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PDR

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October 12, 1990

Mr. Joseph E. Virgona
U.S. Department of Energy
Grand Junction Projects Office
P.O. Box 2567
Grand Junction, CO 81502

SUBJECT: Specifications for New Monitoring Wells at AMAX 151(c) Site, Parkersburg, WV.

Dear Mr. Virgona:

The specifications that Geotech recommends for drilling and installation of new monitoring wells at the AMAX 151(c) site are attached.

Geotech understands that these specifications will be submitted to EM-451 which will send them to the NRC for review and comment. Geotech further understands that the NRC may send these specifications to AMAX as recommended specifications for AMAX's contract with their driller. These specifications were written with these actions in mind. If Amax plans to depart significantly from these specifications, Geotech recommends the departure be reviewed by the DOE before drilling proceeds.

Submittal of these specification, at this time, is in one sense, premature. Submittal should not be construed that Geotech is ready to suggest (or concur in) the number and locations of new wells that will be required. Data on the groundwater gradient(s) at the site are too few. Water-level measurements to be obtained in October (this month) may help correct the problem of insufficient data. Geotech looks forward to receiving the October water-level data at the earliest possible date.

With respect to the attached speci tions, the following need to be emphasized:

1. Installation of groundwater monitoring wells is a more rigorous undertaking than drilling water supply wells. A prerequisite for the drilling contract should be that the driller be experienced in the installation of wells for environmental monitoring. This prerequisite will narrow the number of qualified drilling contractors.

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2. New monitoring wells must, without exception, provide representative water samples and must be capable of doing so over a long period of time. The attached specifications are directed to this end. These specifications may affect the cost of well installation.

3. Hollow-stem augers and split-barrel sampling are the preferred methods for drilling the new monitoring wells. Rotary drilling methods should be used only if conditions at the site preclude use of hollow-stem augers. Rotary drilling usually requires water or drilling mud to advance the borehole. Introduction of water or mud complicates well development and is to be avoided if possible.

Geotech recommends that the DOE have a representative on site during drilling and installation of the new monitoring wells. The responsibility of the representative will be to observe the drilling and installation of the new wells; to note problems if they arise; and to review proposed solutions or deviations from the attached specifications. Geotech also recommends that the DOE have a representative present when the new wells are developed and the initial samples collected.

Finally, the question of what to do with existing wells on the site is unresolved. Options are to cement and abandon the old wells or keep them open. The old wells could be kept open to allow additional water level measurements and future sampling if the new wells have different screened intervals or locations. It would be well if this question were resolved before new wells are installed.

If you have questions or wish to discuss any matters related to specifications for the new wells, please call me or Mr. Jack McCaslin, Geotech, at x6561. Mr. McCaslin is available to discuss the attached specifications with the DOE on the NRC. He may be contacted directly.

Sincerely,

Charles A. Jones
Program Manager
Long-Term Surveillance
and Maintenance Program

CAJ/rm

Attachments: 1

bcc: LS Cahn
JL McCaslin
DL Riddle
DL Scheurerman
File
CA File

PROPOSED MONITOR WELL DRILLING SPECIFICATIONS
FOR
AMAX SITE, PARKERSBURG, WEST VIRGINIA

INTRODUCTION: These proposed methods, techniques, and specifications for the drilling and installation of additional monitor wells at this site are designed for maximum utility of the wells for present and long term surveillance of the shallow ground water underlying the site.

These specifications, methods, and techniques are listed in order of preference for obtaining optimum representative geological and hydrological data. However, the preferred drilling methods may not be possible or cost effective for a number of reasons. Factors that might influence the selection of drilling methods are: availability of suitable equipment and technical expertise within a reasonable distance of the site, funding available for well installation, and subsurface conditions not compatible with the selected drilling methods.

The following drilling methods and specifications are based on several assumptions. These assumptions are: (a) adequate funding is available for standa: state-of-the-art monitor well installation techniques, (b) technical expertise and the required equipment is available within a reasonable mobilization distance of the site, and (c) no unusual subsurface conditions exist, e.g. excessive buried debris or abnormal formation pressures.

DRILLING METHODS

1. HOLLOW-STEM AUGER/SPLIT-BARREL SAMPLING METHODS:

The preferred method of drilling and installing these monitor wells is the use of hollow-stem augers and split-barrel drive sampling or continuous split-tube sampling. These methods provide a means of obtaining relatively undisturbed samples of the subsurface materials as the borehole is advanced and for installing well completion materials (e.g. casing, well screens, seals, grout, etc.) at precise, selected intervals through the hollow-stem augers. The use of fluids during the drilling phase is not usually necessary except in cases where abnormal geological conditions are present, e.g. heaving sands where a positive hydrostatic head must be maintained within the hollow-stem auger column to overcome the formation pressure.

Suggested Drilling and Well Installation Procedure(s):

A drilling contractor should be selected who is experienced in hazardous waste investigation, as well as competent in the use of hollow-stem auger methods and techniques commonly used for installation of monitor wells. The drilling contractor shall use a hollow-stem auger rig rated by the manufacturer to at least 150 feet depth using 7 5/8-inch O.D. hollow-stem augers and equipped to place grout, under pressure, at that depth. Actual drilling will be accomplished by using 7 5/8-inch O.D. X 4 1/4-inch I.D. (larger sizes are acceptable) hollow-stem augers and a retrievable center bit or a flexible center plug.

All samples shall be taken using a 3 inch O.D. X 24 inch long, <u>stainless steel</u> split-barrel drive sampler. In all cases, drive sampling will be accomplished using standard soil sampling procedures and methods, such as: the split-barrel sampler shall be driven into undisturbed ground beneath the lead hollow-stem auger to its usable length or until a blow count of 50 blows per six inches or less of penetration is reached. Fifty blows per six inches or less will be considered as refusal and no further attempt will be made to sample at that interval. The split-barrel sampler will be driven by a free-falling drop hammer, weighing 140 lbs. and falling 30 inches. A hydraulic driver may be used, and in fact, is encouraged, in lieu of the 140 lb. drop hammer. All blow counts per six inches of penetration will be observed and recorded on the Daily Drilling Report.

A continuous sampling system (e.g. CME or Mobile) may be used with the hollow-stem augers in lieu of the split-barrel drive sampling system, providing the continuous sampling system recovery rate is sufficient for lithology identification.

Once the desired depth has been reached and the screen interval selected by a competent groundwater professional, the drilling contractor will install 2-inch I.D. PVC Schedule 40 slotted well screen and casing (TriLok or equivalent) to the desired depth through the hollow-stem augers. The well screen slot-size should be determined by a sieve analysis or by available reliable data from previous drilling. The 2-inch PVC casing shall be flush-joint, threaded, and have an "O" ring joint seal. The top of the riser casing will extend 30 inches above the surface. The annular area between the well screen and hole wall, and extending two feet above the top of the screened interval, will be packed with a well-rounded silica well-sand compatible with the screen-slot size selected. A 1-foot fine-grained silica sand pack (e.g. Mortar Sand) will then be placed, followed by a two to three foot granular or pelletized bentonite seal. If the bentonite seal is placed above the top of the static water table, 5 gallons (or more if needed) of distilled water will be added to aid the hydration of the bentonite material. A weighted measuring tape or similar device will be used to accurately measure the depth of all material as it is placed. All measurements will be recorded to the closest one-tenth of a foot. The hollow-stem auger column should not be raised more than two feet above the top of the material while the material is being installed.

If the bottom of the selected screen interval is above the total borehole depth, the borehole annular area below the screen interval will be filled with well sand or bentonite grout to within two feet of the screen bottom. The remaining annular area between the casing and borehole wall will be filled with a neat cement or bentonite grout to within two feet of the surface. This grout will be placed, under pressure, with a "tremmie" pipe to minimize the possibility of voids or channeling of the grout.

2. ROTARY DRILLING AND SAMPLING:

If hollow-stem auger drilling methods and techniques can not be used for drilling and installation of the monitor wells at this site, rotary drilling is the preferred alternative. Three types of rotary drilling are commonly used; air rotary, mud rotary, and reverse circulation rotary. Each type has distinct advantages and disadvantages as compared to the hollow-stem auger methods.

The major disadvantage of rotary drilling for installing monitor wells is that a circulation medium must be used, which may alter the prevailing groundwater characteristics. The normal circulation mediums are air, water, and drilling mud. Each type of circulation medium has inherent undesirable qualities. However, if used correctly and for the proper application, these mediums will have minimal effects on sample quality.

If air is used to drill monitor wells where organics or heavy metals are suspected, all air must be filtered to remove possible oil emissions produced by the compressors. In addition, all pipe lubricants must be of a composition that will not compromise sample analytical quality.

The use of water as the circulation medium may dilute target contaminants below detection levels, and thus a longer well stabilization period may be required. Also, the quality of water used for drilling must be known prior to usage, as the introduction of water of unknown quality may greatly bias groundwater analyses, and thus compromise the entire sampling effort.

The use of drilling mud in the drilling of monitor wells has many of the inherent undesirable traits as with the use of clear water. Additionally, it is more difficult to remove excess drilling mud and resulting wall mud-cake from the screen intervals and the formation being monitored, thus well development efforts may be extensive and less effective than wells installed with hollow-stem augers. However, certain geological conditions may exist that mandate the use of mud rotary drilling methods to ensure successful completion of the well(s). Such conditions may include heaving sands, unstable saturated zones, and extremely large gravels.

Suggested Drilling and Well Installation Procedure(s):

Assuming that two-inch I.D. diameter screen and casing are of sufficient size and a maximum depth of 150 foot or less is anticipated, a small rotary rig or combination auger/rotary rig is adequate for completion of the well(s).

If air is to be utilized as the circulation medium, filters must be installed in the air lines, after the compressor receiver tank, to remove all traces of oil which may be generated by the compressor. In addition, all drill rods, drillpipe, bit subs, bits and other downhole tools must be thoroughly purged/cleaned of all residue prior to drilling. A filtering system must be integrated into the borehole air discharge so as to prevent any release of potential contaminants to the atmosphere.

If drilling fluid (water or drilling mud) is used as the circulation medium, all fluid must be obtained from an approved source and the quality of the fluids ascertained prior to usage. All fluids should be contained in steel, fiberglass, or other similar impoundments during the drilling operations. The use of earthen pits is not acceptable for the drilling and installation of monitoring wells.

In previous rotary drilling of two monitor wells at this site, it appears that a high-viscosity, medium-weight drilling mud was used to prevent wall caving and excessive fluid filtration to the formation. As the top thirty feet seemed to be the most unstable, a 40 to 50 second viscosity mud should be used to drill this interval. A 9 7/8-inch diameter hole is suggested to approximately 30 feet. Temporary 7-inch I.D. (or larger) casing (steel or PVC) should be set and seated. Fluid properties should then be reduced to the minimum viscosity and weight necessary to prevent caving for drilling of the remainder of the hole.

A minimum-size 6 1/4-inch hole should be drilled out from under the temporary casing seat to the desired depth. The temporary casing will be removed after the well screen, riser casing, filter packs, and seals are installed. Once the borehole has reached the desired depth, all excess cuttings shall be circulated from the borehole. This may require changing or dilution of the drilling fluid as any addition of dispersant agents may bias the groundwater sample quality.

Once the borehole is sufficiently cleaned of excess wall mud-cake and cuttings, 2-inch I.D. Schedule 40, PVC slotted screen and casing (TriLok or equivalent) will be set. The screen and casing must be flush-joint, threaded, and have an "O" ring joint seal. Screen slot-size should be determined by a field sieve analysis or by reliable existing data. The bottom of the well screen will be fitted with a "flow-through" valve to aid in placement of the screen and casing at the desired depth in the event of borehole wall caving. Stainless steel or PVC casing centralizers will be installed approximately 5 feet above the top of the well screen, midpoint, and 5 feet below the surface to center the screen and casing in the borehole and to insure an evenly distributed filter-pack and bentonite seal. The top of the riser casing will extend 30 inches above the surface. The annular area between the well screen and hole wall, and extending two feet above the top of the screened interval, will be packed with a well-rounded silica well-sand compatible with the screen-slot size selected. A 1-foot fine-grained silica sand-pack (e.g. Mortar Sand) will then be placed, followed by a minimum two-foot (no more than 5 feet) granular or pelletized bentonite seal. If the bentonite seal is placed above the top of the static water table, 5 gallons (or more if needed) of distilled water will be added to aid the hydration of the bentonite. A weighted measuring tape or similar device will be used to accurately measure the depth of all material as it is placed. All measurements will be recorded to the closest one-tenth of a foot.

It is suggested that the "backwashing method" be used when installing well materials in a fluid-filled hole. If borehole wall collapse is a problem, material may be placed with tremmie pipe and clear water of known chemical composition. Two samples of the water should be collected prior to usage. One sample should be analyzed and one sample archived.

If the bottom of the selected screen interval is above the total borehole depth, the borehole annular area below the screen interval should be filled with well sand or bentonite grout to within two feet of the screen bottom.

SURFACE COMPLETION OF MONITOR WELLS

Each monitor well will be completed at the surface by installing a steel protective well-cover over the PVC riser casing. This cover shall have a weatherproof, hinged, locking cap equipped with a brass padlock having a marine shackle. The well cover shall extend at least two feet below the surface. All padlocks should be keyed alike to facilitate sampling efforts. A concrete pad, with a minimum thickness of 4-inches and extending a minimum of two feet from the well cover in all directions, will be poured. The concrete pad will be sloped away from the well cover to facilitate drainage. The annular area between the riser casing and the inside of the well cover shall be filled to the corresponding height of the outside concrete pad with a non-binding material so as to allow movement during frost-heaving conditions. Steel guard posts (3-inch O.D. x 60 inches long) will be placed equal distance around the well cover and cemented at least two feet into the ground. The posts may be cemented into the surrounding pad as it is poured. The well covers and riser casing caps will have data plates attached, listing pertinent well data, e.g. well number, owner, elevation, survey coordinates, and etc. Final surface completion of the monitor well should consist of priming and painting the guard posts and well cover with a high-visibility, rust inhibitor paint. Care must be exercised to insure that paint residue is not introduced into the monitor well during priming and painting operations.

WELL DEVELOPMENT:

Each monitor well must be developed to remove silt, fine-grained sand, mud cake, and other particulate matter to insure optimum well productivity and water sample quality. Each well must be left undisturbed a sufficient amount of time after completion for the bentonite seal(s) to hydrate and the grout to set. The amount of time required will vary, depending upon the type of materials installed.

The use of surge-block surging, bailing, and pumping are the preferred methods for well development. Additional techniques, such as gas (nitrogen) lift and "backwashing" may be applied if the primary methods do not develop the well to satisfactory standards.

DECONTAMINATION:

All drilling equipment should be thoroughly cleaned and/or washed prior to commencing any work on this project. The equipment should then be inspected for compliance with any EPA, State, or local statutes applicable to this site. No piece of equipment should be removed from the project site unless it is decontaminated and inspected.

Due to the unknown nature of the subsurface materials, all drillpipe, drill-rod, augers, bits, samplers, and other downhole tools may have some level of contamination after their respective use. Therefore, the Driller should be prepared to decontaminate any downhole tool(s) after usage.

It is suggested that all downhole tools be decontaminated in the following manner:

a. The contaminated tools shall be cleaned, using a high-pressure steam cleaner or hot water washer, until all visible contamination is removed.

b. All tools will be rinsed with clean potable water.

c. All tools will be rinsed with laboratory grade methanol.

d. All tools will be rinced with distilled water.

e. All tools will be air dried.

f. All tools will be inspected before being returned to service.

QUALITY ASSURANCE:

A drilling plan, safety plan, and other applicable documents must be assembled prior to the actual drilling of monitor wells at this site. All pertinent drilling and well installation data should be recorded in an established format. Further, it is suggested that the actual drilling operations be monitored by a Chem Nuclear Geotech representative to ensure compliance with all applicable regulations, specifications, industry standards, and other directives as set forth for this work task.