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NATIONAL LABORATORY
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IWD Part 1, Activity Specific Information

IWD#: 2014-Drilling R63i_R47_CdV-9-1i Revision#: 0			Activity/Task Title **IWD for Drilling and Installation of LANL Wells R-63i, R-47, and Cdv-9-1i**
Company Name / Subcontract #: TerranearPMC Subcontract #86309-010-13			Planner/Preparer (Name/Z No./Date) Robert Brounstein/ 231170/ 6-2-14, Steve White/208872/6-2-14
TA: 16, 15, 09	Building: Outdoors	Room: N/A	Additional Location Description: R-63i: TA-16 near the Burning Grounds, R-47: TA-15 off of R-Site Rd, CdV-9-1i: TA-9, location to be determined.

Activity Description/Overview: Well R-63i will be installed as part of the Environmental Programs Material Disposal Area (MDA) P (TA-16) monitoring network. The R-63i well will be installed at a depth of approximately 1200 feet (ft) below ground surface (bgs). R-63i will be drilled deep enough to collect representative samples from the perched groundwater identified approximately 55 ft above the regional aquifer during the drilling of well R-63. Well R-63i is tentatively designed with one well screen set between 1095 to 1125 ft bgs within Puye Formation deposits. Final well design will be determined based on conditions found during drilling and geophysical logging and will incorporate discussions with NMED.

Well R-47 is being installed to satisfy a recommendation made in the TA-16 well network evaluation and recommendations. The depth to the top of regional saturation at R-47 is expected to be approximately 1250 ft. The target depth for the R-47 borehole is 1350 ft, about 100 ft into the regional aquifer. The depth to water is uncertain, and the target depth may be adjusted once the water depth at this location is determined.

Well CdV-9-1i is being installed to satisfy a recommendation made in the TA-16 well network evaluation and recommendations. The depth to the top of the perched intermediate zone of saturation at CdV-9-1i is expected to be approximately 795 ft. The target depth for the borehole is 1220 ft, about 30 ft below the projected bottom of the lower screen at CdV-16-4ip and about 75 ft above the expected elevation of the regional aquifer. The depth and occurrence of perched and regional groundwater is uncertain, and the target depth may be adjusted once the water depth and producing intervals are evaluated at this location.

List Names of Hazard Analysis (HA) Team: R. Brounstein, S. White, R. McGuill, A Crowder Date HA Performed: 6/2/14

ACTIVITY DESCRIPTION/OVERVIEW

The project may include the following activities and concerns:

This IWD breaks each of these activities into work elements and identifies hazards and controls.

The work being described in IWD-2014 Drilling R-63i, R-47, and Cdv-9-1i is being conducted within LANL Explosive Operations Facilities, TA-16, 15, and 09. All work must be performed in full compliance with the standards set forth in DOE STD-1212-2012 and LANL P101-8 for work being conducted in HE sites. There must be continual coordination with the WFO Duty Officer and the applicable Site Access Control Office during all phases of work being conducted in the areas discussed in this IWD.

Work Tasks/Steps Identify work steps/tasks in sequence when such sequencing contributes to safety, security, and/or environmental protection.	**Hazards, Concerns, and Potential Accidents/Incidents** Identify both activity and work-area hazards for each task/step.	**Controls, Preventive Measures, and Bounding Conditions** Specify preventive measures, controls for each hazard (e.g., lockout/tagout points, specific PPE, TIDs, alarms, safes, recycle, waste minimization)	**Reference Documents** List permits, operating manuals, security plans, and other reference procedures.	**Training** List training and qualification requirements.

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
MOBILIZATION/DEMOBILIZATION This step includes activities related to the moving persons, equipment and supplies to the site and caching them onsite and getting electric power to the trailer.				
Overhead Power Lines	Minimum distances to power lines during transit	➢ Conduct site survey prior to mobilizing any equipment onsite. ➢ Pay attention to hazards such as overhead power lines. Maintain minimum safe distances from all high voltage lines. Ensure that the equipment or any part thereof does not have the capability to come within the following distances from the energized lines: Minimum distances for operation of equipment near high voltage power lines (2300 meters altitude): • 11 feet from lines of 50 kV or less • 17 feet from lines of 51 kV to 200 kV • 23 feet from lines of 201 kV to 350 kV • 28 feet from lines of 351 kV to 500 kV • 39 feet from lines of 501 kV to 750 kV • 51 feet from lines of 751 kV to 1000 kV Minimum distances for equipment in transit with no load and the boom and-or mast lowered (2300 meters altitude): • 5 feet from lines of 0 kV to 50 kV or less • 13 feet from lines of 51 kV to 345 kV • 18 feet from lines of 346 kV to 750 kV • 23 feet from lines of 751 kV to 1000 kV ➢ Designate a person to observe clearances of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. ➢ Use 2-way radios and a spotter, if clearances are tight.	TPMC ES&H Program section 32, "Cranes and Material Handling Equipment"	Pre-job briefing
Site Office Trailer	Electrocution due to improper connection of trailer to power grid or generator	➢ Have a licensed electrician install electric meter and connect trailer to power grid or generator.	TPMC ES&H Program section 36, "Electrical Safety"	Licensed electrician per LANS procedure P101-13
Material Storage	Unstable stacks of materials	➢ Bagged materials shall be cross-keyed and shall not be more than 10 bags high. ➢ Drill rods, core barrels, casing, and pipe shall be stacked and blocked	TPMC ES&H Program section 10, "Housekeeping"	Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		to prevent spreading and rolling. ➢ Avoid staging materials in close proximity to work activities where they may be knocked over or fall on personnel.	TPMC ES&H Program Section 1.8, "Zero Accident Performance Objectives"	
Offloading and Loading Equipment	Off-loading/loading equipment from transport vehicles	➢ Assure the delivery driver has the appropriate PPE or does not exit from the truck cab unless donning the PPE (i.e. hard hat, safety shoes). ➢ Use spotters to help direct the operator while driving equipment off the trailer. ➢ Remove all unauthorized/unnecessary personnel from the off-loading area. ➢ Personnel shall wear leather gloves (or similar material) to protect against potential pinch points. ➢ Notify STR and Complete New Equipment Declaration forms. ➢ Use only appropriate vehicles in transportation across any distance other than directly on drill pad (i.e. pick-up or flat bed service trucks) in movement and support operations. ➢ All equipement that has been down-hole will be spot checked for HE prior to removal from site. ➢ **HOLD POINT:** Any positive HE spot test requires **STOP WORK** and notification to CAP FS. Any sample or piece of equipment that results positive will not be handled or removed.	TPMC ES&H Program section 16, "Motor Vehicles and Powered Industrial Equipment" TPMC ES&H Program section 12, "PPE"	Pre-job briefing TPMC's PPE training, or equivalent
Offloading and Loading Equipmeent	Off-loading/loading equipment from a winch truck	➢ Perform daily equipment inspection of winch truck before moving equipment. ➢ Determine the load weight prior to winching, and verify that the winch cable is rated higher than the load weight. ➢ Inspect winch cable (and document) for damage, including broken wires, flattening, peening, or abrasion before loading. ➢ Establish a safe distance around the winch truck to exclude personnel in case of winch cable failure. ➢ Offload equipment from winch truck in a safe and controlled manner. ➢ While loading, use proper connection technique for the winch cable being used and the type of equipment being loaded. Double check connections before winching. ➢ Ensure personnel stationed on the truck are, at least two feet from the edge. If personnel need to work at the edge, fall protection shall be required.	TPMC ES&H Program section 23, "Fall Prevention/ Protection" TPMC ES&H Program section 32, "Cranes and Material Handling Equipment"	Pre-job briefing Any riggers used shall be qualified/licensed per 29 CFR 1926, subpart CC
Dust Exposure	Exposure to nuisance dust	➢ Avoid working immediately downwind of airborne dust sources to the	TPMC ES&H	Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		extent feasible. ➢ Perform representative real-time aerosol monitoring when there is visible dust in the breathing zones of workers. ➢ Conduct operations in a manner that time-weighted average real-time aerosol monitoring readings do not exceed 3 mg/m^3 for a continuous 2-minute period. ➢ In the event dust suppression is ineffective, TPMC respiratory protection program will be invoked and will be used to manage any respiratory exposure.	Program section 51.2, "Limiting Dust Exposure" Real-time aerosol monitor user manual	
Temporary Fencing	Taking down and reinstalling temporary fencing	➢ Inspect hand tools before use. ➢ Wear leather gloves or equivalent. ➢ Wear safety glasses and hard hat. ➢ Watch out for wire snags and sharp hand tools. ➢ Slings will be inspected by a competent person before each use. ➢ Slings shall not be loaded in excess of its safe working load. ➢ All synthetic slings shall be marked with the name of the manufacturer, serial number, type of material, and rated load.	29CFR1926.602 Material Handling Equipment	TPMC's PPE training, or equivalent Pre-job briefing Competent person designation for sling inspector
Noise Exposure	Potential exposure to excessive noise	➢ Employees shall participate in the TPMC's Hearing Conservation Program when their noise exposure has been assessed at or above the ACGIH TLV of 85 dBA based on an 8-hour time-weighted average. The Hearing Conservation Program includes baseline and annual audiograms, evaluation and training. ➢ Notify TPMC S& H of any processes or areas where there are elevated noise conditions (ex. noise levels in the work area that cause workers to raise their voices when speaking). TPMC S&H will conduct noise monitoring as follows: ❖ Perform a preliminary noise survey to characterize operations that might be excessively noisy. Adjust construction zone boundaries, if necessary, so that hearing protection is not required outside of the construction zone. ❖ Use Noise Dosimeter to conduct representative noise dosimetry when the 8-hour TWA is suspected of being greater than the ACGIH TLV. ❖ Determine the adequacy of hearing protectors using a method listed in 29 CFR 1910.95 Appendix B. *"Methods for estimating the adequacy of hearing protector attenuation"* in instances where the 8-hour TWA has the potential to exceed 95 dBA. ➢ TPMC S&H will post areas with elevated noise levels that require hearing protection devices with warning notifications and entry	TPMC ES&H Program section 14, "TPMC Hearing Conservation Program" Manufacturer's specification 1910.95, Occupational Noise Exposure	TPMC's PPE training, or equivalent TPMC's hearing conservation training

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		requirements (29 CFR 1910.95, Occupational Noise Exposure). ➢ TPMC S&H will determine the types of hearing protection to be used, or whether double hearing protection is required based on their evaluation. This information will be conspicuously posted at the entrance to the work area. ➢ Workers shall wear hearing protection per the requirements established by TPMC S&H.		
Field Work in HE Exclusion Area	Elevated High Explosive concentrations in surface water, groundwater, or spring samples and/or HE particles or chunks in surface soil, sediment deposit, or other location (contingency)	1. Prior to filling sample containers with sample material, perform HE spot test on sample material. 2. Report results of positive HE spot test to Explosives Safety Representative: If HE spot test is negative, collect sample and sample can be removed from the HE area. If HE spot test is positive, follow direction from Explosive Safety Representative. Additional quantitative analysis may be required by the facility before samples can be transported.	TPMC ES&H Plan, Section 1.12, "Assurance that Work Will be conducted in a Safe Manner."	Pre-job meeting Policy for MPPEH 10/11/13 OJT-High Explosive Spot Test #47908 TA-16, 11 AND 37 (S-Site) HE Area Access Training #13334
Field Work in HE Exclusion Area, WFO, Firing Site, or Former Munitions area.	Discovery of unexploded ordnance (UXO) or High Explosives (HE) such as RDX, TDX, TNT, C4, C8	HOLD POINT: Do not handle or approach unknown item/shape for any reason. • Suspend work immediately. • Remove workers from the AOC/work area. • If escort ratio allows, secure area and post at least 2 personnel outside AOC/work area. Personnel shall not allow access to AOC/work area. Remaining personnel shall make the following notifications: • Access Control and STR.	TPMC ES&H Plan, Section 1.12, "Assurance that Work Will be conducted in a Safe Manner."	Pre-job meeting

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT (DUAL ROTARY) Setting up the drill rig and ancillary equipment shall be performed under the following sub steps: A) Unloading and staging materials for later use B) Position rig, support truck, and ancillary trailers C) Set any cribbing necessary and level the rig and support truck D) Set outriggers E) Cut plastic and wood for secondary containments, construct, and set beneath rig and support truck F) Set up generators, air compressor system, and dust suppression unit G) Raise mast H) Work near cuttings pit				
Activity A: Unloading Materials	Using drill rig as a crane	➢ Do not use the drill rig as a crane. Use crane on support truck or fork lift for moving heavy equipment, materials, or supplies. ➢ Pipe must be staged very near the drill rig so that moving the pipe is essentially a vertical lift. ➢ Do not lift items in a manner that causes them to swing wildly. Use tag lines whenever possible.	TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty" TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives"	Pre-job briefing
	Forklift operation, accident or injury	➢ Inspect upon arrival, departure, and before the first use of the day. ➢ Perform and document pre-operational inspection before each shift during which the vehicle is used. Use Form 1568, Inspection Checklist for Forklifts and Powered Industrial Trucks (Checklist - http://enterprise.lanl.gov/forms/1568.pdf), or equivalent. ➢ Be familiar with operation and function of all controls and instruments before using the vehicle. ➢ Operator must be trained and licensed for the equipment he/she will be operating. ➢ Ensure forklift has sufficient capacity to handle the determined load weights. ➢ Evaluate work area hazards, obstacles, and clearances before starting work. ➢ Operate the forklift in a manner that avoids the following hazards: ❖ falling loads caused by overloading ❖ unbalanced loading	TPMC ES&H Program section 16, "Motor Vehicles and Powered Industrial Trucks" 29CFR 1926.600 and .602	PS-13 20299 - Forklift Safety Fundamentals, or equivalent PS-13 20300 - Forklift Examination, or equivalent PS-13 28151 Hands-on Proficiency Training, or equivalent. Certification by employer that operator has current training per 29 CFR 1910.178(L), Operator Training.

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		❖ other improper loading, i.e., free rigging a load ❖ obstructions to the free passage of the load or to the operator's view in the direction of travel; platforms, curbs, or other surfaces, which could cause the vehicle to veer or fall; ❖ poor maintenance ❖ driving the vehicle at excessive speed ❖ using equipment for a purpose for which it was neither intended nor designed. ➢ Only use internal combustion powered forklifts in well-ventilated spaces. ➢ Use personal restraint devices, including seatbelts, if provided. ➢ Use a spotter with 2-way radio when backing-up, if rear view is obscured. Spotters for forklifts must also have forklift training. ➢ Ensure the backup alarm is fully functional and used.		
Activity A: **Unloading Materials**	Unstable stacks of materials and piping	➢ Pipe shall be cribbed, stacked and blocked to prevent spreading and rolling. ➢ Avoid staging materials in close proximity to work activities where they may be knocked over or fall on personnel.	TPMC ES&H Program section 10, "Housekeeping"	Pre-job briefing
Activities B, C and D: Position rig , support truck, and ancillary trailers, Level the rig and support truck set any cribbing necessary. Set outriggers.	Improper rig setup	➢ Maintain the minimum distances provided in TPMC's ES&H Plan during equipment operation. ➢ Level the equipment. ➢ Set brakes, block wheels, set cribbing, and outriggers. ➢ Use outrigger pads as necessary in soft soil. ➢ Do not set outriggers directly over any underground utility line.	TPMC ES&H Program section 32.16.1, "Minimum distances for operation of equipment near high voltage power lines"	Pre-job briefing
Activity B: **Position rig, support truck, and ancillary trailers**	Improper rig setup	➢ Excavate / dig in accordance with excavation permit. ➢ Schedule Utility Locate through UMAP. ➢ Do not collect, dig, drill, power auger, or excavate directly over underground utilities. ➢ Do not place outriggers directly over underground utilities and maintain the designated distances noted in the General Field Work section for mobilization and erection of the rig and any other heavy equipment.	TPMC ES&H Program section 28, "Excavations & Trenching"	LANL Excavation/Soil Disturbance (self study) training Course 31419
Activity E: **Cut plastic and wood for secondary containments; place**	Portable power tools and hand tools Sharp edges and points	➢ Work to the requirements of TPMC's ES&H Plan Section 17, "Tools and Equipment". ➢ STR through the ESO must approve all temporary wiring and extension cords.	TPMC ES&H Program section 17, "Tools and Equipment"	TPMC's PPE training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
containments under rigs and major stationary equipment		➢ Inspect all tools prior to use. ➢ Personnel shall wear leather or equivalent work gloves. ➢ Knife blades shall be retracted or sheathed when not in use. ➢ Cut away from body. ➢ Wear a leather apron or other protective clothing when it is not possible to cut away from your body.		
Activity F: **Set up generators and air compressor system**	Air compressor system, compressed air tools, and hose whip	➢ No job-made or improvised pressure systems or tools are permitted. ➢ Inspect all hoses, fittings, valves, safety valves and regulators before the first use of the day and periodically throughout their use. ➢ Inspect compressed air tools before the first use of the day and periodically throughout their use. ➢ Assume compressors will start automatically and without warning. ➢ Do not expose body parts to compressed air. Do not walk over, stand on, or straddle hoses. ➢ A positive means shall connect the hoses to tools. ➢ Couple hosing into place and use whip checks to secure hose connections. Hoses shall not be used for hoisting or lowering tools. Ensure systems (i.e. cable guards), are fully engaged/extended down the length of the hose lines. ➢ Hoses exceeding ½-inch in diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure. ➢ Protect workers from excessive noise exposure (see controls for "Noise Exposure" under MOBILIZATION/DEMOBILIZATION).	Compressor manufacturer's specification Tool manufacturer's specification	Pre-job briefing
Activity F: **Set up generators and air compressor system**	Setting up and configuring dust suppression system	➢ Inspect system before mobilizing. ➢ Securely connect hose between drilling air exhaust to cyclone inlet and use whip checks at hose connections. ➢ Inspect existing connections between cyclone exhaust and filter housing inlet, also between filter housing outlet and air mover. ➢ Attach blow down capture bags/containers to filter housing and cyclone. ➢ Personnel shall wear leather gloves (or similar material) to protect against potential pinch point hazards.	TPMC ES&H Program section 12, "PPE" Manufacturer's specification	Pre-job briefing
Activity F: **Set up generators and air compressor system**	Electric shock: generator	➢ Use containment to catch small leaks of fuel or fluids from generator. ➢ Follow manufacturer's recommendations. ➢ Assure the generator is grounded to the frame or to a grounding rod and assure the bond is protective. Ground the generator per	TPMC ES&H Program section 36, "Electrical Safety" TPMC ES&H Program section 30,	Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		manufacturer's specifications ➢ Routine maintenance on equipment will be provided by on-site personnel. ➢ Non-routine maintenance will be performed by qualified electrician only. ➢ Each 120-volt circuit must have a ground fault interrupter.	"Lockout/Tagout procedure" Manufacturer's user manual	
Activity G: **Raise mast**	Failure of rig hoisting and rigging equipment	➢ Competent person will inspect the drill rig each day and complete the LANS Drilling Operations Verification Checklist, or equivalent. ➢ Drill rig shall be operated per manufacturer specifications. ➢ Determine the load weight prior to hoisting, and verify that the lifting equipment is rated higher than the load weight. ➢ Wire rope shall be removed from service when any of the following conditions exists: ❖ In hoisting ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay ❖ Abrasion, scrubbing, flattening, or peening, causing loss of more than one-third of the original diameter of the outside wires ❖ Evidence of any heat damage resulting from a torch or any damage caused by contact with electrical wires ❖ Reduction from nominal diameter of more than three sixty-fourths inch (3/64") for diameters up to and including three-fourths inch (3/4") ❖ Other signs of damage are observed. Also remove any tape that may be on top of wire rope damage ➢ Inspect for correct number and orientation of wire rope clamps (if used) or other wire rope terminations. ➢ Synthetic rope shall be removed from service when any of the following conditions exists: ❖ Abnormal wear ❖ Powder between fibers is generated ❖ Broken or cut fibers ❖ Variations in size or roundness of strands ❖ Discoloration or rot ❖ Distortion of hardware in sling ➢ Synthetic slings shall be removed from service when any of the following conditions exists: ❖ Acid or caustic burns	TPMC ES&H Program section 32, "Cranes and Material Handling Equipment" Manufacturer's specifications	TPMC's PPE training, or equivalent Pre-job briefing Competent person designation by drilling subcontractor Riggers training per 29 CFR 1926, Subpart CC

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		❖ Melting or charring of any part ❖ Snags, punctures, tears, of any part ❖ Broken or worm stitches ❖ Distortion of fittings ➢ Establish a cone of safety with physical barriers prior to hoisting and use tag lines whenever possible. ➢ Any damage or deficiencies shall be corrected prior to use. ➢ Personal protective equipment shall include hard hats, safety glasses, leather gloves (or equivalent) and safety toe boots when working in vicinity of hoisting and rigging equipment. ➢ Check for suspect or counterfeit parts. ➢ Stop work and contact STR in case of unusual event.		
Activity G: **Raise mast, operate the hoist**	Crushing hazard and rotating parts	➢ Do not operate machinery without guards in place. ➢ Keep hands away from meshing surfaces and rotating parts. ➢ Wear leather gloves or equivalent. ➢ Do not wear rings around equipment with rotating parts. ➢ Wear safety boots per 29 CFR 1910.136 (Foot Protection). ➢ Keep loose clothing and hair away from rotating drill stem and other rotating objects. ➢ Badge lanyards, neck ties, and other items worn around the neck shall not be worn, but if necessary they shall be "breakaway" style.	TPMC ES&H Program section 12, "PPE"	Pre-job briefing TPMC's PPE training, or equivalent
Activity H: **Working near cuttings pit**	Use of ladder	➢ Work to the ladder use procedure given in TPMC's ES&H Plan	TPMC ES&H Program section 25, "Ladders"	TPMC Ladder training or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
Activity H: Working near cuttings pit	Falling into pit	➢ Prior to entry into a pit (classified as an excavation) the assigned competent person shall assess the conditions to determine the appropriate controls. ➢ No one can enter the fenced area around the pit without having a buddy observe them. ➢ Personnel shall not enter pit without authorization from competent person. ➢ A floatable life ring and rope ladder will be readily accessible to field personnel in the case of someone falling or slipping into the lined retention pond. ➢ Wire fencing 6' in height will be installed at or near the perimeter of the bermed area encircling the lined retention pond. There will be one gated access point to allow for sampling activities and egress from the pit. Life ring and rope ladder will also be located at the gated area.	TPMC ES&H Program section 28, "Excavations and Trenching"	Pre-job briefing Qualified competent person (per TPMC) LANL Excavation Self-study Training
DUAL ROTARY DRILLING Dual rotary drilling will involve the following activities: A) Moving drill pipe, tools, and casing B) Connecting and disconnecting drill pipe and drive head and assembling and disassembling drill tooling C) Drilling D) Collecting drill cuttings and water samples from drill system discharge E) Welding and installing temporary casing F) Removal and cutting temporary casing				
Activity A: Moving drill pipe, tools, and casing	Lifting heavy objects	➢ Before moving or carrying a heavy or bulky object to another location, check the routes to ensure that obstructions and/or slip and trip hazards are removed. Choose an alternate route if clearance is not adequate. ➢ Assess the potential lift against the parameters of a "critical" lift per the ESH Plan and implement the program if the criteria for such a lift is met. ➢ Evaluate the load location, task repetition, and load weight to determine if the material can be lifted safely. ➢ Inspect materials for slivers, jagged or sharp edges, burrs, and rough or slippery surfaces before handling. ➢ Use a handling aid, such as a hand truck or cart, a hand tool, or a jack, to lift and/or move heavy objects, if possible. ➢ Use proper lifting technique to safely lift the load: ❖ Place feet close to load and lift mostly by straightening the legs,	TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty" TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives" DHHS Publication #94-110 Applications Manual for the Revised NIOSH Lifting Guidelines	TPMC's PPE training, or equivalent Proper Lifting Techniques training (conducted as part of the pre-job briefing)

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		keeping the load close to the body ❖ Get a good grip on the load ❖ Do not twist the back or bend sideways ❖ Do not lift or lower awkwardly ❖ Do not lift with the arms extended ➢ Get mechanical help or help from another person if the load is too heavy. ➢ Wear gloves, hand leathers, or other hand protectors to prevent hand injuries. ➢ Wear protective footwear, such as steel-toed shoes where foot injury could occur.		
Activity A: Moving drill pipe, tools, and casing	Crushing hazard and rotating parts	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity A: Moving drill pipe, tools, and casing	Forklift operation, accident or injury	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT, "Activity A"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity A: Moving drill pipe, tools, and casing	Using rig as a crane	➢ Do not use well work-over rig or development rig as a crane. ➢ Pipe must be staged very near the well development/ work-over rig so that moving the pipe is essentially a vertical lift. ➢ Do not lift items in a manner that causes them to swing wildly. Use tag lines whenever possible.	TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty" TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives"	Pre-job briefing
Activity A: Moving drill pipe, tools, and casing	Trailer moves or runs away	➢ Block tires and set stabilizer jacks if equipped after relocating trailer.	TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives"	Pre-job Briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
Activity A: **Moving drill pipe, tools, and casing**	Towing trailer	➢ Ensure that the brake, taillights, and trailer brakes are functioning properly before moving the vehicle. ➢ Connect the trailer safety chains to the vehicle. ➢ Ensure that the towing vehicle and associated equipment have the rated capacity to handle the trailer. ➢ Use a spotter when backing or staging trailer to work location.	TPMC ES&H Program section 16, "TPMC Motor Vehicle Safety Program"	Pre-job briefing
Activity A: **Moving drill pipe, tools, and casing**	Pinch points	➢ Do not operate machinery without guards in place. ➢ Keep fingers away from pinch points. ➢ Wear leather gloves or equivalent when pinch points are present.	TPMC ES&H Program section 12, "PPE" TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty"	TPMC's PPE training, or equivalent
Activity A: **Moving drill pipe, tools, and casing**	Lifting and moving materials with backhoe and lifting strap, or forklift with lifting attachment, or equivalent (Contingency)	➢ In order to exercise this contingency the following is required: ❖ Equipment must be included on the Major Equipment Declaration and inspected by TPMC with LANL oversight ❖ Pre-use inspection, which requires both a visual and operational check ❖ Lift plan (or IWD) for the specific equipment must be submitted to STR and approved prior to use of this equipment to perform lifts; it must identify: • The team members and responsibilities • The item(s) to be lifted, including the weight and dimensions • The lifting equipment and hardware selected • Hazards and controls	TPMC ES&H Program section 32, "Cranes and Material Handling Equipment" Documentation of annual inspection by a qualified person Equipment and lifting attachment owner's manuals / specifications Manufacturer authorization that attachment can be used as an assembly with heavy equipment	Qualified operator trained on specific equipment and lifting attachment.
Activity B: **Making and breaking drill pipe connections and assembling and disassembling tooling**	Crushing hazard and rotating parts	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity B: **Making and**	Exposure to chemicals and chemical products (rod dope and lubricants)	➢ Avoid un-necessary contact with skin and clothing. ➢ Wear approved safety glasses meeting the requirements of ANSI	SDS TPMC ES&H	TPMC HAZCOM training TPMC's PPE training, or

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
breaking drill pipe connections and assembling and disassembling tooling		Z87.1 and having side shields. Use the minimum amount of material required. ➢ Wipe excess material off of tooling after connections are made.	Program section 19 "TPMC Hazard Communication Program"	equivalent
Activity B: Making and breaking drill pipe connections and assembling and disassembling tooling	Failure of rig hoisting and rigging equipment	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity B: Making and breaking drill pipe connections and assembling and disassembling tooling	Portable power tools and hand tools	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity E"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity B: Making and breaking drill pipe connections and assembling and disassembling tooling	Injury from wrenches	➢ When tightening threaded connections with a wrench, ensure you have a firm grip and stable footing. ➢ Use the correctly sized wrench to the diameter of the pipe being manipulated. ➢ Use caution and keep knuckles clear in case of wrench slipping off pipe and ensure other workers and objects are clear of work area. ➢ Inspect tools and only use tools in good working condition. Wrenches with worn jaws or bent or damaged handle shall be taken out of service. ➢ Wear leather work gloves or equivalent to protect hands.	TPMC ES&H Program section 17 "Tools and Equipment"	TPMC's PPE training, or equivalent
Activity B: Making and breaking drill pipe connections and assembling and disassembling tooling	Overhead hazard	➢ Secure overhead objects. ➢ Prior to raising mast, inspect to ensure there are no loose tools or parts, which could fall. ➢ Determine what overhead activities are in progress before entering work area; remain outside of work area if possible. ➢ Watch out for objects falling from mast. ➢ Wear head protection (hard hat to protect from falling objects; bump cap to protect head in limited headspace areas).	ANSI Z89.1-1986, Protective Headwear for Industrial Workers TPMC ES&H Program section 12, "PPE"	TPMC's PPE training, or equivalent
Activity B: Making and breaking drill pipe connections and assembling and	Pinch points	➢ Refer to the controls for this hazard under "Activity A" of this section.	See Reference Documentation in "Moving drill pipe, tools, and casing"	See Training in "Moving drill pipe, tools, and casing"

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
disassembling tooling				
Activity C: Borehole Drilling	Excavation permit requirement	➢ Obtain and comply with excavation permit.	TPMC ES&H Program section 28, "Excavations and Trenching" IHS-IP web-based Excavation/Soil Disturbance Permit Review Process	Pre-job Briefing Qualified competent person (per TPMC) LANL Excavation Self-study Training
Activity C: Borehole Drilling	Exposure to chemicals and chemical products (rod dope and lubricants)	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity B"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Activity C: Borehole Drilling	Potential inhalation exposure hazard from airborne VOCs	➢ A PID with an 11.7 eV lamp shall be used to monitor airborne concentrations of organic vapors. An action level of 10 ppm for a 2-minute period shall be established. ➢ When PID concentrations exceed 10 ppm, for a continuous 2-minute period, a "**STOP WORK**" shall be conducted and controls including revised work practices (i.e. working upwind from the source) and respiratory protection shall be considered.	VOC action level based on an IH expertise using the immediate exposure concentration as opposed to a 8-hour TWA	Pre-job briefing Persons using the PID shall be trained per TPMC training.
Activity C: Borehole Drilling	Contractor exposure to excessive noise	➢ Refer to the controls for "Noise Exposure" under MOBILIZATION/DEMOBILIZATION.	See Reference Documentation in MOBILIZATION/ DEMOBILIZATION	See Training in MOBILIZATION/ DEMOBILIZATION
Activity C: Borehole Drilling	Crushing hazard and rotating parts	➢ Refer to the controls for this hazard under "Activity A" of this Section.	See Reference Documentation in DUAL ROTARY DRILLING	See Training in DUAL ROTARY DRILLING
Activity C: Borehole Drilling	Exposure to nuisance dust	➢ A particulate monitor shall be used to ensure airborne particulate levels will be controlled to an airborne exposure concentration of 3 mg/m^3 for a continuous 2 minute period. ➢ When airborne particulate concentrations exceed 3 mg/m^3 for a 2 minute continuous period, controls including wetting methods will be considered in addition to other controls per assessment.	TPMC ES&H Program section 51.2, "Limiting Dust Exposure"	Pre-job briefing
Activity C: Borehole Drilling	Failure of rig hoisting and rigging equipment	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
			EQUIPMENT	
Activity C: Borehole Drilling	High wind exposure	➢ If the crew shuts down due to high winds and it is safe to do so, the mast shall be lowered. ➢ Keep work area free of debris that can easily blow away	TPMC ES&H Program section 18, "Inclement Weather"	Pre-job briefing
Activity C: Borehole Drilling	Electric shock: trailer-mounted generator	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity F"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity C: Borehole Drilling	Air compressor system, compressed air tools, and hose whip	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity F"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity C: Borehole Drilling	Fall from elevation	➢ Work on unprotected elevated surfaces (6 feet or more above next level) is not permitted without fall protection. ➢ Boart Longyear will document what training has been provided to fall protection users and supervisors. ➢ The Boart Longyear shift supervisor is responsible for ensuring that current fall protection personnel qualification documentation is on-site for inspection before activities requiring fall protection begin and for the duration of the project. ➢ No other TPMC team members are permitted to use fall protection or to work in locations where a 6' freefall could occur.	TPMC Approved Boart Longyear Fall Protection Program	Boart Longyear employees receive training per section 6.6 of the TPMC approved Boart-Longyear fall protection program DBI/Sale self retracting lifeline on rig derrick.
Activity D: Welding drill casing joints together and other drilling activities to be determined	Using aerial work platforms (i.e. JLG, Hi-lift, etc) t, scissor-lift to perform elevated work	➢ Inspect full body harness before each use. ➢ Include the lift on the Major Equipment Declaration form. ➢ LANS must approve the aerial work platform prior to use. ➢ Work to the Boart Longyear Fall Protection Program. ➢ The Boart Longyear drilling supervisor or designee will obtain training on the specific lift from the vendor that supplies the lift and will train other crew members in use of the aerial lift. ➢ Follow manufacturer's user manual. ➢ Person(s) being lifted will wear a full body harness that has been tethered to an anchor point recommended by the lift manufacturer or has been approved by a qualified person.	TPMC ES&H Program section 34, "Aerial Work Platforms" TPMC ES&H Program section 23, "Fall Protection Program" Manufacturer's user manual	Fall protection competent person /qualified person designation by Boart Longyear. TPMC approved Boart Longyear fall protection training Manlift vendor-supplied training
Activity D: Welding drill casing	Fire from spark- or flame-producing operation	➢ Check LANL homepage, or contact Emergency Management and Response (7-6211), for the latest fire conditions if spark- or flame-	Spark- or Flame-Producing Operations	Fire watch and designated worker

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
joints together and other drilling activities to be determined		producing operations will be conducted outside. ➢ Complete a Spark- or Flame-Producing Operations Permit. The permit is available at http://enterprise.lanl.gov/forms/1563.pdf ➢ Work to the requirements of: ❖ The LANL Fire Matrix (http://int.lanl.gov/fire_matrix.html) ❖ The site-specific Fire Protection and Prevention Plan ❖ Any case-by case instructions from the Area's Fire Marshall ❖ Spark flame permit conditions ➢ In the event of a "red" flag condition, spark/flame operations will pause and be re-assessed before commencing or continuance of the activity. Some steps may include the application of water to any area downwind of the spark/flame operations, especially if slash is adjacent to the drill pad. ➢ Ensure a fire extinguisher (minimum 10 BC) is present and in working condition. ➢ Ensure that containers/pipes are emptied, cleaned using non-flammable cleansers and/or purged of flammable and other materials before performing spark- or flame-producing operations on them. Provide trained fire watch whenever spark- or flame-producing operations are performed in locations where other than a minor fire might develop, or any of the following conditions exist: ❖ combustibles are more than 35 ft away but are easily ignited by sparks or hot slag ❖ combustible materials are adjacent to the opposite side of metal and are likely to be ignited by conduction or radiation ➢ Appropriate PPE shall be prescribed by TPMC S&H personnel and documented on daily tailgate meeting form. ➢ Fire watch will observe area for incipient fires for 30 minutes after end of spark flame activity and will be in direct line-of-site when activity is being conducted.	Permit TPMC ES&H Program section 21, "Fire Protection & Prevention" TPMC ES&H Program section 22, "Welding, Cutting, Brazing and Grinding"	Pre-job briefing LANL Course 15672 Fire Extinguisher: Designated Worker and Fire Watch, or equivalent LANL Course 9893 Fire Extinguisher Hands-on Training, or equivalent
Activity D: **Welding drill casing joints together and other drilling activities to be determined**	Welding and brazing	➢ Obtain a spark-flame permit. ➢ Comply with reference documents. ➢ Inspect welding equipment before each use and periodically during use. ➢ Perform only within a building or approved area. ➢ Avoid breathing the fume plume directly (fume plume is the smoke-like cloud containing minute solid particles arising directly from the area of melting material). ➢ Only arc-weld on a dry, non-combustible surface.	Spark- or Flame-Producing Operations Permit TPMC ES&H Program section 22, "Welding, Cutting, Brazing and Grinding" TPMC ES&H	LANL Course 9519 Welding Safety Self-Study, or equivalent training TPMC's PPE training, or equivalent Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		➢ Do not arc weld in the rain. ➢ Check electrode connections before each weld and during the welding process. ➢ Coiled leads should be spread out to avoid overheating and damage to insulation. ➢ Ensure work piece is properly grounded. ➢ Select the correct filter lens for the welding process; consult with ES&H Representative if you are unsure of the welding shade requirements for your work. ➢ Wear Safety glasses meeting the requirements of ANSI Z87.1 having side shields. When operation produces flying debris, safety glasses with a full face shield shall be worn. ➢ Wear protective clothing as prescribed by TPMC S&H personnel to protect from heat and radiation (ex. flame-resistant gauntlet gloves and aprons, etc.). ➢ For heavy work, wear fire-resistant leggings, high boots or similar protection, or safety shoes. ➢ Provide shielding to protect personnel in the vicinity from bright light rays or exposure to flame or sparks. ➢ Appropriate PPE for the specific daily operation shall be prescribed by TPMC S&H personnel and documented on daily tailgate meeting form.	Program section 35, "Gas Cylinder Use and Storage Procedure" SDS for filler metal TPMC ES&H Program section 21, "Fire Protection & Prevention"	
Activity D: **Welding drill casing joints together and other drilling activities to be determined**	Oxygen-Acetylene torch cutting	➢ Obtain a spark-flame permit. ➢ Use of a fire watch per spark-flame permit. ➢ Inspect equipment, including compressed gas cylinders and hoses, connections, before each use and periodically during use. ➢ Perform work only within the approved area (no flammables combustibles within area specified in spark-flame permit). ➢ Worker shall situate upwind from operation so to avoid breathing airborne metal fumes. ➢ Operate on a dry, non-combustible surface. ➢ Stop work during severe weather conditions (heavy rains, lightning, etc.). ➢ Appropriate PPE shall be prescribed by TPMC S&H personnel and documented on daily tailgate meeting form. ➢ Wear Safety glasses meeting the requirements of ANSI Z87.1 having side shields. When operation produces flying debris, safety glasses with a full face shield shall be worn.	Spark- or Flame-Producing Operations Permit TPMC ES&H Program section 22, "Welding, Cutting, Brazing and Grinding" SDS for oxygen and acetylene TPMC ES&H Program section 35, "Pressure safety Including Compressed Gases" TPMC ES&H Program section 21,	LANL Course 9519 Welding Safety Self-Study, or equivalent training TPMC's PPE training, or equivalent Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		➢ Wear protective clothing as prescribed by TPMC S&H personnel to protect from heat and radiation ex. flame-resistant gauntlet gloves and aprons, etc.). ➢ For heavy work, wear fire-resistant leggings, high boots or similar protection, or safety shoes. ➢ Provide shielding (i.e. welding curtains) to protect personnel in the vicinity from UV light rays or exposure to flame or sparks. ➢ Compressed gas cylinders shall be properly stored on-site when not in use, including properly capped, with oxygen and acetylene cylinders being separated by 20 feet or having a ½-hour rated partition.	"Fire Protection & Prevention"	
Activity D: Welding drill casing joints together and other drilling activities to be determined	Failure of hoisting and rigging equipment	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity D: Welding drill casing joints together and other drilling activities to be determined	Crushing hazard and rotating parts	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity D: Welding drill casing joints together and other drilling activities to be determined	Portable power tools and hand tools	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity E"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity E: Collecting drill cuttings and water samples from drill system discharge	Air compressor system, compressed air tools, and hose whip	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity F"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity E: Collecting drill cuttings and water samples from drill system discharge	Injury from exposure to nitric acid, chemical reagents and standard solutions	➢ No bottles of bulk chemical reagents will be used. ➢ Chemical reagents will be packaged and used in a manner that provides no potential for employee exposure. Examples include: ❖ Using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested	TPMC's HAZCOM program. TPMC ES&H Program section 12, "PPE"	TPMC's HAZCOM training TPMC's PPE training, or equivalent LANL HE spot test

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip ➢ Emergency eye-rinse required within 100 ft of point of use of chemicals or testing reagents. ➢ Minimum PPE for using chemical reagents: safety glasses meeting the requirements of ANSI Z87.1 having side shields, nitrile gloves and lab coat. ➢ Drill cuttings and water samples will be spot checked for HE prior to removal from site. ➢ **HOLD POINT**: Any positive HE spot test requires **STOP WORK** and notification to CAP FS. Any sample or piece of equipment that results positive will not be handled or removed.	SDS file on-site	training
Activity E: **Collecting drill cuttings and water samples from drill system discharge**	Drowning in cuttings pit	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity H"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Activity F: **Removal and cutting temporary casing**	Welding/Torch cutting ➢ welding flash ➢ burns ➢ fire hazard	➢ Refer to the controls for this hazard under "Activity D" of this Section.	See Reference Documentation in DUAL ROTARY DRILLING	See Training in DUAL ROTARY DRILLING
Activity F: **Removal and cutting temporary casing**	Sprains/strains from handling casing	➢ Inspect materials for slivers, jagged or sharp edges, burrs, and rough or slippery surfaces before handling. ➢ Casings shall be attached to drilling rig suspension system, providing initial load support. Personnel need to wear work gloves and ensure proper grip on casing while assisting in laying the casing down.	TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty" TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives"	TPMC's PPE training, or equivalent Proper lifting techniques training (pre-job briefing)
Activity F: **Removal and cutting temporary casing**	Potential overhead contusions	➢ Persons shall not be located under suspended loads (operators shall not move suspended loads above people). ➢ Site personnel shall perform a 2-minute drill prior to the commencement of lifting operations that represent a potential overhead hazard, ensuring that all persons are aware of the potential hazards and position themselves at a safe location during overhead transfer operations. ➢ Secure overhead objects.	TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives" TPMC ES&H Program section 12, "PPE" TPMC ES&H	TPMC's PPE training, or equivalent Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		➢ Observe the drill mast for overhead obstructions or potential falling objects from mast. ➢ Wear hardhat to protect head from falling objects (ANSI Z89.1-1986) in areas where overhead hazards are present.	Program section 32.17.2 "Minimum distances for equipment in transit"	

WELL CONSTRUCTION, SETTING SURFACE CASING, AND BOREHOLE ABANDONMENT

Well Construction, Setting Surface Casings and Borehole Abandonment (if necessary) involves: moving casing manually, with lifting equipment, or with drill rig hoist, welding and cutting casing, hoisting casing into borehole, mixing and emplacement of grout, emplacing sand filter pack, constructing wood forms, mixing and finishing concrete pad, welding and cutting surface and grinding casing, and installing bollards.

Borehole abandonment shall only occur if the original borehole needs to be replaced due to unforeseen complications/conditions. This is not scheduled as an anticipated activity. Boreholes will be abandoned by pressure grouting, in accordance with the procedures outlined in SOP-5.03 and documented. A bentonite/cement expanding grout will be mixed at each borehole and pumped from the total depth to ground surface through a tremie pipe.

Loose Items	Loose item falls off of mast	➢ Inspect mast for loose objects, prior to raising mast, such as wrenches or grease guns. ➢ Wear hardhat in construction zone or where possibility of head injury exists.	TPMC ES&H Program section 12, "PPE" TPMC ES&H Program section 1.5 "TPMC Health and Safety General Duty"	Pre-job briefing TPMC's PPE training, or equivalent .
Lifting with Equipment	Lifting and moving materials with backhoe, lifting strap, or forklift with lifting attachment, or equivalent	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity A"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Hoisting and Rigging	Failure of rig hoisting and rigging equipment	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Using Grinders	Grinding: sparks, rotating parts, flying debris	➢ Spark/flame permit and approved designated area required. ➢ Inspect grinder prior to use and periodically during use for damaged housing, conductor insulation, and plug prong conditions. ➢ All guards shall be in place and no modifications shall be made. ➢ Personnel shall wear safety glasses and face shield, long sleeved shirt, and leather (or equivalent) gloves. ➢ Do not mix aluminum grinding dust with iron or steel grinding dust.	TPMC ES&H Program section 22, "Welding, Cutting, Brazing and Grinding" Project-specific ES&H Program section 21, "Fire Protection &	TPMC's PPE training, or equivalent PS-13 courses 15672 Designated Worker and Fire Watch and LANL Course 9893 Hands on Fire Extinguisher Training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		Such a mixture may explode. ➢ Do not exceed the maximum rated speed of grinding wheel or blade.	Prevention"	
Heavy Equipment	Heavy equipment operation (e.g. bobcat or small front end loader)	➢ Inspect heavy equipment upon its arrival to the site and daily prior to start of work. ➢ Be observant as to your location with respect to heavy equipment. ➢ Maintain daily equipment inspection forms on site. ➢ Follow Manufacturer's specification. ➢ Use a spotter with 2-way radio when backing-up, if rear view is obscured. ➢ Wear brightly colored (e.g. orange) vest, and safety toe boots in area where heavy equipment is being operated ➢ Do not cross into path of equipment without first obtaining eye contact with equipment operator.	29 CFR 1926.601 Motor Vehicles. 29 CFR 1926.602 Material Handling Equipment TPMC ES&H Program section 16, "Motor Vehicles and Powered Industrial Equipment"	TPMC's PPE training, or equivalent
Welding	Welding and brazing	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity D"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Inhalation Hazard	Potential inhalation exposure hazard from airborne VOCs	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity C"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Bulk Containers	Falling object or bentonite spill due to failure of flexible intermediate bulk container (FIBC) straps during off-loading/ transportation process	➢ Use accepted lifting/transportation techniques per the "Flexible Intermediate Bulk Container Association." (Fibca) ❖ Use forklift tines appropriately spaced ❖ Lifting loops shall not be twisted ❖ Transport FIBCs on pallets to the degree possible; use lifting eyes for product installation ❖ FIBCs shall be transported at the time of product installation with tines horizontal, load as low as possible w/o dragging on the ground, and w/o obstructing operator's view and mast slightly tilted backwards ➢ Inspect the condition of the FIBCs (including straps) and do not use if degradation, fraying, excessive wear, etc. is noted. ❖ Keep FIBCs covered and out of direct sunlight while being stored	TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives" "Common Sense Handling Guidelines for Flexible Intermediate Bulk Containers" *Fibca*	Pre-job briefing
Borehole Abandonment Using Compressor	Compressor and grout pump	➢ Inspect all hoses, fittings, valves, safety valves and regulators prior to the first use on each work shift and periodically throughout their use.	TPMC ES&H Program section 35, "Pressure Safety Including	Pre-job briefing TPMC's PPE training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventive Measures, and Bounding Conditions	Reference Documents	Training
		➢ Assume that compressors will start automatically. ➢ Do not expose body parts to compressed air or grout stream. ➢ Do not walk on, walk over, or straddle hoses. ➢ A positive means shall connect the hoses to the pump. ➢ Secure hoses to prevent whipping using whip checks at hose connections. Fully engage the whip checks by sliding the cable down the hoses. ➢ Hoses exceeding ½-inch in diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure. ➢ Persons working with compressed gas lines shall wear appropriate eye protection per TPMC S&H assessment (based on 29 CFR 1910.132, "Eye and face protection.")	Compressed Gases" TPMC ES&H Program section 12, "PPE"	

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
DOWNHOLE LOGGING Geophysical logging may be performed in the boreholes if LANL so chooses. This activity involves the general operation of inserting and/or removing and the raising or lowering of objects from a borehole .Personnel involved include Schlumberger contract logging operations or the LANL geophysical logging team. If the LANL geophysical logging team does the logging, they will control the site during the logging operation, work to their own IWD, work authorization documents and training requirements. TerranearPMC personnel who must work in the immediate vicinity of the LANL geophysical logging operation will be briefed and supervised by LANL. Downhole logging involves the following steps: set up the trailer/vehicle at the borehole, set up the test assembly (could be a radioactive source/detector assembly, video camera, or other device), use the winch on the trailer/vehicle to insert the test assembly into the bore of the well, lower to the desired level and obtain an observation or reading, reposition and obtain the additional readings, as necessary, use the winch to extract the test assembly, stow the test assembly. All activities listed in this section are based on the contractual agreement that Schlumberger (Subcontractor) will perform logging functions.				
Subcontractor Approvals	Inadequate work planning for Schlumberger work	➢ Schlumberger must obtain approval from Gilbert Estrada (LANL/RP-3, 505-665-5298 or 505-231-5188) prior to bringing radioactive sources onto LANL property. ➢ TerranearPMC must follow this procedure to get Schlumberger authorized to begin downhole logging activities. ❖ Before start of work Schlumberger will submit documentation to TerranearPMC in advance establishing that their equipment usage procedures have been reviewed and approved by LANS. This documentation will be provided to the STR ❖ Any equipment usage procedures that Schlumberger cannot demonstrate have been approved by LANS will be submitted in advance to TerranearPMC. They will be forwarded to the STR for approval ❖ Schlumberger will complete a Major Equipment Declaration and it will be submitted to TerranearPMC for transmittal to the STR ❖ Schlumberger will submit their hazardous materials list, SDS, and hazardous materials inventory to TerranearPMC. This documentation will be forwarded to the STR for approval ❖ This IWD will be reviewed by TerranearPMC in light of Schlumberger's scope of work, hazardous materials list, and Major Equipment Declaration. If necessary a supplemental IWD will be modified and submitted to the STR for approval. LANS will have the opportunity to review the same information ➢ LANS will inspect and approve equipment on the declaration for use. ➢ The Schlumberger downhole logging activity can begin once the STR authorizes this task to proceed.	TPMC-approved Schlumberger SOPs TPMC ES&H Program sections 3 and 58.	GET Training TerranearPMC HAZCOM training Schlumberger-required training in applicable Schlumberger SOPs
Source Tools	Use of accountable sealed source (radiation exposure)	➢ Handling and use of a radioactive source is covered by a separate hazard analysis, which is pending. ➢ Schlumberger will work to their own written procedures.	TPMC-approved Schlumberger SOPs	Schlumberger radiation worker training

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		➢ LANS logging team will provide a copy of their approved hazard analysis for handling sealed sources to the PIC prior to performing work on-site.		
Using Wire Lines	Wire lines and wire ropes	➢ Inspect each day before using and periodically during use. ➢ Wear leather gloves (or equivalent) and safety glasses with side shields. ➢ Be careful of the wire rope, it can whip dangerously if it becomes knotted or snagged. ➢ Keep away from rotating parts and pinch points. ➢ Use in accordance with Manufacturer's recommendations. ➢ Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted. ➢ Wire rope shall be removed from service when any of the following conditions exists: ❖ In hoisting ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay ❖ Abrasion, scrubbing, flattening, or peening, causing loss of more than one-third of the original diameter of the outside wires ❖ Evidence of any heat damage resulting from a torch or any damage caused by contact with electrical wires ❖ Reduction from nominal diameter of more than three sixty-fourths inch (3/64") for diameters up to and including three-fourths inch (3/4") ❖ Other damage is observed ➢ Check for suspect or counterfeit parts. ➢ Hoisting ropes shall be installed in accordance with the wire rope Manufacturers' recommendations. ➢ Winch operator shall be designated as a competent person by the employer. ➢ Schlumberger will follow its SOP-based requirements.	TPMC ES&H Program section 12, "PPE"	Pre-job briefing Competent person designation by employer for winch operator TPMC's PPE training, or equivalent
Borehole Geophysical Logging (Schlumberger logging)	Exposure to radiation from radiation generating device	➢ Only personnel trained to Schlumberger's radiation program are permitted in the work area when their radioactive source is in use. The area will be posted and controlled by Schlumberger to prevent entry. ➢ Non-Schlumberger personnel will maintain "observer" status while logging operations are performed.	Schlumberger radioactive material license and procedures	Schlumberger radiation worker training
Borehole Geophysical Logging	Portable power tools and hand tools	➢ Inspect before use. ➢ Use tools only for their intended purpose. ➢ Use tools in accordance with manufacturers' operating rules or safe	TPMC ES&H Program section 17, "Tools and	TPMC's PPE training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		practices. ➢ Wear required personal protective equipment (PPE): safety glasses with side shields, leather gloves or equivalent, steel-toe boots. ➢ If sound pressure level is above 85 dBA, wear hearing protectors.	Equipment"	

WELL DEVELOPMENT, AQUIFER TESTING, AND GROUNDWATER WELL SAMPLING

Groundwater Screening and Sampling: If saturation is encountered as a borehole is advanced, drilling will be stopped to determine whether sufficient water volume is available to analyze the water quality. Generally, a total volume of 0.5 to 1.0 L is required for the sample. If a zone is saturated sufficiently to test, the borehole will be advanced to the base of the saturation, and a monitoring well designed. The design will be submitted to NMED for approval. After the design has been approved, the well will be installed. A borehole will be drilled and the saturated zone isolated with a dual rotary casing advancement drilling method to isolate the known saturated zone.

Well Development: Once the well is installed, the well will be developed through swabbing/surging, bailing, and pumping until water quality parameters stabilize. Development procedures involve running various tools in the well on wirelines in order to move water through the filter pack as an initial step. Pumping with an electric submersible pump is then utilized to purge the well until specified turbidity values are obtained.

Aquifer Testing: Aquifer testing, typically several short tests followed by a 24-hr test will be performed on all monitoring wells installed as part of this project. Aquifer testing involves pumping the screened interval at a constant rate for up to 24-hrs. Typically, packers are lowered in the well and inflated to isolate the interval for testing.

Groundwater Sampling: Groundwater samples will be collected from monitoring wells drilled under the MTOA contract as part of a groundwater monitoring program. Groundwater sampling involves using the drill rig or small winch to lower a submersible pump into the well, and pumping or bailing until the produced water becomes clear and specific water chemistry criteria are satisfied. The pump or bailer is then removed from the well. Depending upon the analyses, some groundwater samples are preserved with acids. This activity may use a crane, boom, or an overhead lift instead of the drill rig. Groundwater samples may be collected during drilling, well development, and aquifer testing.

Hoisting and Rigging	Failure of rig hoisting and rigging equipment	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Using Compressor and Pneumatic Tools	Pneumatic: compressor and pneumatic tools	➢ Refer to the controls for this hazard under DUAL ROTARY DRILLING "Activity C"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Sample Preservatives	Exposure to acids	➢ Personnel shall obtain and review manufacturer SDS. ➢ Wear required PPE as follows: ❖ Safety glasses with side shields and face shields ❖ Long pants and sleeved shirt ❖ Nitrile or other suitable gloves for handling acids ➢ Emergency eye-rinse shall be immediately available (within 25 feet of work area). ➢ Preservative (acid) is procured in ~2 ml ampoules. ➢ Proper storage requirements for acids shall be followed.	SDS file on site TPMC ES&H Program section 19, "TPMC's Hazard Communication Program"	Pre-job briefing TPMC's HAZCOM training TPMC's PPE training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		➢ Proper ventilation shall be provided in work area.		
Using Wire Lines	Wire lines and wire ropes	➢ Refer to the controls for this hazard under DOWNHOLE LOGGING "Using Wire Lines"	See Reference Documentation in DOWNHOLE LOGGING	See Training in DOWNHOLE LOGGING
Lifting Heavy Objects	Moving drill pipe, tools and casing: lifting heavy objects	➢ Refer to the controls for this hazard under DUAL ROTARY DRILLING "Activity A"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Crushing/ Rotating Parts Hazards	Moving drill pipe, tools and casing: crushing hazard and rotating parts	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity G"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Forklift Operation	Moving drill pipe, tools and casing: forklift operation, accident or injury	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity A"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Improper Use of Work-Over Rig	Moving drill pipe, tools and casing: using rig as a crane	➢ Do not use well work-over rig or development rig as a crane! ➢ Pipe must be staged very near the well development/ work-over rig so that moving the pipe is essentially a vertical lift. ➢ Do not lift items in a manner that causes them to swing wildly. Use tag lines whenever possible.	TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty" TPMC ES&H Program section 1.8, "Zero Accident Performance Objectives"	Pre-job briefing
Trailer Parking	Moving drill pipe, tools and casing: trailer moves or runs away	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity A"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Trailer Towing	Moving drill pipe, tools and casing: trailer towing	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity A"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
Pinch Points	Moving drill pipe, tools and casing: pinch points	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity A"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Lifting with Equipment	Moving drill pipe, tools and casing: lifting and moving materials with backhoe and lifting strap, or forklift with lifting attachment, or equivalent (Contingency)	➢ In order to exercise this contingency the following is required: ❖ Equipment must be included on the Major Equipment Declaration and inspected by LANL ❖ Pre-use inspection which requires both a visual and operational check ❖ Lift plan (or IWD) for the specific equipment must be submitted to STR and approved prior to use of this equipment to perform lifts; it must identify: • The team members and responsibilities • The item(s) to be lifted, including the weight and dimensions • The lifting equipment and hardware selected • Hazards and controls	TPMC ES&H Program section 32, "Cranes and Material Handling Equipment" Documentation of annual inspection by a qualified person Equipment and lifting attachment owner's manuals / specifications. Manufacturer authorization that attachment can be used as an assembly with heavy equipment.	Qualified operator trained on specific equipment and lifting attachment.
Chemical Exposure	Exposure to chemicals and chemical products (rod dope and lubricants)	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity B"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Using Tools	Portable power tools and hand tools	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT "Activity E"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Using Pipe Wrenches	Injury from wrenches	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity B"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
Overhead Hazards	Overhead hazard	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity B"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
VOC Inhalation	Potential inhalation exposure hazard from airborne VOCs	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity C"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
Installing and Using an Isolation Packer	Pressure system and gas cylinder used to inflate packer	➢ Inspect before the first use of the day. ➢ Do not perform maintenance or repair while system is pressurized. ➢ Wear leather gloves and safety shoes when handling cylinders. ➢ Wear safety glasses w/ side shields. ➢ Comply with requirements of reference documents. ➢ Secure cylinders to a fixed object or gas cylinder cart. ➢ Secure flexible (e.g., braided) tubing such that whipping in the event of breaking does not cause injury. ➢ Complete leak test. ➢ Not to be used in a confined space. ➢ Never use a fitting adaptor or improper fittings between the regulator and cylinder. ➢ Never use sealing tape, such as Teflon, on the connection between the regulator and the gas cylinder. ➢ Regulators or their relief devices must not be considered safety devices for the rest of the pressure system. ➢ Do not lift cylinders by protective caps or with a lifting magnet. ➢ Do not drop or slide cylinders or roll long distances. ➢ When cylinder not in use, remove regulators, close valves, and install protective caps. ➢ Store compressed gas regulators that are not in use in plastic bags and pelican case. Indicate on label the gas they regulate. ➢ Regulators used must be appropriate for the gas in question. ➢ Protect regulators and association pressure system components from potential damage.	TPMC ES&H Program section 35, "Gas Cylinder Use and Storage Procedure"	Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
Prepare and Use Submersible Pump	"Rogue" electrical wiring of high voltage equipment (submersible pump)	➢ A LANL-SSS licensed electrician must inspect the submersible pump wiring each time it is re-wired. ➢ Initial wiring of a pump system must be conducted by a LANL-SSS licensed electrician	TPMC ES&H Program section 36, "Electrical Safety"	Pre-job briefing
Prepare and Use Submersible Pump	Potential electrical shock/short based on electrical connections of 3-phase (460 V) submersible pump (components: pump, motor, control panel and generator)	➢ Electrical connections shall be performed by a qualified electrician (per LANL Electrical Safety Program – ISD 101-13.0). ➢ Appropriate gloves (as specified in NFPA 70E) shall be worn (as well as other PPE, including safety glasses, shoes, etc). ➢ Pump motor and control panel shall be listed by UL or other national recognized testing laboratory (NRTL). ➢ Electrical components and operating practices shall be conducted in accordance with applicable requirements per NEC, NFPA 70E and OSHA (29 CFR 1910, Subpart S "Electrical."	TPMC ES&H Program section 36, "Electrical Safety" and 36-1 "TPMC Electrical Safety Program" TPMC ES&H Program section 12, "PPE"	Qualified electrician per LANL ISD 101-13.0
Troubleshooting Submersible Pumps	Maintenance/investigation of submersible pump system after initial installation	➢ Electrical connections shall be performed by a qualified electrician (per LANL Electrical Safety Program – ISD 101-13.0). ➢ Use of lockout/tagout (LOTO) practices as per LANL requirements.	TPMC ES&H Program section 30 "LOTO" and sections 30-1, 30-2, 30-3 and 30-4. TPMC ES&H Program section 36, "Electrical Safety"	LANL Course 41074 LOTO (when applicable)
USING HEAVY EQUIPMENT This step involves moving heavy equipment to the location.				
Noise Exposure	Contractor exposure to excessive noise	➢ Refer to the controls for this hazard under MOBILIZATION/DEMOBILIZATION "Noise Exposure"	See Reference Documentation in MOBILIZATION/ DEMOBILIZATION	See Training in MOBILIZATION/ DEMOBILIZATION
Utilities	Underground utilities	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT, "Activity B"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
Visibility	Limited visibility when operating heavy equipment (e.g., dozers,	➢ Use spotter or 2-way radio when maneuvering around structures or near edges of work area. ➢ Stay clear of moving equipment and do not cross into pathway of	TPMC ES&H Program section 1.12, "Assurance that	Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
	backhoes and dump trucks)	equipment. If necessary to cross into pathway of equipment, maintain eye contact with operator. ➢ Wear brightly colored (e.g. orange) vest, and safety toe boots in area where heavy equipment is being operated. ➢ Wear hardhats if overhead hazards exist.	Work will be Conducted in a Safe Manner."	
Crushing Hazard	Crushing hazard	➢ Wear brightly colored (e.g. orange) vest, and safety toe boots in area where heavy equipment is being operated ➢ Be observant as to your location with respect to heavy equipment.	TPMC ES&H Program section 12, "PPE" TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty"	TPMC's PPE training, or equivalent
Using Forklift	Forklift operation, accident or injury	➢ Refer to the controls for this hazard under SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT, "Activity A"	See Reference Documentation in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT	See Training in SETTING UP THE DRILL RIG AND ANCILLARY EQUIPMENT
MAINTENANCE AND REFUELING This could include the following activities such as refueling and adding fluids to equipment, arc welding, grinding, jump starting, charging batteries, equipment repairs, and repairs to systems involving hazardous energy. Sub steps for repairs to systems involving hazardous energy are: a) Isolate from hazardous energy (lockout/tagout if possible; otherwise block/chock/tagout) b) Repair or refuel c) Remove lock/block/chock and tag				
Refueling	Refueling equipment	➢ **No subcontractor fueling will be performed on drill sites in HE areas.** All fueling of equipment and vehicles will be the responsibility of LANL personnel. ➢ Contact Contractor's ESH personnel for assistance, as appropriate. ➢ Review the SDS. ➢ Adequate precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to, open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, static, electrical, and mechanical sparks, spontaneous ignition, including heat-producing chemical reactions, and radiant heat. ➢ Fire Extinguisher (20 BC) within 75' of refueling location. ➢ Shut off equipment and let cool before refueling.	TPMC ES&H Program section 19 "TPMC Hazard Communication Program" 29 CFR 1910.106 Flammable and Combustible Liquids TPMC ES&H Program section 21, "Fire Protection & Prevention Plan" SDS file on site	TPMC's HAZCOM training, or equivalent PS-13 courses 15672 Designated Worker and Fire Watch and LANL Cousrse 9893 Hands on Fire Extinguisher Training, or equivalent Any site and/or facility-specific requirements

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		➢ Use UL-listed and approved dispensing devices when flammable liquids are dispensed from drums. ➢ Fuel cans shall meet OSHA requirements (no more than 5 gallons, spring closure). ➢ Observe OSHA regulation 29 CFR 1910.106 (Flammable and Combustible Liquids) requirements for separation and maximum quantities.		
Fall Protection	Fall from elevation	➢ Boart Longyear will work to their approved written Fall Protection Program.	TPMC ES&H Program section 23, "Fall Protection"	TPMC Approved Boart Longyear Fall Protection training
Battery Charging	Battery charging	➢ Battery charging shall not be performed in HE areas. ➢ Batteries and/or equipment shall be removed from HE areas prior to charging. ➢ Battery charging installations shall be located in areas designated for that purpose. ➢ Battery charging apparatus shall be protected from damage by trucks. ➢ Jump starting shall be performed at least 50 feet from structures and 50 feet from any waste accumulation area, or combustibles. ➢ Battery charging areas shall be equipped to provide for the following: ❖ Emergency Eye-rinse ❖ Flushing spilled electrolyte ❖ Fire extinguisher (minimum rating 10 BC) ❖ Protection of charging apparatus against damage by trucks ❖ Adequate ventilation for dispersal of fumes from gassing batteries ➢ When adding electrolytes to batteries or when handling a leaking battery, personnel shall wear the following personal protective equipment: ❖ Acid resistant, long cuff gloves and apron ❖ Safety glasses and face shield ➢ Never add water to acid. ➢ When charging batteries, the vent caps shall be kept in place to avoid electrolyte spray. ➢ Trucks shall be positioned properly and brakes shall be applied before attempting to charge batteries. ➢ If equipment does not have a brake system, a chock will be used on at least one wheel/tire. ➢ The battery compartment cover(s) shall be open to dissipate heat and	TPMC ES&H Program section 21, "Fire Protection & Prevention Plan"	TPMC's PPE training, or equivalent PS-13 courses 15672 Designated Worker and Fire Watch and LANL Course 9893 Hands on Fire Extinguisher Training, or equivalent Pre-job briefing

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		gas. ➢ Personnel involved with charging shall wear a full face shield and safety glasses, acid-resistant apron. Acid resistant gloves (butyl rubber or per manufacturer chemical resistance chart) that are elbow length. ➢ Emergency shower with eye/face wash (per ANSI Z358) shall be located within 25 feet of battery charging location. ➢ No open flame or spark shall be permitted during battery charging. ➢ Tools and other metal objects such as watches and rings shall be kept away from the tops of uncovered batteries. Use the buddy system.		
Hazardous Energy	Hazardous energy control: contractor owned equipment	➢ Work to the Lockout/Tagout procedure given in the General ES&H Plan	TPMC ES&H Program section 30, "Lockout/Tagout"	LANL-required Lockout/Tagout training
Hot Surfaces	Maintenance: hot surfaces	➢ Exhaust pipes and other hot surfaces shall be guarded or insulated in areas where contact by employees is possible in the performance of normal duties. ➢ Allow hot equipment to cool off before servicing or fueling it. ➢ Workers shall wear heavy/leather or insulated gloves when handling/contacting potential hot surfaces/tools/equipment, etc.	TPMC ES&H Program section 12, "PPE" TPMC ES&H Program section 1.5, "TPMC Health and Safety General Duty"	TPMC's PPE training, or equivalent Pre-job briefing
Welding	Maintenance: welding	➢ Refer to the controls for this hazard under DUAL ROTTARY DRILLING "Activity D"	See Reference Documentation in DUAL ROTTARY DRILLING	See Training in DUAL ROTTARY DRILLING
DECONTAMINATION Decontamination activities may consist of dry wiping, brushing, washing with detergent and water, or pressure washing. Decontaminate sampling equipment using dry decontamination procedures (Fantastic spray or equivalent and paper towels.) If dry decontamination proves inadequate, wet decontamination using Alconox detergent and DI water rinses may be required.				
Chemical Exposure	Exposure to contaminants and decontamination fluids	➢ Wear required PPE as follows: ❖ Long sleeved shirt and long pants ❖ Nitrile or other suitable gloves for examining samples ❖ Safety glasses with side shields ➢ Avoid direct contact of sample media or decontamination fluids with skin. ➢ Avoid hand-to-face contact. ➢ Wash hands upon exiting the contamination reduction zone.	SDS file on site TPMC ES&H Program section 49, "Radiological Requirements"	TPMC's HAZCOM training, or equivalent TPMC's PPE training, or equivalent

Work Tasks/Steps	Hazards, Concerns, and Potential Accidents/Incidents	Controls, Preventative Measures, and Bounding Conditions	Reference Documents	Training
		➢ SDS required for chemicals used on-site.		
Waste Generation	Generation of decontamination waste	➢ Manage in accordance with approved Waste Characterization Strategy form.	Waste Characterization Strategy Form TPMC ES&H Program section 39 "Waste Management / Disposal"	LANL Course 7488 RCRA Personnel Training LANL Course 28582 RCRA Refresher LANL Course 23263 Waste Generation Overview (Live)
Using Pressure Washer	Pressure washer injury	➢ Follow Manufacturer's operating limits for pressure and temperature.	TPMC ES&H Program section 12, "PPE" Manufacturer's specifications	Pre-job briefing TPMC's PPE training, or equivalent
Materials	Incompatible materials	➢ Do not place incompatible materials in the same waste container (e.g. acetone or samples mixed with acetone and oxidizers such as nitric acid). ➢ Comply with approved waste Characterization strategy documents.	TPMC ES&H Program section 19, "Hazard Communication Program" SDS file on site.	TPMC's HAZCOM training, or equivalent TPMC's PPE training, or equivalent
HE Spot Tests	HE spot tests	➢ Decontaminated equipment and tooling will be randomly sampled and tested for HE by HE spot testing. ➢ **HOLD POINT:** Any positive HE spot test requires **STOP WORK** and notification to CAP FS. Any sample or piece of equipment that results positive will not be handled or removed.	TPMC's HAZCOM program TPMC ES&H Program section 12, "PPE"	LANL HE spot test training