

CHP/A4171 MEMO 8904

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FEB 08 1989

MEMORANDUM FOR: Jesse L. Funches, Director  
 Program Management, Policy Development and  
 Analysis Staff, PMDA

FROM: Joseph O. Bunting, Chief  
 Engineering Branch  
 Division of High-Level Waste Management, NMSS

SUBJECT: FIN A4171-9, "EVALUATION AND COMPILATION OF DOE WASTE  
 PACKAGE TEST DATA"

We have reviewed a revised proposal (copy enclosed) from the National Institute of Standards and Technology (NIST) in response to our SOW for FIN A4171-9 dated November 9, 1988. The SOW was approved by the SCRB on December 19, 1988.

We find their proposal acceptable. Please provide the balance of the funding approved for this agreement in the amount of \$262,000 to cover operations for the second half of FY89.

Also enclosed is the completed form, "Evaluation of DOE Lab Proposals". If you have any questions, please contact either me (x23394) or Chuck Peterson (x20531).

Original Signed By

Joseph O. Bunting, Chief  
 Engineering Branch  
 Division of High-Level Waste  
 Management, NMSS

Enclosures: 2,  
 As Stated

DISTRIBUTION w/o Enclosures

|                   |                 |                 |                 |
|-------------------|-----------------|-----------------|-----------------|
| Central Files     | NMSS R/F        | HLEN R/F        | RBrowning, HLWM |
| JYoungblood, HLWM | JBunting, HLEN  | RBallard, HLGP  | JLinehan, HLPM  |
| RWeller, HLEN     | PAItomare, HLEN | CPeterson, HLEN | EDavis, PMDA    |
| MSilberberg, RES  |                 |                 |                 |

CONCURRENCES

|      |            |                 |                  |   |   |   |   |
|------|------------|-----------------|------------------|---|---|---|---|
| OFC  | :HLEN      | <i>UP</i> :HLEN | <i>RAW</i> :HLEN | : | : | : | : |
| NAME | :CPeterson | :RWeller        | :JBunting        | : | : | : | : |
| DATE | :89/02/08  | :89/02/08       | :89/02/08        | : | : | : | : |

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EVALUATION OF DOE LAB PROPOSALS

REVIEW TECHNICAL SUBSTANCE

1. Does the technical proposal meet the exact requirements stated in the Statement of Work and is the work proposed consistent with NMSS program needs?

Yes

2. How are the work methods suggested in the proposal appropriate to meeting the requirements of the SOW?

Not explicitly given; work is basically continuation of previous efforts which have been appropriate

3. Does the proposal adequately discuss anticipated difficulties and problem areas as well as recommended resolutions?

No new difficulties are anticipated.

4. Are the proper technical personnel assigned with sufficient labor hours to adequately perform the work outlined in the SOW?

Yes

5. Are the schedules and reporting requirements stated in the proposal reasonable and consistent with requirements of the SOW?

Yes

REVIEW COSTS

1. Do proposed costs appear reasonable in all categories? Is the basis for the estimated hours broken down by category and task, unit cost and sources of costs?

Yes. Breakdowns are given; unit cost not applicable.

2. Are the personnel proposed appropriate to carrying out the tasks outlined in the SOW?

Yes (repeats part of Question 4)

3. Is the total number of labor hours proposed reasonable with respect to the requirements of the SOW?

Yes

4. Are the travel estimates proposed reasonable with respect to the requirements of the SOW?

None specifically allocated at this time

5. Are the estimates of subcontractors/consultants efforts reasonable?

Yes

REVIEW FOR COMPLETENESS

1. Is the administrative information contained in the proposal correct?

Yes

2. Are the staff efforts and cost sections complete?

Yes

3. Are task schedules complete?

Yes

4. Is the proposal responsive to all the requirements of the SOW? Are there any omissions or deficiencies which conflict with our program needs or the SOW?

Yes, no omissions or deficiencies

I certify that the proposal is acceptable

Charles Peterson  
Project Manager

30 January 1989  
Date

I certify that proposal is not acceptable (with explanation)

\_\_\_\_\_  
Project Manager

\_\_\_\_\_  
Date



UNITED STATES DEPARTMENT OF COMMERCE  
National Institute of Standards and Technology  
[formerly National Bureau of Standards]  
Gaithersburg, Maryland 20899

January 13, 1989

Office of the Director  
Attn: (PMPDAS)  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Dear Sir:

Enclosed are five copies of a proposal to the Nuclear Regulatory Commission entitled "Evaluation and Compilation of DOE Waste Package Test Data" FIN A-4171-9, which are submitted for your review and approval. The proposal is being submitted in response to a request from NRC made on December 22, 1988.

This proposal has been prepared in accordance with the Statement of Work attached to the aforementioned letter. If there are any questions regarding this document, please contact Dr. C. G. Interrante, Program Manager, 975-6018, or Dr. D. B. Anderson, Acting Group Leader of the Corrosion Group, 975-6026, Metallurgy Division, National Bureau of Standards, Gaithersburg, MD 20899.

Sincerely

E. N. Pugh, Chief  
Metallurgy Division

5 Enclosures

*revised*

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PROPOSAL

Evaluation and Compilation of DOE Waste Package Test Data

Submitted to:

Program Support Branch  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

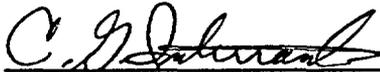
(NRC Contract No. FIN A-4171-9)

By

Corrosion Group  
Metallurgy Division  
Materials Science and Engineering Laboratory  
National Institute for Standards and Technology  
Gaithersburg, MD 20899

Funding Requested: \$524,000

Period Covered: October 1, 1988 to September 30, 1989



C. G. Interrante  
Program Manager



D. B. Anderson, Acting Group Leader  
Corrosion Group



E. N. Pugh, Chief  
Metallurgy Division



L. H. Schwartz, Director  
Materials Science and  
Engineering Laboratory

Proposed budget for work by the Corrosion Group, Metallurgy Division, Materials Science and Engineering Laboratory, National Institute for Standards and Technology (NIST), on a program titled Evaluation and Compilation of DOE Waste Package Test Data, Nuclear Regulatory Commission (NRC) Contract No. FIN A-4171-9, for the period October 1, 1988 to September 30, 1989, as outlined in attached proposal.

Funding Requested: \$524,000

The activity covered by this proposal and work statement consists of work on the Evaluation and Compilation of DOE Waste Package Test Data. As such it complies with OMB Circular A-76, revised under paragraph 5F -- "Activities classified as Government responsibilities or are intimately related to the public interest".

Program Title: Evaluation and Compilation of DOE Waste Package Test Data (NRC FIN A-4171-9)

PROGRAM DESCRIPTION  
FOR  
EVALUATION AND COMPILATION OF DOE WASTE PACKAGE TEST DATA

1.0 BACKGROUND

The technical responsibilities of the DOE and the NRC in achieving the goal of an acceptable engineered barrier system for the disposal of high-level waste (HLW) are defined as follows:

The DOE has the responsibility to design, develop, manufacture, test and demonstrate a waste package and an engineered barrier system (EBS) that meet NRC requirements.

The NRC has the responsibility to advise the DOE of the type of information needed from tests and analyses to determine whether the proposed EBS components meet the performance objectives and design requirements of 10 CFR Part 60. Those rules which affect the waste package include:

|                         |   |
|-------------------------|---|
| 60.11a(6), (7), and (8) | Site Characterization Report                      |
| 60.111, 60.112, 60.113  | Performance Objectives                            |
| 60.135                  | Criteria for the Waste Package and its Components |
| 60.137, 60.140          | Performance Confirmation                          |
| 60.142                  | Design Testing                                    |
| 60.143                  | Monitoring and Testing of Waste Packages          |
| 60.150, 60.151          | Quality Assurance                                 |

To fulfill its responsibility, the NRC must support research and technical investigations in various areas:

- (1) The development of understanding of the actions and interactions of materials and agents under repository conditions as they relate to possible failure modes for materials being considered. This would include understanding the rate controlling steps for processes that can lead to failure of anticipated containment barriers or understanding of processes that can affect the rates of radionuclide releases from the EBS after breach of containment.
- (2) The identification of the design parameters and repository conditions that must be controlled or accounted for to avoid premature failure of specific waste package/repository designs.

- (3) Determinations of the limitations of analytical and testing techniques, which could be used to predict the performance of any proposed EBS, such as
  - (a) Analytical sensitivities of the measurements of chemical, physical, and nuclear properties of material test samples, leachants and corrosive agents.
  - (b) Validity and reliability of predictive equations used to extrapolate short-term data to long-term performance for leaching, corrosion, sorption, transport and other phenomena pertinent to demonstrating compliance with performance criteria and waste-package design requirements.
  - (c) Scaling of non-prototype tests to repository field conditions.
  - (d) Verification of analytical procedures for integrating single component test data to whole system performance and applicability of test procedures used for evaluating individual engineered barriers and multi-component barrier systems.

On the basis of the understandings achieved and the determinations made in the areas above, NRC will define its information needs via staff technical positions and periodic letters to the DOE.

#### DEVELOPMENT OF UNDERSTANDING

The development of understanding of performance-related phenomena associated with the waste packages will be achieved through projects described in Technical Assistance and Research contracts. These projects will address three general areas: (1) waste-package container integrity, (2) waste form integrity, and (3) characterization of potential radionuclide releases from the waste packages. Retention of waste-package container integrity for 300 to 1000 years after permanent closure of the repository, or for such other period as may be approved or specified by the NRC, is the most apparent way of complying with the performance objective of containment. To make a finding on this performance objective, the NRC must understand the processes by which containers are likely to fail. To reach a finding on the controlled release of radionuclides for any time after the containment period, NRC must also understand the processes by which radionuclides are released from the waste form and transported out of the waste packages. Progress toward achieving this understanding has been provided through four research contracts:

BCL: FIN B6764, "Long Term Performance of Waste Package Materials" --

provided development of an understanding of the uncertainties in actual or anticipated DOE claims concerning waste-package failure

and for analyses of potential errors in DOE contractor test procedures. Particular emphasis was placed on engineering alloys.

BNL: FIN A3269, "Pitting Corrosion" --

provided an understanding of corrosion pit growth kinetics and an ability to judge DOE projections of corrosion pit growth.

NBS: FIN D1146, "Statistics of Waste Package Failure" --

provided an understanding of the statistical problems underlying failure by localized corrosion and an ability to judge the probabilistic issues involved in the prediction of waste-package failure.

Manufacturing Science Corporation: FIN B7278, "Research on the Effect of Manufacturing Processes on Material Properties Affecting Failure Mechanisms in High-Level Waste Containers" --

provided an analysis of the sensitivity to changes in metallurgical characteristics due to the manufacturing and welding technologies expected to be used by DOE in producing waste containers.

#### APPLICATIONS

The HLW regulatory program was supported in part through the BNL contract "Development of Nuclear Waste Package Criteria" (FIN A3158), which described reasonably achievable waste packages that would comply with 10 CFR Part 60. FIN A3158 provided materials guidance to the NRC and the DOE through a task that assessed the DOE technical program and identified unresolved technical issues that required further NRC or DOE attention. FIN A3158 was completed in FY81, but this review and assessment activity continued under FIN A3164 and FIN A3167. Under FIN A3168, BNL assisted the NRC Staff in the development of draft staff technical positions (DSTPs) to provide guidance to DOE for achieving compliance with 10 CFR Part 60.

An Aerospace Corporation contract, "Preparation of Engineering Analyses for HLW Packages in Geologic Repositories", (FIN A4165) evaluated analytical methodologies for assessment of waste-package performance. This work is expected to continue at the Center for Nuclear Waste Regulatory Analyses (CNWRA).

One of the objectives of this project is to utilize reviews and assessments of results from NRC sponsored projects at various laboratories. Projects discussed in the "Development of Understanding" section above and in this "Applications" section supply understanding and identify information and data needs on container failure processes, waste

package materials and waste stability. Other projects sponsored by the NRC, which generated information that can be used in the performance of the work described in Section 2.0 of this proposal, are listed below:

LBL: FIN B3040, "Geochemistry Assessment of Waste Isolation" --

identified geochemical variables, processes and mechanisms that affect the performance of the canisters, overpack, and backfill.

ORNL: FIN B0287, "Technical Assistance in Geochemistry" --

reviewed the geochemical data related to DOE's candidate sites for repositories, and compiled and evaluated site specific geochemical data needed to quantify radionuclide migration and characterize the chemical environment important in determining waste-package performance.

ORNL: FIN B0290, "Laboratory Evaluation of DOE Radionuclide Solubility Data and Selected Retardation Parameters, Experimental Strategies, Laboratory Techniques and Procedures" --

examined the reproducibility of the geochemical data being generated by the same DOE program. This was done by conducting selected routine laboratory and/or field measurements and tests to determine the accuracy of the techniques used by DOE. The information is useful in the evaluation of uncertainties in the data.

ORNL: FIN B0288, "Effect of Repository Environment on the Performance of High-Level Waste Packages" --

applied the results of FINs B0287 and B0290 to identify pertinent chemical variables and their ranges (e.g., pH and Eh as well as ionic and colloidal species concentrations) needed to accomplish waste-package failure mode analyses. This information was used in the specification of the methodology/models for determining the repository environment which the waste package must withstand.

## 2.0 WORK REQUIRED

This agreement between the NIST and the NRC involves reviews and assessments of DOE's waste-package development activities, and includes compilation and assessment of DOE's existing and planned data base. It also includes identification of the types of tests that will yield additional data needed to demonstrate that the DOE waste-package designs will meet the performance objectives of 10 CFR Part 60.

The scope of this activity has been reduced by the elimination of the Basalt Repository Project and the Salt Repository Project. It now involves review of waste-package designs for only the Tuff Repository Project. In addition, it involves vitrification of high-level waste (HLW) under the West Valley Demonstration Project, vitrification of defense HLW

at the Savannah River Plant's (SRP) Defense Waste Processing Facility (DWPF), and certain related work as described herein. Another major change that affects the scope of the NIST activity was the establishment on 15 October 1987 of the Center for Nuclear Waste Regulatory Analyses (CNWRA) as an FFRDC under OMB/OFPP Policy Letter 84-1. Thus, coordination of the activities of the CNWRA with those of this proposal will be necessary, as discussed in Section 3 below.

#### TASK 1 Review of Waste Package Data Base

The National Institute of Standards and Technology (NIST) shall review the available documents in DOE's existing and planned data base. After reviewing the available data, the NIST shall identify the most pertinent documents and evaluate them for

- (a) The accuracy, reliability and applicability of the data.
- (b) The technical approach.
- (c) The conclusions drawn.
- (d) The significance of the data regarding resolution of waste-package issues.

The objective goes beyond merely identifying and cataloguing documents. It is to perform critical in-depth studies of technical documents to (1) identify the ultimate technical information on which the NRC may base licensing decisions and (2) to determine how well understood are phenomena of materials degradation under service conditions.

The NIST shall document its findings from the critique of each data set in a format agreed to by the NRC. An example of the current format is provided as Enclosure 1. The most important sections of these reviews are the conclusions found and the in-depth critique. The aim is to make available to a user of the database the findings of each investigation. The reviews are not intended to present detailed data but to permit a user to select for his purposes documents containing definitive data and information.

After Waste Package Data Reviews have been reviewed by the editorial review board of the NIST, they shall be considered to be complete and shall be entered into the extant NIST/NRC high-level waste database and made available to the NRC, its contractors, and others. In addition, a current copy of all completed reviews shall be transmitted quarterly to NRC using suitable magnetic media agreed upon by the NIST and the NRC. Hard copies, of the Data Reviews shall be included in reports: Draft reviews shall be included in monthly and draft semi-annual reports, and completed reviews shall be presented in the final semi-annual reports.

The above portion of Task 1 can be considered to be reactive, i.e., driven by DOE's schedule. The following portion is intended as pro-active work to permit the NRC to reach necessary technical understandings prior to license submittal. These understandings are needed resources for preparation of Standard Review Plan for use in review of DOE License Applications.

For FY89, the NIST shall concentrate on documents dealing with specific degradation phenomena, such as stress corrosion cracking, sensitization, passivation, pitting corrosion, and the like. The NIST shall use information from documents received directly from NNWSI, from available databases, and from that in the NIST/NRC HLW database to prepare papers which in effect are summary statements of the technical understandings of these phenomena. It is recognized that the initial versions of these papers will probably not be sufficiently comprehensive to be considered as state of the art papers but, as resources permit, they shall be updated to approach that status. Generic questions that should be answered by these papers include:

1. Under what conditions do these phenomena occur for the materials of interest? Correspondingly, are there conditions under which these phenomena have never been observed?
2. Are these conditions likely to occur in the NNWSI site as the result of either anticipated or unanticipated events?
3. What is the status of predictive models of these phenomena?

Under this proposal, the NIST shall propose work on three selected topics of the types mentioned above in technical areas that the NIST considers central to the task of predicting long-term performance of waste-package materials.

The level of effort shall not exceed 250K dollars in any fiscal year unless approved in advance by the NMSS Project Manager. The total fiscal year cost for the project shall remain unchanged, and direction shall be within the Project Manager's authority specified in Section 10.0.

**TASK 2 Identification of Additional Data Required and Identification of Tests to Generate the Data**

On the basis of the reviews made under Task 1, the NIST shall identify specific technical questions, with respect to performance of the waste packages in a repository environment, that appear to be insufficiently investigated from a regulatory point of view. The NIST shall identify (1) any additional data, which in its judgement are needed to demonstrate that the DOE waste-package designs will meet the performance objectives of 10 CFR Part 60, and (2) the types of verification tests that could generate the needed information. The results of the following previous efforts shall be taken into account: The materials research and modeling effort made at BCL (FIN B6764, Long Term Performance of Waste Package Materials), and the effort at ORNL (FIN B0288, Effect of Repository Environment on Performance of Waste Package/Engineered System Components) to identify additional data base requirements. The NIST shall then, if requested, prioritize the needed tests and report these to the NRC for its consideration.

To the extent that the DOE is not known to be conducting work in these areas, the NIST shall propose experimental work in these areas to be initiated under this contract in FY89. These proposals shall not be aimed at filling gaps in the DOE experimental program, but rather at developing information to permit independent confirmation of DOE conclusions and at augmenting the NRC capability for assessment of those conclusions. The proposals shall include areas that should be investigated but which may not be within the normal scope of the activities of the NIST. The experimental test program proposed under this task will be limited to that required (1) to confirm the accuracy of DOE data, (2) to assess the reasonableness of the conclusions deduced from them, and (3) to determine the feasibility of possible techniques for measurements, prediction of performance, and monitoring of waste package performance.

The tests identified should be described in meaningful detail, including suggested test parameters and a generalized procedure, since this information should provide technical support for NRC technical positions.

The NIST shall submit, at appropriate times, written proposals for any experimental tests needed to confirm the adequacy of the types of verification tests being considered above. Upon receipt of written approval by the NMSS PM, the proposed experimental testing shall be performed under Task 3.

The results of this activity shall be reported in accordance with the schedule of reports identified in Section 4.3.

The level of effort for this task shall not exceed 24K dollars in any fiscal year unless approved in advance by the NMSS Project Manager. The total fiscal year cost for the project shall remain unchanged, and direction shall be within the Project Manager's authority specified in Section 10.0.

### **TASK 3 Testing**

The NIST shall perform experimental tests proposed under Task 2 and approved by the NRC. This proposal anticipates continuation of work on three existing projects at the NIST. One is concerned with investigating the feasibility of using acoustic emission as a means of detecting and monitoring slow rates of crack propagation in metals. A second is an investigation into the role of resistivity on the transition from general to pitting corrosion. The third is aimed at better understanding of passivation of Zircaloy. Further, additional test projects identified under Task 2 will be initiated after approval of the NMSS PM.

The level of effort for this task shall not exceed 200K dollars of effort in any fiscal year unless approved in advance by the NMSS Project Manager. The total fiscal year cost for the project shall remain unchanged, and direction shall be within the Project Manager's authority specified in Section 10.0.

#### TASK 4 General Technical Assistance

The NIST shall provide general technical assistance on engineering evaluation of waste form/waste package matters as requested by the NMSS PM. Generally, the nature of such technical assistance will be to respond on relatively short notice to requests for information which would not be provided in the normal course of work. Examples of general technical assistance are (a) preparation for and participation in waste-package meetings with DOE contractors for the NNWSI site, (b) review of selected portions of waste-package performance assessment codes, (c) review of the DOE site characterization plan, (d) the NIST participation in activities related to those of ASTM Committee C26 on the Nuclear Fuel Cycle, and (e) participation in work in the area of vitrification of HLW at, for example, the Savannah River Plant and the West Valley Demonstration Project. When specific work requirements are identified, the scope, duration, reporting requirements and funding limits for individual general technical assistance tasks shall be set forth by the NMSS PM in writing.

The NIST shall become familiar with the structure of the NRC Transitional Licensing Support System (TLSS) and with that of the CNWRA to permit coordination of the NIST/NRC database with these systems and to facilitate copying of NIST/NRC HLW data into these systems.

The level of effort for this task shall not exceed 50K dollars in any fiscal year unless approved in advance by the NMSS PM. The total fiscal year cost for the project will remain unchanged, and direction will be within the Project Manager's authority specified in Section 10.0.

#### 3.0 COORDINATION WITH OTHER PROGRAMS

Tasks in this proposal have been structured to avoid duplication of efforts made by other Offices of the NRC. At the same time, this proposal seeks to utilize the accumulated expertise of the NIST in meeting the needs of the DHLWM on a timely basis.

##### 3.1 Database Construction

Semi-annual reports and other technical reports generated by the NIST shall be produced in electronic form to facilitate entry of completed reviews into both the NRC Document Control Center (TLSS) and the CNWRA (database). It is expected that copies of selected NIST documents shall be routinely sent by the NRC Document Control Center (TLSS) to the CNWRA, so that they are kept fully informed as to the progress of work at the NIST. It is noted that monthly letter status reports frequently contain draft reviews conducted by the NIST. It is understood that these draft reviews will be transmitted to this NRC contractor in hard-copy form only; draft reviews are transmitted to NRC contractors to permit their personnel an opportunity to comment on the drafts.

In structuring its database, the CNWRA has tentatively adopted all of the fields used in the NIST database. Thus, an interface has been established to permit further transfer of NIST work to the CNWRA when appropriate. Further coordination of database activities of the NIST and the CNWRA will be required during this fiscal year.

### 3.2 Experimental Work

No duplication or overlap of experimental work under this proposal relative to other NRC programs exists to our knowledge. The NIST is aware of some related projects:

The Waste Management Branch of the Office of Nuclear Regulatory Research (RES) is sponsoring research at the NIST on uncertainties in the measurement of pH, transport of water and radionuclides in tuff, natural analogs, and microbially accelerated corrosion. Failure mechanisms for DOE candidate waste-package materials will be investigated under another RES contract. Finally, the CNWRA is planning a large matrix of experiments to collect additional corrosion data.

The Materials Engineering Branch of RES has a continuing program with ANL but the focus is on problems with the primary system of BWRs. It has been noted that the environments in their studies are so different that there is little chance of duplication.

The Materials Engineering Branch, Division of Engineering and System Technology, Office of Nuclear Reactor Regulations, NRC is concerned with analysis of specific failures in field applications, but does not have technical work in the areas of interest in this proposal.

### 3.3 Coordination with the CNWRA

The NIST shall enter into discussions with the CNWRA to develop and recommend to the NRC an integrated plan for the years beyond FY89 that utilize the specialized capabilities of the NIST in a manner consistent with and supportive of the overall program of the CNWRA. Technical direction of the NIST program shall be provided by the NRC as specified in Section 10.0.

It is anticipated that sometime in FY89 CNWRA will begin its review of technical documents in the waste-package area. As the CNWRA demonstrates its capability, responsibility for some of the reviews now conducted under Task 1 may be transferred to it, so that the NIST can focus more fully on the review of documents related to the position papers that it will prepare. A responsibility of the NIST that is now being transferred to the CNWRA is the responsibility for tracking the activities of the Materials Characterization Center (MCC). Thus, after the Semi-annual Report of Volume 6, the NIST will not be the primary reviewer of the MCC activities.

The NIST shall have its representatives visit the CNWRA in San Antonio, TX, to become familiar with the facilities available and to develop a good working relationship with the CNWRA personnel. Similarly, the NIST shall schedule visits as appropriate by the CNWRA personnel for them to become familiar with the capabilities of the NIST.

#### 4.0 REPORTING AND PROJECT REVIEW REQUIREMENTS

##### 4.1 Monthly Status Reports

Every month, by the 15th of the month, the NIST shall submit one copy of a brief status report which summarizes (1) the work performed; (2) significant findings and conclusions; and (3) personnel time and cost expenditures. Costs shall be presented as a one line summary showing direct labor hours, labor costs, overhead costs, and other costs for both the current month and for the fiscal year to date as well as the total of funds obligated and authorized, and the current balance. The summary shall also show the percent of fiscal year funds obligated to date. In addition, the NIST shall report on a timely basis costs in the level of detail shown on Schedule A. The NIST shall supply additional details of personnel costs by individual as required by the PM.

##### 4.2 Draft and Final Technical Reports

All draft and final technical reports delivered under this agreement must satisfy the quality assurance requirements discussed in Section 7.0 of this proposal. Final reports called for by this SOW shall be presented in draft form to the NRC for review. The NRC shall provide comments within 30 days after receipt of each draft report. These comments shall be reflected in the final reports.

##### 4.3 Deliverable Products

The deliverable products will consist of formal reports and Data Review Sheets as listed in Schedule B. The formal reports shall be issued semiannually and shall cover the work performed under Tasks 1 and 2. The reports will provide an overview assessment of the state-of-knowledge of the properties and predicted performance of waste- package components as evidenced by the developing data base. Semi-annual reports shall include any Data Review Sheets (see Enclosure 1) not previously published. The Data Records will be furnished as duplicated copies of magnetic media on which the completed Data Reviews have been entered; these records shall be submitted quarterly. The results of tests conducted under Task 3 will be reported separately, as final reports for each project; at the discretion of the principal investigators, an interim report(s) may be issued. Deliverables for FY90 are shown solely for planning purposes.

**SCHEDULE A**  
**Cost Report for (Month, Year)**

|  | Current Expense | Cumulative Expense, YTD |
|--|-----------------|-------------------------|
| 1. Direct Labor                        |                 |                         |
| Sponsoring Division                    |                 |                         |
| Professional                           |                 |                         |
| Technical Support                      |                 |                         |
| Other Divisions                        |                 |                         |
| 2. Project Management & Administration |                 |                         |
| 3. Benefits                            |                 |                         |
| 4. Overhead                            |                 |                         |
| 5. Other Costs                         |                 |                         |
| 5.1 Sci/Tech Services                  |                 |                         |
| 5.2 Supplies                           |                 |                         |
| 5.3 Equipment                          |                 |                         |
| 5.4 Travel                             |                 |                         |
| 5.5 Personnel Expense                  |                 |                         |
| 5.6 Other                              |                 |                         |
| Totals                                 |                 |                         |

Notes

1. Direct Labor is Base Rate plus any Leave Surcharge. Project Management and Administration includes supervision, project planning, and personnel and departmental administration.
2. Overhead includes charges distributed on the basis of direct labor.
3. Sci/Tech Services is the total cost of scientific and technical services.
4. Supplies is the sum of direct purchase and storeroom issues.
5. Equipment is the sum of ADP and other equipment.
6. Travel is the sum of per diem, common carrier, mileage allowances, and other travel expenses.
7. Personnel Expense is the sum of transportation and storage charges for personnel moves, training (tuition and fees), and awards.
8. Other is the sum of all other items on the CSS. If any item in this group is more than 5% of the total monthly expense, identify such item.

SCHEDULE B. DELIVERABLES

| <u>DELIVERABLE PRODUCTS</u> | <u>TASK UNDER WHICH WORK IS DONE</u> | <u>DRAFT REPORT (FOR NRC COMMENT)</u> | <u>DATA RECORDS AND FINAL REPORT*</u> |
|-----------------------------|--------------------------------------|---------------------------------------|---------------------------------------|
| 1. Semi-annual Rpt.         | 1, 2, 3                              | Jan. 30, 1989                         | Mar. 31, 1989                         |
| 2. Semi-annual Rpt.         | 1, 2, 3                              | Jun. 30, 1989                         | Sep. 29, 1989                         |
| 3. Semi-annual Rpt.         | 1, 2, 3                              | Dec. 29, 1989                         | Mar. 30, 1990                         |
| 4. Semi-annual Rpt.         | 1, 2, 3                              | Jun. 29, 1990                         | Sep. 28, 1990                         |
| 5. Data Records             | 1                                    |                                       | Dec. 30, 1988                         |
| 6. Data Records             | 1                                    |                                       | Mar. 31, 1989                         |
| 7. Data Records             | 1                                    |                                       | Jun. 30, 1989                         |
| 8. Data Records             | 1                                    |                                       | Sep. 29, 1989                         |
| 9. Data Records             | 1                                    |                                       | Dec. 29, 1989                         |
| 10. Data Records            | 1                                    |                                       | Mar. 30, 1990                         |
| 11. Data Records            | 1                                    |                                       | Jun. 29, 1990                         |
| 12. Data Records            | 1                                    |                                       | Sep. 28, 1990                         |
| 13. Formal Reports          | 1, 2, 3                              | Mar. 31, 1989                         | Jun. 30, 1989                         |
| 14. Formal Reports          | 1, 2, 3                              | Mar. 30, 1990                         | Jun. 29, 1990                         |

\*Camera-ready copy

#### 4.4 Report Distribution

The following summarizes the required report distribution under this agreement. The NMSS PM shall provide the NIST with current NRC mailing addresses for this distribution.

#### SCHEDULE C. REPORT DISTRIBUTION

| <u>Distribution</u>          | <u>Monthly Ltr Status Reports</u> | <u>Meetings, Workshops, &amp; Trip Rpts</u> | <u>Draft Report</u> | <u>Final Rpt</u> | <u>Final Fiche*</u> |
|------------------------------|-----------------------------------|---|---------------------|------------------|---------------------|
| Docket Control Center (TLSS) | 1                                 | 1   | 1                   | 1**              | 0                   |
| NMSS PM                      | 0                                 | 0   | 0                   | 0                | 1                   |

\*Refer to Enclosure 2, Microfiche Specifications. If required, delivery of microfiche copies will lag other copies by about three weeks.

\*\*Camera-ready copy

#### 4.5 Submission of Documents to NRC Public Document Room

All NMSS technical high-level waste project documents will be transmitted to the NRC Public Document Room (PDR) and appropriate Local Public Document Rooms (LPDR's) by the Division of Waste Management. All administrative documents, e.g., financial reports should be submitted separately from technical reports. Proprietary documents shall be properly identified by the NIST in accordance with 10 CFR Part 2.790, Availability of Official Records, and shall not be submitted to the PDR's.

#### 5.0 PROGRAM REVIEW, MEETING AND TRAVEL

##### 5.1 Quarterly Program Reviews

The NIST shall provide quarterly program reviews beginning December 15, 1988. These reviews will evaluate progress made in the previous months and reaffirm and lay out work for the remaining periods of the contract. The NMSS PM shall advise the NIST on areas of emphasis and/or modification to the original work plan submitted by the NIST. These reviews may be waived at the discretion of the PM if there has been sufficient communication between NIST and the NRC on the status of the work.

## 5.2 Meetings

In addition, the NIST shall provide for up to four visits to DOE sites and to White Flint to attend NRC/DOE meetings and program review meetings with other NRC contractors.

## 5.3 Travel

5.3.1 The NMSS PM will be notified prior to all travel performed under this proposal. All foreign travel requires identification and approval per NRC Manual Chapter 1501.

5.3.2 All travel associated with this proposal shall result in trip reports, which may be issued separately or as part of the next monthly progress letter. Copies of trip reports issued separately shall be sent to the NMSS PM within 15 days of the completion of such travel.

5.3.3 Costs expended in any fiscal year for travel associated with this proposal shall not exceed 2% of the total funding authorized in the respective fiscal year unless specific additional amounts within the total authorized are approved by the NMSS PM in advance of their expenditure. Travel costs covered by this provision shall include costs for transportation, lodging, meals, registrations and communication resulting from the travel. Upon request by the NMSS PM, the NIST shall identify travel costs expended in the fiscal year up to the date of the request.

## 6.0 NRC FURNISHED MATERIAL

NRC shall provide the NIST with pertinent reports, data, and information received from other sources which the contractor identifies as beneficial to its understanding of the study and schedules for key NRC and DOE actions. For example, it is the NRC's responsibility to see that the NIST is placed on distribution for other pertinent NRC contractor progress and topical reports and notice of program review meetings.

## 7.0 QUALITY ASSURANCE

7.1 Draft and Final Technical Reports — For all draft and final technical reports delivered under this agreement, the NIST shall assure that an independent review and verification of all numerical computations and mathematical equations and derivations are performed by qualified contractor personnel other than the original author(s) of the reports. If the NIST proposes to verify/check less than 100 percent of all computations and mathematical equations and derivations in the report(s), (such as might be the case when there are a large number of routine, repetitive calculations), the NIST must first obtain written approval from the NMSS PM. Computer-generated

calculations will not require verification where the computer program has already been verified but the source of the computer services must be identified. The NMSS PM has the option of auditing all documentation including project correspondence, drafts, calculations, and unrefined data.

- 7.2 Final Technical Reports — In addition, all reports, including those which do not contain numerical analyses, must be reviewed by the NIST's management and approved with two signatures, one of which is for management at a level above the program manager for the NIST.

The quality of final reports issued under FIN A-4171-9 shall be assured by means of an editorial review process. Responsibilities in this process are as follows:

Investigator/Author: Accuracy of data, adequate support for all conclusions; full disclosure and description of all significant details; maintenance of records of all experimental work, including data; safeguarding all data and records for reference in the case of future questions.

Division Chief: Technical review of all work contained in the reports for scientific/technical adequacy and reliability; certification to higher authority by signing of publication records that the technical aspects are sound.

Laboratory Director: Editorial review of the reports, directly or by delegation, to ascertain that their quality meets minimum standards, that all reasonable care has been taken to insure technical validity, and that the contents may be released for external dissemination.

NIST Editorial Review Board: Review of all manuscripts for editorial/technical excellence.

- 7.3 Revised Reports — When revisions for those reports are issued, a section must be included in the revised report to document dates, reasons and scope of all changes made since the issuance of the first approved report of the NIST.
- 7.4 Peer Review of Draft Reports — NRC has the option of appointing a Peer Group to review the draft report and make changes to the final report. The NIST may recommend candidates for the Peer Group for approval by the NMSS PM. In the occasion of dissent in the content of the final report, the dissenting party will have the option of stating its viewpoints and findings in a section of the report.

7.5 Coordination — As part of the coordination with the CNWRA, QA requirements shall be reviewed and modified as needed to satisfy prevailing QA requirements.

#### 8.0 PERIOD OF PERFORMANCE

The period of performance covered by the work specified in this proposal including preparation and submission of the final report shall be from October 1, 1988 through September 30, 1989.

#### 9.0 KEY PERSONNEL

The NIST shall submit a list of Key Personnel who are considered to be essential to the successful performance of the work proposed and shall not be replaced without the prior approval of the NMSS PM. In such event, the NIST agrees to substitute persons possessing substantially equal abilities and qualifications satisfactory to the NMSS PM.

#### 10.0 TECHNICAL DIRECTION

Charles H. Peterson (FTS 492-0531) is designated the NMSS PM for the purpose of assuring that the services required under this proposal are delivered in accordance herewith. All technical instructions to the NIST shall be issued through the NMSS PM. As used herein, technical instructions are those which provide details, suggest possible lines of inquiry, or otherwise complete the general scope of work set forth herein. Technical instructions shall not constitute new assignments of work or changes of such nature as to justify an adjustment in cost or period of performance. Direction for changes in cost or period of performance will be provided by the NIST Administrative Officer after receipt of an appropriate Standard Order for Work (NRC Form 173A) from the Office of NMSS.

If the NIST receives guidance from the NMSS PM or others that is believed to be invalid under the criteria cited above, the NIST shall immediately notify the NMSS PM. If the NMSS PM and the NIST are not able to resolve the questions within five days, the NIST shall notify the NIST's Administrative Officer.

#### 11.0 SUBCONTRACTS

The NIST shall notify the NMSS PM of potential subcontracts before inquiries are made. The NIST shall also afford NRC the opportunity to be present at initial contacts between itself and the subcontractor and to participate in the discussion of the scope of work. The NIST shall provide a brief description of work that each potential subcontractor has done for the NIST so that the NRC can review it for potential conflicts of interest. The NIST shall also forward a copy of the anticipated scope of

work and give the NRC one week advance notice of meetings between the NIST and the subcontractor. A copy of all written correspondence (including contract change, progress reports, and final reports) for the subcontracts will be forwarded to the NMSS PM.

#### 12.0 TECHNICAL PRESENTATIONS AND PUBLICATIONS

The NIST shall, prior to release by the NIST, obtain approval of the NMSS PM of final drafts of any speeches, journal articles, press release or other form of communication for information generated under this agreement. Costs for actions associated with these communications are beyond the scope of this agreement unless specifically approved by the NMSS PM.

#### 13.0 DISPOSAL OF PROPERTY

Prior to the closeout or termination of this project, a reconciled report will be developed by the NIST to record available equipment and material purchased with NRC funds. This report should be developed as soon as possible after project completion or a termination decision has been made, but not later than 60 days after the termination date. This report should be submitted to the NRC Division of Facilities and Operations Support, ADM and to the NMSS PM.

#### 14.0 NIST ACQUIRED MATERIAL

The NIST must notify the Office of Nuclear Materials Safety and Safeguards (Attn: Program Management, Policy Development and Analysis Staff) and the NMSS PM prior to acquisition of any capital, ADP, or word processing equipment.

#### 15.0 ESTIMATED LEVEL OF EFFORT

The estimated level of effort required to perform this work is 524K dollars per year for a period of 1 year.

#### 16.0 SUBCONTRACTING

In addition to paragraph 10 of the Standard Terms and Conditions, any subcontracting under this Interagency Agreement shall conform to the requirements of the Competition in Contracting Act of 1984 (CICA) as implemented in Part 6 of the Federal Acquisition Regulation (FAR), entitled Competitive Requirements. A copy of the justification for any proposed other-than-competitive subcontracting shall be provided to the NRC prior to award.

17.0 CONFLICT OF INTEREST

The Metallurgy Division of the Materials Science and Engineering Laboratory of the NIST shall not perform any work on high-level waste management or disposal for the DOE, DOE contractors, or any other sponsor in order that there be no possibility of a conflict of interest in any aspect of the work, and especially in the interpretation of results. In the event that the Metallurgy Division enlists the support of any other division of the NIST, potential conflicts of interest shall be reviewed and discussed with the PM to resolve any question of conflict of interest before initiating work with that division.

Enclosure 1

WASTE PACKAGE DATA REVIEW FORMAT

Data Source

- (a) Organization Producing Data
- (b) Citation

Date Reviewed

Purpose/Scope

Key Words

Contents

Amount of Data

Test Conditions Used in Experiments

Uncertainties in Data

Deficiencies/Limitations in the Data Base

Mechanisms and Assumptions on which Models are Based

Deficiencies/Limitations in the Theory/Models

Conclusions

Comments of Reviewer

Related HLW Reports

Applicability of Data to Licensing (Ranking; key data ( ), supporting data ( ))

- (a) Relationship to Waste Package Performance Issues Already Identified
- (b) New Licensing Issues
- (c) General Comments

Author's Abstract

**MICROFORM SPECIFICATIONS FOR  
DIVISION OF WASTE MANAGEMENT CONTRACTS**

Microfiche used for submittal purposes shall conform to the following specifications:

1. Microfiche containing source documentation shall conform to the NMA Type 1 format (ANSI/NMA MS.5) consisting of 98 frames arranged in 7 rows and 14 columns.
2. The reduction ratio shall be 24:1 for all microfiche.
3. The microfiche shall be standard 148mm x 105mm.
4. The microfiche shall be one silver-halide master and one diazo placed in individual acid free envelopes.
5. Diazo duplicates may be either blue/black or black.
6. The microfiche shall be titled in the following manner:

| FIN No.      | Title of Report | Date |
|--------------|-----------------|------|
| Contract No. |                 |      |
| NUREG/CR No. |                 |      |
| Fiche No.    |                 |      |

Fiche number refers to pagination information, e.g., 1 of 2, 2 of 2, etc.

7. Title information shall be eye readable on a clear background.
8. The submittal of microfiche containing proprietary material shall be coordinated with the Information & Records Management Branch, Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, 20555 to set format and procedures for submittal.
9. Foldouts, if any, shall be segmented and filmed in logical order.
10. The first frame shall be blank, and the second frame shall contain the resolution target (NBS 1010A).
11. Questions on microfiche specifications should be submitted in writing to:

Information & Records Management Branch, Division of Technical Information  
and Document Control, U.S. Nuclear Regulatory Commission,  
Washington, DC 20555.



PROJECT AND BUDGET PROPOSAL FOR NRC WORK

FIN-A-4171

DATE

1-13-89

PROJECT TITLE

Evaluation and Compilation of DOE Waste Package Test Data

DOE PROPOSING ORGANIZATION

Department of Commerce, National Institute of Standards and Technology

FORECAST MILESTONE CHART: Scheduled to Start —  — Completed (Shown in Quarter Year)  
 PROVIDE ESTIMATED DOLLAR COST FOR EACH TASK FOR EACH FISCAL YEAR

| TASK   |          | FY 89  |     |     |     | FY  |     |     |     | FY  |     |     |     | FY  |     |     |     |
|--|----------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|  |          | 1st    | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th |
| 1. Review of Waste Package Data Base   | SCHEDULE | △————▲ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | COST     | 250K   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2. Identification of Additional Data Required & Identification of Tests to-Generate Data | SCHEDULE | △————▲ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | COST     | 24K    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3. Testing for Verification and Development of Methods                                   | SCHEDULE | △————▲ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | COST     | 200K   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4. General Technical Assistance  | SCHEDULE | △————▲ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | COST     | 50K    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | SCHEDULE |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|  | COST     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| TOTAL ESTIMATED PROJECT COST   |          |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

PROJECT DESCRIPTION: (Provide narrative descriptions of the following topics in the order listed. Attach on plain paper to this NRC Form 189. If an item is not applicable, so state.)

1. OBJECTIVE OF PROPOSED WORK
2. SUMMARY OF PRIOR EFFORTS
3. WORK TO BE PERFORMED AND EXPECTED RESULTS
4. DESCRIPTION OF ANY FOLLOW-ON EFFORTS
5. RELATIONSHIP TO OTHER PROJECTS
6. REPORTING REQUIREMENTS AND SCHEDULE
7. SUBCONTRACTOR INFORMATION
8. LIST NEW CAPITAL EQUIPMENT REQUIRED (include all ADP equipment)
9. DESCRIBE SPECIAL FACILITIES REQUIRED
10. CONFLICT OF INTEREST INFORMATION
11. EXPECTED CLASSIFICATION OR SENSITIVITY (e.g. safeguards, proprietary, other)

SEE NRC MANUAL CHAPTER 1102 FOR ADDITIONAL INFORMATION

APPROVAL AUTHORITY-SIGNATURE

DATE

# FINANCIAL TERMS FOR NBS PROPOSALS

**PART 1** The National Bureau of Standards requires the following information to be part of the agreement or contract to perform work for other Federal agencies, private, and foreign sponsors.

1.

Correct Billing Address  
for Payment of  
Invoice by Sponsor



2A. Financial Contact for Information and Follow-up (*type or print name*)

Telephone No.

2B. Technical Contact for Information (*type or print name*)

Telephone No.

Charles Peterson

492-0531

3. The sponsor will provide an advance of funds for the entire amount specified on the agreement/contract. State amount of funding provided with this order or amendment.

\$ 524,000.

When NBS has specific statutory authority to provide goods or services to another agency and has documentary evidence of a binding agreement to do so, advances or reimbursements of funds to NBS are not subject to the limitation on the availability of the monies cited in the appropriation of the agency from which the funds are obtained.

4. Period of Performance for Which Funding is Authorized

5. Termination Date of Agreement/Contract  
(if different from No. 4)

From 10/1/88 To 9/30/89

6. For Federal Agencies Only

Appropriation Symbol:

7. NBS will furnish, if required, financial reports as soon as practical after the close of the NBS accounting month, showing total accrued costs, unliquidated obligations and the balance of funds available for agreements/contracts over \$25,000. Financial reports will be prepared quarterly on contracts \$25,000 or less. Please indicate below if reports are required and how often they are required.

YES

NO

Frequency

8. For each non-Federal agreement/contract, the following provisions will be included in accordance with Department of Commerce requirements:

a. Payment is due 30 days from the date of the invoice.

b. The remittance is to be received no later than the due date. A late charge shall be imposed for a remittance received after the due date at a rate determined by the Department of Treasury. The late charge will be calculated for each 30-day period or portion thereof until remittance has been received.

**PART 2** The National Bureau of Standards provides the following as part of the proposal:

**1. Financial Contact for NBS is the Advances and Reimbursements Unit.**

Telephone: (301) 921-2105      FTS: 8-921-2105

**2. Technical Contact for NBS (name and address below):**

Dr. Charles G. Interrante  
Metallurgy Division, 450  
Bldg. 223, Rm. B254  
National Institute of Standards and Technology  
Gaithersburg, MD 20899

Telephone No. (301) 975-6018

Organizational Unit: Corrosion Group  
Metallurgy Division, 450

**3. The amount stated for this order is the estimated cost. Final charges will be based on actual costs incurred which include directly related expenses and appropriate charges for indirect and administrative expenses (15 USC278b(e)) as determined through the NBS cost accounting system. If the legitimate costs to complete the contract run over the amount specified, you will be billed. If it appears that excess funds exist at the termination of the contract, they will be returned to you. However, excess funds may not be refunded until all unliquidated obligations have been accrued. In any case, NBS will not bill or reimburse the sponsor for any amount less than \$500 unless specifically requested.**

**4. Please send proposed contracts to:**

National Bureau of Standards  
Office of the Comptroller  
Advances and Reimbursements  
Building 101, Room A928  
Washington, DC 20234

**5. Please send Remittance to:**

National Bureau of Standards  
Office of the Comptroller  
Billing and Collections  
Building 101, Room A807  
Washington, DC 20234