OKLAHOMA COOPERATIVE EXTENSION SERVICE AGEC-881

Solid Waste Transfer Stations for Rural Oklahoma

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Communities can no longer simply go to the country, find a landfill site, and dispose of solid waste. The Resource Conservation and Recovery Act (RCRA) is designed to make landfills safe and environmentally sound, but it also makes it difficult to locate suitable sites and increases capital and operating costs. Landfills are essential for solid waste disposal, but the costs involved make large regional landfills more economical. Solid waste transfer stations offer an alternative for communities that find they can no longer afford their own landfill.

Transfer stations provide a place to transfer solid waste from collection vehicles to larger transfer vehicles that then transport it to a landfill. This process allows collection vehicles to operate more efficiently because transfer vehicles have the capacity to consolidate several collection vehicle loads, thus saving transportation costs for collection vehicle trips to a landfill.

In most cases, there are two factors to consider in establishing a transfer station. One is the cost of the transfer operation vs. the cost of establishing and/or operating a landfill. The other is the cost of the transfer operation vs. the cost of hauling the solid waste to the landfill with the collection vehicle. Knowledge of the daily waste stream for the area to be served will help determine economic feasibility of the transfer station and equipment needed to operate it.

This fact sheet presents information on transfer stations regarding 1) site, building, and equipment needs; 2) permits and fees; and 3) estimated costs of establishing and operating a basic rural transfer station. This information will assist local decision makers in selecting the solid waste disposal alternative most appropriate for their community.

Transfer Station Needs

Site. The transfer station site must be large enough to include a building for collection trucks to enter and unload and outside space for moving and turning both collection and transfer vehicles. If construction and demolition material, white goods (refrigerators, stoves, washers and dryers, etc.), bulky items (furniture, mattresses, etc.), and tires are to be accepted and separated at the transfer station, more space will be needed. A space of from two to five acres should be sufficient for most transfer stations. The site should have perimeter fencing to provide security and restrain loose trash. The gate should be wide enough to permit passage of large collection and hauling vehicles and have a lock for closed times. Landscaping will improve the aesthetics of the site. Easy-to-read signage at the gate and building should describe types of solid waste accepted, hours of operation, and tipping fee structure. (See Figure 1.)

Topography is also important. A sloping site is preferred. A level floor can then be built with a drop-off on one side so that waste material can be dropped into the transfer containers. If a level site is used, a ramp must be built.

Location of the site requires careful consideration. The site will need access to utilities. It should be located on an all-weather road capable of handling heavy trucks, so weather conditions will not limit access to the transfer station. It should be located so that transfer vehicles do not have to go through town on the way to the landfill. Given other constraints, the site should minimize travel distance for the collection and transfer vehicles. Some transfer stations are located on county property formerly used as the dumpsite. Zoning laws and city/county comprehensive plans will also influence the location of the site.

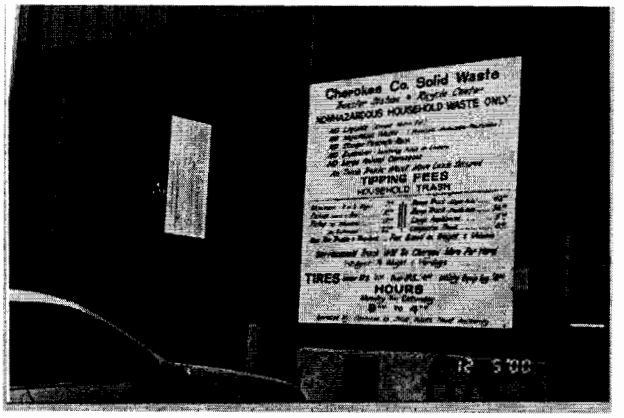

Figure 1.

Building. Size of the transfer station building will depend on the type and volume of waste material to be handled. Future need for expansion must also be considered. At a minimum, the building should be large enough to allow collection vehicles to enter and dump either onto the floor or directly into the transfer vehicle. It is not necessary for the transfer vehicle to be inside. However, a structure extending over the transfer vehicle will keep water from entering the material to be transferred. An enclosed building will prevent weather from interrupting operations and also help contain waste material. Venting and/or a circulation system will help control odors. Space may be provided in the building for an office, restroom, associated transfer equipment, and any vehicles. (See Figure 2.)

If white goods and other bulky items are to be separated at the transfer station, the area where the material is to be dropped into transfer containers may be, but does not have to be, in the building. Inside or outside, this area should be constructed on a sloping lot or a ramp so that these materials may be dropped into transfer containers. Additional turnaround space should be included in the layout of the transfer station for these additional collection containers. (See Figure 3.)

Equipment. A wide variety of equipment is available for solid waste transfer operations. The volume and type of solid waste, regulations, and political or personal choice will influence the type and amount of transfer equipment to be used. There are two common methods of transferring solid waste—with semitrailers and tractors or with large roll-off boxes hauled by a specially built tilting tandem-axle straight truck. The trailers and roll-off boxes can be open-top containers or enclosed compactable containers. Open-top containers may be used to haul any type of solid waste, but are necessary for separating white goods from other bulky items. Oklahoma rules require that open-top containers be covered while in transit.

Figure 2.

Figure 3.

There are several common ways of compacting solid waste into compactable containers. At a minimum, a steel plate attached to the back of a backhoe can be used to tamp solid waste into an open-top transfer trailer. A second option is the use of a stationary compactor. In this case, the solid waste is placed into a hopper and chute directly above or beside the stationary compactor. The compactable container (trailer or roll-off box) is attached to the stationary compactor, and a hydraulic ram compresses the material in the container. When the container is full, it is removed and another put in its place. The material is emptied by gravity from this type of container by tilting the container, or by mechanical devices that move the material out the back of the container.

The third most common method of compacting solid waste is with a self-contained compaction trailer. In this case the collection vehicle dumps its load into the hopper and chute directly over an opening at the front of the compaction trailer. A hydraulic ram in the trailer compacts the material into the back of the trailer. Hydraulic pressure is supplied either by an on- site electric motor and hydraulic pump combined with a hydraulic pump on the tractor, or by a separate motor and pump on the trailer. When the trailer is full, it is removed and an empty trailer is placed in position for loading. The compaction trailer is emptied at the landfill by opening the end of the trailer and pushing the material out with the hydraulic ram.

Open-top containers can be either roll-off boxes or trailers. Trailers can be the type with a simple tilt bed, or those that are unloaded with a special hydraulically operated undulating floor (walking floor) or blade that moves waste out the back. Roll-off containers typically hold up to 10 tons (40-50 cubic yards) of material, and trailers up to 20 tons (80-120 cubic yards). Trailers hauling 20 tons of waste usually weigh approximately 80,000 pounds, which often is the maximum truck weight permitted on highways. State regulations on truck weight may influence the decision to use a tilt bed or undulating floor trailer, both of which weigh less than a trailer with a hydraulic ram. Distance to the disposal site and daily volume of solid waste to be handled will influence the type of transfer equipment chosen.

A self-contained compaction trailer system requires more maintenance and an additional staff person at the transfer station to move materials dumped onto the floor into the compaction trailer. The basic weight of the compaction trailer is greater because of the need for thicker walls and the weight of the ram, motor, and hydraulic system. The additional weight reduces the payload approximately five tons which means less income as each load to the landfill is less than what can be hauled in an open-top compacted system. Use of a stationary compactor reduces the payload to approximately three tons, but still requires a trailer with a lightweight ram, thicker walls, and a hydraulic system to push out the trash. The walking floor type of open-top trailer with

compaction done by a backhoe is the most economical type of transportation.

Some operators might want to install scales as a part of the transfer station. The cost of scales is approximately $20,000 plus an additional $5,000 for installation, including concrete piers and slab, electrical wiring, and groundwork. Installation costs can be absorbed as in-kind services.

Permits and Fees

A transfer station must have a permit from the Oklahoma Department of Environmental Quality. Transfer stations must meet standards established by state rules before being licensed. Contact the Land Protection Division, Oklahoma Department of Environmental Quality, (405-702-5100), to obtain additional information about transfer station regulations and permits. Permitting documents and check lists are also available on the DEQ website http://www.deq.state.ok.us. In addition, there will be legal and engineering fees connected to the design and construction of the transfer station.

Estimated Cost of Basic Rural Transfer Station

The population to be served, type of solid waste to be accepted, type of transfer equipment, distance to the disposal site, and other factors affect the size and cost of a rural transfer station. The estimated costs discussed below are based on the best and most recent information available from various sources.

Initial Capital Costs for Basic Transfer Station

Initial capital costs are the cost of land, buildings, and equipment. (See Table 1.)

Land. Costs can range from $1,000 to $5,000 per acre. There may be an additional expense if the land requires any preparation prior to construction of the transfer station. It may be possible to build the transfer station at a closed dumpsite or other property already owned by a governmental agency. Usually $3,000 is satisfactory for a basic transfer station (three acres @ $1,000/acre).

Building and Site. The building is assumed to be a 1,500 square foot steel building. It includes a concrete floor and concrete retaining wall on the back of the building. The retaining wall is high enough to place the transfer vehicle below the level of the floor in the building. Also included in the cost of the building is a roof at the rear that extends over the transfer trailer, an overhead door, and a small office with restroom. (See Figures 1, 2, and 3.) An estimate of $50 per square foot is used to calculate a building cost of $75,000 ($50 x 1,500 square feet). Size, terrain, and local market factors could significantly affect this estimate. Office equipment includes a desk and chair ($150), computer and printer ($1,000), and air conditioner ($500). It may be possible to reduce the cost of office equipment by purchasing used equipment or by obtaining donated equipment.

Utilities, including electricity, gas, water, sewer, and telephone, will cost approximately $200 per month. Cleaning supplies, including supplies for the restroom and bleach to clean the dumping floor, will cost approximately $20 per month. It is critical to control odor at the transfer station. Internal odor control will cost approximately $6 per month. External control of odor for the site will cost approximately $8 per month. Pest control that includes spraying and setting bait both inside and outside the transfer station will cost approximately $25 per month. It may be more economical to contract lawn service at approximately $100 per month rather than purchase a commercial lawn mower ($1,000) and pay labor ($5.50/hour minimum wage).

A concrete ramp and retaining wall must be built at an approximate cost of $20,000 to allow residents and others to dump white goods and other bulky items into a separate container at the side of the transfer station. The ramp also serves as the access ramp to the transfer station. (See Figure 3.) It is assumed that crushed rock will be used for all the roadways and parking areas at the site, except for the concrete pads. The delivered cost of crushed rock can double or triple depending on the distance from the quarry. Quarry prices can also vary considerably. A reasonable delivered price ranges from $3 to $10 per ton. For this example, it was assumed that the roadbed and parking area covered two acres. A six-inch layer of crushed rock at $6 per ton would total $13,068. A six-foot chain-link perimeter fence enclosing the three-acre area would cost $16,400 ($10 per linear foot). Total estimated building, office equipment, and site costs are **$126,118.**

Other expenses for the development of a transfer station include legal and engineering fees, estimated at $10,000, and an additional contingency of $20,000 to allow for underestimation of any items that may have higher costs due to local conditions, to cover vehicle license(s), or to cover items that

Table 1. Initial Capital Costs for Basic Transfer Station.

Item	Cost per unit*	Sub-total
Land (3 acres @ $1,000/acre)	$ 3,000	$ 3,000
Building & Site		
Building		
(1,500 sq ft @ $50/sq ft)	$ 75,000	
Office equipment	$ 1,650	
Ramp and wall	$ 20,000	
Crushed rock (@ $6/ton)	$ 13,068	
Fence (@ $10/ linear foot)	$ 16,400	
		$ 126,118
Fees		
Legal & engineering	$ 10,000	
Contingency	$ 20,000	
		$ 30,000
Equipment		
Hopper & chute	$ 3,000	
Open top trailer		
(2@ $47,000 each)	$ 94,000	
Semitractor (1)	$ 52,000	
Backhoe	$ 25,000	
	$	174,000
TOTAL		**$ 333,118**

*Data for calculations obtained from local service providers

may have inadvertently been excluded. Total estimated other expenses is **$30,000.**

Equipment. Costs presented are the estimated purchase price of selected equipment for transferring solid waste. Minimal equipment needed are a hopper and chute to direct solid waste into the trailer ($3,000), two 100-cubic-yard open-top trailers ($47,000 each), one tractor ($52,000), and a backhoe ($25,000). The backhoe can be used to compact the waste in the transfer trailer. Compaction helps to assure maximum utilization of capacity of the transfer trailer. Two transfer trailers are needed so that one is on-site at all times of operation. The volume of waste collected at the transfer station combined with the distance to the landfill will determine the number of trips taken daily and the need for additional semitrailers and tractors. Purchasing used equipment would reduce equipment costs. Estimated equipment costs total **$174,000.**

Total estimated cost for construction and equipment for a basic transfer station is **$333,118.**

Annual Capital and Operating Costs for Basic Transfer Station

Annual capital costs are the straight-line depreciation of the capital items such as building and equipment. Operating costs are the daily costs for labor, fuel, utilities, etc.

Annual Capital Costs for Basic Transfer Station

Depreciation of the building, chute, fence, roadway, and equipment are included in annual capital costs. The building, chute, backhoe, and box ramp are expected to have a 25-year life. It is estimated that the rock in the parking area and roadway will be replaced on an average of every five years. The semitrailer, tractor, and fencing will each last about 10 years. It is estimated that office equipment will be replaced every ten years. Annual capital cost (depreciation) is estimated at **$23,939** annually. (See Table 2.)

Table 2. Annual Capital Costs for a Basic Transfer Station.

Item	Cost*
Building and Site	
Building (25-year life)	$ 3,000
Office equipment (10-year life)	$ 165
Ramp and wall (25-year life)	$ 800
Crushed rock (5-year life)	$ 2,614
Fence (10-year life)	$ 1,640
Equipment	
Hopper & chute (25-year life)	$ 120
Open-top trailer (2) (10-year life)	$ 9,400
Semi-truck (1) (10-year life)	$ 5,200
Backhoe (25-year life)	$ 1,000
TOTAL	**$ 23,939**

*Data for calculations obtained from local service providers.

Annual Operating Costs for Basic Transfer Station

Annual operating costs are the day-to-day costs of operations based on the volume of solid waste handled on a yearly basis, number of employees, and distance to the landfill. For many transfer stations, funding comes from service fees and a line-item budget from the governmental agency running the service.

Labor. The transfer station attendant and driver are each paid $8 per hour ($16,000 per year) plus 35% for FICA, workers' compensation insurance, unemployment insurance, and other benefits. An alternate part-time attendant/driver, if needed, is paid $6 per hour without benefits based on an annual work year of 2,080 hours.

Maintenance Costs. Transfer truck and trailer operations cost $.60 per mile for fuel, routine servicing, maintenance, vehicle insurance, and tires. There is greater-than-normal wear on the truck because of the terrain of most landfills and frequent shifting of gears. Similarly, the trash being transported in the trailers often includes caustic materials that degrade the interior of the trailer.

Insurance. Additional insurance coverage should be obtained for the building and equipment. Liability insurance should be carried to cover potential injuries at the transfer station site. The estimated cost for this coverage is $225 per month.

Tipping fees. $25 per ton.

Annual Capital and Operating Costs for Example Rural Transfer Station

For this example, it is assumed that a population of 10,000 will be served and there are no provisions for recycling except for white goods. It is assumed that a population of 10,000 will produce about 8,213 tons (4.5 lbs/person/day) of solid waste per year from households, institutions, and small businesses. In addition, there will be about 2,400 cubic yards of white goods and other bulky material produced each year to be hauled away by a contractor in 40-cubic-yard roll-off boxes—60 boxes per year.

The trailer has a capacity of 20 tons per load. With 8,213 tons of material to haul, 410 trips to the landfill will need to be made yearly. Most transfer stations transport to the landfill Monday through Friday even though operating hours may include Saturday and/or Sunday. At a round trip distance of 100 miles at 50 mph, it will take 820 hours in driving time and about 410 hours loading and unloading time per year to transfer the solid waste. This results in approximately 1.6 loads per day to the landfill or 7.9 trips per week. If the landfill is only open five days per week, additional trips might be required periodically to adjust for a six-day collection operation. The number of trips will also need to be adjusted for seasonal variations such as the Christmas holidays.

Maintenance costs are based on 41,000 miles per year (410 trips at 100 miles). One full-time driver and one half-time driver are included to allow time for a 6-day workweek. Costs for utilities, cleaning supplies, and site maintenance are approximately $4,068 per year. A full-time station attendant is provided. Fringe benefits are included for all full-time salaries. Tipping fees are for 8,213 tons of compacted waste. A contract fee of $250 is charged for each of the 60 roll-off

Table 3. Annual Capital and Operating Costs for Example Rural Transfer Station.*

Annual Capital Costs	$ 23,939
Annual Operating Costs	
Maintenance ($.60/mile)	$ 24,600
Utilities, cleaning supplies, site maintenance	$ 4,068
Insurance—building, liability ($225/month)	$ 2,700
Station attendant (1) ($8/hour)	$ 16,640
Driver (1 full-time, 1 half-time) ($8/hour FT; $6/hour PT)	$ 22,880
Fringe Benefits (35% full time only)	$ 11,648
Tipping fees ($25/ton)	$ 205,325
Roll-off boxes (60 @ $250)	$ 15,000
Contingency	$ 20,000
	$ 322,861
TOTAL	**$ 346,800**
COST PER TON PER YEAR WITH TIPPING FEE	**$ 42.23**
HOUSEHOLD COST PER MONTH	**$ 7.28**
COST PER TON PER YEAR WITHOUT TIPPING FEE	**$ 17.23**

*Data for calculations obtained from local service providers.

boxes of white goods and other bulky material. The operator may be able to arrange for free pick up of white goods and other metals through a local scrap dealer. Insurance coverage, based on a rate of $225 per month, is estimated to be $2,700. A contingency fee of $20,000 is also included in the estimate. Total annual operating cost is estimated to be **$322,861**. (See Table 3.)

Total capital and operating cost for this example is **$346,800** per year, or about $42.23 per ton per year. Service fees for the transfer station can be based on this estimated cost per ton. Estimating household size at 2.52 people, there are approximately 3,968 households in the community. Based on the estimated annual cost of $346,800, the cost per household would be approximately $7.28 per month. Actual cost to the citizens will vary based on the percentage of households in the community compared with industry, construction, and other sources of solid waste. A line-item budget for the transfer station from the local governing agency would also help reduce actual cost to the citizens.

After removing tipping fees from the above costs, the estimate for operating the transfer station per ton is $17.23. This is the cost that decision makers need to compare with direct haul costs to a landfill.

Conclusion

The above information shows that transfer station operating costs add significantly to solid waste disposal costs. Transfer stations that serve smaller populations like this example have an estimated operating cost in the range of $40-50 per ton. Economies of scale may make transfer stations for larger communities more economical.

Community leaders should make a careful evaluation of all solid waste disposal options in order to provide citizens with an economically sound solid waste management system. Technical assistance is available in the form of feasibility studies from Oklahoma State University Cooperative Extension. Technical assistance is available from the Oklahoma Department of Environmental Quality.

Selected resources on transfer stations:

Costello, D., Dinneen, J. (1998). "The Transfer Tune-Up." World Wastes, 41 (4), p. 42,46+. http://www.wasteage.com/ww/edit/month/9804/199804d.html.

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Merrill. L. (1997). "Buying Transfer Equipment: Stocking Your Station." World Wastes Online, http://www.wastage.com/ww/edit/month/9704/199704a.html.

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Parker, R., (1999). "The Transfer Station Siting Controversy." Waste Age, 30 (5), pp. 284-285. http://www.wasteage.com.

Roberts, C. (1997) "How to Plan a Rural Transfer Station." World Wastes Online: http://www.wasteage.com/ww/edit/month/9705/199705f.html.

Schwartz, R. (2000). "10 Not-So-Easy Steps to Transfer Station Siting." Waste Age, 31 (1), pp. 8-9. http://www.wasteage.com/edit/month/0001/20001i.html.

Van Heuit, R. (1998). "Include the Customer in Your Safety Plan." World Wastes, 41 (6), pp. 9-10. http://www.wasteage.com/ww/edit/month/9806/199806j.html.

Webb, S. (1999). "Buying Transfer Trailers: Trucking the Trash." Waste Age. http://www.wasteage.com/edit/month/9905/199905s.html.

Website:

Oklahoma State University Cooperative Extension Service. http://www.agecon.okstate.edu/waste.
This website will lead to a variety of regional and national solid waste websites.

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