Moab Fault system is not a capable fault and does not pose a significant earthquake or surface-rupture threat to the present tailings pile.

Vertical subsidence rates in the northwest end of Moab Valley in the site area provide an estimate of the amount of collapse that could be expected from continued salt dissolution beneath the site. Rates of subsidence evaluated by Woodward-Clyde Federal Services (1996b) yield maximum estimates of 1 to 3 ft over 1,000 years. This deformation is expected to occur as a process of slow incremental displacements over time.

Radiocarbon dating of a wood fragment found deep in Colorado River alluvial deposits on the Moab millsite during monitor well drilling in summer 2002 provides another estimate of subsidence for the site. The carbonized wood fragment was in core from alluvial deposits at a depth of 116.5 ft in the boring for well MOA-435. The fragment was 89.5 ft below the top of gravel deposited by the Colorado River. A radiocarbon date of 45,340 years was determined for this wood fragment. Details of this wood occurrence and its radiocarbon dating are in the SOWP, Appendix D (DOE 2003). On the basis of this radiocarbon dating, a subsidence rate of approximately 2 ft per 1,000 years is indicated for the site; this rate is in the middle of the range (1 to 3 ft per 1,000 years) estimated by Woodward-Clyde Federal Services (1996b).

The rate of incision (downcutting) of the Colorado River where it has cut through sandstone bedrock upstream and downstream from the Moab site is much less than the estimated subsidence rate for the Moab Valley. The incision rate for this area has been estimated as 0.6 ft per 1,000 years by Willis (1992), using a dated volcanic ash bed preserved in a terrace at a known vertical elevation above the Colorado River. These subsidence and incision rates indicate that the tailings pile would become approximately 1.4 ft lower during the next 1,000 years in relation to the Colorado River.

Subsidence refers to the geologic process that is lowering the elevation of the entire tailings pile and the Earth's surface at the Moab site because ground water is dissolving the Paradox Formation salt deposits underlying the Moab-Spanish Valley. The rate of subsidence of the Moab-Spanish Valley is approximately 2 ft per 1,000 years. This gradual downward sinking of the tailings pile is partially offset by the gradual regional uplift of the Colorado Plateau.

River incision refers to the geologic process by which the Colorado River cuts down through the bedrock sandstone outcroppings located upstream and downstream of the Moab site. The rate of river incision in this area has been estimated as 0.6 ft per 1,000 years, much less than the estimated subsidence rate for the Moab Valley.

Over geologic time, the combined processes of subsidence and river incision will change the position of the tailings pile in relation to the underlying ground water and the Colorado River. As for ground water, these processes will eventually cause the bottom of the tailings pile to converge with the underlying ground water at an estimated rate of approximately 1.4 ft per 1,000 years. At this rate, DOE estimates that the tailings in the disposal cell would come into permanent contact with ground water in approximately 7,000 to 10,000 years, assuming the minimum depth to ground water ranges from 5 to 7 ft. As for the Colorado River, these processes will eventually lower the disposal cell by approximately 1.4 ft in relation to the river over the 1,000-year regulatory design period. This would place the 100-year floodplain of the river about 1.4 ft higher on the east toe of the cell, creating a higher probability for flooding over time. This potential impact would be very long term, and the potential hazard would be reduced by the proposed buried riprap diversion wall.

3.1.2 Soils

Surface soils in disturbed areas of the site are predominantly sands mixed with clays, silts, and gravels and are saturated within 16 ft of the surface most of the year (NRC 1999). Remaining native soils surrounding the site are predominantly sands mixed with clays, silts, and gravels and are classified as Nakai fine sandy loams (Table 3–1). Soils include sandy loams to loamy fine sands. Soils are generally deep (depths greater than 36 inches), are well-drained, and have a minimal water-erosion potential, a moderate hazard of blowing potential, and an estimated erosion rate of 3 tons per acre per year. Additional information is available in the *Soil Survey of Grand County, Utah, Central Part* (SCS 1989).

Table 3–1. Properties of the Nakai Soil Type

Soil Name	Taxonomy	Depth (inches)	pH	Salinity (mmho/cm)
Nakai	Coarse-loamy, mixed, mesic Typic Calciorthids	40–>60	7.4–8.4	< 2
Permeability (inches/hour)	**Available Water (percent)**	**Textural Class**	**Clay (percent)**	**Erodibility Factors[a]**
2.0–6.0	10–16	Fine sandy loam to loamy fine sand	10–18	K = 0.28 T = 3 Wind = 3

[a]Erodibility factors: "K," used in the Universal Soil Loss Equation, is an indicator of the susceptibility of a soil to sheet and rill erosion by water. Values range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion. "T" is an estimate of the maximum average annual rate of water or wind erosion in tons per acre per year.
Wind erosion factors range from 1 to 8; the lower the value, the more susceptible the soil is to wind erosion.
mmho/cm = millimhos per centimeter.
Source: SCS 1989.

3.1.3 Description of Contaminated Materials at the Moab Site

3.1.3.1 Millsite Contamination

In 2001, DOE began radiometric characterization of soils on the millsite. To date, the area north and northeast of the tailings pile have been assessed. Most of the site has soil contamination exceeding EPA standards for radium-226 except for small areas north of the tailings pile and one larger area northwest of the pile where a borrow pit was excavated and soils were used for pile surcharge (i.e., weight on the pile to squeeze out moisture) and for the interim cover. Shallow contamination was also identified north of US-191 on DOE property extending to the property line with Arches National Park.

Depths of contamination range from 6 to 120 inches. The area outside the tailings pile (i.e., the area of windblown contamination) is estimated to contain 71,000 yd^3 of contaminated soils. Measuring the depth of contamination with surface scanning and downhole logging instruments has inherent uncertainties; experience at other UMTRCA sites suggests that the final volume could exceed the volume characterized by a range of 50 to 100 percent.

Additional data collected also suggest that contamination occurs elsewhere on the site. Preliminary surface scans by DOE show contamination between the railroad and SR-279 and also near the abandoned ore-loading station adjacent to the rail tracks. Preliminary scans also show elevated gamma levels southeast of the tailings pile in the tamarisk. However, statistical sampling performed to minimize cutting of the tamarisk between the property fence and the Colorado River indicates that radium-226 concentrations in the area may not exceed EPA standards. A 1980 survey performed for Atlas Corporation (Ford, Bacon & Davis 1979) suggests that contamination does not extend across SR-279 to the southwest and up the steep hillside. A 1982 aerial survey performed by a DOE contractor (EG&G) did not provide any additional data on millsite contamination.

On the basis of site knowledge and past UMTRCA site experience, DOE estimates that 11.9 million tons (8.9 million yd^3) of contaminated materials exist at the Moab site and vicinity properties.