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BASIC RESEARCH FOR EVALUATING
NUCLEAR WASTE FORM PERFORMANCE

Special Group: "Research Needs for Nuclear Waste Management"

November 14, 1979

Mr. John T. Collins
c/o U.S.N.R.C.
Box 311
Middleton, Pennsylvania 17507

Dear Mr. Collins:

We are planning a special group of papers for publication in *Nuclear Technology* which will incorporate some of the papers submitted at the Argonne National Laboratory Specialist Workshop on "Basic Research Needs for Waste Management" held September 5-6, 1979, at Argonne, Illinois. In publishing groups of papers, certain special considerations are appropriate for those papers that contribute to the group but would not meet publication acceptance standards if published alone. For example, these include some papers that may not meet originality requirements but provide background information and analyses necessary to the full understanding of associated papers. To help you in your evaluation we are enclosing a list of all papers to be included in this special group.

I would like to solicit your help in reviewing one of these papers. Our experience has shown that two weeks is a reasonable time to allow for a technical review. If your schedule does not permit you to devote sufficient attention during this time, I will appreciate your early advice. We are striving to publish all papers as soon as possible and a few days here and there can easily save a month or more in final publication.

Again, I will appreciate your recommendation for acceptance, revision or rejection of the manuscript. Quality of the Journal can be maintained only by good papers and I am sure that not only do the readers and I appreciate your efforts, but that the authors do as well.

Sincerely,

Roy G. Post
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Roy G. Post
Editor
RGP:en
Enclosure

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The following is a rough, first draft of a statement of purpose for holding the "Specialists' Workshop on Basic Research Needs for Nuclear Waste Management." Such a statement will precede and provide an introduction for the papers and recommendations of the Workshop to be published in Nuclear Technology. Please give to your session organizers any recommendations as to changes or corrections you may have to this statement.

In order to place your paper into the context of the intended goals of the Workshop, please have your paper and, in particular, the Abstract, Introduction and Summary address the goals of the Workshop, i.e., discussion of the present status of knowledge in your area, outstanding problems to be solved and future research needs. It would be most useful if your personal recommendations for future research be stated explicitly in your Abstract and Summary. Each session organizer will give you specific recommendations for text changes and the time schedule for manuscript submission.

Also, for your information, I have attached here another copy of the "Instructions to Authors" for Nuclear Technology. The publication of your paper will be expedited if you follow this format.

Statement of Purpose for Conducting "The
ANL Specialists' Workshop on Basic Research
Needs for Nuclear Waste Management"

The absence of a demonstrated technology for the safe, long-term isolation of nuclear radioactive wastes 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 nuclear 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 ground water 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 of flowing ground water. As added protection against a future, unexpected low probability occurrence of tectonic activity leading to intrusion of water into the site, nuclear waste emplacement strategies are being developed which present multiple barriers to minimize water transport of the nuclear wastes. These barriers consist of 1) a waste form containing the nuclear wastes which is highly resistant to leaching by ground waters, 2) chemically stable canisters to contain the waste forms, 3) back filling materials surrounding the canisters which minimize transport of the nuclear wastes, and 4) careful selection 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 research 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 underway to assess the long-term stabilities of actual waste repositories and the consequences of low probability breachings 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. In order to enhance such interactions, Argonne National Laboratory has initiated a number of specialists' workshops. Each workshop focuses upon 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 held at Argonne on September 5 and 6, 1979, focussed upon 1) the dissolution mechanisms of glasses (as one possible

waste form), 2) identification of the chemical species present in solution after dissolution, and 3) determination of the interaction of these chemical species during their migration through geological strata. 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 ground water. This first meeting only considered dissolution mechanisms of glasses rather than all waste forms because 1) there is more extensive information available on glasses at this time, 2) glasses are at this time the most seriously considered waste form candidates in the United States and several European countries, and 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 management activities. A separate one-half day session was devoted to each of the three topics considered. A fourth one-half day session was devoted to the formulation of recommendations for future needed research in these areas. A summary of each formal presentation is included here as well as the recommendations made by the participants.