SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0344-N

December 9, 2003

U.S. Nuclear Regulatory Commission
ATTN: Mr. Myron Fliegel, Senior Project Manager
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
And Safeguards, NMSS
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: Sequoyah Fuels Corporation, Docket – 40-8027
Additional Information on Site Seismicity and Geomorphology
Follow-up to Telephone Conference of September 29, 2003

Dear Mike,

Attached please find a Technical Memorandum from MFG concerning the Sequoyah Facility Seismicity and Geomorphology. The intent of the memorandum is to respond to comments and questions raised during a conference call with your staff on September 29, 2003. MFG provided the disposal cell design, and geological and hydrogeological modeling which led to the current reclamation plan under review by your staff.

If you have any questions, don't hesitate to call me at (918) 489-5511, ext. 14.

Sincerely,

Craig L. Harlin
Director, Regulatory Affairs

Enclosure

cc: Philip Justus
Abou-Bakr Ibrahim

NMSS01

consulting scientists and engineers

TECHNICAL MEMORANDUM

MFG PROJECT: 180734

TO: Craig Harlin, Sequoyah Fuels Corporation

FROM: Clint Strachan, Project Manager

DATE: December 2, 2003

SUBJECT: Response to NRC comments on Sequoyah Fuels Corporation Facility Seismicity Evaluation Report

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This document outlines preliminary Nuclear Regulatory Commission (NRC) technical comments on the report "Sequoyah Fuels Corporation Facility Seismicity Evaluation" prepared by MFG, Inc. in July 2003. The comments were made by NRC personnel during a conference call with Sequoyah Fuels Corporation and MFG Inc. personnel on September 29, 2003. The comments discussed on September 29 are organized in terms of (1) geomorphology and hydrologic stability and (2) seismic stability. These comments are summarized below in italics, followed by our responses.

Geomorphology and Hydrologic Stability

The report needs discussion of the potential for gullying within the 005 drainage relative to the location of the west side of the disposal cell.

The 005 drainage is west of the Emergency Basin. From pre-facility topography, the catchment area for the 005 drainage extended from the hill north of the OG & E substation (west of Highway 10 and north of the process building) to the eastern side of Robert S Kerr Reservoir. The pre-facility catchment area for the 005 drainage was approximately 36 acres. The lower portion of the catchment (at the western edge of facilities, north of the Pond 1 Spoils Pile) is approximately 22 acres. The remaining upper portion of the original catchment is approximately 14 acres. Construction of the ponds for the SFC facility temporarily reduced the 14-acre upper portion of the catchment area contributing to the 005 drainage. Construction of the disposal cell and site regrading for reclamation will reduce the catchment area contributing to the upper portion of the 005 drainage from the original 14 acres to approximately 3 acres under long-term conditions.

The key factors affecting gully intrusion potential (outlined in NRC, 2002) are the catchment area contributing to runoff and the erosional stability of the drainage surface. In this case the 005 drainage is relatively stable, having incised into weathered Pennsylvanian-age (Atoka Formation) sedimentary rocks at the upper portion of the drainage and into Pleistocene epoch alluvial terrace deposits at the lower portion of the drainage. The potential for long-term gullying is reduced by the significant reduction in

contributing catchment area after site reclamation. The depth of gullying is restricted by the erosional resistance of the underlying sedimentary rocks.

The report needs discussion of the rate and further potential for further erosion of the gully in the 005 drainage (specifically head cutting and deepening of the channel).

Based on current topography, the head of the 005 drainage has a relatively steep slope. This slope provides the appearance of the potential for head cutting. However, comparison of the current topography with pre-facility topography shows that this area has been steepened during facilities construction, specifically with fill placement associated with features west of the Emergency Basin. The original drainage was less steep and extended to the east through the Emergency Basin area. This means that the relatively steep slope at the had of the 005 drainage is from recent fill placement, and is not at the top of a gully that is experiencing head cutting.

The methods for estimating future gullying in NRC (2002) are based on gully intrusion into a soil embankment or cover slope. The Pennsylvanian-age sedimentary rocks beneath the bottom surface of the 005 drainage do not fit into the categories for gully intrusion prediction in NRC (2002) due to their extremely high erosion resistance compared with soils (specifically density and cohesion). The development and deepening of the bottom of the 005 drainage is relatively slow, based more on the rate of chemical weathering of the sedimentary rock than physical erosion.

As discussed in the disposal cell preliminary design report (MFG, 2002), the outside slopes of the disposal cell (including the western side that drains into the 005 drainage) will be covered with a rock mulch and topsoil surface. This surface will preclude gully intrusion (having been designed for erosional stability under peak flow conditions from the Probable Maximum Precipitation event). This rock mulch and topsoil surface will extend past the toe of the slope as a perimeter apron around the disposal cell. This apron surface will be extended on the western side of the disposal cell over the head of the 005 drainage as necessary for long-term erosional stability.

The discussion of geomorphology in the report needs to be consistent with the NRC Standard Review Plan, specifically acceptance criteria for geomorphic features.

The geomorphic features review procedures (Section 1.3) from the Standard Review Plan (NRC, 2003) are listed below.

The following specific descriptive information should be reviewed to determine the acceptability of the assessment of the regional and site-specific geomorphology as it relates to geomorphic stability of the site.

1) Description of the physiographic (geomorphic) province(s) in which the site is located, including a discussion of the distinguishing characteristics such as elevation and relief.
2) Discussion of the active processes, such as erosion, mass wasting, and stream encroachment within the site region and the nature and extent of those processes.
3) Topographic maps depicting geomorphic surfaces, physiographic provinces, landforms, drainage networks, rivers, surficial geologic units, areas of subsidence, and geomorphic hazards.
4) Aerial photographs of the site area.

5) Discussion of the age, occurrence, and origin of geomorphic features, in particular those that may adversely affect site stability.

This information has generally been provided in Section 6 of the Seismicity Evaluation Report. There are no active processes (erosion, mass wasting, stream encroachment) in the site area, as well as no areas of subsidence or geomorphic hazards. Aerial photographs of the site area are available from pre-facility periods to the present.

Seismic Stability

The text in Section 4.1 (page 16) includes the following sentence: The results were compared with data published by the Oklahoma Geologic Survey from 1900 to 1998 compiled in Lawson and others (1979), Lawson and Luza (1983), Luza and Lawson (1993), and subsequent publications. *What are the "subsequent publications"?*

The subsequent publications are annual data published by the Oklahoma Geological Survey Observatory entitled "Oklahoma Earthquake Catalog". The catalogs can be accessed on the Internet at www.okgeosurvey1.gov/level2/okeqcat.index.html.

The empirical relationship between earthquake magnitude and fault surface rupture length in Section 4.3.1 (page 20) was obtained from Slemmons (1982). Are there more recent references?

Another commonly referenced paper is entitled "New Empirical Relationships among Magnitude, Rupture Length, Rupture Width, Rupture Area, and Surface Displacement" by Wells and Coppersmith (1994). The calculated magnitudes from Slemmons (1982) were compared with calculated values from Wells and Coppersmith for rupture lengths of zero to 100 km. This comparison (shown in Figure 1) shows minimal differences in calculated earthquake magnitude, and indicates that the relationships in Slemmons (1982) are still valid.

Attenuation relationships used to estimate peak ground acceleration in Section 4.3.2 (page 20) were obtained from Campbell (1981). Are there more recent references?

Campbell and Bozorgnia published a paper in 1994 that included new earthquake events and updated attenuation relationships. The calculated peak horizontal accelerations from the two papers are shown in Figure 2 for selected earthquake magnitudes. The attenuated accelerations from the 1994 paper are lower than the 1981 values used in the report, indicating that the accelerations calculated in the report are valid.

The text in Section 4.4 (page 21) describes selected study areas as circles on the Figures 4.1 and 4.2, but shapes appear on these figures as ellipses.

Figures 4.1 and 4.2 show circular approximations of the varying tectonic provinces. However, due to the projection of this part of the earth onto a flat map, the circles appear as ellipses on these figures.

Table 5.1 (page 30) shows a peak horizontal acceleration of 0.145g for the Maximum Credible Earthquake (MCE), but larger values are shown in Appendix B.

The line in question on Table 5.1 is for the MCE associated with all capable faults considered as active. There are peak horizontal acceleration values in Appendix B for faults that are not considered as active.

Specifically, values greater than 0.145g in Appendix B.6 include 0.661g for the Marble City Fault (fault ID 103), 0.168g for the South Fault of Warner Uplift (fault ID 99), and 0.150g for the unnamed fault north of the site (fault ID 95). However, an unnamed fault north of the site (fault ID 95) is assumed for this study to be active, and the corresponding horizontal acceleration of 0.150g should be the estimated maximum acceleration at the site, not 0.145g in Table 5.1. However, this value is significantly less than 0.28 g, which is the horizontal acceleration required to reduce the factor of safety of the disposal cell to an unacceptable level.

In Appendix B, are site locations on figures correct and consistent?

On figures in Appendix B entitled "Locations of Earthquakes," the circular marker that appears in the legend is mistakenly labeled "site location" on four of the five figures. In the figure in Appendix B.1, which represents earthquake events within a 300-mile radius of the site, the circular marker is indeed the site location. In the figures that appear in Appendix B.2 through B.5, which represent the earthquake events in various tectonic provinces, the circular marker represents the center of the tectonic province, not the site location.

References

Campbell, K.W., and Bozorgnia, Y., 1994. "Near-Source Attenuation of Peak Horizontal Acceleration from Worldwide Accelerograms Recorded from 1957 to 1993," in *Proceedings* of the Fifth U.S. National Conference on Earthquake Engineering, Earthquake Engineering Research Institute, Vol. 3, pp. 283-292.

MFG, Inc., 2002. "Preliminary Design Report for the Disposal Cell at the Sequoyah Fuels Corporation Facility," prepared for SFC, December.

U.S. Nuclear Regulatory Commission (NRC), 2002. "Design of Erosion Protection for Long-Term Stabilization, Final Report" *NUREG-1623*, prepared by T.L. Johnson, September.

U.S. Nuclear Regulatory Commission (NRC), 2003. "Standard Review Plan for Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978, Final Report" *NUREG-1620*, Revision 1, prepared by J. Lusher, June.

Wells, D.L., and Coppersmith, K.J., 1994. "New Empirical Relationships Among Magnitude, Rupture Length, Rupture Width, Rupture Area, and Surface Displacement," *Bulletin of the Seismological Society of America*, Vol. 84, No. 4, pp. 974-1002.

Figure 1
Magnitude versus Surface Rupture Length

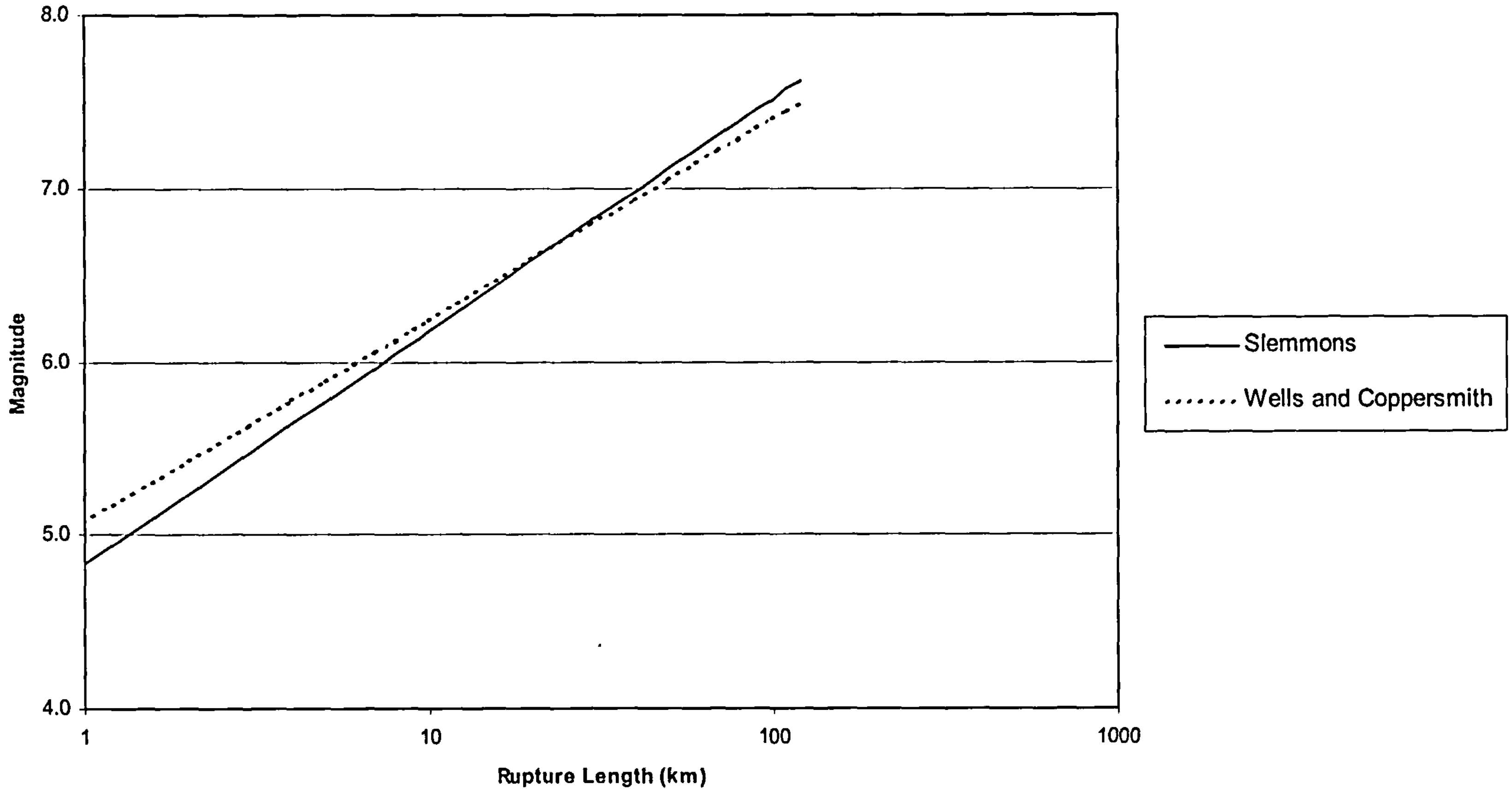
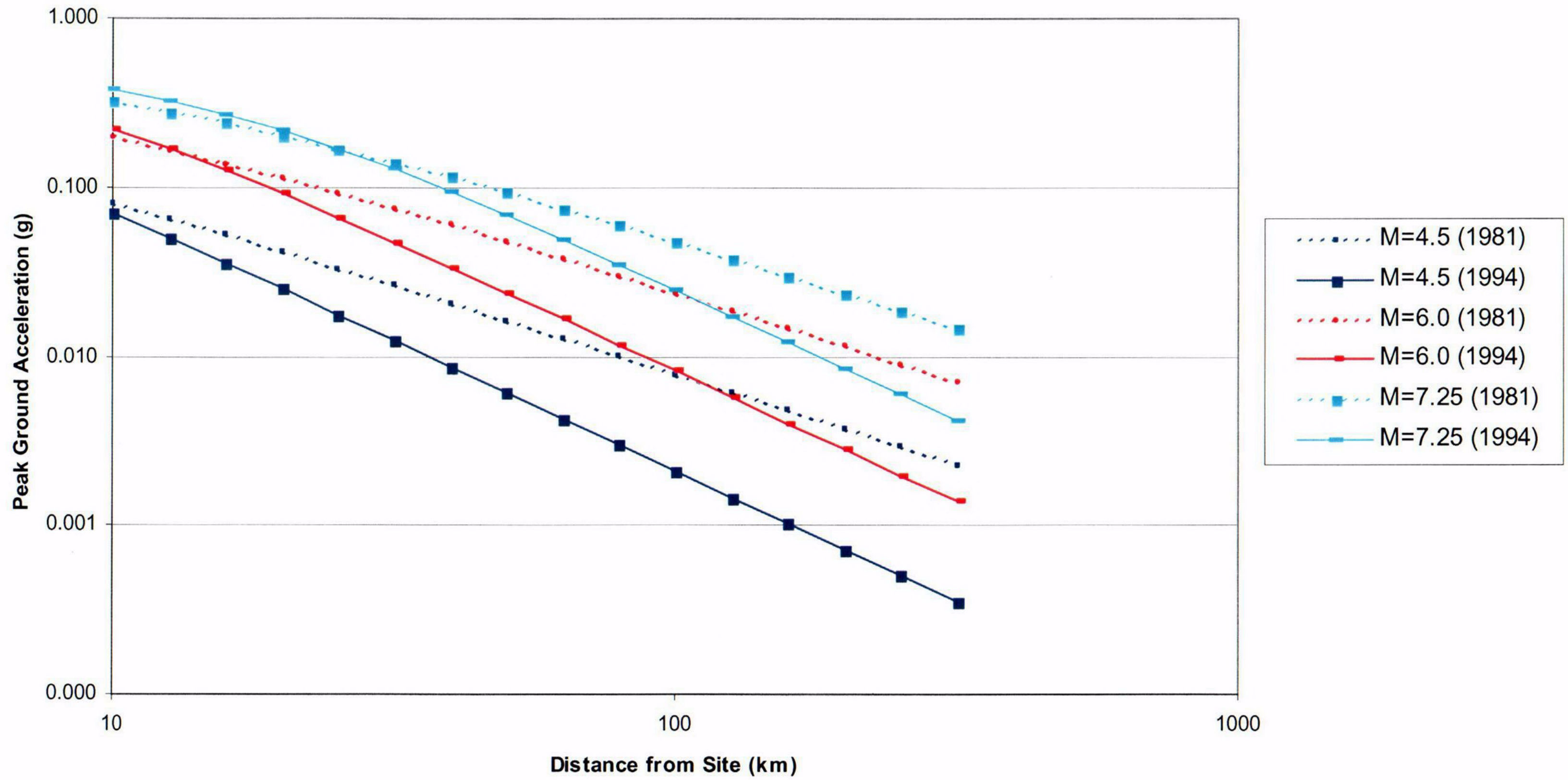


Figure 2
Ground Acceleration Attenuation
Based on Campbell (1981), and Campbell and Bozorgnia (1994)



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