



Seismic Vulnerability Assessment Forms

Form 6: Burns and Dikes Surrounding Tank Farms (BER)

Begin with a walk-thru of the entire berm/dike system and document the following possible deficiencies:

1. Does the geotechnical investigation or report show any variation between each length (all sides) of the berm/dike? Is the berm susceptible to differential settlement or liquefaction? Can the protective layer remain intact under differential settlement or liquefaction conditions? **(BER1)**
2. Are there any cracks in the concrete? For LNG tanks, concrete dikes are required. What is the general condition; is there any exposed rebar? Provide cross-sectional drawings to facilitate the review and evaluate fitness-for-purpose, including the evaluation of seismic loads (demand and capacity) calculations including possible overturning, stability, and potential differential settlement. Provide the age of the dike and all structural properties. **(BER2)**
3. Are there any penetrations for piping or drainage – explain and sketch. **(BER3)**
4. Is there any evidence of water ponding at the base. If the tank farm is on a slope, is the downslope dike length and volume sufficient to facilitate the maximum postulated tank farm leakage? **(BER4)**
5. Is the design sufficient (demand and capacity) to be fit-for-purpose post DE event? Will the potential leakage be contained post-earthquake or fire? **(BER5)**
6. What is the plan to evacuate the spillage after an event? **(BER6)**
7. Are there any penetrations, pipelines, or other possible openings in the dike. Are there rigid pipeline penetrations that might rupture during seismic displacement? **(BER7)**
8. Any evidence of other damage to the existing dike, and does it satisfy the DE requirements of OAR 340-300-0003. **(BER8)**
9. Are the secondary containment systems designed to withstand the effects of the Maximum Considered Earthquake ground motion when empty and two-thirds of the Maximum Considered Earthquake ground motion when full, including all hydrodynamic forces per ASCE 7-22 Section 15.6.5. **(BER 9)**

Additional questions for earth berms or dikes:

10. Assess possible deterioration from rodents, erosion, liquefaction, cracks, vegetation, or other visible signs of distress. **(BER10)**
11. Evaluate the soil for permeability and fitness-for-purpose, based on a local geotechnical review, for all areas and lengths. What soil types are used for the berm and is there is multiple different soil types for various layers. Provide a geotechnical fitness-for- purpose of the earth berm and underlying foundation material. **(BER11)**
12. Determine if the height is sufficient to accommodate the postulated maximum spill volumes. Has the height decreased over time. Compare actual height to the design dimensions. **(BER12)**

Translation or other formats

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13. For minimum top horizontal widths (Ref: TABLE 5-1, "Earth Dams and Reservoirs", TR-60, US department of Agriculture, Conservation Engineering Division, July 2005. **(BER13)**)

Height (ft.)	Minimum width (ft.) at top
15-18	8
20-24	10

14. Is there a protective layer over the soil material, and if so, specify the type, durability, and estimated remaining life? **(BER14)**
15. Is there evidence of earlier failures, patched sections, or other possible historical damage? **(BER15)**
16. Is there water ponding at the interior base of the berm? If the tank farm is not on level soil, can the downslope berm facilitate the required spill volume? **(BER16)**
17. Are there sheet piles in addition to the soil? **(BER17)**
18. Does the geotechnical report show any differential characteristics from one end of each segment of the berm to the other? How will this be accommodated during an earthquake with possible differential settlement/motion? Is there any evidence of subsidence? **(BER18)**
19. Possible seepage beneath the base? What about a piping failure through the berm? How is this being assessed? **(BER19)**
20. Verify that the earth berm will satisfy the seismic demand as provided in OAR 340- 300-0004. **(BER20)**
21. Possible slumping of the berm during an earthquake? **(BER21)**

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