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MEMORANDUM

MFG PROJECT: 180734

TO: Dr. A. K. Ibrahim, U.S. Nuclear Regulatory Commission

FROM: Roslyn Stern, Clint Strachan

DATE: June 1, 2005

SUBJECT: **Sequoyah Fuels Corporation Site, Shear Wave Velocities**

COPY: Craig Harlin, Sequoyah Fuels Corporation

This memorandum has been prepared to address outstanding issues regarding shear wave velocities of the material underlying the Sequoyah Fuels Corporation disposal cell site. Specifically, Dr. Ibrahim has asked for shear wave velocity estimations in order to evaluate the potential for ground motion amplification.

Request for Additional Information (RAI) Issue S8 asked for justification for not accounting for local soil amplification at the disposal site when calculating the design seismic ground motion. In the response to that RAI, MFG (MFG, 2004) explained that significant thicknesses of unconsolidated soils are not present in the disposal cell area. In addition, site soil cleanup work will remove most of the remaining terrace soils or other surface soils in the disposal cell footprint area. Therefore, no local soil amplification is anticipated for these foundation conditions. This is consistent with seismic analysis methods (such as Spudich and others, 1999) where soils less than 5 meters thick are not evaluated for amplification.

The disposal cell will be constructed on sandstone and siltstone units of the Pennsylvanian Atoka Formation. Geologic cross sections of the site area with these units and their geologic descriptions are provided in MFG (2002). In addition, a copy of Drawing 14 from the Specifications and Drawings (Reclamation Plan, Attachment A) is attached to this memo. The upper 20 to 30 feet of the Atoka formation are weathered.

As shown in Drawing 14, terrace deposits estimated to be a maximum of 12 feet thick are overlying the Atoka Formation in the disposal cell footprint area. Boring logs in the area (Hemphill Corporation, 1980 and Roberts/Schornick and Associates, Inc, 1990) describe the terrace deposits as varying from gravelly silty clay, silty clay, to clay. Consistency is soft to firm with an average dry unit weight of approximately 105 pcf. The majority of these soils will be excavated during subsoil clean up, then placed and compacted within the disposal cell.

The disposal cell footprint is likely to have an irregular surface from areas that have been excavated during subsoil cleanup. Subgrade fill will be used in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation (shown on the Drawing 14). Depths of subgrade fill will be sufficient to maintain the base of the compacted clay liner of the disposal cell a minimum of three feet above the maximum observed groundwater level. Subgrade fill will consist of off-site granular materials, or soils and weathered sedimentary rock from approved on-site excavation areas. Subgrade fill will be compacted in 12-inch lifts. The depths of compacted granular fill versus remaining in-place terrace materials is unknown at this time. However, the total depth of unconsolidated soil material underlying the disposal cell will vary from negligible amounts to a maximum of ten feet, with an average depth of five feet.

Geophysical testing has not been performed at the site. However, the underlying Atoka Formation units are of the same geologic age and geophysical province as the Pennsylvanian units evaluated in the Black Fox Geotechnical Investigation. Measured shear wave velocities at Black Fox were greater than 2,000 feet per second in the upper weathered zone (20 to 30 feet thick), and were greater than 4,000 feet per second below the weathered zone. The National Earthquake Hazard Reduction Program (FEMA, 1995) and the International Building Code (IBCO, 2000) site class definitions for these materials are site class B in the upper 20 to 30 feet, and the site class A below this depth. The corresponding ground-motion amplification through these materials is expected to be negligible.

Shear wave velocities of the terrace clays are estimated using empirical correlations as developed by various authors (Hardin and Richart 1963, Hardin and Drnevich 1972, Kanai 1966, Ohsaki and Iwasaki 1973, Ohta and Goto 1978, Imai and Tonouchi 1982, Sykora and Stokoe 1983, Fumal 1978, and Fumal and Tinsley 1985) as compiled by Sykora (1987). The empirical correlations estimate shear wave velocities based on void ratio, effective confining pressure, and Standard Penetration Test (SPT) blow counts. For these correlations, the void ratio of the clay is estimated to be approximately 0.63 based on a dry unit weight of 105 pcf and an assumed specific gravity of 2.75. Effective confining pressure is approximately 3,300 psf based on an average height and unit weight of disposal cell material of 30 feet and 110 pcf, respectively. SPT blow counts are assumed to be approximately 15, corresponding to a stiff clay. It is assumed that any clays encountered that are softer than this would be removed before construction of the disposal cell. Calculated shear wave velocities using various relationships ranged from approximately 700 to 1200 fps, with a median value of approximately 770 fps.

Shear wave velocities of the compacted granular materials are also estimated using empirical correlations related to void ratio, effective confining pressure, and Standard Penetration Test (SPT) blow counts (Sykora, 1987). For these correlations, the void ratio of the compacted granular fill is estimated to be approximately 0.50 based on a dry unit weight of 110 pcf and an assumed specific gravity of 2.65. Effective confining pressure is approximately 3,300 psf based on an average height and unit weight of disposal cell material of 30 feet and 110 pcf, respectively. SPT blow counts are assumed to be approximately 25, corresponding to medium dense sand. Calculated shear wave velocities using various relationships ranged from approximately 650 to 1500 fps, with a median value of approximately 920 fps.

REFERENCES

Federal Emergency Management Agency (FEMA), 1995. NEHRP Recommended Provisions for Seismic Regulations for New Buildings, 1994 Edition, FEMA 222A, May.

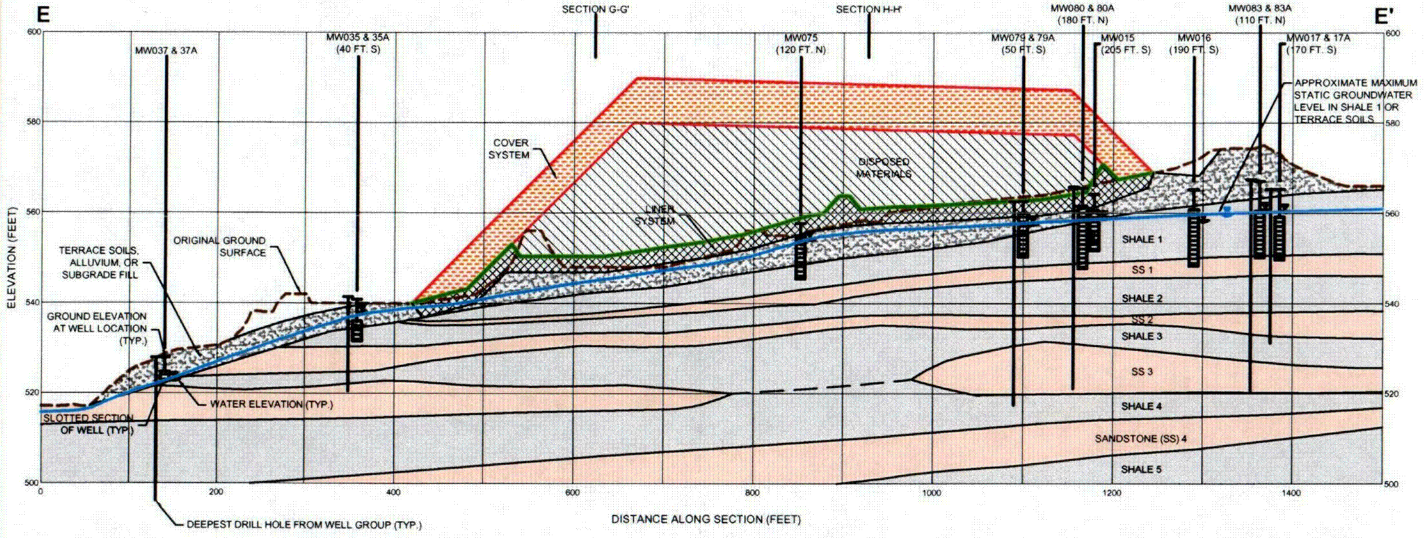
International Conference of Building Officials (IBCO), 2000. International Building Code.

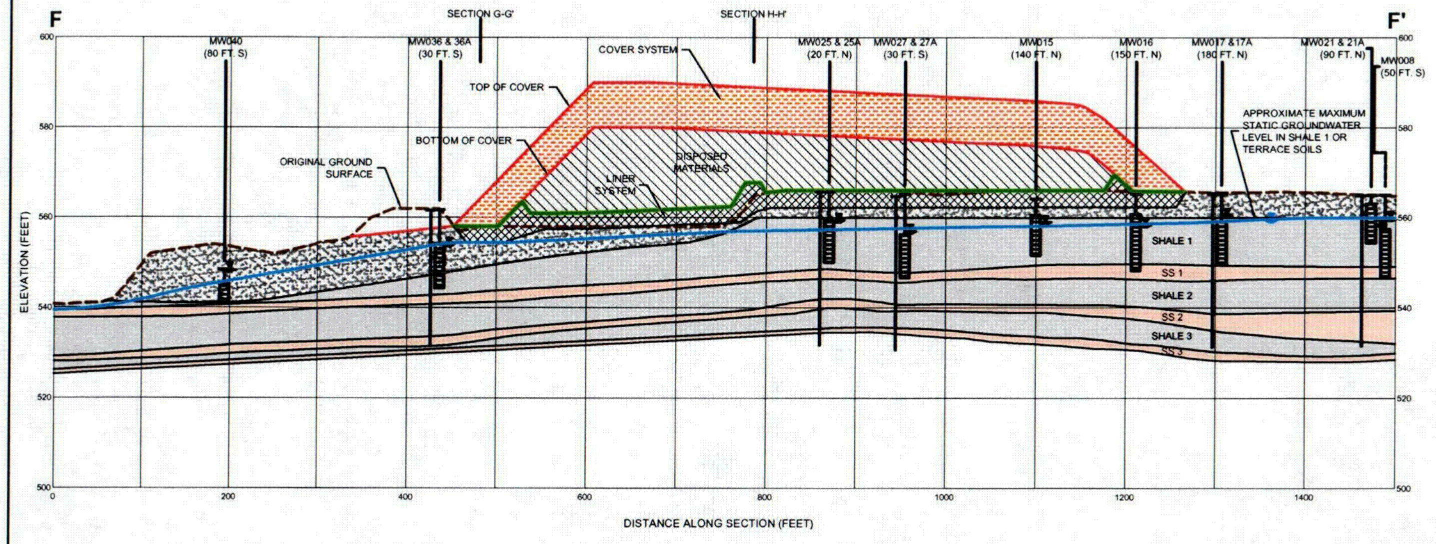
MFG, Inc. (MFG), 2002. Hydrologeological and Geochemical Site Characterization Report." Prepared for Sequoyah Fuels Corporation, July.

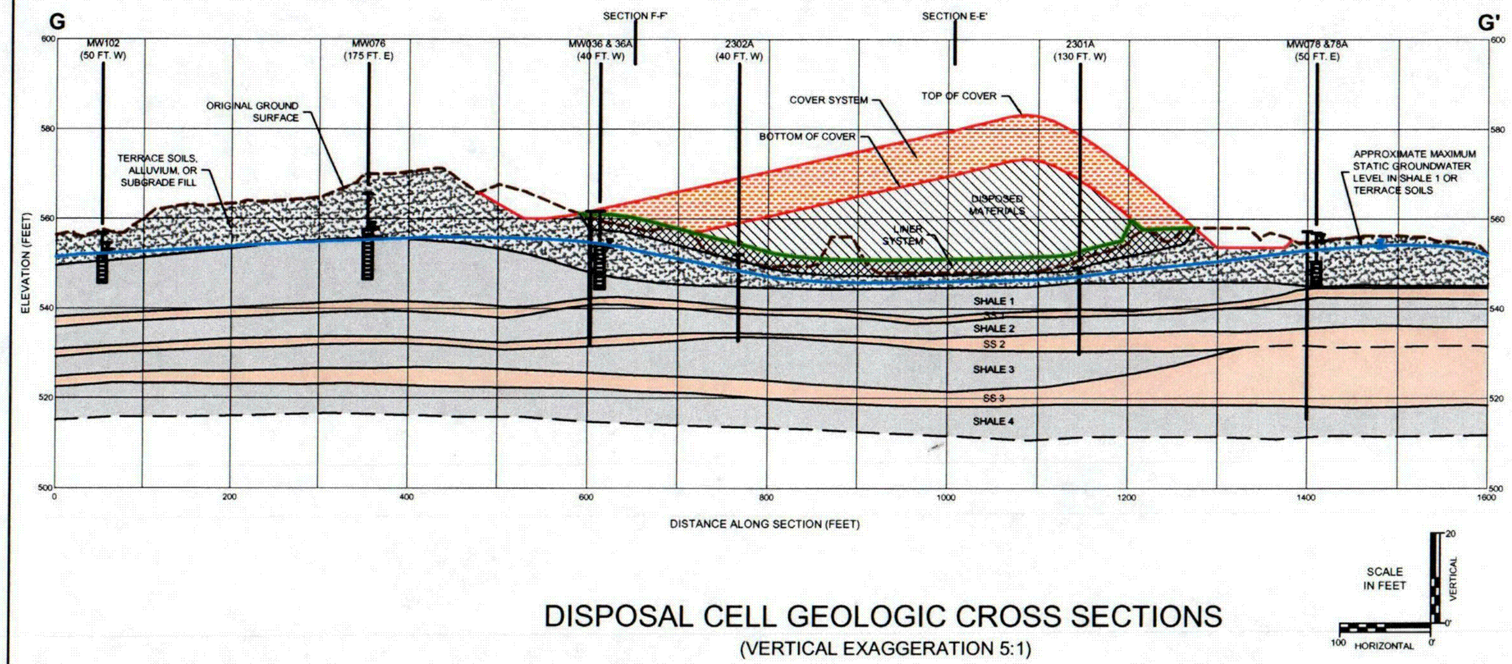
MFG, Inc. (MFG), 2004. Memorandum to Dr. A.K. Ibrahim, (NRC) dated September 7, 2004.

Spudich, P., W. B. Joyner, A.G. Lindh, D.M. Boore, B.M. Margaris and J.B. Fletcher (1999). DEA99: A Revised Ground Motion Prediction Relation for Use in Extensional Tectonic Regimes, Bulletin of the Seismological Society of America, 89, 5, pp. 1156-1170, October.

Sykora, D.W. (1987). Examination of Existing Shear Wave Velocity and Shear Modulus Correlations in Soils, U.S.Army Engineer Waterways Experiment Station, Miscellaneous Paper GL-87-22, September.

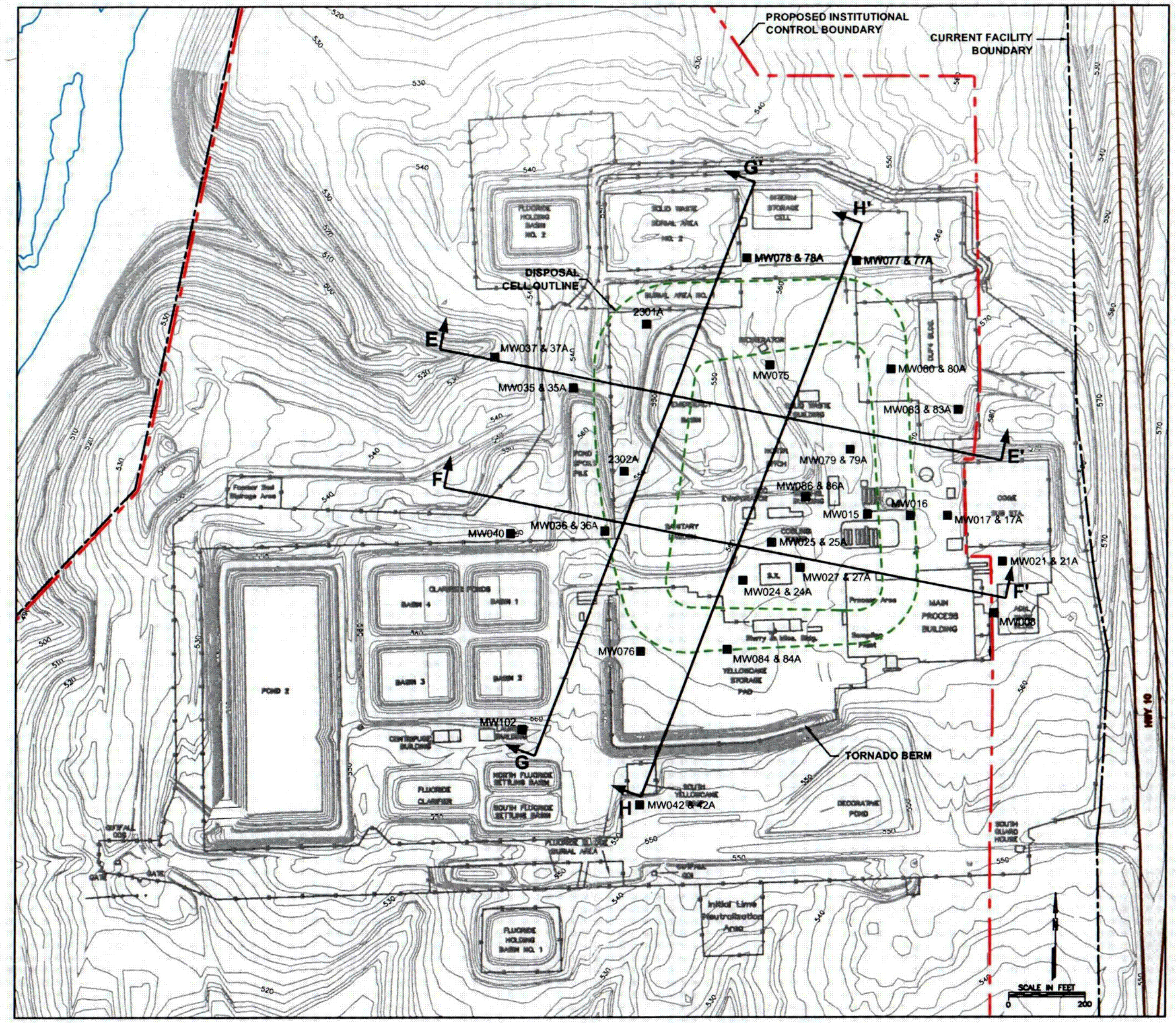




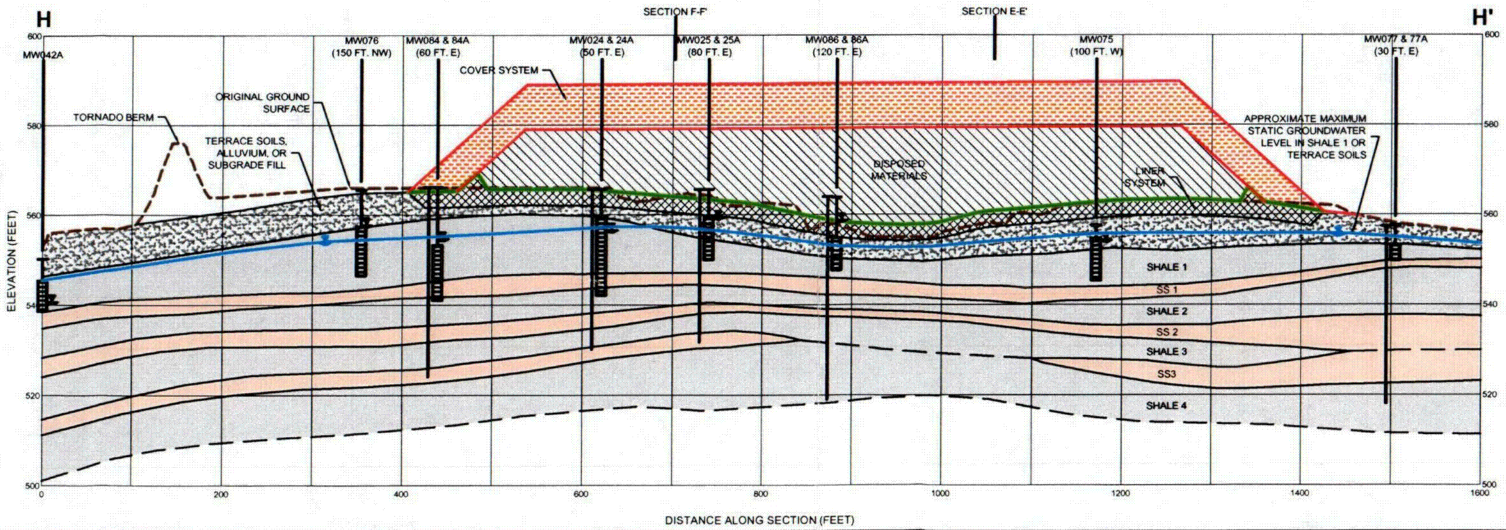


DISPOSAL CELL GEOLOGIC CROSS SECTIONS

(VERTICAL EXAGGERATION 5:1)



PLAN VIEW AND SECTION LOCATIONS



REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	ISSUED FOR PERMITTING	MV	RS	CLS	3/05

REFERENCES

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DESIGNERS

ENGINEERING RECORD	BY	DATE

PREPARED BY

consulting scientists and engineers

Fort Collins, CO
970 223-9600

PREPARED FOR

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

TITLE

DISPOSAL CELL GEOLOGIC CROSS SECTIONS

PROJECT	DATE	DRAWING	REVISION
100734	MARCH 2005	14	A
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