

OCCUPATION SCHEDULE FOR: Geothermal and Well Drilling Operator

O*NET/SOC CODE: 47-5021.00

RAPIDS CODE: 2006HY

This schedule is attached to and a part of these Standards for the above identified occupation.

1. TERM OF APPRENTICESHIP

The term of the occupation shall be three years with an OJL attainment of not less than 4000-6000 OJL hours supplemented by the required hours of related instruction.

2. RATIO OF APPRENTICES TO JOURNEYWORKERS

The ratio of apprentices to journeyworkers is established in the applicable collective bargaining agreement, or as agreed by the JAC. This ratio will be defined as no more than one (1) apprentice for every five (5) journeyworkers.

3. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on a percentage of the current journeyworker wage rate, as follows or as per the collective bargaining agreement.

3 Year Term:

60%	1 to 1000 Hours
70%	1001 to 2000 Hours
80%	2001 to 4000 Hours
90%	4001 to 6000 Hours

**4. SCHEDULE OF WORK EXPERIENCE
(See attached Occupation Schedule)**

The Sponsor may modify the work processes to meet local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

**5. SCHEDULE OF RELATED INSTRUCTION
(See attached Course Outline)**

WORK PROCESS SCHEDULE
Geothermal and Well Drilling Operator
O*NET-SOC CODE: 47-5021.00 RAPIDS CODE:

Description: Drill boreholes and set wells or loops to a given depth and/or to an aquifer of sufficient flow and quality to meet the expected drinking water, heat exchanger or bearing capacity demands on the bore or well location. Boreholes will be advanced using mechanical drilling equipment utilizing auger, mud or air rotary, down the hole hammer, coring, or sonic percussion drilling methods. Workers are responsible for the safe operation of all capital equipment as well as protecting the environment and public safety from ground water contamination by using prudent drilling, casing, and grouting practices. Drill crews are expected to perform maintained, advance boreholes, set and grout casing, set wells, keep good drill logs, provide accurate samples and data, and perform any other tasks necessary for the completion of the boring or well. Drill crews must be able to determine the right drilling method (see above) for the equipment, and the type of bore hole or well being drilled. After choosing a method the drill crew must be able to enact that method accounting for any variables encountered during the drilling process. Common tasks include digging mud pits, mixing drilling mud, hoisting tooling, taking rock or soil samples, attaching drill string extensions, monitoring ground water encountered, and setting and grouting in wells and geophysical instruments. Workers must have the skill to advance boreholes in a variety of soil and rock conditions, and must have a basic understanding of geologic and hydrologic conditions and how they affect the drilling process.

Max/Min Hours

Drill Rig:

1980-3000

- a) Perform preventive maintenance, proper oils and greases, and minor adjustments.
- b) Operate using the controls, their importance in proper operation, and movement of machine for safety of other employees, drilling around underground utilities, working the proper distance from overhead power lines, and other equipment working near machine.
- c) Apply technical knowledge and assist during major overhauls while working with the operator, heavy duty repairperson, and welder.
- d) Auguring: Both with solid flight augers and hollow stem augers.
- e) "Direct" Mud Rotary: Using both polymer and bentonite based fluids, filtration control, and the use of additives to solve down hole problems.
- f) Air Rotary: Using air, mist, foam, and "stiff foam" to overcome hole stabilization problems when using air in "non-cohesive" soils.

- g) Reverse Rotary: Air lift and vacuum lift using both polymer and bentonite based fluids to stabilize the hole during “flooded hole drilling.”
- h) Direct push: With the installation of monitoring wells and environmental procedures for collection and equipment decontamination.
- i) Cable Tool: Advance holes and casing using drill stem percussion to break up and stir formation in to a solution to be bailed out of the hole.
- j) Sonic: Drill and sample holes using vibration of varying hertz imparted on a casing used as a drill stem to break up and liquefy the formation while the casing protects form formation collapse.
- k) Dual rotary: Two rotary heads are employed to drill and case the hole at the same time. The top head drive is used to advance the drill rods and bit while the bottom drive advances the casing with the bit thru the overburden. Once the overburden is cased the top drive operates the same as on a conventional rig.

Backhoe - Wheel & Track:

330-500

- a) Perform preventive maintenance, proper oils and greases, and minor adjustments.
- b) Operate using the controls, their importance in proper operation, and movement of machine for safety of other employees, digging underground utilities, working the proper distance from overhead power lines, and other equipment working near machine.
- c) Perform the movement of heavy drill collars, tooling, as well as digging mud pits and providing drainage to slurry pits.
- d) Apply technical knowledge and assist during major overhauls while working with the operator, heavy duty repairperson, and welder.

Tractor-Type Skid Steers Loaders/Hi-Lifts:

330-500

- a) Perform preventive maintenance, proper oils and greases, and minor adjustments.
- b) Operate on the different types of work assigned the dozer from rough excavation to finish work.
- c) Perform the movement of heavy drill collars, tooling, as well as digging mud pits and providing drainage to slurry pits.
- d) Assist in making minor adjustments and repairs and work with the mechanic on major repairs.

Powered Industrial Trucks:

180-300

- a) Perform preventive maintenance, proper oils and greases, and minor adjustments.
- b) Operate on the different types of work assigned the dozer

- from rough excavation to finish work.
- c) Perform the movement of heavy drill collars, tooling, as well as digging mud pits and providing drainage to slurry pits.
 - d) Assist in making minor adjustments and repairs and work with the mechanic on major repairs.

Bulldozer: **150-200**

- a) Perform preventive maintenance, proper oils and greases, and minor adjustments.
- b) Operate on the different types of work assigned the dozer from pioneer and rough excavation to finish work.
- c) Assist in making minor adjustments and repairs and work with the mechanic on major repairs.

Drill Rig Driver: **230-350**

Drive a truck mounted drill. Study the Federal Commercial Driver's License (CDL) laws and obtain a CDL license.

Use of Grade Instruments and Plans: **296-450**

- a) Use instruments and read plans for making grades.
- b) Read and set grade stakes as well as read plans and instructions.
- c) Read boring plans for layout.

Material Sampling: **152-200**

- a) Perform proper description of soils and logging.
- b) Principles and methods of soil collection.
- c) Record geological

Miscellaneous Equipment: **200-300**

- a) Operate, service, and adjust all types of pumps.
- b) Assist in installing, operating, and maintaining well-point systems.
- c) Operate, service, and adjust all types of electric generating plants.
- d) Operate, service, and adjust all other types of equipment.

Maintenance - Cutting and Burning - Greases and Oils: **152-200**

- a) Use various welders and welding equipment.
- b) Assist in making minor repairs and adjustments.
- c) Assist in welding and cutting.
- d) Gain knowledge and use appropriate greases and oils.

Total Hours **4000-6000**

RELATED INSTRUCTION OUTLINE
Geothermal and Well Drilling Operator
O*NET-SOC CODE: 47-5021.00 RAPIDS CODE

First Year	Total Hours: 184
Introduction	20
a) Apprenticeship Rules and Regulations	
b) Issue Books and Manuals	
c) Drug & Alcohol presentation	
d) Diversity	
Safety	10
Occupational Safety and Health Administration(O.S.H.A) Rules and Regulations	
Commercial Drivers License Preparation	8
a) Testing Requirements	
b) Inspection Stipulations	
c) Driving Course	
Hazmat	40
40 Hour Hazwoper Certification Course	
Drilling Fundamentals	18
a) Describe soils	
b) Log procedures	
c) Principles and fundamentals	
Health	8
Standard First Aid, CPR and AED	
Basic Equipment Skills (technical training and seat time)	80
a) Drill Rig	
b) Skid steer loader	
c) Forklift and Powered Industrial Truck Training	
d) Support Equipment	

Second Year**Total Hours: 144**

Soil/Exploration

60

- a) Theory
 - a. Syllabi will include American Society for Testing and Materials and American Society of Civil Engineers guidelines where they pertain to geotechnical classes
 - b. Concentration on the protection of aquifers that provide our civilization its potable water supply.
- b) Logs and data collection
- c) Foundations and layout
- d) Tooling
- e) Boring

Rigging

12

- a) Chart Reading
- b) Drill Set-Up
- c) Cable Specification

Hazwoper Re-Certification

8

- a) 8 Hour Refresher
- b) Safety Review
 - a. Industry specific safety training and best practices including excavation and safe lifting practices.

Health

8

- a) Standard First Aid, CPR and AED

Basic Equipment Skills (technical training and seat time)

56

- a) Drill Rig
- b) Skid steer loader
- c) Dozer
- d) Combination Backhoe Loader
- e) Forklift and Powered Industrial Truck
- f) Support Equipment

Third Year

Total Hours: 144

Geothermal and other well types

60

- a) Theory and components
- b) Well construction
 - a. *The apprenticeship will make use of the curriculum associated with the International Ground Source Heat Pump Association (IGSHPA) accredited driller classes and will institute the IGSHPA and National Ground Water Association (NGWA) standards and best suggested practices*
 - b. All well head protection standards for the jurisdiction cover through the apprenticeship will be taught and enforced. These may include but are not limited to:
 - i. Bore hole sealing and grouting
 - ii. The use of pit less adapters
 - iii. Grading of the surface around the well head
 - iv. Offset distances for sitting a well from different environmental hazards
 - v. Well chlorination
 - vi. Residential standards
 - vii. Commercial standards
- c) Grouting – Mud and Grout Awareness
- d) Pump selection and installation
- e) Practical application –
 - a. Set and seal surface casing
 - b. Before mixing mud adjust makeup water to the correct ph and calcium content
 - c. Mix mud to the proper marsh funnel viscosity for the formation being drilled
 - d. Keep the formation open and/or adjust for down hole problems, clay swelling sand caving etc
 - e. Take mud weight readings before and during drilling to check solids control of mud tank
 - f. Drill, log, and sample the hole to a given depth in a given time using safe industry recognized procedures and techniques
 - g. Retrieve samples both disturbed “Shelby Tube” and undisturbed “Shelby Tube” at given intervals with good recovery

Hazwoper Re-Certification	8
a) 8 Hour Refresher	
b) Safety Review	
Industry specific safety training and best practices including excavation and safe lifting practices	
Health	8
Standard First Aid, CPR and AED	
Use of Grade Instruments and Plans	16
a) Transit and Hand Level	
b) Theodolite	
c) Leveling Rods	
d) Measurement Instruments	
e) Stakes	
f) Print Reading	
Mechanical System	6
a) Basic Hydraulics	
b) Basic Electrical	
c) Fundamental Power Trains	
Equipment Skills (technical training and seat time)	46
a) Drill Rig – Mud Rotary Proficiency	
b) Skid steer loader	
c) Dozer	
d) Combination Backhoe Loader/Excavator	
e) Forklift and Powered Industrial Truck	
f) Support Equipment	