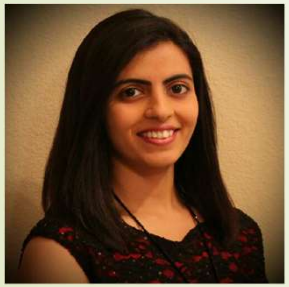
Navigating through the Challenges of NSPS OOOOa



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Prepared for -
STEP Dallas Meeting
September 11, 2018

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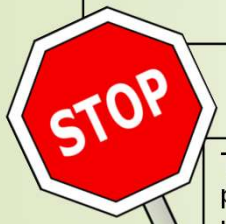

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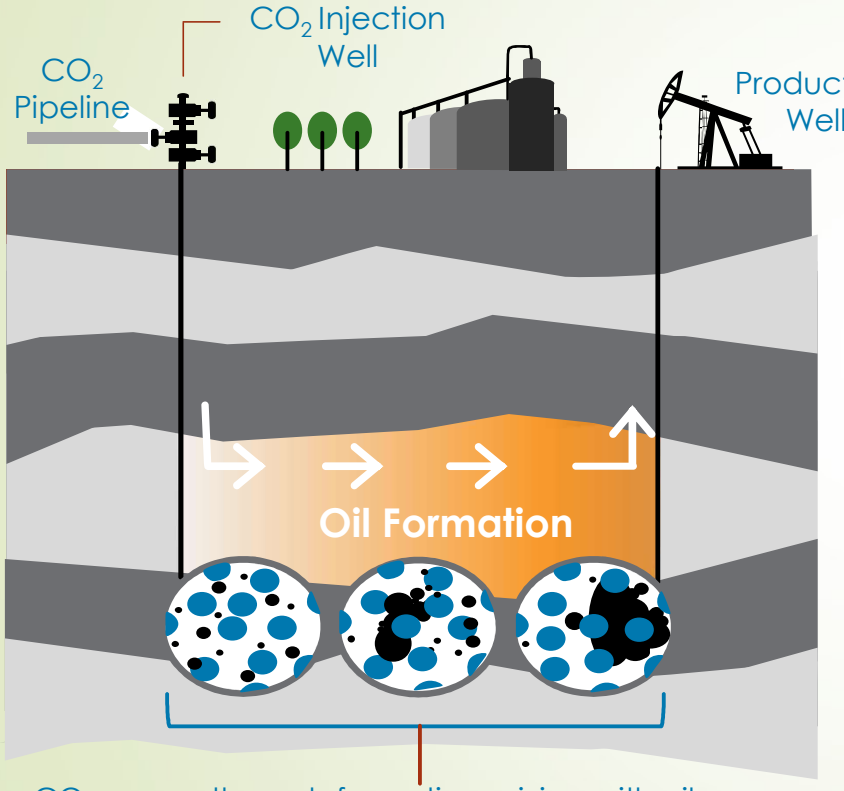
This is not a .....

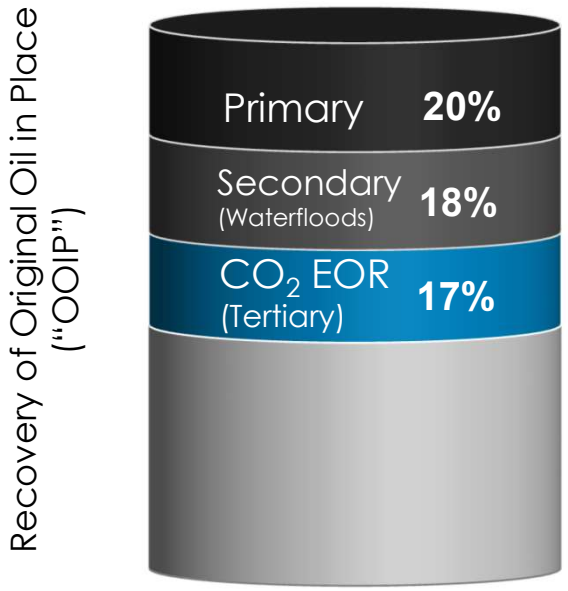
Agenda

- Understanding Company Operations
- NSPS OOOOa Regulatory Background
- Challenges Faced with LDAR
- Applicability and Definitions
- Navigating through the Challenges

CO_2 Enhanced Oil Recovery Process (EOR) Process



CO_2 EOR can produce about as much oil as primary or secondary recovery(1)



1) Based on OOIP at Denbury's Little Creek Field

Courtesy: Denbury Resources, Inc.

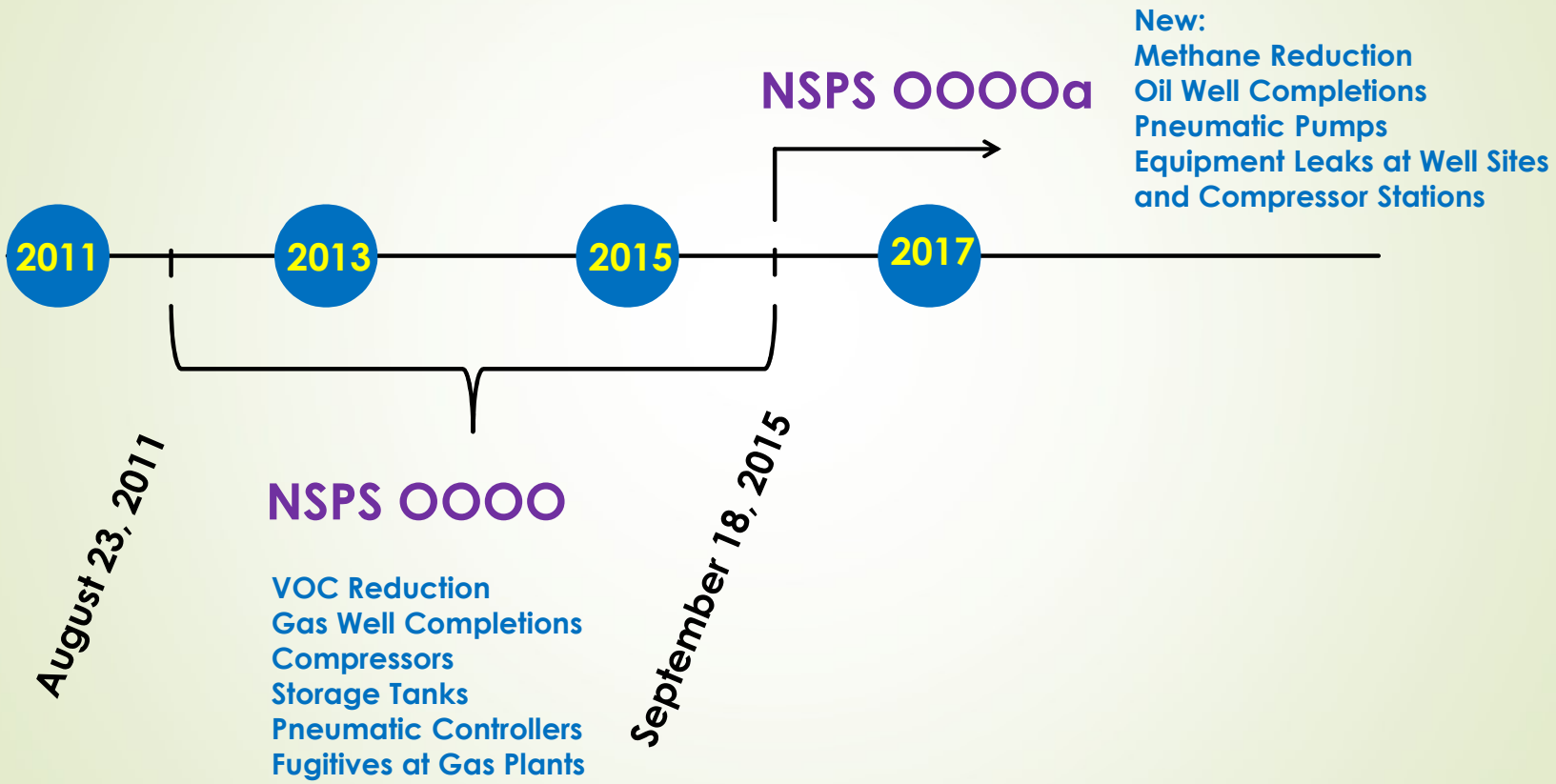
CO_2 EOR Facility vs. Conventional Tank Battery

Hastings EOR Facility
Alvin, TX

Glendive Well 31x-22
Cedar Creek Anticline Field, Montana

Courtesy: Denbury Resources, Inc.

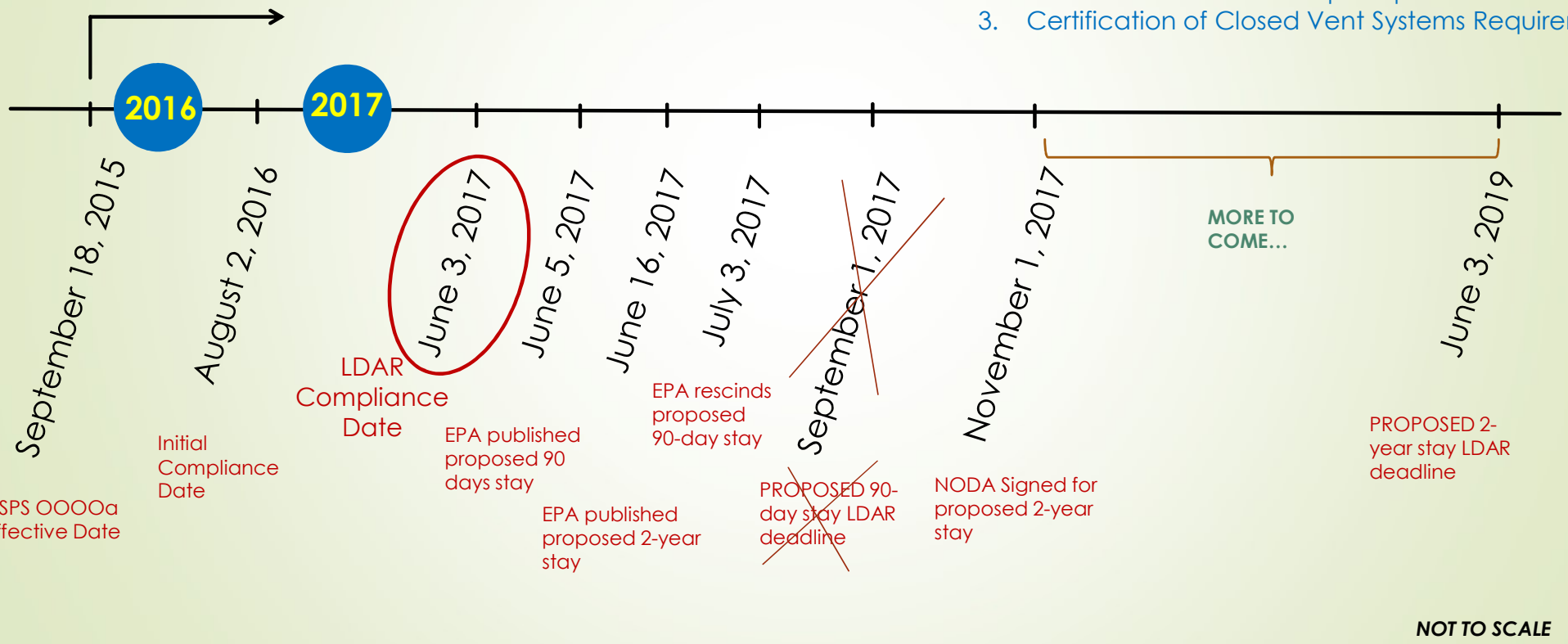
Applicability Dates



Timeline of NSPS OOOOa Delays

NSPS OOOOa

*Delays proposed for:
1. Fugitive Emissions Requirements
2. Well Site Pneumatic Pump Requirements
3. Certification of Closed Vent Systems Requirements



NOT TO SCALE

Purpose of NSPS OOOOa

§60.5360a What is the purpose of this subpart?

This subpart establishes emission standards and compliance schedules for the control of the pollutant greenhouse gases (GHG).

The greenhouse gas standard in this subpart is in the form of a limitation on emissions of ***methane*** *from affected facilities in the crude oil and natural gas source category that commence construction, modification, or reconstruction after September 18, 2015.*

This subpart also establishes emission standards and compliance schedules for the control of ***volatile organic compounds*** *(VOC) and* ***sulfur dioxide*** *(SO_2) emissions from affected facilities in the crude oil and natural gas source category that commence construction, modification or reconstruction after September 18, 2015.*

The effective date of the rule is August 2, 2016.

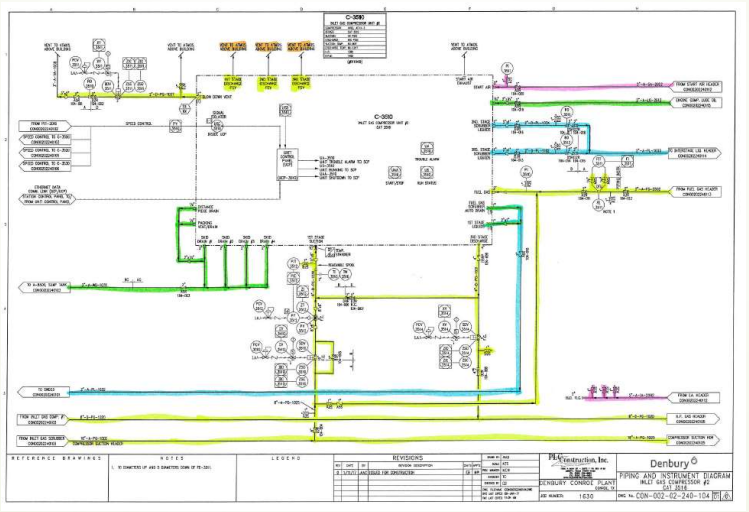
https://www.ecfr.gov/cgi-bin/text-idx?SID=16758fd1a6fb990e32e88bb84e348957&mc=true&node=sp40.8.60.oooo_0a&rgn=div6#se40.8.60_15360a

Challenge

- NSPS OOOOa does not define the minimal threshold for Methane and VOCs content in process stream.
- Operations with CO_2-EOR typically have >97% by wt. CO_2 in process streams and <3% by wt. of VOCs and Methane.
- There are challenges in detecting CO_2 leaks with FLIR Camera.

Steps: Understanding Process Flow

- Step 1: Review P&IDs and determine gas composition for various streams within process.



- Step 2: Identify streams with <0.5% by wt. of VOCs.

Resolution

- CO_2 purchase meter and associated piping can potentially be exempted from NSPS OOOOa LDAR requirements due to high CO_2 content.

- FLIR camera could be operated in high sensitivity mode to detect leaks with high CO_2 content.

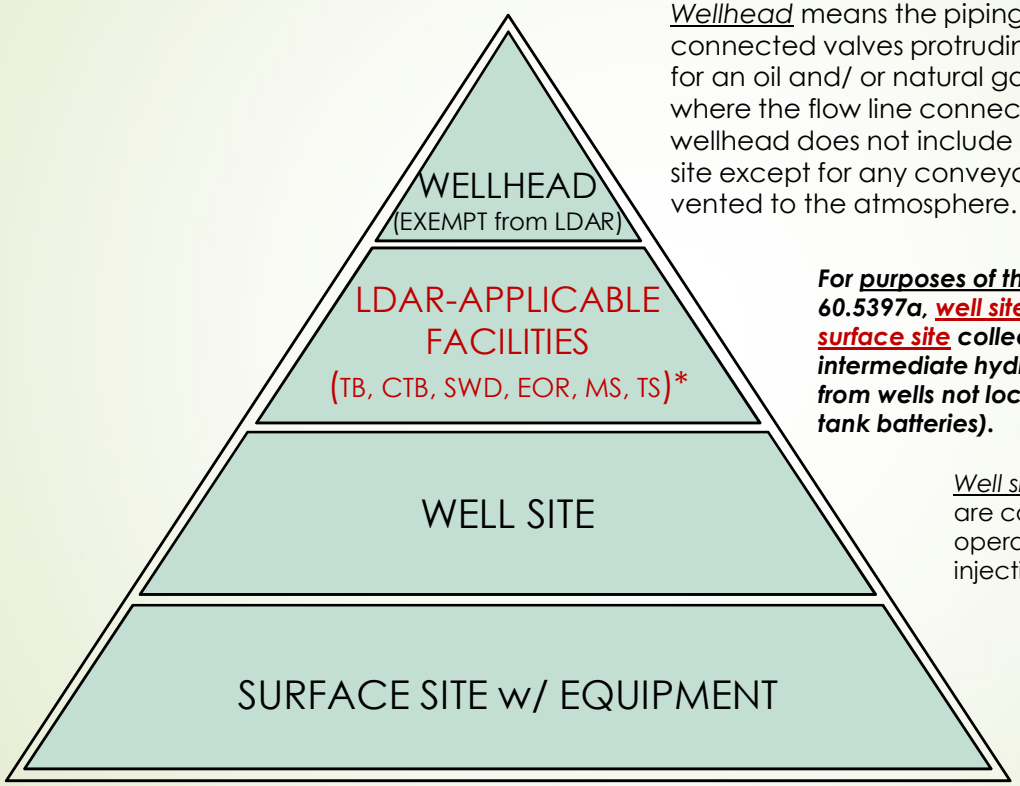
Challenge

- Definition of well site is very broad and inconsistent with other regulations.
- New drills and refracs can affect older site's applicability to LDAR.
- Definition does not address production.

  Even if production declines, site may become applicable to LDAR.

Steps: Understanding what is a Wellsite?

BOTTOM-UP APPROACH



Wellhead means the piping, casing, tubing and connected valves protruding above the earth's surface for an oil and/ or natural gas well. The wellhead ends where the flow line connects to a wellhead valve. The wellhead does not include other equipment at the well site except for any conveyance through which gas is vented to the atmosphere.

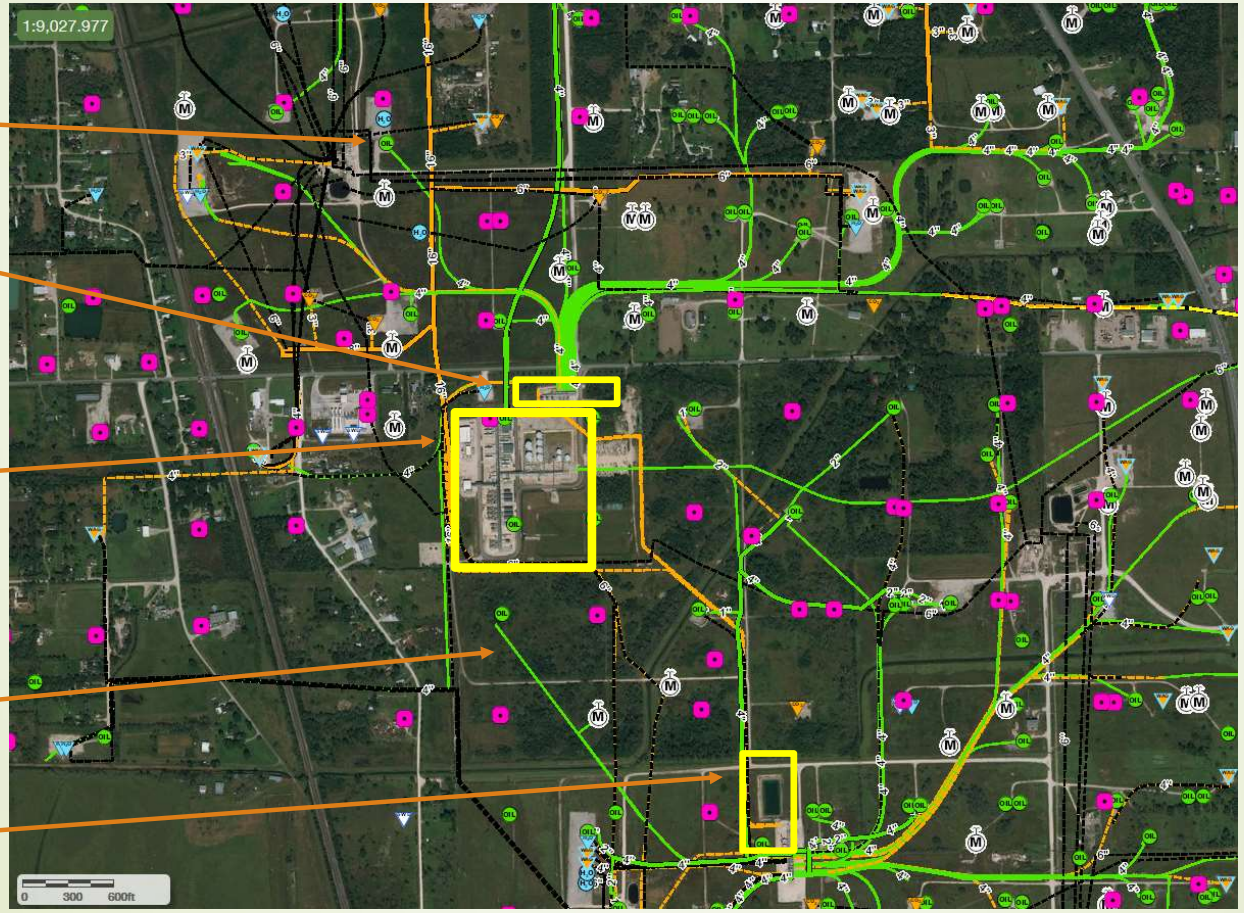
For purposes of the fugitive emissions standards at § 60.5397a, well site also means a separate tank battery surface site collecting crude oil, condensate, intermediate hydrocarbon liquids, or produced water from wells not located at the well site (e.g., centralized tank batteries).

Well site means one or more surface sites that are constructed for the drilling and subsequent operation of any oil well, natural gas well, or injection well.

Surface site means any combination of one or more graded pad sites, gravel pad sites, foundations, platforms, or the immediate physical location upon which equipment is physically affixed.

*(Tank Batteries, Central Tank Batteries, Salt Water Disposal Sites, Enhanced Oil Recovery Sites, Meter Stations, Test Sites)

Example of CO_2 EOR Oil Field



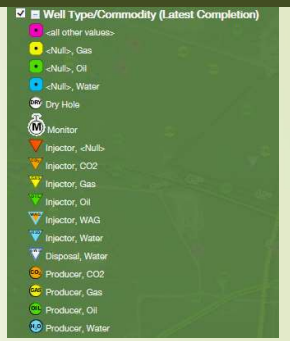
Wellheads

Test Site

EOR Facility

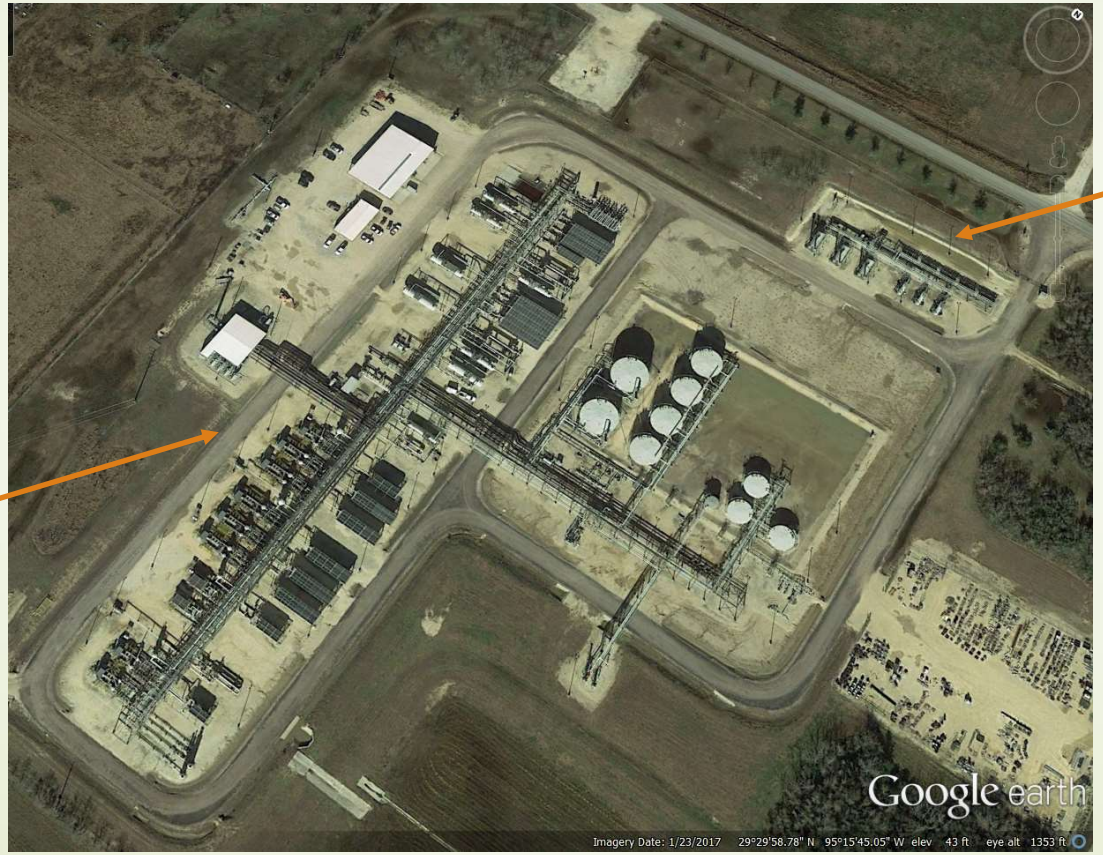
Flowlines

Test Site



Courtesy: Denbury Resources, Inc.

CO_2 EOR Facility and Associated Test Site

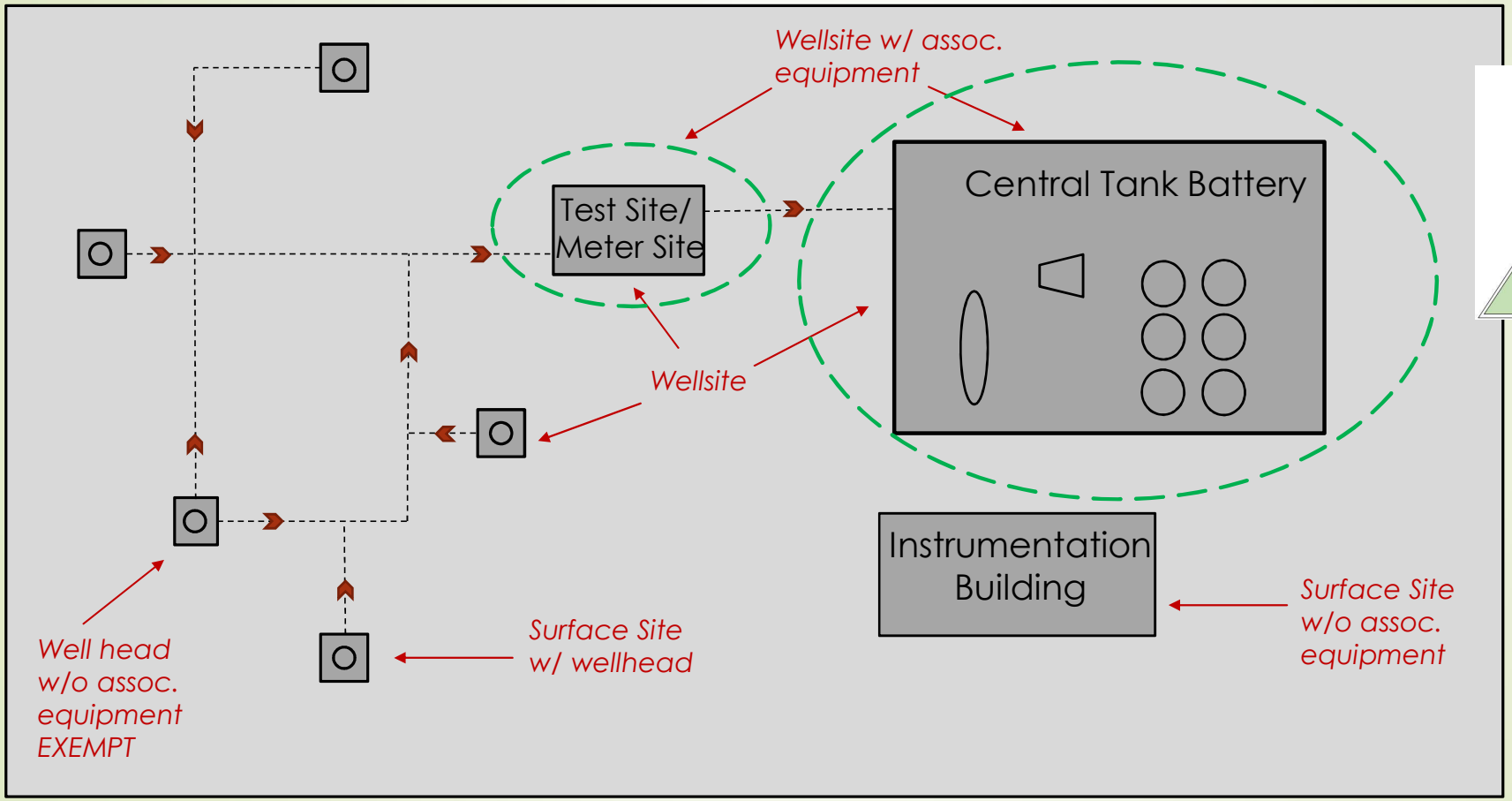


Test Site #2

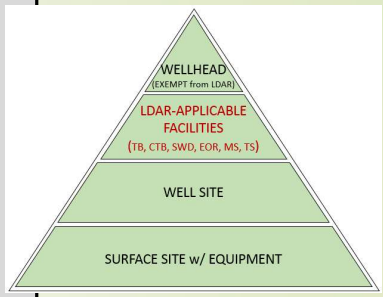
Hastings EOR Facility
Alvin, TX

Courtesy: Denbury Resources, Inc.

Wellsite: Oil Field Schematic



LEGEND:



LDAR Applicable

Steps: Understanding a New Drill

- What is a new drill?
  - Application for Permit to Drill (APD) or Drilling Permit
  - Drilling rig or motor on a workover rig
- The following **WOULD** be considered as drilling operations:
  - Drilling a new well (greenfield)
  - Drilling a P&A'd well (reactivating) for production
- The following would **NOT** be considered as drilling operations:
  - Perforating
  - Horizontal or vertical re-entry
    - Existing TA's well or shut-in or inactive well
    - Deepening a well/recompletion
  - Workovers – general well work
  - APD for plugging or re-plugging
  - Relief well/twin well drilled solely for the purpose of P&A of another well
  - Water source wells

*Per § 60.5365a (i)(3), For purposes of § 60.5397a, a "**modification**" to a well site occurs when:*

- ***(i) A new well is drilled at an existing well site;***
- *(ii) A well at an existing well site is hydraulically fractured; or*
- *(iii) A well at an existing well site is hydraulically refractured.*

Per § 60.5430a Definitions

Well means a hole drilled for the purpose of producing oil or natural gas, or a well into which fluids are injected.

Steps: Understanding Injection Wells

- Which injection wells ***ARE*** applicable?
  - Water Injection Wells for water flood
  - Water Alternating Gas injection wells (WAG)
  - CO_2 Injectors
  - Salt water disposal Wells (SWD)

Per § 60.5430a Definitions

Well means a hole drilled for the purpose of producing oil or natural gas, or a **well into which fluids are injected.**

- Which injection wells are ***NOT*** applicable?
  - Water curtain well
  - Salt water disposal Wells (SWD)
  - Acid gas disposal well

Steps: Internal Practices and Determinations

- Document internal assumptions and applicability determinations

NSPS OOOOa SUMMARY for NEW WELL:

APPLICABLE: "well site" which includes **wellpad** with separation and/or production equipment or **separate storage facilities**.

APPLICABLE: oil, gas, and injection wells

EXEMPT: wellpad that consists of a **wellhead only** with no other equipment on the pad itself.

INTERNAL APPLICABILITY SCREENING:

APPLICABLE: "Well site "includes tank batteries, central tank batteries, salt water disposal stations, EOR facilities, metering and test sites.

EXEMPT: By injection wells includes water injection wells, not salt water or acid gas disposal wells.

MODIFICATION: If a new well is drilled that is routed to an existing "well site", then that entire site becomes subject to LDAR.

NEW DRILL: Use the start date of production of a newly drilled well as the effective date for that well.

Challenge

- Definitions may lead to chain reaction effect and operator may inaccurately subject multiple facilities to the LDAR program.

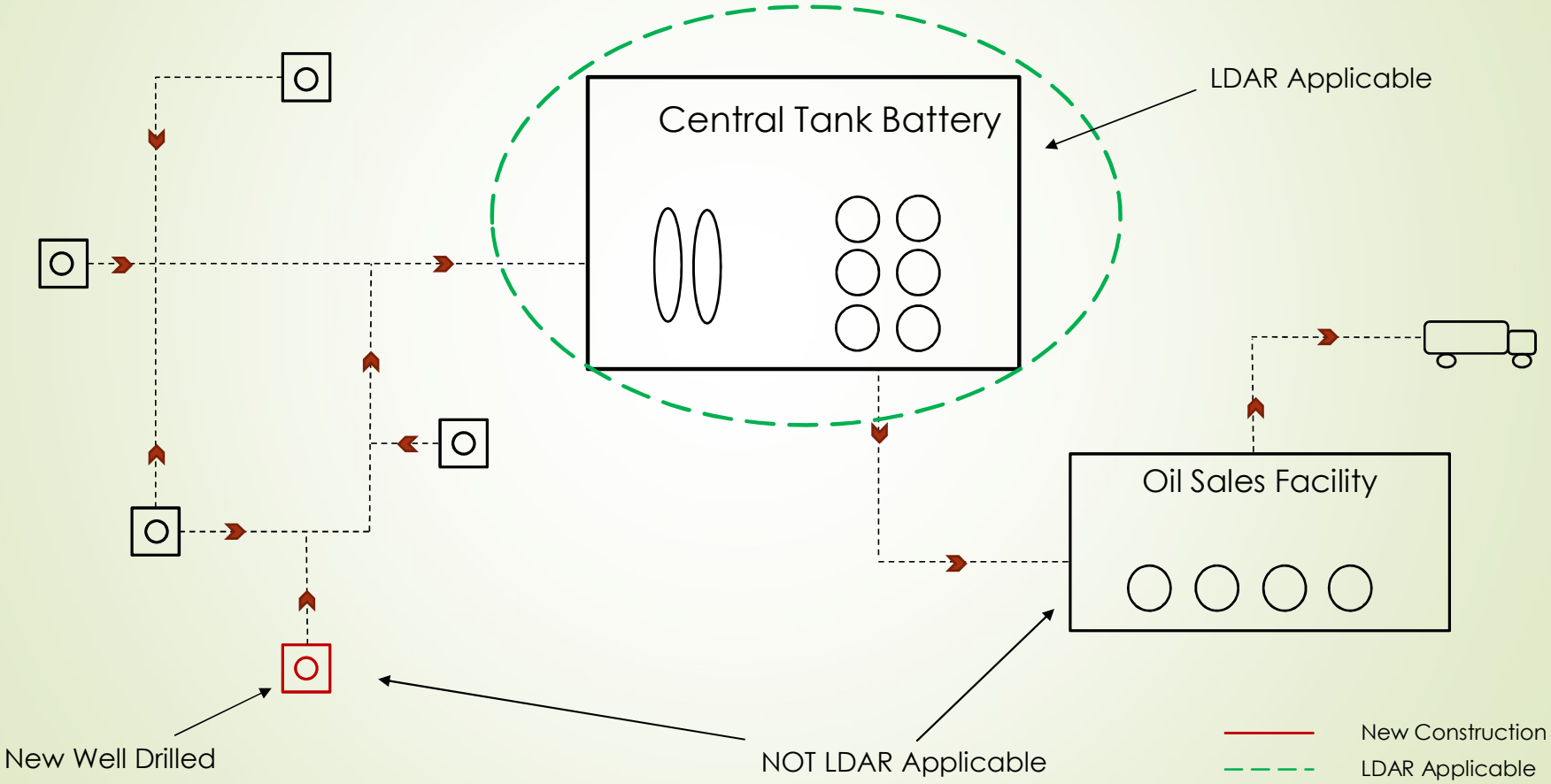
A domino effect or chain reaction is the cumulative effect produced when one event sets off a chain of similar events.

- *If one facility is subject to LDAR, are all downstream facilities also affected by the program?*

Per § 60.5430a Definitions

Custody transfer means the transfer of crude oil or natural gas after processing and/or treatment in the producing operations, or from storage vessels or automatic transfer facilities or other such equipment, including product loading racks, to pipelines or any other forms of transportation.

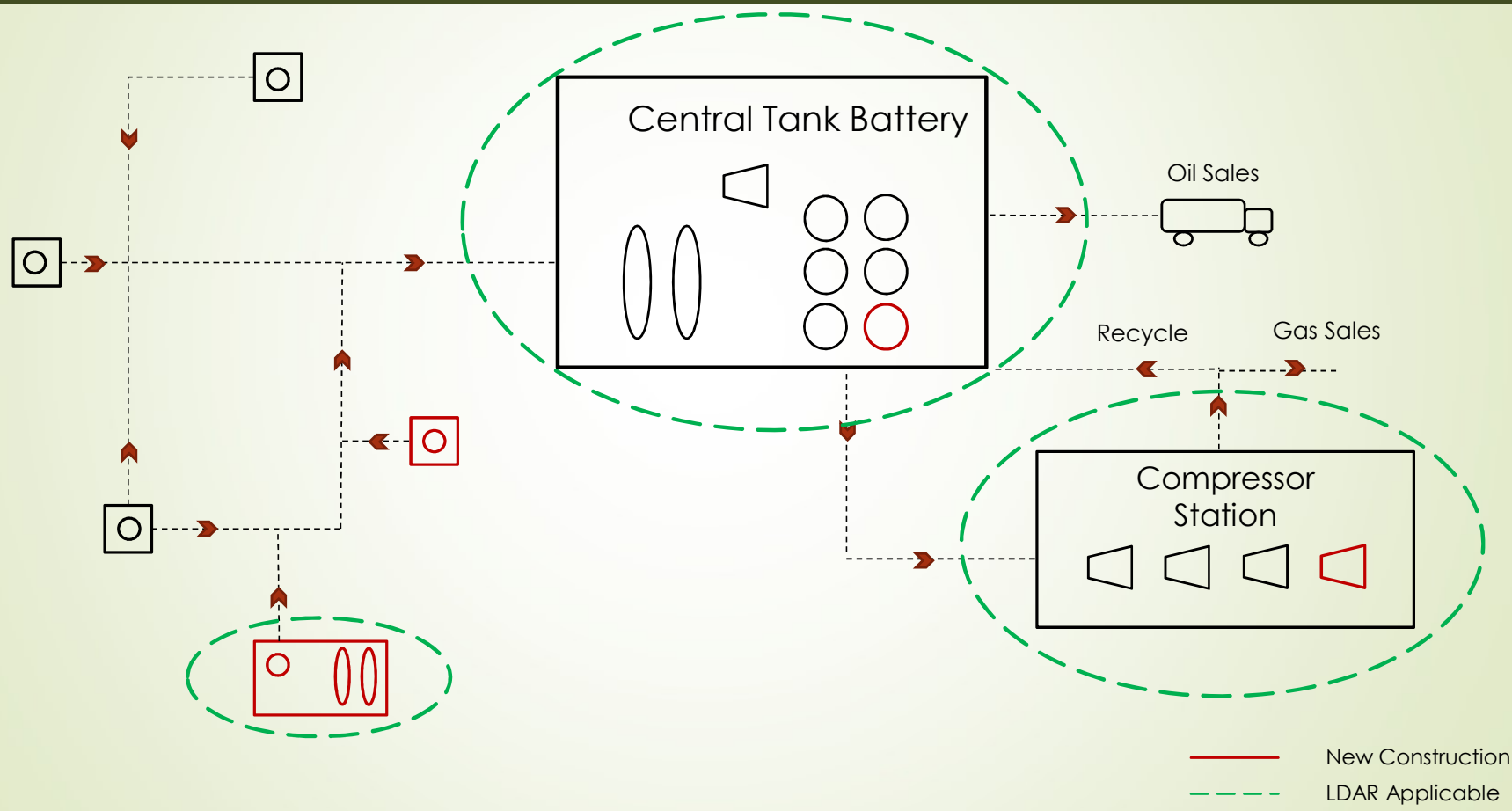
Custody Transfer: Scenario



Steps: Application to Operations

- **Engage** with field operations and know your processes.
- **Apply** definitions, applicability determinations, assumptions, and exemptions to field operations.
- **Train** field operations and facility design staff to identify applicability criteria and notify HSE.
- Work with existing company **procedures** – MOC, work orders, etc.
- Conduct preliminary **audits** to understand scope of work and implementation of the LDAR program.

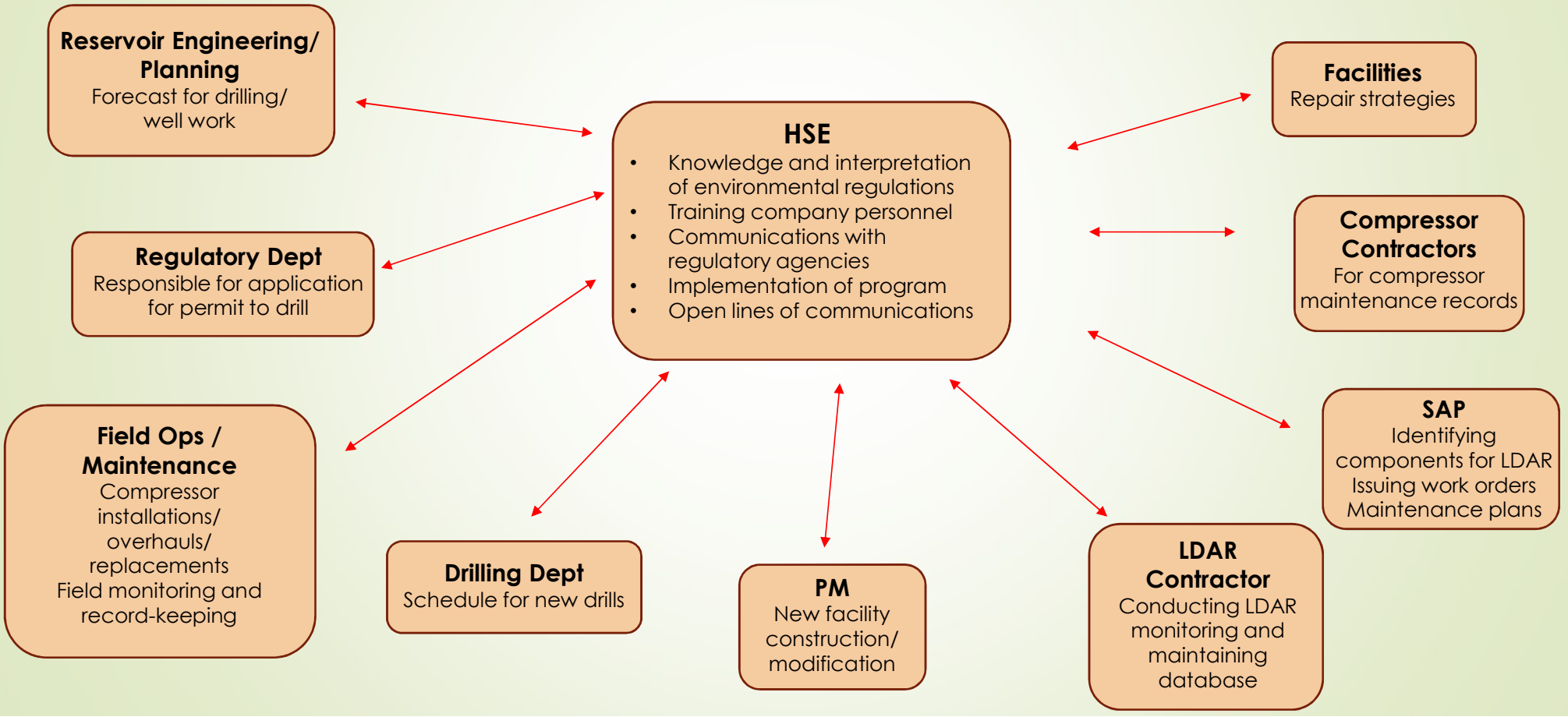
Operational Scenarios



Challenges

- How do I know if a site or a process is subject to LDAR?
- How do I know if a new well is drilled?
- How much is the LDAR Program going to cost me?
- What are my compliance obligations?

Steps: Cross Department Information Sharing



Summary of Challenges

Challenges for Compliance Maintenance

- Multi-department communication
- Complexity of rule
- Constant up-keep with monitoring and record-keeping
- Parallel efforts between state and federal regs
- Budget constraints
- Operations training required to maintain compliance

Challenges to Implement an Effective LDAR Program

- Overlap of federal and state regs (VVa, OOOOa, GHGRP, State LDAR programs)
- 60 days to perform LDAR after being subject (after the initial deadline of June 1, 2017)
- Stringent frequency of LDAR
- Site-specific observation path
- Cost and time constraints
- Resources (HSE, operations, I&E, maintenance, vendors)

Navigating through the Challenges

- Understand the regulations
- Know your operations
- Engage with industry peers
- Develop internal communication processes
- Invest in a robust program
- Allocate resources upfront and ongoing
- Plan ahead, plan well

THANK YOU

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