# Perspectives on Past and Present Waste Disposal Practices: A Community-Based Participatory Research Project in Three Saskatchewan First Nations Communities

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## Abstract

The impact of current and historical waste disposal practices on the environment and human health of Indigenous people in First Nations communities has yet to be adequately addressed. Solid waste disposal has been identified as a major environmental threat to First Nations Communities. A community-based participatory research project (CBPR) was initiated by the Saskatoon Tribal Council Health and Family Services Incorporated to investigate concerns related to waste disposal in three Saskatchewan First Nations Communities. Utilizing a qualitative approach, we aimed to gain an understanding of past and present waste disposal practices and to identify any human and environmental health concerns related to these practices. One to one interviews and sharing circles were conducted with Elders. Elders were asked to share their perspectives on past and present waste disposal practices and to comment on the possible impacts these practices may have on the environment and community health. Historically waste disposal practices were similar among communities. The homeowner generated small volumes of waste, was exclusively responsible for disposal and utilized a backyard pit. Overtime waste disposal evolved to weekly pick-up of un-segregated garbage with waste disposal and open trash burning in a community dump site. Dump site locations and open trash burning were identified as significant health issues related to waste disposal practices in these communities. This research raises issues of inequity in the management of waste in First Nations Communities. It highlights the need for long-term sustainable funding to support community-based waste disposal and management strategies and the development of First Nations centered and delivered educational programs to encourage the adoption and implementation of waste reduction, reutilization and recycling activities in these communities.

**Keywords:** first nations, community-based participatory research, waste disposal and management, human and environmental health

## Introduction

Throughout the history of Canada, First Nations interests have not been represented with respect to laws, regulations and enforcement towards the environmental protection and management of their lands.[1,2] In Canada, a series of municipal, provincial and federal laws and regulations have been developed to govern land use for the environmental protection of off-reserve communities. Although these laws and regulations are in place, enforced, and utilized as tools to control an extensive assortment of environmental risks in off-reserve communities, no such laws of environmental protection are currently in place for First Nations Communities.[2–4]

For over a century (from 1876 to the early 1980's), the *Indian Act* has been the main mechanism employed to govern the use of First Nations lands).[5] Under this act, Indian and Northern Affairs Canada (INAC) is the authority responsible for regulating First Nations land use, environmental management and protection. In the early 1980's, through the development of land management and administrative programs, INAC provided some options to First Nations to enable communities to assume more land management responsibilities. The Regional Lands Administration Program (RLAP) and the Delegated Lands Management Programs (DLMP), introduced in the 1980's, but then replaced in 2005 by the Reserve Land and Environment Management Program (RLEMP), enabled the transfer of various land use planning, environmental and natural resource management and administrative land transaction responsibilities from INAC to First Nations[3,6] The only current alternative, under the Indian Act, is The First Nations Land Management Act (FNLMA), a federal law enacted in 1999 which provided signatory First Nations law-making authority over reserve lands, resources and the environment.[7] The FNLMA sanctioned a Framework Agreement on First Nations Land Management, negotiated and signed, in 1996, between 14 First Nations and the Minister of Indian Affairs and Northern Development. In 2002, the Land Management regime was opened to other interested First Nations, however, policy decisions were made in 2008 to close the regime to new entrants due to the lack of sustainable long-term funding and thus the majority of First Nations communities are governed by INAC under the Indian Act.[3,6]

During negotiations of the Framework Agreement, solid waste was identified as one of 4 major environmental threats to First Nations communities.[3,8] In addition,

discharge of household sewage and industrial and commercial wastewater into surface water, fuel storage tanks and environmental emergencies, such as chemical spills, were considered essential for environmental protection and recognized to pose significant risks on reserves. In 2007, Environment Canada also recognized landfills, solid and hazardous wastes, as well as the air emissions from incineration and open burning of garbage as significant on-reserve risks requiring immediate attention.[3] The Minister of Indian and Northern Affairs Canada, under the "*Indian Reserve Waste Disposal Regulations"*, is responsible for the operation of landfills and waste dumps in First Nations communities.[9] To date, INAC neither promotes nor conducts significant surveillance of dumping sites and is not equipped to monitor compliance, conduct inspections or enforce waste disposal regulations.[3,10] Thus the majority of waste sites in First Nations communities across Canada remain unregulated.[1,2]

Under current national and provincial legislation, the location of landfills on off-reserve communities requires a geological site selection process; however in most First Nations communities, derivation of landfill (more appropriately referred to as community dump site) location does not consider this process. As a result, community dump sites are often developed in geologically unacceptable sites and are not equipped with modern engineered liners and leachate collection systems. Community dump sites are known to be located in areas with silty sandy soils, near surface water features, rather than in more geologically acceptable areas composed of less permeable soils and distant from major water sources.[1,4] Additionally, abandoned dump sites are not monitored for gas emissions or appropriately sealed with a clay cap, to prevent vertical penetration of water into wastes.[1,4,11] At present there are no central records documenting past as well as current waste disposal practices in Saskatchewan First Nations and the number and location of active and inactive dump sites are not known.[1,11]

Inadequately managed solid waste disposal sites are common sources of pollution in First Nations communities[12] and the detrimental effects of ineffective waste management practices on human and environmental health is well documented.[13] First Nations communities are highly dependent on the health of the environment and the concerns of First Nations people with respect to the adverse effects of inadequate dump site locations, garbage burning, and poor waste management practices have increased over the years.[1,4,11,14] The historical poor management, monitoring and remediation of solid waste facilities across Canada's First Nations Communities and

the lack of current resolve over this issue has left many First Nations people feeling the consequences of environmental pollution.

One of the first well-documented cases, to the present issue includes mercury poisoning in the Asubpeeschoseewagong Netum Anishnabek community in the 1960's as a result of the Dryden Chemical Company discharging chemical waste directly into the English-Wabigoon river system, a main water source for the Asubpeeschoseewagong Netum Anishnabeck, or Grassy Narrows First Nations Community located north of Kenora, Ontario. The Anishnabek suffered economically, socially and culturally as a result of the mismanagement and illegal disposal of industrial chemical waste. Some thirty years later, there are still severe restrictions on game fish consumption,[15–17] unemployment is at a high of 80%, social problems have arisen as a result of the loss of the communities' self-sufficiency,[15] community members are more reliant on market foods due to the growing lack of confidence in traditional foods due to the pollution of their river system and today, still suffer the effects of mercury poisoning.[18] The disruption and decay of cultural practices and participation in traditional economy (hunting, fishing trapping), as a result of perceived, or documented, cases of environmental contamination, has had a negative impact on the health and well-being of individuals, their families, and communities and has contributed to the current inequity in the health status of First Nations in Canada.[19,20]

In 1976 the United States Environmental Protection Agency (USEPA) stated: "… 90 percent of municipal and industrial wastes are disposed of on land in environmentally questionable ways. The results are potential public health problems, groundwater contamination by leachate, surface water pollution by runoff, air pollution from open burning, fires, and explosions at dumps, and risks to ecological systems.[21] In fact, cases have been documented where leachate from municipal solid waste disposal sites have contaminated groundwater that supplied residential wells in Sayvill, Long Island New York,[22] and Rockford Illinois.[23] Hazardous substances associated with waste management have been identified as persistent environmental pollutants and known or suspected human carcinogens.[13] Waste incineration is known to produce a variety of pollutants from the combustion of chemical, industrial and household wastes. These can be grouped as particles and gases, metals and organic compounds.[24] Metals such as cadmium, mercury, arsenic, chromium, nickel; organics that include, dioxins, polychlorinated biphenyls (PCB), polyaromatic hydrocarbons (PAHs); particulate

matter and sulphur dioxide, are waste associated pollutants that have been classified as having the greatest potential impact on human health based on their environmental persistence, bioaccumulation, amount emitted and their inherent toxicity.[13]

The impact of current and historical waste disposal practices of the environment and human health of First Nations communities across Canada has yet to be adequately addressed or investigated. The Saskatoon Tribal Council Health and Family Services Inc. (STC) and the Health Canada Regional Environmental Health Officer, for the Saskatchewan Region, identified the potential for contamination of surface and groundwater by historical and current dump sites as a top priority. This issue was identified as critical since most First Nations rely on local surface or groundwater for their drinking water supplies, and the potential impacts to health and environment associated with waste disposal practices is potentially significant through contamination of drinking water supplies in First Nations communities. Groundwater analysis, in areas of active and inactive community dumps, as well as backyard waste disposal pits indicated that health- and aesthetic- based water quality guidelines for Canadian Drinking Water Quality (GCDWQ) were exceeded in water samples collected for analysis. Parameters found to exceed GCDWQ[25] included: chloride, sulphate, pH, arsenic, barium, iron, manganese, lead, total dissolved solids and total coliform bacteria.[1] The results of the water analysis demonstrated a risk to groundwater quality in the areas of waste disposal. Chemical analysis of soil and ash samples collected from one active community dump site indicated the presence of dioxins and furans at concentrations well above the Canadian Council of Ministers of the Environment (CCME)[26] soil quality guidelines for the protection of human and environmental health. These results suggest a risk for the community to dioxin and furan exposures at levels above the safety guidelines.

A community-based participatory research project (CBPR) was initiated to describe waste disposal practices and to explore health and environmental concerns related to these practices in three Saskatchewan First Nations Communities. This research project serves to present the views of First Nations Elders on past and present waste disposal practices in their communities. This article is a presentation and analysis of the knowledge presented on waste management practices during sharing circles and one to one interviews with participating Elders from three Saskatchewan First Nations communities.

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## Methods

The community-based participatory research project was initiated by the Saskatoon Tribal Council Health and Family Services to investigate concerns related to waste disposal and possible groundwater contamination in First Nations Communities in Saskatchewan. The research reported here was part of the larger CBPR project that examined the hydrological, microbiological, and toxicological aspects of active and inactive waste sites in three Saskatchewan First Nations Communities. Community-based participatory research strives to be community situated, collaborative and action oriented.[27–29] This specific project was based on a respectful collaboration built between researchers and communities for the purpose of creating new knowledge and understanding of waste disposal that was of practical relevance to the involved communities.

With the inclusion of a qualitative approach, we aimed to gain an understanding of the past and present waste disposal practices in three First Nations Communities and the potential human and environmental health concerns related to these practices of waste disposal. All participating communities are located north of Saskatoon, Saskatchewan, Canada, an urban center with approximately 250,000 residents located in the center of the province of Saskatchewan. Mistawasis First Nation is located northwest of Saskatoon, has approximately 2,254 registered members, and is situated on 12,431 hectares of land, the majority of which is forest and lakes, with some agriculture activity.[1] The Muskeg Lake Cree Nations is located north of Saskatoon, has approximately 1950 registered members, a land mass of 7536 hectares and agricultural is a major economic activity. The Muskoday First Nation is located northeast of Saskatoon, spans approximately 9687 hectares and has 1583 registered members.[1] Depending on community preference, information was gathered utilizing one of two approaches; a one to one interview or a sharing circle.[30,31]Two one to one interviews were conducted with two female Elders from one of the participating communities. Three sharing circles, consisting of both men and women were conducted in each of the participating communities. Interviews and sharing circles were held at the Health Centre’s of the participating communities. Significant topics of inquiry directed discussions however opportunities for communication between participants as well as participants and interviewer took place during these sessions.

Elders were invited to talk about past practices of waste disposal. They were invited to share their experiences of waste disposal as they remembered it when they were younger (late 1950's). Elders were also asked to share their perspectives on present waste management practices and on the possible impacts of waste practices on community and environmental health. Elders also provided recommendations for future management of waste in their communities.

Interviews and sharing circles, varied in length, participant gender and number. In general, one to one interviews took place with female participants and ranged in duration from seven to twenty five minutes. Sharing circles generally had equal gender representation, were composed of at least three men and three women and ranged in duration from thirteen to sixty minutes. Interviews and sharing circles were videotaped and recorded into DVD format and conducted in the summer of 2004. In keeping with the principles of Ownership, Control, Access, Possession (OCAP) and community-based participatory research,[32] a consultative and approval process was undertaken with Elders along with Chief and Council prior to the engagement of research and dissemination activities.[28]

Thematic content analysis of transcribed interview and sharing circles was conducted to identify main themes arising from participants' responses.[33] Video recordings were digitally transcribed verbatim. Utilizing Atlas.ti software, transcribed data were managed, organized, and coded by use of topic and descriptive categories, into emerging themes.[34,35] Major emergent themes were identified using an iterative process of comparison and evaluation across interviews and sharing circles. Comparative data analyses[36] were used to uncover similar and dissimilar relationships among emergent themes within and between communities.

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## Findings and Discussion: Past and Present Waste Disposal in First Nations

The analysis revealed that historical waste disposal practices among the three communities were fairly consistent. In the past options for waste disposal were limited and the homeowner was exclusively responsible for disposing waste. Typically, households generated small volumes of garbage and a backyard pit or personal waste site was the most common past practice of waste disposal.

Larger waste sites, designated for the disposal and eventual burial of metals, iron scrap, construction materials and appliances, were also utilized in the past by community residents. The number of larger waste sites, in operation, at any one time, in a single community, was not determined. However it was assumed that a single large waste site was in operation until capacity, at which time, the contents at the site were buried and a new site was created. Elders did not refer to these large waste sites as public dumping grounds or landfills but considered these sites as places to store junk.

Overtime, the responsibility for waste disposal transferred from the homeowner to the community. Waste disposal practices evolved from backyard pits and larger waste sites to weekly pick-up of un-segregated garbage with waste disposal into larger community dump sites. This present practice, a convention on many First Nations communities across Canada today, includes open-air dumping coupled with trash burning. Like many communities across the nation, community dumps, are built without engineered liners, leachate collection systems, and a site selection process inclusive of sound geological information.[1] Open-air dumping coupled with trash burning was the current practice in two communities. Weekly garbage truck pick-up with off-reserve disposal in an appropriately engineered landfill, governed by a local municipality, was currently practiced in the third community.

Elders expressed that community dumpsite locations as well as the practice of open trash burning were significant health issues related to waste disposal practices in their communities. Waste segregation and recycling were recommended as future waste management practices by Elders from all communities.

Overall, discussions with Elders were centered on the description of past and present practices of waste disposal, the health and environmental issues related to these waste practices and the options for future waste management. These main areas of discussion are sequentially reviewed below.

### Past waste disposal practices

All participants indicated that historically very little household waste was generated and most waste consisted of glass and old cans. All participants mentioned that the disposal of plastic waste was diminutive. For example one Elder explained:

*We didn't create much garbage, you know. A few tomato cans and usually a pile of moss that my mother used for moss bags. And that's all I knew of.*

Another Elder commented:

*There wasn't that much garbage back then. Yeah, no pampers. Little, or no plastic.*

Elders recalled some disposal of old furniture, vehicle scraps, oil cans and wood. These items were in general, personally disposed in an area within an individual's backyard or in a larger waste sited located in a designated area within the community. These sites of waste disposal were not considered public dump sites and were often referred to as places to store junk. Elders recollected that these "junk storage sites" were also utilized for the disposal of metals and iron scrap such as fridges and stoves, as well as the disposal of construction materials during the period when reserve housing was built. For example one Elder recalled:

*I don't remember any landfills or anything like that. We may have had some place to store junk like iron and stuff like that.*

Elders described that community members had very few options for waste disposal, there was no central management and methods were limited. Public garbage dumps were non-existent and in general community residents were responsible for their own waste disposal. Primarily due to convenience and as a result of the limitations in waste disposal methodologies, historically, a small pit dug in the backyard was the most common past practice for disposing waste. Briefly a household member would simply dig a pit in the backyard, dispose their garbage into the pit, ignite the garbage and eventually cover the ashes with dirt thus refilling the pit. An alternate site in the backyard was then selected for subsequent waste disposal. The methods of past waste disposal were expressed by three Elders as follows:

*They used to dig a hole. And burn it. Go in there and light a match. And then cover it.*

*When we used to throw our garbage, you know, in the garbage dump, we used to burn it right away. So when it got full, just buried it and then make another little hole. They weren't big. Just a little hole.*

*We didn't have much choice in my younger days … garbage wasn't just thrown around. It was always kept, you know, stuff that got burnt was burnt and the stuff that could be buried was buried.*

Elders commented on the number and location of past dump sites. All Elders recalled that numerous unfenced backyard pits and larger dump sites were sporadically located across reserve land. These past dump sites were generally placed in locations away from homes however as the community expanded, houses were built in close proximity to covered waste sites. Backyard pits and larger dump sites, designated for metal waste, were not considered public waste sites and central records documenting the location or quantity of these sites were not available or in existence. Elders commented that it was likely that existing residences are located in close proximity to covered waste sites as a result of sporadic placement and absence of any central waste site records.

Three Elder's commented on this topic as follows:

*There used to be one by [name] there, like, before the house was built.*

*"[name] was saying there was one over here where her place is now too. I guess one time. But it was all tin and steel and stuff like that. Not regular waste … it was probably tools and instruments or whatever". You know, [name] was telling us that right where our garden is was a dump. And when [name] works that up, he brings up old tin and stuff."*

In summary, past waste disposal practices were similar among communities, and homeowners were primarily responsible for disposing waste. Historically, households generated small volumes of garbage and a backyard pit was the most convenient, practical and common practice for waste disposal. A small number of larger waste sites were utilized for the disposal and eventual burial of metals, iron scrap, construction materials and appliances and a small number are still in operation today. Past waste sites were sporadic and not formally documented and as communities grew, houses were built in close proximity to covered waste sites perhaps posing some health risks. The total number of backyard or personal waste disposal pits could not be determined in each community. However it was estimated, based on the information gathered, that at least 100 nonoperational pits, could exist on community land.

All Elders indicated that a few historic backyard pits were still in operation today. These pits were mainly utilized for the disposal of household, some agricultural, and construction wastes. Although backyard pits were primarily utilized for household waste disposal in the past, it was established that in one community, a backyard pit

was utilized for the preservation of wooden fence posts and still contained traces of chromium, copper and arsenic. Like the backyard pits, Elders also indicated that a few larger waste sites were still in operation today. The past locations and total number of the nonoperational sites was not known or recorded. Elders stated that there was a strong possibility homes were built in areas where these former waste sites were once in operation.

### Present waste disposal practices

Open-air dumping, coupled with trash burning was the current waste management practice employed in two of the three communities involved in the project. Resident's of these communities disposed all household and industrial waste into residential bins which were emptied weekly by use of a garbage truck. Waste was transported to, and then disposed of, in the community's waste site. Each community had one active waste site at the time of the interviews. Waste disposed was un-segregated and included: plastics, household products, paper, industrial wastes such as paint and oil containers as well as tires. One participant describes how tires, oil and paint cans, and old oil, items that generally require separate disposal, are simply disposed of along with other materials.

*I think they throw them all into that one dump. I think that's right … into that one part. I think it's one big hole, yeah.*

All refuse brought to the community waste site was burned. In one community garbage was burned twice a week, every Monday and Thursday. The details regarding the frequency of garbage burning in the other community was not explained. Segregation and recycling of waste materials was not currently practiced in these communities. With the exception of two concerns; burning garbage and waste site location, the Elders of these communities were generally satisfied with the current waste disposal practices in their communities. Two Elders commented on the current waste practices as follows:

*Looking at it from past years and now, it's much cleaner.*

*I'm proud of our reserve, you know? Very proud. Cause it looks clean all the time.*

Weekly garbage truck pick-up with off-reserve disposal, to a neighbouring city landfill, was the current practice in one of the three communities involved in the

project. Household garbage was disposed into residential bins, emptied weekly by garbage truck and then transported to the landfill. To some extent waste segregation was practiced in this community. For example; paint cans and other paint products were separated from household garbage and taken to a depot in the city. Used oil was collected on reserve and hauled to a city oil depot. Elders believed that the oil was then reprocessed or recycled. Various metals and household appliances (washers, dryers, refrigerators, freezers, stoves, bed frames etc.) were disposed in a designated site on reserve. How these items were dealt with following their disposal to the site was not determined. Elders, from this community also indicated that a community waste site utilized prior to off-reserve disposal was cleaned out with the majority of its contents hauled to the neighboring city's landfill. Elders in this community indicated that abandoned cars were an issue of environmental concern. One Elder declared:

*Cars are everywhere.*

In the past a non-resident would travel from the nearby city and haul the cars off reserve however this is not a current practice and abandoned cars litter the community.

With the exception of the abandoned car issue the Elders indicated that they are pleased with the current waste disposal methods practiced in their community.

As one Elder stated:

*"We're sort of ah, fairly happy with what we got with dealing with our waste right now"*.

Elders noted that overtime, the volume of household waste increased and the responsibility of waste disposal on reserve transferred from the individual to the community. As a result the practice of waste disposal evolved from the backyard pit to the community dump site. The timeline for this transition was not confirmed. However, the modification in disposal methods may have occurred in time with, and as a consequence of, population growth and the increased availability of over-packaged commercial commodities within these communities. Present waste disposal methods practiced encompassed either open-air dumping coupled with trash burning or off-reserve disposal. On the whole, Elders were content with current waste management practices employed in their communities.

### Human and environmental health concerns related to waste disposal practices

All Elders raised concerns over the potential effects of past and present waste disposal practices on human and environmental health. Health related discussions were centered on dump site locations and the current practice of open air trash burning at the community dump sites. Methods of dump and burn are commonly utilized in First Nations across Saskatchewan, yet these methods came to a halt in non-reserve communities with the enforcement of the provincial New Clean Air Regulations Act in 1989.[37] The community waste sites contain a variety of waste materials including; plastics, wood, paper, cardboard, tires, and electronics. Open air trash burning is known to create conditions for incomplete combustion[26] and, as a result, a complex mixture of substances can be released to air for potential inhalation. Carbon monoxide, carbon dioxide, and nitrogen oxides represent the largest portion of pollutants emitted from open trash burning.[26,38]However, other chemicals such as; benzene, styrene, formaldehyde, polychlorinated dibenzodioxins (PCDDs; also known as dioxins), polychlorinated biphenyls (PCBs), polychlorinated dibenzofurans (PCDFs; also known as furans), and heavy metals (lead, mercury and arsenic) have been detected in smoke produced through the incineration of waste materials.[38–40]

Open air burning was conducted in two of the three communities. This practice was carried out mainly due to the small size and limited capacity of the current community dump sites. All Elders were dissatisfied with the practice of open air trash burning in their communities. Elders demonstrated concern for community members living in close proximity to the community dump and spoke of potential risks to their health, the health of their children and the air quality in their communities in relation to this practice of waste disposal.

For example as one Elder stated:

*Everything gets dumped there. The worst part of it is they burn that and all that smoke gets into our little village. We have to shut all our windows. My little grandchildren are playing outside and inhale everything. And we got sick. They burn the garbage twice a week- Monday and Thursday.*

Another Elder expressed great concern over the impacts to the ambient air quality in their community as a result of burning tires at the community dump site.

The Elder commented:

*No [I don't notice any smells from the garbage dump], but the only thing I don't like seeing burnt is tires. There's a thing in those tires, they come and it goes all over. Travels with the air, I figure. And that's not very good. That's the same thing as you have your car running in the garage. That's the way I think those tires. And maybe there is a lot of other things there that we don't like [being burnt]*.

The burning of refuse helps to minimize the build-up of materials in the community dump sites; however, as a number of respondents pointed out, the smoke is a nuisance, and they are concerned with the possible impacts to ambient air quality, exposures to airborne contaminants and the impacts to the health of their children and community members as a result of these airborne exposures.

All participating Elders noted that past and present dump site locations were an environmental issue. Elders expressed concern over the potential contamination of local lakes and rivers in their communities through run-off from the community dump site.

For example as two Elder's acknowledged:

*There's a lake by the garbage dump too. And some of these lakes, you know, they have a stream going from lake to lake or creek and that can carry that disease right down to where we get our water.*

*So what would be stopping that there after they burn that, melts the plastic, big rain comes. Well naturally it's got to go someplace. I can see your point there.*

It is not surprising that ground and surface water pollution was an environmental concern for the Elders of these communities. First Nations waste sites in general, are not built with engineered liners, leachate collection systems, and a site selection process, based on sound geological information, is not completed. For example; one of the current operational community dumpsites, was located in an area of silty sandy soils close to a lake.[1]

Elders from all three communities recalled that in the past, a major staple of their diet was fish. However, Elder's indicated that members in the community, including themselves, no longer eat fish locally caught in their communities. This change in fish consumption behaviour was mainly attributed to the perception that the lakes, rivers and fish are contaminated. Elders noted, through visual observations, that fish health,

appearance and meat quality have declined over the years. Two participating Elder's views on this discussion point were articulated as follows:

*Well people do fish around here but I don't think anyone eats them. There's too much contamination. The fish don't even look good to me. Not like they used to anyway.*

*You could go down to the river anytime and go and catch a few fish, you know, for a meal. But now I wouldn't even eat them. And when you cook them, they fall apart.*

Elder's comments indicate that point source contamination of community water and fish supplies are considerable concerns in their communities.

### Recommendations for future waste management practices

Throughout discussions on waste disposal practices, Elders provided recommendations to improve current waste management practices in their communities. Their suggestions concentrated on two main areas of waste disposal; segregation and recycling. They pointed out for example that, separating garbage at home into recyclable, compostable, and toxic materials would be important steps in decreasing the amount of garbage sent to the community waste site.

*There is all kinds of ways that we would cut down on the amount that's going into the landfill.*

*One thing we could do to help is ah, I know I would have a hard time with it, but we get used to things and you start doing them. The garbage should be sorted at home and then plastics could be recycled … Papers, those can all be recycled.*

*The only thing I can think of right now is what we talked about is some of our disposal, I guess, garbage bins, we call it here. Cardboard boxes, stuff like that. That stuff can be recycled you see- Certainly take a lot less room on [name] truck there."*

Elders indicated that the recycling of plastics, papers and batteries could be introduced as a first step for waste reduction. All Elders were in favor of incorporating recycling at the household and community level. They indicated that special recycling bins could be distributed to individual homes in the community or could be located in designated locations where community members could then drop off their recyclables.

Several Elders noted:

*I think maybe that's what we could use on this reserve here is a place to, maybe even in the village, maybe three or four places where a person could take these recyclable materials, just like a mesh bin or something. Take these paint cans and stuff and throw them in there instead of throwing them anyplace else. And they could be picked up there once in a while.*

*But you see, if we had a recycling bin, all that stuff would be put in there, whatever we don't use, like magazines ... I still say we could use a recycling bin for paper and also for cans. Like paint cans and all that stuff, we could use that.*

Elders recognized that it would take some time to implement segregation and recycling in their communities. However they optimistically indicated that overtime these methods would eventually be accepted and practiced within their communities. As one Elder briefly commented:

*But it would catch on. It would work.*

The Elders from these communities provided several relevant solutions to remedy some of the issues with current waste disposal practices in their communities. Introducing bins for recyclable materials and teaching residents to separate garbage at home are achievable targets that would reduce waste entering the community dump site.

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## Conclusions

Where and how to begin waste management programs is a critical issue for First Nations communities with limited resources. The fundamental problem that faces the management of virtually all solid wastes is they comprise complex mixtures. Comprehensive solid waste management incorporates a diverse range of activities including reduction, recycling, segregation (separation), modification, treatment and disposal—all of which have varying levels of sophistication.

First Nations communities across Canada are not homogenous, have various waste disposal requirements and perhaps in some communities, due to their geographic

locations may not have the opportunities to partner with municipalities. Thus, community-based strategies for solid waste disposal and management may be the best option for First Nations Communities across Canada. Possible strategies of addressing immediate waste management issues could include the adoption of waste reduction, reutilization and recycling activities in these communities. Local government initiatives, public education programs, and federal/provincial support for, and participation in, regional efforts have been highly effective in reducing solid waste through programs aimed at waste reduction, reuse and recycling of waste (3Rs) in off-reserve communities.[41] The creation and introduction of First Nations developed and centered educational programs that promote these waste management strategies could complement and enhance their successful and sustainable implementation in First Nations Communities. Federal and provincial agencies must understand that First Nations communities are restricted in terms of economic capital, constrained in terms of available labour, operational capabilities, and technical expertise. Long-term stable funding should be made available to support the engineered construction of landfills and the human and physical infrastructure required for the technical operation, inspection, monitoring and overall management of these landfills. Adequate infrastructure, education and training for the segregation of hazardous from household waste could also facilitate better waste disposal practices and lead to the cessation of burning waste in both backyard pits and community dump sites thus alleviating the risks to human and environmental health in these communities.

The Public Works Department (PWD) of a First Nations community, or other named group, is typically responsible for community services, and establishes and maintains the community dump site. The PWD seems to be the logical body to take on the main requirement of centralized collection and disposal of solid waste in First Nations communities. However funding allocated to this department for the operation and management of solid waste activities is often diverted to other competing priorities such as water supply, sewage disposal, housing, road repairs and construction. Secured funding for the PWD that is targeted strictly for solid waste management may be a critical step to ensure appropriate solid waste management in these communities. This could be achieved, at least in part, by utilizing Indian and Northern Affairs Canada (INAC) funding provisions through the Capital Assets Management System, and partly by the action of individuals within the communities themselves. Based on concerns for health, safety and the environment, community members could vote and

agree to dedicate funding to the management and monitoring of waste and to meet requirements of a centralized sanitary landfill where there would be daily covering of wastes, secured and controlled access to the site and no open trash burning. These actions may lead to greater separation and segregation of wastes and recycling initiatives. For example communities may agree to arrange for special collections of major items (old appliances, furniture and automobiles) once or twice a year or even the development of a drop-off facility for hazardous wastes.

Regional scale waste disposal may be another option for First Nations Communities. First Nation communities could partner and share the costs of collection, disposal equipment and labour for the operation and management of a regionally centralized waste site. Some First Nations communities have relatively small land bases and geologically, land may not be suited for waste site placement. While other communities may have a larger land base, could serve a larger population and offer a more geologically sound site for waste disposal. Agreements between partnering communities could be arranged to share existing or new collection and compaction trucks, any administration, monitoring, and management costs and revenue from the regional collection of recyclable materials.

To better inform waste management practices, communities could take part in a waste inventory to gain a better understanding of the types and volume of hazardous, household and recyclable wastes generated and the need for, and degree of, segregation, waste reduction and recycling regimes required for these communities. The process of local waste disposal could also be explored to inform waste practices and the initiation of a composing regime to promote waste reduction could be implemented.

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The term “First Nations”, is the common title used in Canada to describe the various societies of indigenous peoples who are accorded status as “Indians” according to the Indian Act (1985), and, who are not of Inuit or Métis descent. The constitutional term applied to all three groups collectively (Indian, Inuit, and Metis) is “Aboriginal”.

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## Footnotes

**Disclosure**

This manuscript has been read and approved by all authors. This paper is unique and is not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers of this paper report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material.

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