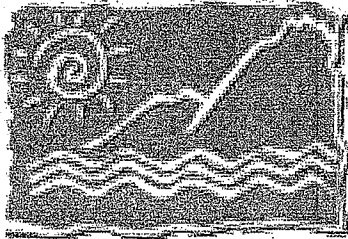


TECHNICAL GUIDANCE DOCUMENT

WASTE
MANAGEMENT



IN INDIAN COUNTRY

FOR

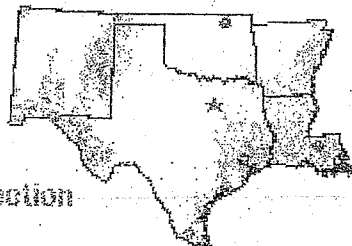
PLANNING AND DESIGN OF A TRANSFER
STATION

IN

INDIAN COUNTRY



United States
Environmental Protection
Agency



REGION 6

Arkansas Louisiana
New Mexico
Oklahoma Texas

TABLE OF CONTENTS

Section	Page
1.0 INTRODUCTION	1
2.0 GENERAL TRANSFER STATION SITING IN INDIAN COUNTRY	1
2.1 Selection of Site Location	1
2.1.1 Siting Criteria	3
2.1.1.1 Regulatory Exclusion Siting Criteria	3
2.1.1.2 Technical Siting Criteria	3
2.1.1.3 Tribal Specific Criteria	5
2.1.2 Tribal Involvement	5
2.1.3 Zoning Designations and Requirements	7
2.1.4 Secure the Best Site	8
2.2 Site Access/Traffic Pattern	8
2.2.1 Central Location to Collection Routes	9
2.2.2 Access to Major Transportation Routes	9
2.2.3 Truck and Traffic Compatibility	9
2.2.4 Sufficient Space for Onsite Roadways, Queuing and Parking	9
2.2.5 Loop Circulation	10
2.2.6 Traffic Circulation	10
2.2.7 Flexibility in Rearranging	10
2.3 Environmental Concerns	10
2.3.1 Site Drainage	10
2.3.2 Water Pollution Control	11
2.3.3 Air Pollution Control and Ventilation	12
2.3.4 Noise Control	13
2.4 Waste Assessment	13
2.4.1 Amount of Waste Generated in the Operational Area	13
2.4.2 Type of Waste Generated	14
2.4.3 Storage of Solid Waste	14
2.5 Transfer Station Add-On	14
2.6 Tribal Requirements/Compliance	14
3.0 FACILITY ENGINEERING DESIGN CONSIDERATIONS	16
3.1 Water, Sewer and Electricity Design	16
3.1.1 Water Supply and Fire Protection	17

Section**Page**

3.1.2	Wastewater	17
3.1.3	Electricity	18
3.2	Roadways Design	18
3.3	Sign and Ramp Design	18
3.2.1	Signs	18
3.2.2	Ramps	19
3.4	Main Building/Transfer Structure Design Features	19
3.4.1	Doors	19
3.4.2	Tipping Floor	20
3.4.3	Trailer Stall	21
3.4.4	Operator's Shelter	21
3.4.5	Site Drainage	21
3.4.6	Site Communication	22
3.5	Transfer Station Equipment	22
3.5.1	Fixed Equipment	22
3.5.1.1	Hopper	22
3.5.1.2	Push Pits	23
3.5.1.3	Bridge Cranes	23
3.5.1.4	Stationary Compactor	23
3.5.1.5	Baler	24
3.5.1.6	Scale	24
3.5.2	Mobile Equipment /Rolling Stock	24
3.5.2.1	Front Loader	24
3.5.2.2	Transfer Trailers	25
3.5.2.3	Tractors	25
3.5.3	Backup Equipment	26
3.5.4	Maintenance shop	26
3.5.5	Safety Equipment	26
3.6	General Site Security	27
4.0	References	28

Disclaimer

The purpose of this document is to address the general planning, design and technical aspects of a Transfer Station Solid Waste Management Facility in Indian Country. This document is solely developed for guidance purposes. Site-specific conditions must be considered while designing a transfer station facility. The execution of an engineering design does, however, involve the judgement of an engineer/designer to ascertain whether a technique or guidance can be applied to a certain situation. Experts in this field should specify the most economical and efficient facility structure, including equipment best suited for the transfer station. This document points out that what technically can be done and how to establish the requirements for the design of a Transfer Station. This document is not a regulation and should not be construed as such. Any comments related to this document should be addressed to:

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1.0 INTRODUCTION

A higher incidence of open dumping and/or illegal disposal of household wastes is mostly related to absence of residential solid waste services in any particular community. This is even more prevalent in Indian Country in Oklahoma and New Mexico. Approximately one third of the high priority open dump sites in the entire nation, as classified by the Indian Health Services (IHS), exist in Oklahoma on Indian lands. To mitigate illegal dumping and to establish a comprehensive solid waste management program in these areas, it is absolutely necessary to provide an alternate waste management program at an affordable rate and at convenient locations.



Roofing shingles dumped on a rural road

A transfer station is very convenient, cost effective and an attractive alternate. A transfer station can range from a simple waste collection container where residents may drop off their household wastes, to a sophisticated facility where waste is collected, compacted and hauled by a tractor trailer to a nearby disposal facility. The transfer station may also include recycling and composting areas. Transfer stations are an increasingly popular option to meet the waste disposal needs of residential communities across the nation.

Due to stringent federal and state regulations, the number of landfills is declining and this trend will continue in the future. Not only can transfer stations be integrated into a community smoothly, but they can preserve and even contribute to an area's unique character. The key, though, to a successful transfer station facility is diligent planning and evaluation of all objectives. Planning, in general, is a process of collection, evaluation and presentation of data relevant to some problem, in this case mitigation of open dumps in Indian Country. There are many factors that must be considered before choosing a location. These factors are discussed in the following sections.

2.0 TRANSFER STATION SITING IN INDIAN COUNTRY

2.1 Selection of a Site Location

One of the principal reasons to use a transfer station is to increase productivity of a pick-up crew and its truck mobility in the collection area. A transfer station should really be near the center of a collection area, convenient to good haul roads and zoned according to local ordinances. As the transfer station is seldom located right at the center of the collection route, each collection vehicle will travel some distance to the transfer station. A site can be at some reasonable distance from the center of the collection area without excessive economic disadvantage. A break-even cost analysis should be performed before finalizing a transfer station site. The transfer station will be economical as long as the combined costs of travel by the waste collection vehicles and the transfer of waste to a disposal facility does not exceed the cost of a direct haul by the collection vehicle to a disposal facility itself. According to the publication (*EPA Waste Transfer Station: A Manual for Decision Making EPA530-D-01-001*), a transfer station is generally cost effective when the round trip distance to a disposal facility exceeds 35 miles. However, this distance may vary depending upon a site-specific data. A site-specific

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<Insert Picture of Transfer Station (depicting spatial relationship of transfer station, access roads, and surrounding environment)>

Most of the Native American population is located in suburban or rural areas. The selection of a suitable location is based on community needs and concerns and is relatively easier to choose than in urban areas. However, site suitability also depends on numerous technical, environmental, economical, social and political criteria. A balance must be achieved among the multiple criteria when selecting a site that might have competing objectives. The site should not be located in a residential area and the site easement holders should always be specified. The location of the transfer station will most likely raise issues with the public, particularly people living or working near the potential site, or who might be affected by odor, truck traffic, noise, etc.

2.1.1 Siting Criteria

All siting criteria must be objective and developed before a potential transfer station site is chosen. The general sets of criteria that are applied during various stages of the siting process should include:

- Regulatory Exclusions;
- Technical; and
- Tribe-Specific Criteria.

2.1.1.1 Regulatory Exclusion Siting Criteria

The exclusionary criteria vary locally, but typically include factors based on local, state, federal or tribal regulations that prohibit or restrict areas available for solid waste facility development. These criteria must include but are not limited to the following:

- Proximity to Airports
- Flood Plains and Wetlands
- Fault and Seismic Impact Zone
- Endangered Species and protected habitats
- Prime Agricultural Land
- Tribal Secret Sites
- Tribal Historical Sites

2.1.1.2 Technical Siting Criteria

Following are the general technical siting criteria that should be considered while choosing a location. The details of technical criteria, including general technical specifications, are provided in Section 3 of this Part.

- **Station Setting:** The site should be large enough to provide space for a main building, storage, scale house, and a maintenance shop. The area required for a transfer station can vary significantly depending on the volume of waste to be transferred, rates at which waste will be delivered, the functions to be carried out at the site, and the types of customers the facility is intended to serve. Typically, three acres could be large enough to serve a small tribal community, however, there should be enough space for future expansion.
- **Ability for Expansion:** When selecting a site, consider the potential for an increase in the daily tonnage of waste that the facility will be required to manage, or for added processing capabilities for recycling, composting and diversion of the waste. It is frequently less expensive to expand an existing transfer station than to develop a new site, due to the ability to use existing staff, utility connections, traffic control systems, office space, and maintenance buildings. A transfer station should be sited in an area that is conducive to recycling or composting activities, and should be designed to enable residents and businesses to drop-off recyclables and yard waste

- in addition to trash.
- **Buffer Space:** To mitigate the facility's impact on the surrounding community, a transfer station should be located in an area that provides separation from sensitive adjoining land uses such as residences. Buffers can be natural or constructed and can take many forms, such as tree lines, fences, sound walls, berms, and landscaping.
- **Site Topography:** Typically, transfer stations are multilevel buildings and need to have vehicle access at several levels.
 1. Flat sites would need to have ramps or bridges constructed to allow vehicle access to upper levels, or may require areas to be excavated to allow access to lower levels.
 2. Moderately sloping terrain can use the topographic advantage, allowing access to the upper levels from the higher parts of the natural terrain and access to lower levels from the lower parts.
 3. Steep slopes might require extra cost associated with earth work and retaining walls.

2.1.1.3 Tribe-Specific Criteria

Community-specific criterion is developed by the tribal community in order to incorporate its social and cultural factors. Examples of these criteria include, but are not limited, to the following:

- Impact on the local tribal infrastructure;
- Impact on historic or cultural features
- Adjacent land uses, including other environmental stressors that might already exist;
- Proximity to schools;
- Proximity to churches;
- Proximity to burial ground;
- Proximity to parks and recreation areas;
- Prevailing winds;
- Proximity to residences;
- Number of residences impacted;
- Impacts on existing businesses;
- Presence of natural buffers;
- Buffer zones and screening measures
- Expansion capability;
- Traffic compatibility

2.1.2 Tribe Involvement

Tribal council and other community participation should be integral components of planning a transfer station. The tribal members must be legitimate partners in the facility-siting

process in order to integrate community needs and concerns. The tribal members also have the ability to influence the decision-making process. Integrating public input is essential to building integrity and instituting good communications with the community. Establishing credibility and trust with the tribal community is equally as important as addressing environmental, social, and economic concerns about the solid waste facility. The following are some general guidelines for developing and implementing a siting process that is open and integrates meaningful public input.

The first step in the site selection process involves working with the tribal council to establish a siting committee. The committee's main responsibility includes developing criteria to identify potential sites and to evaluate those sites. The committee should be made up of key individuals who represent various stakeholder interests. These stakeholders might include, but are not limited to:

- Tribal Community members
- Tribal Environmental Departments
- Consortia (POEP and ITEC)
- Tribal elected officials (Tribal Governors, Council members etc.)
- Academic institutions
- Federal Agencies (EPA, IHS, BIA, ETC.)

Committee members should be selected especially to ensure representation from the area that the transfer station is intended to serve. Volunteer participation should also be solicited. The meeting times and dates must be planned and scheduled to facilitate attendance by all committee members and other members of the public. Therefore, meeting schedules should avoid conflicts with other major community, cultural, or religious events. In order to encourage active public participation, meetings should be prominently advertised in a timely manner in the local area and held in facilities that are easily accessible. A facilitator should be appointed to keep the meetings focused, to minimize the potential for certain individuals or interest groups to dominate the process, and to encourage active participation by all stakeholders throughout the process.

Individual duties, group responsibilities, and process issues must be established during the first meeting. Expectations and limitations of the committee need to be clearly communicated, which might also be summarized in mission statements. After establishing general procedures, the next step involves educating the committee to further ensure equal participation and means of influencing the decision-making process. Committee members should understand the reasons why a transfer station is needed and the role the facility plays within the solid waste management system. In addition, committee members must be educated with respect to the numerous technical, environmental, and economic aspects associated with siting, designing, and operating of a transfer station, so that siting criteria developed by the committee will result in identifying potential sites that are feasible from engineering and operational perspectives, as well as acceptable to the public. To maximize participation, the process should:

- Give everyone on the committee a chance to be actively involved;

- Allow the committee to remove the selected facilitator, if concerns about objectivity exist;
- Encourage members to discuss relevant concerns and to raise freely questions or objections. Criticisms or challenges should be directed toward the issues;
- the facilitator should swiftly mitigate personal criticisms;
- Agree on a means to resolve disagreements before they arise;
- Provide members the opportunity to discuss the results of each meeting with their constituents;
- Provide technical experts to educate participants; and
- Distribute informational literature before meetings about upcoming issues.

When initiating a siting process, education must be extended beyond the siting committee to include a community-wide outreach initiative. Components of this type of public outreach typically include:

- Special community meetings;
- Internet sites;
- Informational literature;
- Direct mail with project updates;
- Presentations to tribal members;
- Community education programs and workshops; and
- Reading material located in public libraries or community centers that document the process.

2.1.3 Zoning Designations and Requirements

A transfer station is frequently classified as industrial or commercial use, which limits its siting to areas zoned for industry. If local zoning ordinances are so restrictive so that they disallow facility siting outside preestablished industrial zones, substantial engineering and architectural design must be incorporated into the facility in order to minimize impacts on the surrounding communities. In rural areas, equally on Indian lands, this may not be an issue due to small communities and availability of land.

2.1.4 Secure the Best Site

Once all criteria have been agreed upon and issues addressed, it is time to narrow down all applicable sites. It must be noted that despite best efforts, no site is a perfect site. Every site has some shortcomings that must be addressed. Once unsuitable areas are eliminated, the potential sites should be ranked considering all criteria. The top two to four sites should undergo rigorous analysis to determine each site's technical feasibility, degree of compliance with the environmental regulations and tribal objectives.

The exclusionary criteria can be plotted on maps, which helps the committee visualize where the facility cannot be sited due to local, tribal, state or any other requirements. Plotting of maps could be facilitated with Geographic Information Systems (GIS) software, which is available to all tribes via consortia (AIPC/POEP and ITEC/OES). The GIS is a software capable of assembling, storing, manipulating, and displaying geographically referenced information that could be of value for siting solid waste facilities (such as transfer stations) because positive attributes and exclusionary criteria can be entered into the system and overlaid on municipal maps that show these variables in relation to infrastructure and housing patterns. After the data is entered, each positive attribute or exclusionary criteria can be layered on top of the municipal maps, and on top of each other, to narrow down potential acceptable site locations.

2.2 SITE ACCESS/TRAFFIC PATTERN

The site should be accessible from good haul roads in all weather conditions without creating interference with normal traffic flow. Details of site roads, traffic control and pattern are discussed in Section 3 of this part. The roads leading to the site are as important as the roads designed to smoothly handle the flow of the traffic within the facility itself. The roads leading to the transfer station must handle increase in the traffic volume without causing a bottleneck for the local traffic. A traffic survey of primary access roads to the facility should be conducted to assess the potential impact on the existing traffic flow. The traffic inside the station must flow smooth. The lanes must not cross each other and cause traffic backup on both sides and on the surrounding streets. The following listed criteria should be addressed.

2.2.1 Central Location to Collection Routes

To maximize waste collection efficiency, transfer stations should be located centrally to waste collection routes. As a rule of thumb, in order to maximize collection efficiency, any far end of the collection route should not be further than 10 miles. Beyond that distance, collection

routes might need to be altered to enable the refuse to be collected and deposited at the transfer station within one operating shift.

2.2.2 Access to Major Transportation Routes

Transfer stations should be located in an area with efficient highway, rail, or barge access systems in order to minimize impacts of vehicular traffic on neighboring land uses. The transfer station should be located so as to have direct and convenient access to truck routes, major arterial and highway systems (or rail or barge access, if appropriate). It is preferable to avoid routing traffic through residential areas since traffic generated by the transfer station may contribute to congestion; increased air emissions, noise, wear and tear on roads and litter problems.

2.2.3 Truck and Traffic Compatibility

Transfer stations often receive surges of traffic when collection vehicles have finished their routes. This varies locally, but peak traffic flows often occur near the middle of the day. The best sites for transfer stations, therefore, are those located away from areas that have midday traffic peaks and/or school bus and pedestrian traffic.

2.2.4 Sufficient Space for Onsite Roadways, Queuing, and Parking

Transfer stations typically have onsite roadways to move vehicles around various parts of the site. Waste collection trucks could be up to 40 feet long. Transfer trailers that move waste to a disposal facility are typically 50 to 70 feet long. These long vehicles need wide roadways with gradual slopes and curves in order to maneuver efficiently and safely. Also, space at the site will be needed for parking of transfer vehicles and to allow queuing for incoming and outgoing traffic without backing up onto public roads.

2.2.5 Loop Circulation

Use a loop circulation system as the fundamental site organization device. It provides a basic framework for the site layout. It also produces flexibility in the event of program changes. This is often the secret of routing visitor traffic to the office area. If the loop does not organize the scheme, go to another arrangement. Remember that a loop always has a knot or constriction

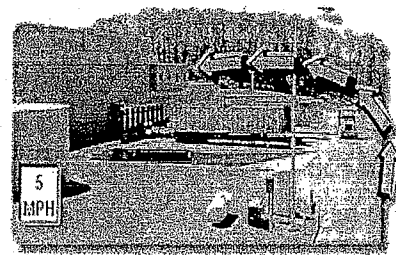
in it. This knot is always at the entrance to the facility. How constricting it is depends on how the traffic flows through it and what obstacles are placed near the knot.

2.2.6 Traffic Circulation

A counter-clockwise traffic circulation is desirable. It is usually easier to turn left due to driving control being on the left side and better vision to the left. Obstacles are slightly closer and the edge of the pavement and the side of a vehicle can be seen plus it is easier to backup on the driver side than right side where vision is impaired. Gatehouse transactions occur on the driver side. However, right turns are usually safer in conventional traffic situations.

2.2.7 Flexibility in rearranging

If a particular function is causing grid lock in the traffic, consider housing it in the satellite building. Moving recycling items and/or wood waste functions to a different building in a particular station could be beneficial. Making a loop work is not too hard until you have to route the traffic out through the gatehouse. Be flexible to relocate the scale to accomplish a smooth traffic flow within the facility.



2.3 ENVIRONMENTAL CONCERNS

2.3.1 Site Drainage

Surface water flows from roofs, roads, parking areas, and landscaped areas at a transfer station, eventually reaching natural or man-made surface water drainage systems. Run-off also percolates into the groundwater. Keeping surface water free of contamination from waste, mud, fuel and oil that drip from vehicles is important in maintaining the quality of both the surface and ground water. A transfer station typically results in an addition of new impervious surfaces (paving over) that increase the total quantity of run-off and can contribute to the potential for flooding. Surface run off must conform with all regulations at which the station is located. In addition, water quality requirements may involve:

- De-silting facilities (an on-site pond before release);

- Biofiltration to remove contaminants;
- pH adjustment;
- Oil/water separator (under flow dams etc.); and
- Other forms of pretreatment.

Minimizing impervious areas and maximizing landscape and vegetative cover areas will reduce the total surface run-off. Waste handling areas must be covered. In addition, ensure that run-off from waste receiving and processing areas drain into the sanitary sewer system for proper treatment, if allowed by the local ordinance. In rural areas and other areas not served by a sanitary sewer system, it is common to connect building drains to underground holding tanks. The tanks are pumped as needed and the leachate is trucked to a sewage treatment plant or other approved waste liquid processing facility.

2.3.2 Water Pollution Control

Transfer station design should ensure that contaminated water generated from waste contact is collected separately and not discharged on-site. Transfer operations that relate primarily to water quality issues include:

- Restricting all waste handling to covered areas that are designed to drain into sanitary sewer facilities;
- Maintaining all surface water management facilities in good operating condition, including periodic cleaning and removal of silt and debris from drainage structures and ponds as well as removing collected oil from the oil-water separators;
- Responding promptly to exterior spills to prevent this material from entering into surface water system;
- Removing on-site liquid spills such as oils, paints, and pesticides with an absorbent material rather than hosing it into drains. Although these liquids are generally prohibited at transfer stations, they might find their way into the waste stream in small quantities; and
- Removing as much debris from the tipping floor by mechanical means (such as scraping or sweeping) as possible before hosing down the tipping floor.

2.3.3 Air Pollution Control

Tipping areas can often have localized air quality problems (dust and odor) that can constitute a safety and /or a health hazard. Dust can be particularly troublesome, especially where dusty, dry commercial loads are tipped. As in noise control and reduction, there are also limited design measures available to cope with air quality issues. The following are suggested methods that could be implemented to lessen the effect.

- Water-based dust suppression misting or spray systems can be used to "knock down" dust. Different types of systems are available, typically involving a piping system with an array of nozzles aimed to deliver a fine spray to the area where dust is most likely to be generated (e.g., over the surge pit). These systems are actuated by station staff "on demand" when dust is being generated.
- Use of handheld hoses to wet down the waste, typically in a pit, where it is being moved or processed. Designers need to consider using convenient reel-mount hoses for this purpose.
- On a limited basis, ventilation systems can provide some measure of air quality control inside enclosed transfer buildings. Since these structures generally require high roofs and large floor areas, it is usually impractical to develop the air velocities needed to entrain dust particles. The most practical approach is to concentrate the fans and air removal equipment above the dustiest and most odor-prone area so that there is a positive flow of air from cleaner areas. This approach will usually give the customer area some measure of protection.

The following general operating practices should be considered that may reduce air emissions:

- Maintaining engines in proper operating condition by performing routine tuneups;
- Considering the purchase of newer-generation low-emission diesel engines;
- Minimizing idling of equipment including engines shut off when not in use;
- Keeping truck bodies and tires clean to reduce tracking of dirt onto streets;
- Keeping paved surfaces clean;
- Coordinating with hauling companies to minimize the number of dusty loads that are allowed at the transfer station at anyone time (i.e., staggering the deliveries) and insuring that these types of loads are delivered in closed or covered vehicles; and
- Ensuring that street sweeping operations use sufficient water to avoid kicking up dust.

2.3.4 Noise Control

In Indian country the site location may not demand much noise control. However, because of typical noise levels, customers might not hear instructions or warnings from station operators or from other customers, and might not hear the noise from an unseen approaching hazard. Based on a transfer station size and operations, high noise levels could come from heavy equipment, increased truck traffic, unloading of waste or recyclables onto a tipping floor or into a pit. A steel drop box or trailer can also create substantial noise, as can stationary compactors. Fall distance and surface material render an effect. Good facility design can help reduce noise that could include maximizing the utility of perimeter site buffers, particularly along site boundaries with sensitive adjoining properties. Providing natural or man-made barriers are the most effective ways of reducing noise when the sound generation level cannot be reduced. A designer must consider noise reduction material to minimize noise effects on the overall operations of the transfer stations.

2.4 WASTE ASSESSMENT

2.4.1 Amount of Waste Generated in the Operational Area

Due to the general lack of residential waste management services in Indian country, it might be a challenge to calculate the amount of waste generated in any particular area of consideration. Therefore, a survey of actual waste collection could be necessary in order to determine the quantity and type of waste generated in the receiving area. Another study, which will be necessary, is a projection of waste based on a growth pattern for the community or for industry, whichever is necessary. The transfer station should be designed to handle 20-year growth and have the potential for easy expansion as specified earlier.

2.4.2 Type of Waste Generated

All types of waste, including wastes to be excluded, need to be specified. As mentioned in a previous paragraph, a survey of actual waste collection may be necessary to determine the type of waste generated in the receiving area. An area growth pattern is also very important to the type estimate and amount of waste generated. If the projected growth is commercial, then the types of support industry that will be built should also be assessed.

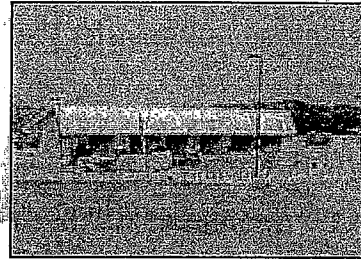
2.4.3 Storage of Solid Waste

The waste-storage time at the facility should be as low as practically possible. As soon as a waste receiving trailer is full, it should quickly be transported to the receiving landfill or waste processing facility. However, in small receiving areas, it may not be economical to transport waste everyday, as the trailer may be only partially full. In any event, the waste should not be stored more than 48 hours at the transfer facility as odor/ vector must be controlled to protect human health and the environment. The waste should be covered and house-keeping be maintained during all hours of storage.

Waste Recycling/Segregation
Area

2.5 TRANSFER STATION ADD-ON

Municipal solid waste is accepted and transferred to the disposal facility at a transfer station. However, it should be specified in the plan as to what else will be processed at the transfer station. Other activities may include recycling and composting of yard and food waste. Recycling of materials could include tires, clothing, yard waste asphalt, plastic, furniture, paper, glass, aluminum, batteries, waste oil/lubricants, etc. To handle and process on-site recycling, additional equipment and waste processing space will be required. Therefore, any additional activities to be performed at a given transfer station must be planned and agreed upon during the siting, planning and designing phase.



2.6 TRIBAL REQUIREMENTS/COMPLIANCE

Tribal government requirements must be fulfilled before registration of a solid waste transfer station. All information required to process an application must be provided to the tribal council and to appropriate federal agencies (if applicable), including but not limited to the following:

- A site plan;
- Description of the collection, transfer, treatment or disposal of waste from the facility;
- Frequency of collection, removal and final destination of waste;
- Special operational procedures;
- Copy of applicable regulations; and

- Any other information requested to process the application (facility closure and financial assurance plan, operator certification, etc.).

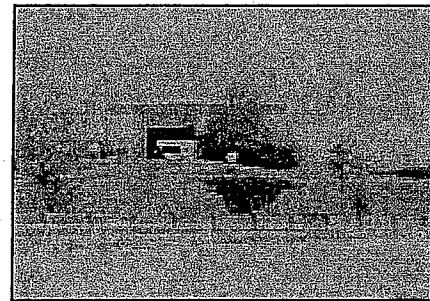
The details of tribal and other regulatory compliance review of an application is provided in Part II (C) of this document.

3.0 FACILITY ENGINEERING DESIGN CONSIDERATIONS

A solid waste transfer station can be classified as a small, medium or large facility, based on the quantity of waste processed by the station in any given day. However, the station may also be broadly classified into one of three main categories, based on the method of waste handling at the facility. These broad categories are given below:

1. Direct waste-loading from collection vehicles to transfer-trailers without compaction;
2. Waste collection pits to collect waste and then load into transfer trailers via a compactor. The waste is pushed into a compaction compartment by a front end loader and then compacted; and
3. A hopper to collect waste:
 - i) waste is dumped directly from the collection vehicles into a hopper. A hopper is connected to a stationary compactor and then waste is compacted and loaded into transfer trailers; or
 - ii) Waste is dumped onto a collection floor and then a front loader is used to push the waste into a hopper for further processing as described above.

A typical transfer station engineering design guidance is provided in this section. It should be noted that the design criteria provided in this section are for guidance purposes only. A site-specific design will be developed by the operator/owner for the site-specific conditions, conforming to tribal and local ordinances as applicable. The plans and specifications should be prepared accordingly. The execution of an engineering design, however, involves the judgement of an engineer/designer to ascertain whether a technique or guidance can be applied to a certain situation. These experts should specify the most economical and efficient facility structures including equipment best suited for a specific transfer station.



View of Main Buildings above is small Transfer Station and

3.1 Water, Sewer and Electricity Design

Potable and flushing waters are necessities at any waste-transfer facility design for

maintaining good house-keeping and personal hygiene. The generic guidelines are provided in the following subsections.

3.1.1 Water Supply and Fire Protection

The water supply should have a minimum delivery rate of 100 gallons per minute (gpm) while maintaining a pressure ranging from 60 to 80 pounds per square inch (psi).

- A fire hydrant within close proximity to the facility should be available. The fire protection system, consisting of water outlets at critical locations, must be designed.
- A sprinkler/spray system and fire hoses should be provided at each unloading area.
- Ionization-type smoke detectors and fire extinguishers (Type A, B and C) should be installed at each unloading station.
- The fire protection system should include an audible alarm that would alert site personnel of any emergency situation at any time.

3.1.2 Wastewater

Most transfer stations discharge some amount of wastewater to sanitary sewer systems. This wastewater usually originates from daily cleaning of the waste handling areas (tipping floor, leakage from compactor and waste pits, etc.) as well as wastewater from facility restrooms. Sanitation facilities for site personnel and other accessing the station must be provided.

- The local Publically Owned Treatment Works (POTW) establish guidelines for discharge into the sanitary system. To comply with POTW standards, transfer stations must pre-treat wastewater that comes into contact with waste before its release into the sanitary system.
 - Pretreatment methods may include silt setting ponds, oil/water separators or other treatments.
 - The waste handling and storage areas must be covered so that rainfall does not contribute to leachate on order to minimize discharge from the station.
- In rural areas where a public sanitary system is not available, a septic system/portable tanker may be used to collect the leachate and sanitary water from the restrooms.

3.1.3 Electricity

Transfer stations will require electricity to operate equipment, such as balers, chipper/mulcher, compactors and general lighting of the site. Consequently, a potential site should have nearby existing utility hookups or have the ability to get connected in a cost efficient manner. Three phase electricity will be required to operate much of the equipment at the facility.

3.2 ROADWAYS DESIGN

The facility roadways should be designed to handle all weather conditions and could be constructed of asphaltic concrete, Portland cement concrete or all-weather gravel.

- All one-way roadways should have a minimum width of 12 feet. Two-way roadways should have a minimum width of 20 feet plus appropriate side shoulders.
- The roadways should be designed to support heavy-vehicle loads. Base and sub-base material should be compacted to achieve a field density that will support heavy vehicular activities.
- Maximum grades should be approximately 8%. But, if circumstances require more grade, an absolute maximum grade must not exceed 10%. If conditions permit, it is preferable to maintain a grade of 6% or less.
- There should be enough parking space for site personnel, public visitors and transfer station vehicles. Usually five to six standard car parking spaces are enough for general parking. The transfer station vehicle parking spaces are dependent upon the number of vehicles utilized by the facility.

3.3 SIGN AND RAMP DESIGN

3.3.1 Signs

Proper signs must be installed at all appropriate places in order to facilitate safe transfer operations. This includes stop, directional, caution/safety, office, scale platform, etc signs. The facility speed limit should be clearly posted. A main facility sign near the entrance gate, which displays facility information such as name, address, hours of operations, emergency telephone number and facility permit number, should be installed. All the signs should meet minimum

applicable DOT/tribal standards.

3.3.2 Ramps

Ramps should extend at least 100 feet beyond the door. In case semi-trailers are permitted to carry waste, the ramps should be a minimum of 150 feet beyond the building. The construction of retaining walls would be required to construct ramps for unloading waste and facilitating waste handling. Depending on the topography, ramps could be on raised areas or trailer loading area could be excavated. The elevation difference between tipping floor and trailer loading should be at least 16 feet. This height can vary and should be specified by the engineer. Retaining wall design and backfill will be site-specific.

3.4 MAIN BUILDING/TRANSFER STRUCTURE DESIGN FEATURES

A functional attractive building should be designed and constructed for transfer stations. The building should enhance visual harmony with the surrounding areas. Open or partially-enclosed buildings should be avoided due to potential dust, noise, disease vector and debris control issues. Therefore, the main building should be enclosed. The following factors should be considered while designing various components of the main structure.

3.4.1 Doors

In general, the building should be tall enough to accommodate 16-foot high vehicles. However, if gravity discharge vehicles are to be used to deliver waste, 24-foot tall door opening will be required to ensure enough clearance for those drivers who may leave the building with their beds in upright position.

- i) Motorized and overhead doors are always preferable.
- ii) The doors should be protected by pipe guards, which are typically 6-inch in diameter, filled with concrete and buried in the ground to a depth of at least four feet.
- iii) The roof of the structure should be high enough to provide ample clearance for gravity discharge vehicles with their body lifted.

3.4.1 Tipping Floor

The tipping floor is that portion of the structure where collection vehicles unload collected waste. It must be long enough to shelter the unloading crew and the width of the floor should be designed to accommodate the number of unloading vehicles expected during peak hours of operation on an average day. Rule of thumb, the floor should be 2 to 2.5 times the load carrying capacity of an average hourly number of vehicles expected on an average day. Average automatic unloading vehicles may take five to seven minutes from entry to exit while manually unloading of a vehicle may take from 15 to 30 minutes.

- The tipping floor should be constructed of concrete in order to sustain heavy truck loads. This floor should be obstruction free, that includes load-bearing columns of the main structure, for backing-up trucks. A stopper is required at the end of the floor just before the hopper or open drop.
- A minimum of 40 to 50 feet distance must be maintained from an open drop/stopper to the door of the building.
- Sufficient room will be required at those facilities where trucks dump the waste directly on the floor during peak hours and waste is pushed into transporting trailers by front loader or cranes.

2.4.3 Trailer Stall

Transfer trailer stall/tunnel is the general area where a trailer is pulled into a loading spot that may be coupled with a stationary compactor. These stalls should be at least 16 feet wide, 16 feet high and deep enough to accommodate compactor and trailer. In addition, a stair-case should be provided to the tipping floor. Lighting must be adequate to perform transfer station operations and to provide security measures at night.

3.4.4 Operator's Shelter

Transfer station operators' shelter (located near waste dump area) should be air conditioned and also a minimum of six air changes per hour in the tipping floor and waste pit areas is recommended.

- In a cold climate, a minimum temperature of 60° F should be maintained except for the operators shelter, which should be at least 70° F.

- An infrared heater will work well in most cases at the tipping floor area for maintaining desired temperatures during cold weather.

3.4.5 Site Drainage

Run-on and run-off control system should be designed to handle a peak discharge from 24-hour, 25 year storm event or any other stringent criteria required by regulations.

- The tipping floor, pit and leakage/leachate from compactor area should drain into a sanitary sewer. The rest of the site drainage (i.e. not contaminated) should drain into a storm sewer, if it is available in the area.
- The drainage along the facility access road should be maintained by installing a culvert under the entrance road. The culvert must be designed to handle a peak discharge from 24-hour, 25-year rainfall events or any other stringent criteria required by regulations.
- The site drainage system should be designed and constructed to provide adequate protection to all identified water supplies within a specified range as required by local ordinance.

2.4.6 Site communication

Communication plays a vital role in the success of any operation. A good internal communication should always be maintained among all facility personnel, as well as external public communication. Telephone service and an intercom system provide outside and interoffice communication. Hand-held radios could be used to facilitate internal site operations when spread over a wide area, e.g., recycling, composting and waste collections are located at different places.

3.5 TRANSFER STATION EQUIPMENT

Transfer stations require many types of fixed, mobile and back-up equipment. Types of fixed and mobile equipment are specified based upon transfer station type and size of operation. Three to four months worth of fuel supply should be stored for all facility vehicles and other equipment for contingency planning purposes. At least one reservoir refilling of hydraulic oil should also be stored on-site. The hydraulic oil could be stored in 55-gallon drums.

3.5.1. Fixed Equipment

Size of any transfer station is dependent upon the population it will serve and the waste it will receive from all residential and commercial areas. The fixed equipment type and quantity varies with different design. Some stations receive waste into hoppers, hydraulic push pits or bridge cranes unloaded pits while other require collection vehicles to dump onto tipping floor.

3.5.1.1 Hopper

A hopper is a simple loading device where collection vehicles back-up and dump the refuse, which is then emptied by the cycling ram of the compactor. Some stations may require collection vehicles to dump onto the floor where a front loader pushes the waste into the hopper for further processing. The size of hopper and compactor should be selected bases on the waste handling process.

3.5.1.2 Push Pits

Push Pits could be either hydraulically or screw operated. It consists of a push plate that is pushed hydraulically or with the help of a screw. The plate unloads the waste from the pit into a ram of the stationary compactor for further processing.

- The length of hydraulically operated pits will have a maximum of 50 feet lengths while screw driven pits could extend up to 100 feet.
- The rate of refuse feed must be controlled by the station operator.
- Controls for push-plate and compactor will be installed in the operator's room with a clear view of both push pit and ram of the compactor.
- Emergency cut off switches must be located at each discharge location.
- The end wall of the compactor slopes at one to two percent toward the pit to direct all waste into the compactor.

3.5.1.3 Bridge Cranes

Bridge cranes are used in some transfer station to empty the pits. The overhead crane places waste into a hopper that is attached to a stationary compactor.

- The crane is armored with steel rails installed vertically into the concrete.
- The crane is heavy-duty equipped with a minimum of 0.5 cubic yard bucket.

3.5.1.4 Stationary Compactor

Stationary compactors are the part and parcel of compaction-type transfer stations. A stationary compactor is placed on a concrete base on the lower level. The access opening to the transfer trailer must be at least 12 feet wide and 6 feet high. A drain sump should collect any leakage from the trailer during loading operations, and drain into a sanitary sewer system. The characteristics of a stationary compactor should be designed according to facility requirements by an expert in this field.

3.5.1.5 Baler

For processing of recycling material, a baler may be required. A multi-material heavy duty baler should be specified for this operation. In addition, a chipper/mulcher may be required to process wood and yard wastes. The design engineer will specify this equipment according to site-specific waste processing needs.

3.5.1.5 Scale

The scale should be at least 70 feet long and 10 feet wide. An automatic recording, card-operated scale with up to 100,000 lbs. capacity should be considered to facilitate billing/invoicing. However, the size and sophistication of scales could vary with the size of operations. The scale should be equipped with a signaling device so that weighing activities can be expedited. A scale that is capable of weighing without dismounting is preferable. The scale should be located in such a place that ingress and egress will not obstruct any normal facility traffic flow.

3.5.2 Mobile Equipment

Mobile equipment is always specified and procured according to site-specific requirements.

3.5.2.1 Front Loader

A front loader is an essential part of a station where waste is dumped onto the tipping

floor and then is pushed into a hopper by the front loaders. The loader should be fitted with the following:

- A protective shield over the radiator;
- Equipped with rear weights to provide traction. A backhoe, used instead of rear weights, could serve two purposes.
 - First, it will provide weight for traction and
 - Second, it could be used to transfer and compact waste into open trailers;
- Rock-type treads on foam-filled rubber tires to reduce downtime due to tire failure while moving trash; and
- Equipped with standard safety equipment including roll bars, seat belts, and backup warning.

3.5.2.2 Transfer trailers

Transfer trailers receive processed waste from the station and transfer them to a designated landfill. The trailers may or may not be owned by the facility itself. This service could be contracted to an independent waste hauling company. There are basically two types of transfer trailers and semi-trailers: open and enclosed. If the service is conducted by the facility itself, at least one backup trailer must be maintained in the equipment inventory to avoid any interruption in an event of the breakdown. The typical requirements of any vehicle that hauls waste on any highway should be cost efficient, waste must be covered during transportation, comply with highway traffic specifications, vehicle capacity must not exceed highway weight limits, and methods of unloading should be dependable.

The following table provides the general characteristics of open and enclosed trailers, however, the design engineer must specify vehicles according to facility specific needs.

Transfer Trailer General Specifications			
Trailer Type	Typical Loading Capacity (yd ³)	Maximum Compacted Densities (lbs/yd ³)	Remarks
Open	45-130	200 ¹ to 400	Optional Dumping (manual or ejector)
Enclosed	45-75	550 to 800	Self Emptying

NOTE: ¹ non-compacted waste in open trailers

3.5.2.3 Tractor

The number of vehicles required to handle peak-days demand at a typical transfer station varies. Enough transfer trailer tractors will be required to deliver the waste to a designated landfill during an average work day. Note that the productive time during an 8-hour work day is approximately 70 percent. Time should be permitted to allow on-site maneuvering of the trailers for drop-off and pick-up.

3.5.3 Backup Equipment

In an event of equipment failure, the station operator must be prepared to provide alternatives. Mobile equipment, e.g., loaders, semi-tractors could be rented on short notice. However, stationary equipment is difficult to replace quickly. An extra transfer trailer should always be available to deal with this type of situation as part of contingency planning.

3.5.4 Maintenance Shop

The maintenance facility must be designed based on a transfer station size and fleet equipment. A fully equipped (maintenance equipment, spare parts, tools, air compressors, lifts, etc.) on-site maintenance shop should be constructed to minimize down time in an event of equipment failure, and to conduct a routine operational maintenance of processing equipment, transfer and collection equipment. The maintenance program must be designed on a planned preventive maintenance schedule resulting in a systematic inspection of all equipment, which could minimize breakdown events. Some of the advantages of a regular maintenance program are fewer breakdowns, minimum lost time and wages, development of records for future planning and increase in overall work efficiency. In addition, the building itself should be maintained on an as needed base.

3.5.5 Safety Equipment

Site safety equipment needs vary with different types of transfer stations.

- Safety harness at each unloading area will be required at those stations which have pits and hoppers. The harness could be attached to the roof with a rope.
- An emergency ram stop-button must be provided at each unloading location that is equipped with a compactor. Same type of safety measure should be taken for

balers, chippers or mulchers.

- All mobile equipment must be fitted with backup alarms.
- First aid kit should be located near tipping floor and operator's shelter, and at other appropriate places. They should be checked periodically for adequate supplies.

3.6 GENERAL SITE SECURITY

A chain link fence, up to a height of 8 feet, should be installed along the perimeter of the site to prohibit any unauthorized access to the site. The fence should have 12-inch high 45° inclined (outward) barbed wire straps. No unauthorized waste dumping and/or public access should be permitted at the site. The site entrance must be controlled by a main gate and each vehicle should be logged in and out of the facility. Ample lighting should be installed along the premises and other main building areas to ensure site security.

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