APPENDIX D
SOIL LOSS CALCULATIONS

CALCULATION COVER SHEET

MWH

PROJECT TITLE:	EAST DRAINAGE REMOVAL ACTION CONSTRUCTION WORK PLAN NORTHEAST CHURCH ROCK MINE
PROJECT NO:	1012217
CALCULATION TITLE:	NECR-1 Soil Consolidation Area Soil Loss Calculation

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INTRODUCTION

This soil loss analysis was prepared to estimate long term soil loss from the Soil Consolidation Area constructed for the East Drainage Removal Action at the Northeast Church Rock (NECR) Mine site, as described in the Removal Action Construction Work Plan (MWH, 2012). This analysis was performed as part of the *NECR East Drainage Removal Action Construction Work Plan*, prepared for the United Nuclear Corporation (UNC).

METHODS

Soil loss was estimated using the Revised Universal Soil Loss Equation 2 (RUSLE2) version 1.26.6.4. (Foster and Yoder, 2006) RUSLE2 software is the primary tool used in erosion modeling by federal agencies (e.g., Office of Surface Mines and U.S. Forest Service) to assess soil loss for mine reclamation applications. RUSLE2 technology uses several factors in determining erosional extent including climate, soil properties, base management, slope length, shape, and gradient. The RUSLE2 soil loss equation is:

a=(r)(k)(l)(s)(c)(p);

where:

a = daily soil loss
r = rainfall/runoff
k = soil erodibility
l = slope length
s = slope steepness
c = cover management
p = supporting practices

To obtain average annual soil loss, RUSLE2 sums all daily soil loss values (a) provided by the above equation. Site-specific parameters were entered in a soil loss model in order to obtain average annual soil loss for the top surface and slopes of the Soil Consolidation Area on the NECR-1 pile at the NECR mine site. These parameters were:

1. R-factor of 13 (NRCS, 1999)
2. Time variant k factor based on likely borrow soil characteristics
3. 7.5% and 8% grade, 220 foot (average) and 300 foot (max) slope length for the Soil Consolidation Area top surface
4. 33% grade, 25 foot (max) slope length for the Consolidation Area side slopes
5. Bare ground, no revegetation or natural growth factored into calculation
6. Perfect contouring, no row grade
7. Normal residue burial

Regional climate and soil data were input into RUSLE2 directly from the U.S. Department of Agriculture, Natural Resource Conservation Service. This database provided specific time-variant annual rainfall data as well as provided a soil type that most represents the likely borrow soil that will be used for cover purposes. The climate location database is New Mexico, McKinley County R13, which is based off of the R-factor of 13 for the project location. The soil type selected that most represents the borrow soil is the "525 SILCAT Clay Loam, 1 to 10 percent slopes, SILCAT clay loam 85 %", and is located in the New Mexico soil database McKinley area, McKinley and parts of Cibola and San Juan, NM.

SOIL LOSS ANALYSIS

Using the climate and soil data from the NRCS database and the slope designs for the Soil Consolidation Area, RUSLE2 simulations estimated soil losses for several scenarios incorporating varying slope lengths and gradients

that may be present on the Soil Consolidation Area. Annual soil loss values were then used to estimate the amount of time it would take to erode away one inch of surface material using an assumed density of soil backfill material of 85 lbs/ft^3. The results of these simulations are shown below in Table 1, *Soil Loss Analysis Results.*

TABLE 1
SOIL LOSS ANALYSIS RESULTS

	Horizontal Slope Length (ft)	Slope Grade (%)	Annual Soil Loss (t/ac/yr)	Time Duration for 1 Inch of Soil Loss (yrs)
Consolidation Area Top Surface Drainage	220 (average)	7.5%	2.8	55
Consolidation Area Top Surface Drainage	300 (max)	7.5%	3.0	51
Consolidation Area Top Surface Drainage	220 (average)	8%	3.0	51
Consolidation Area Top Surface Drainage	300 (max)	8%	3.3	47
Consolidation Area Slope	25 (max)	33% (rough surface)	7.5	21

CONCLUSIONS

Based on RUSLE modeling, six inches of cover material on the top surface and side slopes will be sufficient to prevent exposure of underlying material due to sheet erosion prior to implementation of final removal actions.

REFERENCES

Foster, George, Daniel Yoder, Jim Lyon, and Joel Lown. *RUSLE2*, Computer software. Vers. 1.26.6.4. Revised Universal Soil Loss Equation Version 2. 8 May 2009

USDA-NRCS. NRCS-NM, 1999. *RUSLE R-Factor Values for New Mexico*, Map.