



DATE August 16, 2019

PROJECT 19139

ATTN **City of Arlington**

Planning and Development Services

101 W Abram Street

Arlington, Texas 76010

Attention: Jessica Youngblood

SUBJECT **Proposed Post-Production Inspection Guidance**

Arlington, Texas

Dear Ms. Youngblood:

As requested, Modern Geosciences, LLC (Modern) is pleased to provide our suggested elements of a Post-Production Inspection (PPI) program to the City of Arlington (City).

BACKGROUND INFORMATION

As oil and/or natural gas padsites are decommissioned and future development contemplated, it is important that final site conditions be evaluated to confirm if potential hazards to reuse are present. While multiple regulations by the Texas Railroad Commission (RRC) and Texas Commission on Environmental Quality (TCEQ) apply during initial drilling, hydraulic fracturing, and production, little guidance from either regulatory entity is focused on reuse. Further, since many regulatory elements of the TCEQ, RRC, and Texas Department of State Health Services (DSHS) are not consistent, it is possible for the conditions at a former padsite to be a potential concern to reuse despite having properly addressed other regulatory needs.

This can include a possibility for subgrade leaks if residual gathering lines are present, elevated radiation from technologically enhanced naturally occurring radioactive material (NORM)-containing scale, and/or other unidentified spills or releases that have not been properly evaluated.

While no level of investigation can completely remove all risk at a given property, Modern has worked with numerous municipalities to develop some basic PPI best practices to consider. An additional benefit to performing a PPI on a padsite is the consolidation of final RRC documentation and field inspection results together in a format that can be referenced by future parties considering redevelopment of property formerly having had a padsite present. This can be of vital importance in future environmental due diligence and save time and resources.



POST-PRODUCTION INSPECTION (PPI) GUIDANCE

Modern suggests the following be considered when evaluating a padsite that is transitioning to unrestricted use and potential residential development. Modifications may be needed for site-specific concerns, but the following provides general guidance and best practices in assessing potential environmental risk from prior natural gas operations.

Interim PPI Effort:

When possible, it is preferred to bridge any production inspection programs with the post-production evaluation effort. This will allow the inclusion of any past concerns (e.g., NORM-containing equipment, record of spills, leaks, or other issues unique to the padsite). An interim inspection should occur whenever the operator has plans to plug an existing well. This will often be triggered by the submission of Form W-3A (*Notice of Intention to Plug and Abandon*) to the RRC. The City of Arlington currently includes a requirement for the operator to copy the City whenever this is submitted within its governing ordinance (Section 7.03 C(1)).

Since the purpose of the PPI is to screen for potential environmental risk to future uses and may include sampling and the generation of new geoscientific data, a Texas-licensed Professional Geoscientist (PG) or Professional Engineer (PE) should be engaged to complete the following. Additionally, any investigation effort should only be performed if proper health and safety planning has been performed.

1. **Infrastructure Verification:** Record all existing and prior infrastructure locations at the padsite using GPS equipment with an accuracy of 24" or less and develop representative figure(s). Record the latitude and longitude coordinates for all wells, separators, compressors, and aboveground storage tanks to at least a six-digit resolution. If subgrade piping is present, make note of where this is likely located so future inspections can be informed by this. Keep in mind that some padsites will have off-site infrastructure related to other production equipment and may leave subgrade components in place and otherwise undocumented. It is recommended that the location of this subgrade piping also be noted up to 250 feet off the padsite boundary. It is preferred that a GIS shapefile also be provided for City use in the future.
2. **Compliance Records Review:** Review all prior inspection reports concerning leaks, spills, releases, or other record of non-compliance to inform future field screening efforts once equipment is removed. Emphasis should be placed on confirming any elevated NORM observations or poor operator maintenance records suggestive of problem areas to include in any future inspections.
3. **Compliance Inspection:** Complete a review of the current operational state of the padsite relative to City ordinance requirements.



4. **Surface Inspection:** Complete a surface inspection for the presence of visual evidence of a release or NORM immediately near all static equipment and within all secondary containment. This should include:
 - a. Visual inspection of all equipment and operational areas for suggestion of spills/releases, or other concerns that should be addressed by the operator;
 - b. Collection of a background radiation reading at least 250 feet away from the nearest padsite boundary and/or above grade equipment or assume 10 μ R/hr (general background);
 - c. Collection of radiation data using meters consistent with 16 TAC §4.605(d)/25 TAC §289.259(e), on an approximate 10' x 10' grid in all applicable areas, including within secondary containment;
 - d. Note all current radiation readings at each piece of equipment and, if applicable, that signage per 16 TAC §4.603(7) is present;
 - e. Note all areas exceeding site-specific NORM screening criteria (i.e. twice background); and
 - f. Note any remnant equipment or piping staged at the padsite that could be indicative of containing elevated NORM.

The result of any interim PPI should be communicated to the operator to allow them the opportunity to address concerns during the padsite decommissioning process.

Final PPI Effort:

When all wells have been properly plugged according to current RRC rules (i.e. RRC SWR 14), all equipment and piping removed, and the Form W-3 (Plugging Record) provided to the City, the following is recommended for completion by a Texas-licensed PG or PE.

1. **Infrastructure and Compliance Summary:** Completion of Items 1 through 3 outlined in the Interim PPI effort – if not previously addressed;
2. **Plugging Records Review:** A review of all submitted RRC plugging documents should be made to ensure all required steps have been completed. These documents should be included with the final report;
3. **Surface Inspection:** The inspector should prepare a 10' by 10' grid of all areas of the padsite historically associated with production infrastructure to allow surface screening for potential concerns. At a minimum, grids should extend at least 10 feet beyond prior infrastructure. Once the grid is marked off in the field, screening should include an evaluation of background at least 250 feet away from the nearest padsite boundary and/or above grade equipment with any survey instrument and at least one inspection point per grid for the following:
 - a. **Visual Evidence of Releases:** An evaluation of each grid should be made to determine if visible evidence of a release or odors are present. This can include dark staining, sheens, or other observations suggestive of remnant impact on the padsite. If visual evidence of a release is noted, the impact should be documented with a perceived area of highest impact confirmed and a soil sample collected. See suggested analysis details below.
 - b. **Methane:** Using calibrated equipment capable of detecting methane to 1 ppmv, screen within 2" or less above the surface. If methane is noted above 10 ppmv or 2x background, inspection should be continued until the highest observation is verified and marked to allow further evaluation of possible subgrade leaks. The operator, landowner and City should be contacted if elevated methane is identified so the source can be identified and addressed. If methane above 10,000 ppmv (1% by volume), this should be immediately reported to the City Fire Department for further evaluation of possible explosive environments remaining on site.
 - c. **VOCs:** Using a PID capable of detecting total VOCs (tVOCs) to 1 ppbv, screen each grid by removing approximately three (3) inches of surface soil from the selected point in each grid and cup your hand to prevent dilution with ambient air. If tVOCs are noted above 100 ppbv (0.1 ppmv) or 10x background, inspection should be continued until the highest observation is verified and marked to allow collection of a soil sample. See suggested analysis details below.

- d. **Corrosivity (pH):** Using a pH meter capable of measuring to 0.1 standard units (s.u.), screen surface soil by inserting the probe in each grid to confirm the representative pH. If pH is noted outside a typical background range (e.g., 5 to 9.5 s.u.) or within 25% of the background reading collected, inspection should be continued until the highest/lowest readings outside normal is identified to allow collection of a soil sample. See suggested analysis details below.
- e. **Radiation:** Using a radiation meter consistent with 16 TAC §4.605(d) and 25 TAC §289.259(e), screen immediately above the existing surface of all grids (no more than 2" above). If a grid exhibits a concentration more than 2x background, inspection should be continued until the highest observation is verified and marked to allow collection of a soil sample and further evaluation to determine if buried NORM-containing equipment is present. See suggested analysis details below. If collecting a soil sample for analysis, always collect an off-site sample for background comparison.

All grids exhibiting radiation in excess of 2x background should also be evaluated using a calibrated alpha ionization detector (AID) with a detection limit of <0.1 pCi/L to screen for a combined ²²⁰Rn and ²²²Rn value since these portions of the expected decay series are radioactive gases.

Concern	Soil Analysis
Visual evidence of a release	TPH by TCEQ Method TX1005/EPA 5035A VOCs by EPA Method SW-846 8260/5035A RCRA 8 Metals by EPA Methods SW-846 6010/6020/7471/7470 Corrosivity (pH) by EPA Method SW-846 9045/4500 Chlorides by EPA Method 300
tVOCs >0.01 ppmv to 0.1 ppmv	TPH by TCEQ Method TX1005/EPA 5035A VOCs by EPA Method 8260/5035A Chlorides by EPA Method 300
Corrosivity (pH) <5 or >9.5 s.u	Corrosivity (pH) by EPA Method SW-846 9045/4500 Chlorides by EPA Method 300 RCRA 8 Metals by EPA Methods SW-846 6010/6020/7471/7470
Radiation >2x Background (or 20 uR/hr)	Chlorides by EPA Method 300 Corrosivity (pH) by EPA Method SW-846 9045/4500 Gamma Spectroscopy NORM/TENORM Compounds by DOE HASL 300/GA-01R/901.1, ASTM D3972, and/or LANL ER200M for the common radionuclides noted below and targeted Alpha Spectroscopy by EPA 900 for Po-210. Must include Target Radionuclides at a minimum (related to the ²³⁸ U and ²³² Th decay series). Note: Provide activity in pCi/g

Common Radionuclide List		
**Actinium 228	Europium 152	Radium 223
Americium 241	Europium 154	**Radium 224
Antimony 124	Europium 155	**Radium 226
Antimony 125	Iodine 131	**Radium 228
Barium 133	Iridium 192	Ruthenium 106
Barium 140	Iron 59	Silver 110
Beryllium 7	**Lead 210	Sodium 22
**Bismuth 212	**Lead 212	**Thallium 208
**Bismuth 214	**Lead 214	**Thorium 234
Cerium 139	Manganese 54	Tin 113
Cerium 141	Mercury 203	Uranium 235
Cerium 144	Neptunium 239	**Uranium 238
Cesium 134	Niobium 94	Yttrium 88
Cesium 137	Niobium95	Zinc 65
Chromium 51	**Potassium 40	Zirconium 95
Cobalt 57	Promethium 144	
Cobalt 58	Promethium 146	
Cobalt 60	**Polonium 210 (Alpha Emitter)	** = Target Radionuclide

Notes on sample collection:

- If extensive impact is present over multiple 10' by 10' grids from a common release, representation using the highest observed screening result over no more than a 500 ft² contiguous area can be used in lieu of sampling every grid.
 - If releases are identified from this screening and soil sampling event, further evaluation of groundwater may be warranted. Professional judgement by a licensed PG or PE will be needed to update the final sampling design once releases are confirmed.
4. **Site-wide Subgrade Leak Evaluation:** If the padsite previously included subsurface piping or related gathering lines at the padsite or up to 250 feet away the padsite boundary, screening with an optical gas imaging (OGI) camera should be performed across the padsite and at least 250' from all areas where subgrade piping is suspected or known. If any OGI visual evidence of a leak is identified, this should be marked and brought to the attention of the landowner, operator, and City for additional corrective action.



Note: It is highly recommended that any remnant subgrade piping from the prior operations be removed to minimize future concerns. If subgrade piping will remain in place, the operator must consult with the City to ensure the City is aware of the subgrade piping locations. Any remaining lines should be flushed and have integrity confirmed prior to continued use.

5. **Reporting:** A summary report should be prepared documenting all the above items are completed with a summary of all screening results and any sampling results. The report should include infrastructure locations, a compliance summary, field screening results, equipment used including calibration and resolution data, a figure depicting the padsite, photos, and laboratory data (if applicable). Any soil sampling results should be compared to applicable RRC, TCEQ, and/or DSHS regulations. If exceedances are noted, the operator and landowner should be contacted to determine if additional corrective action is needed. If final conditions are anticipated to exceed applicable regulatory criteria, the results should be forwarded to the applicable regulatory agency for review and further direction.

SELECTED COMPLIANCE NOTES:

- In order to protect public health and safety and the environment, the RRC requires the owner or operator of oil and gas equipment to determine whether the equipment contains or is contaminated with NORM waste. Citation: 16 TAC §4.635(c)(1);
- NORM-contaminated equipment is defined as “equipment that, at any accessible point, exhibits a minimum radiation exposure level greater than 50 μ R/hr including background radiation level.” Citation: 16 TAC §4.603(7);
- Owner or operators shall identify NORM-contaminated equipment with the letters "NORM" by securely attaching a clearly visible waterproof tag or marking with a legible waterproof paint or ink. Citation: 16 TAC §4.605(a);
- Disposal of oil and gas NORM waste by spreading on public or private roads is prohibited. Citation: 16 TAC §4.611;
- Burial of NORM-contaminated equipment is prohibited. Citation: 16 TAC §4.614(c);
- A person may “dispose of oil and gas NORM waste at the same site where the oil and gas NORM waste was generated by applying it to and mixing it with the land surface, provided that after such application and mixing the radioactivity concentration in the area where the oil and gas NORM waste was applied and mixed does not exceed 30 pCi/g Radium-226 combined with Radium-228 or 150 pCi/g of any other radionuclide.” Citation: 16 TAC §4.614 (c)&(d). *It should be noted that laboratory analysis is required to determine concentrations of individual radioisotopes. Additionally, the current unrestricted criteria for selected radioisotopes may differ should the site use change. For example, 30 TAC 336.356 (Standards for Protection Against Radon) sets an individual maximum for radium-226 or radium-228 at 5 picocuries/gram (pCi/g), averaged over the first 15 centimeters of soil below the surface. Consultation with the landowner is suggested if an exceedance of this criteria is anticipated so this information can be incorporated into future redevelopment planning;*
- Decontamination of NORM-contaminated equipment requires a license from the Texas Department of State Health Services pursuant to 25 TAC 289.259(i). Citation: 4.632(d)(6) & (7); and
- In addition to State requirements, the City ordinance specifies that “the property on which a drill site is located shall at all times be kept free of...contaminated soil” (Sec 7.01(18)). Further, Section 7.03 of the City ordinance requires restoration of the pad site, approval of final site conditions by City inspectors, a permanent marker pipe above each former well, and prohibition of structures over a plugged well.