



Multiphase Extraction Techniques

Mary Anne Kuserk

Bureau of Underground Storage Tanks

**New Jersey Department of
Environmental Protection**

Multiphase Extraction Techniques

- Description of Techniques
 - What is Multiphase Extraction
 - Effective Uses
 - Appropriate Site Conditions
 - Monitoring the Effectiveness of the Remediation
 - Use of Surfactants
- Case Examples
- Cost Effectiveness

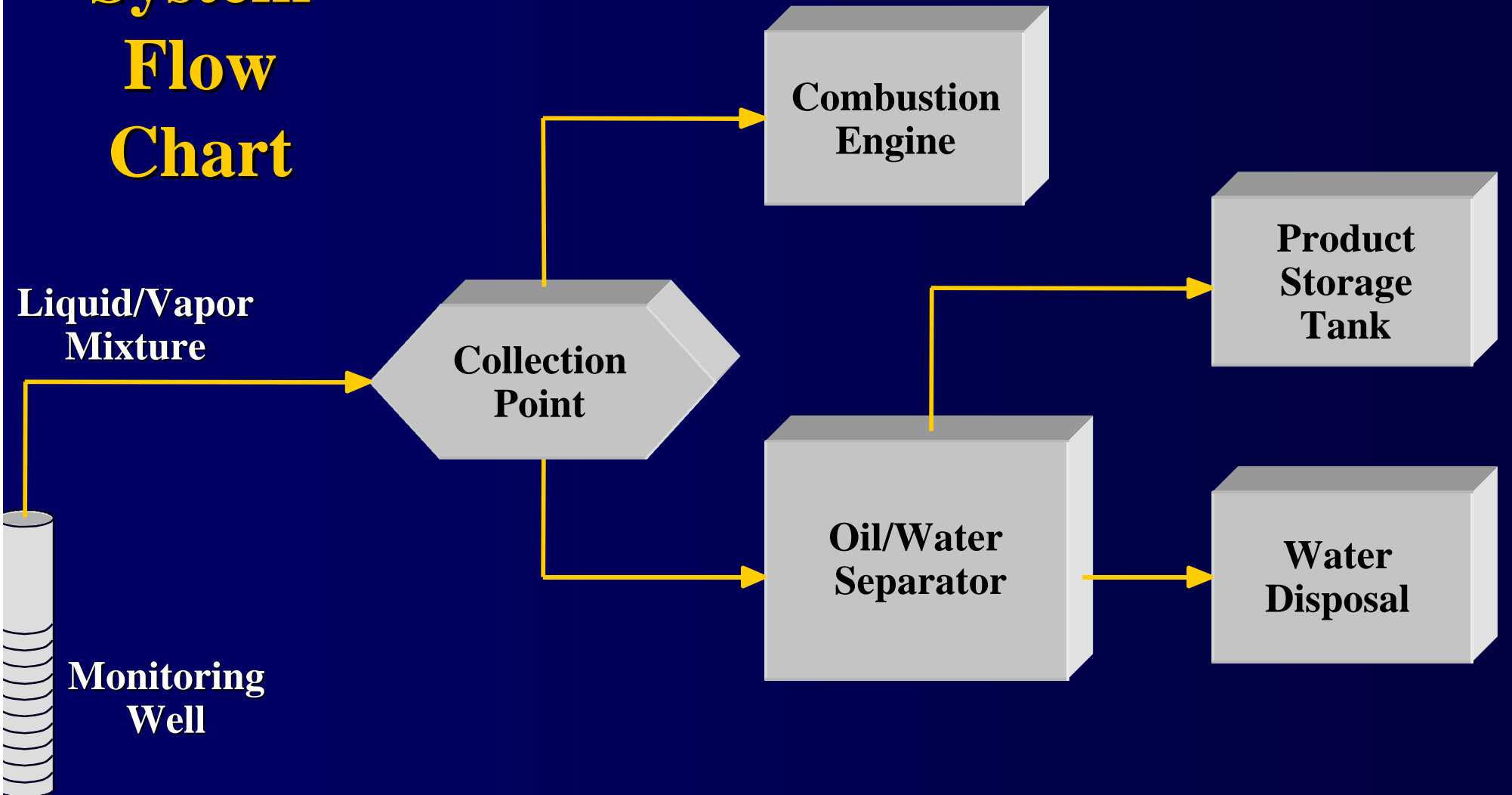
Multiphase Extraction

- High Vacuum Processes which remove vapors and total fluids, both dissolved and residual phase product, from the subsurface.
- Usually short term (6-8 hours) and temporary (once a month).

Multiphase Extraction

- Extraction of total fluids through the installation of extraction points in a single well or multiple wells.
- High vacuum is placed on the point : 29 inches of mercury with flow rate of 150 cfm.
- Vapor is treated with combustion engine and water/product is disposed off-site.

System Flow Chart



Multiphase Extraction

- Trade Names
 - HIT – High Intensity Extraction and Treatment
 - HEAT – High Vacuum Extraction and Treatment
 - EFR – Enhanced Fluid Recovery

Effective Uses

- Removing residual free product from saturated and unsaturated zone.
 - Most effective at site where product is relatively isolated and $< .5$ feet in wells.
 - Objective is to remove mass of contamination to then allow for Natural Attenuation.

Effective Uses

- Emergency Situations
 - catastrophic tank failure
 - enables RP to respond quickly – no need for permanent equipment
- Not to be used to establish hydraulic control or used as a method or receptor control

Site Characteristics

- Sites where SVE or g.w. pump tests have shown influence (demonstrating air and water flow through)
- Hydraulic conductivity of .5 to 15 feet/day
- Product found in a few monitoring wells (ideally <.5 feet of product)
- < 30 feet to the water table
- Unconsolidated material that is relatively homogeneous

Monitoring Effectiveness of System

- During remediation must monitor :
 - water flow rates
 - vapor flow rates
 - vacuum response
 - water level response
 - concentration data – both ground water and vapor
 - amount of total fluids removed
 - calculation of amount of product recovered

Use of Surfactants

- Some RP's use a surfactant in conjunction with Multiphase Extraction Techniques.
- Surfactant mobilizes free product bound to the soils which allows the product to be recovered in monitoring wells.

Cost Effectiveness

- Allows RP to remediate without upfront capital costs
- Uses existing monitoring well network
- Does not disrupt on-going station activities
- Specific events – RP pays for direct use

Cost Effectiveness

- Least expensive method of mass removal to then allow for Natural Remediation.
- In general, \$10 to \$75 per gallon of product recovered vs. \$250 per gallon for traditional methods.

Estimated Hydrocarbon Recovered

	WEEK							
	1	2	3	4	5	6	7	8
HOUR	112	112	112	56	56	56	28	28
I(PPM)	6200	5800	5400	5000	4500	4100	3800	3300
Q(CFM)	200	200	200	200	200	200	200	200
PRODUCT (GAL)	296	277	258	119	107	98	45	39

TOTAL (GAL) 1239