by wiping nose, sticking hands in mouth, etc.
Honeybucket disposal- <i>direct contact</i>	Very high If wastes are dropped into open disposal pond	Emptying bucket contents can splash sewage water directly onto clothing or into mouth, nose, other cavity, or open sores.
Honeybucket disposal- <i>pet tracking</i>	Medium-high Depends on degree of interaction with pets, especially children's interaction	If they have access to dump, pets can track through or ingest/inhale wastes. Once at home, interaction with pets can spread disease if hands are not washed after.
Honeybucket disposal- <i>swimming in or drinking from untreated, contaminated water sources</i>	Medium- swimming Highest - purposeful and regular drinking Depends on degree of contamination. Rashes, respiratory, ear, and cut infections can occur with swimming also.	If water floods through dump it can carry disease organisms into nearby rivers, lakes. The first flush through dump at breakup probably carries the highest risk. Accidental ingestion, transmission through sores, eyes or nose of organisms can occur. If the water has to travel through ground to get to river or lake, it is unlikely that disease organisms survive. Flow through wetland can lessen risk also.
Rabid foxes	Very low- humans Medium- unleashed dogs	Dumps attract foxes that may carry rabies. Foxes can bite pets or humans and infect them. Rabid dogs might then bite humans. Still, there hasn't been a case of human rabies in Alaskan villages for many years.
Clinic wastes	Low Assumes residents do not intensively scavenge through wastes	Residents can come into contact with infected gauze, bandages, or needles when dumping or scavenging at dump.
Insect vectors	Unknown Probably medium-low, will vary dramatically with species and disease	Insects can land on, or feed on, honeybucket wastes, clinic wastes, or contaminated food leftovers. They can transmit disease organisms by landing on humans (especially directly on or near mouth, nose, open sores). They may also transmit disease through bites.
Birds	Low Depends on number of birds and frequency of visits to rooftops or playgrounds	Birds may also land on or feed on wastes contaminated with disease organisms. They may land on roofs that have rain catchment systems, and disease organisms may contaminate water via their droppings or contaminated feet. They may also spread disease if children touch contaminated droppings and then touch their mouths or noses.

^a Relative chance of occurring, assuming necessary conditions are present.

Table 3-5
Solid waste management health risks, other than infectious disease risks, in Alaska villages.

Source	Typical relative risk ^a	Pathway
Open burning- <i>Injury due to flare-ups</i>	Medium high Depends how close residents must get to drop off wastes	Build-up of gases in smoldering dump can shoot up flames without warning for several days after a burn. Several injuries have been reported, including children.
Open burning- <i>Illness or rash due to smoke inhalation, skin contact</i>	High Depends on frequency of dump visits, distance from dump to town, frequency of burns	Frequent and regular contact with smoke is associated with increased risk of respiratory diseases, coughing, throat irritation, faintness, and rashes (especially for sensitive persons). Open burning is a problem because the smoke is generally more toxic and duration of burn is longer. Separation of hazardous wastes produces less toxic smoke, but it is difficult to control for this.
Burnbox burning- <i>Illness or rash due to smoke inhalation, skin contact</i>	Medium Depends on frequency of visits, distance from burnbox to town, O & M, frequency of burns	See above. Burning wastes in a burnbox generally presents a lower health risk than open burning due to less toxic smoke (from higher burn temperatures and greater control of what is burned) and a shorter burn period, so less smoke exposure.
Home barrel burning- <i>Illness due to smoke inhalation, skin contact</i>	Medium to Very high - outside of home Med. high to Highest -inside home or steam bath	See above. Burning wastes at home can be less risky than open burning due to greatest control of what is burned. If smoke is fully vented up chimney/pipe, risk is much less, but rest of community may be subject to increased risks due to smoke proximity. Burning of non-coated paper, cardboard, and wood is acceptable, but respiratory disease is still a risk. Burning of unseparated wastes in poorly vented homes likely presents serious short- and long-term health risks.
Waste dumping	Low Assumes decent access, relative ease of waste drop-off, and no dump smoke	Residents can slip on slimy boardwalks or trip on potholes, wastes. Blind corners or narrow access roads can cause vehicle collisions.
Scavenging/ playing at dumpsite	Medium to High Depends on frequency of visits, and whether stepping directly on wastes.	Injury from stepping/falling on nails and other sharp objects has been reported several times and can cause serious infections. Burns from leaking battery acid have been reported. Contact/inhalation with toxic fumes can occur stepping through rusting hazardous waste drums. Snowmachining around dump area is risky due to buried objects such as scrap metal.
Bears	Low Depends on degree of human caution exercised	Bears that are used to dumps may become assertive, but generally are not aggressive. Near-misses are reported when humans don't maintain a respectful distance, or surprise a bear. A man was killed by a dump bear near Hyder-- it was assumed he was sleeping in the bear's path. A Yakutat waste-hauler has been chased-- possibly because he must drop wastes off near the fish pit.

^a Relative chance of occurring, assuming necessary conditions are present.

2. ENVIRONMENTAL IMPACTS OF OPEN DUMPS

While the health expert in the CCTHITA-funded study was looking at the village's health an ecology expert looked at the land's health. The study was limited, but they found several things important for your community to understand.

Here is the short list of the most important environmental considerations:

- **Dumps affect the type and number of plants** in the area
- Having **wetlands around your dump are a good thing!** Keep them there!
- **Dumps disturb the permafrost.** Environmental changes can result that expand the disturbed area, and increase the chance of contamination in downstream areas.
- **Heavy rain and flooding can temporarily release lots of dump contaminants** into water.

Impact on Plant Community

An open dump can impact the surrounding and downstream plant communities in a couple of ways. You know how one area of land can have lots of different types of plants, and another area just a few? Scientists call this plant "diversity", and they use it as one way to see whether a site has been disturbed. The ecology expert looked at the area around the dumps, and an area away from the dumps, called a "reference site", that was similar in the lay of the land and water flow patterns. If the dump wasn't having any impact on the land, the reference site and the dump area should have contained pretty similar plants.

Plant diversity and richness The Yukon Interior dump in our study was small, well-designed and maintained, with a good single access road. The surrounding plant community was not very different from the non-dump reference area. But at the Northwest and Southeast dumps, which were less-well managed and designed, the dump areas had lower plant diversity than they should have. At the YK Delta dump, which was also not well-managed, the plant diversity was actually higher than the untouched reference site, but the increase was due partly to weedy plants, such as petasites, fireweed, grass and sourdock. Also, there was only a small number of each type of plant. Usually in the sub-arctic tundra of the YK Delta there is a high number of each plant present.

At each of the Northwest, Southeast, and YK Delta dumps - the three less well managed and/or designed dumps-- the species "richness", a measure of how many of each plant there are, was lower than at the untouched reference sites. This means that **just a few**

plants would tend to dominate less-well managed dumps, and other types of plants would be harder to find.

Mosses Out of any plant, mosses were most impacted at the less-well managed dumps, and there was less of them there than at the reference sites. **Sphagnum moss covered about one-third less area** than at the reference sites (28 and 31 percent for the Northwest and YK Delta tundra dumps and 35 percent for the Southeast dump).

The *destruction of moss is a big concern in tundra areas*. Moss serves as a primary insulator of permafrost, and the invasive plants that might take its place are not good insulators. Moss also retains high amounts of water, an important function in tundra, because readily available water for the surrounding ecosystem is generally scarce. Without insulation, permafrost can be altered, leading to dramatic changes in plant communities, water level, and thaw depth. Read about this process more under the Impact on Tundra Section below. The presence of moss in the forests of the Southeast is important to maintaining soil pH and the balanced understory of plants typical for these forests.

Dead Vegetation Another impact is **that a much higher amount of dead plants can be found near dumps**. It is clear that much of the dead vegetation is a result of trampling by foot, vehicle, or bears (in the case of the Southeast). Not surprisingly, the Northwest and Southeast dumps, **the two dumps with the greatest number of access trails, had by far the highest amount of dead vegetation**. An average of 43 to 63 percent of the land surrounding these dumps was covered by dead plants! The YK Delta and Yukon Interior dumps, both with a single access trail, had just a very small amount of dead vegetation. Additionally, the Northwest dump, **by far the least consolidated and the most poorly managed, had the highest amount of dead vegetation**, partly due to garbage covering the plants and blocking sunlight.

It couldn't be determined whether the dead vegetation results also from dump contaminants and/or slight changes in hydrology, topography, or soil conditions caused by the dump's presence. Significant contamination with some compounds can certainly kill plants or stunt growth. The Northwest and Southeast dumps, with the greatest percentage of dead vegetation, are much larger than the other two dumps, so assumedly the potential for soil-- and thus plant-- contamination is greater. In terms of dump-caused changes in ecology, it is known that tundra plants are highly sensitive to small land slope and water level changes. Such changes might occur during dump site compaction, grading, berming, or erosion. Additionally, loss of moss in tundra and non-tundra environments may make soil pH (the acid content) increase outside of a plant's tolerance zone.

Impact on Tundra

The disturbance of tundra is a primary environmental concern for tundra open dumps. A healthy tundra ecosystem capable of supporting its plants and animals depends on a vegetation layer to insulate the underlying permafrost from heat in the summer and cold in the winter.

The tundra insulative layer can be degraded, and the permafrost impacted, by the following processes:

- Loss of moss, as well as other less-insulative plants, due to dump traffic and other processes not yet understood
- Replacement of moss by invasive plants that are poor insulators
- Compaction of tundra from dump traffic and overlying wastes
- Tearing up of tundra from vehicle traffic

Additionally, open dumps may melt permafrost directly by:

- Liquid waste dumping, particularly propylene and ethylene glycol (antifreeze), sewage wastes (honeybucket and sewage sludge), and oil.
- Large quantities of food wastes piled together with a ready carbon source, such as paper. The breakdown process produces heat.
- Ground fires

What can happen when permafrost gets disturbed? If you live on tundra you likely know already. Here is how scientists explain it in case you need to write about it in your grant proposal, or to educate community members. There are three potential impacts:

- (1) **Ice mound and expansion of impacted area** First, the permafrost might actually thicken and form a "lens" of ice-- an ice mound. What happens is that the ice goes through a freeze-thaw cycle each year. The ice thaws in summer, and during winter the ice forms again, but with more water to make a larger mound. During the freeze events, soil is often brought to the surface. **The upheaved mixture of soil and ice, called a "frost heave", then piles on top of the protective vegetative area, killing the plants and thus increasing the size of the impacted area.** Frost heaves can be very disruptive to roads and bridges, as well as dump facilities.
- (2) **Thaw bulb and development of an expanding pond** A second possibility is that damaging the vegetative layer could melt the permafrost and a thaw bulb could form. Where ice is melted, water is left in its place. This can lead to the development of a pond that can continue to increase in size each year. What happens is that during summer the on-shore winds force the melted water to the sides of the pond. **The warm water melts away more permafrost yielding a slightly larger pond each year.** The development of a pond would dramatically the type of plants found in the area.

Instead of arctic/coastal tundra plants, freshwater marsh type plants like pendant grass would take hold.

- (3) **Quagmire of expanding peat mud** Another possibility is that the permafrost melts, but no pond forms. The ground gets too full of water and plants can't grow. A muddy swamp, or "quagmire" of very **saturated peat is left that is impossible to walk on or more move over without getting stuck**. These types of areas take a very long time to recover. If you live on tundra you probably have first-hand experience getting stuck in this stuff.

Wetland Mitigation

An important factor in how much contamination your dump might cause to the surrounding soil and water is the presence of wetlands. Wetland plants and soil take up pollutants like heavy metals, filter out disease organisms, and detoxify certain chemicals. Having wetlands between your dump and what you are concerned about is a very big help. **If you are looking into developing an area, make sure you do not physically disturb any wetlands** located between your dump and waters or land that you are concerned about.

Want some numbers?

In one village, the dump leachate and runoff from the adjacent honeybucket site flowed through wetlands before reaching the river from which residents fish. Going through 250 meters of wetlands, water sample counts of fecal bacteria went from too high to count (over 10,000) down to only 70 per 100 ml, what scientists would call a two-orders of magnitude decrease). Diesel in the water went from 170 ppm to non-detectable. In another village in the Southeast, lead went from 130 parts per billion in the water to 10 ppb about 1 mile downstream.

Hydrology

Something important that you should be aware of is that wetland or permafrost destruction changes the hydrology around and downstream of the dump. Thawing of permafrost may allow water to flow to areas it couldn't before. This may be okay or it could have very serious consequences. **Changes in permafrost and water flow may link the dump runoff directly or indirectly to your river**, or other areas that you use for subsistence. If a link to your river is created or the path shortened, the potential for contamination is greatly heightened. You need to look into this factor if you notice the land shapes or plant types around or downstream of your dump changing. And make sure this possibility is evaluated when community development plans are made (be especially careful locating water treatment ponds which can create thaw bulbs in permafrost).

Contaminant Release

Here is another good environmental process to know: **If left alone, wetland soil can keep metals, like lead and mercury, from getting into your water.** Soil in wetland areas locks heavy metals away by binding them fast with other compounds. But if this soil gets exposed to oxygen in water or air, the heavy metals are released. So one worry is that a new water flow path (on or under the surface) will release these heavy metals. The more oxygen the water has, the better its ability to release heavy metals. Turbulent water from rain, and rushing water from Breakup or a creek or river, breaking past and through contaminated soil should be avoided because of heavy metal release. **Digging up wetlands and exposing the soil to air will also result in release of contaminants.** If you are re-working or closing your dump, be aware of this process. Timing your heavy equipment work well after Breakup should be planned if possible. Another good remedy is to channel water to ponds first, before it flows into the river. The time in the still ponds will allow contaminants to resettle and the heavy metals can bind up again.

Subsistence Impacts

Not a lot of data exists on the impact of dumps on wildlife or subsistence plants. We know that chemicals can accumulate in our animals, and high levels of some contaminants, like mercury have been found in some parts of marine animals. And heavy metals like cadmium, lead, and mercury are found in soil, and sometimes in water, at open dumps. As Table 3-1 showed, subsistence contamination from dumps concerns a lot of us.

Soil Contamination You should know that **the contamination of soil from dumps does not appear to occur too far outside of the dump.** In one sampling study performed, soil contamination of heavy metals did not extend past about 500 yards. Many contaminants are trapped by soil, especially heavy metals. Since most wildlife tend to stay away from areas of human activity, and therefore, stay away from the dump, **it is likely that wildlife is not affected significantly by dump soil contamination.**

Water contamination Because water flows over long distances, it is more difficult to say how wildlife might be impacted from dump water contamination. In the villages studied, the level of contamination in the water from the compounds listed in Table 3-1 was quite low, and likely of little to negligible concern to fish and wildlife. **If the waters that you are concerned about are relatively far from the dump, or are not directly connected to the dump** except through several hundred yards of wetland or subsurface flow through soil, **the fish and wildlife are almost certainly okay to consume.**

However, open dumps can cause heavy contamination of water in the wrong circumstances. **If a creek flows right through or past your dump, without any wetland mitigation, contaminant levels near the dump may be substantial enough to impact fish populations.** Anecdotal evidence suggests that heavily polluted dump water can degrade fishing streams and spawning beds. High organic loading can deplete oxygen and also cause

creek populations to decline or change in species type. Also, the jump in contaminant levels during flooding events should be considered when conducting subsistence activities.

First Flush We mentioned the “first flush” effect of rain and flooding in the Health Section. The first big rain event of the season or flooding from Breakup flushes out lots of contaminants that had settled on creek and river bottoms, been trapped by plant filtration, or locked up with soil. During this time some water sources that mix with dump runoff may be very polluted. If honeybucket wastes are mixed in with solid wastes or you have a honeybucket dumpsite, and the river water is mixed in with honeybucket runoff, it may be unsafe to wade in the river while conducting subsistence activities. Even without accidental ingestion, skin contact with water highly polluted with bacteria can cause rashes, and delay the healing of sores.

Berries Because dump soil picks up contaminants, plants near the dump will take up some of these contaminants. Plant uptake is a helpful process because it helps clean up dump contamination. You should be aware that picking berries for consumption near the dump is probably not a good idea. Many fruit plants concentrate their nutrients (and contaminants) in their seeds and fruits. To be safe, make sure residents know to go at least 30 yards upstream or uphill of the dump, or 400 yards downstream or downhill of the dump. **Eating a small handful of berries closer to the dump should be fine, but it should not be a habit without testing the area first.**

General Rule A general rule is that **if fish are just passing through contaminated water, or animals only occasionally drink it, the fish and animals are almost certainly okay to consume.** If fish have been living in highly contaminated water for several weeks, it may be better to fish elsewhere for a while. For example, fishing in a pond right at the dump should be heavily discouraged. If plants are flooded by dump runoff infrequently, they should be okay as well. Even in warmer temperatures between 68° to 86°, bacteria and viruses do not survive in agricultural crops watered with processed wastewater (or fertilized with sewage sludge), over 60 days. And they usually survive less than 15 days. **So if you are concerned about consuming berries that might have taken up honeybucket or sewage treatment water, wait 60 days after plant exposure and you should be completely safe.** If you think the berry plants may be regularly exposed to a significant level of bacterial contamination, boiling berries for jams at least 25 minutes also will kill bacteria.

What to look for

Remember we are only talking about fish or animals living in highly contaminated water continuously or eating plants in heavily contaminated soils continuously. Heavily contaminated water or soil will often look or smell different from other areas. **Make sure your community's subsistence practices do not change unless they have to. Test areas that you are worried about.** Please send the results to us, ANTHC, EPA, or DEC so that we can all share dump risk information.

Nutrient loss To be complete, we should mention that open dumps could have an indirect impact on subsistence by changing the plant community type around the dump. One way to look at plants is in two broad types of categories - invasive plants, and non-invasive plants. Invasive plants are better adapted to disturbed areas—like the access trails and interior of open dumps. And the nutrition value of these kinds of plants can be of poor quality compared to non-invasive plants that establish themselves over long periods of time. For example, the Northwest dump studied had highly disturbed land due to numerous access trails, and lower nutritive grass replaced the higher nutritive sedge. **So the presence and/or health of wildlife living around the dump may be impacted.** Of course, since it is only disturbed areas that this problem might occur, the easy solution is to limit dump traffic to a single route.

Bears

Speaking of nutrition, the health of bears is definitely impacted by open dumps. The presence of bears was noted as a problem in over half of tribes responding to a statewide survey. **Bears who depend on garbage for their food tend to live 10 to 15 years less than non-dump bears.** Of course, the other health hazard for bears is that they are often killed at dumps. Two-thirds of the tribes with bear problems stated that at least one bear had been killed at their dump in the last five years. Village residents tell stories of bears being killed often for easy sport and not for safety or subsistence reasons. At one Yukon dump, an out-of-towner cut off the paws (to sell in China) and left the body. Keeping bears away from the dump not only protects your community, it prevents this type of killing and wastefulness.



Figure 3-4 Brown bears at a Southeast dump site.

Summary of Environmental Impacts

If you made it through this whole section, you should be congratulated. It's like taking a whole college course on ecology in one sitting! A handy summary of what you just read is provided for you in Table 3-6. Remember too, if you have questions about environmental processes at the dump, call your agency staff person and they should be able to set you in the right direction for information. Another good idea is to call the University of Alaska Cooperative Extension Service at the College of Rural Alaska (474-2631). The purpose of College Extensions is to reach out to the community and help them with real-life problems. While they may not have specific information about dump contamination, they know a lot about the types of ecological processes and factors that can make contamination worse or better. They may be able to put you in touch with the perfect person for your question.

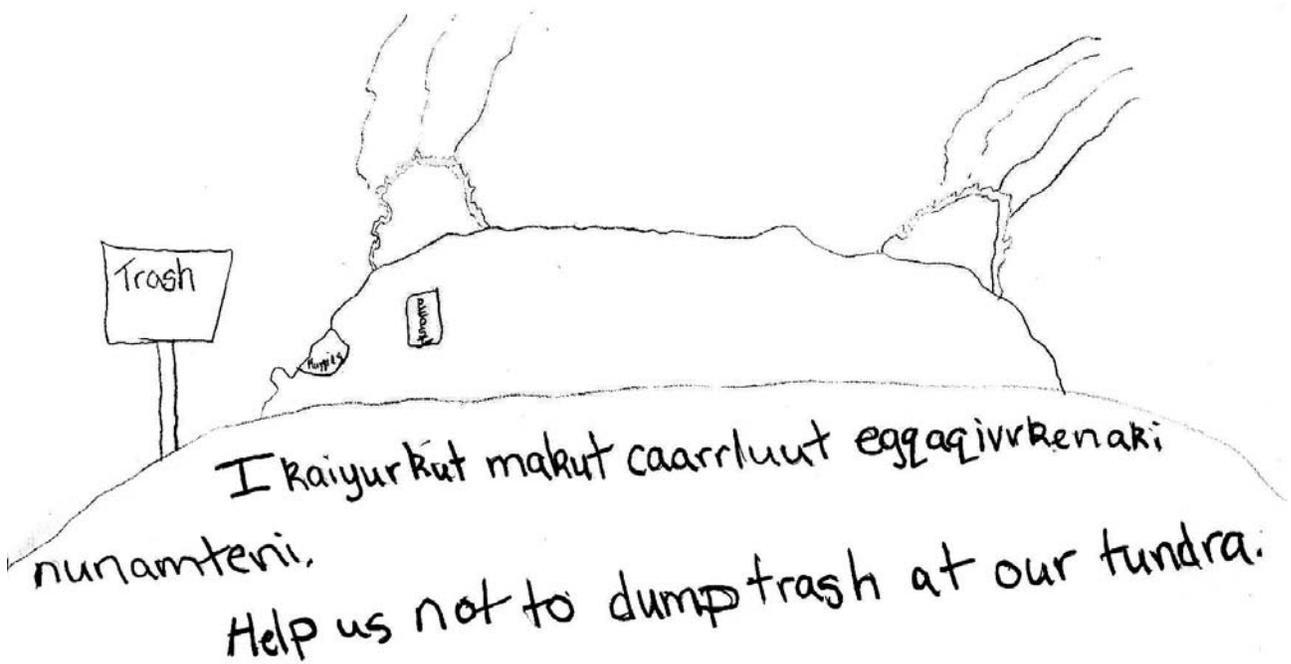


Table 3-6
Environmental risks related to open dumps in Alaska villages.

Source	Typical relative risk ^a	What it does
Soil contamination in immediate dump vicinity	Very high But decreases rapidly away from dump	Dumping batteries, used oil, ethylene glycol, paints, or other hazardous wastes contaminates soil and may impact plant community or make berries unsafe to eat.
Water contamination in immediate dump vicinity	High – water flow through dump will be contaminated to at least some level	Runoff to dump ponds may make water acidic, causing acid burns and impacting plant health, continued uptake of contaminated water may affect animal health.
Soil contamination away from dump	Low- except in case of direct water flow to area of sediment settling	May impact plant and animal communities over long-term.
Water contamination away from dump	Very low to high – depends on level of dilution and initial contamination, and much greater risk if water flows directly from dump and not through wetland or subsurface soil.	May impact plant and animal communities over long-term. A high bacterial count may make use of water in subsistence activities unsafe.
Plant diversity loss-	High- in immediate dump vicinity Low – other areas depending on water flow	Makes plant community more susceptible to changes, may change type of animal species in area. May impact berry gathering practices. May decrease nutritive value of area to wildlife. Loss of moss affects permafrost.
Tundra degradation	Very high If more than one access route, unmaintained access, or unconsolidated wastes	Impacts plant community directly. Kills moss and other plants, changes plant types. May set in place ever-increasing area of impact due to permafrost changes. May create new hydrology, and link water sources of concern to dump.
Contamination of animals	Very low- unless animals live continuously in immediate vicinity of poorly managed dump	Accumulation of dump contaminants in animal organs may make sustained eating of these animals a health risk.
Contamination of berries	Low – except immediate dump vicinity	Berries in immediate dump vicinity may accumulate contaminants.
Bear health jeopardized	High	A diet of garbage dramatically reduces a bear's lifespan. Killing bears for easy sport may also result
Contaminated air from burning	Very high – during smoke period, less toxic with burnboxes	Continuous dump burning may deprive oxygen to plants exposed to heavy smoke. Health risks to humans discussed in health section. Smoke turns rain into acid rain and can impact plant health in that way.

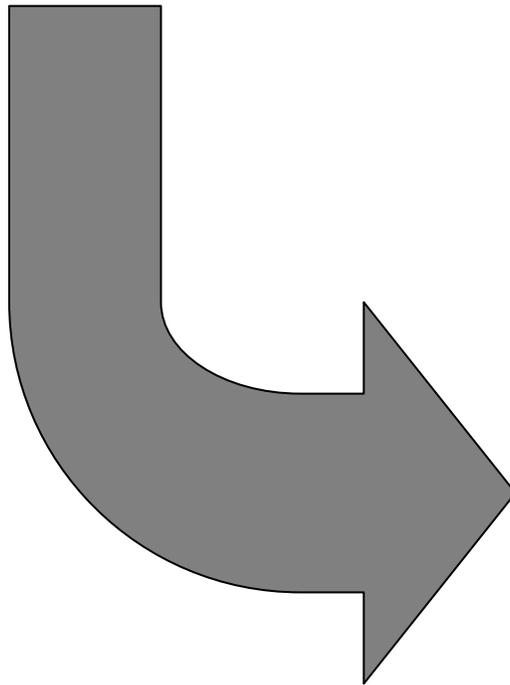
3. FIXING HEALTH AND ENVIRONMENTAL PROBLEMS

You may be reeling from thinking about how many health and environmental risks your dump might have. And we all know getting funding for big things like closing a dump and starting a new one can be a long time in coming. The good news is that there are lots of ways to reduce the risks of your dump. In fact, **you may be able to reduce your risks enough that you won't need to close your dump at all.**

Table 3-7 lists problems talked about in this Chapter, and ways to solve or reduce them. The methods listed are all no-cost to medium-cost options, so you should be able to afford at least some of them. The medium-cost options (about \$5,000 to \$30,000) may take a bit of creative funding. Check out especially the ANHB Solid Waste Demonstration Grants (see Chapter 4). Also many agencies have discretionary funding at the end of year for these types of simple and effective improvements. You just need to make it clear what the money is for and how much it will reduce your risks.

The problems listed first are some of the most risky to community health, so try to give them priority. Also, if you read Table 3-7, you'll see some of the same solutions mentioned for different problems. If you can swing them, those solutions will be the most effective efforts to carry out, because they will solve more than one problem.

Here is the top ten list of risk-reducing choices:



TOP TEN WAYS TO REDUCE YOUR SOLID WASTE DISPOSAL RISKS

Education

Changes people's risky behavior like scavenging, burning plastics, dumping batteries, drinking untreated water downstream of dump (without testing), and dumping honeybucket wastes at dump, or solid wastes at honeybucket site.

Waste (And Honeybucket) Collection Program

Keeps people out of dump, prevents random fire setting and battery disposal, helps with waste consolidation, waste area separation, stops honeybuckets from being dumped at dumpsite, and garbage being dumped at honeybucket site.

Better Access

Reduces tundra degradation, promotes waste consolidation and waste area separation, reduces people/waste contact

Separate Waste Area

Stops scavenging, promotes waste reuse (and volume reduction), stores wastes for future recycling.

Burnbox or Incinerator

Reduces disease organisms, reduces volume, reduces disease vectors, deters bears, stops uncontrolled fires. *Burn wastes only in well-designed and maintained burnbox, and downwind of village.*

Frequent Cover

Reduces disease organism contact, reduces volume, reduces disease vectors, deters bears. Alternative cover materials include tarp(s), wood chips, rock, shredded or weighted plastic, crushed glass, old clothing, textiles, rugs, etc.

Stop Smoke Inhalation

Reduces respiratory symptoms and reduces potential for rashes, cancer and respiratory diseases. Switch to good, maintained burnbox, burn wastes only downwind of homes, prevent people from entering dump during burn days or when smoky, ban home barrel burning of non-paper/food wastes.

Battery Recycling

Greatly reduces toxicity of leachate, stops risk of acid burns to children visiting dump. Contact Frank at Anchorage Battery, 276-5251 or Joe Sarcone at EPA, 271-1316.

Know Your Risks

Safeguards community health, prevents subsistence activities from being altered unless necessary. Test suspected water that is used without treatment (e.g. drinking from traditional source, swimming, wading). Test during or just after big rains and flooding for maximum contamination, and test at other times for minimum contamination. Until you are certain it is safe, you may need to stop village use of this water during or just after big rains and flooding. Test for heavy metals and E. coli or Fecal coliform. Ask your water operator or EPA for help for free or low-cost testing.

Ban Or Separate Plastics

Reduces smoke toxicity and reduces windblown wastes, litter. Villages in the Yukon River Inter-Tribal Watershed Council have banned Styrofoam and plastic. Contact: Andrea Bongen, 563-9334.

Table 3-7
No-cost to medium-cost ways to reduce risks of solid waste disposal in Alaska villages.

Problem	Type of solution	Ways to reduce the risks associated with it
Honeybucket wastes mixed with regular garbage disposal	Education	Ask people why they dump their honeybucket wastes at dump site, or garbage at honeybucket site, and see if you can address that. Explain how these practices increase community health risks.
	Designated area	If people continue to dump honeybuckets at dump site, then mark off an area for them to dump at. Try to berm the area. If possible, mark a low area of the dump that is not prone to flooding.
	Make access clear	Make sure that people can dump their garbage without having to walk onto wastes. Keep access and turnaround clear. Build movable platform to dump wastes from.
	Collect wastes	Set up a mandatory honeybucket collection system and/or mandatory garbage collection to keep people away from disposal sites;
	Fencing & staffing	Fence disposal sites to keep pets out, or confine pets. Restrict dump open hours to times when it can be staffed.
People scavenging through dumpsite	Education	Let people know how high the risk of injury and illness is when they walk through and on top of wastes. If kids play there, work with the schools to educate them on the dangers. Get funding for creating an interesting place for them to play.
	Separate area	Make and maintain a separate area for reusable items. If you have a spare building, make that a reuse center to bring materials that will get ruined if they stay outside.
	Fencing & staffing	Fence off the area and restrict dump open hours to times when it can be staffed.
Swimming in or drinking from contaminated water	Education	Tell/show people that using untreated water that is mixed with dump runoff may make them sick or give them rashes.
	Test water	Test water to see if it is okay to drink or swim in.
	Restrict use	Try to keep people from swimming/wading/ or drinking water during and just after big rain events or flooding (e.g. Breakup)
	Site remediation	Start better dump management practices, like separating out wastes, picking out batteries. Take off all snow before melting. If heavy equipment is available – try to redesign slope of dump so water goes around, not through dump. Erect berms to redirect surface water.
Decreased subsistence activity	Education	Let people know that all studies have shown it is much healthier for them to continue subsistence diets.
	Sample Testing	Test waters or soils in areas where people are concerned. IGAP funds can cover this, or you may be able to get funding from other agencies. Call someone like Bill Stokes, Compliance Assistance, ADEC, 269- 7580, or Joe Sarcone, Rural Sanitation Coord., EPA, 271-1316, to figure out what to test, how to do it, and how to interpret results. Make sure you send them or us a copy of results so that the information can be used to help other tribes in similar situations.

Continues on next page

Table 3-7 (contd.)

No cost to medium-cost ways to reduce risks of solid waste disposal in Alaska villages.

Problem	Type of solution	Ways to reduce the risks associated with it
Smoke and fires from open burning	Designated burner	Have a designated person who is the only one allowed to set dump on fire. Set fires only on non-windy days and/or when wind is away from village.
	Education	Tell/show people how dangerous smoke and flare-ups can be. Get them to stop lighting fires on their own, and ask the designated person instead. Post signs in-town say when the burn days are, and to stay away for 2 days.
	Separating wastes	Get people to separate out their plastics. If open burning is the only option for now, consider banning plastic bags at the stores ^a .
	Burnbox	Consider using a burnbox instead.
	Collection program	Mandatory collection program so people don't set dump on fire and so hazardous wastes can be better separated out.
	Protect boardwalk	Make boardwalk at dump fire-proof or fire-resistant, or secure funding for insulated gravel platform, so that good access is kept.
	Cover wastes	If possible, compact and cover wastes often instead of burning. Look for alternative cover material such as a tarp(s), wood chips, rock, shredded or weighted plastic, crushed glass.
Smoke from burnbox	Separating wastes	Get people to separate out their plastics. Consider banning plastic bags at the stores. Staff burnbox or do random visits and help people see what wastes they should be separating out..
	Restrict burning	Burn only on non-windy days and/or when wind is away from village.
	Maintain	Maintain burnbox for high draft, hot fire, and quick burn.
	Relocation	If impossible to keep smoke away from village, relocate burnbox.
Smoke from home barrel burning	Education	Tell/show people how risky it is to breathe smoke from fires with plastics, used oil, or hazardous household product wastes.
	Ordinance	Ban household burning within village limits or confine it to certain days and allow only paper, food, and wood wastes to be burned.
	Burnbox	Find out if people would burn at home less if there were a burnbox. If so, get a burnbox and place it in a good, downwind location.
Out-of-town business and government agency dumping	Ordinance	Write an ordinance making it illegal for businesses to dump their wastes. Require backhaul. Or if you want the revenue, require them to pay for disposal. These businesses save a lot by not paying for waste disposal. But our villages end up paying in the end! Note it is illegal for federal agencies to dump at unpermitted dumps.
	Call ADEC	Take action against businesses that have dumped hazardous wastes and refuse to clean them up, or continue to dump other types of wastes against village wishes. First, write an official letter. Then try calling ADEC Spills and Prevention, 451-2121.

Table 3-7 (contd.)

No cost to medium-cost ways to reduce risks of solid waste disposal in Alaska villages.

Problem	Type of solution	Ways to reduce the risks associated with it
Clinic waste dumping	Make plan	Work with clinic to set up a strict plan of burning <i>all</i> clinic medical wastes daily.
Dump expanding/ people littering	Education	Explain how unconsolidated trash creates higher risks (people are exposed more and tundra and wetlands are destroyed).
	Better access	Find out why people are doing this – if it's because they don't like going to the place they should be dumping, make a better access (funding for small site improvements may be available from ANTHC).
	Collection program	Start a mandatory waste collection program so all wastes can be placed correctly by waste collector.
	Recycle	Start a recycling program to reduce volume of wastes. See Chapter 8 and Appendix C.
	Bale	Bale wastes to keep dump neat
	Clean up	Try paying community groups to clean up litter, or make it part of a school program to award "points" to students.
	Ban plastics	Ban plastic bags from your village. Because they are light-weight and don't degrade, plastic bags contribute highly to unsightliness.
Tundra destroyed	Burnbox	Purchase a good burnbox, or construct one yourself using a good design and materials.
	Education	Let people know about the degradation process they are producing. Mark off the area of "bad" tundra around the dump and let people see how the area increases over time.
	Consolidate waste area	Practice waste consolidation measures – start a collection program, or pay someone to consolidate wastes 1 or 2 days per week. Bale, compact and/or trench wastes if possible. Burn paper wastes. When ground is frozen, bring out or rent heavy equipment to work over landfill (ask project managers of village construction projects to borrow theirs)– at least once just after summer, and once before summer.
	Improve access	Improve and maintain a single access route to the dump, making it by far the most convenient path to take. Make boardwalk at the dump fire-resistant or fire proof so it doesn't burn away. Try for funding to make an insulated gravel platform at dump.
	Erect barriers	Erect barriers so people only go to dump along a single route and only to the "active face" – the small part of the dump where people should be bringing their wastes currently.
	Backhaul antifreeze	Make certain that antifreeze (ethylene or propylene glycol) is not dumped – make sure that construction, housing, electrical, fuel projects and businesses backhaul or recycle their antifreeze.

Continues on next page

Table 3-7 (contd.)

No cost to medium-cost ways to reduce risks of solid waste disposal in Alaska villages.

Problem	Type of solution	Ways to reduce the risks associated with it
Foxes, rodents	Fencing Control dogs	Erect fencing. Restrict dogs from entering dump.
Birds, insects	Cover wastes Burnbox Compost	If possible, compact and cover wastes. Look for alternative cover such as a tarp(s), wood chips, rock, shredded or weighted plastic, crushed glass. Reduce water ponding to reduce insect breeding. Purchase/construct a well-designed burnbox. Burn food wastes. Start a covered worm compost operation like the Village of Iguigig, or compost food wastes in an area away from dump and houses. Call Can-O-Worms 1(888) , 422-2129.
Plant life changed	Education Consolidate Barricade Test water Stop runoff	Show people the difference in plant diversity and abundance at dump and away from dump. Reduce impacted area by consolidating wastes. Block off area and revegetate. If area is not at dump, but downstream, test water to make certain it is not too contaminated for fish, wildlife, and human use. See runoff and flooding suggestions.
Leachate from dump	Prevent formation Recycle - reduce toxicity	Prevent water from passing through. See runoff and flooding suggestions. Prevent hazardous wastes from entering dump. Start recycling batteries immediately. Find out if used oil is dumped. Ensure machinery and vehicles are drained of oil and fluids before dumping. Make certain antifreeze is backhauled, recycled, or treated.
Odor from dump	Move fish Quick burn Check odor	Bring fish wastes to another area. Burn/compost food wastes. Burn or bury dead animals immediately. If odor is not from food/animal waste, make certain its not a chemical.
Bears	Separate Grind Compost Accept bears Buffer zone Burnbox	Separate fish wastes and discard away from dump and human traffic. If available, use grinder for fish wastes and compost with wood, paper, etc. Call Jeff Benson, Metlakatla Compost Project, 886-4200. Compost food wastes – you may need to store compost barrels inside a building. Accept bears presence. Most dominant bears tend to avoid human traffic. Get people to visit dump only at certain hours so that bears may avoid them. Maintain a clear buffer zone free of trees, heavy brush, and wastes so that bears do not emerge next to humans unawares. Use a burnbox.



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Help us fix this dump before it
kills our environment.

MADE BY: ADELINA ROSE
4-11-01 PHNUK