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GENERAL CORRESPONDENCE

YEAR(S):

2002

IR357

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Betty Rivera
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

FAX

TO: Randy Bayless 476-3462

FROM: Larry Johnson
Energy Minerals and Natural Resources Department,
Oil Conservation Division

RE: Attached Proposal

DATE: 5/22/02

LJ asked about this method

3 Pages (Including Transmittal)

Oil Conservation Division * 1625 French Drive * Hobbs, New Mexico 88240
Phone: (505) 393-6161 * Fax (505) 393-0720 * http://www.emnrd.state.nm.us

Larson & Associates, Inc.
Environmental Consultants

May 10, 2002

VIA FACSIMILE: (505) 393-0720

Mr. Paul Sheeley
Environmental Engineer
New Mexico Oil Conservation Division
1625 N. French Drive
Hobbs, New Mexico 88240

RE: Work Plan for Investigation of Major Oil Release, Anadarko Petroleum Corporation, Unit Letter K (NE/4, SW/4), Section 21, Township 22 South, Range 37 East, Lea County, New Mexico.

Dear Mr. Sheeley:
Anadarko Petroleum Corporation (Anadarko) has retained Larson and Associates, Inc. (LA) to prepare a work plan to investigate a major release of oil from a pipeline at the above-referenced location (Site). In a letter dated September 5, 2001, the New Mexico Oil Conservation Division (NMOCD) required Anadarko to submit a C-141 form for this specific release, and any other unreported releases that may have occurred in the area. The NMOCD also required Anadarko to submit a remediation plan to determine the horizontal and vertical extent of the total petroleum hydrocarbons (TPH), as well as benzene, toluene, ethylbenzene and xylene (collectively referred to as BTEX) in the soil. Appendix A presents correspondence from the NMOCD. Figure 1 presents a Site Location map.

Anadarko will initially conduct an electromagnetic (EM) terrain conductivity survey using an EM-31 or EM-34 conductivity meter to assess the vertical and horizontal impact from produced water and oil. The EM technique measures the electrical properties of soil and rock, as well as the electrical properties of groundwater. The major factor that contributes to the conductivity of soil and rock is the conductivity of the formation water. The conductivity of the formation water depends primarily on the dissolved solids content. The conductivity of the soil and rock components are generally less important to soil conductance. The EM induction technique utilizes current flow induced in the subsurface materials by a surface transmitter. Alternating electric current produced by a transmitter coil generates an alternating magnetic field that induces current flow through the earth material. The secondary magnetic field sensed at the receiver coil depends on the strength of the primary magnetic field, current frequency, distance between transmitting and receiving coils, and ground conductivity. The primary magnetic field, current frequency, and coil separation can be accounted for, leaving ground conductivity as the only unknown variable to be measured. The EM-31 has a depth of exploration of approximately 9.8 feet (horizontal dipole) and 19.7 feet (vertical dipole). The EM-34 terrain conductivity meter has a depth of exploration ranging from about 25 feet to 200 feet, depending on the intercoil spacing (i.e., spacing between the transmitting and receiving coils), and the orientation of the transmitter and receiver coils (i.e., horizontal or vertical dipole). The EM-34 has three intercoil spacings: 10 meters (25 or 50-foot

depth of exploration), 20 meters (50 or 100-foot depth of exploration), and 40 meters (100 or 200-foot depth of exploration). The EM survey will be conducted using sample grids, and conductivity measurements will be collected at each grid intersection. The measurements will be recorded on field sheets for inclusion in a report, and presented as contours on Site drawings to show the distribution of conductivity.

A select number of soil borings will be drilled at the Site to confirm the extent of impact, and soil samples will be collected from the surface, and approximately every five (5) feet until the vertical extent of the impact is defined. The samples will be submitted under chain-of-custody control to a qualified laboratory for possible analysis. A duplicate of each sample will be placed in a clean glass sample jar for headspace analysis using the ambient temperature headspace (ATH) method. The ATH method is a qualitative test that detects the presence of petroleum hydrocarbons, and incorporates a photoionization detector (PID) to measure the concentration of hydrocarbons in headspace vapors. The samples exhibiting the highest PID reading, and the deepest sample (above groundwater) will be analyzed for TPH by EPA method SW-846-8015 for gasoline-range (GRO) and diesel-range (DRO) hydrocarbons. The samples will also be analyzed for chloride to evaluate the produced water impact.

LA will prepare a final report with recommendations for remediation or additional investigation following completion of the project. The NMOCD will be given at least 48-hours notification prior to conducting the fieldwork. Please do not hesitate to call Mr. Mike Gray with Anadarko at (915) 682-1666 or myself at (915) 687-0901 if you have any questions.

Sincerely,
Larson and Associates, Inc.

Cindy K. Crain
Geologist

Encl.

cc: Mike Gray