

PREFACE

ARGONNE NATIONAL LABORATORY SPECIALISTS' WORKSHOP ON BASIC RESEARCH NEEDS FOR NUCLEAR WASTE MANAGEMENT

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The absence of a demonstrated technology for the safe, long-term isolation of nuclear radioactive waste poses one of the major impediments to the development of nuclear energy. A general consensus has now emerged among technologists that deep geological repositories can be successfully developed to effectively isolate these radioactive wastes from the biosphere. Consequently, a great deal of research and development is now being directed, internationally, to supportive basic and applied research, establishing criteria for design of such repositories and identifying suitable sites. Transport by groundwater is considered to be the only mechanism of importance for movement of nuclear wastes away from deep geological repositories selected free of igneous activity. Therefore, current site selection criteria emphasize tectonic stability and low probability of intrusion by flowing groundwater. As added protection against a future, unexpected low probability occurrence of events leading to intrusion of flowing water into the site, nuclear waste emplacement strategies are being developed that present multiple barriers to minimize water dissolution and transport of the nuclear wastes. These barriers consist of

1. a waste form containing the nuclear wastes that is highly resistant to leaching by groundwaters
2. chemically stable canisters to contain the waste forms
3. back-filling materials surrounding the canisters, which minimize transport of the nuclear wastes

4. careful selection of the chemical and physical properties of the surrounding geological media, which can itself present an effective ultimate barrier isolating the nuclear wastes from the biosphere.

At present, because of the urgency to proceed rapidly with site selection criteria and design, the major emphasis in nuclear waste management-related activities is being expended on studies of an empirical nature. However, many of these empirical studies are being found to be quite limited because of the complexities of the phenomena being considered. The number of variables needed to be considered is quite extensive and not all of these variables and their interrelationships can be studied empirically. Fundamental research paralleling the empirical studies is needed to fully understand the basic mechanisms of processes taking place in actual repositories as well as to develop needed new experimental methods. Understanding the basic mechanisms involved will greatly add to our confidence in extrapolating the many short-term laboratory and field studies now under way to assess the long-term stabilities of actual waste repositories and the long-term consequences of low probability breaching of repositories.

Successful development of the scientific foundation underlying nuclear waste management technologies will require concerted efforts and strong interactions on the part of researchers from a broad range of different disciplines. To enhance such interactions, Argonne National Laboratory (ANL) has initiated a series of specialists' workshops. Each

workshop focuses on a selected area of the waste management field. Experts from the appropriate disciplines review the status of each area and formulate recommendations for additional research needed for future development of the technology.

The first workshop was held at ANL on September 5 and 6, 1979, and focused on

1. the dissolution mechanisms of glasses (as one possible waste form)
2. identification of the chemical species present in solution after dissolution
3. determination of the interaction of these chemical species with geological media.

These three topics are closely coupled and must be considered together since they determine the rate at which nuclear radioactive wastes will be released and migrate through geological media in the event that the waste form is contacted with groundwater. This first meeting only considered dissolution mechanisms of glasses rather than all waste forms because

1. there is more extensive information available on glasses
2. glasses are at this time the most seriously considered waste form candidates in the U.S. and several European countries
3. consideration of alternative waste forms was judged to be such an extensive topic that it warranted an entirely separate meeting in the future.

This meeting was attended by 56 selected participants. These participants ranged from basic researchers working in areas of importance (but not directly coupled to waste management) to researchers working in direct support of specific waste-manage-

ment activities. The meeting itself was organized into the following four one-half day sessions:

- I. Dissolution Mechanisms of Glasses
- II. Specification of Trace Elements in Aqueous Solutions—Chemical Effects on Migration
- III. Secondary Mineralization and Rock-Solute Interactions
- IV. Discussions of Basic Research Needs and Formulation of Recommendations

All but two of the papers presented during Sessions I, II, and III of this workshop are contained in this volume. The paper "Assessment of Potential Radionuclide Transport in Site Specific Geological Formations" by R. Dosch will appear as a Sandia National Laboratories Report, SAND-79-2468. Another paper, "Effective Aquifer Surface Area and Importance to Pollutant Transport" by H. Claassen, will also be published apart from these proceedings.

The fourth and last session was a lively discussion among the participants designed to identify the areas of basic research needed to develop stable glass waste forms and understand the consequences of groundwater contacting glassified nuclear waste forms in deep geological repositories. A summary of these discussions and recommendations is presented here.

The organizing committee wishes to express their appreciation to the authors and participants of this workshop for their important contributions.

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