Scott County Household Hazardous Waste Facility

Problem

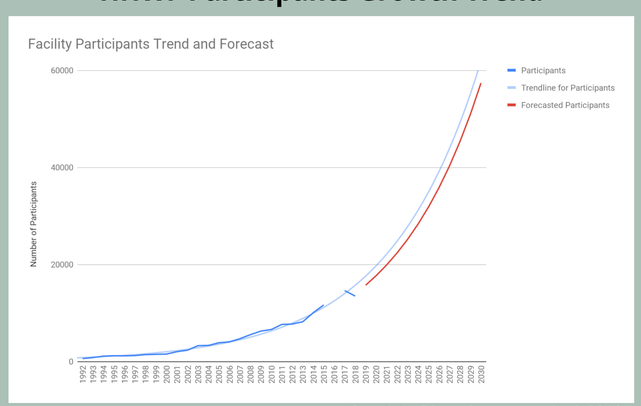
Scott County is the fastest growing county in Minnesota and the Household Hazardous Waste Facility (HHWF) is expected to be strained with the growth of the county. Without the ability to expand the building to accommodate the influx of materials, the throughput of the hazardous materials being delivered needed to be addressed and improved.

Approach

Eleven-Year Expected Growth Rate

The project team forecasted the number of participants using the facility by graphing the participant data from 1992-2018 and determining the trendline equation. The projected number of annual facility participants follows the trend of $654.83e^{0.1177x}$.

HHWF Participants Growth Trend



Graph by Diana Sorenson - April 2019

The number of participants for the next eleven years was predicted and the growth for each year was calculated. By 2030, the number of facility participants is expected to grow by 326%.

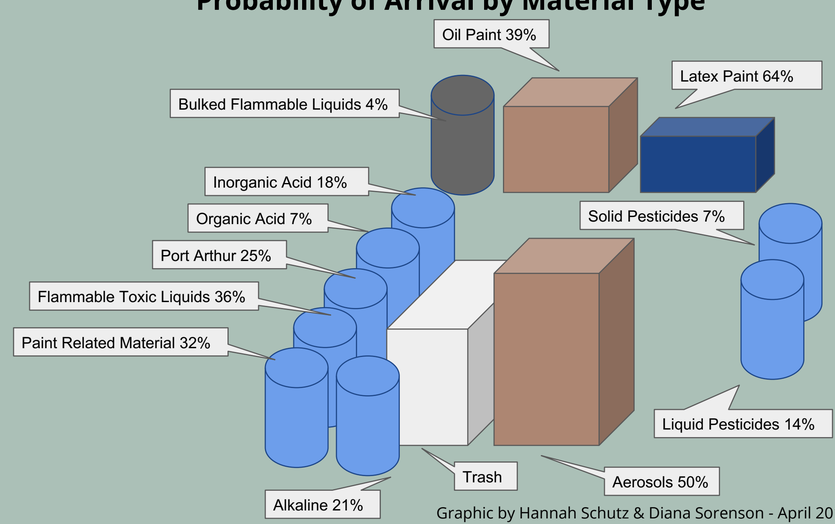
Photo by Hannah Schutz - March 2019

Scott County HHWF internal lab-packing area

Simulation of Interior Material Throughput Through 2030

The project team calculated the arrival rate of customers, the material arrival breakdowns, and the expected growth rate of the number of customers. Using these calculations, they created a simulation using Simio to model the internal lab packing area. In the simulation, when a cart of materials arrived, it moved through the paths and determined what was contained on the cart using the material breakdown probabilities, shown below.

Probability of Arrival by Material Type

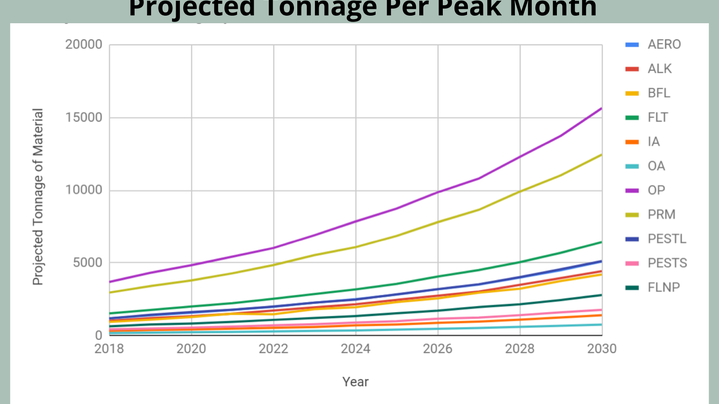


Graphic by Hannah Schutz & Diana Sorenson - April 2019

Symbols are arranged to represent the layout of the HHWF interior facility

If the simulation determined that the cart contained a material, the average weight per customer for that material was compounded on the material's total tonnage for the month. A simulation was run for each year through 2030 and the customer arrival rate to the facility was manipulated based on the growth rate for that year. At the end of the each simulation run, the total tonnage for each material type was outputted to show the facility's maximum monthly throughput corresponding to each year.

Projected Tonnage Per Peak Month



Graph by Hannah Schutz & Diana Sorenson - April 2019

Failure Modes and Effects Analysis for Facility Problems

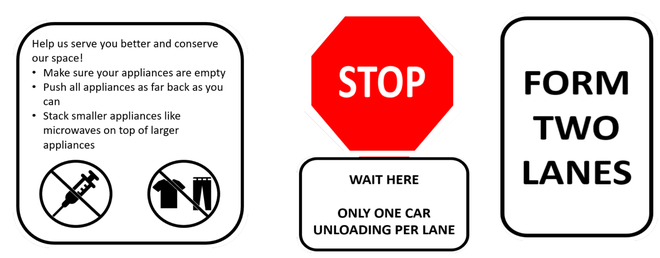
The project team had several concerns with the HHWF's current process that prompted them to perform a Failure Modes and Effects Analysis (FMEA). The three functions the team analyzed were the facility's effectiveness in providing a easy hazardous waste disposal site, sorting the hazardous waste safely and efficiently, and transporting the hazardous waste from the facility. The team consulted project sponsor Richard Jones to help score the Severity, Occurrence, and Detection for each failure mode.

Failure Modes and Effects Analysis for HHWF

Line	Component/function	Failure Mode	Effect of Failure	Severity	Potential Causes	Occurance	Current Controls, Prevention	Current Controls, Detection	Detection	RPN	Reccomended Action
1	To provide an easy way for residents to dispose of hazardous waste	Residents arrive faster than employees can sort and pack material	Long wait times for residents, slowdowns within the facility	8	Increased demand, not enough employees	5	Increased staff presence during busy season	Historical trends	2	80	Have a seasonal employment plan to account for influx in materials
2		Residents do not follow signage for the HHW drop off or the appliance and tire drop off area	Confusion in drop off, slowdowns, inefficient usage of space in appliance and tire drop off areas	5	Lack of signage, lack of direction for customers to properly dispose of items	6	Some signage, employees rearrange material if they have enough time	Visibly checking the area where these items go	2	60	Improve signage in both problem areas, provide a dolly in the appliance and tire storage area
3		The appliance drop off area fills quickly and exceeds capacity	Appliance storage area fills before a shipment can remove the material	4	Lack of storage	6	Manual rearranging of the appliance drop off to make more room	Visibly checking the area to determine how full it is	1	24	Swap tire and appliance drop off areas
4		Residents attempt to drop off prohibited materials (sharps, explosives, cardboard, etc)	Residents are turned away, informed of other disposal sites if applicable	3	Lack of knowledge on customer end	3	Literature on website about accepted materials	Visible detection of prohibited items	1	9	Provide signage outside the facility outlining what is not allowed and where it can be taken for disposal
5	To safely and efficiently sort and pack hazardous waste for future removal	Arrangement of bins/containers in the labpacking area is inefficient	More time is taken to put the items where they need to be	5	Non-realization of highest intake item types, along with fastest route to storage	2	Frequent rearrangement of floor layout to find optimize intake process	Employee awareness of the route they must take to properly place each item	7	70	Continue to rearrange the labpacking area to determine the most efficient layout
6		Equipment is stored in improper zones (in front of exits, fire suppression systems	Building codes and alloted spaces for equipment are not adhered to	6	Unclear or lack of marking on where equipment can be stored	2	Knowledge of building codes and designated storage areas	Inspection of problem areas	4	48	Place high visibility tape on areas that require it
7		The current system for tracking intake is outdated and inefficient	Loss of accuracy in vehicle counts	3	Employees forgetting to hit the clicker when customers arrive	3	Employees remembering to check in the customers	Remembering to account for each vehicle that arrives	5	45	Install an automated system to detect entering customers
8		Workers are exposed to harmful fumes or vapors from toxic materials	Detrimental effects on employee health	8	Harmful or toxic materials being brought into the facility for disposal	1	Mitigated handling times and efficient air circulation system inside	Frequent inspeciton of air quality	4	32	Provide PPE such as respirators, install a negative pressure hood
9		No standardized sequence of sorting	Employes take different routes to put items away and interfere with others' routes	5	Different preferences for routes when putting items away	3	Situational awareness	Analysis of surroundings	2	30	Determine and adibe by the quickest and easiest route through the labpacking area
10		Multiple bins of non-hazardous waste and scrap metal need to be emptied frequently	Employees take time out of sorting/packing to empty multiple bins	3	Small bins that fill quickly	6	Emptying bins only when full	Visual inspection of bins	1	18	Consolidate non-hazardous waste into one large recepticle
11	To properly store and remove hazardous waste from the facility	Shipments to take away material do not come frequently enough	Facility loses ability to intake and store material safely	8	Improper communication between the facility and the shipping companies	3	Adhering to a pre-determined schedule for shipments	Communication with shipping companies	4	96	Adjustment of shipping schedules that increases incrementally to account for larger intake of material
12		The facility runs out of storage space for required materials	Lack of necessary storage area for materials	8	Increase in demand at the facility	3	Efficiently using space to store packed material	Visible build up of materials in the storage area	2	48	Addition of shelving units to utilize verticle space, rearrangement of storage for material that can be stored outside

Table by Max Jacobson and Don Letson - March 2019

Suggested Signage Improvements to Direct Traffic Arriving to the HHWF



Signs designed by Max Jacobson - March 2019

From left to right: instructional signage for the appliance, tire, and scrap metal drop off area; sign directing residents where to wait for assistance; sign directing traffic

Findings

- Simulation showed roughly a 326% growth in material throughput over the next eleven years, exponentially increasing the number of material bins being shipped
- FMEA showed top priority problem areas to be the variable lab packing process, determined shipping schedule, and fixed work hours (despite fluctuating seasonal demand)
- Observations determined a need for clarifying signage around the facility and a better use of the material storage space

Recommendations

Based on the findings, the project team has the following recommendations for Scott County:

- Create a seasonal employment plan to account for the growing number of participants
- Increase the material storage capacity to help support an influx of materials
- Request an additional 12.9% in funding annually to increase shipping frequency and reduce on-hand waste inventory
- To optimize flow, standardize the lab packing process by implementing a single-stream floor layout and eliminating repeated paths when lab packing materials

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