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November 23, 2005

Mr. David Cobrain  
State of New Mexico Environment Department  
Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303



RE: Work Assignment No. 06110.240.0002; State of New Mexico Environment Department, Santa Fe, New Mexico; LANL Permit Support; Technical Document; Well Description and Well Completion Information; Task 2 deliverable.

Dear Mr. Cobrain,

Enclosed please find the deliverable for the above referenced work assignment. The deliverable consists of Technical Document which addresses multi-level well completion information.

Contained within the deliverable are areas which reference the LANL Order. These areas have been highlighted in "yellow". Please double check these references to insure they are correct. In addition, NMED may wish to remove the reference completely. TechLaw has also emailed to you four documents used in researching this deliverable. While we have emailed this material to you we did not include it directly into the hard copy deliverable.

The document is formatted in Word. The deliverable was emailed to you on November 23, 2005 at dave.cobrain@state.nm.us. A hard (paper) copy of the letter will be sent to you via mail.

If you have any questions, please feel free to contact me at (303) 763-7188, or Mr. James Ashworth at (770) 752-7585.

Sincerely,

*June K Dreith*  
June K. Dreith  
Program Manager

Enclosure

cc: Denver Files

32498



**TASK 2 DELIVERABLE**

**TECHNICAL DOCUMENT; WELL DESCRIPTION  
AND WELL COMPLETION INFORMATION**

**Submitted by:**

**TechLaw, Inc.  
560 Golden Ridge Road  
Suite 130  
Golden, CO 80401**

**Submitted to:**

**Mr. David Cobrain  
State of New Mexico Environment Department  
Hazardous Waste Bureau  
2905 Rodeo Park Drive East  
Building 1  
Santa Fe, New Mexico 87505**

**In response to:**

**Work Assignment No. 06110.240.0002**

**November 23, 2005**

## MULTILEVEL WELL COMPLETIONS

Multilevel well completions are useful in characterizing the three-dimensional distribution of groundwater contaminant plumes. A multilevel well completion allows the groundwater from multiple aquifer horizons to be monitored from one sampling location. This can be achieved primarily through three different approaches:

1. Well Clusters
2. Nested Wells
3. Multilevel Sampling Systems

A brief description of each of these methods is presented in the following sections. While the selection of the specific multilevel completion method will depend on site-specific geologic conditions, justification for the method selected must be provided to the Department.

### 1. Well Clusters

Well clusters consist of the installation of multiple individual monitoring wells in separate boreholes at a single location. For example, five individual boreholes may be advanced, each within a distance of a few feet of each other, and a single screen would be installed at a different stratigraphic horizon in each of the five boreholes. This method would result in the completion of five separate wells monitoring different stratigraphic horizons. Each well would be constructed in accordance with the well completion procedures specified in Sections X.C.3 and X.C.4 of the Order. The advantage of this approach is that the groundwater samples are representative only of the zones in which the screens are completed, and there is no possibility of cross-contamination between different stratigraphic horizons or contamination due to inadequate well construction. The primary disadvantage of this approach is the costs associated with installing multiple wells.

### 2. Nested Wells

Nested wells are wells which include the installation of more than one monitoring well in a single borehole. For example, a single large diameter borehole may be advanced, and three individual screens and risers will be installed within the single open borehole. Each screen would be completed in a different stratigraphic horizon, and bentonite seals or inflatable packers would be placed between each screen to isolate the stratigraphic zone of interest. Each individual well (screen and riser) would be constructed in accordance with the well completion procedures specified in Sections X.C.3 and X.C.4 of the Order. The advantage of this approach is that multiple stratigraphic zones can be sampled from one borehole location, which provides substantial cost savings over the installation of multiple individual monitoring wells at the same location. The primary disadvantage of this approach is the risk of potential cross-contamination of different stratigraphic intervals if the well screens are not properly constructed and isolated from each other. This typically occurs when the bentonite seals are not properly placed, leading to "short circuiting" of the groundwater between different stratigraphic zones.

low-flow rates. The specific number of vertical zones that can be monitored in one borehole is contingent upon the number of pumps and pressure transducers utilized. For example, if only dedicated pumps and transducers are used, 8 zones can be monitored. However, if only pressure transducers are used, up to 24 discrete zones can be monitored in a standard two-inch WaterLoo® system. While there are no depth limitations to the WaterLoo® system, there are no provisions for high-capacity groundwater pumping (e.g., for aquifer pumping tests).

### C. Westbay MP® Sampling System

The Westbay MP® sampling system (Slumberger, Inc.) is a modular system consisting of casing, couplings (for groundwater sampling and/or pumping), and packers installed as a single-access tube. The system components are constructed of stainless steel, or combinations of stainless steel and PVC. By adjusting the various lengths of tubing and joints, sampling couplings can be set adjacent to different vertical zones of interest.

The Westbay MP® system can be installed either in uncased or cased wells. If the system is installed in an uncased overburden well, the sampling and/or pumping port is typically installed inside a well screen, which is subsequently surrounded by a sand pack. In a competent open hole (i.e., bedrock well), the sampling port and inflatable packers are installed directly against the adjacent borehole wall. In a cased well, the sampling port and inflatable packers are installed directly inside the well screen. In all settings, inflatable packers are used to isolate the different sampling ports.

A MOSDAX® pressure probe (which includes a fluid pressure transducer) is used for the measurement of water levels. Groundwater samples are collected by lowering a MOSDAX® sampler probe to the zone of interest and opening the sample port valve. After the sample container is filled, the sampling port valve is closed and the sampler probe is returned to the surface. Since a sampler probe is used for the collection of groundwater samples, the number of stratigraphic zones that can be sampled is only limited by the number of measurement ports and packers originally installed in the well. There are no depth limitations to the Westbay MP® system. Furthermore, if pumping ports are included in the well string, pumping tests can be conducted on the different zones of interest.