

## THE DEPARTMENT OF ENERGY PERFORMANCE ASSESSMENT TASK TEAM

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### ABSTRACT

Activities of the Performance Assessment Task Team are presented. The Team was established by the U.S. Department of Energy-Headquarters (DOE-HQ) to integrate the activities of the sites that are preparing performance assessments (PA) for low-level waste disposal facilities. Members are included from the six U.S. Department of Energy (DOE) sites that are currently disposing of waste, as well as representatives from DOE-HQ, the DOE Peer Review Panel, and the U.S. Nuclear Regulatory Commission. The purpose is to recommend policy and guidance to DOE-HQ on issues that impact the PAs, including release scenarios and parameters. The intent is to make the methods as consistent as is reasonable across the DOE complex, while allowing for site-specific and facility-specific differences. The Team has reached agreement on specific recommendations for several issues, ranging from the use of passive controls to requirements for software testing and control. Discussion continues on the more complex issues, ranging from the simulation time used in the PA to methods for considering intruder protection. Initial comparisons of results from intruder scenarios showed several orders of magnitude variation. However, substantial agreement was achieved for common inputs after a detailed examination of codes and parameters revealed the reasons for differences.

### INTRODUCTION

A Performance Assessment Task Team has been established by the U.S. Department of Energy-Headquarters (DOE-HQ) to integrate the activities of the sites that are preparing performance assessments for the disposal of new low-level waste (LLW), as required by Chapter III of DOE Order 5820.2A (1). The intent is to achieve a degree of consistency among these performance assessments (PA) as the analyses proceed at the disposal sites. The purpose is to recommend policy and guidance to DOE-HQ on issues that impact the PAs, including release scenarios and parameters, so that the results are as consistent as possible across the DOE complex.

Compliance with the performance objectives in Section 3.a. of Chapter III (1) requires demonstration through a performance assessment, as specified in Section 3.b. The six sites actively involved in disposal of new LLW are currently in various stages of conducting these assessments. However, the release scenarios and parameters in use are not necessarily the same, so there are inconsistencies in the results. In addition, site experts and others have felt the need for a forum to meet and discuss mutual problems and approaches, and a survey (2) of 5820.2A compliance confirmed the need. Thus, DOE-HQ requested formation of the Team, consisting of representatives from disposal sites, DOE-HQ, and a liaison from the U.S. Nuclear Regulatory Commission (NRC). The Team is to develop and recommend policy and supporting rationale in order to make the PAs as consistent as possible, recognizing that some aspects will need to be specific to individual sites and disposal system designs.

The scope of the PA guidance to be provided by the Team includes radiological performance assessments for the disposal of low-level radioactive waste that has not been disposed of prior to the issuance of the DOE Order (1) on September 26, 1988. The objective is to produce consensus policy and rationale for radiological PAs to be used in evaluating compliance with the performance objectives in DOE Order 5820.2A, Chapter III. If the work identifies revisions needed to the Order, these revisions are to be proposed. Initial guidance from DOE-HQ stated that "The purpose of the task team

is to raise and propose resolution to issues that impact the radiological performance assessments and ultimately recommend policy and guidance to DOE-HQ." The intent is to make these PAs as uniform as possible, consistent with site-specific and facility-specific differences. Some of the needs recognized are to ensure a consistent level of protection; to provide credibility of the analyses; to ensure documentation of bases for assumptions, parameters, and release scenarios; to provide a basis for development of facility-specific acceptance criteria (with justification for any site-specific differences); and to avoid having criteria at some sites unnecessarily impacted by assumptions at other sites. The wide variety of sites and disposal systems will need to be considered because the DOE Order requires development of site-specific acceptance criteria rather than development of a DOE system-wide classification system.

The Team identified a number of issues where recommendations were needed. It was recognized that waste managers designed their facilities to match specific waste streams, taking into account the different isolation capabilities of their individual sites. Thus, it was not considered reasonable to require standardization of the PAs or facility designs. Instead, the recommendations deal with certain aspects of meeting common performance objectives and dose limits. For some issues, the Team has reached consensus, and the recommendations for these closed issues are summarized below. Others are still under consideration, and these are listed. In addition, members compared scenarios in use at the various sites, found inconsistencies, and developed benchmark scenarios and data for use by site analysts in comparing methods.

It is expected that the recommendations will be reviewed by the Peer Review Panel, DOE-HQ and Field Offices, and contractors before implementation. The work may also be used as part of a future effort, now under consideration, to revise DOE Order 5820.2A.

### ISSUES AND RECOMMENDATIONS

A number of issues have been developed to the point of consensus on recommendations, which may be in the form of changes or added material to sections of the Order, guidance on interpretation, or new requirements, as appropriate. These

recommendations are summarized here, followed by a list of open issues.

### **Reasonable Assurance**

The degree of confidence with which the performance objectives in Order 5820.2A must be met is unclear. The objectives state "assure that" the limits will not be exceeded, but the degree of assurance required is not specified. The Team recommended that the objectives be reworded to state: "Disposal systems shall be designed, operated, closed, and controlled after closure such that there is reasonable assurance that exposure to individuals will not exceed . . ." The intended meaning is similar to that of the NRC in 10 CFR 60 (3). Determination of reasonable assurance is expected to be made by the Peer Review Panel and other reviewers.

### **Passive Controls**

The current statement of the dose objective in Section III.3.a. of DOE Order 5820.2A is silent on the issue of passive controls, leaving site analysts uncertain about the degree to which such controls should be incorporated. It was recommended that language be added to state: "it is intended that disposal systems shall be designed to provide reasonable assurance that the potential dose to individuals who may inadvertently intrude into the facility after the active institutional control period (taken to be 100 years after closure) will not exceed 500 mrem for a single exposure or 100 mrem per year for exposure continuing over several years. Passive controls (e.g., physical barriers, markers, long-term government ownership and control) may be incorporated into the design to provide reasonable assurance that the performance objectives will be met. The time of effectiveness of passive controls must be specified, and shall be justified."

### **Special-Case Waste**

The usual definition of Special-Case Waste is: "those wastes which have limited or no planned disposal alternatives." This includes noncertifiable defense transuranic (TRU) waste, nondefense TRU waste, fuel and fuel debris, sealed sources, DOE-titled (held by licensees) excess nuclear materials, and PA-limited wastes. Although most of these are limited by policy, the latter category is the one addressed by the Team because PA can provide some guidance for disposal requirements. The Team recommended that each disposal site develop specific limits on radionuclide concentrations or amounts for LLW through performance assessments specific to the site and disposal system. For wastes exceeding such limits, new facilities with a greater degree of isolation could be designed to accept such waste at the same site or at another DOE site.

### **Software Testing and Control**

The level of testing and control for software used in PAs needs to be specified, with emphasis on the importance of using site-specific data to demonstrate the ability of a code to model performance of a specific site. The Team recommended a combination of verification and benchmark testing to build confidence in the ability of a code to simulate behavior of a site-specific disposal system. Where appropriate, calibration exercises should be performed, and existing plumes should be used for testing. Other requirements include (1) a software analysis of the programming, (2) use of input data

that addresses conditions representative of the site to be modeled, (3) exercising of all options to be executed for the proposed application, (4) a record of tested and untested options, (5) documentation and control through the use of a software management program, and (6) independent peer review of the process and results.

### **Data Quality**

Data quality needs to be established by ensuring that there is sufficient documentation of the data to provide auditability and traceability. It was recommended that the PA data base should be documented in a manner that will allow evaluation of representativeness, accuracy, precision, and range of applicability, and a review process should be provided. Data files for computer codes should be permanently archived on electronic storage media.

### **Site-Specific Groundwater Codes**

It is not currently possible to find a single set of codes that have been demonstrated to be scientifically valid and applicable to the diverse hydrogeologic setting of all the DOE facilities. Thus, it was recommended that groundwater flow and transport codes should be selected on the basis of their applicability to the hydrogeologic setting of the waste site, with a reasonable degree of standardization of codes at a given site. The selected codes should be well documented (theory document and user's manual), maintained under a structured software quality assurance and configuration control program, verified and benchmarked to the site, and demonstrated to be applicable by comparison of results with field data.

### **Apportionment of Dose Objectives**

Some sites may have the potential for releases to groundwater or other pathways from more than one facility, and it might be possible for plumes resulting from such releases to overlap. It was recommended that if there was a potential for future exposures from two or more LLW facilities to overlap, the PA should consider the combined impacts and present data for the combined exposure at the point and time of maximum impact for comparison with dose limits. The predictions should consider the times at which exposures might occur, so that impacts would be combined at the specific times predicted, rather than simply adding peak impacts from different times. Alternatively, the dose limits may be partitioned with a fraction allowed to each potential facility.

### **Point of Compliance**

It was recommended that the point of compliance for the groundwater pathway should be set at a well at the point of maximum individual exposure outside of a buffer zone of no more than 100 meters beyond the disposal facility. For pathways other than groundwater, consideration is being given to allowing a point of compliance up to the overall site boundary during the period when active controls are maintained (up to 100 years after disposal).

### **Groundwater Dose Objective and Compliance**

The performance objectives in DOE Order 5820.2A specify protection of current sources of drinking water, but defer to other federal and state standards for groundwater protection. The Environmental Protection Agency (EPA) is considering a requirement to protect groundwater as a future

resource. In addition, the EPA has proposed maximum contaminant levels (MCL) based on 4 mrem/yr effective dose equivalent for beta-gamma emitters, with specific concentration limits for alpha-emitters (4). However, it is not clear how compliance is to be demonstrated in terms of modeling of lateral and vertical dispersion, potential pumping rate and well size, or well completion and use practices that may define the effective source volume at the point of use of the groundwater. The Team recommended that if no specific standards for groundwater are in effect at a given site, analysts should use MCLs, based on the Proposed Rule, as benchmarks for comparisons with modeling predictions to demonstrate protection of groundwater as a resource. Protection is defined in terms of the concentrations at the wellhead (or surface discharge zone, if applicable) for the appropriate drinking water or irrigation uses that may be appropriate to the area and aquifer. Area-specific aquifer parameters, water use practices (well size, usage rate, irrigation practices), and well-completion practices (screen depth and other appropriate parameters) may be used to define the effective source volume.

#### **Long-Term Changes and Effects**

Long-term changes, such as climate change, ice ages, volcanism, earthquakes, erosion, and others, may impact the performance of the disposal system. The Team recommended that each site PA should consider the effects of expected long-term changes to the degree that such changes may significantly impact the isolation capability of their disposal systems within the time period that the waste remains hazardous. Events and processes with small impact and probability should be omitted. Generally, a qualitative discussion will suffice.

#### **Open Issues**

Several other issues are under consideration and have received varying degrees of study and discussion. These include concentration averaging, time for compliance, intruder protection and use of dose objective, scenario development and application, source term, and waste characterization.

#### **BENCHMARKING SCENARIOS**

One of the early recommendations of the Team was to use site-specific scenarios and data for the PA at each site. However, it is also necessary to determine that the methods are consistent to the degree that they give the same answer when applied to the same problem with the same input data. An

early comparison of results from intruder scenarios revealed orders of magnitude differences due to use of different scenarios and input data. A Subteam was established to define a set of benchmark scenarios that analysts could use for comparison with their own methods and data. The effort was successful in achieving substantial agreement among the methods, and the results are reported in another paper at this conference (5).

#### **CONCLUSIONS**

The Team considered a number of issues relevant to PAs and reached consensus on recommendations for most of these issues. Work will continue to address the remaining issues and to identify other problems needing attention.

One of the objectives of the Team was to provide a forum for discussion of mutual problems and concerns, and this has certainly been a useful result. In addition, a major benefit has been the increased understanding among the members of the problems and issues at other sites. Interactions between members have also led to greater consistency in the site PAs. Coordination with similar programs at the NRC and other organizations will be maintained to improve consistency and understanding among these groups.

#### **REFERENCES**

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5. R. R. SEITZ, J. R. COOK, M. I. WOOD, P. D. RITTMAN, D. E. WOOD, and B. A. NAPIER, "Comparison of Computer Codes and Approaches Used at DOE Sites to Model Intrusion Scenarios," these Proceedings (March 1992).