

The Development of an Effective Transportation Risk Assessment Model for Analyzing the Transport of Spent Fuel and High-Level Radioactive Waste to the Proposed Yucca Mountain Repository

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Past approaches for assessing the impacts of transporting spent fuel and high-level radioactive waste have not been effectively implemented or have used relatively simple approaches. The Yucca Mountain Draft Environmental Impact Statement (DEIS) analysis considers 83 origins, 34 fuel types, 49,914 legal weight truck shipments, 10,911 rail shipments, consisting of 59,250 shipment links outside Nevada (shipment kilometers and population density pairs through urban, suburban or rural zones by state), and 22,611 shipment links in Nevada. There was additional complexity within the analysis. The analysis modeled the behavior of 41 isotopes, 1091 source terms, and used 8850 food transfer factors (distinct factors by isotope for each state). The model also considered different accident rates for legal weight truck, rail, and heavy haul truck by state, and barge by waterway. To capture the all of the complexities of the transportation analysis, a Microsoft® Access database was created.

In the Microsoft® Access approach the data is placed in individual tables and equations are developed in queries to obtain the overall impacts. While the query might be applied to thousands of table entries, there is only one equation for a particular impact. This greatly simplifies the validation effort. Furthermore, in Access, data in tables can be linked automatically using query joins.

Another advantage built into MS Access is nested queries, or the ability to develop query hierarchies. It is possible to separate the calculation into a series of steps, each step represented by a query. For example, the first query might calculate the number of shipment kilometers traveled through urban, rural and suburban zones for all states. Subsequent queries could join the shipment kilometers query results with another table containing the state and mode specific accident rate to produce accidents by state.

One of the biggest advantages of the nested queries is in validation. Temporarily restricting the query to one origin, one shipment, or one state and validating that the query calculation is returning the expected result allows simple validation. The paper will show the flexibility of the assessment tool to consider a wide variety of impacts. Through the use of pre-designed queries, impacts by origin, mode, fuel type or many other parameters can be obtained.