

Oil/Fuels Facility Contamination Causes and Cleanup Considerations



Presentation to include:

- Overview of upstream and downstream Oil/Fuels Facility sources of contamination
- Discussion on AST tank construction and operation
- Primer on Federal Regulatory Authority and Resources available
- Proven, Practical, Remediation Options for Contaminated Sites

FUELS MANAGEMENT FACILITIES

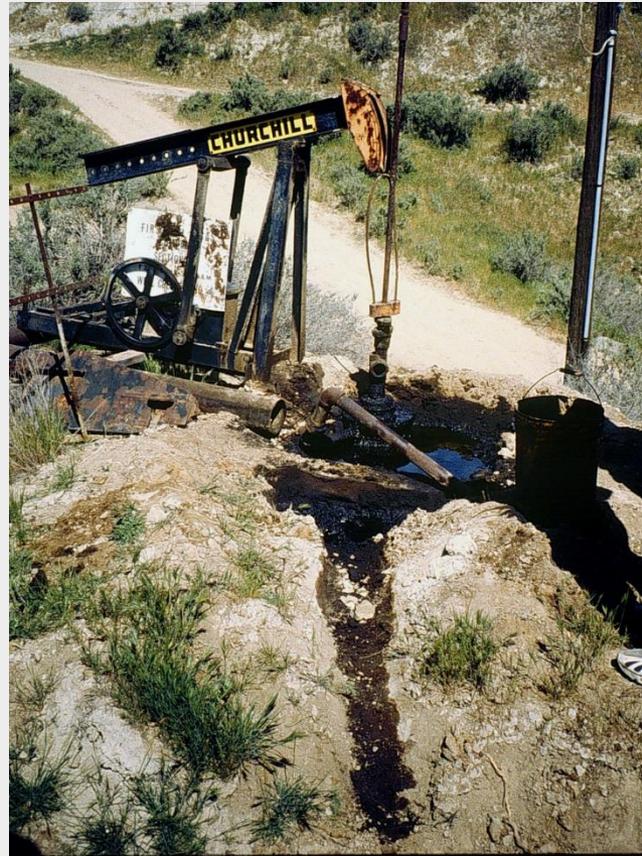
- Oil and Gas Fields
- Transmission Pipelines
- Refineries
- Terminals
- Service Stations
- Transportation Systems (tankers, railroads, trucks)
- Recyclers, landfills, chemical plants, etc.
- Biodiesel facilities

Fuels Management Cleanup Sites

- We do not know the extent of the problem, or the universe of sites.
- It is difficult to find an oil production unit, a refinery, a storage tank farm, a pipeline system, a rail transfer facility, or a recycling operation without a substantial hydrocarbon contamination problem.



OIL FIELDS



Tidy Operations





Not Tidy

What Chemicals are to be considered?

- Crude oil - PAHs, aromatics, paraffins
Iso-paraffins, cyclo-paraffins, trace metals
- Methane gas
- Diluent - as crude but more mobile
- Brines - chloride and trace metals
- Operations chemicals – mercury, solvents, surfactant, drilling fluids, biocides (arsenic), PCBs, trash

Environmental and Response concerns at Oil Wells

- Sumps and pits
- Oil wells (blow-outs)
- Cellars
- Casing leaks
- Piping (valves, fittings)
- Separators and dehydration facilities
- Re-injection wells
- Tanks

Oil Wells cont.

- Reservoirs
- Compressor stations
- Gathering lines
- Pig recovery areas
- Waste pits and landfills
- Surfactant and chemical storage
- Transformers

PIPELINES



Many pipeline systems are not regulated



What is Transmitted in Pipelines?

- Crude
- Refined product
- Other refined chemicals



How Long are these Pipelines?

- Petrochemical lines
 - usually short runs
- Petroleum liquids
 - intra-state
 - inter-state
- High Pressure Natural Gas
 - intra-state
 - inter-state

How Long? cont.

- Crude Oil Field lines
 - usually short runs
- Off-shore wells
 - underwater runs

Where are these Pipelines?

- Many run along rail lines
- Over, under, through rivers and lakes and on the sea floor
- Maybe under your backyard

Do we know their location?

- Most maps based on “as built” info
 - piping buried at depths ranging from near surface to ?
- For oil fields, probably not
- For other pipelines the mapping is often poor

How much do they transmit?

- > 100 million gallons of petroleum products per day in California
- 40 million gallons of gasoline per day in California

Operating pressures?

- 50 to 1000psi

How old are pipelines?

- up to 100 years!



That leak monitoring is in place?

- Pressure drop sensors for catastrophic breaks
- a very few facilities with full-run leak detection

Are Pipelines currently the safest transmission method?

- Yes, but they could be improved



REFINERIES



What chemicals are found at refineries?

- Crude
- Refined products
- Other refined chemicals (MTBE)
- Process chemicals (HF, HCL)
- A variety of liquid and solid wastes

How much Petroleum Product is stored at a refinery?

- - > 50 million gallons

What is it stored in?

- USTs (leaking?)
- Above Ground Tanks (leaking?)

How old are the refineries?

- Up to 100 years

Accidents at refineries often



Other Concerns at Refineries

- Pipeline leaks
- Process unit failures
- Air emissions,
- Waste discharge problems
- Subsurface leaks

Where are they located?



Refineries in Urban Areas



Near Water Bodies



Is there a Refinery without a Subsurface Release?

- We can't find one (yet)

STORAGE TERMINALS



What is stored at terminals?

- Everything
- Crude
- Refined products
- Other chemicals

Remote Control Operations

- Prone to problems from overfilling, etc.
- Unattended truck loading issues

Airports

- AST farms?
- Hydrant delivery to the jetway
- Many (if not all) have jet fuel releases to soil/groundwater

Co-located Operations



Issues at Co-located Operations

- Safety
- Security
- Allocation of Responsibility
 - maintenance and testing
 - spills
 - remediation

Condition of these tanks?



Tanks often leak from the bottom



Do Tanks Leak from the Top?



Do tanks ever leak from the sides?



OOPS!



Other Concerns

- Piping
- Fittings
- Valves
- Floating Roof drainage
- Poor housekeeping procedures

What about Containment?



Where are these Terminals?

- Urban areas (often industrial or low income)
- Next to water (Rivers, Estuaries, Harbors)

Is there a Terminal Without Subsurface Contamination?

- We can't find one (yet)

Bio fuels Production Plants



What are the chemicals of concern?

- Crude
- Refined products
- Other refined chemicals (MTBE)
- Process chemicals (HF, HCL)
- Solvents
- A variety of liquid and solid wastes

What are the areas of concern?

- ASTs
- USTs
- Piping
- Drums
- Barges

What is the Status of these Facilities?

- Many are in disrepair and are located in defunct terminals, refineries, etc. that had problems long before the oil recycling operation commenced
- Abandoned facilities are common
 - the market for used oil is soft
 - sham recycling is a great way to make money

SERVICE STATIONS



What are the chemicals of concern?

- Gasoline
- Diesel
- Aromatics (benzene)
- Additives

What are they stored in?

- UST systems with known leak problems
- ASTs with uncertain oversight

What about the UST program?



Do new UST systems leak?

- Yes
 - Not all new systems are installed correctly
 - Vent pipes, dispenser fittings and other portions of the system still pose problems

FUEL TRANSPORTERS



“Card Lock” Loading Rack Systems

- Most are contained and cannot allow a truck to fill unless the proper mechanics (valve sequence, grounding, etc.) are in use
- The terminal operator requires (assumes) that all drivers have proper training and are always qualified
 - unless the regular driver is sick

Transport Truck Problems



Do fuel delivery trucks ever have problems?



“Example” Fuel Delivery Truck Problems

- Driver pumped 600 gal diesel fuel into a monitoring well
- Delivery driver over-filled customer's tank - fire ensued
- Driver pumped load of fuel into abandoned water well
- Driver pumped 300 gal of fuel oil into crawl space ventilator

Do oil tankers ever have problems?

- Yes, even a ship with a double hull can leak, run aground, or catch fire

Do railroads ever have problems?

- Yes, often derailments are next to a water body
- Bakken by rail issues



Fuel Docks



Fuel Dock Problems

- Marine
 - storage tanks
 - containment during fueling
 - hoses and fittings
- Fresh water
 - storage tanks
 - hoses and fittings
 - seasonal maintenance at some facilities

**WHAT IS BEING DONE TO
MITIGATE ENVIRONMENTAL
PROBLEMS AT Oil/FUELS
FACILITIES?**

High Investment Retrofit



Low Investment Retrofit



Preparedness and Response



Safety Issues

- At most facilities Local agencies have the lead
- Fire Departments are supposed to ensure that there are no problems
- For facilities that have several operations, the trick is to get them to coordinate safety plans, etc.

Remediation



Good News

- For most Petroleum related problems the fix is not that bad
- Unlike many CERCLA sites, the clean-up can be completed in your lifetime

AST Tank and Pipeline Test Methods



Pipeline Integrity Testing

- Test methods
 - hydrostatic
 - pneumatic
 - acoustic
 - Pigging
 - X-ray
 - wet finger in the wind...

Pipeline Leak Detection Systems

- Computer-Based LDS
 - Instrumentation
 - flow meters
 - pressure transducers
- SCADA/Communications

Pipeline LDS cont.

- Internal Leak Detection Systems
 - Volume Balance
 - Pressure Analysis (Refraction Wave Monitoring)
 - Real Time Transient Modeling

Pipeline LDS cont.

- External Leak Detection Systems
 - Acoustic Emissions
 - Fiber Optic Sensing
 - Liquid Sensing
 - Vapor Sensing
 - Airborne methods, (Thermal I.R., etc.)
 - Molecular marking of fuel
 - Fuel in the river, town on fire...

Pipeline LDS Performance Issues

- Multiphase and Slack-Line effects
- Pre-existing Leaks
- Variations in Temperature, Pressure, & Flow Conditions
- Connected Production Areas
- False Alarms
- Instrumentation
- Controller Training
- Redundant Systems

Test methods for ASTs

- Integrity tests
 - Hydrostatic
 - Mag Particle
 - Magnaflux/Vacuum Box/Ultra-Sound
 - X-ray
 - Other Tricks
 - Robotics

Leak Detection for ASTs

- Interstitial Monitoring
- Release Prevention Barriers (Double Bottom Tanks)
- Liquid Sensing Probes and Cables
- Volumetric and Mass Measurement Methods
- Statistical Inventory Control

Leak Detection for ASTs cont.

- Automatic tank Gauging
- Passive-Acoustic Sensing
- Vapor Monitoring
- Fiber Optic Sensing Probes
- Dye tests
- Molecular Marking of Fuel

AST Leak Detection System Performance Issues

- Pre-existing and Previous Leaks
- False Alarms
- Redundant Systems

TRENDS IN THE INDUSTRY



-
- Reduce cost to maintain profits
 - Mergers
 - Downsizing and layoffs
 - External approach (unit cost contracts, outside contractors)
 - Sell off to “mom and pop”
 - Walk away

What's coming?



-
- Very few new refineries, (NIMBY, cost)
 - Closures of aging refineries
 - More imports
 - AST boom
 - Increased transport over water, by rail, by truck
 - “Remote control” terminals
 - Increased accidents

Section on AST construction and operation by Mark Howard

SPCC/FRP section by Peter Reich

Are All Oil/Fuels Sites covered by the Regulatory System?

- Federal Regulations cover some, but not all sites and situations
- State, County, Local Regulations usually cover almost any aspect of any site (However, they often short on staff and resources)



Federal Regulatory System

- EPA
- USCG
- BOEM
- PHMSA
- NTSB
- Others?

EPA's Regulatory Authorities

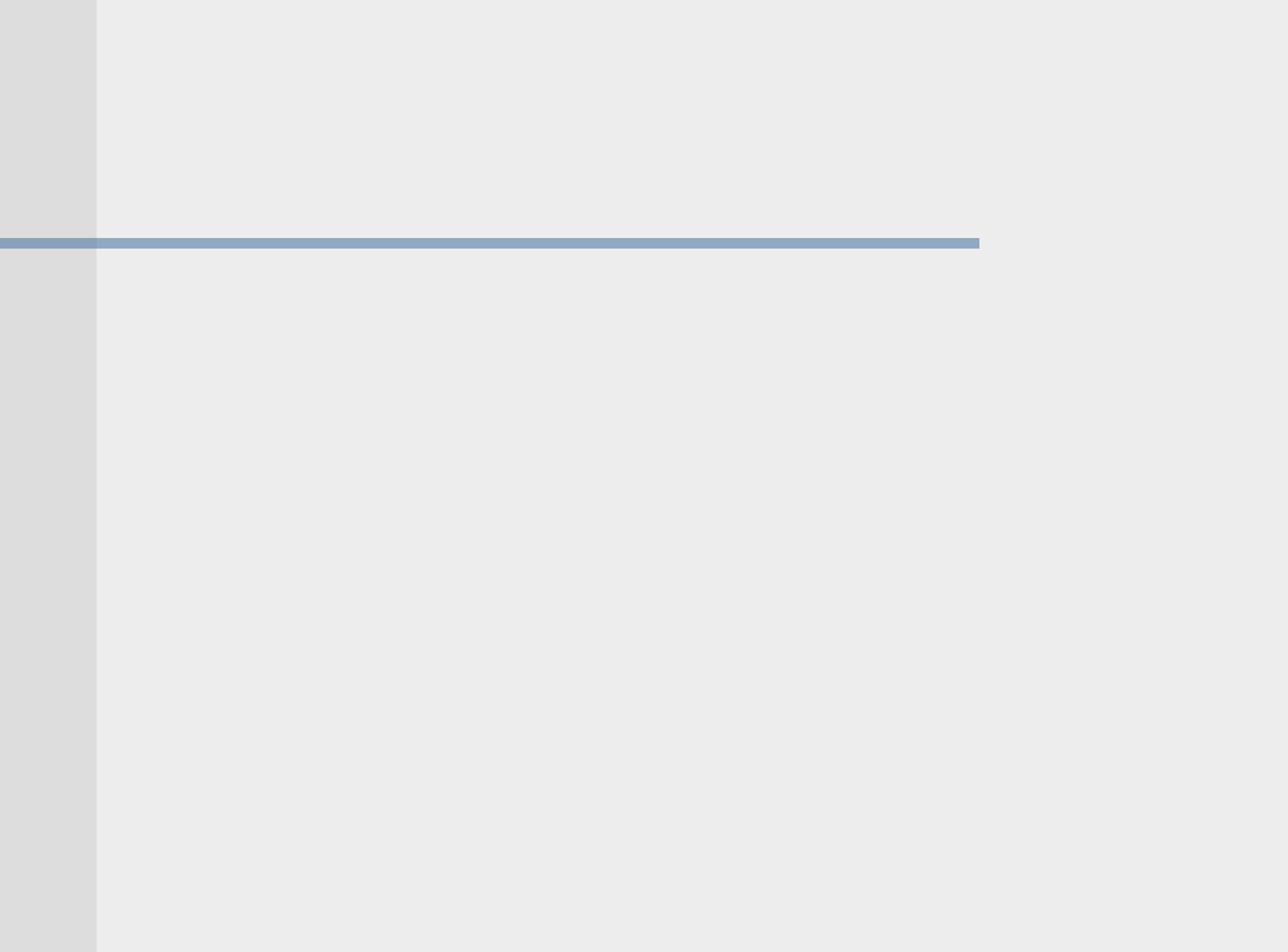
- SPCC
- OPA
- CERCLA
- RCRA

EPA's Authorities cont.

- Active operations
 - SPCC, RCRA, CERCLA (maybe)
 - Compliance and Remediation for closed sites with an RP (maybe)
- Closed sites with an RP
 - If non-petroleum contaminants are present then CERCLA applies
 - If there is an actual or potential threat of release of oil into surface waters, then OPA may apply
 - RCRA may apply, but no fund

EPA's Authorities cont.

- For sites with no RP
 - If non-petroleum contaminants are present then CERCLA applies
 - If there is an actual or potential threat of release of oil into surface waters, then OPA may apply
 - Many sites go unattended because: If no CERCLA and no OPA, then no \$\$



Remediation Options

- Dig and haul
- Free product recovery
- Dual Phase recovery
- Air Sparging
- Vapor extraction
- Chemox

Free Product Recovery

Great approach when possible

Most bang for the buck



Pump and Treat

Often used to provide containment of the problem

Requires management of considerable waste volumes



Air Sparging

Involves pumping air through the water table

Forces the contaminant out of the water into the soil gas where it can be recovered by VES

Introduced oxygen into the water, accelerating microbial action



Vapor Extraction

Limited impact if used as
the only technique

Useful in conjunction with
other tools



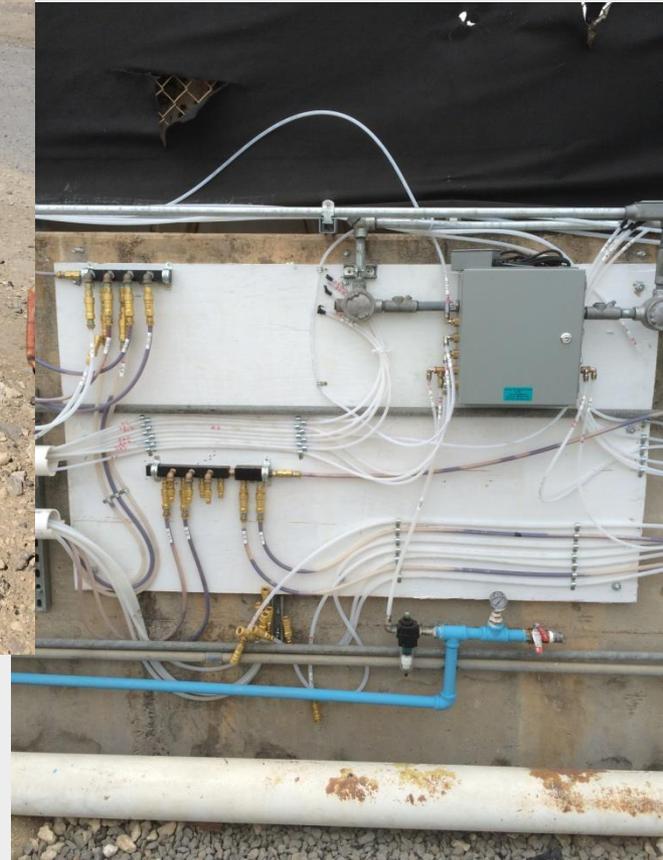
Chemical Oxidation

Most effective for polishing low levels of contamination

Materials cost can be a drawback



Xitech Skimmer System



Sand Island tank farm case study

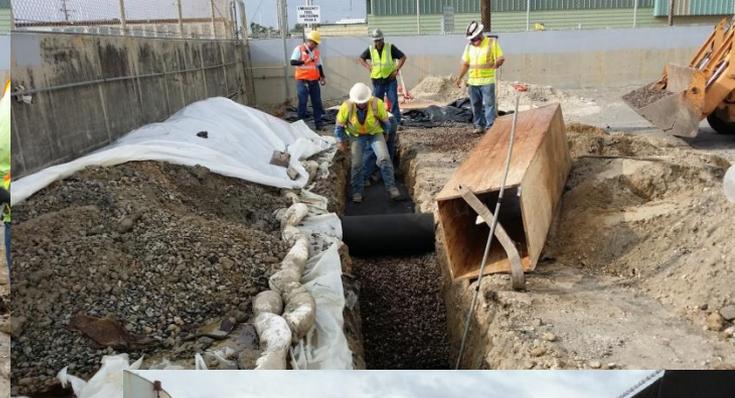


Sparks or Selby case study

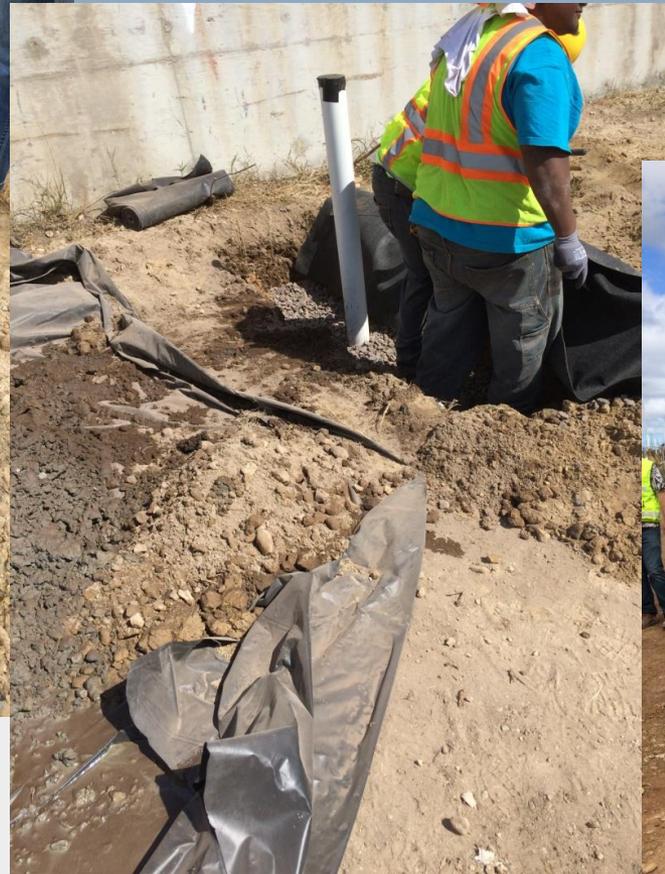
No Bucks, No Buck Rogers



Extraction Trench



Extraction sump/well

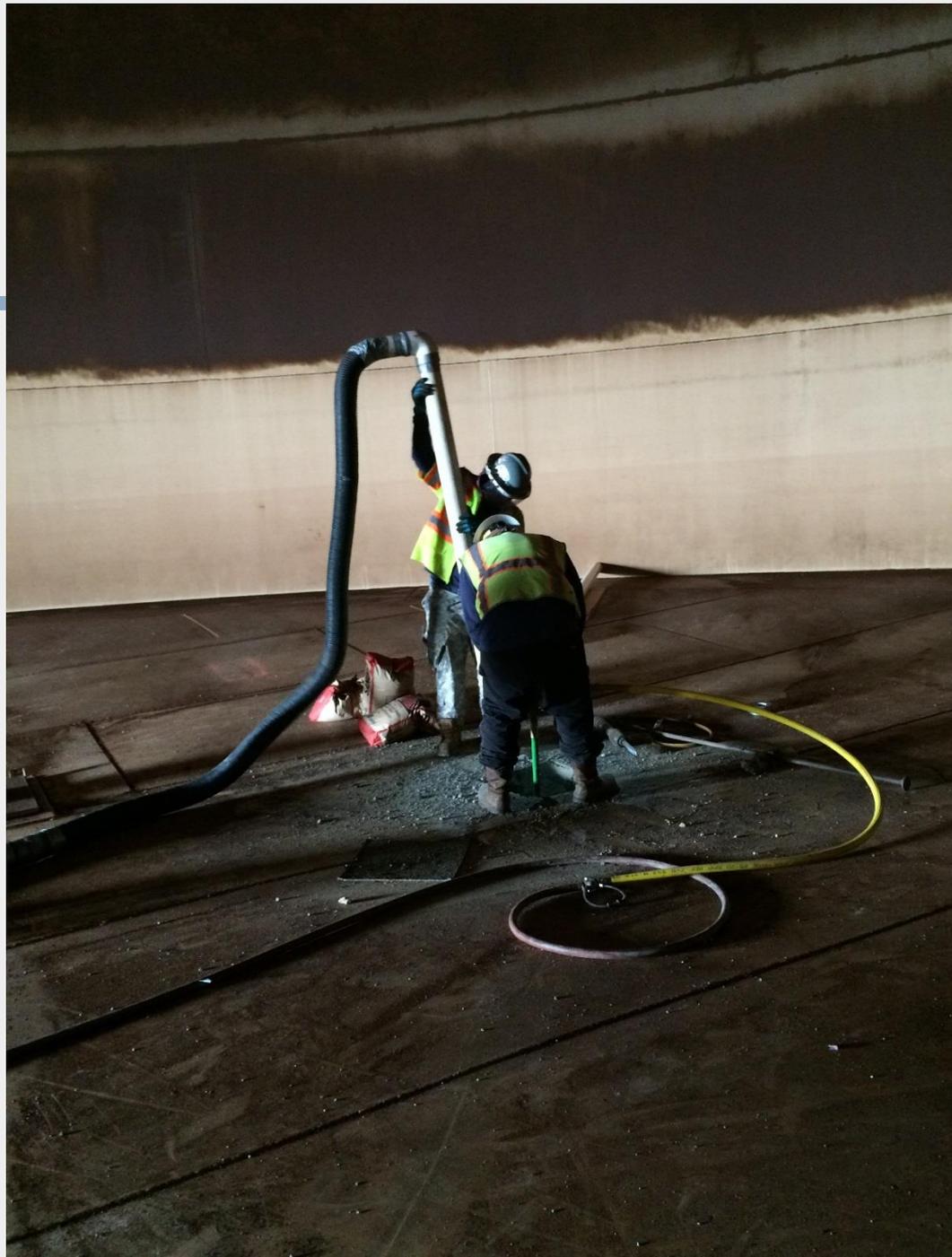


Tank #2 extra effort...



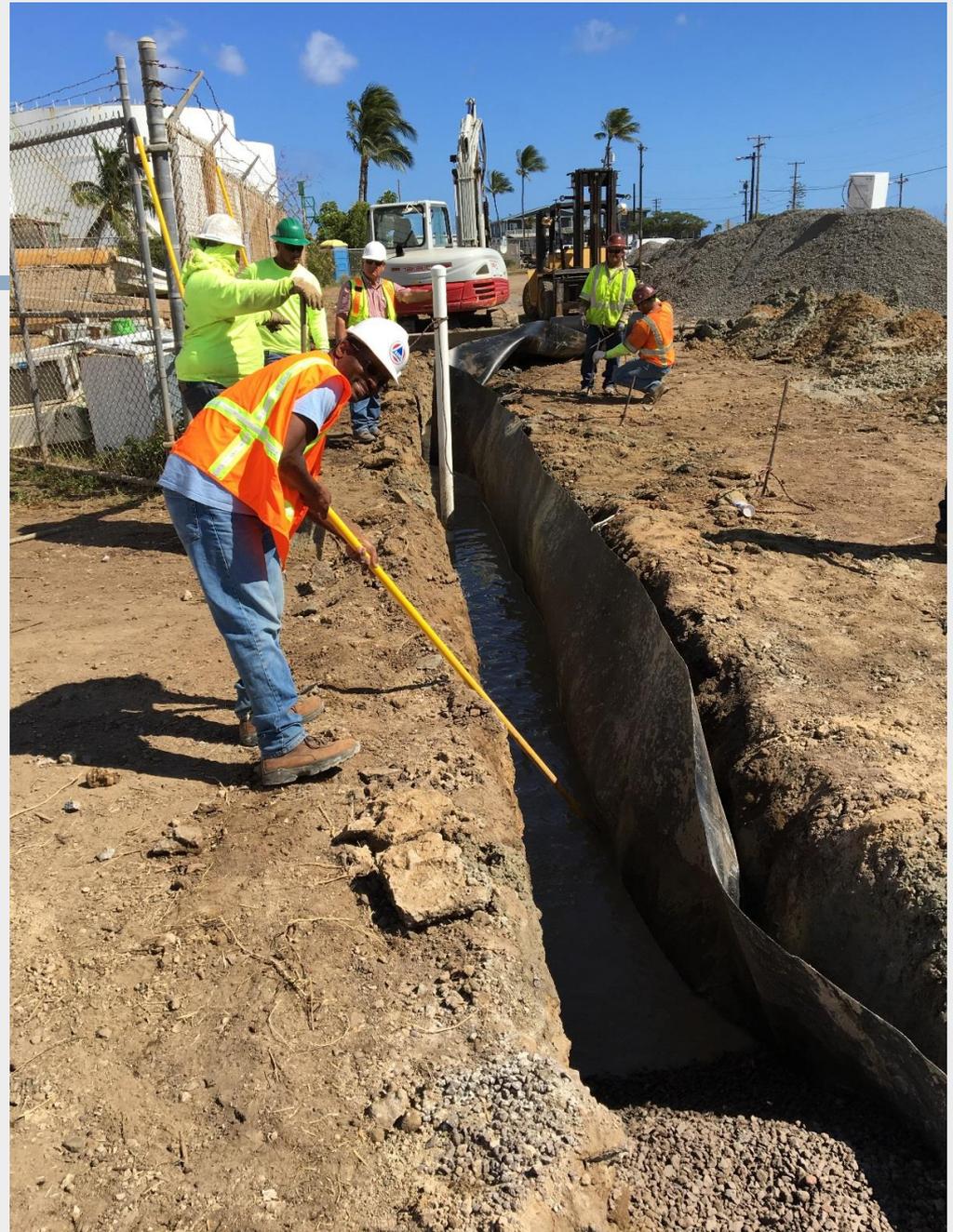
Recovered Jet Fuel







Containment Wall





And so it goes (on and on)...

