Roles and Responsibilities of Alaska Natives 3

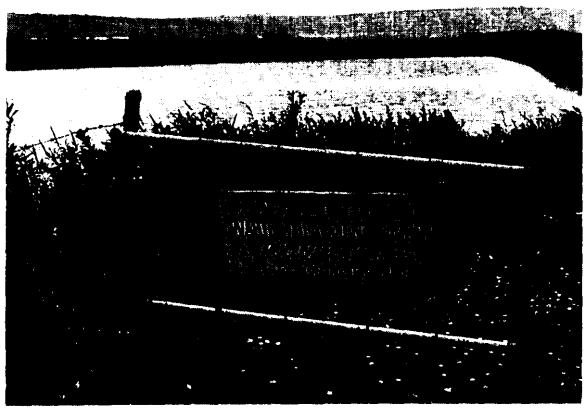
OPERATION AND MAINTENANCE OF EXISTING PIPED SANITATION TECHNOLOGIES

In addition to the harsh climate and geographical constraints typical of the rural Alaska environment, the economic conditions found among Native villagers living in these remote lands also have a direct bearing on the ability of a village to acquire, support, and maintain modern sanitation systems.

The poor economic base in most Native villages in Alaska's southwestern, western, interior, and Arctic regions creates considerable management difficulties for local governments in addressing community needs, including sanitation. Federal and State agencies responsible for building sanitation projects are often forced to recognize these difficulties because sanitation projects require support for operation and maintenance (O&M) at levels that are often beyond the technical and financial capabilities of local villages.

The majority of Native communities in rural Alaska rely almost completely on transfer payments and subsidies to operate basic village programs, including electricity, education, and transportation. Although quantification is difficult, most experts agree that Federal and State subsidies continue to be vital to local village economies.

Because of the extreme economic difficulties experienced by Natives, a subsistence 1ifestyle continues to be the dominant practice in most remote communities. Many personal, social, and cultural values essential to the civilization of Alaskan Native groups are intrinsically embedded in the practice of subsistence living.



Waste collected through piped sewer systems is discharged into sewage lagoons for treatment,

Today, subsistence constitutes a critical continuity with the cultural life of the past.

Several experts and expert groups have recognized that operation and maintenance of existing sanitation projects are vital for protection of the community's health (246). O&M costs are, however, generally high. The shortage of technical assistance from outside agencies and the inadequate training of facility operators contribute to poor O&M. Among the consequences most commonly associated with poor O&M are shortening of the useful life of sanitation projects, system breakdowns, and sometimes, human casualties. Despite insufficient support and capabilities, Native villages continue to be responsible for facility O&M.

The prevalence of disease throughout Alaska is due primarily to a limited potable water supply and the use of inadequate technologies for collecting and disposing of sanitary waste. This has led to an insistent demand for installation of adequate collection and treatment facilities in each Native village.

Even though State and Federal agencies have allocated more than $1.3 billion in the last 30 years (and have been recently spending about $120 million per year), the existing sanitary conditions in many rural Native villages of Alaska indicate that much remains to be done to solve this problem.

Provision of long-term solutions to each community has been the major objective of Federal and State agencies and continues to be so. The most frequent long-term solution is piped sanitation. Attempts to develop and demonstrate short-term or interim promising technologies that might improve sanitary conditions have been limited. Three types of sanitation technologies are used in Alaska: gravity, pressure, and vacuum (see box 3-l).

Although large-scale piped systems continued to be the type of sanitation technology most favored by Federal and State agencies, delivering piped sanitation services takes time and, more importantly, large sums of money for facility construction, operation, and maintenance, which most Native communities now lack. The discussion that follows focuses mainly on the economic health of, and the role played by, Native communities in sanitation projects.

ECONOMIC HEALTH AND CULTURE OF NATIVE VILLAGES

B Role of Subsistence Practices in Village Cost of Living

Subsistence practices among Natives often hide the actual cost of living and economic difficulties of communities, as well as their ability to pay for the construction, maintenance, and operation of new or improved large-scale sanitation projects.

From a distance, cash expenses have traditionally appeared to be the primary means of acquiring food by Native families. A closer look, however, has enabled researchers to conclude more accurately that subsistence practices are as critical to the survival of Natives as food purchased from the local community store. In a 1983 study, subsistence harvests of salmon, for example, were reported to be not only a significant protein source, but also capable of providing up to 55 percent of the food consumed by the average household per year in some localities.

Considerable research on village economics has been carried out since the 1983 study (204). As a result of these efforts, it has been shown that of the regional corporations in Alaska, the Bering

BOX 3-1: Types of Conventional Piped Sanitation Technologies in Rural Alaskan Villages

As of April 1994, gravity piped sewer technology had been Installed in 69 of the 191 Alaskan Native villages identified by the Indian Health Service as needing support for sanitation purposes. Residents of these villages have flush toilets draining to a community collection system that transports human waste to a sewage lagoon for treatment. The majority of communities served by this type of piped sanitation system are found in the Aleutian (8 of 10 villages), Kodiak (all 6 villages), North Pacific Rim (all 4 villages) and Southeast (all 12 villages) regional corporations. All Native villages currently operating gravity sanitation systems are Iisted in appendix C

Installation of gravity piped sanitation technology is generally dependent on an adequate water supply to transport sewage through the system, the absence of groundwater near the surface where it could infiltrate buried pipes, and proper insulation and heating of system components to prevent winter freeze-up. Although aboveground Installation of gravity piped sewage systems may be used when underground pipes are impractical, it is Inferior to underground installation because of its greater potential for experiencing heat loss (sometimes as much as three times that of underground lines), the likelihood of vandalism, and the adverse effect on community aesthetics. [1]

Gravity sewer pipes cannot always be installed in rural Alaska because of the harsh soil conditions, permafrost, rocks, and flat surfaces typical of this State, With the exception of Naknek and Iguigig (Bristol Bay) and Aniak (Yukon -Kuskokwim region), where drinking water is obtained from Individual wells, all of the Native villages with gravity sewer systems in rural Alaska are also served by a piped water delivery system

When local environmental conditions make their installation Impractical, pressure piped technology can be substituted for gravity systems Rather than depending on gravity, this type of conventional sewerage system utilizes the pressure provided by pumps to transport human waste through service collection pipes to the disposal area. The possibillity of building a pressure piped sewer system at Nuiqiut and Point Hope is being examined as part of the Indian Health Service effort to deliver piped water and sewer sanitation services to seven Arctic Slope Regional Corp. villages,

The third type of conventional piped technology used in rural Alaskan Native communities is vacuum sewer technology.[2] In addition to the specialized flush toilet Installed inside the home, the vacuum-type system consists of one or more vacuum collection stations situated in a central location in the community, one or more collection tanks for holding incoming sewage, several vacuum pumps for handling sewage flow or discharging sewage into the community's disposal facility; and a network of small service collection pipes. A separate vacuum tank to provide additional capacity and prevent moisture from reaching the vacuum pumps might also be Installed inside the collection station.

The use of a vacuum Instead of gravity allows considerably smaller collection pipes[3] than those employed in gravity and pressure technologies, thus making the installation of vacuum systems possible on almost any type of terrain, with litttle concern for slope. The use of smaller pipes also provides a greater opportunity for

(continued)

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[1] Collection lines are generally installed deep in the ground, whenever possible, otherwise additional Protective measures 'ust be taken to prohibit excessive surface loads If underground installation is not possible, collection lines are placed on the surface or on pilings CollectIon lines can also be installed in "utilidors" along with other utility pipes

[2] The three major types of vacuum sewer system in use in the United States are 1) the conventional gravity fixture with exterior vacuum valve, in which collection of sewage is accomplished in a sump located outside the home and maintained by the utility authority (the most common type of vacuum system operated in the lower 48 States), 2) the "two-pipe vacuum sewer system, " which requires the use of two municipal collection lines, one for toilet waste and the other for greywater; and 3) the "vacuum toilets and vacuum sumps with greywater valves" in operation m the villages of Noovik and Emmonak, Alaska

[3] Generally between 2 1/2 and 4 inches in diameter

BOX 3-1: Types of Conventional Piped Sanitation Technologies in Rural Alaskan Villages (cont'd)

water conservation, Another advantage of vacuum sewerage systems is their ability to separate blackwater[4] and greywater[5] in the user's home.[6]

Noorvik (Northwest Arctic) and Emmonak (Yukon- Kuskokwim) are the only two Native villages of rural Alaska operating vacuum sewer technology. In Noorvik, the sewage is vacuumed through 2 l/2-inch high-density pipes Inserted in a utilidor[7] into a 7,000-gallon sewage collection tank located within the sanitation facility building. Two discharge pumps are then used to draw sewage out of the tank for disposal through 1,300 feet of 4-inch Insulated sewer force main into a 2.2-acre sewage lagoon for treatment. Heat inside the utilidor is provided by a circulating water distribution system backed up by a glycol heating loop.

Unlike Noorvik's vacuum technology, the vacuum collection pipes and the glycol heating lines of the Emmonak vacuum sewer system are not contained in a utilidor but inside a separate Arctic carrier pipe As a backup heating system, engineers have installed electric thaw cables along the carrier pipe.

The use of the vacuum sewage technology has also been proposed for the City of Selawik in the Northwest Arctic Regional Corp. If sufficient funds are available, two vacuum sewage collection stations[8] WiII be Installed as part of the Memorandum of Agreement between local and Federal Government officials to provide water and sanitation services to the city's nearly 600 residents.[9]

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[4] The term backwater refers to urine, fecal matter, and related debris, such as toilet paper, deposited in a toilet, as well as the water used to transport these materials

[5] Greywater is household wastewater without toilet waste, It consists primarily of discharged water from bathtubs, showers, sinks, and appliances such as washing machines and dishwashers

[6] In communities where this technology has been Installed, separation is accomplished by dividing the single line that provides vacuum service to the home into two lines: one to serve a specially designed vacuum toilet and the other to serve a vacuum greywater valve To dispose of human waste, the user flushes the vacuum toilet, which in turn causes a vacuum interface valve to open and allows the stored raw sewage to enter the vacuum line connecting the toilet to the vacuum system Once collected, the sewage can be pumped through a force main directly to the community's sewage lagoon or to a lift station from which it is pumped to a lagoon

[7] A utilidor is an above-or underground pipe-llke structure des gned to protect the utility services Of the community; it might contain, for example, utility piping (water and sewer pipes), fuel and central heating conduits, and electrical and telephone lines

[8] These vacuum sewer stations will be manufactured by AIRVAC Vacuum Sewer Systems

[9] The agencies acting on behalf of the Federal Government in ths agreement are the Indian Health Service and the U S Environmental Protection Agency

SOURCES Arctic Slope Consulting Group, Inc (ASCG), *Water and Sewer Utilities Master Plan Report for Selawik,* Alaska, prepared for City of Selawik, Alaska, Jan 1992, Canadian Society for Civil Engineering, *Co/d Climate Utility Manual* (Montreal, Canada Beauregard Press Ltd , 1986), John A Olofsson and H P Schroeder, University of Alaska Anchorage, *Sanitation Alternatives For Rural Alaska,* report prepared for the Congressional Office of Technology Assessment, Washington, DC Aug 15, 1993

Straits, Calista, and Nana areas—located in the southwestern, western, and Arctic regions of the State— are the most economically depressed. The virtual absence of any viable economic base in these areas creates considerable management difficulties for local governments in addressing community needs. Similar difficulties are experienced by those responsible for sanitation facilities in the community because such projects require support for operation and maintenance at levels that are often beyond the technical and financial capabilities of local villages. Attempts by Natives to acquire "matching" capital funding from the village have been largely unsuccessful due to the virtual absence of any self-sustaining economic base.

Villages in the Bering Straits, Calista, and the Nana corporations fall well below the overall average income for the 12 regional corporations and below the overall statewide Alaskan average. The Calista Region, for example, ranked last in the average per capita category and next to last in the average median household income category.

Dismal regional economies and generally low per capita income are exacerbated by the high cost of living in rural areas. Although Anchorage is considered a high cost of living area by most economic experts, the cost of living in areas such as the Calista Region is nearly 40 percent higher than that in Anchorage because of their limited accessibility and the increased shipping costs

A recent comparison between the average annual expenditures reported for Calista Regional Corp. villages and their average annual median household income showed a shortfall of up to $255 (204). An obvious conclusion is that these village households operate at a loss or at a near break-even level. Severe winters with increased heating cost and utility bills, and poor subsistence harvests, are known to place Native residents in these communities in a deficit position. For example, the unprecedentedly low salmon harvest reported to Office of Technology Assessment staff during a visit to the City of Buckland in August 1993 was considered a potentially serious economic concern by community leaders. This was primarily because of the uncertainty about how the community would be able to simultaneously make up for the loss and pay for services during the coming winter months.

Throughout the State of Alaska, the level of sewerage service can be linked directly to the annual average per capita income. Of the 223 Native and non-Native village communities surveyed during the 1990 U.S. Census (53), about 100 did not have a flush toilet inside their homes. Of these, 85 villages (89 percent) fell below the average per capita income, indicating that in addition to geotechnical constraints, economic conditions in remote Alaskan villages limit their ability to support and maintain highly complex and costly sanitation projects, once they have been built.

Any additional monthly payments required for improved water and sewer systems may easily overwhelm the residents' ability to meet their basic living expenses. Because of this, it appears imperative that any proposed technological solutions—particularly those that are large scale in nature—to the waste sanitation problems in Native Alaskan communities need to be based on a detailed analysis of the economic health of each village. Only in this way can its ability to sustain the additional costs for such sanitation systems be determined.

1 Transfer Payments and Subsidized Goods and Services

The ability of most native governments of rural Alaskan villages to provide vital goods and services to their residents, including water and sewer sanitation, is extremely limited without adequate external financial support.

Without subsidies of goods and services by Federal and State agencies, Native village communities throughout rural Alaska are unlikely to survive. Subsidies are also key to the success of large-scale waste sanitation projects. Although quantification is almost impossible, annual subsidies are estimated to be in the range of several thousand dollars per capita. This is a fair assumption, according to most experts, since subsidized goods and services cover a wide range of needs including electric power, education, postal freight service, television and telephone, passenger air service, school lunch programs, and several State loan programs, to name a few. Eligibility y for transfer payments from Federal and State agencies is based on the financial needs of a particular community.

Federal and State subsidies are considered vital to the local economy of most villages, particular y in the Bering Straits, Calista, and Nana regional corporations. Other regional corporations in the western, interior, and Arctic areas of Alaska, where similar problems exist, are Ahtna, Arctic Slope, and Doyon. In 1984, for instance, the average per capita income from transfer payments alone was $5,338 for Calista residents. Federal funding of Native health care, education, and a variety of Native social programs is also included in this figure.

The disturbing conclusion drawn by many experts is that the majority of Native communities of rural Alaska rely almost completely on transfer payments and subsidies to operate their programs. Some view per capita income today as a clear re-

suit of direct transfer payments. “Villages are no longer self-sufficient,” said a respected Native leader recently (221). Since sustaining the current level of external financial support appears uncertain in light of recent reductions in State oil revenues and Federal Government contributions, the economic potential of Native communities must be evaluated carefully prior to undertaking any large-scale, costly sanitation projects. The relevance of this consideration cannot be neglected in regional corporations such as Ahtna, Arctic Slope, Bering Straits, Calista, Doyon, and Nana, where at least half of the Native villages operating honey buckets have per capita incomes below the State average.

1 Cultural Importance of Subsistence Among Alaska’s Native Villages

Although Alaskan Native culture has been affectedly outside forces, it is vital for Federal and State agencies to recognize the importance of subsistence as a cultural factor.

Subsistence is critical to the existence of Alaska Natives. From their beginnings as hunter/gatherers, Alaskan Natives have consistently relied on the land as the source of their most basic needs. Additionally, religious and spiritual ties with nature have long been part of Native culture. As influential as Western culture might be today among rural communities, subsistence continues to be an important factor in defining the cultural fabric of most Natives in the State.

On close inspection of the sociocultural conditions in the southwestern, western, interior, and Arctic regions of Alaska, one finds that without exception, subsistence—not merely economically, but also culturally—is the dominant and largely preferred practice in these regions. More than any other factor, subsistence inspires powerful sentiments, represents significant bonds between family and community members, defines domestic roles and personal identity, represents great cultural achievement, provides critical sustenance and commodities, and demonstrates the persistence of Native culture through time and in the face of adverse conditions.

Therefore, the importance of subsistence as a means of both physical and cultural survival cannot be overemphasized. Although fish wheels and modem technology have thrust Alaskan Natives beyond basic subsistence into a partial cash economy, subsistence salmon fishing, for example, still represents a critical continuity with the cultural life of the past. The importance of subsistence also frequently results in conflicts between periodic summer employment (e.g., cash earnings from sanitation construction projects) versus the need to maximize the salmon catch to survive the winter.

With relatively few exceptions, the economic and sociocultural conditions of most villages in rural Alaska represent significant barriers to planning complex sanitation projects. Examples of this can be found in most villages within the Calista Regional Corp., whose lack of a viable economy reflects their potential inability to support new complex sanitation projects satisfactorily. Furthermore, the lessons learned from previous failures indicate clearly the need for better coordination among Federal, State, and Native governments to create the management base necessary within each village to ensure proper O&M of existing projects. Strong local leadership and community support are also essential for ensuring the success of sanitation projects (221). Similarly, serious consideration must be given to the sociocultural patterns of Alaska Natives early and throughout the planning, construction, and operation of sanitation projects.

| Western Influence and Accessibility of Native Communities

The level of accessibility to external organizations and institutions varies among Native villages.

The cultures and people of Alaska areas different as the many types of land areas found throughout the State. The Native people are ancestrally linked to Eskimo, Aleut, and Indian groups. Each of the Native groups inhabits a specific region of Alaska and is historically related to the people of the Russian Far East to some degree. A major por-

tion of the State's non-Native population has migrated from the rest of the United States or other locations and is generally found in urban areas.

The relationship with the Westerner or "white man" has sometimes been considered tolerable at best. Two factors have been cited as being most disruptive to this relationship: the gold rushes that introduced Eskimos to a variety of Western ways, including intermittent economic opportunities, and the introduction of diseases of epidemic proportions that halved the historical Eskimo population by the early 1900s. The impact of epidemics resulted in a dramatic loss of the elderly. Young Natives frequently lacked the knowledge to continue traditional customs and ceremonies. The remaining Native population was further affected by the introduction of family dwelling units, American political institutions, village schools, trading posts, and post offices, which more gradually, but perhaps also more conclusively, altered the Eskimo lifestyle.

The presence of exploitable resources may also determine the degree of Western exposure that a village has experienced. The gold rush era in the late 1800s and early 1900s, for instance, brought sudden and vast exposure of the Yukon River communities to Western culture. However, the exposure of the Kuskokwim communities was less disruptive, primarily because of the absence of large gold finds along the Kuskokwim River. Additionally, early difficulties in navigating the Kuskokwim further delayed exploration and exploitation of limited resources along the river. Consequently, with much later exposure to Westerners, Kuskokwim communities tend to be more traditional and to favor retaining the old ways of life. A comparative overview of Yukon and Kuskokwim River communities is presented in box 3-2.

Although the intrusion of Western culture has met with resentment, Alaska Natives have occasionally welcomed Western social and economic programs. Many Natives believe that the main source of resentment has emerged primarily from being told by outsiders what to do and how to do it, and rarely being included in the development of solutions to local problems—an obviously understandable response to the worsening economic conditions being experienced by villagers. Some attempts by outside institutions to install sanitation systems unilaterally, and then expect village residents to operate and maintain them, have received little acceptance and consequently have failed.

The misapplication and subsequent abandonment of comporting toilets by Fort Yukon and Galena residents appear to indicate that agencies—in this case, the Farmer's Home Administration—need to evaluate in advance how the technology would perform in a particular community (e.g., through pilot tests), as well as involve potential users in the planning and technology selection process. In the view of many, this is essential for maintaining the agency's credibility. Of the many State and Federal institutions involved with Native communities in rural Alaska, the Indian Health Service (IHS) and the Village Safe Water (VSW) program have been the most successful in encouraging and supporting villagers' participation in the planning, design, and construction of projects. This is extremely important because the degree of project success will ultimately depend on the level of commitment of community leaders and residents.

ROLE OF NATIVE COMMUNITIES IN OPERATION AND MAINTENANCE OF SANITATION PROJECTS

Alaska's rural Native villages are responsible for managing their waste sanitation projects but often lack the financial resources needed to ensure their long-term operation on and maintenance.

The hope of some Native leaders is to see a government program that provides "all Alaskan villages with piped water and sewer systems to serve every home within the village" (300). Others, however, recognize that this might in some cases be economically prohibitive, and they call for the development of more affordable sanitation alternatives. Under the current system, villages are given the responsibility for operating, maintain-

BOX 3–2: Comparative Overview of the Yukon and Kuskokwim Communities

There are several major differences between Yukon and Kuskokwim River communities, including economic, social, and cultural factors. Observation indicates that the downstream villages on either river appear to be in more precarious condition than those upstream. Upstream villages tend to be fewer in number and more viable in almost all respects. From a sanitation perspective, upstream communities have greater access to gravel and permeable soil, and experience fewer waste disposal constraints. They are also generally less assimilated and more traditional in outlook.

There are 10 Calista villages along the Yukon, of which 6 have modern sewage disposal systems. The average per capita income for these Yukon River comrnunities is higher than for the Kuskokwim River and coastal communities in the region. In contrast, only 4 of the 20 Calista communities along the Kuskokwim River operate wastewater disposal systems above the honey bucket level. The remaining 16 have the lowest per capita annual income.

The apparently significant variation in level of sewer service between the Kuskokwlm and the Yukon River communities is generally attributed to the geophysical characteristics of the Yukon River. The SOil and drainage characteristics of Yukon River villages are usually signficantly better than those of Kuskokwim River communities. In addition, gravel IS more readily available along the Yukon, making infrastructure improvements easier. The seasonal flooding and erosion potential is also much higher along the Kuskokwim than along the Yukon River. All of these factors favor Yukon villages in the successful provision of improved sanitation systems. Permafrost distribution does not significantly favor either region.

Regarding water quality, none of the 10 villages along the Yukon experience problems with iron, manganese, or arsenic However, 15 of the 20 villages along the Kuskokwim report difficulties with high inorganic levels, especially iron, in their drinking water sources. Among the coastal communities in the Yukon -Kuskokwim Delta, 8 of 16 villages recorded high iron concentrations in their drinking water source. From a cost perspective, compliance with water treatment standards for villages along the Yukon require a smaller capital Investment and lower operation and maintenance costs because of generally higher quality source water,

Water availability cannot be compared accurately because of the subjective interpretation of the term “adequate. ” Adequacy of a water source IS relative to the type of water system installed in a given village and the specific lifestyle of the residents. In general, Yukon River communities are located in an area that is more conducive to cost-effective installation and operation of state-of-the-art piped water and sewer systems.

Socioeconomic Comparison

Historically, the accessibility of a given region to non-Natives has been a major factor in determining the intensity of cultural change, Within the Yukon-Kuskokwlm Delta, Yukon communities, in general, are less traditional than comparable communities on the Kuskokwim River.

Noticeable differences also exist between the average per capita incomes of Yukon and Kuskokwim communities. With Federal and State subsidies identical for both communities, the major difference is attributed to the value of the commercial fishery in each subregion. For a variety of reasons, the Yukon River commercial salmon fishery is larger and more valuable than the Kuskokwim fishery. Prices paid to fishermen are higher along the Yukon than the Kuskokwim, primarily because of well-developed, relatively stable, and more competitive fish processing. Consistently higher value is realized per pound for lower Yukon salmon harvests, compared to similar catches on the Kuskokwim. The Kuskokwim fishery has also been plagued by market instability, the inability of buyers to accept the entire harvest, and an absence of competition among buyers, which have resulted in consistently lower prices.

There IS a significant difference of approximately $800 in annual per capita earnings between Yukon and Kuskokwim communities, For an average household size of 4.9 persons, this translates into a monthly household income of $327 more for Yukon than for Kuskokwim homes. From an income comparison perspective, one might conclude that Yukon households are therefore more financially capable of supporting expenses, Including those associated with municipal infrastructure.

The size of each village should also be considered in terms of operating and maintenance cost dlstribu-hon. Simply stated, a larger village would be more able to distribute its costs over a greater population base than a smaller one, if normal economies of scale in the municipal Infrastructure are assumed.

In summary, Yukon River communities, in general, are more capable of Implementing improved sanitation systems than Kuskokwim villages Geophysical conditions along the Yukon are more conducwe to installing and maintaining improved systems, and the quality of source water is higher,

Overall, this comparison between Yukon and Kuskokwim communities supports several general theories expressed by U.S. Public Health Service and Village Safe Water officials, Village attitudes, coupled with an overall readiness and potential to accept improved sanitation systems, are intangible factors, but correlations seem to exist with villager's attitudes. The economic supportability of sanitation systems and the presence of effective local leadership have often been cited as key criteria in ensuring the long-term success of sanitation projects,

SOURCE John A Olofsson and H P Schroeder, University of Alaska Anchorage, Sanitation *Alternatives for Rural Alaska,* report prepared for the Congressional Off Ice of Technology Assessment, Washington, DC, Aug. 15, 1993

ing, and managing sanitation projects, without the funds needed to hire trained, certified operators capable of ensuring that such projects are safely and properly operated (58). One reason villages feel that they should receive adequate support is that other communities in high-altitude regions are supported with O&M funds by their governments. Alaskan sanitation experts have been made aware of this when attending international conferences held in other high-altitude countries, such as Canada, Denmark, Finland, Russia, and Sweden.

Operation and maintenance were recently recognized by the Governor's Sanitation Task Force as the most vital components for ensuring the long-term success of sanitation projects and protecting the health of Alaska Natives. Unfortunately, most communities lack the funds to pay for adequate maintenance (58). This difficulty sometimes results in shortening the useful life of the system, as well as in breakdowns. Inadequate O&M has also been responsible for some human casualties. For instance in 1992, a malfunctioning pump allowed excess fluoride to enter the Hooper Bay water supply, killing one person and causing many other village residents to be ill (300).

According to the Alaska Native Health Board, the State of Alaska spent about $11 million for equipment repair or replacement at sanitation facilities between 1988 and 1991 (58). Many more sanitation projects are expected to require replacement of their mechanical systems in the near future. Although specific figures are difficult to arrive at, the Governor's Sanitation Task Force estimated that the cost of repairing all existing facilities that are inoperative or operating with difficulty due to equipment malfunction will exceed $750 million (67).

Unfortunately, operation and maintenance costs are generally too high for Native communities to afford. Operation of sewer and water systems in remote villages, generally considered the province of local governments, is typically "in the

The inadequate condition of roads in some villages often results in spillage of human waste during its transportation to disposal sites

red" or technically bankrupt. The scarcity of Federal or State subsidies makes the operation of sanitation systems at village communities challenging (104). In some cases, State subsidies for electric power, heat, and fuel are helpful, but insufficient to meet the high O&M costs typical of rural Alaska which are several times higher than those in major Alaskan cities.

FACTORS THAT HAMPER SUCCESSFUL OPERATION AND MAINTENANCE IN NATIVE COMMUNITIES

Several factors appear to be hampering the successful operation and maintenance of sewerage facilities in Native communities. These include, for example, a shortage of technical assistance from outside agencies and inadequate training of facility operators. Little change is expected in the near future because Federal and State agencies continue to favor the construction of new capital projects with little direct financial support for O&M of existing sanitation systems.

Other relevant factors hampering successful O&M throughout rural Alaska include the following:

Factor 1—The limited ability of remote villages to hire certified and trained personnel can often result in higher O&M costs. Because a large segment of the rural Native population of communities found in the southwestern, western, interior, and Arctic regions of Alaska falls below the national poverty level, only a few villages can afford to hire an operator on a full-time basis. Where this is not possible, the level of oversight is inadequate and responsible for system malfunctions. Because most communities lack the funds to correct such malfunctions, they often wait until system parts are seriously damaged or inoperative, at which time, their repair or replacement costs are considerably higher and even more difficult to afford. According to Willie Thomas, Vice Mayor of Buckland, a village of 300 residents:

> It is difficult to generate jobs. Some people are trying to develop their own skills. Training would be helpful but once investments are made [by the Native village], there would not be any jobs [in the Village] and trained personnel would go somewhere else (238).

Sanitation facility operators are trained in many technical areas, including water chemistry and treatment, vacuum pumps, operational safety and record keeping.

Factor 2—The small size of the community adversely impacts its ability to pay for O&M because of the inability to develop the economies of scale capable of reducing rate of payments or to support the construction of more advanced, and generally more expensive, sanitation projects.

Factor 3—In addition to the poor economy, lack of roads makes it difficult for communities to acquire spare parts and supplies because of the high costs of freight and fuel (70).

Factor 4—The inability of governments of small villages to fund the O&M of sanitation projects often places an increasing number of operation, maintenance, and management responsibili-

ties on a relatively small number of facility operators. This, in turn, makes the protection of residents' health and the success of sanitation projects problematic (64).

Factor 5—Inadequacies of staffing, planning, and accounting in many small rural villages have resulted in equipment and mechanical failures—many of which are premature in nature. In addition, the lack of consistency and uniformity in fee collection practices results in insufficient funds for O&M expenses and operators' salaries.

Factor 6—Most villages find it difficult to fund a public works department or a full-time, certified sewerage operator. Sanitation facilities are often run by part-time operators, and occasionally volunteers, who are often ill-equipped to deal with the challenges posed to sanitation projects by the harsh climatic and environmental conditions typical of rural Alaska (64).

Factor 7—Some local governments have shown little interest in assuming or sharing responsibility for utility management. Thus, problems relating to utilities are often referred to city managers and facility operators (if they exist) or to other individuals, who do not have the authority required to effect corrective policy within the community.

Factor 8—City clerks and administrators are often left with the responsibility of collecting user fees and keeping records of all financial transactions associated with a waste sanitation facility. The lack of support by local governments, along with low salaries and heavy work loads, has contributed to the high rate of city clerk and/or administrator turnover-ften precluding communities from having skilled clerks and administrators and, therefore, well-managed sanitation facilities (70).

Factor 9—The use of computers is widespread, but the knowledge of software and technical support are highly deficient. Computer systems are generally purchased on the basis of cost, with little attention given to the capability of the software, manuals, and training (227). Unfortunately, the high turnover rate of capable village administrators or city clerks does not allow time for personnel familiar with a computer system to train others in its use.

Factor 10-Many local governments lack the leadership and leadership stability required to ensure the success of a project. Unfortunately, among agencies involved with sanitation projects in rural Alaska, the number of programs to deal with community dysfunctionality is extremely limited.

Factor 11—the lack of meaningful participation in the planning, construction, and management phases of waste sanitation projects leads to community frustration. In addition, the lopsided support by Federal and State agencies for construction, rather than for O&M, often leaves a poor perception among community leaders and members that subsequently may lead to the neglect of the facility (70).

FUNDING OF OPERATION AND MAINTENANCE ACTIVITIES

Although Federal and State agencies have programs to provide essential capital funds for repairing existing facilities and building new ones, the funding for proper O&M of sanitation facilities is not traditionally part of any Federal and State plans. It is not rare to find a recently built multimillion-dollar facility in need of preventive maintenance due to lack of proper operation and adequate local financial support.

Recognizing this deficiency, Congress amended the Indian Health Care Improvement Act of 1976[1] by passing the Indian Health Amendments of 1992,2 and authorizing the Indian Health Service (IHS) to provide, for the first time, up to 80 percent of the O&M funding needed by economically deprived Native communities. Villages with fewer than 1,000 residents, which in-

[1] 25 U.S.C. 1601 et seq.

[2] P.L. 102-573; 106 STAT. 4526-4592.

elude all villages operating honey buckets, could obtain additional funding. To date, IHS has not requested any funding for this purpose. IHS officials have found it dificult to clarify the congressional intent as to how to implement the law, particularly the language of the Act indicating that ". . . the non-Federal portion of the costs of operating, managing, and maintaining such facilities may be provided, in part, through cash donations or in kind property, fairly evaluated."[3] Therefore, Native communities have yet to receive this much-needed help. Under one scenario, it was estimated that if funds are authorized, about $15.1 million would be required to implement the 1992 law throughout rural Alaska (122,204,206).

The need to protect public health often forces local officials to implement programs and activities through which revenues can be obtained to pay for the O&M costs of sanitation facilities. Unfortunately, success has been achieved only in those few communities with the best economies and most effective local leadership. To obtain needed O&M funds, the leaders in these communities have: 1) adopted user fee ordinances and disconnection policies; 2) hooked up and charged industrial-type users such as schools, stores, apartment houses, and businesses; and 3) adopted sales taxes (e.g., 1 percent). Once collected, these funds are used to setup reserve accounts to pay for operational costs and defray residential user charges (104).

Unfortunately, most villages in rural Alaska with fewer than 1,000 residents have almost no basic economy (limited fishing, very limited mining, some tourism), their cash flow is extremely low, and their potential for economic improvement in the future is restricted. All Native villages operating honey buckets as their only means of waste sanitation exhibit these characteristics. The absence of trained managers is also evident among many villages. As a consequence, the difficulty in obtaining funds for O&M activities is expected to increase further in the future.

CONCLUSION

The prevalence of certain diseases in Native Alaskan villages is in large part a direct result of a limited potable water supply and the use of inadequate waste disposal technologies such as honey buckets. Federal and State agencies have provided some villages with more adequate technologies such as gravity, pressure, or vacuum piped systems. These are now installed in more than half of the 191 Native villages identified by the Indian Health Service. However, the continuing inadequate sanitary conditions still found among the remaining communities show that much remains to be done to solve this problem.

Unfortunately, delivering piped sanitation systems takes time and, more important, substantial funds that most Native communities now operating honey buckets lack. In addition, the maintenance and operation of sanitation projects in remote villages—generally considered the province of local governments-are typically unfunded and inadequate. In fact, the virtual absence of a viable economic base among these communities creates considerable management difficulties for local governments in addressing sanitation as well as other important community needs, including electricity, education, and transportation. The almost complete reliance on transfer payments and subsidies forces many experts to conclude that without continued Federal and State subsidies, most Native village communities throughout rural Alaska are unlikely to be able to provide minimally safe and effective sanitation for their people.

[3] 106 STAT. 4561.