



Harambe 2920

304.c. (13): Fluid Leak Detection Plan

Introduction and Site Description:

The Harambe 2920 is located in the center of the S2N2 of Sec 32 T2N R64W Pad is a Verdad Resources oil and gas production facility that will have 9 horizontal oil and gas wells.

Surface Land Description: Fee

Maximum Disturbance Acreage: 10 Acres

Working Pad Surface Acreage: 6.37 Acres

Post Drilling/Completion Acreage: 5.14 Acres

Site Elevation: 4965'

Proposed Drilling Timeframe: 49 Days

Proposed Completion Timeframe: 59 Days

Verdad has developed the following fluid leak detection plan to document and to describe the engineering and administrative processes to prevent the discharge of fluids (oil, condensate, or produced water) to the environment, and to document the repair of any fluid leaks or discharges. The procedures and processes used to monitor, inspect, test, and maintain the equipment, vessels, tanks, structures, flowlines, at the Harambe 2920 pad are described in greater detail below. This Fluid Leak Detection Plan has been prepared in accordance with the requirements of COGCC Rule 304.c.(13).

Drilling Operations Leak Detection Measures:

During drilling operations, regular Auditory, Visual, and Olfactory Monitoring (AVO) inspections are performed on equipment containing hydrocarbons, fluids, or associated chemicals. AVO inspections include taking the time to look, smell and listen for leaks. In addition to these AVO inspection, regular daily hazard identification inspections are conducted on all areas of the pad.

The fluid management system used during drilling operations is monitored from the rig floor ("dog-house") for changes in pressure, volume, or rate which are used as indicators for leak detection. In the event abrupt changes in operating conditions are identified on surface equipment used to manage fluids, rig personnel are deployed to inspect the system including transfer lines and storage tanks.

Verdad utilizes a polyethylene liner beneath the drilling rig during drilling operations to ensure there is an impermeable layer between the rig and the ground. The use of this liner prevents hydrocarbons and other fluids from reaching the soil in the unlikely event a leak does occur. The liner is inspected for integrity throughout drilling operations and maintenance/repair to the liner occurs as needed.

Completion Operations Leak Detection Measures:

During completion operations, regular AVO inspections and Hazard ID inspections are performed on all areas of the pad including lines, containers/tanks/totes containing fluids or fluid additives as well as any



storage tank (i.e., container, vessel, etc.) that is used for hydrocarbon storage or through which hydrocarbons or other fluids pass through.

The fluid transfer system used during completion operations is monitored from the on-site mobile command center for changes in pressure, volume, or rate which are used as indicators for leak detection. In the event abrupt changes in operating conditions are identified on equipment used to in fluid transfer, completions personnel are deployed to inspect the system including pumps, transfer lines and storage tanks.

Operator utilizes polyethylene liners beneath the areas where completions equipment (including pump trucks and other heavy equipment) is placed on the pad to ensure there is an impermeable layer between the equipment and the ground. The use of this liner prevents hydrocarbons and other fluids from reaching the soil in the unlikely event a leak does occur. The liner is inspected for integrity throughout the completions phase and maintenance/repair to the liner occurs as needed.

Produced Fluids Procedures:

During production operations an AVO inspection will occur daily on location. Field staff have been instructed to look, smell, and listen for leaks as part of standard field protocols. Equipment to be inspected includes storage tanks, separators, heater treaters, pneumatic controllers for proper function, wellhead, engines, air pollution control equipment, combustors, and other pressure reducing equipment (e.g. VRT). All flowlines associated with a facility, above and below ground, on location, shall be inspected along the entire length assessing soil for staining or distressed vegetation around below ground flowlines.

Personnel walk down the lines and equipment of the entire facility and look, listen, and smell for leaks at connections, flanges, pump seals, valves, and other components associated with well production equipment.

Staff are required to inspect all above-ground natural gas flowlines for leaks. This will include walking the entire line from separator to custody transfer point (as applicable), listening, smelling, and looking for any hydrocarbon release points.

In the event a leak is identified, staff should make an immediate attempt to address the leak by attempting to repair the component(s). If the leak cannot be repaired immediately, staff will record that an attempt to repair was made and schedule the leak for repair at the next available opportunity – i.e., when parts arrive, when the proper tools/equipment are available, during the next scheduled shut down, etc. Once the leak is repaired, the repaired component, valve, gasket, etc. will be re-inspected within 5 days of repair by performing another AVO or other approved instrument monitoring method (AIMM).

Operator will install an engineered containment system around and beneath the tank battery. The containment system is constructed of perimeter of walls that are post driven into the ground around a flexible geotextile base. All components including the underlayment are sprayed with a polyurea liner technology. This liner technology maintains impermeability and puncture resistance under exposure to UV



rays, weather extremes, and chemicals commonly encountered in oil and natural gas production, and provides seamless protection.

During truck loadout, additional inspection protocols include the inspection of loading equipment including the hoses, couplings, and valves to ensure no dripping, leaking, or other liquid or vapor loss occurs during liquid loadout events.

Monitoring and Inspection Procedures and Schedules:

Production equipment is physically monitored and inspected by Verdad field staff during daily visits to each location as described above. During these site visits, the field staff are visually inspecting all components of the fluid production process for any signs / evidence of active leaks, drips, or pending leaks. The routine, physical inspection of the location and production equipment includes a close examination of the following components:

- Production Tanks
- Secondary Containment Structures and poly liners (if equipped)
- Separators (interior and exterior)
- Flowlines and Production Piping between the wellhead and the processing equipment

The field staff are specifically looking for any evidence of active leaks from tanks, piping and associated fittings. Obvious signs of leakage may include drips, bubbles, puddling and pooling of liquids, wet spots, corrosion (rust, flaking / blistered / bubbled paint, etc.). Less obvious signs of leakage may include an unexplained loss of tank volumes, loss of normal operating pressures, unusual sounds, odors, etc. When a leak or loss of fluid is confirmed, the field staff takes immediate action to stop the flow of liquids (if possible) and initiate the appropriate repairs. Field staff will communicate details of the fluid loss with their direct supervisor, who will notify Verdad's Environmental Manager who will investigate and evaluate the incident and initiate spill reporting and cleanup actions as needed.

As required by Spill Prevention Control and Countermeasures (SPCC) regulations found at 40 CFR 112, Verdad conducts routine inspections of all regulated oil storage facilities and related equipment (including secondary containment structures). These inspections are conducted annually to verify the types and number of production equipment that is located at each well pad, and to ensure that the secondary containment structures are in good working condition, and that they are adequately sized to contain the contents of the largest single tank (plus a 25-year, 24-hour precipitation event) in the event of a spill / release.

As required by the Colorado Department of Public Health and Environment (CDPHE) Storm Water Discharge Permit requirements, Verdad conducts on-going and routine inspections of all well pads, pipeline corridors, and access roads. Depending upon the location, these inspections are conducted every 2 weeks (active construction sites), or every 30 days (post-construction sites). These inspections are yet



another opportunity where oil and gas locations, facilities, and equipment are being inspected and monitored on a continual basis.

All oil and gas locations are also equipped with Supervisory Control and Data Acquisition (SCADA) monitoring technology which enables remote monitoring of individual well attributes (e.g., well-head pressures, casing pressures, production/sales volumes, etc.). In addition, most locations with produced water / condensate tanks, are also equipped with SCADA systems to monitor fluid production rates, actual fluid volume tank levels, etc. In addition, various alarms (e.g., high liquid level alarm) can be set to notify technicians if a tank is close to exceeding its maximum capacity and is at risk of overfilling / spilling. The SCADA is also useful to detect any sudden, unexplained loss in fluid volumes ... another means indicative of a potential leak / release. A SCADA system also allows for remote monitoring and shut-in capabilities.

Additionally, Verdad has developed a robust Leak Detection and Repair (LDAR) program, which utilizes Forward Looking Infrared (FLIR®) cameras to identify and fix leaks. These inspections will begin during the drilling phase and continue throughout the life of the Oil & Gas Location.

Testing and Maintenance Procedures and Schedules:

Flowline testing will be conducted in accordance with COGCC's 1100-Series rules.

Verdad production personnel perform pressure / integrity testing of all new construction production piping and pipeline facilities prior to being placed into active service. Pressure testing for all new and relocated pressure piping and facilities are pressure tested according to Verdad's Flowline Installation, Inspection and Repair SOP.

Pressure / integrity testing is also conducted on all existing (in-service) off-location flowlines on an annual basis, or after any repair. All pressure / integrity testing is conducted per Verdad's Flowline Installation, Inspection and Repair SOP.

All maintenance required for production piping, pipeline facilities, tank storage, and secondary containment structures is performed by Verdad's Construction and Maintenance personnel. Maintenance is performed on an "as-needed" basis as discovered and documented during inspections and testing.

Record Keeping:

All inspection procedures, inspections and findings will be documented. All testing and maintenance procedures, tests and maintenance work will be documented. Verdad has developed and will maintain site-specific inspection protocols to monitor the Production Facilities for leaks on this location as discussed above. Inspection records are kept, maintained and stored in various corporate systems specifically eVIN, Carte, and the Verdad server. In the event that an inspection results in maintenance or repair, these actions are logged in an internal well/facility maintenance file. All leaks (e.g., agency-reportable, agency-nonreportable) are logged and tracked until the issue has reached final resolution. Leaks are reviewed and discussed on a monthly basis; root-cause analyses are performed when as



necessary. Required testing (i.e., pressure testing, flowline integrity testing) is tracked, recorded, and maintained in the Verdad server.

Site Specific Fluid Leak Detection BMPs:

- AVO (Audio, Visual, Olfactory) inspections of pipe and connections will be performed daily on production equipment to detect leaks which will be immediately corrected, repaired and reported to COGCC as required. AVO inspections will include all production equipment, wellheads and flowlines on site.
- Separators are encompassed by steel berms lined with an impervious poly or spray in liner and on top of road base that is approximately 1-2 feet to greatly minimize impact to the soil from any potential leak or drip from the separators. Sites are visited and inspected daily so a spill would be detected and cleaned up before any significant infiltration could occur. The berms would contain a spill from leaving the area around the separators.
- Tank secondary containment will be lined with an impervious poly or spray in liner. Steel berms are able to contain spills with capacity > 150% volume of the largest tank. Pad will also have tertiary containment of ditch and berm to prevent any spills from leaving site. Any spills will be immediately cleaned up and reported if volume exceeds reporting limit.
- Operator's wells have remote monitoring and shut-in capabilities to mitigate spills and safety issues. Remote shut-in will allow Operator to immediately shut a well in the event of a reported problem on location or in the event of a potential threat such as a grass fire or flood.
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- All pressure piping and facilities are pressure tested and inspected according to Verdad's Flowline Installation, Inspection and Repair SOP and in compliance with flowline integrity testing per 1100 Series Rules.
- Annual SPCC inspections ensure fluid storage, processing, transport and handling equipment and containment integrity and operation.
- All fluid handling employees are trained annually on spill prevention and response.
- Verdad has developed a robust Leak Detection and Repair (LDAR) program, which utilizes Infrared cameras to identify and fix leaks. The infrared gas detection camera is an Approved Instrument Monitoring Method (AIMM). These inspections will begin during the drilling phase and continue throughout the life of the Oil & Gas Location. These AIMM inspections will be conducted on a monthly frequency.
- To minimize potential impacts to soil, containment will be used during fueling of equipment to contain spills and leaks during all phases of operations.
- The fluid transfer system used during completion operations is monitored from the on-site mobile command center for changes in pressure, volume, or rate which are used as indicators for leak detection.



- Operator utilizes polyethylene liners beneath the areas where completions equipment (including pump trucks and other heavy equipment) is placed on the pad to ensure there is an impermeable layer between the equipment and the ground.
- A polyethylene liner beneath the drilling rig during drilling operations to ensure there is an impermeable layer between the rig and the ground to detect and capture leaking fluids.