



Data Workflows for Remediation System Pilot Testing

Kristen Brown

Technical Director – Environmental Data Services

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Agenda



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- Pilot Study Overview
- Goals & Objectives
- Schema Review
- O&M EDD Format
- Mobile Data Collection
- Reporting and Visualizations
- Full-Scale System Implementation

Pilot Study Overview



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- Pilot testing is a **critical early-stage step** in designing and implementing a remediation system. It involves running a scaled-down version of the intended technology at the site to assess **feasibility, effectiveness, and scalability** before committing to a full-scale installation
- **How Pilot Testing Works**
 - **Collect samples** to use as a baseline.
 - **Install a treatment system** matching the full-scale design but on a reduced scale onsite to replicate real conditions.
 - **Operate under controlled parameters** (e.g., vacuum levels, injection rates, pressures)
 - **Collect and analyze data** to determine effectiveness, efficiency, and scalability
 - **Monitor key metrics:**
 - Radius of influence (ROI)
 - Contaminant concentration changes
 - Flow rates, pressures, and treatment outputs
 - Environmental parameters (DO, ORP, pH, etc.)
 - **Adjust design parameters** based on results before full-scale rollout

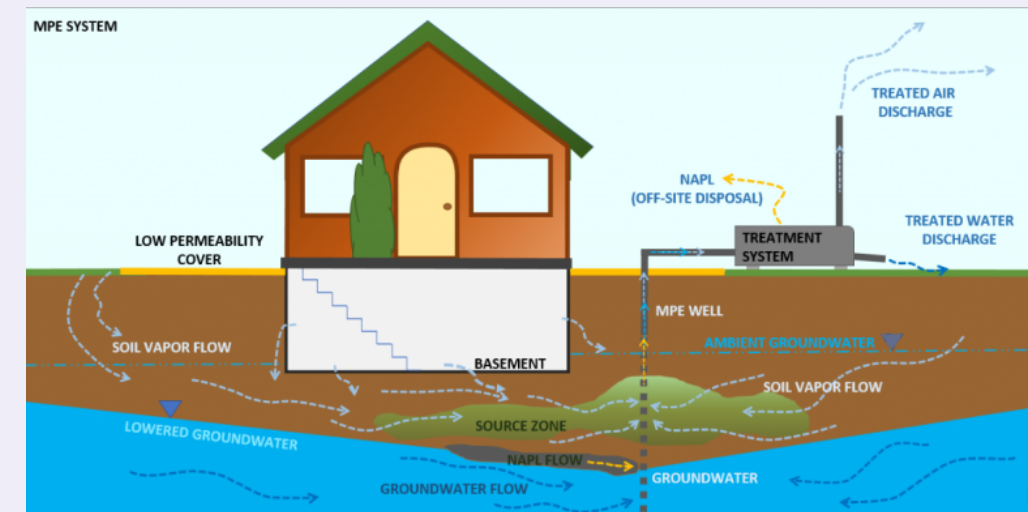
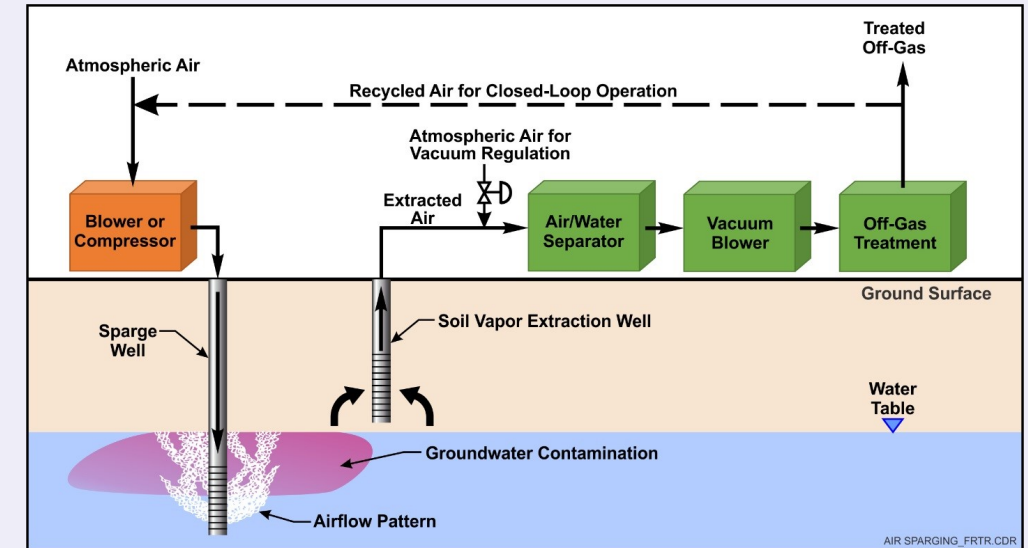
Pilot Study Overview



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Pilot tests can be tailored to various in-situ methods, including:

- **Soil Vapor Extraction (SVE)** — small-scale vacuum systems with 1–2 wells, monitoring radius of influence and contaminant removal
- **Air Sparging** — small blower/compressor units to measure dissolved oxygen changes and influence radius
- **Dual Phase Extraction (DPE)** — mobile systems to test fluid recovery and treatment needs
- **Remedial Injections** (e.g., ISCR, ISCO) — small-scale reagent injections to determine radius of influence, reagent acceptance, and effectiveness
- **Thermal Remediation** — small probe installations to assess heating efficiency and contaminant degradation



Goals & Objectives



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SHORT TERM GOALS

- Capture:
 - General information about the overall treatment system.
 - Detailed information about the components that make up the system.
 - Observations/Measurements from each system component.
 - Flow data from recovery/injection wells.
 - Capture rollover events for totalizers.
 - Associate monitoring locations with treatment system.
- Design/Adopt a workflow that will allow for the capture and analysis of data collected during a pilot study to support decision making and design of final system.
- In some cases, multiple treatment technologies/methodologies are being tested and need to be compared to identify the most effective remedy.

Goals & Objectives



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LONGER TERM GOALS

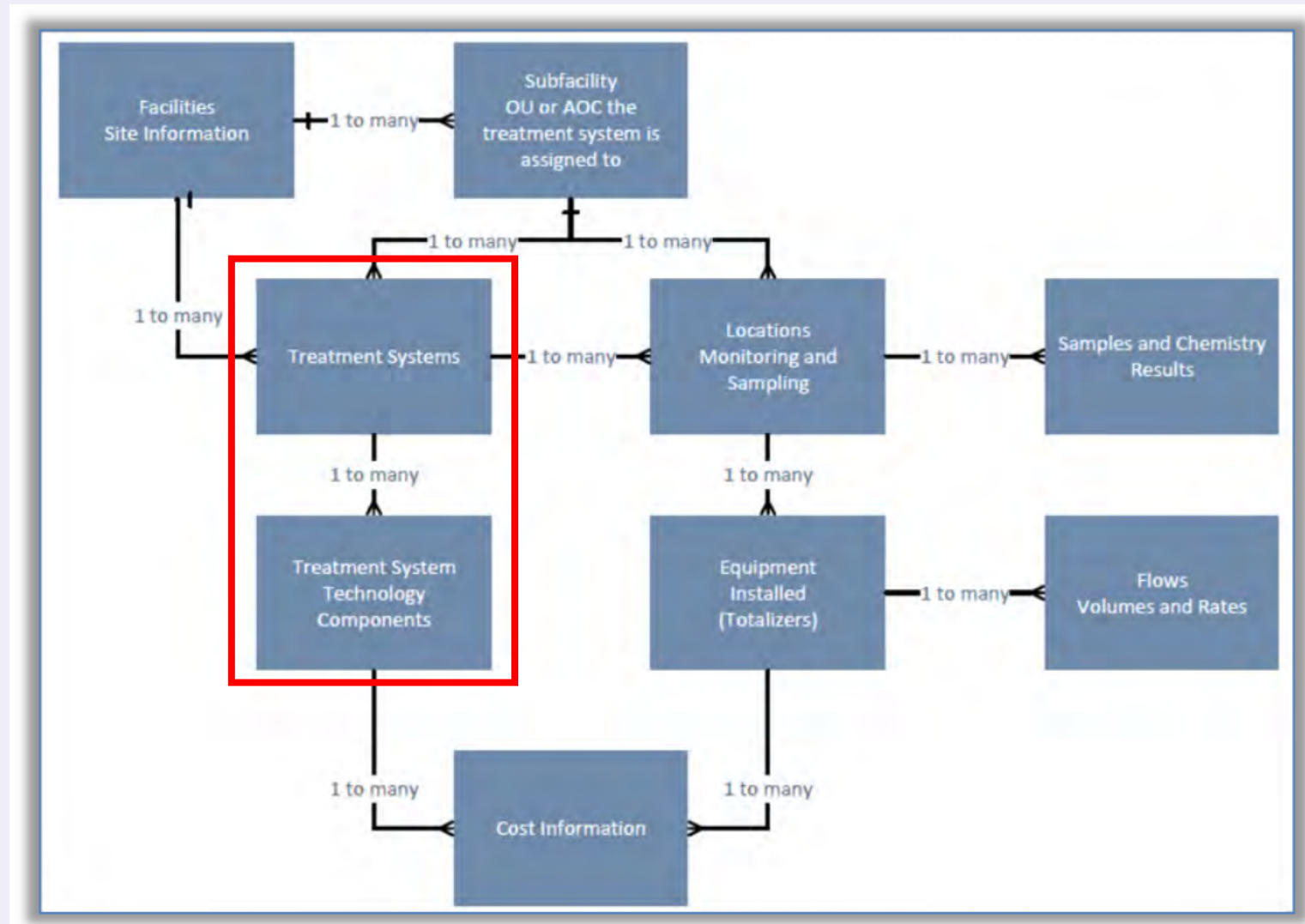
- Capture equipment changeouts
- Calculate and report constituent mass removal based on volume of groundwater extracted, soil vapor flow rate, and laboratory analytical results, etc.
- Capture, manage, and report costs associated with remedial operations.
- Workflow should:
 - Eliminate all pen & paper information collection.
 - Allow for automation where possible.
 - Provide clear visuals accessible by all stakeholders.
 - Be scalable/expandable for use with the full-scale system
 - Limit the need for customization where possible

Schema



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- Capture:
 - General information about the overall treatment system.
 - Detailed information about the components that make up the system.
 - Observations/Measurements from each system component.
 - Flow data from recovery/injection wells.
 - Manage equipment changeouts.
 - Capture rollover events for totalizers.
 - Associate monitoring locations with treatment system.
- Options
 - Out of the box schema – Use parameter tables
 - Adopt existing custom schema
 - Develop new custom schema



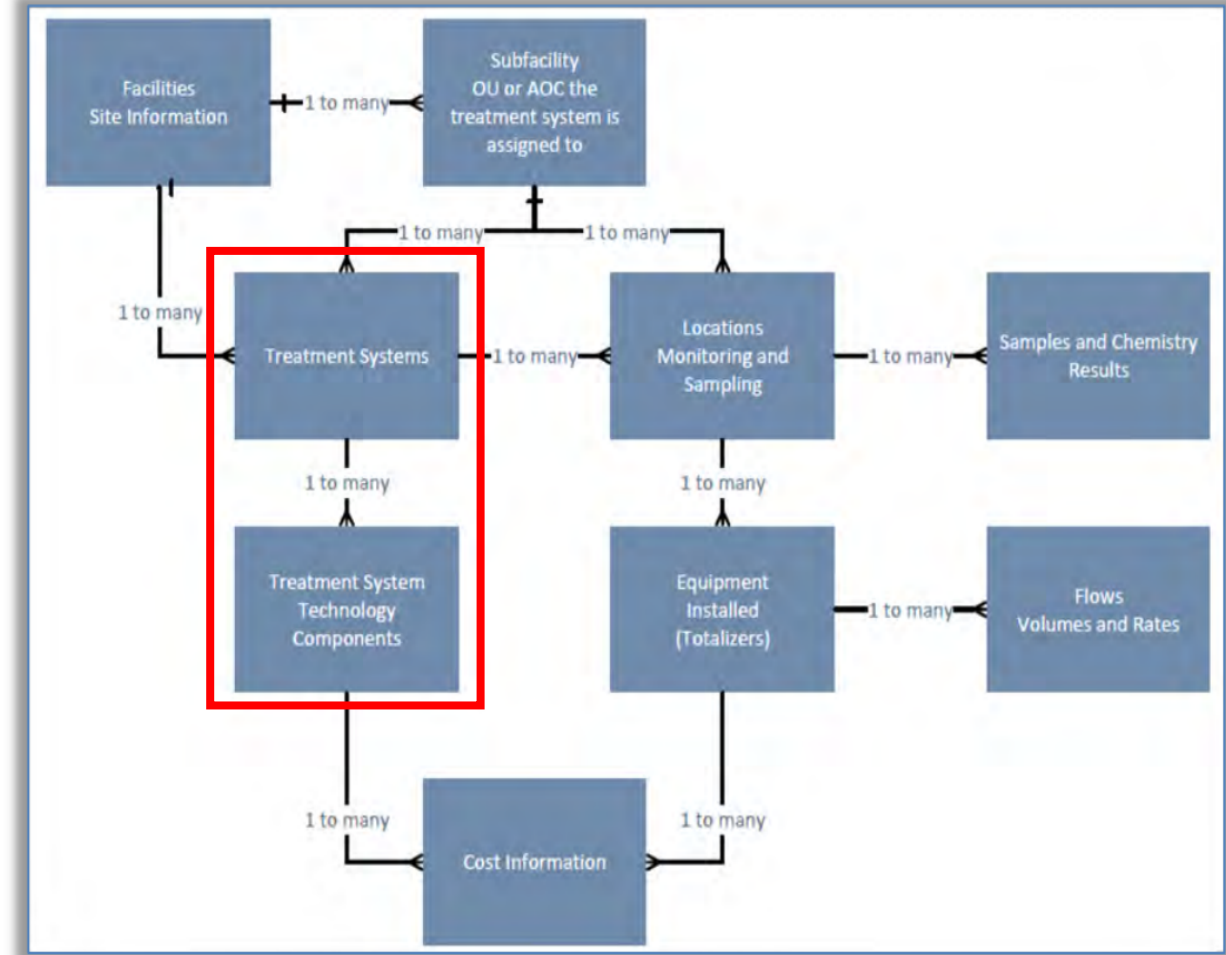
Schema



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Adopt existing custom schema – NYSDEC O&M Module

- Reference Tables
 - **Treatment Type** – Defines different types of treatment systems (e.g., pump and treat, soil vapor extraction, soil stabilization, etc.)
 - **Treatment Parameter Type** – List of the individual components of a treatment systems (e.g., extraction/injection wells, air strippers, filters, chemical additives, etc.)
- Attribute Tables
 - **Treatment Location** – Joins the individual wells or other relevant locations to the treatment system.
 - **Treatment Parameter** – Joins the treatment system types to the various treatment technologies. This is a many to many relationship.
- Data Tables
 - **Treatment** – Information about the whole system (system type, construction dates, size, etc.)
 - **Treatment Parameter** – Captures the number of treatment technologies implemented as part of the treatment type.



O&M EDD Format



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[-]	Initial
	DataProvider_v1
	Task_v1
	TaskParameter_v1
	Subfacility_v1
	Location_v1
[+]	Subsurface Investigation
[+]	Field Activities
[+]	Lab Chemistry
[-]	O and M
	TreatmentSystem_v1
	TreatmentSysComponents_v1
	TreatmentSysLocations_v1
	Equipment_v1
	EquipmentParameter_v1
	EquipmentLocations_v1
	TreatmentFlowVolume_v1
	TreatmentCost_v1
	CostUnitBreakdown_v1
	Flow_Measurement_v1
	Equipment_Inventory_v1
	Files_v1

- TRC standard format
- Incorporate O&M section
- Adopt most business rules
- Limits the number of custom EDDs

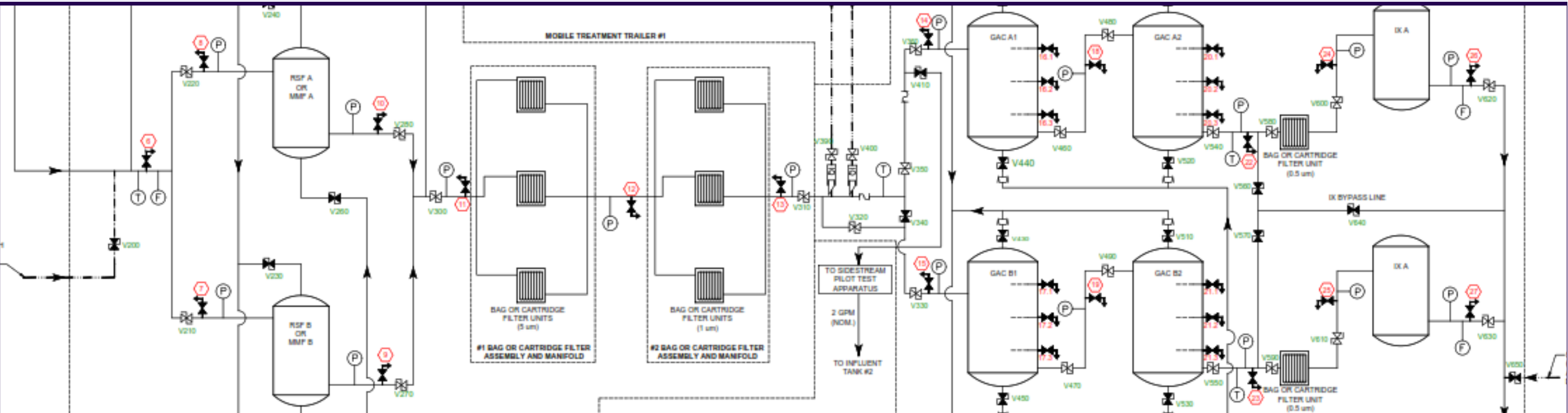
Field Name	Data Type	Key	Required	Comment
data_provider	Text(20)		Y	Code for the company that is submitting the data. Choose a company code from the lookup table.
treatment_code	Text(40)	PK	Y	Treatment code is a project and site specific code used to identify a remediation treatment system within a facility. Define a unique treatment code for each treatment system on the project site. Use abbreviations that include the type of media treated and type of treatment system along with facility location or area information. For example: code "Site_A-OU1-WG-PaT_AirStripper" for a treatment system on facility "Site_A" and subfacility "OU1" that is treating groundwater using a pump and treat air stripping treatment system process.
treatment_type	Text(40)		Y	Type of treatment being performed. Select a treatment type from the lookup table.
treatment_desc	Text(255)			Describe the treatment system technology and characteristics of the system.
subfacility_code	Text(20)			A unique code used to group treatment locations into different areas of the facility or into different remediation tasks. The subfacility code is designated by the TRC Project Manager for the facility and must be a code that already exists in the database for this facility or in the Subfacility section of this EDD.
install_date	DateTime			The date the treatment system was installed and activated.
design_contractor	Text(40)			Engineering company (designer) responsible for the design of the treatment system. Choose a company code from the lookup table.
construct_contractor	Text(40)			Installation/Construction company (constructor) responsible for the construction/installation of the treatment system. Choose a company code from the lookup table.
area_desc	Text(255)			Description of the area being treated.
area_size	Numeric			Numeric value of size of the area being treated.
area_unit	Text(15)			Unit of measure for the area being treated.

Mobile Data Collection Workflow



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- Pilot Study
 - Valve status and instrumentation readings
 - Based on as-builts which aren't provided until the last minute
 - Traditional sample data
 - SPM for planned samples but not for valve and instrumentation readings
 - Instrumentation readings are not consistent. Some valves are only adjusted one time



Mobile Data Collection Workflow

EQIS Collect

Analytics

Map

Template Designer

Data Forms

User Groups

Reports

Details

Form Template...

VALIDATE

CHANGE STATUS

MERGE

SAVE

CLOSE

Name*

Field Data Form

Version*

3.4

Description

Type

User Groups

Windsor_Team

Format

TRC_EQEDD_OM_MERGE

Facility

Template Reports

Form Summary/Form Table Summary

☒ Automatically Push Form to EDP

Site Visit Form

+ New Sub Form

HLF_GFCS_SP1

+ New Sub Form

HLF_GFCS_V100

+ New Sub Form

HLF_GFCS_F100

+ New Sub Form

HLF_GFCS_pH100

+ New Sub Form

HLF_MTT1_T100

+ New Sub Form

HLF_MTT1_P120

+ New Sub Form

EQIS Collect

7.24.2.24185

Template Designer - HLF_GFCS_V100

Analytics

Map

Template Designer

Data Forms

User Groups

Reports

Form

Form Name*

HLF_GFCS_V100

Description

Valve 100 Of Location GFCS

Header Field - Requires fields in the form to set *

header

☐ Enable Two Column View

Related Records

Delete Prohibited

SORT

GRID

MAP SETUP

LOGGER SETUP

DATA SETS

DATA MAPPING

Fields

Unique Data Set

Auto generated for the dataset

Formula

Visible

header

Header

Formula

Visible

completeYN

Complete YN

Formula

Visible

1A

sys_loc_code

Sys location code

Editable

Default

🕒

V100_Time

Time

Default

✓

V100_ValvePosition

Valve Position

Default

3.5

V100_ValveOpen_Percent

Valve Position Open (in %)

Required

1A

V100_Note

Notes

6:54

shop

32%

MAP

REPORTS

Search text

📷

Data Form for General Visit and Si...

New

▼

SP1 Of Location GFCS (9)

New

▼

Valve 100 Of Location GFCS (0)

New

▼

Flow Meter 100 Of Location GFCS (0)

New

▼

pH Meter 100 Of Location GFCS (0)

New

▼

T100 Of MTT1 - Mobile Treatment T...

New

▼

P120 Of MTT1 - Mobile Treatment T...

New

▼

BF2.1 Of MTT1 - Mobile Treatment T...

New

▼

CMP1 Of MTT1 - Mobile Treatment T...

New

▼

Sampler Signature Form (0)

New

▼

Reviewer Signature Form (0)

New

▼

Equipment (Reference Form) (6)

New

🏠

New

CANCEL

SAVE

Valve 100 Of Location GFCS

HLF_GFCS_V100

✓

Search by name

Sys location code

HLF_GFCS_V100

Time

6:59 PM

Valve Position

Closed

Open

🔄

Valve Position Open (in %)

50

Notes

Notes

🔍

Reporting and Visualization



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- Flow & Mass Concentration Removed Report
- Sample Result * Flow Volume = Mass Removed for a specific time period and location.
- Allowing for aggregation by time period.

```

1 SELECT f.facility_id, w.sys_loc_code, w.sys_sample_code,
2 w.measurement_start_date, v.ymd_date, v.mdy_date,
3 CAST(v.[cum_flow] AS decimal(9,0)) AS Totalizer_Reading_Flow,
4 v.cumulative_flow_unit, CAST(y.[totalizer_correction1] AS decimal(9,0)) AS
5 s.sample_date, a.chemical_name, result_text, result_numeric, result_unit,
6 (CASE WHEN detect_flag = 'Y' THEN result_text WHEN detect_flag = 'N' THEN '
7 ((CASE WHEN result_numeric is Null THEN 0 ELSE result_numeric END) * v.[Flow
8 FROM dt_flow w JOIN dt_facility f ON w.facility_id = f.facility_id
9 INNER JOIN vw_Totalizer_flow_calc_pt2 v ON (w.facility_id = v.facility_id)
10 INNER JOIN vw_Totalizer_Correction_pt2 y ON (v.facility_id = y.facility_id)
11 INNER JOIN dt_sample s ON w.sys_sample_code = s.sys_sample_code
12 INNER JOIN dt_test t ON s.sample_id = t.sample_id
13 TNNFR JOIN dt_result r ON t.test_id = r.test_id
    
```

mdy_date	10/20/2017			11/17/2017			12/01/2017			
sys_loc_code	Totalizer_Read	Total_Flow	FlowDiff	Totalizer_Read	Total_Flow	FlowDiff	Totalizer_Read	Total_Flow	FlowDiff	'TRG' AND a.chem
EFFLUENT	99530824	52836800	103192	99667472	52973448	136648	99736208	53042184	68736	
RW-1	568250	2062030	610	569070	2062850	820	569500	2063280	430	
RW-2	1744796	31200610	27754	1781560	31237374	36764	1799886	31255700	18326	
RW-3	8474380	19574160	74830	8573440	19673220	99060	8623420	19723200	49980	

Flow Measurement Date		10/20/2017			11/17/2017			
chemical_name	FlowDiff	Result (ug/L)	Mass_Removed	FlowDiff	Result (ug/L)	Mass_Removed	FlowD	
Cis-1,2-Dichloroethylene	610	95.0000000000	0.0004836463437	820	51.0000000000	0.0003490265937	430	
Tetrachloroethylene (PCE)	610	320.0000000000	0.0016291245	820	360.0000000000	0.002463717	430	
Trichloroethylene (TCE)	610	38.0000000000	0.0001934585468	820	34.0000000000	0.0002326843906	430	

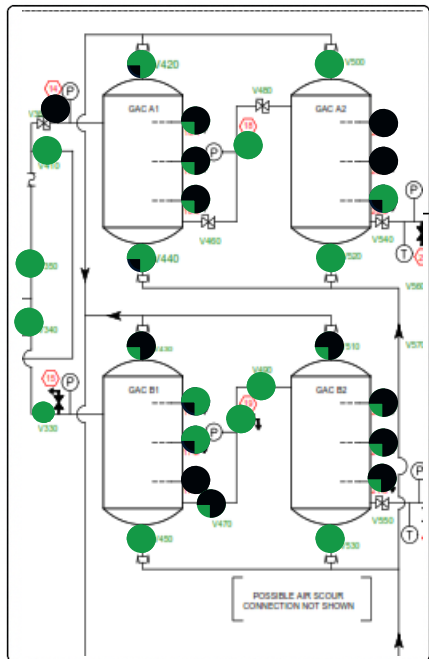
Reporting and Visualization

- Flow & Mass Concentration Removed Report
- Sample Result * Flow Volume = Mass Removed for a specific time period and location.
- Allowing for aggregation by time period.

mdy_date	Totalizer_Read	Total_Flow	FlowDiff	Totalizer_Read	Total_Flow	FlowDiff	Totalizer_Read	Total_Flow	FlowDiff	'TRG' AND a.chem
10/20/2017	99530824	52836800	103192	99667472	52973448	136648	99736208	53042184	68736	
11/17/2017	99667472	52973448	136648	99736208	53042184	68736	99736208	53042184	68736	
12/01/2017	99736208	53042184	68736	99736208	53042184	68736	99736208	53042184	68736	

- Pilot Study
 - Laboratory analytical data
 - System configuration data

System Optimization Phase Active

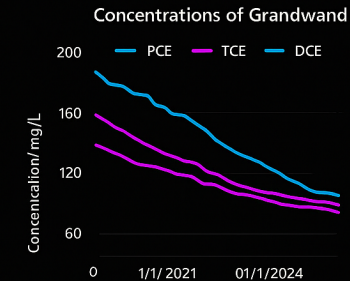


Mass Removal
Rate
52 lbs/day

**Total Treated
Volume**
109,000
gallons

Calculated Cost
Mass Removed
\$149
per lb

The schematic diagram illustrates the water distribution network for the city of Bham. It features a central vertical pipe with a 'Pump' at the top and a 'Monitoring Well' at the bottom. A horizontal pipe branches off to the left, connecting to 'EW-1' (Electric Well 1) and 'MW' (Monitoring Well). To the right, another horizontal pipe branches off, passing through 'Valve' and 'Valve 2' before connecting to 'Tank 1'. 'Tank 1' is represented by a green square and is connected to 'IW-1' (Injection Well 1), shown as a green circle at the bottom right. The network is depicted with blue lines for pipes and various colored circles (blue, green, and white) representing different components or nodes.



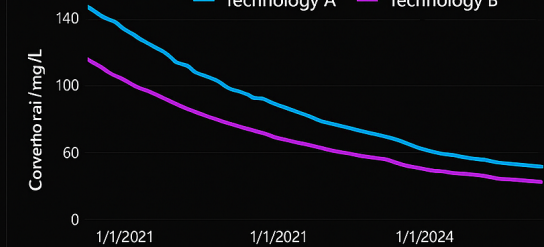
Current Mass of
Contaminants removed

81,2 lbs

Calculated Cost
per Mass Removed
\$150 per lb

Baseline Sampling			
Well	PCE	TCE	DCE
EW-1	3.65	2.48	1.82
EW-2	1.59	3.13	0.05
Regulatory	0.005	0.015	0.007

Concentration Reduction Over Time

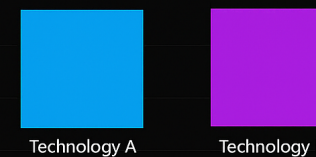


Total Mass of Contaminants Removed	
Technology A	Technology A
1,230 lbs	1,450 lbs

Total Treated Water Volume	
Technology A	Technology A
40,000,000 gallons	37,500,000 gallons

Cost per Mass Removed	
Technology A	Technology B
\$170 per lb	\$155 per lb

Average Removal Efficiency



Next Steps



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OTHER POTENTIAL REPORTS

- Overall Treatment System Inventory
 - Treatment system type, engineer/designer, installer/constructor, and install date.
- Treatment System Performance Metrics
 - Cost of operations, area of treatment, and O&M frequency for each treatment system type
 - Advanced performance report - statistics on average flow rates, average monthly energy costs, average monthly volatile organic compounds (VOCs) removed, cost of VOC per pound removed and other contaminant (to be determined) removal costs
- Focused Performance Reports
 - Air Stripper VOC Removal Efficiency -This report calculates the VOC removal efficiency, which is the overall percentage (%) of VOCs that are exiting the system, using the following formula.
 - VOC Cost Removal Trend Line - For each set of data collected, the previous VOC removal cost will be calculated to produce a series of removal costs over time. The representation of these costs over time will produce the VOC Cost Removal Trend Line.
- Run Time and Percent Operating Time Calculation Reports
 - Include information regarding the system run time and down time
 - $\% \text{ Operating Time} = \frac{\text{Totalizer Hour Reading} - \text{Previous Totalizer Hour Reading}}{\text{Previous Reading Date} - \text{Current Reading Date}}$

Next Steps



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- Complete custom report development.
- Development of “universal” Collect templates for pilot study data collection.
- Create a dashboard to facilitate the review of field data and update the status of the data.
- Integration of telemetry data with O&M to accommodate PLC (programmable logic controller) systems.
- Expand dashboard visualizations to incorporate information from additional reports.
- Incorporate threshold-based triggers or “alarms” to dashboards and notifications.
- Design a universal PowerBI dashboard for O&M data

Thanks!



Call Us:

Kristen Brown
610.737.8049



Email Us:

Kristen.Brown@TRCcompanies.com



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