Process Review Report August 2013

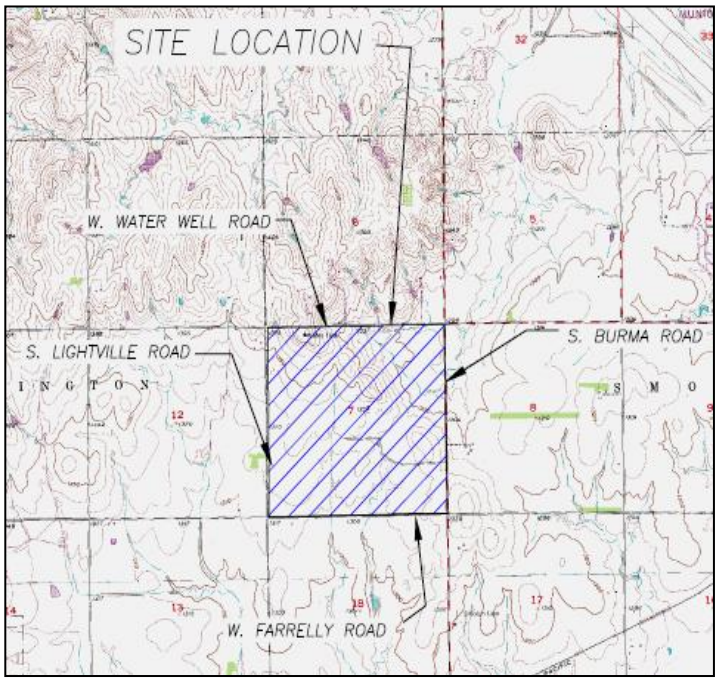
Use this report to identify waste and update processes
Use the A3 Report when solving a specific problem

Process Title	Unit Review - Salina Municipal Solid Waste Landfill (MSWLF)
Process Number	None
Date	August 13, 2013
Originator	Jason Gage, Mike Fraser
Team Members	Ron Rouse, Larry Hammond, David Lady, Cindy Beneke, Jim Teutsch, Byron Erickson
Objective	Review the design, cost, productivity, and service quality in order to identify the very best Landfill design that will meet the City of Salina's needs, both now and in the future.

DEFINE the scope
and describe the current situation

This review includes 43 processes for 7 full-time and 2 part-time employees at the Landfill.

Introduction With very few exceptions, all solid waste generated within Saline County is disposed at the City of Salina Landfill. The landfill was originally issued a landfill permit on March 17, 1976. The City owns and operates this Subtitle D landfill. It is located at 4292 South Burma Road, just west of Salina.

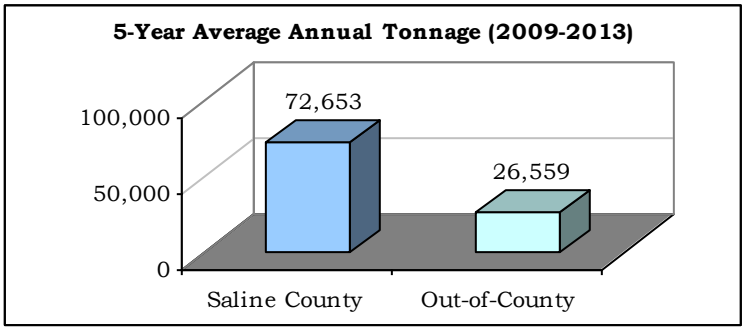


The landfill received extensive study and investment in the 1990s. In 2013, the Kansas Department of Health and Environment (KDHE) approved the City of Salina Master Plan, which increased the total useable airspace by 10.99 acres, 8.4M cubic yards, and 7.1M tons of refuse, which as of 2011 extended its life expectancy by 72.5 years (from 87.5 years) for a new total landfill life expectancy of approximately 160 years (this includes the loss of McPherson tonnage in 2014). The City owns extensive land surrounding the disposal area itself. It has excellent transportation access from all points within Saline County and is totally supported by user tipping fee revenues.

According to the Salina/Saline County Solid Waste Management Plan, (updated in 2013), the City of Salina Landfill is well-located, efficiently operated, cost-effective, and environmentally sound for solid waste disposal. No other landfills exist within the County or within a reasonable distance. Trucking waste to other counties would be more costly and less environmentally sound. Landfill tipping fees remain reasonable when compared with other areas in Kansas and across the nation.

The City of Salina landfill is authorized to accept solid waste from individuals and/or businesses from outside of Saline County, if City staff determines that waste to be acceptable by the same standards they use to screen solid waste from within Saline County.

The City of Salina, as the operator of the only landfill facility in Saline County, has the following primary roles: 1) enterprise service provider, in which maximizing revenues is typically the primary goal; 2) recycling advocate and conserver of natural resources, in which recycling and reducing landfill volumes is typically a primary goal; and 3) landfill operator, in which maximizing existing operational resources is typically a primary goal.



Process Improvements In 2013, Public Works staff made the following changes to 1) improve existing processes, 2) identify waste, and 3) improve efficiency:

- **002 Scale House Processing**: Standardized instructions used by Scale House Attendants to improve directions given to customers
- **003 Leachate Disposal**: Received approval to build a leachate detention pond during the construction phase of Cell #19 in 2014. This will reduce the cost of leachate storage and disposal and reduce the use of the leachate truck, thereby extending its estimated life expectancy up to 5 additional years, resulting in an annual savings of approximately $4,846 and 209 hours of increased capacity, beginning in 2015.
- **007 Scheduled Maintenance**: Performed a 6S project on the landfill's equipment and supply storage areas to better organize the facilities and improve employee productivity
- **010 Waste Processing**: Assigned the landfill's Saturday crew the task of preparing the work area for the following week to facilitate a timelier opening on Monday mornings. Adopted standardized hand signals to improve communications among equipment operators and other landfill staff
- **011 Cell Maintenance**: Removed a 16" water line running through Cell #19 to save the cost of having the contractor remove it during cell construction.

Planned Improvements (The following improvements are anticipated):

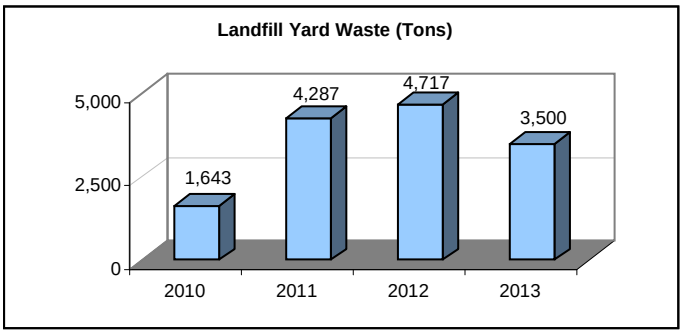
- Construct a leachate detention pond to reduce reliance on pumping operations for the disposal of leachate (Cell #19 construction.)
- Use gravity-fed lines, where possible, in lieu of force mains with electrical or pneumatic pumping systems for the conveyance of leachate (Cell #19 construction.)
- Replace existing pull-behind road broom with motorized vehicle-mounted road broom to improve the removal of nails and other metal fragments that cause tire punctures to public and private vehicles. The old broom is used about once every 2 weeks from spring through fall. A vehicle mounted system would likely be used weekly.
- Consider the purchase of retrofit GPS systems for existing equipment to improve the accuracy and efficiency of compaction, grading, and other horizontal construction efforts and on new equipment purchases. Will start phased purchase in 2015 budget.
- Install 6' portable chain-link fence to improve litter catchment, thereby reducing the likelihood of on/off-property litter issues, especially during high-wind events. Will develop perimeter fence plan with phased purchase in 2015 budget.
- Purchase the necessary components to construct a large litter vacuum to more efficiently pick up litter in the open fields in and around the landfill property.
- Continue to review scheduling and manpower use, including seasonal workload variations.

Current Landfill Practices (The following observations were made during on-site visits):

Each employee is trained to 1) perform their individual duties efficiently, 2) serve in other positions as necessary, 3) quickly assist landfill customers, and 4) help maintain the landfill in a state of continuous state of compliance with all KDHE regulatory requirements that govern the landfill. Landfill employees use industry-accepted and state-approved operational practices for cell preparation and maintenance.

These practices include soil excavation, waste compaction, groundwater protection (run-on and run-off controls), air quality standards, and other regulatory requirements as prescribed in the approved Facility Operations Plan. All of the landfill's equipment is necessary. The following tasks occur concurrently as needed throughout the business day:

- The scraper scrapes and transports intermediate cover material for the bulldozer and other soil as necessary to construct and maintain the landfill and the required cell features.
- The bulldozer initially spreads the waste on the cell to enable the compactor to further spread and properly compact it. Additionally, when required, the bulldozer spreads intermediate cover material to help stabilize the compacted waste and prevent unacceptable landfill conditions, such as: excessive wind-blown litter, odors, and vectors. Additionally, the bulldozer pushes soil throughout the landfill site to properly construct cell features, helps build the necessary haul roads to provide haulers access to the open face of the working cell, levels cover materials as required, and helps in the construction and maintenance of run-on and run-off control berms.
- The compactor compresses (compacts) waste in a deliberate pattern to achieve the required compaction rates to maximize valuable landfill space. When necessary, the compactor can spread waste in addition to compacting it. However, this may create a crisscross pattern of waste with unwanted air voids and loss of airspace when it is compacted, whereas the compactor-bulldozer team working in tandem compacts waste in a systematic and linear manner by moving forward and backward along the same tracks, and then shifting the distance of one tire width as it continues compacting newly spread waste.
- The grader helps maintain proper grading throughout the landfill site, helps build haul roads, levels the cover materials, and helps in the construction and maintenance of run-on and run-off control berms.
- The landfill supervisor is on site and provides directions to operators as necessary, but also regularly functions as an extremely knowledgeable and highly versatile equipment operator. The landfill supervisor often switches from one piece of equipment to another to ensure everything continues running smoothly. His primary function is to assist operators in managing the landfill's waste disposal operations in accordance with the Facility Operations Plan and all applicable KDHE regulations.
- Litter collection is an ongoing task at the landfill, especially with the number and degree of high-wind events at the site. In addition to landfill personnel performing this task, staff uses volunteer assistance when it is available. This primarily comes from individuals who've received court-mandated community service and typically accounts for about 300 hours of labor.
- Since the landfill is open and customers are present during the majority of time employees are on site, landfill workers perform preventive maintenance, vehicle, equipment, and facility repair, litter collection, and other miscellaneous site maintenance activities during slower periods due to inclement weather or other reasons.
- Additionally, landfill employees use various vehicles and equipment to maintain the City's yard waste collection site. The following chart represents yard waste acceptance rates since its establishment at the landfill:



MEASURE

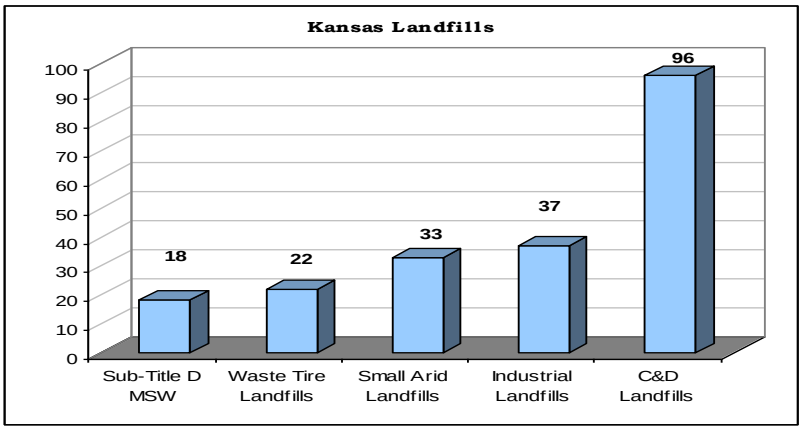
Record takt times and compare with the work scheduled

#	Process Title	PPT	TT (1.15)	TT (1.25)
630-350-001	Scale House Daily Opening and Closing (232.50 Hrs. PTE)	0.00	0.00	0.00
630-350-002	Landfill Scale House Operation (1,818.87 Hrs. PTE)	0.00	0.00	0.00
630-350-003	Leachate Disposal	247.80	284.03	309.75
630-350-004	Convenience area Container Disposal	223.60	256.29	279.50
N/A	Employee Training sessions (209 Hrs. TT)*	0.00	0.00	0.00
630-350-005	Equipment Repair & Maintenance	174.00	199.44	217.50
630-350-006	Track Cleaning Dozer 1851	264.30	302.94	330.38
630-350-007	Clean Engine& Cab Filters - Compactors	72.60	83.21	90.75
630-350-008	Tire Changes & Repairs	14.00	16.05	17.50
630-350-009	Waste Processing (Hrs based on Equip. Meter Readings)	4,682.37	5,366.94	5,852.97
630-350-010	Cell Maintenance (Hrs based on Equip. Meter Readings)	1,860.21	2,132.17	2,325.26
630-350-011	Secure Landfill	51.70	59.26	64.63
630-350-012	Prepare Daily Equipment Sheets	69.40	79.55	86.75
630-350-013	Daily Load Inspection	41.30	47.34	51.63
630-350-014	Water Truck Usage - Dust Control	17.20	19.71	21.50
630-350-015	Water Truck Usage - Spray Litter Fences	26.00	29.80	32.50
630-350-016	Water Truck Usage - Clean Radiators	48.25	55.30	60.31
630-350-017	Lubrication - Roll Off Truck 1820	8.85	10.14	11.06
630-350-018	Lubrication - Scraper 1846	24.75	28.37	30.94
630-350-019	Clean Engine & Cab Filters - Dozer 1851	59.73	68.46	74.66
630-350-020	Track Check & Adjustment Dozer 1851	9.10	10.43	11.38
630-350-021	Lubrication - Loader 1844	12.20	13.98	15.25
630-350-022	Lubrication - Maintainer 1855	6.75	7.74	8.44
630-350-023	Lubrication - Scraper 1845	26.55	30.43	33.19
630-350-024	Truck & Equipment Washing	96.70	110.84	120.88
630-350-025	Road Brooming	30.68	35.17	38.35
630-350-026	Fencing	100.00	114.62	125.00
630-350-027	Litter Collection	1,326.65	1,520.61	1,658.31
630-350-028	Process Rimmed Tires	14.08	16.14	17.60
630-350-029	Wash Bay Clean Out	12.00	13.75	15.00
630-350-030	Clean Convenience Area	55.47	63.58	69.34
630-350-031	Gas Vent Turbine Replacement	3.40	3.90	4.25
630-350-032	Maintain Tire Collection Area	4.45	5.10	5.56
630-350-033	Safety Yellow Painting	28.00	32.09	35.00
630-350-034	Janitorial In Shops	287.56	329.60	359.45
630-350-035	Leachate Containment Sump Pump Clean Out	12.00	13.75	15.00
630-350-036	Mowing/Weed Eating	450.45	516.31	563.06
630-350-037	Tree & Brush Removal	40.00	45.85	50.00
630-350-038	Document Special Waste Coordinates	36.70	42.07	45.88
630-350-039	Moving & Cleaning Portable Fences	127.50	146.14	159.38
630-350-040	Fire Extinguisher Inspection	36.00	41.26	45.00
630-350-041	Limb Area Processing & Disposal	110.23	126.35	137.79
630-350-042	Machine and vehicle startup inspections	158.46	181.63	198.08
	Total	**10,870.99**	**12,460.33**	**13,588.74**
	Pure Production Time	**10,870.99**	**10,870.99**	**10,870.99**
	Takt Time	**N/A**	**1,589**	**2,718**
	Takt Time Factor	**N/A**	**15%**	**25%**
	# Employees (Total/1,780 Hours)	**6.11**	**7.00**	**7.63**

*Note: Although training is considered takt time and is not included in the pure production figures, landfill employees are required by the KDHE and EPA to receive mandatory training. Training documents (attendance rosters) are inspectable items during periodic random inspections at the landfill.

ANALYZE
Identify and evaluate those areas where changes may be possible

Background



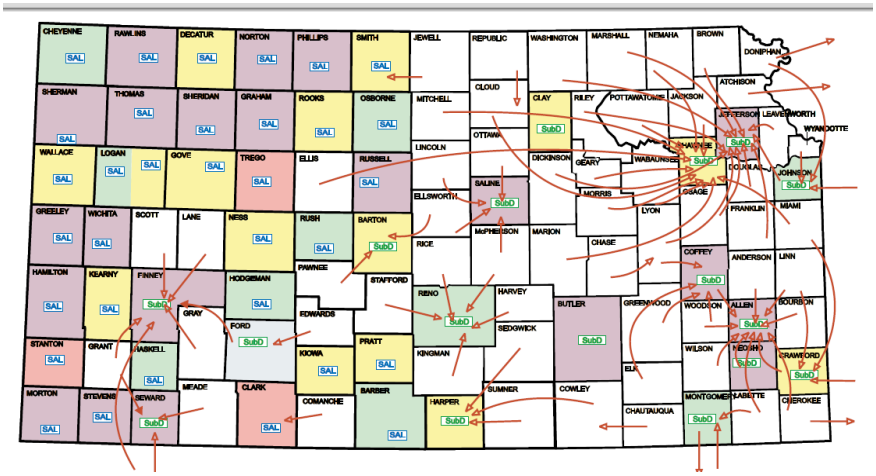
Landfill Types

- Municipal Solid Waste Landfills (MSWLF) consist of mixed, non-hazardous waste generated by households, commercial businesses, institutions, and manufacturers (i.e. trash or garbage comprised of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, etc. This may come from our homes, schools, hospitals, and businesses. These landfills consist of engineered areas where waste is placed into specially prepared land in accordance with Subtitle D regulations designed to prevent the pollution of groundwater and other impacts to the environment. There are 18 MSW landfills in Kansas.
- Waste Tire Landfills accept whole tires removed from vehicles, equipment, or aircraft. In lieu of recycling the tires into various products, such as alternative mulch or fuel.
- Small Arid Landfills as defined by the KDHE, 1) dispose of less than 20 tons of MSW per day based on an annual average, 2) are located in an area that receives less than 25 inches of precipitation per year, 3) Have no practical disposal alternative as judged by the appropriate authority, 4) Have no evidence of groundwater contamination caused by landfill, 5) are exempted from Subtitle D regulations.
- Industrial Landfills are sanitary landfill facilities that process solid waste generated by manufacturing or industrial operations, such as: electric power; fertilizer/agricultural chemicals; food and food-related products/by-products; inorganic chemicals; iron and steel; leather and leather products; nonferrous metals; plastics and resins; pulp and paper; rubber; stone, glass, clay and concrete; textiles; and transportation equipment.
- Construction & Demolition Landfills accept waste from the construction, renovation, repair, and demolition of structures, such as residential and commercial buildings, roads, and bridges. The composition of C&D waste varies for these different activities and structures. Overall, C&D waste is composed mainly of wood products, asphalt, drywall, and masonry; other components often present in significant quantities include metals, plastics, earth, shingles, insulation, and paper and cardboard.

Transfer Stations

- Transfer Stations are facilities where municipal solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger, long-distance transport vehicles for shipment to landfills or other treatment or disposal facilities.
- They are commonplace and growing in popularity, as there is a nationwide trend to build larger, more remote, regional landfills. Economic considerations, heavily influenced by regulatory and social forces, are compelling factors leading to this result. Many communities find the cost of upgrading existing facilities or constructing new landfills to be prohibitively high. As a consequence these communities find transferring waste to a regional landfill an appealing alternative.

- The Salina Landfill typically serves Saline, Ottawa, Lincoln, McPherson, and Ellsworth, (McPherson expected to stop in 2014); along with smaller amounts (less than 20 tons annually) periodically from Dickinson and Mitchell Counties.



The Salina Landfill The Salina Landfill is permitted by the KDHE (Permit #0144.) According to the KDHE's Bureau of Waste Management, "The Salina landfill is well-designed and constructed, professionally managed, and well operated as a composite-lined Subtitle D landfill. The City's practices consistently conform to state laws and regulations as determined by reviews by KDHE permitting and inspection staff. In summary, the management team of this facility applies sound engineering and management principles to current operations and in planning for the future. They have been progressive in making improvements at the facility and partnered well with the Bureau of Waste Management in a variety of ways." The Salina Landfill consists of the following cells:

Cell	Acreage	Yr. Opened	Yr. Closed	Life (# Years)
Pre-Subtitle D	66.9	1977	1995	18 years
1	7.74	1995	2003	8 years
2A	8.86	1999	2003	4 years
2B	1.42	1999	-open-	@ 6 months remaining
3	12.03	1999	-open-	@ 6 months remaining
4	14.79	2003	-open	@ 7 months remaining
5	11.70	2010	-open-	@1 year remaining
(19)	(9.54)	(2014)	(N/A)	(4-5 years)

- **Location restrictions** ensure that landfills are built in suitable geological areas away from faults, wetlands, flood plains, or other restricted areas. The Salina MSWLF is a 656.5-acre facility consisting of a scale house, equipment storage buildings, an administrative building, a maintenance facility, and an active disposal area. The disposal area is generally surrounded by pasture land and crop fields, which are leased to neighboring landowners by the City of Salina.

- **Groundwater monitoring** is an extremely important aspect of maintaining KDHE compliance for the operation of landfills. Groundwater monitoring occurs at the Salina landfill semiannually in May and November of each year. The landfill lies near the border of the Great Plains and the Central Lowland. Semiannual groundwater monitoring continues to confirm reasonably consistent groundwater elevations with generally stable VOC concentration trends. The monitoring network consists of 31 monitoring wells, and 8 piezometers (Piezometer P-6 will soon be removed as part of the construction of the newest landfill cell - #19.)

- **The liner system** at the landfill consists of a subgrade and a 2' thick compacted soil layer at a minimum of 7' above groundwater surface, overlain with a flexible membrane liner (FML). The liner system is to be constructed in accordance with the Engineering Design Report, the Construction Quality Assurance Plan, test pad results for the materials used, and industry standards.

The liner floor is to be constructed at a minimum slope of 1 percent with side slopes no steeper than 3:1 (H:V.) The soil liner is to be constructed in 6" thick lifts within required moisture and density requirements and compacted with equipment, such as a sheep's foot compactor. The FML will consist of a 60-mil high density polyethylene (HDPE) geomembrane (smooth on cell floor and textured on side-slopes). As phased construction progresses from cell to cell, the liner system of each new cell will be tied into (welded) to the geomembrane from the adjacent cell areas.

- **The leachate collection & drainage system** for the new and future cells (beginning at the southern leachate conveyance line) will be gravity flow until it is pumped via force main into the new leachate pond. This new system is expected to reduce the costs and maintenance associated with force main conveyance lines and pumping systems, and is the recommended approach by the KDHE when it is possible.

  The leachate drainage system will consist of 12" of sand placed atop the liner system. Depending on test results of the selected material, a double-sided geocomposite drainage layer may be installed under the sand.

  The piggyback of cells (overlap onto Pre-Subtitle D landfill cell) in the Landfill's approved Master Plan will enable the expansion of 4 cells onto 28.51 acres of the old pre-Subtitle D landfill cell. This overlap contributes to additional waste capacity, eliminates wasted space between individually-constructed cells, and improves overall site characteristics for drainage, roadways, and other landfill features.

- **The tarping system** used at the landfill in lieu of daily soil cover is placed across the working face of the open cell at night and on days when the landfill is closed. When the landfill cell reaches the appropriate grade or elevation, it is covered with approximately 6"-12" of soil and planted with an approved vegetative cover. Covering waste in this manner reduces odors; helps control litter, reduces the likelihood of unwanted insects, rodents and other animals; and protects public health.

- **Landfill Gas (LFG) monitoring** and control is required at all sanitary landfills. The City monitors LFG on a quarterly basis in accordance with KDHE regulations along its boundaries (outside the waste footprint.) As part of its Title V permit, the landfill completes 5-year Tier II testing for concentrations of non-methane organic compounds (NMOCs) released by the facility.

  This testing was last completed on March 15, 2011 and indicated an NMOC emission rate for 2011 of 11.5 megagrams (MG) per year, which is under the 50 MG/yr limit. When the facility does eventually reach this limit, it will have 1 year to submit a design for an active gas collection and control system and an additional 18 months from the system's approval date to complete installation.

- **Landfill Gas (LFG) collection & utilization** at the Salina MSWLF remains elusive. Based on results from the Landfill Gas Utilization Feasibility Study performed by our engineering consultant, and representatives from the Environmental Protection Agency's Landfill Methane Outreach Program (LMOP), in January 2011, five potential LFG-to-energy projects were identified for economic analysis.

  From the data collected, only 1 option provided technical and economic feasibility: the use of micro-turbines with combined heat and power (CHP). This project showed the potential for a positive rate of return over a 15-year period. However, an end user for the hot water/steam would need to be located within 1 mile of the landfill.

  The only existing potential end users for LFG at this time (Phillips Lighting and Exide Technologies) are located 3.6-4.6 miles away. The large capital cost to develop a landfill gas collection system and the necessary pipeline presently restricts the feasibility of a project at this time.

- **Solid Waste Management** (The EPA encourages and City staff in conjunction with the Salina/Saline County Solid Waste Management Committee recommend practices that help reduce the amount of materials placed in the waste stream, including: 1) Recycling; 2) Composting; 3) HHW Collection; 4) E-waste Collection; 5) Mulch Mower Promotion; and 6) Clean Rubble Processing.

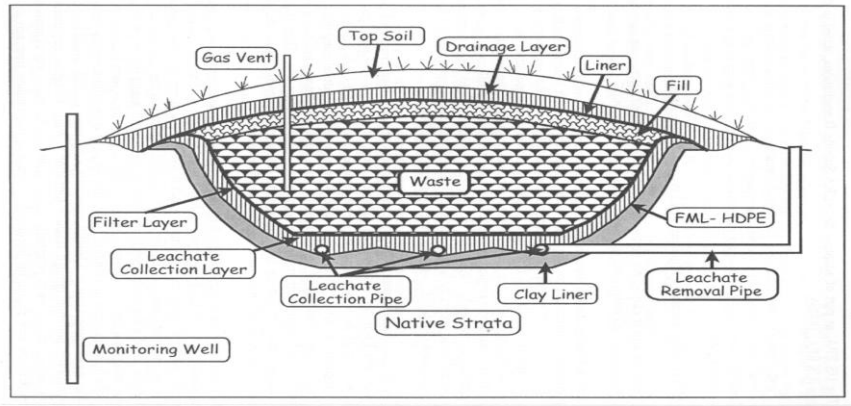
- **Closure and post-closure care** include providing final cover to landfills and providing long-term care of closed landfills. This entails updating financial assurance cost analysis to the KDHE for immediate closure and long-term maintenance requirements on an annual basis. Financial assurance provides the necessary funding during and after landfill closure (i.e., closure and post-closure care) The Finance Department sets aside funds ($.50 a ton) for closure and post-closure care. It is anticipated that the costs for closure and post-closure care may increase by 25-40% as a result of increased emphasis from the KDHE to refine its methods for calculating these costs.

Landfill Options (There are several different options available for MSW landfills in the US.)

- **Dry Tomb Landfill** Within the state of Kansas, MSW landfills that fall within Subtitle D regulations are typically of a "dry tomb" design and, in principle, operation. For the past 20 years, states (including Kansas) followed the EPA's regulatory lead and required design and operational practices that minimize the amount of liquids that enter MSW landfills. Subtitle D regulations were developed to keep water out during the operational period and after closure by minimizing stormwater run-on and by constructing low-permeability final covers.

  However, the KDHE and some landfill owners within the state of Kansas believe the goal of producing dry landfill cells that generate little leachate and reduced amounts of landfill gas may have been short-sighted. While the active processes within the landfill may slow and even appear to "turn off" by drying out the waste, the landfill has not truly reached a stable or inert condition. The day will come in virtually every landfill when the liners and caps fail, and the landfills reawaken to become an environmental problem for some future generation. As a result, the KDHE has begun allowing landfill owners to consider alternative final covers that promote the enhanced biodegradation of waste within landfill cells by allowing the controlled injection of liquids into the waste mass. It is estimated that a cost savings of as much as $15,000 per acre may be achieved using alternative final covers, resulting from the elimination of geotextile liners and reducing the amount of final cover soils necessary to close a cell.

  Typical Dry Tomb Cell



- **Bioreactor Landfill** more rapidly degrades organic waste by injecting liquids or air in a controlled fashion into the waste mass. This concept differs from the traditional "dry tomb" approach. A bioreactor landfill is not just a single design and will correspond to the operational process invoked. There are three different general types of bioreactor landfill configurations:

  - Aerobic - In an aerobic bioreactor landfill, leachate is removed from the bottom layer, piped to liquid storage tanks and re-circulated into the landfill in a controlled manner. Air is injected into the waste mass, using vertical or horizontal wells, to promote aerobic activity and accelerate waste stabilization.

  - Anaerobic - In an anaerobic bioreactor landfill, moisture is added to the waste mass in the form of re-circulated leachate and other sources to obtain optimal moisture levels. Biodegradation occurs in the absence of oxygen (anaerobically) and produces landfill gas. Landfill gas, primarily methane, can be captured to minimize greenhouse gas emissions and for energy projects.

- Hybrid (Aerobic-Anaerobic) - The hybrid bioreactor landfill accelerates waste degradation by employing a sequential aerobic-anaerobic treatment to rapidly degrade organics in the upper sections of the landfill and collect gas from lower sections. Operation as a hybrid results in the earlier onset of methanogenesis compared to aerobic landfills

  NOTE: A Bioreactor Landfill is more costly to install and maintain. It must also be built into the original design of the cell. One potential drawback to this type of landfill is the potential for slope failure when significant amounts of liquid are injected into the landfill. Slope failures are catastrophic events that may lead to major environmental impacts that trigger EPA and KDHE oversight. Such events often require significant long-term resource expenditures to correct.

- **Bale-fill Landfills** are constructed of baled waste. The waste is compacted into rectangular bales at a landfill or transfer facility and placed into a landfill cell in stacked rows. A typical bailing operation consists of dumping the waste within a transfer station and efficiently sorting any recyclable materials from it prior to baling. Typically the waste is transported from the transfer station to the baling area via conveyors. The conveyors discharge trash to a baling hopper, where it is compressed and wrapped with steel straps to form a 2+/- cubic yard bale.

  The bales are then loaded onto a truck and transported to the landfill. In this system, the baling hopper replaces a compactor. This is the type of system McPherson County is currently constructing. It is quite expensive; however, McPherson County will use their transfer station as a staging area, and thereby mitigate some of those costs. SCS Aquaterra does not recommend Salina convert to bale-fill operations since they require:

  - double handling and transporting;
  - higher manpower costs to staff the transfer station and the landfill;
  - high maintenance and operational costs for the bailing equipment;
  - additional buildings for waste deposit, balers, and temporary bale storage;
  - leachate management at the balers
  - bale transport trucks

  NOTES:

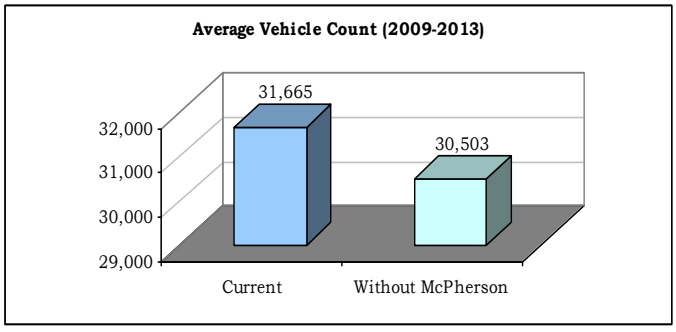
  The failure of a single piece of baling equipment will stop the entire operation, unless a backup is purchased and installed. This redundancy is extremely expensive, and not cost effective.

  One consultant that SCS Aquaterra contacted regarding this issue reported that he had participated in the conversion of a bale-fill landfill to a traditional dry tomb landfill, which cut the workforce in half, making the landfill significantly more profitable.

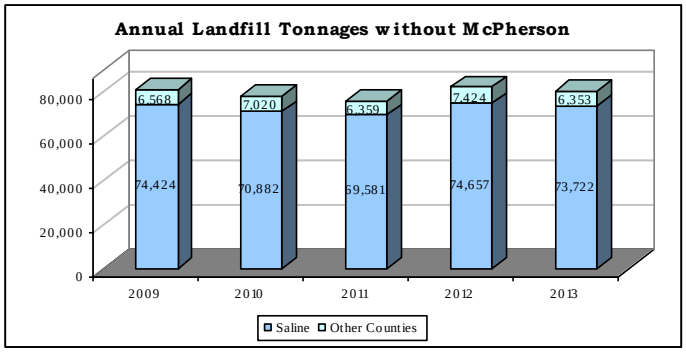
- **Combustion or Incineration Landfills** minimize volume and often convert water into steam to fuel heating systems or generate electricity. The upfront cost of a Municipal Solid Waste combustion facility is extremely expensive and may reach $100,000,000.

McPherson Area Solid Waste Utility (What will happen when the MASWU stops bringing waste to Salina?)

- **Number of Customers**: Based on the average number of customers (vehicles) at the landfill for the past 5 years, it is anticipated that there will be a **3.7% decrease** when MASWU vehicles no longer arrive.



- **Annual Landfill Tonnage**: The average tonnage/year for the past 5 years (w/o McPherson) is 79,398 tons (72,653 tons in Saline County and 6,745 other Counties.)

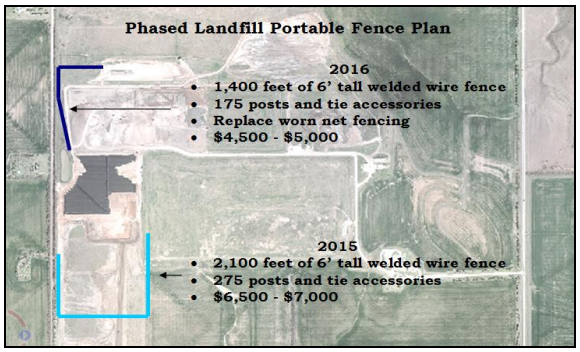


IMPROVE
What is the ideal? What improvements can be made?

Design Parameters (What is the optimal landfill design for a facility of our size, number of customers, composition of waste, hydrogeology, existing site features and waste in place and what additional improvements could be made?)

SCS Aquaterra, Public Works staff, and the Lean Design Team members suggest the City follow the recommendations listed below to maintain an efficient operation:

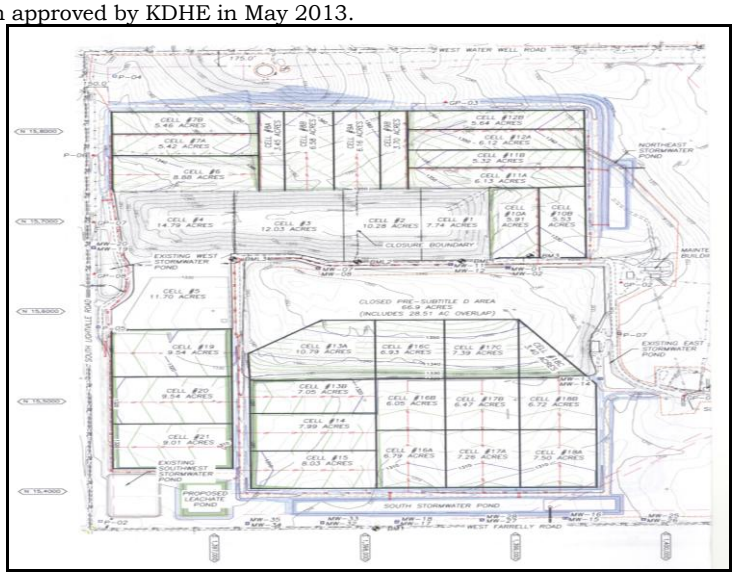
- When available use the City surveyor in lieu of hiring outside agencies to continue assisting Public Works staff and the engineering consultants
- Use landfill staff to excavate soils for future cell construction as much as possible to save on future construction costs
- Consider ways to increase compaction rates, such as the purchase of GPS equipment for the landfill's heavy equipment
- Use gravity-fed leachate conveyance lines where possible; use electrical pumps in lieu of pneumatic pumps when required
- Identify additional sources of landfill soil to accommodate long-term landfill needs; piggyback onto old cell as described in the Master Plan and explore options for future excavation of pre-Subtitle D cell to recover soils
- Use reduced amount of sand (12" in lieu of 18") for leachate conveyance and omit geotextile above the sand (if sand meets specific gradation/quality requirements)
- Explore future options for alternative final covers that may permit the introduction of select liquids into the waste mass
- Explore future options for LFG-to-energy projects, such the conversion to natural gas for supplying power to landfill structures and/or vehicles
- Continue to select future cells based on the most current landfill data and financial considerations in consultation with the engineering consultant, the KDHE, the Finance Department, and best practices within the solid waste industry to meet the goal of providing 4-5 years of disposal at projected waste acceptance rates
- Purchase a new road broom for collecting nails and other sharp metal to reduce tire punctures; increase usage from twice monthly to weekly, spring-fall (2015 budget)
- Purchase additional portable 6' chain-link fencing and fabricate a new vacuum system for improved litter collection (phased plan beginning in 2015)



Master Plan

The Master Plan, which was adopted by the City Commission in 2012, provides the City with a permitted footprint from which it can select different cell sizes according to ongoing needs from predetermined cells. Further, the cell sizes depicted on the Master Plan drawings may be modified to adjust cell sizes as required by the City to optimize future cell configurations.

Additionally, the Master Plan expanded the landfill's total disposal area from 280.1 to 289.69 acres; expanded the total landfill capacity from approximately 12.9M tons to 17.9M tons; expanded disposal airspace from 21.4M to 29.8M cubic yards; increased maximum disposal elevation from 1,408 feet to 1,540 feet; increased facility life from 87.5 years to approximately 160 years (figure includes the loss of tonnage from McPherson); and reduced the cost of future cell design by about $1,800 per constructed acre. These changes consider the overlap and height increase allowance in the Master Plan approved by KDHE in May 2013.

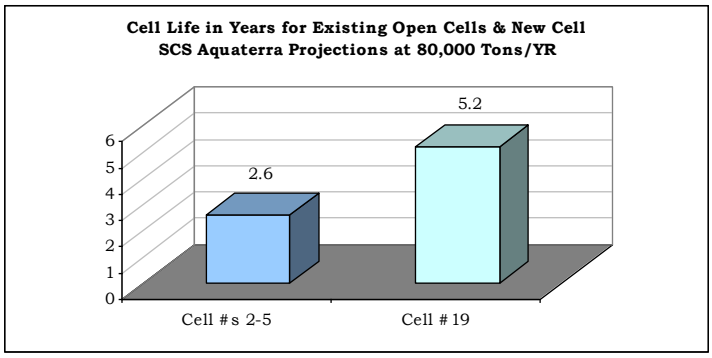


Existing cell sizes in the Master Plan vary from 7.99 acres to 21.12 acres in size due to site restrictions including total acreage, topography, groundwater flows, and other site characteristics. SCS Aquaterra analyzed various cell configurations and construction alternatives to achieve the City's stated goal of providing for approximately 4-5 years of disposal at projected waste acceptance rates. It was determined that constructing Cell 19 (a 9.54 acre cell) provided the best fit to meet the City's goals for the new cell being constructed in 2014.

Since there are a variety of cell options, City staff can select the cell that best meets the City's goals at the time of construction. Important financial considerations include: 1) the amount of revenue generated by the landfill, 2) current waste acceptance rates and the amount of time it takes to fill the cell, 3) available funds for cell construction, 4) the current interest rate, and 5) mobilization expenses.

Reduced waste acceptance rates (How will reduced waste amounts affect cell life?)

Cell life is directly related to waste acceptance rates throughout the life of the cell. The graph below shows the anticipated cell life available for all remaining space within currently open cells, plus Cell #19.



- **<u>Productivity</u>** (There are two significant issues that should be considered when evaluating productivity at landfills):

  1. **It is important to achieve high waste compaction density.** High compaction density is a major means by which owners can maximize the return on their equipment and infrastructure. The operating cost is small relative to the additional volume and revenue the site can accommodate. As a consequence good companies focus on maximizing compaction, which 1) extends the life of the cell, 2) improves safety by providing a stable surface to work on, and 3) reduces the major nuisance factors of rodents, odor, blowing debris, and surface-water contamination.

  - The compactor is a very specialized piece of equipment, which is used to compact waste. It is designed for spreading, compacting and trimming refuse. It has a large, high capacity blade and cleated steel wheels that shred and compact refuse. It weighs approximately 41.2 tons. It is not interchangeable with a bulldozer, but it does use its blade similar to a bulldozer when spreading waste.
  - The best approach is to compact thin layers, which increases speed and reduces rolling resistance. Thin layers create less wear on the compactor and increase the compaction density. Waste becomes compacted when the weight and motion of the compactor moves over it, crushing out air voids, shredding the material and binding it to other waste. By running over the waste in one direction with one pass and returning along the same tracks with a second pass, waste rebound is minimized as the structure of the waste breaks down. The action degrades the waste, improving compaction.
  - Operators then move over by one wheel width and continue to compact across the new layer. Once the entire area has been compacted the operator will turn 90 degrees and begin compacting the other way. To ensure the best possible compaction, the operator continues to move in this manner, which also helps to minimize blowing debris. While different types of waste may require some modification of these techniques, this is the preferred method industry-wide and is used at the Salina Landfill. Due to settling and the poor waste materials that normally arrive in the late afternoon, the compactor operator will begin compacting first thing in the morning, even before that day's waste has arrived. Typically, the ideal working face is approximately 50' wide by 150' long. However, the size of working face is influenced by several factors, including the number of vehicles arriving to the site at a given time, the elevation of the cell and grade of the slope, the wind direction and speed, etc.
  - **The City should begin purchasing on-board GPS sensors to confirm compaction rates and the compactor operator should continue to compacting waste in thin layers (will start budgeting for this capability in 2015 budget.) The thinner the layer, the better the compaction; and the better the compaction, the longer the cell will last.** It is far more effective to increase the compaction density by processing thin layers, than to wait for the accumulation of more trash. As the volume of trash diminishes the compactor operator will spread materials instead of the bull dozer operator, thereby freeing it up to be used elsewhere.

  2. **An efficient method for excavation and placement of cover materials is critical**

  - The dozer is considered the most versatile piece of equipment at the landfill. It weighs 30.75 tons. Because of its track design, it may be used in a variety of footings. It gathers, pushes, spreads, and helps compact refuse although it is not as heavy as a compactor and doesn't have cleated steel wheels.
  - It is also used to excavate or place cover material. The dozer works best as a pushing machine and its primary purpose at the landfill is to move large amounts of refuse from where it is dumped to the active working area. The ideal situation is for the dozer to push the refuse to the working face and spread it in a thin layer (1-2 feet deep). The compactor then further spreads, places, and compacts the refuse.
  - The key to a bulldozer operator's productivity is to 1) minimize the distance needed for obtaining cover material, 2) keep dozing distances short, and 3) construct large areas for use during inclement weather while ensuring internal slopes and water diversion berms are maintained. This allows surface water to flow away from the waste mass, enabling operations to continue as uninterrupted as possible during inclement weather.
  - The bulldozer operator may have some time in between work cycles, whereas the compactor operator does not. It is quicker to push and spread the waste than it is to compact, so the bulldozer operator is routinely assigned work in other areas; fixing washouts, walking in slopes, creating storm water berms etc.

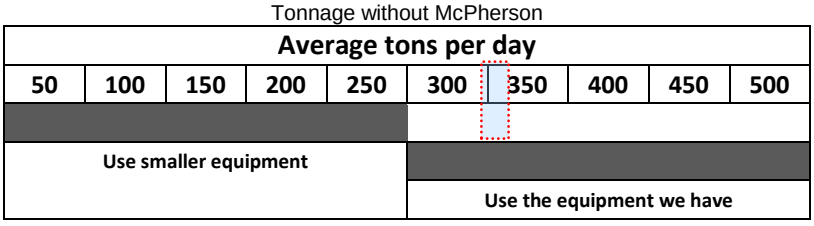
- The bulldozer operator may also use the scraper to haul cover material or use the motor grader to maintain the roads in between cycles. With a reduction in tonnage, the bulldozer operator's job will remain essentially the same, except he will have more time to excavate.
- Another key to productivity is locating borrow soils near the working face whenever possible, which helped staff determine Cell #19 as the next cell for construction. As staff excavates material from the future cell area, waste soils may be used as cover and berms for the current working face, thereby reducing hauling distances and enabling the excavation of more material in less time.
- Engineering estimates call for the excavation of 184,000 cubic yards of soil for the construction of the leachate detention pond and future cell.

  This methodology enables staff to reduce the City's costs, since much of the excavation of the cell is completed before the contractor arrives. The excavation of cells requires the use of a bulldozer, scraper, and motor grader. Advanced excavation doesn't require coordination with the contractor. It only requires the site grading plan from the engineering consultant.
- **As much as possible, landfill staff should obtain cover material from future cell and site construction areas in advance of contractor selection to save the City additional costs. The pre-excavation credit calculated by Finance for both the construction of the Cell #19 and the leachate pond was estimated at $500,000. However, landfill staff calculates they will actually be able to excavate about 50-60% of the total 184,000 cubic yards (CY) of soil needed or approximately 92,000 CY – 110,400 CY of soil. At an estimated contractor price of $2.25/CY (excavation cost for low bidder of this project), this equals approximately $207,000 - $248,400 in savings.**

Landfill Equipment (How will equipment be affected by a reduction in tonnage?

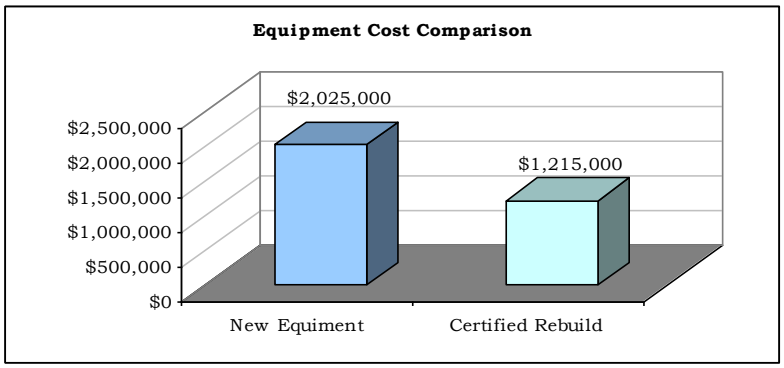
- **Landfill Tonnage and Equipment Sizing** Choosing the right equipment for the task is extremely important for landfills, particularly due to its heavy usage and uniquely harsh conditions in which it must operate. The proper equipment is vital in meeting daily production demands and complying with regulatory requirements. The average tonnage per day from 2009-2013 was 365.4 for Monday through Friday and 100.9 tons for Saturdays (or 292.2 tons without McPherson on Monday through Friday and 81.68 tons without McPherson on Saturdays.) The Caterpillar Machine Tonnage and Usage Selection Guide recommends a D7 Dozer and 826H Compactor for landfills that receive between 250-500 tons per day and have construction & demolition waste.

  Further, at current projected growth rates based on the 2010 Census figures (6-8% growth per decade), tonnage can be expected to be about 310 – 316 tons by 2020 for weekdays and an additional 86-88 tons for Saturdays. This growth in tonnage would not affect the type of equipment we purchase. Reduced tonnage may not significantly affect wear and tear on the compactor, since it will continue to be operated in a similar way and for the same number of hours. While the bull dozer's workload at the waste collection site may be decreased, its workload loss will be offset by increased excavating responsibilities.



- One option the City should continue to use when making landfill equipment purchase decisions is a Cat®-certified rebuild of our dozer and compactors whenever possible. This could save us between 40% - 50% over the cost of a new machine. This option results in the City getting a virtually new machine with a full equipment warranty.
  - **Continue to use a CAT® D7Dozer and CAT® 826H Compactors, and choose the Cat-certified rebuild program whenever possible. The total savings for rebuilding this equipment is estimated to be $810,000 (at today's prices), which is expected to be recovered in 2015, 2017, and 2018.**
    - 826H Compactor (#1841) is scheduled for replacement in 2015 at a cost of $725,000 – Rebuild cost $435,000
    - D7Dozer is scheduled for replacement in 2017 at a cost of $575,000 – Rebuild cost $345,000

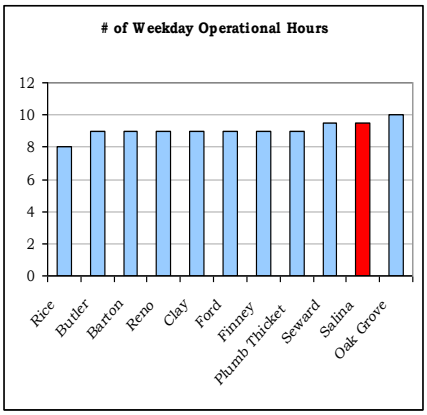
- 826H Compactor (#1842) is scheduled for replacement in 2018 at a cost of $725,000 – Rebuild cost $435,000

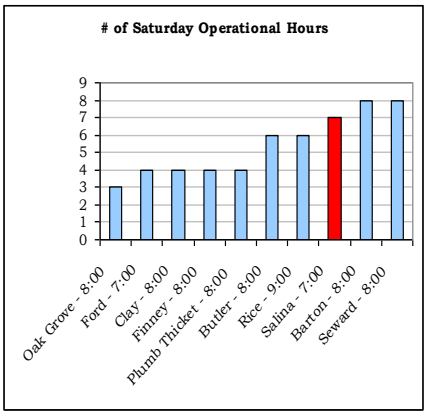


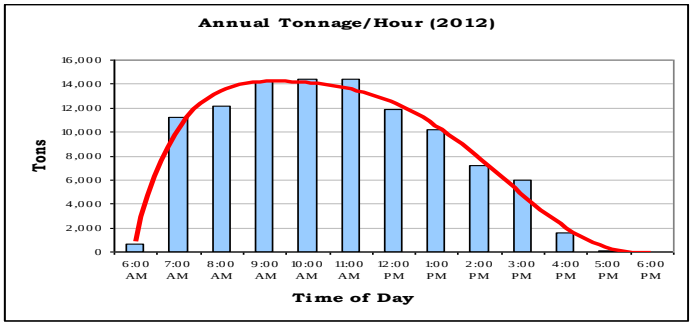
Landfill Hours (How many hours should the landfill be open?) The landfill's current hours of operation are Monday – Friday: 7:00am – 4:30pm; Saturdays: 7:00am – 2:00pm

- Currently employees are scheduled to arrive at work ½ before the landfill opens and remain 1 hour following closure. During 2012, an average of only 3 vehicles was processed per day between 4:00pm – 4:30pm; two of those arriving during this time were large haulers, Salina Waste at 4-5 times a week and Salina Iron & Metal approximately once every other week).

Comparison with other Subtitle D Landfills





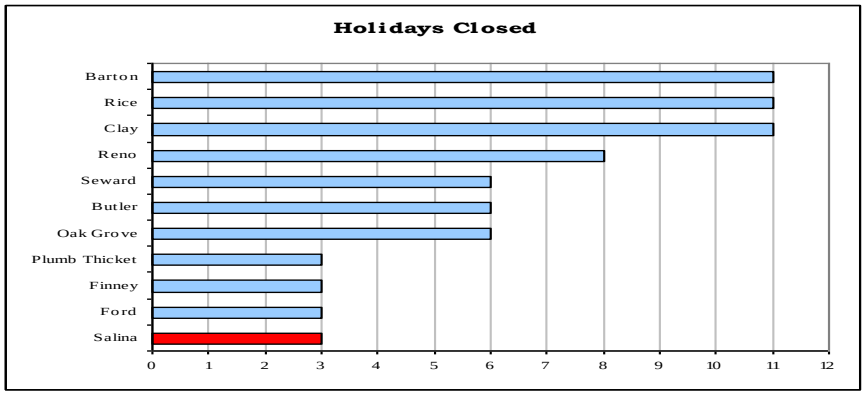


- The Salina Landfill is open more hours on both weekdays and Saturdays than most of the other landfills. Employee schedules are staggered in order to provide public access throughout the day. Only a skeletal crew (2 operators and 1 scale house attendant) is scheduled to arrive 30 minutes prior to the 7:00 am opening. The majority of residential customers and large haulers on Saturdays arrive 8:00am – 2:00pm.
- Opening at 8:00am instead of at 7:00am on Saturday would save the City approximately $14,132 in fuel and maintenance costs. There are no large haulers that come 7:00am – 8:00m on Saturday, and on average, only 6 residential vehicles.
- Closing at 4:00pm instead of at 4:30pm on weekdays, plus opening 1 hour later on Saturdays for a total of 3 ½ hours weekly would save $33,930 annually in fuel and maintenance costs.

- However, closing 1/2 hour earlier on weekdays would require Salina Waste and Salina Iron & Metal to adjust their schedules.
- **Staff believes that the Saturday hours should be changed from 7:00 am to 8:00 am, and that closing ½ earlier on week days from 4:00pm to 4:30pm should be considered. SEE thoughts from major haulers below.**

Holidays (How many holidays should the landfill be closed)?

- The Salina landfill is currently closed on 3 holidays a year (New Years Day, Thanksgiving, and Christmas), while most other landfills are closed on more holidays.



- Salina Iron & Metal was the only large hauler that voiced any concerns regarding the possible closure on more holidays. They currently operate 7 days a week.
- **Closing for 3 additional holidays would save <u>$2,434.00</u> annually and would greatly boost morale for landfill employees (i.e. Memorial Day, Independence Day, and Labor Day); closing for 6 additional holidays would save <u>$5,865.00</u> annually and also increase employee morale. Staff recommends considering closing for 3 of the additional holidays as specified above. SEE thoughts from major haulers below.**

<u>Thoughts from Major Haulers – Work and Holiday Schedules</u>

Salina Waste Systems

- There are no issues with opening at 8:00 am rather than 7:00 am on Saturdays and they could make it work.
- Closing at 4:00 pm on Monday – Friday would reduce at least one roll-off load from their daily work schedule, depending on available drivers, it could be more. Most routes finish and get to the landfill around 4:00 pm. He feels that ½ hour could pose significant issues for them to properly manage their routes and customers.
- Holidays – closing 3 additional holidays is acceptable. SWS management feels their employees would like the additional days off. However, employees would have to work Saturday to make up the routes.

Salina Iron & Metal

- There are no issues with opening at 8:00 am rather than 7:00 am on Saturdays and they could make it work.
- Closing at 4:00 pm on Monday – Friday is significant for them and they don't support this plan, as it may affect 5 loads per week or more, per driver.
- Holidays – closing 3 additional holidays would be an inconvenience for the company. They operate 7 days a week and don't have an extra day to collect their routes. They would have to double up on routes, but wouldn't be able to empty their trucks. They indicate they don't own enough trucks and aren't in favor of it.

Sanitation

- There are no issues with opening at 8:00 am rather than 7:00 am on Saturdays and they could make it work.
- Closing at 4:00 pm on Monday – Friday: Generally, there are no issues with this option; there is a slight chance for minor inconvenience in the spring as yard waste increases and trucks could have to hold over some waste at the end of the day. However, this is unlikely and will be resolved with the establishment of a 5th route.

- Holidays – closing 3 additional holidays would most likely be seen as an inconvenience for the Sanitation work group, since workers would have to work on Saturdays 3-6 additional days each year. This may also pose some confusion for certain customers who set out their cans a day early as now with existing holidays.

Customers after 4:00 PM (2012)

Get-r-Done	City Sanitation	Salina Waste	Salina Iron & Metal	Other/cash
4	6	193	33	615

*851 vehicles; 258 weekdays; 3.29 vehicles per day average

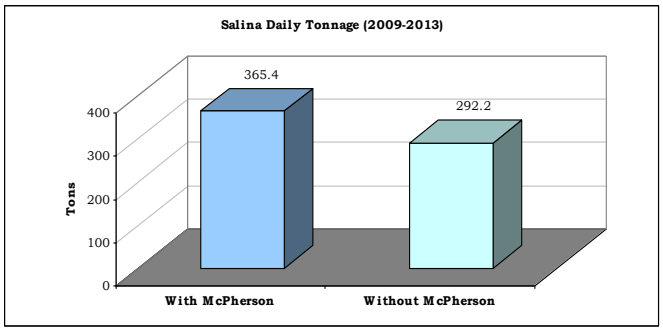
Customers from 7:00 – 8:00 AM on Saturdays (2012)

Get-r-Done	City Sanitation	Salina Waste	Salina Iron & Metal	Other/cash
10	0	67	71	151

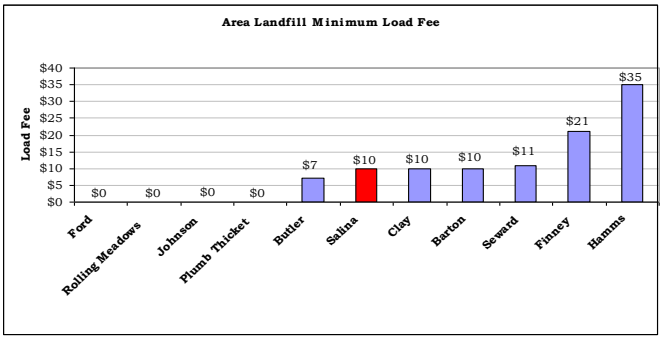
*299 vehicles from 7 – 8 AM; 52 Saturdays; 5.75 vehicles per day average

Customer Service (What can be done to boost customer service)?

- **Daily Landfill Tonnage**



  - From 2009-2013, the City of Salina averaged 365.4 tons per day Monday through Friday and 100.9 on Saturdays. Without McPherson, the same average was 292.2 and 81.68 tons per day respectively.
  - Significant or frequent backlogs don't currently occur on weekdays. However, while tonnage is quite low on Saturday, the number of vehicles remains high and very close to the weekly average, although squeezed into a shorter time period. Backlogs often occur on Saturdays during the spring and summer usually between the hours of 10:00am and 1:00pm. The loss of waste from McPherson won't affect Saturday's workload.
  - To reduce backlogs of this type, some landfills charge a minimum per load. These charges typically range from $7 to $35. **Since January 1st, the landfill has charged a minimum per load fee of $10.00 as shown below.**



- **Litter** This only applies to blowing litter and doesn't apply to non-blowing waste or limbs, as these materials do not typically pose issues on roads in and around landfills. There are several counties that charge a "failure to tarp, tie, or cover fee" in order to reduce the amount of trash that accumulates along the roadsides and fields surrounding the landfill property. This only applies to loose and blowing material in the back of a vehicle or trailer. This does not apply to properly secured loads, but would only occur if the loose or blowing debris is present in the back of the vehicle or trailer, or if the scale house operator sees material blow out of it. Blowing litter is a major problem for landfills that can result in citations and fines from the KDHE for repeat offenses during unannounced inspections. It also creates a significant workload.

- Counties who have adopted this type of fee include the following:
  - Miami County - $10.00
  - Clay County
    - 1st violation - $10.00
    - 2nd violation - $50.00
    - 3rd violation - $100.00
  - Ford County – 2 x the current tipping fee
  - Barton County – 50% of total

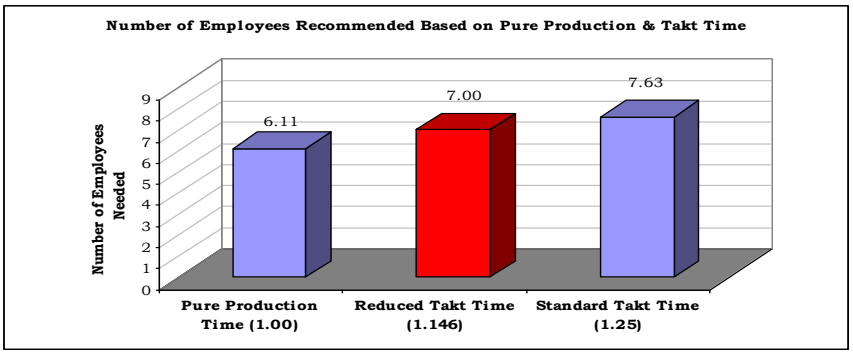
- **Although there is a potential for some negative feedback by customers who refuse to tarp their loads when carrying loose and blowing litter, staff recommends the City consider some response; perhaps:**
  - 1st violation - Initial warning (scale house operator explains the important of preventing loose/blowing trash and the need to tarp all loads and provides the customer with a brochure regarding this topic.)
  - 2nd violation – Final warning/brochure/notice of impending charge if 3rd violation occurs.
  - 3rd violation - $10.00 charge added to the standard tipping fee charge.

Quality of Service

The average vehicle processing time at the scale house is 3.07 minutes, which includes weighing in and out. They currently accept credit or debit cards, and large, repetitive haulers are invoiced. These haulers also have the option of using a tare weight, rather than going through the scale house twice, but most have not selected this option. Occasionally, there will be 3-4 haulers waiting at 7:00am for the landfill to open, however this is very inconsistent. These trucks work overnight collecting refuse. Overall, excessive customer waiting is not an issue at the landfill.

Staffing (The number of employees should match the workload).

- Currently the Landfill is staffed by a total of 11 employees:
  - 1 Superintendent
  - 1 Supervisor
  - 2 Operator II
  - 3 Operator I
  - 2 Maintenance Workers
  - 2 PT Scale House attendants



  - Pure Production Time, not including mandatory training requirements set by the KDHE and EPA, calculates to 6.11 employees (6.22 with 209 additional training hours included) and validates the need for 7 FTE.

  - Equipment operation times are necessarily based on the equipment's hour meters for processes #10 & #11, and estimates Takt Times included in these figures.

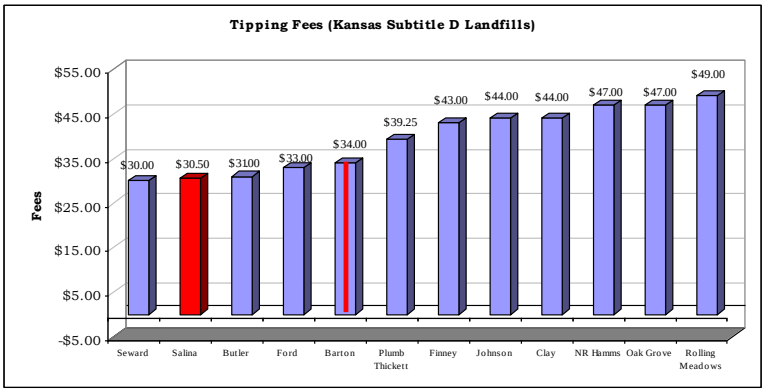
  - The use of an adjusted (targeted) Takt Time was calculated using 1,780 hours per employee. Identifying the variation from pure production time in relation to this figure (7 x 1,780 employees = 12,460-10,870.99 = 1,589.01/ 10,870.99 = 0.146 or 15%. Therefore, the targeted Takt Time calculated at 1.146 PPT or 15%, represents the actual variation for employees at the Landfill, which is based upon current workload, productivity levels, and regulatory requirements. The process times for part-time employees and training were not counted in these figures. The Standard Takt Time factor of 1.25 shows 7.63 employees.

  - Initially, the Landfill Superintendent thought it may be possible to eliminate 1 position on a trial basis from the landfill staff by restructuring staff work hours from a 4-day work week to a 5-day work week. However, this idea is not supported by actual pure production and takt times, and since considering this matter further, no longer believes this to be feasible.

- **Staff agrees that a change in work schedule to a 5-day work week for the operators would improve working conditions for employees and is still advisable; however, any further reduction in personnel currently is not recommended. Rather than lowering the number of personnel on staff, the Landfill Superintendent should balance the workload for employees more equally by changing the equipment operators' schedules to 5 days rather than 4 days. Staffing should be reviewed after all of the changes in workload have occurred and other improvements have been implemented.**

Tipping Fees (What changes in tipping fees would be appropriate)?

- Tipping Fees at the landfill are the second lowest of all Kansas Subtitle D Landfills.



- **Based on operational requirements, Finance recommends increasing the tipping fee as follows: from current fee to $32.00/ton in 2015 (+$120,000), $33.00 in 2016(+$80,000), $33.50/ton in 2017 (+40,000), and $34.00/ton in 2018 (+40,000) at 80,000 tons annually.**

Process Review Check List – Landfill

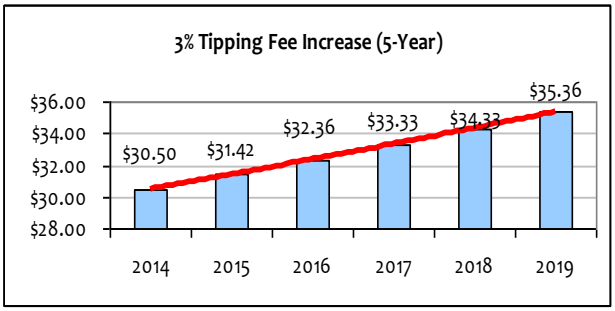
1. Annualize all Labor and Cost Savings numbers (these figures are based on adjusted Saturdays only (not weekdays)

2014	Cell # 19 Excavation	191,202
	Subtotal	**191,202**
2015	Leachate Disposal	4,846
	Compactor Rebuild	290,000
	Reduced Hrs (Sat)	14,132
	Subtotal	**298,978**
2016	Leachate Disposal	4,846
	Reduced Hrs (Sat)	14,132
	Subtotal	**18,978**
2017	Leachate Disposal	4,846
	Bulldozer Rebuild	230,000
	Reduced Hrs (Sat)	14,132
	Subtotal	**248,978**
2018	Leachate Disposal	4,846
	Compactor Rebuild	290,000
	Reduced Hrs (Sat)	14,132
	Subtotal	**298,978**
Total		**1,077,114**

*Average annual cost reduction over the next 5 years = $ 215,423

2. Recalculate the tipping fees for the next 5 years based upon a minimum 3% increase per year.

- The following figures were calculated using the current rate of $30.50/ton and multiplying by 1.03 (3%) thereafter:
  - 2015 - $30.50 x 1.03 = $31.42
  - 2016 - $31.42 x 1.03 = $32.36
  - 2017 - $32.36 x 1.03 = $33.33
  - 2018 - $33.33 x 1.03 = $34.33
  - 2019 - $34.33 x 1.03 = $35.36



2015	**Cumulative Total (+3%)**	**$ 73,600**
2016	Cumulative Total (+3%)	$ 148,800
2017	Cumulative Total (+3%)	$ 226,400
2018	Cumulative Total (+3%)	$ 306,400
2019	Cumulative Total (+3%)	$ 380,800
Total		**$ 1,136,000**

* Average annual revenue increase over the next 5 years = $ 227,200

3. Calculate the type/size of equipment needed in a landfill of our size independent of CAT recommendations

The waste disposal industry relies heavily on materials (books, magazine articles, and waste studies) originally produced by Neal Bolton, PE. His work is referenced in many states across the US. This information reflects that material including the Landfill's Handbook of Landfill Operations, A Practical Guide for Landfill Engineers, Owners, and Operators, Neal Bolton, PE, Blue Ridge Waste Consulting, 1995.

Landfill Compactors

- Compactors typically fall into one of these 3 categories:
  1. Small: 50,000 – 60,000 pounds
  2. Medium: 70,000 – 80,000 pounds
  3. Large: 90,000 – 120,000 pounds

- We utilize the 70,000 - 80,000 pound compactor. We have 2 of these, one is used as the primary machine and the other is the backup unit.
- Compactor selection is typically determined by the following criteria:
  1. Tons of waste processed per day
  2. Peak tons per hour
  3. Types of waste typically processed at the facility

For a 300/tons-per-day site, which will be our approximate tonnage once McPherson County stops using our facility, about half of the daily tonnage is delivered during our peak hours (9 am – 11 am), and averaging 165 tons during that time period. A smaller compactor in the 50,000 to 60,000 pound weight class would be too small and too slow to correctly spread, place and compact trash delivered at this rate. Mid-sized 70,000 – 80,000 pound weight class machines can efficiently process waste at this rate.

Additionally, this weight class machine provides the necessary compaction rate for the landfill. A smaller compactor would result in less compaction and a loss of extremely valuable airspace, which ultimately means a higher cost for the City. The machine sizes at the landfill take into account the amount, rate, and types of waste we receive. According to Mickey Cereoli, writing for *Waste 360* at http://waste360.com/mag/waste_breaking_down_compactor, "small landfills should consider machines in the 70,000- to 80,000-pound class to help extend their landfill's life. This information coincides with the CAT-guide and industry standards at http://pdf.cat.com/cda/files/3479222/7/Waste+Landfill++AEXQ0037-01+Final.pdf.

Section 3	Basic Landfill Operations	
Part C	Selection and Use of Heavy Landfill Equipment	
Table 3C-1	Waste Handling Capabilities for Different Sizes/Types of Landfill	
	(After Bolton, 1995 and State of Kentucky, 1987.)	
Machine Type	**Machine Weight (lbs.)**	**Practical Capacity (tons/**
Track Loader	<20,000	up to 20
Track Loader	25,000	up to 50
Track Loader	33,000	up to 130
Track Loader	45,000	up to 175
Dozer	30,000	up to 100
Dozer	40,000	up to 125
Dozer	50,000	up to 175
Dozer	80,000	up to 250
Dozer	110,000	up to 400
Compactor	32,000	up to 100
Compactor	45,000	up to 250
Compactor	70,000	up to 400
Compactor	90,000	up to 600
Note: Waste handling capacity will vary depending on waste type(s), speed of the mac distance, wheel and track design, machine weight, lift thickness, operator skill and n other factors. http://deq.state.wy.us/shwd/SW/owner%20manager%20workbook/O		

Bulldozer

- Bulldozer sizes typically range from 30,000 to 110,000 pounds
- Salina uses a 50,000 pound bulldozer
- Landfill data suggest we are properly sized with our present dozer. A 50,000 pound machine has a capacity from 175 tons per day to 350 tons per day. (Neil Bolton Basic Landfill Operations – Selection and Use of Heavy Landfill Equipment / CAT- Machine Tonnage and Usage Selection Guide.) Currently we are at 365 tons per day. With the loss of the McPherson County waste, the 50,000 pound machine remains the proper machine for our projected tonnage.

  The dozer continues to be the most versatile piece of equipment at the landfill. It is operated in a wide range of footing conditions. It gathers, pushes, and spreads refuse. It is used to place cover material over exposed refuse. The dozer works best as a pushing machine, with its primary purpose to move refuse from where it is dumped to the active face. The dozer is better suited to handle poles, stumps, rubble and other bulky or heavy objects. The dozer can push and spread the refuse more quickly than

a compactor. It is also used to build, repair and maintain run-on and run-off control berms and other earth moving operations at the landfill.

4. Do you expect the rebuilt equipment to last as long as the new equipment, or will it wear out sooner?
    - The rebuilt equipment will have the same lifecycle expectancy as new equipment. The process is a major rebuild, whereby the equipment is disassembled to the frame rails and every piece is replaced with new or completely refurbished components, subassemblies, and ancillary parts. When completed, the machine is virtually new, with new serial numbers and a better-than-new warranty.

5. If it is now available, identify the exact pre-excavation credit and explain how it was calculated.
    - 84,979 yards of material removed by City staff
    - $2.25 per yard of excavation (bid from Sporer Land Development, the successful bidder for the Cell #19 construction project)
    - $191,202.75
    - Staff calculated this credit based on the number of scraper loads removed from the cell area, estimating 16 yards (Unit #1845) and 12 yards (Unit #1846) per load. Typically these estimates are reasonably close to exact survey data. The City Surveyor will compare last year's survey data to the survey completed at the beginning of this month. That data is not yet available.

6. Due to the change in the Master Plan, does this increase the height of the cells before they are closed? Does this mean more tonnage will be placed in each cell? If so, how much? Or does this mean new cells will be created on top of old cells? Please clarify how this works.

    Each cell is built to hold a specific amount of tonnage based upon its length, width, and height. The consulting firm SCS Aquaterra calculated the life cycle for Cell 19 at 5.2 years based on placing 80,000 tons of waste into it annually. This estimate is based upon the new cell configuration recommended, included length, width, and height. The increases in elevation identified in the Master Plan will be built into future cells.
    a. The Master Plan calls for elevation increases in Cells #1-4, however; Cell #1 and part of Cell #2, are currently closed and will require the top liner to be removed, so that the elevation may be increased. And cells #3-4 cannot be filled to their maximum elevations until Cells #8-9 are built. Using the current phasing plan, it will be approximately 40 to 50 years before these cells can be filled to their maximum elevation.
    b. Future cells will overlap onto Cells #1, #2, #3, and #4. Also, 28.51 acres of future cells (#13A, #16C, #17C, and #18C) will overlap the pre sub-title D landfill.
    c. Full elevation gain will not take place until several Cells (#6, #7, #8, and #9) are in place. These cells create a base that can then be used to increase the elevation of other cells.
    d. Cell #19 (the new cell under construction) will be used to build a ramp that will have a stair step effect in order to fill Cell #5 to its maximum capacity. Cell #5 should be filled within the next two years. Cell #19 will be available by the end of this year.

7. How much time does it take to excavate soils for future cell construction?
    - This depends on the size of the cell to be excavated. With the equipment we currently have, it would take approximately 2.5 – 3 years to excavate one designed cell.
    - It should be understood that this work takes place during non-peak hours when opportunities permit.
    - We have limits on the depth and amount of the excavation that we can perform per cell, without third-party Construction Quality Assurance (CQA) oversight, at additional expense, in accordance with KDHE regulations.

8. Now that the excavation work is done, what work will be done with this work time?
    - Excavation work will continue, just at a different location. Cover material and soils are still needed on a daily basis at the working area and other locations throughout the landfill site for proper cell management, stormwater run-on/run-off control berms, road construction, and other projects.
    - The landfill is a <u>continually changing construction site</u>, in which cells don't have completely fixed starting and ending points. Various activities involving cells, borrow sites, run-on/run-off controls, monitoring wells, ponds, ditches, checks, berms, tie-ins, leachate structures, wet wells, pumps, vents, and other infrastructure require ongoing operation and maintenance.
    - Landfill employees simply move to other locations as cell construction, waste placement, and site maintenance progress. For example, haul roads and working faces of cells shift from the time an individual cell opens until it receives its final cover. For example, we've relocated the haul/access roads approximately 12 times

during the life of Cell #5. This will occur several more times until the cell is full and we begin placing waste in the new Cell #19.

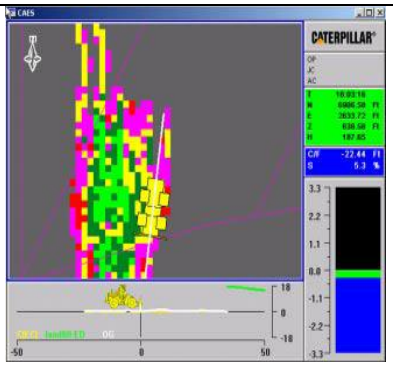
- Additional excavation sites are opened and closed to best use the landfill space. Staff does this based on current planning models, the Facility Operations Plan, and the Master Plan in consultation with the City's landfill consultants, industry standards and best practices, and oversight by the KDHE Permit Manager and others.
- The excavation work that City employees may perform in Cell #19 is complete, but staff will continue to haul cover material from/to other locations. Hauling times are expected to increase by 25-30% as the excavation area moves further away from the current working area.

9. Determine the life cycle of each cell, and prepare a plan that identifies the cells that will most likely be selected over the next 30 years.
    - Currently the plan for new cell construction is to finish the line of cells running south from Cell #5 (Cells #19-#21). These were selected so that the stair step method could be used to completely fill each cell in turn. Then the plan is to switch to the north side of Cell #4 (Cells #6-#8) as listed below. Dates are approximate:

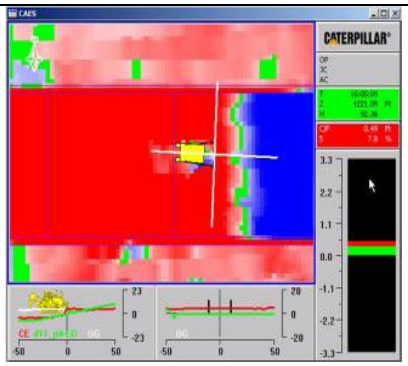
Cell#	From	To
19	2015	2019
20	2020	2024
21	2025	2029
6	2030	2034
7	2035	2039
8	2040	2044

10. How does GPS systems work in landfills?
    - Computer Aided Earthmoving System for Landfills (CAES) uses advanced GPS technologies to improve machine efficiency, maximize air-space utilization, and extend the life of the landfill. This equipment is suitable for compactors, scrapers, track-type tractors and motor graders.
    - CAES is a tool that allows machine operators to achieve maximum landfill compaction, desired grade/slope, and even distribution of valuable cover soil with increased accuracy without the use of traditional survey stakes and crews.
    - Using GPS, machine-mounted components, a radio network and office management software, this system delivers real-time elevation, compaction and grade control information to machine operators on an in-cab display. By monitoring grade and compaction progress, operators have the information they need to maximize the efficiency of the machine, resulting in proper drainage and optimum airspace utilization. This system also aids in the identification of site-specific storage areas for hazardous, medical, industrial, and organic waste requiring special handling and placement records as required by the KDHE.
    - **How the system works:** The compactor display shows colored grids representing the number of compaction passes the machine has made across each area. As the compactor wheel travels over an area, the screen changes color to acknowledge the pass. Green areas indicate when optimum compaction has been reached. The system also monitors thick lift information and visually displays when a lift exceeds maximum site parameters. In *tractor, scraper and motor grader* applications, the color display graphically shows the operator cut, fill, and grade work to be done according to plan.

      As the machine works, the screen changes color. Green indicates when the operator has achieved plan grade.

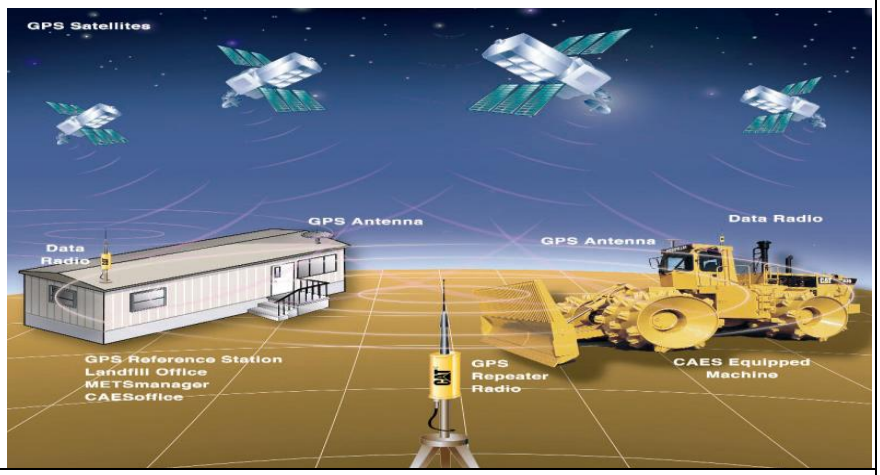


Compactor Screen



Dozer Screen

- **GPS Reference Station:** A GPS reference station is used to achieve the centimeter level accuracy needed in a landfill application
- **Radio Network:** The radio network for CAES has two channels. GPS correction data is transmitted over one channel, while the other channel is used to send site planning and production data to the machine and from the machine back to the site office
- **Landfill Planning Software:** Site planning and surveying begins with the landfill planning software. CAES is compatible with most third party CAD planning software packages. Data formats used between the CAES software and the planning software are industry standard .DXF and ASCII.
- **CAES Office Software:** The software enables landfill management staff to monitor CAES equipped machines and work progress throughout the site in near real time.
- **METSmanager: METSmanager.** This software package allows for integration of the landfill planning system and the machine. It provides the user interface for CAES and controls all communications over the wireless radio network. METSmanager reads design files in standard .DXF formats, converts them to CAES format (.CAT), and sends the design files to the on-board display on the machine over the radio network. This program continually updates the site model by regularly requesting data transmissions from the machine to the office.



Recommendation	(This should be a short phrase that the approving authority can approve or deny – all justification should have been made previously) 1. Continue using the current dry tomb MSW Landfill methodology. 2. Continue to select future cells based on the most current landfill data and financial considerations in consultation with the engineering consultant, the KDHE, the Finance Department, and best practices within the solid waste industry to meet the goal of providing 4-5 years of disposal at projected waste acceptance rates. 3. Continue to explore future options for LFG-to-energy projects, such the conversion to natural gas for supplying power to landfill structures and/or vehicles. 4. Use the City surveyor in lieu of hiring outside agencies to continue assisting Public Works staff and the engineering consultants.

5. Use landfill staff to excavate soils for future cell construction as much as possible to save on future construction costs.
6. Continue to use the compacting strategies currently in place, but consider ways to increase compaction rates, such as the purchase of GPS equipment for the landfill's heavy equipment.
7. Use gravity-fed leachate conveyance lines where possible.
8. Use electrical pumps in lieu of pneumatic pumps to reduce ongoing operation and maintenance requirements where gravity lines are not possible and pumps are required.
9. Identify additional sources of landfill soil to accommodate long-term landfill needs.
10. Purchase a new road broom for collecting nails and other sharp metal to reduce tire punctures.
11. To reduce litter purchase additional 6' portable chain-link fencing; fabricate a new vacuum system for improved litter collection; consider hiring inmates from Saline County to pick up litter.
12. Piggyback onto old cell and evaluate long-term possibility for future excavation of pre-Subtitle D cell to recover soils.
13. Use reduced amount of sand (12" in lieu of 18") for leachate conveyance and omit geotextile above the sand when possible (requires sand with specific gradation/quality.)
14. Explore future options for alternative final covers that may permit the introduction of select liquids or rainwater into the waste mass.
15. Have the D7 Dozer and the 826H Compactor undergo a Cat-certified rebuild, rather than replacing them with new equipment at the next replacement cycle (2015, 2017, and 2018).
16. Open 1 hour later on Saturday - new hours would be 8:00am to 2:00pm.
17. Increase the tipping fee as suggested by Finance
18. Review takt time and workload requirements in 2015 after McPherson County has stopped using the landfill, Cell #19 has been built, and the Leachate Pond is in use. At that time, sufficient data should be available to reconsider staffing levels.
19. Balance workload using a 5 day work week in lieu of the current 4 day work week

Labor and cost savings XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Annual dollar savings: **REDUCTION IN COSTS**

Year	Description	Anticipated Savings	
2014	Pre-excavation Cell #19	$ 191,202	
2015	Leachate Disposal, Compactor Rebuild, Reduced Hrs (Sat)	$ 4,846 $ 290,000 $ 14,132	
2016	Leachate Disposal, Reduced Hrs (Sat)	$ 4,846 $ 14,132	
2017	Leachate Disposal,Reduced Hrs (Sat) Bulldozer Rebuild	$ 4,846 $ 14,132 $ 230,000	
2018	Leachate Disposal, Reduced Hrs (Sat) Compactor Rebuild	$ 4,846 $ 14,132 $ 290,000	
Total		**$1,077,114**	

Other potential reductions in costs that are currently not quantifiable include:

- Increase or confirm compaction rates and provide on-board geo-locating for special wastes by installing GPS on heavy equipment
- Reduce litter costs by purchasing 6' portable chain-link fence, fabricate a new vacuum system for litter pick up, hire inmates from Saline County for litter control
- Use reduced amount of sand for leachate conveyance and omit geotextile above the sand, if possible (based on gradation & sand quality)

Increased Revenue from Tipping Fees (3% per year for 5 years) = $1,136,000

TOTAL =$ 2,213,114

Average annual increase in revenue due to a reduction in costs and increased revenue for the next 5 years = $442,623

XXXXXXXXXXXXXXXXX

Annual hours of increased capacity:

- 209 hours beginning in 2015 due to a reduction in leachate disposal.
- In 2015, staff will reevaluate the recommendations implemented in this report and consider additional improvements for efficiency.

XXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXX

Use bullet points to identify customer service or employee benefits:

	• Backlogs on Saturdays may be reduced • Increased employee morale for adding holidays
Implementation plan	(Briefly describe the implementation plan upon approval of this project) • Upon approval of the scheduling change at the Landfill, City staff will finalize the implementation date and begin a vigorous month-long educational program for the Landfill's customers and all residents of Saline County. Newspapers, radio ads, TV ads, and water bill inserts may be utilized for public education. • After the month-long educational program is complete, the new schedule will be implemented.
Recommended changes in employee process roles	(Identify those changes in employee roles where duties would be transferred to another employee, division, or department) • N/A
Technologies that could be applied to this process	(Identify any software or hardware that could be applied to this process) • On-board GPS for real-time, automatic compaction calculation
Overview of workgroup's participation	**Highlight those words which best describe this workgroup:** • non-participative, uncooperative, hostile, turbulent, halfhearted, disinterested, divided, collaborative, participating, supportive, enthusiastic
Attachments	(Include current and proposed process documentation forms, or before and after photos, or other before and after descriptions as appropriate) None.
XXXXXXXXXXXXXXXXX	**Approval Process**
Superintendent's Review	Instructions: This form is submitted through the chain of command to the Director. Date: 3/18/14 Name: Ronald E Rouse Comments:
Operation Manager's Review and others in the Chain of Command	Instructions: This form is submitted through the chain of command to the Director. Date: 3/18/14 Name: James E. Teutsch Comments:
Director's Approval	Instructions: Approval authority is delegated to each Director for all recommendations that result in $5,000 or less in annual savings, or 250 hours or less of annual increased capacity. This form is sent to the Process Improvement Director for his approval Date: 3/18/14 Name: Mike Fraser Approved/Denied: Comments:
Process Improvement Director's Approval	Instructions: Upon approval this form is sent to the CMO Executive Assistant, who forwards a copy to members of the Executive Support Team. They determine how to convert hours into budgetary savings. Date: 3/20/2014 Approved/Denied: Comments:
City Manager's Approval	Instructions: Final sign off for all recommendations that exceed $5,000 in annual savings, or 250 hours of annual increased functional capacity is by the City Manager, who also signs off on any plans to convert hours to budgetary savings. The CMO Executive Assistant converts the approved form into a pdf file that is saved on the P drive and in Laserfiche. Date:

	Approved/Denied: