

SUBSIDENCE MONITORING AT THE WASTE ISOLATION PILOT PLANT

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Abstract

This paper presents historical and contemporary measurements of subsidence collected at the Waste Isolation Pilot Plant (WIPP). The WIPP, owned by the U.S. Department of Energy (DOE), is the world's first geologic repository certified for the disposal of both transuranic radioactive (TRU) waste and mixed transuranic and hazardous waste (mixed TRU) generated as byproducts of U.S. defense programs. Subsidence measurements are made under the WIPP Subsidence Monitoring Program, one of several formal programs established by the DOE to comply with federal regulations calling for the implementation of certain assurance requirements (e.g., monitoring).

Digital leveling techniques that achieve better than Second-Order Class II loop closure accuracies are used to survey the elevations of more than 50 subsidence monuments and 14 National Geodetic Survey vertical control points installed at the ground surface. The majority of these benchmarks form a rectangular grid directly above the underground workings of the WIPP; however, some benchmarks are also located far from the influence of the WIPP workings. Elevations have been determined annually since 1987 using ten survey loops (traversing more than 26 km) comprising as many as thirteen and as few as two benchmarks in each loop. Subsidence is then determined as the difference between the current elevation and the initial elevation at each benchmark.

Empirical and numerical models have been used to make *a priori* predictions of the spatial and temporal characteristics of subsidence at the WIPP. The models were validated before use at WIPP against subsidence data collected from nearby potash mines, which are located in similar geology. Based on model predictions, the maximum subsidence at the WIPP is expected to be -0.62 m, but will not occur until the creep closure of the disposal rooms is complete (estimated to be a few centuries). To date, the maximum subsidence observed at the WIPP is only -0.06 m, occurring directly above waste disposal Panel 1. In addition, the maximum observed subsidence rates range from 5×10^{-3} to 8×10^{-3} m/yr with changes in rate corresponding directly to active mining. These subsidence magnitudes and rates are consistent with model predictions and confirm the WIPP is performing as expected.

Key Words: Subsidence Measurements, Monitoring, WIPP, Modeling, Regulatory Requirements.

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