

ENVIRONMENTAL EXPERTISE FROM THE GROUND UP



Remedy Performance Reporting Driving Remediation System Optimization and Site Progression

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Agenda

- 01 A Programmatic Approach to OM&M
- 02 Field Data and Optimization
- 03 Key Performance Indicators (KPIs)

A Programmatic Approach

Establishing a Framework

Types of OM&M Projects

- Groundwater Extraction
- Vapor Extraction
- Air Sparging, Biosparging
- Multi-phase Extraction
- NAPL Recovery
- Vapor Mitigation
- ISCO and Ozone Sparging
- Storm/Surface Water Treatment
- Leachate Recovery and Treatment
- Landfill Gas Management

Active (Mechanical)



- Soil Cap
- Barrier Wall
(sheet piling/slurry wall)
- Permeable Reactive Barriers
- Landfill Cap
- Phytoremediation
- NAPL Sorbent Socks
- MNA

Passive (Non-Mechanical)



- ISCO
- ISCR
- Bioremediation
- MNA Enhancement
- Surfactant
- In-situ Activated Carbon
- Dewatering
- Vacuum Truck Program

Other (Short-Term/ Temporary)



OM&M Program Benchmarking

Program Element	Major Oil	Major Oil	Major Oil	Divers. Mfg	Major Oil	Aero. Mfg	Chem. Mfg	Pipeline Co.	Power Utility
Defined OM&M Practices	Yellow	Yellow	Yellow	Yellow	Grey	Grey	Grey	Grey	Grey
Defined Work Scopes / Units	Yellow	Yellow	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Defined MOC Processes	Yellow	Grey	Yellow	Grey	Grey	Grey	Grey	Yellow	Grey
Performance Scorecards	Yellow	Yellow	Yellow	Yellow	Grey	Grey	Grey	Grey	Grey
MMS	Grey	Grey	Yellow	Yellow	Grey	Grey	Grey	Grey	Grey
Defined Technical Reporting Requirements	Yellow	Yellow	Yellow	Grey	Yellow	Grey	Grey	Grey	Grey
Defined Financial Reporting Requirements	Yellow	Yellow	Grey	Yellow	Grey	Grey	Grey	Grey	Grey
Formal Site Review / Audit Process	Yellow	Yellow	Yellow	Yellow	Grey	Yellow	Yellow	Grey	Grey

OM&M Priority Benchmarking



Remediation introduces immediate risks that were not present prior to implementation.

Why is Management of Change Important?

Changes occur during OM&M

- Often less rigorously evaluated and reviewed
- May be “field determinations”
- Introduces new or different risks
 - » Injury to site workers
 - » Permit non-compliance
 - » Loss of treatment efficiency
 - » Exceed design flow rates
 - » Damage to equipment



Audits and Peer Reviews

Safety & Compliance Audits

- Internal and/or third party
- Avoid injury and related costs
- Avoid downtime
- Avoid regulatory and public scrutiny:
 - » Consent orders, permit non-compliance
 - » Re-work

Peer Reviews

- Get new perspectives on languishing issues
- Break status quo for continuous improvement

Engage stakeholders in the process. Assign action items and accountability for further vetting and/or implementation.



Field Data and Optimization

Working Together

Workflow Process

Meter Readings

Tran ID	Date Taken	Taken By	Meter Reading
GoTo_40Q0M284N	09/13/2014	WIC	100
GoTo_40Q0M3ZVP	09/13/2014	WIC	200
GoTo_40Q0M01C	09/13/2014	IMPORT	200

PM Schedules

PM Group	Asset ID	Produce Every?	Calendar Based Freq.	Calendar Freq. Type	Brief Description	Next PM Date	Last PM Work Order Date	Last PM Work Order No.	Est. Hours	Assign To
GoTo	01	1.00	1.00 Months	Static	Month-to-Sump-Pump and Basin-Check	01/04/2015	08/21/2015	1196	1.00	ABC Company (Tim Johnson)
GoTo	01	1.00	0.00 N/A	Static	LUBRICATION			8	0.00	The Green (Shelley Lawless)

Work Order Details

WO No.: 103
WO Date: 05/26/07
WO Type: PM
Sched. Date:
Est. Hours: 2
Asset ID: 1003
Asset Description: Compressor, Air
Building: Main
Floor: Ground
Request #: GoTo
Requested By: P.H. Schedule
Assign To Type: Employee
Assign To: Acme Company (Jeff Worth)

Status: H
Completed Date: 06/21/07
Downtime: 0
Problem Type:
Work Order Status:
Project #:
Priority:
Req. Telephone:
Req. E-mail:
Perform For Type: Other
Perform For:

Brief Description: Air Compressor 90 Day Service

1. Perform normal tour checks and operations.
2. Change compressor crankcase oil
3. Clean air intake filter
4. Check air dryer, automatic condensate drains, and air tank for proper operation. Clean condenser coils and cover grills.
5. Inspect belt alignment and condition. Adjust or replace belts as required.
6. Check for corrosion and scale on water cooled units.
7. Clean heat exchange surfaces.
8. Check accuracy of gauges with calibrated test gauge.
9. On two stage compressor, check intermediate pressure.
10. Test relief valves, replace if leaking or the relief range is incorrect. Do not readjust safety relief valves in the field.
11. Check operation of compressor unloaders, repair or replace if not loading and unloading properly.
12. Check compressor suction and discharge valves for proper operation. Replace leaking valves.
13. Check out in and out compressor pressure controller, readjust if necessary for proper air pressure requirements. Do not exceed ASME maximum tank pressure.
14. Check to make sure belt guard is installed prior to putting air compressor back in service.
15. No pressure vessel is to have its hand hole or man hole covers removed unless the vessel is at atmospheric pressure.

Work Order Preparation

Fieldwork Scheduling

Deliverable Tracking

Document Management

V&V

Work completed

Deliverables submitted

Permit compliance

Select System Data

Flow rate

Mass flow rate

NAPL recovery rate

Pore volumes recovered

Groundwater geochemistry

NAPL thickness

Mass recovered

COC concentrations

PID and LEL

Groundwater elevation

Operator hours

Utility costs

Uptime

Sustainability factors

Waste generation

Process data (pressure, flow)

Chemical usage rate

Equipment hour meter

Permit compliance data

Every piece of data collected should be used.
Timely review data and trends.

If data is not being used:

1. Should it be used?
2. Is it valuable for later use?
3. Should it be collected?

Remedial Process Optimization (RPO)

Remedy Optimization

Protective of human health and environment

Hydraulic control and plume capture

Subsurface barrier

Groundwater extraction system

Contaminant concentrations in soil and groundwater

Stabilization, reduction

Vapor intrusion mitigation

Soil cap condition

Permit and regulatory compliance

Process Optimization

Flow rates and pressure

Process stream chemistry

Contaminants, pH

Equipment cycling rates, condition, life cycle

Treatment train effectiveness and necessity

Chemical/consumable usage

Waste generation volume and frequency

Data collection needs

Field

Laboratory

Control logic appropriateness

Process safety management

Industry Optimization Approaches

- Traditionally viewed as separate from OM&M
 - » Defined process
 - » Holistic review of remedy success/progress
 - » Cost review
 - » Treatment train evaluation
 - » Safety review
- Increasingly considered part of OM&M
 - » Some have defined process
 - » Expectations often less clearly defined
 - › “Reduce cost”
 - › “Site progression”
 - » May be expected as “value-added” service

Ensure remedy performance is routinely monitored and continuously improved. Optimization almost always leads to the need to implement a management of change process.

Key Performance Indicators

Selecting the Right Metrics

Performance Metrics: KPIs

Defining objectives and measuring performance

Program KPIs

- Health and safety
- Regulatory compliance
- Schedule compliance
- Financial & cost savings
- Project progression
- Peer reviews
- System performance
- Optimization

Site-specific KPIs

- Operating as designed
- Mass removed / treated
- Uptime
- Carbon footprint
- Inspections

Select remedy performance KPIs that provide a quantitative measure of remedy performance toward remedial goals.

KPI Selection

- If met, site will reach remedial goals in the predicted time
- Evaluate the rate at which the site is remediated
- Benchmarked against established standards
- Specific to a site, system, and a remedy
- Defined prompt action plan for deficiencies

Uptime

- Good first look
- Identify problematic systems or trends
- Always tracked but minimal diagnostic value

Mass Recovery

- Track as total mass, rate, or \$/lb
- Value dependent on initial mass estimate
- Tracking by well or area useful

Supplemental KPIs

- Specific to a given technology and site
- Targeted to evaluate rate at which system is achieving remedial goal or evaluate key operational parameters
- Monitor changes in regulations and site use

SVE Examples

- Pore volume exchange rate at maximum ROI
- O₂ and CO₂ concentrations
- Vadose zone temperature changes
- Respiration test data

LNAPL Recovery Examples

- Actual vs. predicted recovery rates
- Recovery per unit area
- Changes in transmissivity at recovery and monitoring wells
- Apparent thickness (often regulatory closure criteria)

Key Takeaways

- Build “fit for purpose” OM&M program
- Safety, cost, change management, and KPIs
- Use independent “fresh eyes” reviews to share best practices, highlight innovation, and continuous learning opportunities
- Select useful OM&M data to collect
- Optimization is change
- Standardize performance tracking, but allow flexibility in site-level implementation



A GOAL
WITHOUT A
PLAN IS JUST
A DREAM.

-dave ramsey

THANK YOU.

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