Practical Lessons on the Geologic Disposal of Nuclear Waste

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1. Introduction

This talk sets out to illustrate important lessons pertinent to the disposal of nuclear waste learned from regional studies. Illustrative examples are drawn from the Yucca Mountain site in Nevada, the Coconino Aquifer in Arizona, the Barrick Gold mine in Nevada, and studies here on Jeju Island. All of these study sites are characterized by complexity due to their geologic and hydrogeologic settings and patterns of primary and secondary porosity development.

2. Results

The first lesson is that all successful projects require considerable time and effort in describing the physical setting. In this respect, we emphasize the geology and hydrogeology as essential components of a "defense in depth" strategy for risk reduction. Of particular importance are measurements on the distribution of key geologic and hydrostratigraphic units, key faults and on the character of fracture development.

The second lesson concerns the particular importance of faults and fractures in controlling local and regional patterns of flow and transport. Studies around the world have shown the enormous importance of such features in site safety assessments particularly in hard rock settings. For example, at Yucca Mountain very extensive test drilling still was unable to define the influence of these features on flow.

The last lesson concerns quantitative assessments. Successful projects undertake modeling before, during and after projects are completed. These efforts are needed to validate conceptual models, help to interpret field observations, and finally to predict how the geosphere contributes to waste isolation. Such modeling typically provides an essential component of the total system performance assessment.

3. Conclusions

Studies in country after country have emphasized the importance of favorable performance of the site in an overall safety assessment. Detailed information about the important elements of the geologic and hydrogeologic setting, the contribution of faults and fractures to flow and transport, and finally model based evaluation of the hydrogeologic setting are essential components of an overall "defense in depth" strategy for geologic disposal of nuclear wastes. This strategy builds redundancy into a design to overcome uncertainties in performance of containers and the near-field setting.