affect natural barriers, (such as degradation of concrete liners affecting the pH of ground water or precipitation of minerals due to heat changing hydrologic processes), including appropriate details as to magnitude and timing regarding any exclusions that would significantly change the dose to the reasonably maximally exposed individual;

(7) Provide the technical basis for models used in the total system performance assessment such as comparisons made with outputs of detailed process-level models and/or empirical observations (for example, laboratory testing, field investigations, and natural analogs);

(8) Identify natural features of the geologic setting and design features of the engineered barrier system important to isolating radioactive waste;

(9) Describe the capability of the natural and engineered barriers important to isolating radioactive waste, taking into account uncertainties in characterizing and modeling such barriers;

(10) Provide the technical basis for the description of the capability of the natural and engineered barriers important to isolating radioactive waste;

(11) Use the reference biosphere and reasonably maximally exposed individual assumptions specified in applicable NRC regulations; and

(12) Conduct appropriate sensitivity studies.

§ 963.17 Postclosure suitability criteria.

(a) DOE will evaluate the postclosure suitability of a geologic repository at the Yucca Mountain site through suitability criteria that reflect both the processes and the models used to simulate those processes that are important to the total system performance of the geologic repository. The applicable criteria are:

(1) Site characteristics, which include:

(i) Geologic properties of the site—for example, stratigraphy, rock type and physical properties, and structural characteristics;

(ii) Hydrologic properties of the site—for example, porosity, permeability,moisture content, saturation, and potentiometric characteristics;

(iii) Geophysical properties of the site—for example, densities, velocities and water contents, as measured or deduced from geophysical logs; and

(iv) Geochemical properties of the site—for example, precipitation, dissolution characteristics, and sorption properties of mineral and rock surfaces.

(2) Unsaturated zone flow characteristics, which include:

(i) Climate—for example, precipitation and postulated future climatic conditions;

(ii) Infiltration—for example, precipitation entering the mountain in excess of water returned to the atmosphere by evaporation and plant transpiration;

(iii) Unsaturated zone flux—for example, water movement through the pore spaces, or flowing along fractures or through perched water zones above the repository;

(iv) Seepage—for example, water dripping into the underground repository openings from the surrounding rock.

(3) Near field environment characteristics, which include:

(i) Thermal hydrology—for example, effects of heat from the waste on water flow through the site, and the temperature and humidity at the engineered barriers.

(ii) Near field geochemical environment—for example, the chemical reactions and products resulting from water contacting the waste and the engineered barrier materials.

(4) Engineered barrier system degradation characteristics, which include:

(i) Engineered barrier system component performance—for example, drip shields, backfill, coatings, or chemical modifications, and

(ii) Waste package degradation—for example, the corrosion of the waste package materials within the near-field environment.

(5) Waste form degradation characteristics, which include:

(i) Cladding degradation—for example, corrosion or break-down of the cladding on the spent fuel pellets;

(ii) Waste form dissolution—for example, the ability of individual radionuclides to dissolve in water penetrating breached waste packages.

(6) Engineered barrier system degradation, flow, and transport characteristics, which include:

(i) Colloid formation and stability—for example, the formation of colloidal particles and the ability of radionuclides to adhere to these particles as they may migrate through the remaining barriers; and

(ii) Engineered barrier transport—for example, the movement of radionuclides dissolved in water or adhering to colloidal particles to be transported through the remaining engineered barriers and in the underlying unsaturated zone.

(7) Unsaturated zone flow and transport characteristics, which include:

(i) Unsaturated zone transport—for example, the movement of water with dissolved radionuclides or colloidal particles through the unsaturated zone underlying the repository, including retardation mechanisms such as sorption on rock or mineral surfaces;

(ii) Thermal hydrology—for example, effects of heat from the waste on water flow through the site.

(8) Saturated zone flow and transport characteristics, which include:

(i) Saturated zone transport—for example, the movement of water with dissolved radionuclides or colloidal particles through the saturated zone underlying and beyond the repository, including retardation mechanisms such as sorption on rock or mineral surfaces; and

(ii) Dilution—for example, diffusion of radionuclides into pore spaces, dispersion of radionuclides along flow paths, and mixing with non-contaminated ground water.

(9) Biosphere characteristics, which include:

(i) Reference biosphere and reasonably maximally exposed individual—for example, biosphere water pathways, location and behavior of reasonably maximally exposed individual; and

(ii) Biosphere transport and uptake—for example, the consumption of ground or surface waters through direct extraction or agriculture, including mixing with non-contaminated waters and exposure to contaminated agricultural products.

(b) DOE will evaluate the postclosure suitability of the Yucca Mountain disposal system using criteria that consider disruptive processes and events important to the total system performance of the geologic repository. The applicable criteria related to disruptive processes and events include:

(1) Volcanism—for example, the probability and potential consequences of a volcanic eruption intersecting the repository;

(2) Seismic events—for example, the probability and potential consequences of an earthquake on the underground facilities or hydrologic system; and

(3) Nuclear criticality—for example, the probability and potential consequences of a self-sustaining nuclear reaction as a result of chemical or physical processes affecting the waste either in or after release from breached waste packages.