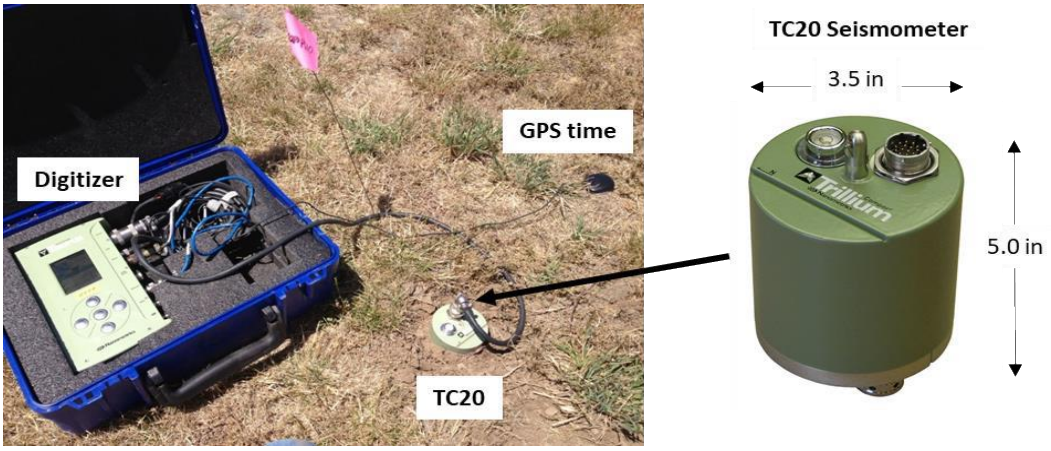
SECTION A. Project Title: INL Site-wide Seismic Velocity Boreholes

SECTION B. Project Description and Purpose:

Revision 4

Two seismic surface techniques, Microtremor Array Measurements (MAM) and Multi-channel Analysis of Surface Waves (MASW), use non-invasive methods to record passive and active source surface waves to assess subsurface shear-wave velocity profiles. MAM uses 8 seismometers arranged in three separate circular or L shaped-arrays with increasing apertures, 165 ft, 985 ft, and 3,300 ft, to collect surface waves by monitoring ambient ground noise for 2 to 4 hours. The MAM array sensors are small broadband seismometers, 3.5-inches in diameter and 5.0-inches tall, and are placed in small hand dug holes less than 6 inches deep (Figure R-8a). When done, each small hole is back filled using native soils removed to create the hole. MASW employs a linear string of 24, 4.5-Hz vertical geophones coupled to the ground using a ~3 inch spike pushed by hand into the ground (Figure R-8b). The geophones are spaced from 3 to 16 ft and record surface waves generated by using a sledge hammer to strike a plate set on the ground. The MAM and MASW surveys will be conducted at six INL sites; proposed seismometer and array locations are shown for: ATR (Figure R-9), MFC (Figure R-10), NRF (Figure R-11), INTEC (Figure R-12), INEL-1 borehole (Figure R-13), and CFPP Site 3 (Figure R-14). Field walkdowns and discussions with facility managers are planned prior to determining final locations of sensors for performing cultural and environmental surveys.

a)



b)

Figures R-8. a) Nanometrics Trillium Compact 20s (TC20) broadband seismometer and field deployment. b) Geospace Technologies GS-11D geophone installed in the red PC21 land case with spike.

Figure R-9. Map of ATR showing the proposed seismometer locations (labeled yellow dots) for the MAM surveys using three circular arrays, 165 ft (50-m), 985 ft (300-m), and 3,300 ft (1,000 m); MASW will be conducted within the smallest circular array.

Figure R-10. Map of MFC showing the proposed seismometer locations (labeled yellow dots) for the MAM surveys using two circular arrays, 165 ft (50-m) and 985 ft (300-m); and an L-shaped array covering an aperture of ~3,300 ft (1,000 m); MASW will be conducted within the smallest circular array.

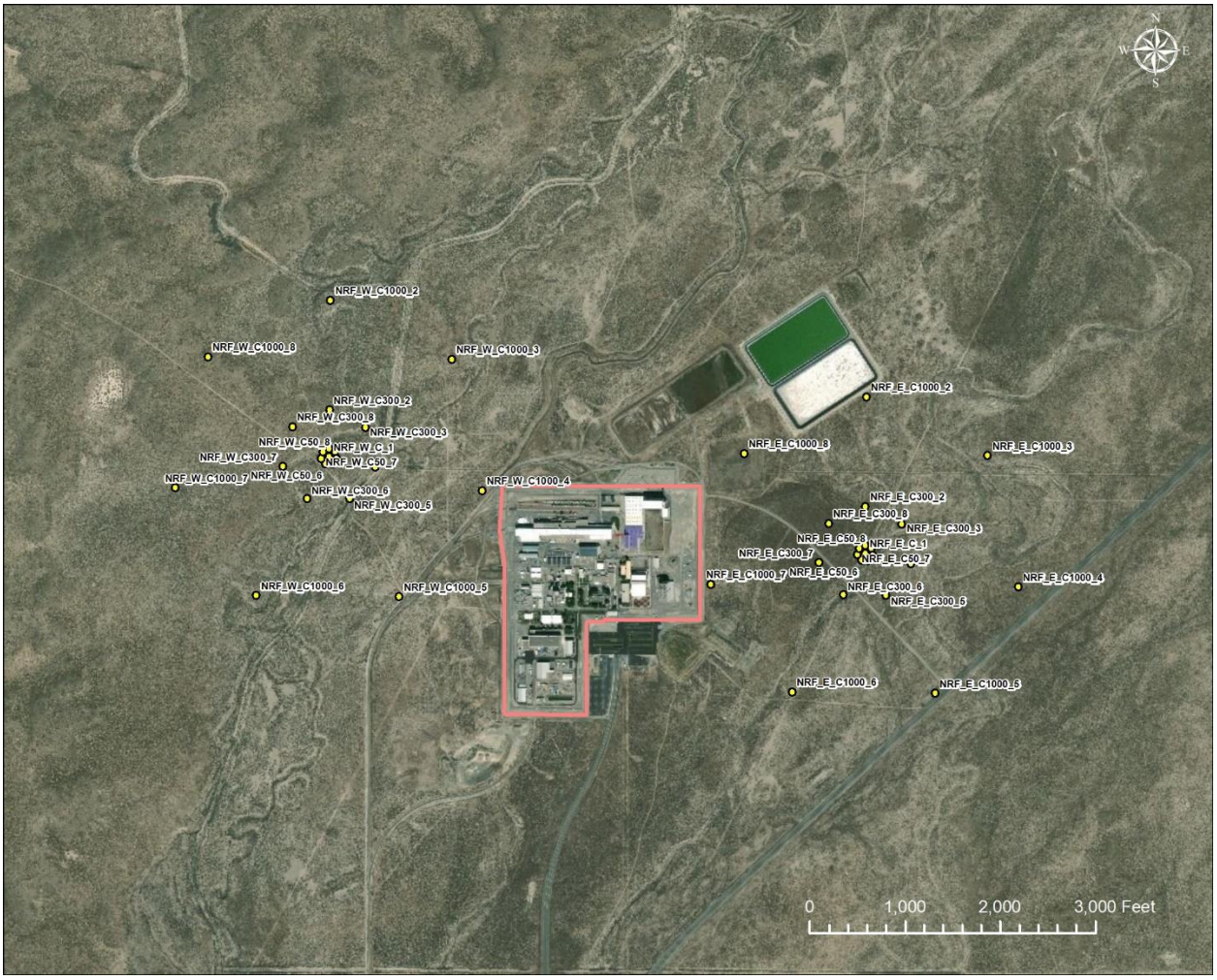


Figure R-11. Map of NRF showing one location of two possible array configurations with proposed seismometer locations (labeled yellow dots) for the MAM surveys using three circular arrays, 165 ft (50-m), 985 ft (300-m), and 3,300 ft (1,000 m); MASW will be conducted within the smallest circular array. The MAM array locations east or west of NRF will be determined by NRF personnel.

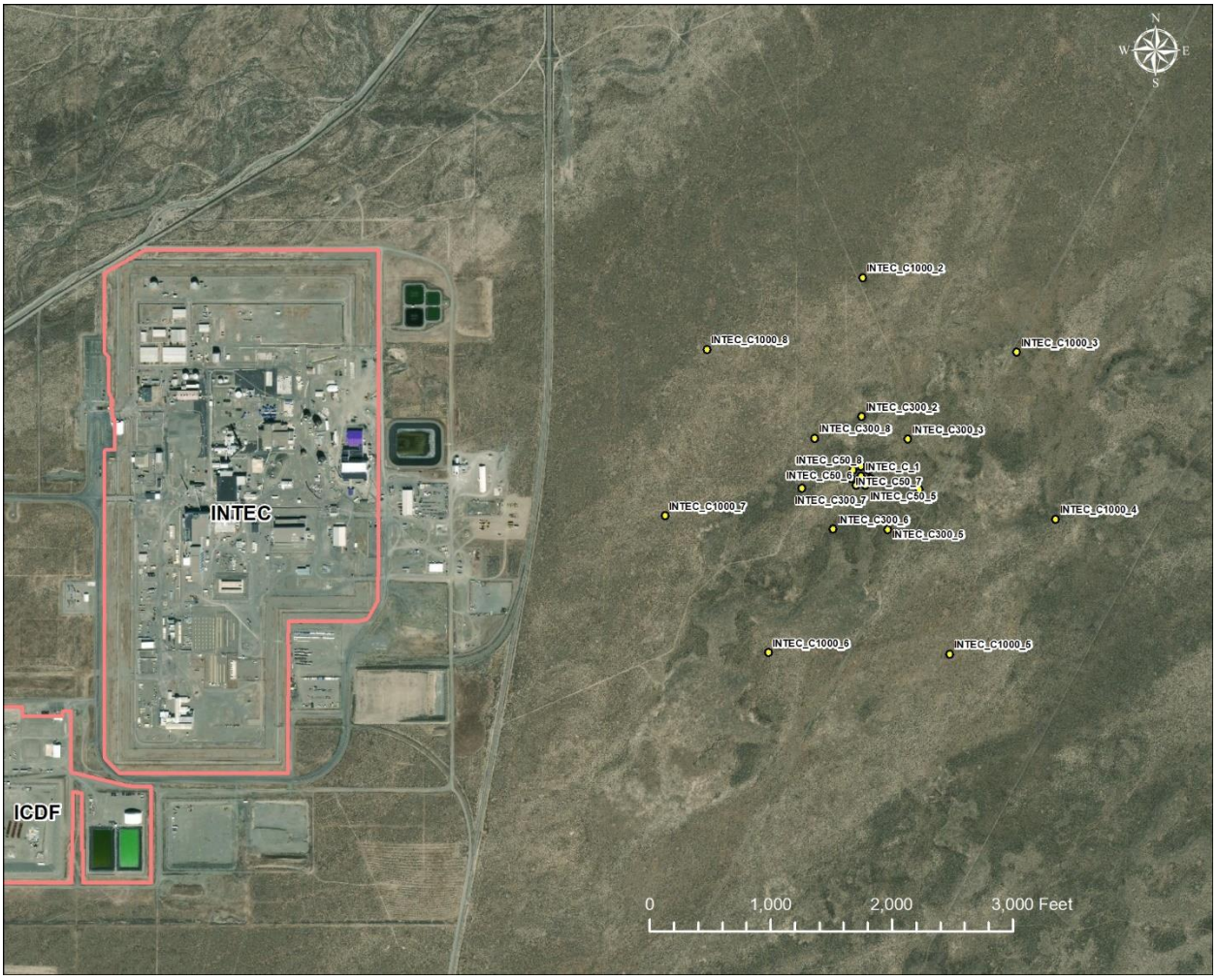


Figure R-12. Map of INTEC showing the proposed seismometer locations (labeled yellow dots) for the MAM surveys using three circular arrays, 165 ft (50-m), 985 ft (300-m), and 3,300 ft (1,000 m); MASW will be conducted within the smallest circular array.

Figure R-13. Map of INEL-1 borehole site showing the proposed seismometer locations (labeled yellow dots) for the MAM surveys using three circular arrays, 165 ft (50-m), 985 ft (300-m), and 3,300 ft (1,000 m); MASW will be conducted within the smallest circular array.

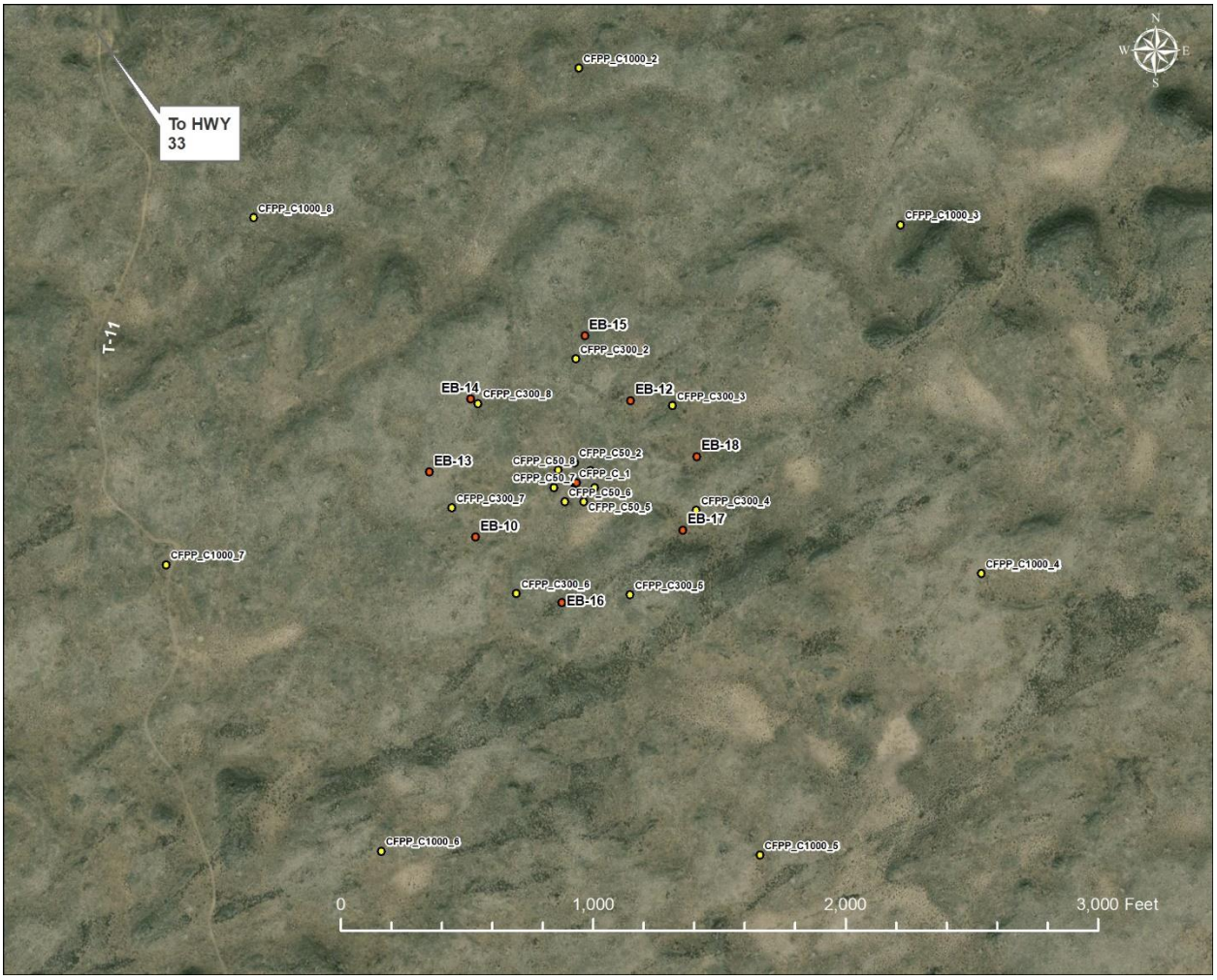


Figure R-14. Map of Site 3 for CFPP showing the proposed seismometer locations (labeled yellow dots) for the MAM surveys using three circular arrays, 165 ft (50-m), 985 ft (300-m), and 3,300 ft (1,000 m); MASW will be conducted within the smallest circular array. MAM arrays may be included as part of this proposed study concurrence from UAMPS. Red dots are a representation of Plant 2 location, which may not reflect current plans for the plant.

Revision 3

The purpose of this revision is to capture the addition of 2 new water tanks (T1 and T2) and a hose, which will be placed next to the USGS-102 well at drill site USGS-152 (Figure R-7) located next to the Naval Reactors Facility (NRF). The purpose of these tanks is to supply water to water tank (T3) for drilling activities. No grubbing will be performed, and water tanks will be set on ground surface in areas with minimal sage brush. Small gas-powered pumps will be set near the water tanks to pump water between each water tank. The drill site has already been reviewed and grubbed at the time drilling began in September 2019. The water hose will be laid on ground surface as guided by Cultural Resource surveys to avoid impacts to any nearby artifacts. NRF personnel will assist with placing the hose beneath the railroad track. Water will be pumped from USGS-102 as permitted by the State of Idaho to the USGS for the purposes of supplying water during drilling from March to June 2020 at drill site USGS-152.

Figure R-7. Locations of water tanks T1, T2, and T3 and the approximate location of the hose connecting them.

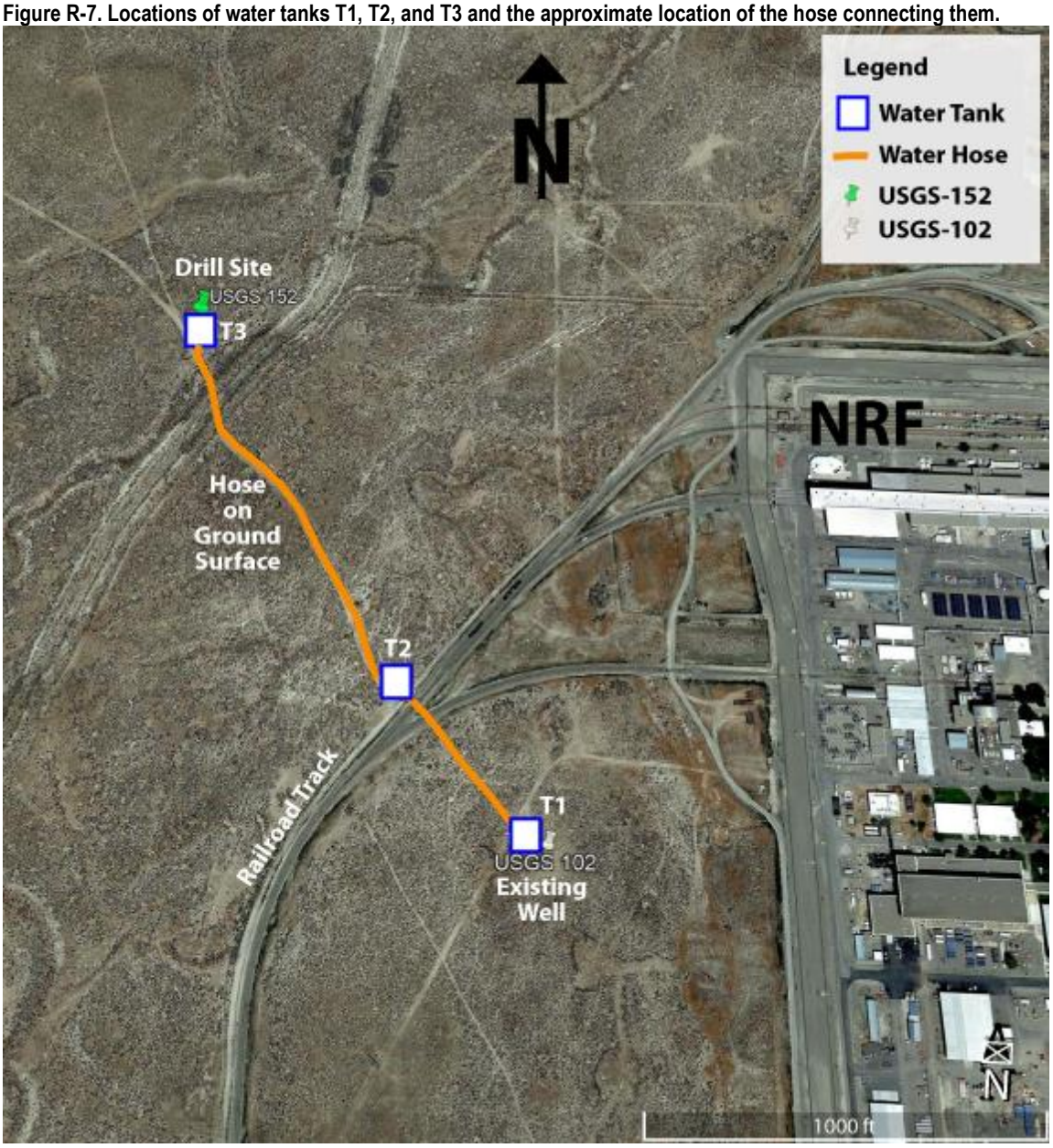
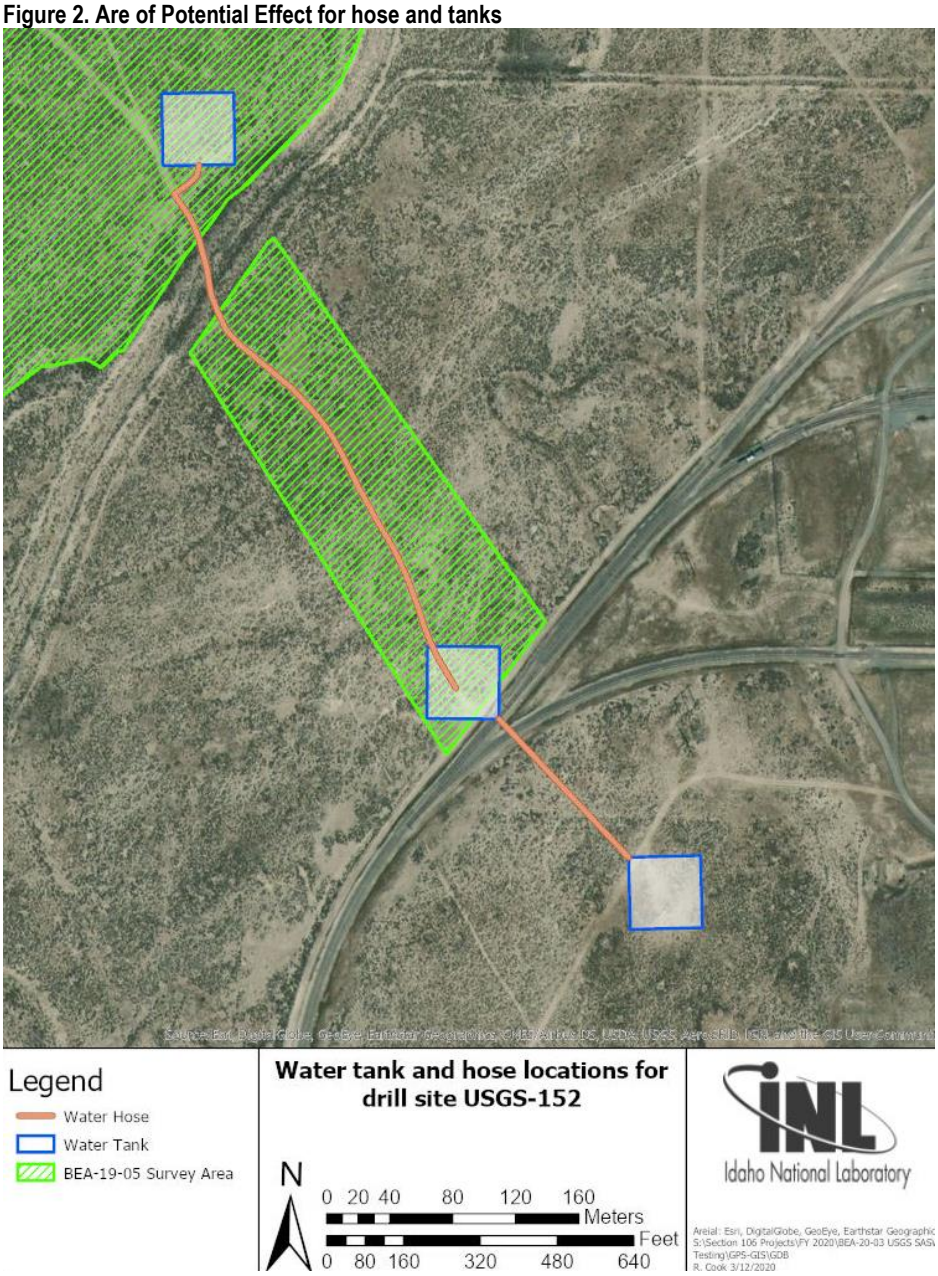


Figure 2. Are of Potential Effect for hose and tanks



Revision 2:
The purpose of Revision 2 is to:
1) update alternative contact (above),
2) add Spectral Analysis of Surface Wave (SASW) testing near borehole and INL seismic station sites,
3) change locations of the proposed drill site near Idaho Nuclear Technology and Engineering Center (INTEC), and
4) remove "Item 4. Small Modular Reactor (SMR) Site", which is now in EC INL-19-067.

Scope Addition: Spectral Analysis of Surface Wave (SASW) Testing
Up to 17 survey lines are proposed for SASW testing near seismic velocity boreholes and existing INL seismic stations at: ATR (Figure R-1A), NRF (Figures R-2A and Figure R-2B), INTEC (Figure R-3), MFC (Figures R-4A and R-4B), and INEL-1 deep drill hole (Figure R-5). SASW testing is a non-destructive/non-invasive method used to estimate the relative stiffness of layered rock or soil materials by generation of surface energy waves from a fixed location and the subsequent recording of resulting motions by geophones. Seismic data are collected by receiver geophones buried <2 ft deep at ground surface along a single path radiating from the source of the surface waves. Surface waves are generated using a truck-mounted vibratory source (Figure R-6). For profiling up to depths of 1,600 feet, the truck source impacts the ground surface at several positions along each SASW survey line. The following disturbances may occur:

- The surface wave generator truck and support vehicle (carrying geophone equipment) will access and traverse along each SASW survey line which can be between 2,000 and 4,000 ft long. Where possible, existing roads will be used. Vegetation will be removed via grubbing of a 15-ft wide path where the survey line is located off an existing road.

- At some locations source pads may be needed at each end of the SASW survey line. The source pad is a poured concrete slab that would be installed at the ends of each SASW survey line; see Figures R-1A, R-2A, R-2B, R-3, R-4A, R-4B, and R-5 for proposed locations should pads be needed. The poured slabs would be about 8-feet long, 10-feet wide, and up to 2-feet high. The recent SASW survey on INL (CFPP site) did not need to use concrete pads for coupling. Should any source pads be installed, they will be removed and disposed of after seismic data have been collected.
- Ground vibrations will be generated during the surveys and may be perceived as potential disturbances to operations at ATR, NRF, MFC, and INTEC. The ground vibrations will not be sufficient to shake buildings. However, SASW lines can be surveyed during Friday's off and weekends to avoid any potential impacts to operations and will be performed when ATR is not operating.

Revision to Item 3: Idaho Nuclear Technology and Engineering Complex (INTEC)

The proposed action drills and measures seismic velocities in one 800 ft borehole and along possible four SASW lines located east of INTEC for an updated seismic safety basis for potential future projects/activities. The borehole will also provide research data to the USGS. The USGS will core-drill the borehole and ground disturbance around the drill site will cover 250 ft by 250 ft or less. If the preferred borehole site shown in Figure R-3 is selected, after collecting seismic borehole data the USGS will install ground water monitoring instrumentation for long-term monitoring of the aquifer. Also, four ~2,000 ft long SASW lines will be measured. If the alternate borehole site shown in Figure R-3 is chosen, the borehole will be abandoned after collecting seismic borehole data, and only two 2,000 ft long SASW lines will be measured.

Revised figures showing SASW lines near seismic velocity boreholes and INL seismic stations

Figure R-1A.USGS-150 seismic velocity borehole (red dot) and ATRF seismic station (blue dot) near three SASW survey lines (yellow dashed lines).

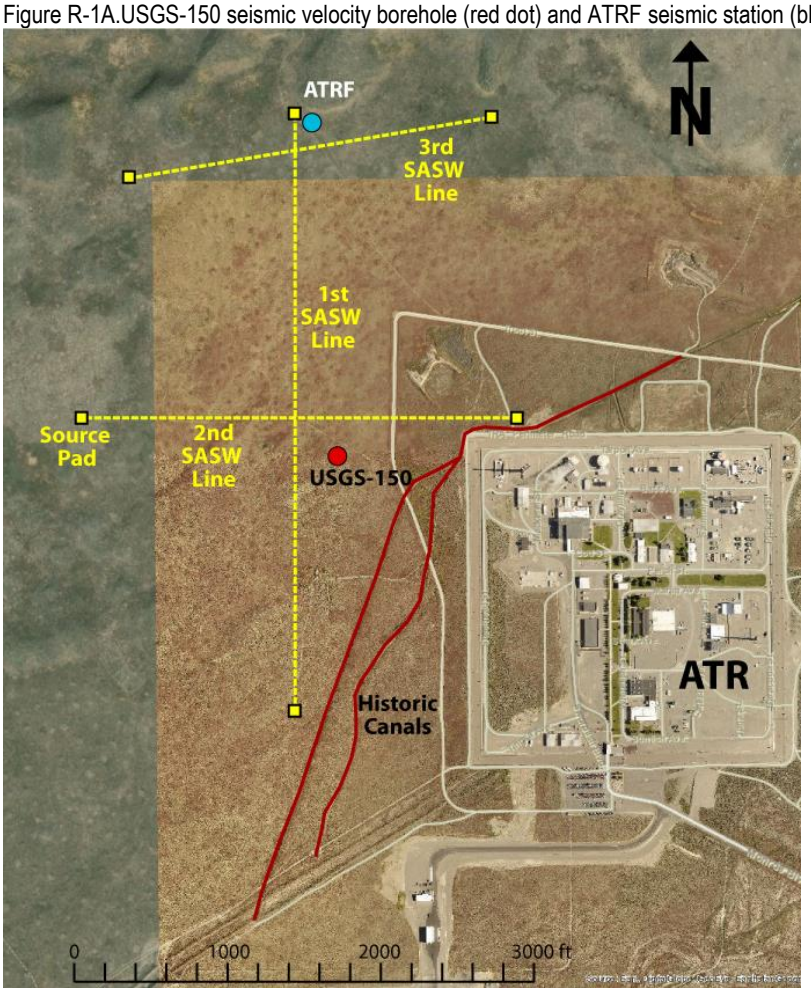


Figure R-2A. USGS-151 seismic velocity borehole (red dot) near two proposed SASW survey lines (yellow dashed lines) east of NRF.

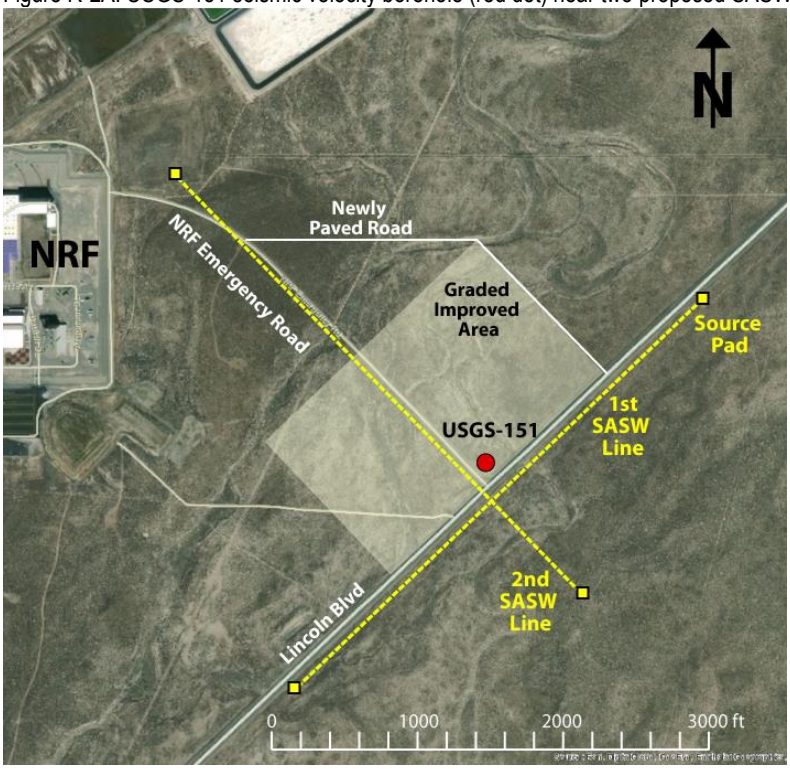


Figure R-2B. USGS-152 seismic velocity borehole (red dot) and NRVF seismic station NVRF (blue dot) near two proposed SASW survey lines (yellow dashed lines) west of NRF.

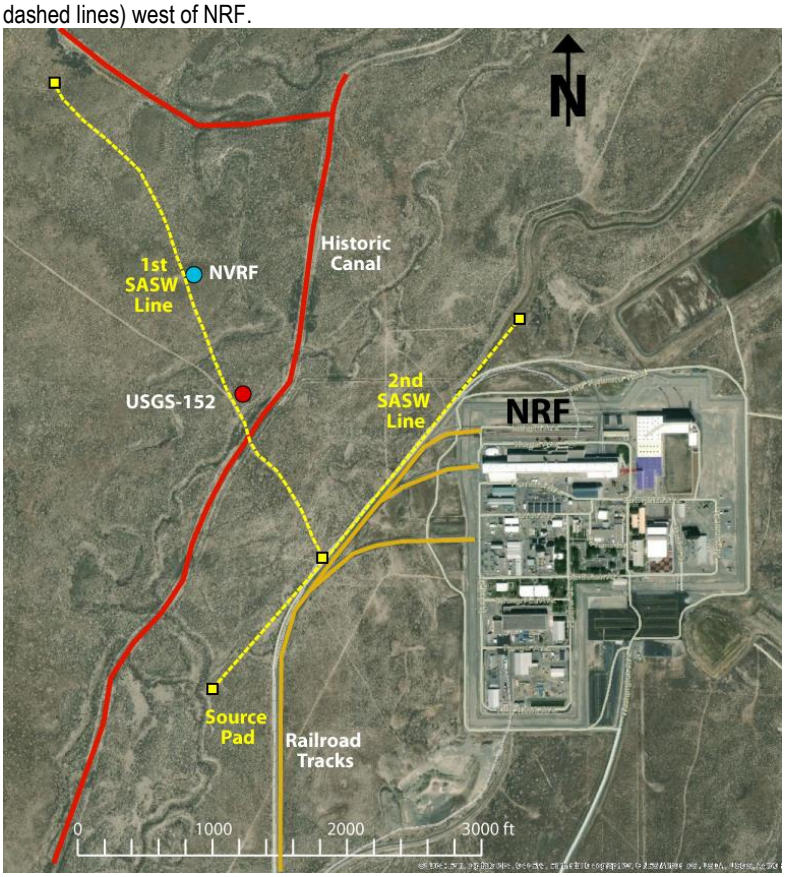


Figure R-3. INTEC borehole location with possible 250 ft x 250 ft drill site areas (white box) at the preferred or alternate location. If preferred drill site selected, all four SASW (yellow dashed lines) will be surveyed; only 1st and 2nd lines will be surveyed if alternate drill site selected.

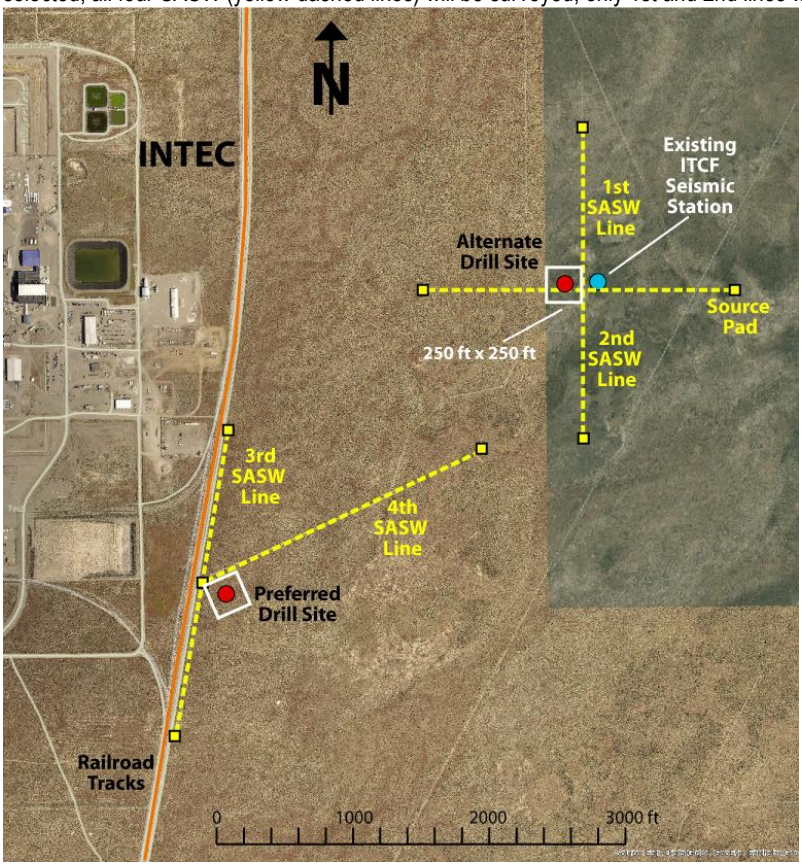


Figure R-4A. USGS-148 and USGS-149 seismic velocity boreholes (red dots) and VTRF seismic station (blue dot) near two proposed SASW survey lines (yellow dashed lines) east of MFC.

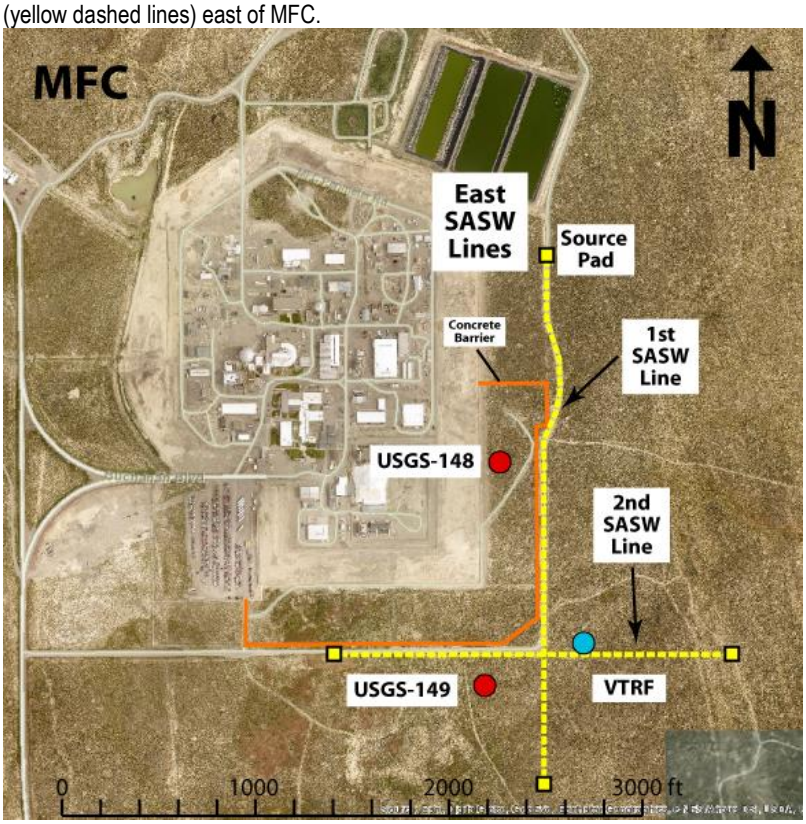


Figure R-4B. ANL-1 borehole (red dot) and MFCF seismic station (blue dot) near proposed SASW survey lines (yellow dashed lines) west of MFC; 1st and 2nd lines are preferred but the alternative line could be surveyed.

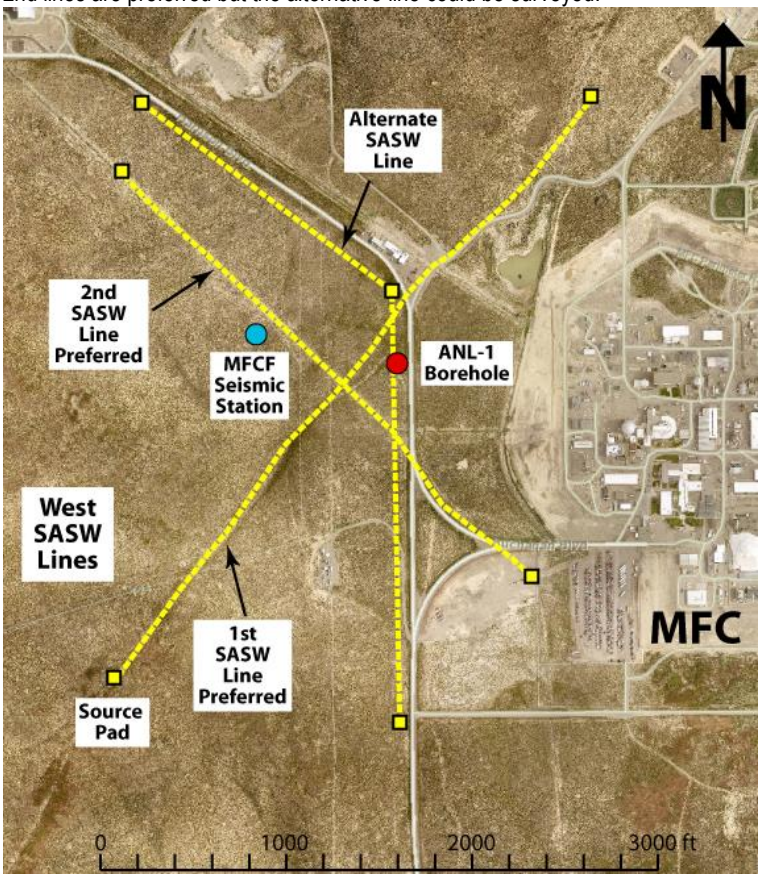


Figure R-5. INEL-1 deep drill hole (red dot) and INLF seismic station (blue dot) near two SASW survey lines located off of INL road T-3 west of Lincoln Blvd.

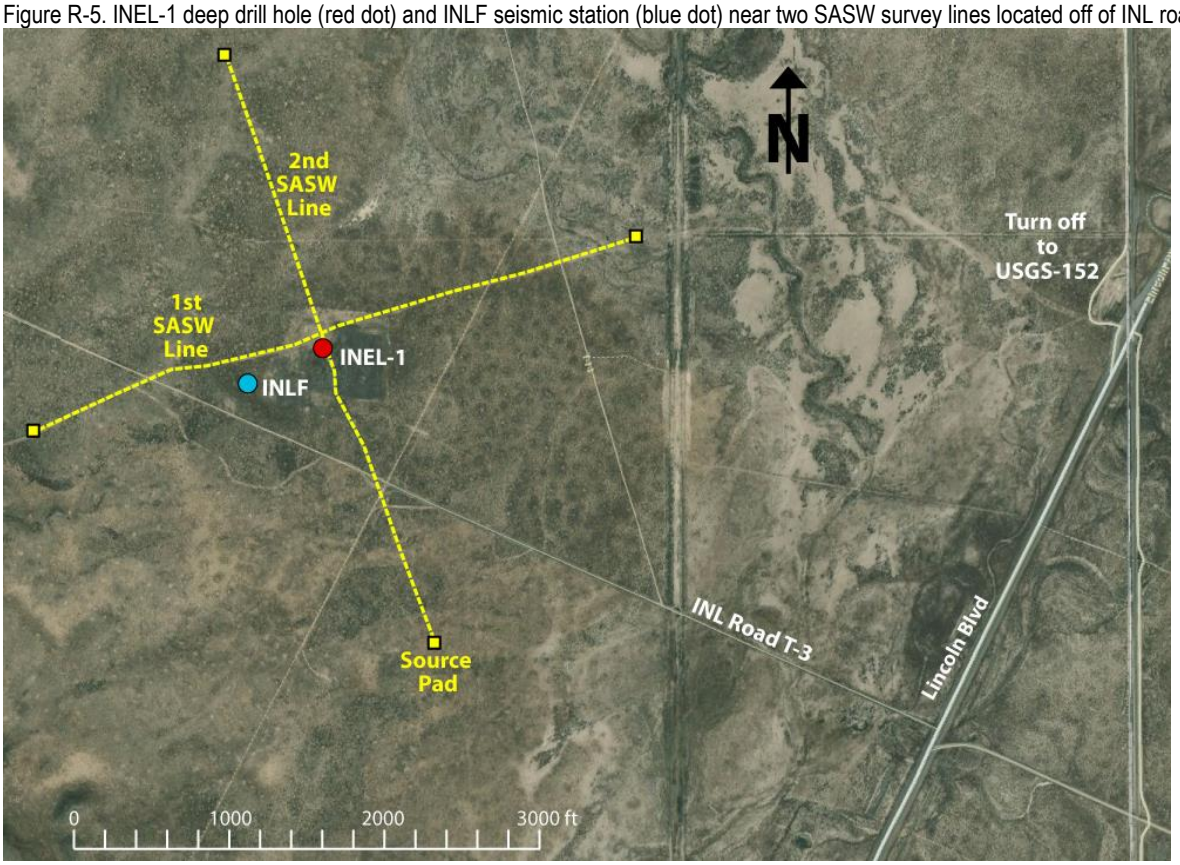
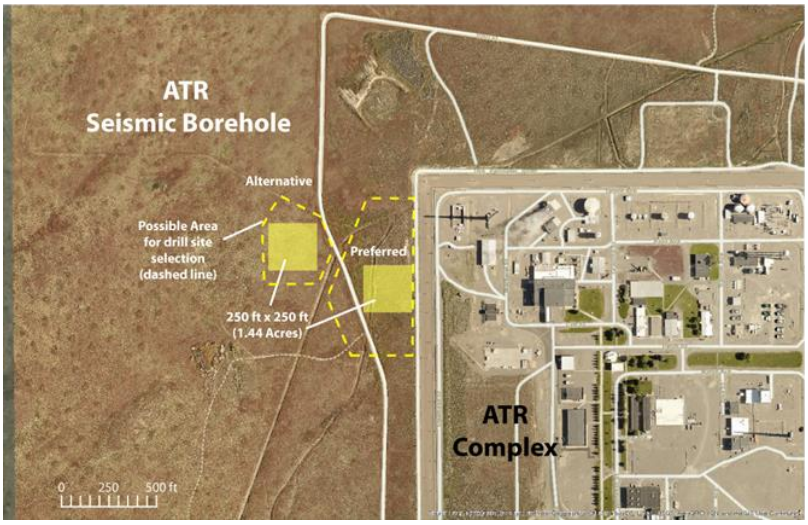


Figure R-6. Image shows surface wave generator truck and concrete pad with associated excavations.

The remaining scope in revision 1 is valid, with the exception of item 4, which is now under its own EC, INL-19-067.

Revision 1:
The purpose of this revision is to document a change to the seismic borehole location near the Advanced Test Reactor (ATR) Complex. Two alternative sites on the northwest side of ATR are proposed for the borehole (Figure R-1). The preferred site covers about 250 ft x 250 ft and is adjacent to the west fence of the ATR. If this location is not suitable, an alternative site west of the ATR perimeter road is proposed. The depth to the aquifer is ~450 ft. At this time, the ATR borehole is planned for abandonment following data collection.

Figure R-1. ATR seismic borehole location with possible area (dashed yellow line) for selecting the 250 ft x 250 ft drill site (yellow box) at the preferred location or at an alternative location



The remaining scope in the original EC remains valid and is included below:

Original EC

Under the proposed action, the U.S. Geological Survey (USGS) drills up to eight boreholes, each with ≤10 inch diameter and extending to depths between 800 and 1,600 ft, at four locations on the INL Site. After seismic measurement collection, USGS may take ownership of the boreholes for future monitoring activities. Borehole depth varies depending on location (discussed below for each location). The following discussion summarizes project scope at each location:

- Borehole drilling and logging disturbs an area about 250 ft x 250 ft to accommodate the drill rig, lay-down area, water tank, water truck turnaround, and vehicles. Access to and from the drill sites uses existing roads. Drilling takes between 40 and 80 days, depending on borehole depth. Seismic velocity logging is performed over a period of 3 to 10 days.

- The USGS core-drills a ≤5 inch diameter borehole to the top of the aquifer and performs geophysical logging in open-hole conditions. A geotechnical firm logs cores on site, places cores in boxes, and transports cores to the USGS core library. The USGS grouts (mixture of water, cement, and bentonite) the borehole from the bottom to the top, reams the grout to a ≤5 inch diameter borehole, then places a FLUTe Flexible Liner containing a 50 ft slug of water and a seismic sensor in the borehole. Seismic velocities are measured by moving the 50 ft slug of water and seismic sensor from the bottom of the hole to the surface. The seismic sensor generates and records vibrations transmitted into and out of nearby rock. For deeper boreholes extending into the aquifer, the USGS reams the borehole out to 9.8-inches diameter and sets and grouts 6-inch steel casing to stabilize the borehole for further core-drilling. The USGS core drills below the bottom of the steel casing to the bottom-hole depth. If the borehole is stable, geophysical and seismic velocity logging occurs in open-hole conditions. If not stable, then the FLUTe Flexible Liner and seismic sensor log seismic velocities. Following seismic velocity logging, the USGS completes the borehole as a monitoring well, or borehole is abandoned in compliance with regulatory requirements.

The following four sections describe each project location, the number of boreholes, and proposed disposition of the boreholes:

1. Naval Reactors Facility (NRF)

The proposed action drills and measures seismic velocities in two deep boreholes near NRF to support seismic design of current and planned nuclear facilities at NRF. The two boreholes will be core-drilled to 1,500 ft depths at a location on the east side of the NRF, and another location on the west side of NRF. The depth to the aquifer is ~425 ft. Once seismic velocities have been logged, the USGS will install monitoring instrumentation in each borehole and take ownership of the boreholes.

The NRF East borehole drill site is located off of Lincoln Blvd on the NRF emergency road (Figure 1) and has been reviewed and cleared for use as part of the Naval Spent Fuel Handling (NSFH) Facility. The NRF West borehole location is located west of an historic canal and has not been assessed (Figure 2). Drilling at the NRF West borehole includes placing a hose that connects to a refillable water tank along the road on the east side of the historic canal to avoid disturbance to the historic canal from water trucks crossing the canal to the drill site. Also, alternate roads around the historic canal will be used to transport the drill rig to and from the borehole location. The area for the temporary water tank and truck turnaround covers about 50 ft by 50 ft.

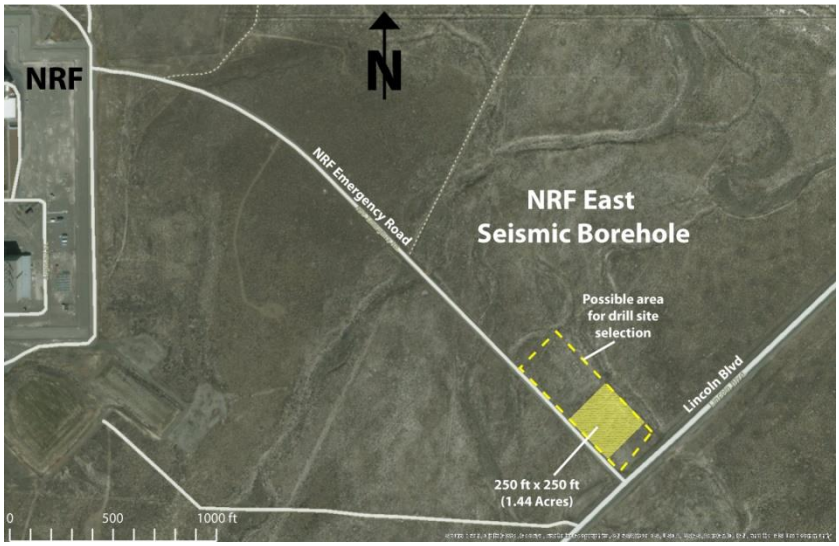


Figure 1. Map showing NRF East seismic borehole location with possible area (dashed yellow line) for selecting the 250 ft x 250 ft drill site (yellow box).

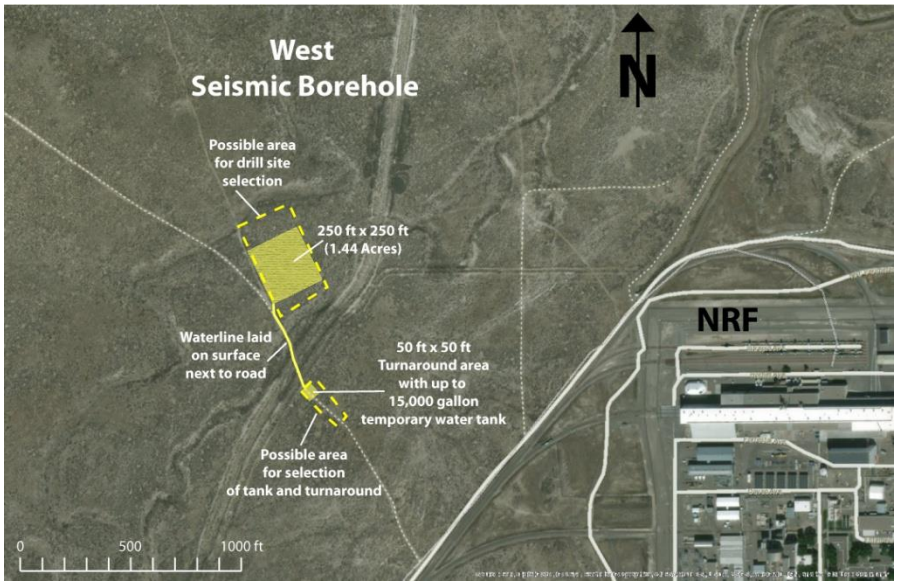


Figure 2. Map showing NRF West seismic borehole location with possible areas (dashed yellow line) for selecting the 250 ft x 250 ft drill site (yellow box), and truck turnaround and water tank, and the water line location across the historic canal.

2. Advanced Test Reactor (ATR)

The proposed action core-drills one 1,600 ft deep borehole at ATR to obtain seismic data for an updated ATR seismic safety basis. Two alternative sites are proposed for the borehole at ATR (Figure 3). The preferred site covers about 250 ft x 250 ft north of the ATR fence. If this location is not suitable, an alternative site further north of the ATR northern perimeter road is proposed. The depth to the aquifer is ~500 ft. At this time, the ATR borehole is planned for abandonment following data collection.

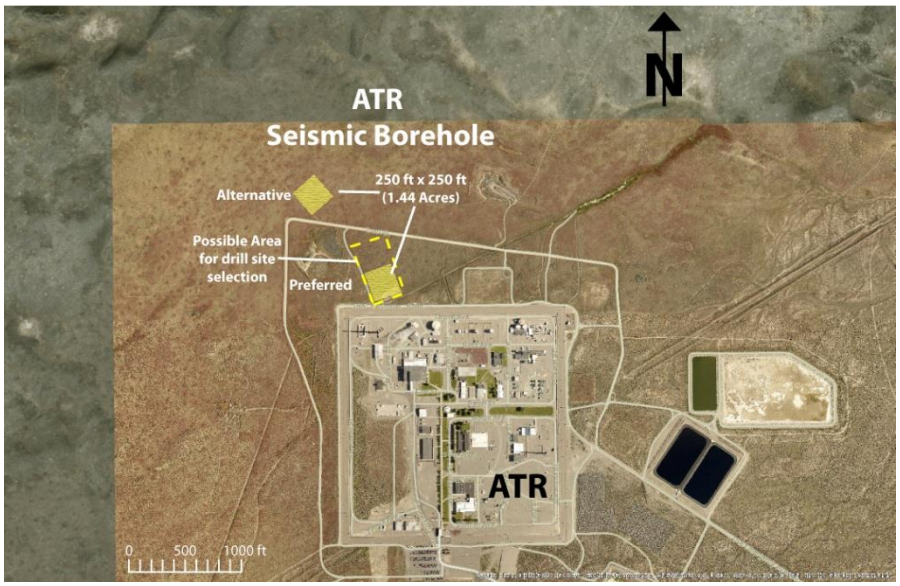


Figure 3. Map showing ATR seismic borehole location with possible area (dashed yellow line) for selecting the 250 ft x 250 ft drill site (yellow box) at the preferred location or at an alternative location further north.

3. Idaho Nuclear Technology and Engineering Complex (INTEC)

The proposed action drills and measures seismic velocities in one 1,500 ft borehole east of INTEC to obtain data for an updated seismic safety basis for potential future projects/activities. The proposed site covers about 250 ft x 250 ft near the INL seismic station, ITCF (Figure 4). The borehole location and seismic station are located east of INTEC and outside of the restricted zone for drilling. At this time, the INTEC borehole is planned for abandonment following data collection.

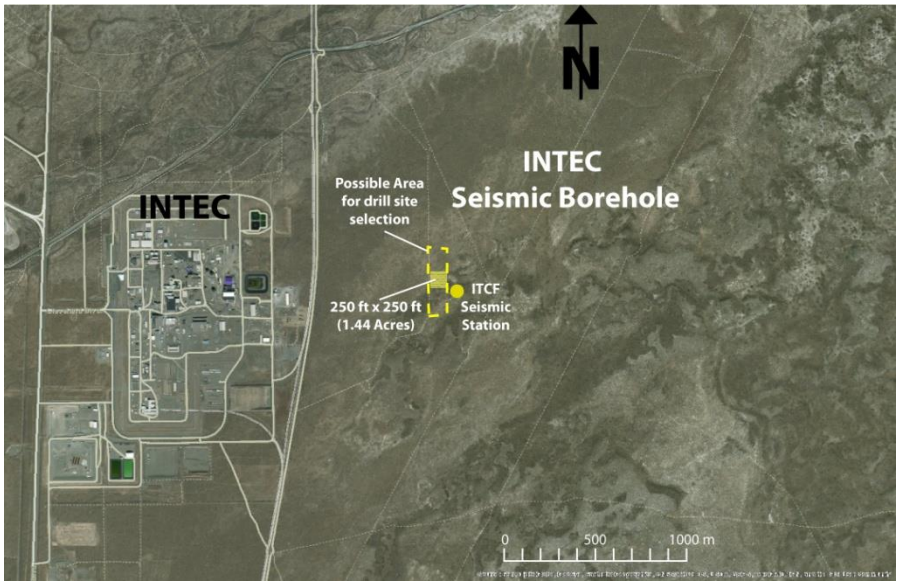


Figure 4. Map showing INTEC seismic borehole location with possible area (dashed yellow line) for selecting the 250 ft x 250 ft drill site (yellow box).

4. Small Modular Reactor (SMR) Site

The Utah Association of Municipal Power Systems (UAMPS) is evaluating siting a Small Modular Reactor (SMR) on the INL Site. Environmental checklist INL-18-095 evaluated the environmental impacts of installing a seismic station for the proposed SMR at location south of Central Facilities Area (CFA). UAMPs is reconsidering the location and has not identified a new location at present. In advance of UAMPS site characterization studies at a new INL location, it is proposed that the USGS drill and measure seismic velocities in four boreholes to obtain data for the INL SSHAC Level 3 Study. A new seismic station may also be installed to collect regional earthquake data. Earthquake recordings and seismic velocities are vital for developing site-specific ground motion models for the INL SSHAC Level 3 PSHA at the SMR site.

The four seismic velocity boreholes will be drilled for the SMR. They will be located on the site selected for the SMR. Each of the boreholes will be drilled to depths from 800 to 1,600 ft depending on the site location on INL. If the SMR site selected is south of CFA, then each borehole will be 800 ft deep. If the SMR site is located in the western or northern parts of INL, then each borehole will be 1,600 ft deep. When the SMR site is selected, this EC will be revised to include the map, depth, location, and disposition of each borehole and seismic station.

The project anticipates locating a new seismic station near one of the seismic velocity boreholes. Installing the seismic station requires soil disturbance within a 50 ft radius around the seismic station. The soil disturbance includes:

- Placing a 4 ft-diameter concrete circular pad housing a circular culvert enclosure (4 ft high) and steel lid with handle
- Hand-augering a 12-inch diameter hole to a depth of 3 or 4 ft to place a steel rod in concrete
- Hand-excavating a 3 x 3 ft base for a 10’ tower in 1 to 2 ft of concrete.

The seismic station consists of the following instrumentation:

- A datalogger, three-component broadband seismometer, and three-component accelerometer housed in the culvert enclosure
- Two solar panels and one antenna attached to the tower
- Global Positioning System (GPS) antenna attached to the top of the steel rod
- Digital 2.4G radio and GPS receiver in a small enclosure on the tower
- A 2 x 3 ft steel box set on the soil surface adjacent to the tower to house two or more sealed 12 volt, 100 amp/hr Gel Cell batteries.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Fugitive dust and emissions from mobile equipment may be generated during excavation activities.

Discharging to Surface-, Storm-, or Ground Water

Drilling boreholes has the potential to impact groundwater.

The project will have little, if any, effect on the floodplain, nor will the floodplain adversely affect the project. However, project personnel should use practices to prevent and minimize spills (e.g., good housekeeping) during storage and use of chemicals and fuels. Projects should also minimize soil disturbance to the extent practical.

Disturbing Cultural or Biological Resources

The proposed locations for the seismic stations, boreholes, and seismic lines are outside the previously disturbed facility fenced areas/improved grounds and have the potential to disturb Cultural or Biological resources.

Generating and Managing Waste

The seismic investigation portion of the project may generate small amounts of industrial waste such as concrete, scrap metal/wire, packaging material, etc. Hazardous waste is not expected to be generated. Batteries will be used while operating the seismic stations and will need to be replaced on occasion. Drill cuttings from the boreholes and wells will also be generated. All waste will be appropriately characterized and disposed at the direction of the facility Waste Generator Services representative. Program personnel will incorporate waste minimization measures and recycling where practical.

Releasing Contaminants

Typical construction chemicals such as fuels, lubricants, adhesives, paints, concrete, concrete cure, asphalt, refrigerants, etc., will be used and will be submitted to chemical inventory lists with associated Safety Data Sheets (SDSs) for approval in the vendor data system prior to use. The Facility Chemical Coordinator will enter these chemicals into the INL Chemical Management Database. All chemicals will be managed in accordance with laboratory procedures. When dispositioning surplus chemicals, project personnel must contact the facility Chemical Coordinator for disposition instructions.

Although not anticipated, there is a potential for spills when using chemicals or fueling equipment. In the event of a spill, notify facility Environmental Staff. If the facility Environmental Staff cannot be contacted, report the release to the Spill Notification Team (208-241-6400). Clean up the spill and turn over spill cleanup materials to WGS."

Using, Reusing, and Conserving Natural Resources

All applicable waste would be diverted from disposal in the landfill when possible. Program personnel would use every opportunity to recycle, reuse, and recover materials and divert waste from the landfill when possible. The program would practice sustainable acquisition, as appropriate and practicable, by procuring construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, and are non-toxic or less-toxic alternatives.

SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification: Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

References: 10 CFR 1021, Appendix B, B3.1 "Site characterization and environmental monitoring", B1.18 "Water supply wells", and B5.2. "B5.2 Modifications to pumps and piping"

Justification: Project activities are consistent with 10 CFR 1021, Appendix B, B3.1 "Site characterization and environmental monitoring (including, but not limited to, siting, construction, modification, operation, and dismantlement and removal or otherwise proper closure (such as of a well) of characterization and monitoring devices, and siting, construction, and associated operation of a small-scale laboratory building or renovation of a room in an existing building for sample analysis). Such activities would be designed in conformance with applicable requirements and use best management practices to limit the potential effects of any resultant ground disturbance. Covered activities include, but are not limited to, site characterization and environmental monitoring under CERCLA and Resource Conservation and Recovery Act (RCRA). (This class of actions excludes activities in aquatic environments. See B3.16 of this appendix for such activities.) Specific activities include, but are not limited to:

a) Geological, geophysical (such as gravity, magnetic, electrical, seismic, radar, and engineering surveys and mapping, and the establishment of survey marks. Seismic techniques would not include large-scale reflection or refraction testing;
b) Installation and operation of field instruments (such as stream-gauging stations or flow-measuring devices, telemetry systems, geochemical monitoring tools, and geophysical exploration tools);
c) Drilling of wells for sampling or monitoring of groundwater or the vadose (unsaturated) zone, well logging, and installation of water-level recording devices in wells;
d) Aquifer and underground reservoir response testing; (e) Installation and operation of ambient air monitoring equipment;
e) Sampling and characterization of water, soil, rock, or contaminants (such as drilling using truck- or mobile-scale equipment, and modification, use, and plugging of boreholes);
f) Sampling and characterization of water effluents, air emissions, or solid waste streams;
g) Installation and operation of meteorological towers and associated activities (such as assessment of potential wind energy resources);
h) Sampling of flora or fauna; and
i) Archeological, historic, and cultural resource identification in compliance with 36 CFR part 800 and 43 CFR part 7.",

B1.18, "Siting, construction, and operation of additional water supply wells (or replacement wells) within an existing well field, or modification of an existing water supply well to restore production, provided that there would be no drawdown other than in the immediate vicinity of the pumping well, and the covered actions would not have the potential to cause significant long-term decline of the water table, and would not have the potential to cause significant degradation of the aquifer from the new or replacement well.", and

B5.2 "Modifications to existing pump and piping configurations (including, but not limited to, manifolds, metering systems, and other instrumentation on such configurations conveying materials such as air, brine, carbon dioxide, geothermal system fluids, hydrogen gas, natural gas, nitrogen gas, oil, produced water, steam, and water). Covered modifications would not have the potential to cause significant changes to design process flow rates or permitted air emissions."

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) ☐ Yes ☒ No

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on: 6/4/2020