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INTER-OFFICE CORRESPONDENCE

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FROM: D. L. Hughes  LOCATION: EPA Compliance Programs

TO: Memo to File LOCATION: File

SUBJECT: SEISMIC ACTIVITY WITHIN THE DELAWARE BASIN

The DOE has screened out, on the basis of either probability or consequence or both, all tectonic, magmatic, and structural related processes but used tectonic activity as a siting criterion for the purposes of determining seismic design parameters for the facility. The intent was to avoid tectonic conditions such as faulting and igneous activity that would jeopardize waste isolation over the long term and to avoid areas where earthquake size and frequency could impact facility design and operations.

The purpose of the continuation of seismic monitoring is to build a basis from which to predict ground motions that the WIPP repository may be subjected to in the near and distant future. The concern about seismic effects in the near future, during the operational period, pertains mainly to the design requirements for surface and underground structures for providing containment during seismic events. The concern about effects occurring over the long term, after the repository has been decommissioned and sealed, pertains more to relative motions (faulting) within the repository and possible effects of faulting on the integrity of the salt beds and/or shaft seals.

Seismic monitoring data is divided into two categories, pre and post-instrumentation. Seismic data for New Mexico prior to 1962 was not instrumented and was derived from reports of earthquake effects on people, structures, and surface features. Since 1962, seismograph coverage for New Mexico became comprehensive enough to locate earthquake epicenters in the region. The number of recorded events increased. In the early 1990s, to provide increased coverage in the vicinity of the WIPP Site, the New Mexico Institute of Mining and Technology (NMIMT) installed a network of seven seismograph stations in southeastern New Mexico. This further increased the number of seismic events being recorded in the area.

Starting in January, 1997, a large number of seismic events being recorded were concentrated in an area known as Dagger Draw, northwest of Carlsbad, New Mexico, near the Dagger Draw gas field, which suggests that they may be induced. In 2003, to further define what was occurring in this area, two more seismograph stations were added to the array, both located in the vicinity of Dagger Draw. This also allowed for the recording of smaller events in the area. The number of recorded events increased dramatically in this area until peaking in 2004.

Recently, NMIMT generated comprehensive catalogs that incorporated new programs for locating the epicenter and defining the magnitude of seismic events. They went back through the old catalogs and regenerated the information incorporating the new programs. In some events the magnitude and epicenter changed while in others it was either the magnitude or the epicenter that changed. The Delaware Basin Drilling Surveillance Program (DBDSP) tracks seismic events occurring in the vicinity of the WIPP Site. In 2007, the DBDSP completed the update of their seismic database incorporating the changes and adding the events that were not previously defined as being in this area.

During the current CRA-2009 monitoring period (Oct 2002 thru Sept 2007) there were 703 seismic events recorded within approximately 300 kilometers of the WIPP Site. Fully 85% of the recorded events occurred in the Dagger Draw area of Eddy County. Approximately 50% of the events that occurred in the Dagger Draw area would not have been recorded by the NMIMT seismic array if it wasn't for the two recorders placed in that vicinity.

Although the DBDSP collects information on areas outside of the Delaware Basin, such as Dagger Draw, the Delaware Basin is used as the defining area for data collection and input into PA. Table 1, Seismic Events in the Delaware Basin, shows the number of recorded events that have occurred within the Delaware Basin.

Earthquake catalogs are usually divided into categories according to the magnitude registered for each event. Most catalogs have a section detailing seismic events with a magnitude greater than 3.0 because this is the point at which most seismic events can be felt. Below this range most events are very seldom or barely felt. Figure 1 shows the location of 60 seismic events that have had a reported magnitude greater than 3.0. Of these 60 events only four have occurred in the Delaware Basin. The one closest to the WIPP Site was from a roof fall in one of the local potash mines.

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Attachment

Table 1. Seismic Events in the Delaware Basin

County	No. of Events	Earliest Event	Latest Event	Smallest Magnitude	Largest Magnitude
Culberson	12	10/27/1992	12/20/2005	1.1	2.4
Eddy	15	11/28/1975	07/05/2007	0.5	3.7
Lea	1	06/23/1993	06/23/1993	2.1	2.1
Loving	4	02/04/1976	04/24/2003	1.1	2.0
Pecos	18	01/30/1975	12/22/1998	1.0	2.6
Reeves	18	02/19/1976	05/25/2002	1.0	3.1
Ward	47	09/03/1976	08/19/1978	0.3	2.8
Winkler	8	09/24/1971	09/15/1988	0.0	3.0
Totals	123	09/24/1971	07/05/2007	0.0	3.7
Key: Magnitude Less than 2 Very seldom ever felt 2.0 to 3.4 Barely felt 3.5 to 4.2 Felt as a rumble 4.3 to 4.9 Shakes furniture; can break dishes 5.0 to 5.9 Dislodges heavy objects; cracks walls 6.0 to 6.9 Considerable damage to buildings 7.0 to 7.3 Major damage to buildings; breaks underground pipe 7.4 to 7.9 Great damage; destroys masonry and frame buildings Above 8.0 Complete destruction; ground moves in waves					

