

ORNL/HSSI (6953)/MLSR-2000/11

HEAVY-SECTION STEEL IRRADIATION (HSSI) PROGRAM (W6953)

**Monthly
Letter Status
Report**

August 2000

DOCUMENT AVAILABILITY

Reports produced after January 1, 1996, are generally available free via the U.S. Department of Energy (DOE) Information Bridge.

Web site <http://www.osti.gov/bridge>

Reports produced before January 1, 1996, may be purchased by members of the public from the following source.

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone 703-605-6000 (1-800-553-6847)
TDD 703-487-4639
Fax 703-605-6900
E-mail info@ntis.fedworld.gov

Web site <http://www.ntis.gov/support/ordernowabout.htm>

Reports are available to DOE employees, DOE contractors, Energy Technology Data Exchange (ETDE) representatives, and International Nuclear Information System (INIS) representatives from the following source.

Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
Telephone 865-576-8401
Fax 865-576-5728
E-mail reports@adonis.osti.gov
Web site <http://www.osti.gov/contact.html>

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

ORNL/HSSI (6953)/MLSR-2000/11

HEAVY-SECTION STEEL IRRADIATION
PROGRAM
JCN W6953

MONTHLY LETTER STATUS REPORT
FOR
AUGUST 2000

Submitted by

T. M. Rosseel
HSSI Project Manager

Compiled by
R. D. Godfrey

Submitted to
C. J. Fairbanks
NRC Project Manager

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
managed by
UT-Battelle, LLC.
for the
U. S. DEPARTMENT OF ENERGY
Under DOE Contract No. DE-AC05-00OR22725

Internal Use Only

This document has not been given final patent clearance and is for internal use only. If this document is to be given public release, it must be cleared through the site Technical Information Office which will see that the proper patent and technical information reviews are completed in accordance with UT-Battelle Policy.

PREFACE

This report is issued monthly by the staff of the Heavy-Section Steel Irradiation (HSSI) Program (JCN:W6953) to provide the Nuclear Regulatory Commission (NRC) staff with summaries of technical highlights, important issues, and financial and milestone status within the program.

This report gives information on several topics corresponding to events during the reporting month: (1) overall project objective, (2) technical activities, (3) meetings and trips, (4) publications and presentations, (5) property acquired, (6) problem areas, and (7) plans for the next reporting period. Next the report gives a breakdown of overall program costs as well as cost summaries and earned-value-based estimates for performance for the total program and for each of the eight program tasks. The six tasks correspond to the 189, dated March 23, 1998, and modified by the inclusion of the former "Embrittlement Data Base and Dosimetry Evaluation" Program, JCN 6164 in March, 1999. The final part of the report provides financial status for all tasks and status reports for selected milestones within each task. The task milestones address the period from April 1998 to December 2000, while the individual task budgets address the period from October 1999 to November 2000.

Beginning in October, 1992, the monthly business calendar of the Oak Ridge National Laboratory was changed and no longer coincides with the Gregorian/Julian calendar. The business month now ends earlier than the last day of the calendar month to allow adequate time for processing required financial reports to the Department of Energy. The precise reporting period for each month is indicated on the financial and milestone charts by including the exact start and finish dates for the current business month.



Thomas M. Rosseel, Manager
Heavy-Section Steel Irradiation

MONTHLY LETTER STATUS REPORT
August 2000

| | |
|---------------------------------|--|
| Job Code Number: | W6953 |
| Project Title: | Heavy-Section Steel Irradiation Program |
| Period of Performance: | 4/1/98 to 11/30/00 |
| Performing Organization: | Oak Ridge National Laboratory |
| Program Manager: | T. M. Rosseel |
| Address: | P.O. Box 2008 Oak Ridge, Tennessee 37831-6138 |
| Telephone: | (865) 574-5380 |
| Telefax: | (865) 241-3650 |
| Email: | rosseeltm@ornl.gov |

1. PROJECT OBJECTIVE:

The primary goal of the Heavy-Section Steel Irradiation (HSSI) Program is to provide a thorough, quantitative assessment of the effects of neutron irradiation on the material behavior, and in particular the fracture toughness properties, of typical pressure vessel steels as they relate to light-water reactor pressure vessel (RPV) integrity. The program includes studies of the effects of irradiation on the degradation of mechanical and fracture properties of vessel materials augmented by enhanced examinations and modeling of the accompanying microstructural changes. Effects of specimen size; material chemistry; product form and microstructure; irradiation fluence, flux, temperature, and spectrum; and post-irradiation mitigation are being examined on a wide range of fracture properties. This program will also maintain and upgrade computerized data bases, calculational procedures, and standards relating to RPV fluence-spectra determinations and embrittlement assessments. Results from the HSSI studies will be incorporated into codes and standards directly applicable to resolving major regulatory issues that involve RPV irradiation embrittlement such as pressurized-thermal shock, operating pressure-temperature limits, low-temperature overpressurization, and the specialized problems associated with low upper-shelf welds. Six technical tasks and one for program management are now contained in the HSSI Program.

2. TECHNICAL ACTIVITIES:

TASK 1: Program Management (T. M. Rosseel)

This task is responsible for managing the program to ensure that the overall objectives are achieved. The management responsibilities include three major activities: (1) program planning and resource allocation; (2) program monitoring and control; and (3) documentation and technology transfer. Program planning and resource allocation includes: (a) developing and preparing annual budgetary proposals and (b) issuing and administering subcontracts to other contractors and consultants for specialized talents not available at Oak Ridge National Laboratory (ORNL) or that supplement those at ORNL. Program monitoring and control includes: (a) monitoring and controlling the project through an earned-value, project-management system; (b) ensuring that quality assurance (QA) requirements are satisfied; and (c) issuing monthly management reports. Documentation and technology transfer includes: (a) participating in appropriate codes and standards committees; (b) preparing briefings for the NRC; (c) coordinating NRC and internal ORNL review activities; (d) coordinating domestic and foreign information exchanges approved by NRC; and (e) documenting the activities of the program through letter and NUREG reports.

(Milestone 1.2.B) The MTS, 100-kip, servohydraulic machine in the hot cell is ready to be repaired with the reconditioned actuator. However, since the cost estimate for the entire repair is high, the 20-kip servohydraulic machine in an adjoining cell was activated and tested for use on the highly embrittled KS-01 1T compact specimens. Due to limited pressure, the rig was found to be not suitable for use for this test matrix.

The repair issue has caused a delay in completion of the fracture-toughness testing of the irradiated KS-01 1T compact specimens that will be used to examine shape of the master curve for highly-embrittled RPV material (see subtask 2.2). Testing of the PSI-supplied JRQ specimens (subtask 3.3) will also be delayed until the next fiscal year.

(Milestone 1.3.D) On August 2, 2000, Mr. Masakazu Yoshino, Japan Power Engineering and Inspection Corporation (JAPEIC), Dr. Yoshio Urabe (Mitsubishi Heavy Industries), Mr. Hiroshi Ueda (Ishikawajima-Harmina Heavy Industries), and Mr. Katsumasa Miyazaki (Hitachi, Ltd.) visited the HSSI Program. The visitors discussed the status of the Japan Safety Assessment of Flawed Equipment (SAF) program sponsored by MITA and directed by the Japan Power Engineering and Inspection Corporation (JAPEIC). Specifically, they presented four talks entitled:

1. "Evaluation of Fatigue Crack Shape Change by Large Scale Model Testing for Reactor Pressure Vessel Integrity," presented by Mr. Yoshino
2. "Experimental Results of Fatigue Crack Growth Tests of 12 inch Carbon Steel Pipes," presented by Mr. Ueda
3. "The Effects of Loading Rise Time on Fatigue Surface Crack Growth of Carbon Steel in Simulated BWR Environment," presented by Mr. Miyazaki
4. "Experimental Studies in influence of Flaw with Near Allowable Size on Pipe Fracture for Nuclear Power Plant," presented by Mr. Ueda

ORNL HSSI staff members participating in the visit included T. M. Rosseel, S. K. Iskander, J. G. Merkle (consultant), R. K. Nanstad, M. A. Sokolov, R. E. Stoller, E. T. Mannes Schmidt, and P. S. Bishop. ORNL HSST participants included B. R. Bass and C. E. Pugh. In addition to overviews of the HSSI Program, presented by the program manager, and the HSST program, by C. E. Pugh, R. K. Nanstad presented a "Summary of HSSI Program Activities on Intergranular Fracture, HAZ Embrittlement, and Material Variability." Tours of the hot cell and fracture mechanics facilities and extensive discussions completed the visit.

Task 2: Fracture-Toughness Transition and Master-Curve Methodology (M. A. Sokolov)

Fracture-toughness transition and master-curve (MC) methodology will be broadly explored for pressure-vessel applications through a series of experiments, analyses, and evaluations in eight Subtasks. For example, pertinent fracture-toughness data needed to assess the shift and potential change in shape of the fracture-toughness curves due to neutron irradiation will be collected and statistically analyzed. The effects of irradiation on fracture-toughness curve shape for highly embrittled RPV steels, dynamic effects, crack arrest, intergranular fracture, and subsized specimens will also be explored. Finally, guidelines for the application of "surrogate materials" to the assessment of fracture toughness of RPV steels will be evaluated.

Subtask 2.1: Fracture-Toughness Transition-Temperature Shifts (M. A. Sokolov)

The purpose of this subtask is to collect and statistically analyze pertinent fracture-toughness data to assess the shift and potential change in shape of the fracture-toughness curves due to neutron irradiation. The MC methodology will be applied to provide a statistical analysis of the fracture-

toughness data and Charpy data will be fitted by hyperbolic tangent functions. The resulting reference fracture-toughness temperature, T_0 , shifts will be compared with Charpy shifts determined by various indexing methods.

(Milestone 2.1.A) As they become available, additional data are added to the database.

The report by M. A. Sokolov and R. K. Nanstad, *Comparison of Irradiation-Induced Shifts of K_{Jc} and Charpy Impact Toughness for Reactor Pressure Vessel Steels* [NUREG/CR-6609 (ORNL/TM-13755)], was submitted to the NRC for publication in May 1999.

Subtask 2.2: Irradiation Effects on Fracture-Toughness Curve Shape (M. A. Sokolov)

The purpose of this subtask is to evaluate the assumption of constant shape for the MC even for highly embrittled RPV steels. The evaluation will be performed through irradiation of a pressure-vessel steel to a neutron fluence sufficient to produce a fracture-toughness transition-temperature shift (T_0) of about 150°C (270°F). Evaluation of the MC shape will be determined with sufficient numbers of 1T compact specimens, 1T C(T), to allow for testing at three temperatures in the transition-temperature region. Additionally, 0.5T C(T), and precracked Charpy V-notch (PCVN) specimens, for both quasi-static and dynamic tests, will be irradiated and tested to investigate the use of more practical surveillance-size specimens. Tensile specimens will also be included to determine the irradiation-induced hardening. A comprehensive test program with unirradiated material will be included to provide the necessary baseline data for comparison.

(Milestone 2.2.A) As previously reported, an actuator has been reconditioned by a commercial vendor to replace the original leaking actuator on the MTS servohydraulic machine in the hot cell. Preparations have begun to perform the repairs on the hot cell servohydraulic machine. As soon as the repairs are complete, the testing of 1T C(T) of KS-01 weld will be resumed.

Irradiation of the Midland beltline weld and a high-nickel weld from the Palisades steam generator is under way and proceeding on schedule.

Subtask 2.3: Dynamic Effects, Including Precracked Charpy V-Notch Testing (S. K. Iskander)

As reactors age, the operating window between the startup or shutdown K_a curve, generated from the allowable pressures and temperatures, and the K_{Ia} curve becomes smaller, making it difficult for plants to startup and shut-down. Dynamic testing of relatively small specimens will be evaluated as an alternative method to determine a lower bound to fracture toughness. Results from Subtask 2.5 (crack-arrest), which measures dynamic properties, will also be used in this subtask.

(Milestone 2.3.A) No activity during this reporting period.

Subtask 2.4: Irradiation Effects on Fracture Toughness of Midland RPV Weld (R. K. Nanstad)

The purpose of this subtask is to determine the transition-temperature shift and to evaluate transition-toughness curve shape for a low Charpy upper-shelf weld metal at a relatively high neutron fluence that will produce greater embrittlement damage than previously obtained with irradiations at lower fluences. This subtask will evaluate the assumption of constant shape for the MC with highly embrittled low-upper-shelf RPV steels that exhibit onset of stable ductile tearing at relatively low-fracture toughness. The evaluation will be performed through irradiation of the beltline weld from the Midland Unit 1 RPV to a fluence of about 2.5 to 5×10^{19} n/cm² (>1 MeV) for which a substantial database of unirradiated and irradiated results to a fluence of 1×10^{19} n/cm² (>1 MeV) already exists. This research is needed to assess the fracture-toughness behavior of such a weld at high-embrittlement levels. Evaluation of the MC shape will be determined with sufficient numbers of 0.5T C(T) to allow for testing at three temperatures in the transition-temperature region. Additionally, PCVN specimens, for both quasi-static and dynamic tests, will also be irradiated and

tested to investigate the use of more typical surveillance-size specimens, and tensile specimens will be included to determine the irradiation-induced hardening. A comprehensive-test program with unirradiated material was previously completed under the first HSSI Program (L1098) 10th Irradiation Series, except for dynamic testing of PCVN specimens, which will be included to provide the necessary baseline data for comparison.

(Milestone 2.4.D) The final report, *Evaluation of WF-70 Weld Metal from the Midland Unit 1 Reactor Vessel - Final Report*, by D. E. McCabe, R. K. Nanstad, S. K. Iskander, D. W. Heatherly, and R. L. Swain, NUREG/CR-5736 (ORNL/TM-13748), was submitted to the NRC for publication in February 1999.

Further evaluation of the Midland beltline weld will be performed under Subtask 2.2.

Subtask 2.5: Crack-Arrest including Midland (S. K. Iskander)

In this subtask, the low-temperature operating pressure regulatory concerns will be addressed through testing of the 15 irradiated, Midland crack-arrest specimens. This evaluation will provide an excellent opportunity to determine whether the lower bounds of crack initiation and arrest toughness coincide for this very important class of irradiated LUS welds. These specimens, which were produced and irradiated as part of the previous HSSI (L1098) program, will be used to evaluate the lower and transition arrest-toughness values.

(Milestone 2.5.A) The preparation of the draft NUREG report, *Detailed Results of Testing Unirradiated and Irradiated Crack-Arrest Toughness Specimens from the Low Upper-Shelf Energy, High Copper Weld, WF-70*, by S. K. Iskander, C. A. Baldwin, D. W. Heatherly, D. E. McCabe, I. Remec, and R. L. Swain, NUREG/CR-6621 (ORNL/TM-13764), has been completed and the manuscript is being prepared for technical review.

Subtask 2.6: Intergranular Fracture (R. K. Nanstad, and J. G. Merkle)

This subtask will address the issue of whether the MC technique can be applied to materials that experience brittle fracture by an intergranular mechanism. Specifically, it will be determined whether steels that experience intergranular fracture can be correctly characterized by the MC T_O temperature and whether the transition-curve shape can be changed by different fracture modes. Complete intergranular fracture from temper embrittlement occurs only at lower-shelf temperatures. As it is with transgranular cleavage, the transition to upper shelf is marked by an increased volume percentage of ductile rupture mixed with the lower-shelf, brittle-fracture mechanism. Since the onset of crack instability is most likely triggered in the brittle zones, the critical issue is understanding the influence of the triggering mechanism on the distribution of K_{Jc} values obtained. This information can be obtained on the lower shelf and, in part, into the transition range.

The proposed approach is to determine if there is an operational weakest-link effect when instability is triggered within an intergranular region. If an effect is observed, there should also be a measurable specimen-size effect on K_{Jc} . It will also be determined if the temper-embrittled materials exhibit a change in the J-R fracture toughness since such steels do not show a significant change in upper-shelf CVN energy.

(Milestone 2.6.B) Two broken halves of previously tested compact specimens were sent for machining to obtain 12 0.5T compact specimens for further testing. The specimens were received, fatigue precracked, and seven specimens were tested at -125°C , the temperature estimated to result in a median K_{Jc} value of about 75 MPa m from the previous results. The actual value obtained was 70.4 MPa m, which is very close to the predicted value based on the test results obtained at the higher temperatures. The remaining five specimens will be tested at a different temperature, and a multitemperature master curve analysis will be conducted and included in the final letter report.

Subtask 2.7: Subsize Specimens (M. A. Sokolov)

The purpose of this subtask is to evaluate the applicability of the weakest-link theory-based size-adjustment procedure in the MC methodology to specimen sizes that are the most likely to be present in surveillance capsules. The MC methodology will be applied using precracked Charpy-size or smaller specimens to test the lower-size limit applicability. Testing will be performed at two or more temperatures with at least six specimens at each temperature. The exact number of temperatures and specimens will be determined following analysis of initial results. The testing of these subsize specimens will also satisfy the HSSI Program suggested testing matrix within the New Coordinated Research Program (CRP) of the International Atomic Energy Agency (IAEA). Subsize specimens will be fabricated from previously characterized materials within the HSSI Program, such as HSST Plate 02, HSSI Welds 68W through 73W, the Midland beltline weld and plate JRQ.

(Milestone 2.7.A) Abstracts continue to arrive for the ASTM Fourth International Symposium on Small Specimen Techniques. This symposium will be held in January of 2001 and M. A. Sokolov is serving as the Chairman of the Symposium.

Three blocks of materials will be machined into 1T C(T) and precracked Charpy specimens will be machined and tested for the size effects study. Two of the blocks are broken halves of 4TC(T) specimens of two A302B plates previously tested by the HSSI Program. The third block of material is the well-characterized Plate 13A.

Subtask 2.8: Quantification of Surrogate Materials for use in a Statistics-based Fracture Toughness Assessment (R. K. Nanstad and J. G. Merkle)

The purpose of this subtask is to establish guidelines for the use of "surrogate materials" in the assessment of fracture toughness of RPV steels. A plan will be developed to describe the information acquired and the means of collecting it, the method of evaluating the information, and the methods for using the information. Analyses will be performed to provide a methodology for determining limits for predicting fracture toughness of one material, i.e., a surrogate material, with measured fracture toughness of similar materials.

(Milestone 2.8.B) A NUREG report, *Considerations for Use of Surrogate Materials Data for Reactor Pressure Vessels*, by R. K. Nanstad, J. G. Merkle, and J. Galt, has been sent to the NRC technical monitor for review. Further review of data, both unirradiated and irradiated, is continuing for the preparation of a table of uncertainties that could be utilized for evaluating the application of surrogate materials. This work will be included in the final NUREG report on this subject.

Subtask 2.10: Dosimetry and Fluence Analysis of the IAR Irradiation Capsules from the First IAR Campaign (C. A. Baldwin, I. Remec, T. M. Rosseel)

The purpose of this task is to measure and analyze the dosimeters used during the first IAR Campaign and to obtain accurate fluence determinations.

(Milestone 2.10.A) No significant activity during this reporting period

Task 3: Irradiation Embrittlement of RPV Steel (S. K. Iskander)

The purpose of this task is to examine two important issues affecting the application of mitigation procedures to RPVs. The first addresses the effects of temper embrittlement on the coarse-grained HAZ in RPV steels. The second examines the effects of reirradiation on K_{Jc} and K_{Ja} in order to evaluate the relative changes in the recovery and reembrittlement between CVN and fracture-toughness properties and a detailed examination of reembrittlement rates. These questions will be

addressed using the IAR facility designed, fabricated, and installed as part of the previous HSSI (L1098) program and with a matrix of irradiated and tempered specimens supplied by the Swiss Paul Scherrer Institut (PSI). Further data on reirradiation embrittlement will be obtained through reconstitution and reirradiation of previously irradiated specimens at the RRC-KI.

Subtask 3.1: HAZ Embrittlement (M. A. Sokolov and R. K. Nanstad)

Research conducted to date on temper embrittlement of the coarse-grain materials in HAZs of RPV steel multi-pass welds has revealed the potential for such embrittlement under some conditions. AEA-Technology discovered that using high-temperature austenitization to produce very coarse grains, followed by thermal aging resulted in large transition-temperature shifts. Further, post-irradiation mitigation of such material resulted in an even greater increase of the transition temperature. Subsequent research at ORNL under the previous HSSI Program (L1098) used five commercial RPV steels to investigate potential temper embrittlement. The first phase simulated the AEA-Technology heat treatment and observed large transition-temperature shifts, although not as large as those from AEA-Technology. The second phase of the ORNL study used the same five RPV steels, but used the Gleeble system (an electrical-resistance heating device) to produce material deemed representative of the coarse-grain region in RPV welds. These materials revealed very high toughness in the initial condition (i.e., from the Gleeble). After thermal aging at about 454 °C for 168 hours the materials exhibited only modest transition temperature increases, however, after aging at the same temperature for 2000 hours, significant transition temperature increases were observed. Of course, 2000 hours is much in excess of the time that RPV steels would be exposed to mitigation cycles, but potential synergistic effects of irradiation and thermal aging are unknown. Moreover, questions also remain regarding other time-temperature effects, such as post-irradiation mitigation at somewhat lower or higher temperatures.

(Milestone 3.1.B) Following the observations of significant intergranular fracture on the irradiated/annealed specimens, further analyses and discussions are under way, with particular attention to the cooling rate following postweld heat treatment of the simulated HAZ material. To investigate the cooling rate effect, additional material will be treated in the Gleeble system to simulate the coarse-grain HAZ as accomplished previously. This will be followed by thermal aging, as well as by irradiation and tempering. Consideration is also being given to reirradiation of the remaining specimens from the initial series.

The paper by R. K. Nanstad et al, "Investigation of Temper Embrittlement in Reactor Pressure Vessel Steels Following Thermal Aging, Irradiation, and Thermal Annealing," presented at the ASTM 20th International Symposium on Radiation Effects on Materials, has been reviewed and is being modified for final submission to ASTM. Moreover, a presentation has been prepared for the IGRDM meeting in September in Leuven, Belgium.

Subtask 3.2: Embrittlement Rate of Reirradiated Steel (S. K. Iskander, I. Remec, E. D. Blakeman, and C. A. Baldwin)

This subtask will examine the effects of reirradiation on K_{Ic} and K_{Ia} toughness of RPV steel so as to evaluate the relative changes in recovery and reembrittlement between CVN and fracture-toughness properties and to provide a detailed examination of reembrittlement rates. This will be accomplished using the HSSI IAR and the University of California Santa Barbara (UCSB) irradiation facilities at the University of Michigan, Ford Nuclear Reactor (FNR), and through the reirradiation of previously irradiated specimens at RRC-KI, if funding is available. Emphasis will also be placed on completing dosimetry calculations for the new IAR facility.

(Milestone 3.2.B) Neutronics Analysis of the IAR/UCSB Irradiation Capsules (I. Remec, E. D. Blakeman, C. A. Baldwin) - The report entitled: *Characterization of the Neutron Field in the HSSI/UCSB Irradiation Facility at the Ford Nuclear Reactor*, by I. Remec, E. D. Blakeman, and

C. A. Baldwin, NUREG/CR-6646 (ORNL/TM-1999/140) was submitted to the NRC in September, 1999.

(Milestone 3.2.C) Internal and external reviewers' comments are being incorporated into the paper, "Reirradiation Response Rate of a High-Copper Reactor Pressure Vessel Weld," by S. K. Iskander, R. K. Nanstad, C. A. Baldwin, D. W. Heatherly, and I. Remec, which is currently being prepared for publication in *Effects of Radiation on Materials, 20th International Symposium*, ASTM STP 1405. The paper is undergoing final revisions prior to being sent to ASTM for publication.

Subtask 3.3: Evaluation of Reirradiated JRQ Specimens (R. K. Nanstad, and T. M. Rosseel)

The purpose of this subtask is to examine the fracture-toughness behavior of a model steel that has been irradiated, tempered, and re-irradiated. The specimens, identified as JRQ, will be supplied by the Swiss PSI from a terminated research program.

(Milestone 3.3.A) The testing of the JRQ specimens has been placed on hold due to scheduling issues in the hot cells, resulting from the delayed repair of the servohydraulic machine.

Task 4: Validation of Irradiated and Aged Materials (R. K. Nanstad)

The purpose of this task is to validate the assessment of the effects of neutron irradiation on the fracture-toughness properties of typical RPV materials obtained in the previous HSSI (L1098) Program, tasks 2 and 3 of this program, and retired RPVs. This will be accomplished through the examination of the effects of neutron irradiation on the fracture toughness (ductile and brittle) of the HAZ of welds and of typical plate materials used in RPVs. The irradiated materials from retired RPVs will be machined and tested in the Irradiated Materials Examination and Testing (IMET) hot cells. The feasibility of reconstitution for CVN and 0.5T C(T) and aging of stainless steel welds will also be explored in this task. Other issues to be addressed include foreign interactions and technical assistance to the NRC.

Subtask 4.1: Examination of Materials from Retired RPVs (S. K. Iskander and J. T. Hutton)

This subtask will examine the issue of neutron-irradiation-induced damage attenuation through the RPV wall. The damage will be related to measurements of received dose, such as displacements per atom (dpa) through the wall. The HSSI program will obtain suitable-size trepans of materials from previously decommissioned RPVs, because these materials would incorporate conditions from actual operating reactors such as the effects of irradiation on stressed material. A sufficient number and size of trepans will be obtained to permit use of the MC approach to relate measures of damage to the fracture toughness. Specimens will be machined on the CNC milling machine located in Cell 6 of the IMET facility. Depending upon availability and appropriateness, trepans from the Japan Power Demonstration Reactor (JPDR) project, Trojan, and Maine Yankee RPVs may be examined.

(Milestone 4.1.2.B) The new shelf for the auxiliary control unit of the computer controlled milling machine has been completed (see July 2000 report). Consideration is being given to lashing this shelf to the railing above it as an extra safety precaution. Since this could change the present configuration, it may require obtaining additional approvals.

Subtask 4.2: Reconstitution of Irradiated Toughness Specimens (S. K. Iskander)

Feasibility studies for reconstitution of CVN, PCVN, and 0.5T bend bar specimens will be prepared. To adequately survey the state-of-the-art capabilities, on-site evaluations of US and international facilities will be required. A letter report that includes the estimated costs of either

using existing and available facilities or implementing a reconstitution facility at ORNL will be prepared at the completion of this task.

No work is currently funded in this subtask.

Subtask 4.3: Toughness Changes in Aged Stainless Steel Welds (R. K. Nanstad)

The purpose of this subtask is to evaluate the effects of irradiation and thermal aging on stainless-steel weld metals. Two projects are incorporated in this subtask. The first involves completion of fracture-toughness testing on irradiated stainless-steel weld-overlay cladding specimens at 288°C to complete the testing of the matrix from the HSSI (L1089) 7th Irradiation Series. The PCVN specimens were irradiated in HSSI Capsule 10.06. The second project involves completion of a NUREG report on thermal aging of stainless-steel welds for nuclear piping, a project that began before the inception of the HSSI (L1098) Program and involved thermal aging at 343°C for up to 50,000 hours.

(Milestone 4.3.B) The report, *The Effect of Aging at 343°C on the Microstructure and Mechanical Properties of Type 308 Stainless Steel Weldments*, by D. J. Alexander, K. B. Alexander, M. K. Miller and R. K. Nanstad, NUREG/CR-6628 (ORNL/TM-13767), was submitted to the NRC for publication in July 1999.

Subtask 4.4: Foreign Interactions (R. K. Nanstad)

The purpose of this subtask is to provide technical support and continued collaboration for a number of cooperative relationships with foreign institutions in the area of radiation effects on RPV steels. Collaborative relationships may be developed during the course of this program and will be developed with the cognizance of NRC. Current relationships are:

1. U.S.-Russia Joint Coordinating Committee for Civilian Nuclear Reactor Safety (JCCCNRS) Working Group on Radiation Embrittlement and Aging of Components.
2. Cooperation with SCK-CEN in Belgium regarding the supply of well-characterized materials and comparison of test results, including dynamic PCVN testing for development of RPV testing standards.
3. Collaboration with AEA-Technology in the United Kingdom regarding fracture toughness testing of intergranular embrittlement of RPV HAZs.
4. Collaborative studies on fracture properties of high-copper RPV materials with Korean institutes such as KAERI.
5. Collaboration with institutes in the Czech Republic, Germany, and Finland on fracture toughness with small specimens in support of MC evaluations.
6. Collaboration with PSI in Switzerland on reirradiation.
7. Information and data exchange with all of the above and other countries, especially regarding RPV surveillance data and comparisons of fracture toughness and Charpy impact data.
8. Participation, including membership on the Executive Committee, in the International Group on Radiation Damage Mechanisms (IGRDM).

9. Participation in two coordinated research programs (CRPs) sponsored by the International Atomic Energy Agency (IAEA), informally designated CRP-5 and CRP-6. These CRPs will investigate: the use of PCVN specimens to determine fracture toughness of RPV steels, and effects of nickel on irradiation-induced embrittlement of RPV steels, respectively.
10. Collaboration with NRI, Rez (Czech Republic) in the area of microstructural evolution in RPV steels as a consequence of irradiation, annealing, and reirradiation.
11. Collaboration with the University of Lille (France) in the area of primary radiation damage simulation.

Planning for the next meeting of the IGRDM in Pressure Vessel Steels, IGRDM-9, has been completed. Approximately 75 presentations have been scheduled for the meeting, with contributions from Europe, Asia, and the United States. The meeting will be held in Leuven, Belgium, September 18-23, 2000, and will be hosted by SCK-CEN and Tractebel. R. K. Nanstad, Secretary of the IGRDM, has assisted the local host and the IGRDM Chairman in the planning. Seven presentations have been offered from the HSSI Program. The program on Friday, September 23, will be an open seminar, open to members of industrial, academic, and research organizations. The topic of the open seminar will be lifetime management of RPVs and invitations have been extended to organizations in all countries with IGRDM members.

Prior to the IGRDM meeting, R. K. Nanstad will travel to the United Kingdom and visit with researchers at AEA-Technology, Harwell, regarding ongoing collaborations in the areas of phosphorus segregation and fracture mechanics.

Subtask 4.5: Technical Assistance (R. K. Nanstad, S. K. Iskander, and M. A. Sokolov)

The purpose of this subtask is to provide special analytical, experimental, and administrative support to the NRC in resolving various regulatory issues related to irradiation effects. Specific identified activities are incorporated in this subtask, while other activities may be included through modification to the task by the NRC. The currently identified activities involve evaluation of the irradiated specimens contained in capsules previously irradiated at the University of Michigan FNR by Materials Engineering Associates (MEA), evaluation of highly irradiated high-nickel weld surveillance specimens from the Palisades Reactor, evaluation of the effects of post-weld heat treatment (PWHT) on the copper solubility and fracture toughness of unirradiated RPV steels, and compilation of available materials at ORNL and elsewhere for studies of irradiation effects on RPV steels.

(Milestone 4.5.B) The letter report on RPV materials available for irradiation studies is in progress.

(Milestone 4.5.F) Testing of unirradiated specimens has continued with the high-copper weld given varying time/temperature postweld heat treatments. A Charpy impact energy versus temperature curve has been obtained for each condition to evaluate toughness as a function of PWHT. If funding can be realized, atom probe tomography will be used to determine the matrix copper contribution as a function of PWHT. A presentation has been prepared for the IGRDM meeting in September in Leuven, Belgium.

Task 5: Modeling & Microstructural Analysis (R. E. Stoller)

This task shall determine the microstructural basis for radiation-induced property changes in RPV materials to aid in understanding and applying the experimental results obtained in Tasks 2 through 4. The subtasks comprise two major components: (1) theoretical modeling and data analysis, and (2) experimental investigations. The modeling work focuses on the development of an improved description of primary-damage formation in irradiated materials, and the further development and

use of predictive models of radiation-induced microstructural evolution and its impact on the mechanical behavior of RPV materials. The experimental component consists of special-purpose irradiation experiments to isolate particular irradiation variables (neutron-flux level and energy spectrum), and detailed microstructural characterization of RPV materials in relevant conditions using atom probe and transmission electron microscopy techniques. These conditions include: long-term, thermally-aged, irradiated, post-irradiation mitigation (IA), and reirradiated (IAR). The information obtained from the experiments and microstructural characterization will be used to support validation of the theoretical models. Further model verification will be carried out through extensive use of the commercial-reactor surveillance data and test-reactor data contained in the NRC-funded Embrittlement Database (EDB), and data generated in other experiments coordinated by this task.

The major areas of inquiry will be: (a) the effects of chemical composition; (b) the role of displacement rate (neutron flux level); (c) the impact of differences in neutron-energy spectrum; (d) potential differences in hardening and embrittlement behavior at very high fluence; and, (e) the response of materials that are reirradiated following a post-irradiation mitigation. Damage modeling will also address such questions as attenuation through the RPV wall. The overall goal of the task is to provide an embrittlement model that can be used in a predictive way to anticipate the response of RPV materials at high fluences near or slightly beyond their nominal end-of-life, and to provide support to the NRC for related safety or licensing questions. The tools developed in this task will also be used to support the analysis of experimental results obtained in other program tasks. Both the modeling and experimental research will be coordinated with complementary activities carried out by other NRC contractors.

Subtask 5.1: Modeling of Damage Evolution (R. E. Stoller)

The modeling and analysis work will include completion of the development required to incorporate alloying effects in the embrittlement model. Additional thermodynamic components are needed to account for chemical effects, particularly for the simulation of high-fluence effects and thermal mitigation. Enhancements to the code used for simulating displacement cascades will permit the investigation of the effects of alloying elements on primary damage formation.

(Milestone 5.1.A) A meeting was held with other NRC contractors to discuss the next phase of embrittlement model development. The discussions focused on the best approach to integrate previously-developed models from ORNL, UCSB, and LLNL into a single, multi-scale model. A plan was developed over the course of two days and will be implemented in the coming year. In part, this effort will involve the development of a modified radiation-damage source term based on ORNL primary-damage simulations and cascade aging simulations carried out at UCSB and LLNL. The ORNL embrittlement model and the UCSB multi-state kinetics code will be integrated and coupled with improved micro-mechanical models.

The NUREG report entitled "Evaluation of Neutron Energy Spectrum Effects Based on Primary Damage Simulations in Iron," NUREG/CR-6670, (ORNL/TM-1999/334) was submitted to the NRC in July.

Subtask 5.2: Microstructural Analysis (R. E. Stoller and M. K. Miller)

Round-Robin studies, using atom probe field-ion microscopy (APFIM), small angle neutron scattering (SANS), and field-emission scanning transmission electron microscopy (FEGSTEM), will be coordinated to resolve the inconsistencies between these techniques that have been used to determine the matrix copper content and the chemical composition of radiation-induced precipitates in RPV materials. Additionally, APFIM characterization will be used to determine whether additional radiation-induced phases are forming.

(Milestone 5.2.A). Atom probe tomography results on weld 73W specimens were summarized and prepared for insertion into the NUREG report entitled, "Effect of Reirradiation Rate on The Charpy Properties of an Irradiated/Annealed High Copper Reactor Pressure Vessel Weld HSSI 73W."

The NUREG report entitled, "Atom Probe Tomography Characterization of the Solute Distributions in a Neutron-Irradiated and Annealed Pressure Vessel Steel Weld", NUREG/CR-6629, (ORNL/TM-13768), was submitted to the NRC in September 1999.

Subtask 5.3: Experimental Verification of Neutron Flux and Energy Spectrum Effects
(R. E. Stoller)

An experimental examination of neutron-flux level (displacement rate) and neutron energy spectrum effects (thermal-to-fast-flux ratio) will be conducted in collaboration with other NRC contractors.

No significant activity occurred in this subtask during this reporting period.

Task 6: Test Reactor Irradiation Coordination (K. R. Thoms)

This task provides the support required to supply and coordinate irradiation services needed by NRC contractors, such as the UCSB and the ORNL HSSI Program at the University of Michigan FNR. These services include the design and assembly of irradiation facilities (and/or capsules), as well as arranging for their exposure, periodic monitoring by remote computer access and interaction with the FNR staff, and return of specimens to the originating research organization.

Subtask 6.1: Operate the HSSI Irradiation (IAR) Facility (K. R. Thoms and D. W. Heatherly)

With the fabrication, installation, and initial testing of the HSSI IAR facility at the University of Michigan FNR completed as part of the previous (L1098) HSSI program, the activities associated with the new program include supervising the irradiation of the reusable irradiation capsules in the dual-capsule irradiation facility at FNR. A NUREG report on the design, assembly, installation, and operation of the HSSI IAR facility will be prepared.

(Milestone 6.1.A) Irradiation of the ORNL specimens in the HSSI-IAR 1 and 2 irradiation facilities continued during this reporting period.

During this reporting period, the reactor operated for 9.5 days of half-cycle 448B and 9.3 days into half-cycle 449A. The FNR did not operate for the half-cycle 448A, scheduled for 7/25/00 to 8/4/00, due to instrument problems in the FNR control room. The FNR staff decided to use the two week period originally scheduled for half cycle 448A to repair some of the instruments and upgrade others to ensure more dependable service.

During the 9.5 of days of half-cycle 448B the HSSI-IAR irradiation facilities received a total of 226 EFPH (effective full power hours). During the 9.3 days of reactor half-cycle 449A, the facilities received an additional 222 EFPH. The total irradiation time received by the HSSI-IAR irradiation facilities during this reporting period was 448 EFPH.

At the beginning of this reporting period, the second group of specimens to be irradiated in the new IAR facilities had been irradiated for a total of 2625 EFPH. At the end of this reporting period, the second group of specimens had been irradiated for a total of 3073 EFPH. The facilities themselves had been in service for a total of 7401EFPH.

Calibration and maintenance activities will be performed during the next reporting period.

(Milestone 6.1.B) The NUREG report on the reusable irradiation facilities will be completed in October due to limited staff availability.

Subtask 6.2: Operate the HSSI/UCSB Irradiation Facility (K. R. Thoms and D. W. Heatherly)

This subtask includes supervising the overall operation and providing assistance to the reactor personnel in the routine operation and maintenance of the HSSI/UCSB irradiation facility. A NUREG report on the design, assembly, installation, and operation of the UCSB facility will be prepared.

(Milestone 6.2.A) Irradiation of the UCSB specimens in the HSSI-UCSB irradiation facility continued during this reporting period.

During this reporting period, the reactor operated for 9.5 days of half-cycle 448B and 9.3 days into half-cycle 449A. The FNR did not operate for the half-cycle 448A, scheduled for 7/25/00 to 8/4/00, due to instrument problems in the FNR control room. The FNR staff decided to use the two week period originally scheduled for half cycle 448A to repair some of the instruments and upgrade others to ensure more dependable service.

During the 9.5 of days of half-cycle 448B, the HSSI-UCSB irradiation facility received a total of 226 EFPH (effective full power hours). During the 9.3 days of reactor half-cycle 449A, the facility received an additional 222 EFPH. The total irradiation time received by the HSSI-UCSB irradiation facility during this reporting period was 448 EFPH.

At the beginning of this reporting period, the HSSI-UCSB facility and original specimen compliment had been irradiated for a total of 14,438 EFPH. At the end of this reporting period, the HSSI-UCSB facility and original specimen compliment had been irradiated for a total of 14,886 EFPH. The latest irradiation plan received from the UCSB experimenters indicated that the final specimens would be removed from the HSSI-UCSB facility after 13,500 EFPH. Additional specimen irradiation's have been added to the original plan and at the end of this reporting period, the UCSB irradiation program had obtained 110% of the original desired irradiation time.

Calibration and maintenance activities will be performed during the next reporting period.

Task 7: Embrittlement Data Base and Dosimetry Evaluation (T. M. Rosseel)

This task was until March 1, 1999, the Embrittlement Data Base (EDB) and Dosimetry Evaluation Program, JCN: 6164. The objectives of the two subtasks listed below have been reduced but the focus remains the same. Nuclear radiation embrittlement information from radiation embrittlement research on nuclear RPV steels and from power-reactor surveillance reports will be maintained in a data base to be published on a periodic basis. The information will assist the Office of Nuclear Reactor Regulation and the Office of Nuclear Regulatory Research to effectively monitor current procedures and data bases used by vendors, utilities, and service laboratories in the pressure vessel irradiation surveillance program. It will also provide technical expertise and analysis to the NRC regarding dosimetry and transport calculations and methodologies.

Subtask 7.1: Embrittlement Data Base (J.-A. Wang)

The purpose of the subtask is to maintain and update the EDB. This includes evaluating surveillance reports, entering the data into the EDB, and providing an update to the NRC by the end of the fiscal year.

(Milestone 7.1.B) The completed UPDATE-11 of PR-EDB was transmitted to the US NRC technical program monitor in July.

Subtask 7.2: Dosimetry Evaluation (I. Remec)

Technical expertise and analysis regarding dosimetry and transport calculations and methodologies will be provided as needed to the US NRC. Specifically, work will be performed to complete the review of, and hold final discussions with the NRC concerning, the dosimetry guide, DG-1053.

This activity was eliminated as directed by SOEW 60-99-356.

3. MEETINGS AND TRIPS:

On August 2, Y. Urabe of Mitsubishi, K. Miyazaki of Hitachi, H. Ueda of Ishikawajim-Harmina Heavy Industries, and M. Yoshino of the Japan Power Engineering and Inspection Corporation visited ORNL for discussions and presentations with HSSI Program staff.

On August 31, Waldek Bose of the University of San Paulo, Brazil, visited ORNL for discussions with HSSI Program staff members concerning fracture mechanics testing of low-alloy steels.

Travel arrangements have been made for R. K. Nanstad and M. A. Sokolov to participate in the upcoming IGRDM meeting scheduled for September 17-23 in Leuven, Belgium, and for R. K. Nanstad to visit AEA-Technology, Harwell, for discussions of ongoing collaborations.

4. PRESENTATIONS, REPORTS, PAPERS, AND PUBLICATIONS:

T. M. Rosseel, "Heavy-Section Steel Irradiation Program Overview," presented by T. M. Rosseel to the Japan SAF Team at ORNL, Oak Ridge, TN on August 2, 2000.

R. K. Nanstad, "Summary of HSSI Program Activities on Intergranular Fracture, HAZ Embrittlement, and Material Variability," to the Japan SAF Team at ORNL, Oak Ridge, TN on August 2, 2000.

Mr. Yoshino, "Evaluation of Fatigue Crack Shape Change by Large Scale Model Testing for Reactor Pressure Vessel Integrity," ORNL, Oak Ridge, TN on August 2, 2000.

Mr. Ueda, "Experimental Results of Fatigue Crack Growth Tests of 12 inch Carbon Steel Pipes," ORNL, Oak Ridge, TN on August 2, 2000.

Mr. Miyazaki, "The Effects of Loading Rise Time on Fatigue Surface Crack Growth of Carbon Steel in Simulated BWR Environment," ORNL, Oak Ridge, TN on August 2, 2000.

Mr. Ueda, "Experimental Studies in Influence of Flaw with Near Allowable Size on Pipe Fracture for Nuclear Power Plant," ORNL, Oak Ridge, TN on August 2, 2000.

5. PROPERTY ACQUIRED:

Items listed in this section include all nonconsumable project purchases that were actually paid for during this reporting period. They do not include either accruals or accrual reversals and hence may not accurately reflect total material procurement charges within this period.

| Item | Cost (\$) |
|-------------|------------------|
| None | |

6. PROBLEM AREAS:

The MTS, 100-kip, servohydraulic machine in the hot cell is ready to be repaired with the reconditioned actuator. However, since the cost estimate for the entire repair is high, the 20-kip servohydraulic machine in an adjoining cell was activated and tested for use on the highly embrittled KS-01 1T compact specimens. Due to limited pressure, however, the rig was found not to be suitable for use for this test matrix.

The repair issue has caused a delay in completion of the fracture-toughness testing of the irradiated KS-01 1T compact specimens that will be used to examine shape of the master curve for highly-embrittled RPV material (see subtask 2.2). Testing of the PSI-supplied JRQ specimens (subtask 3.3) will also be delayed until the next fiscal year. With the anticipated additional funding to complete the repair and operation of the test rig, it is expected that testing will resume in November.

7. PLANS FOR THE NEXT REPORTING PERIOD:

The plans for the next reporting period are described in Section 2.

FINANCIAL STATUS
for W6953

Reporting Period: 7/24/00-8/27/00

| | Current Month | Fiscal Year to Date | Cumulative Project to date |
|---|------------------|------------------------|-------------------------------|
| I. Direct Staff Effort | 7 MM | 8.8 MY | 28.7 MY |
| II. A. Direct Lab Staff Effort (\$) | | | |
| Direct Salaries | 54,870 | 858,724 | 2,911,963 |
| Materials and Services | 8,519 | 35,421 | 356,585 |
| ADP Support | 61 | 723 | 1,724 |
| Subcontracts | 6,546 | 92,399 | 289,703 |
| Travel | 6,417 | 24,197 | 114,705 |
| Indirect Labor Costs | 0 | 0 | 0 |
| Other: NRC-PO Tax | 4,000 | 45,000 | 138,500 |
| General and Administrative | 26,716 | 383,333 | 1,330,183 |
| Total UT-Battelle Costs | 107,129 | 1,439,797 | 5,143,363 |
| B. DOE Federal Access Costs | 0 | 0 | 0 |
| TOTAL PROJECT COSTS | 107,129 | 1,439,797 | 5,143,363 |
| Percentage of available cumulative funds costed | | 92 | |
| Percentage of available current FY funds costed | | 76 | |
| Funds Remaining | | 466,637 | |
| Commitments: | | 114,171 | |
| BA Remaining | | 352,466 | |

III. Funding Status

| Prior FY Carryover | FY 00 Projected Funding Level | FY 00 Funds Received to Date | FY 00 Funding Balance Needed | Cumulative Amt. Obligated | Cumulative Amt. Costed |
|-----------------------|----------------------------------|---------------------------------|---------------------------------|------------------------------|---------------------------|
| 306,434 | 1,650,000 | 1,600,000 | 50,000 | 5,610,000 | 5,143,363 |

Comments:

| | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|--|----------|----------|-----------------|-----------------------------------|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - Heavy-Section Steel Irradiation Program | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | | 1/31/00 | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) | |
| | | | | | | | | | | | | | | | | | | 1,906 | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) | |
| | | | | | | | | | | | | | | | | | | 306 | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 168 | 156 | 99 | 115 | 118 | 166 | 163 | 166 | 172 | 142 | 132 | 140 | 100 | 69 | | | | |
| | ACTUAL | 113 | 207 | 29 | 149 | 153 | 159 | 137 | 147 | 144 | 95 | 107 | | | | | | | |
| | EARNED | 140 | 157 | 104 | 107 | 172 | 139 | 137 | 112 | 122 | 101 | 119 | | | | | | | |
| | CUM. PLAN. | 168 | 324 | 423 | 538 | 656 | 822 | 985 | 1151 | 1323 | 1465 | 1597 | 1737 | 1837 | 1906 | | | | |
| | CUM. ACT. | 113 | 320 | 349 | 498 | 651 | 810 | 947 | 1094 | 1238 | 1333 | 1440 | | | | | | | |
| | CUM. EARN. | 177 | 334 | 434 | 508 | 680 | 819 | 956 | 1068 | 1190 | 1291 | 1410 | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|--|----------|----------|-----------------------------------|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--------|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--------|----|----|----|----|----|----|----|----|----|----|----|--|--|--|------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|--|--|--|------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|--|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 1. Program Management | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES 1/4/00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td rowspan="5">ACCRUED COSTS (\$K)</td> <td>PLANNED</td> <td>18</td><td>25</td><td>21</td><td>17</td><td>13</td><td>11</td><td>12</td><td>13</td><td>15</td><td>12</td><td>14</td><td>20</td><td>13</td><td>15</td> </tr> <tr> <td>ACTUAL</td> <td>18</td><td>37</td><td>20</td><td>17</td><td>21</td><td>19</td><td>25</td><td>15</td><td>16</td><td>11</td><td>13</td><td></td><td></td><td></td> </tr> <tr> <td>EARNED</td> <td>18</td><td>24</td><td>23</td><td>14</td><td>18</td><td>13</td><td>14</td><td>12</td><td>15</td><td>13</td><td>17</td><td></td><td></td><td></td> </tr> <tr> <td>CUM. PLAN.</td> <td>18</td><td>43</td><td>64</td><td>81</td><td>94</td><td>105</td><td>117</td><td>130</td><td>145</td><td>157</td><td>171</td><td>191</td><td>204</td><td>219</td> </tr> <tr> <td>CUM. ACT.</td> <td>18</td><td>55</td><td>75</td><td>92</td><td>113</td><td>132</td><td>157</td><td>172</td><td>188</td><td>199</td><td>212</td><td></td><td></td><td></td> </tr> <tr> <td>CUM. EARN.</td> <td>18</td><td>42</td><td>65</td><td>79</td><td>97</td><td>110</td><td>124</td><td>136</td><td>151</td><td>164</td><td>181</td><td></td><td></td><td></td> </tr> </table> | | | | | | | | | | | | | | | | | ACCRUED COSTS (\$K) | PLANNED | 18 | 25 | 21 | 17 | 13 | 11 | 12 | 13 | 15 | 12 | 14 | 20 | 13 | 15 | ACTUAL | 18 | 37 | 20 | 17 | 21 | 19 | 25 | 15 | 16 | 11 | 13 | | | | EARNED | 18 | 24 | 23 | 14 | 18 | 13 | 14 | 12 | 15 | 13 | 17 | | | | CUM. PLAN. | 18 | 43 | 64 | 81 | 94 | 105 | 117 | 130 | 145 | 157 | 171 | 191 | 204 | 219 | CUM. ACT. | 18 | 55 | 75 | 92 | 113 | 132 | 157 | 172 | 188 | 199 | 212 | | | | CUM. EARN. | 18 | 42 | 65 | 79 | 97 | 110 | 124 | 136 | 151 | 164 | 181 | | | |
| ACCRUED COSTS (\$K) | PLANNED | 18 | 25 | 21 | 17 | 13 | 11 | 12 | 13 | 15 | 12 | 14 | 20 | 13 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ACTUAL | 18 | 37 | 20 | 17 | 21 | 19 | 25 | 15 | 16 | 11 | 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | EARNED | 18 | 24 | 23 | 14 | 18 | 13 | 14 | 12 | 15 | 13 | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CUM. PLAN. | 18 | 43 | 64 | 81 | 94 | 105 | 117 | 130 | 145 | 157 | 171 | 191 | 204 | 219 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CUM. ACT. | 18 | 55 | 75 | 92 | 113 | 132 | 157 | 172 | 188 | 199 | 212 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CUM. EARN. | 18 | 42 | 65 | 79 | 97 | 110 | 124 | 136 | 151 | 164 | 181 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td colspan="2">ELEMENT COSTS FOR PRIOR FYS (\$K)</td> <td colspan="15">29</td> </tr> </table> | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) | | 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ELEMENT COSTS FOR PRIOR FYS (\$K) | | 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|--|----------|---|--|--|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 2. Fracture Toughness Transition and MC Methodology | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | 1/31/00 | | | | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) 539 | | | | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) 21 | | | | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 29 | 25 | 14 | 20 | 36 | 80 | 57 | 55 | 47 | 52 | 45 | 39 | 25 | 15 | | | | | | |
| | ACTUAL | -18 | 43 | 14 | 50 | 53 | 53 | 63 | 51 | 44 | 29 | 43 | | | | | | | | | |
| | EARNED | 24 | 24 | 11 | 26 | 89 | 59 | 36 | 20 | 18 | 13 | 23 | | | | | | | | | |
| | CUM. PLAN. | 29 | 54 | 68 | 88 | 124 | 204 | 261 | 316 | 363 | 415 | 460 | 499 | 524 | 539 | | | | | | |
| | CUM. ACT. | -18 | 25 | 39 | 89 | 142 | 195 | 258 | 309 | 353 | 382 | 425 | | | | | | | | | |
| CUM. EARN. | 24 | 48 | 59 | 87 | 174 | 233 | 269 | 289 | 307 | 320 | 343 | | | | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|------------|----|-----|-----|-----|-----|-----|-----|-----|--|-----|-----|-----|-----|-------------------------------------|---|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 3. Irradiation Embrittlement of RPV Steel | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | 1/31/00 | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) 552 | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) 167 | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 52 | 43 | 30 | 41 | 35 | 42 | 46 | 52 | 51 | 41 | 41 | 32 | 24 | 22 | | | |
| | ACTUAL | 92 | 31 | -50 | 48 | 28 | 62 | 17 | 32 | 35 | 20 | 25 | | | | | | |
| | EARNED | 48 | 42 | 29 | 33 | 28 | 33 | 38 | 40 | 41 | 40 | 47 | | | | | | |
| | CUM. PLAN. | 52 | 95 | 125 | 166 | 201 | 243 | 289 | 341 | 392 | 433 | 474 | 506 | 530 | 552 | | | |
| | CUM. ACT. | 92 | 123 | 73 | 121 | 149 | 211 | 228 | 260 | 295 | 315 | 340 | | | | | | |
| | CUM. EARN. | 48 | 90 | 119 | 152 | 180 | 213 | 251 | 291 | 332 | 372 | 419 | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|--|----------|-----------------|-----------------------------------|--|--|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 4. Validation of Irradiated and Aged Materials | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | | | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | | 1/31/00 | | | | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) | | | | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | | 272 | | | | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) | | | | |
| | | | | | | | | | | | | | | | | | | 30 | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 35 | 37 | 20 | 15 | 11 | 12 | 20 | 15 | 18 | 17 | 13 | 23 | 22 | 14 | | | | | | | |
| | ACTUAL | 1 | 57 | 29 | 20 | 17 | 13 | 14 | 11 | 26 | 29 | 17 | | | | | | | | | | |
| | EARNED | 30 | 31 | 23 | 14 | 15 | 18 | 23 | 14 | 18 | 20 | 18 | | | | | | | | | | |
| | CUM. PLAN. | 35 | 72 | 92 | 107 | 118 | 130 | 150 | 165 | 183 | 200 | 213 | 236 | 258 | 272 | | | | | | | |
| | CUM. ACT. | 1 | 58 | 87 | 107 | 124 | 137 | 151 | 162 | 188 | 217 | 234 | | | | | | | | | | |
| | CUM. EARN. | 30 | 61 | 84 | 98 | 113 | 131 | 154 | 168 | 186 | 206 | 224 | | | | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|--|----------|-----------------------------------|--|--|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 5. Modeling and Microstructural Analysis | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | 1/4/00 | | | | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) | | | | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) | | | | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | 42 | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 20 | 15 | 5 | 12 | 13 | 5 | 3 | 3 | 6 | 4 | 3 | 5 | 5 | 3 | | | | | | |
| | ACTUAL | 4 | 29 | 7 | 5 | 24 | 5 | 6 | 10 | 8 | 1 | 1 | | | | | | | | | |
| | EARNED | 5 | 25 | 9 | 9 | 10 | 4 | 7 | 7 | 8 | 3 | 5 | | | | | | | | | |
| | CUM. PLAN. | 20 | 35 | 40 | 52 | 65 | 70 | 73 | 76 | 82 | 86 | 89 | 94 | 99 | 102 | | | | | | |
| | CUM. ACT. | 4 | 33 | 40 | 45 | 69 | 74 | 80 | 90 | 98 | 99 | 100 | | | | | | | | | |
| | CUM. EARN. | 5 | 30 | 39 | 48 | 58 | 62 | 69 | 75 | 84 | 87 | 92 | | | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|--|----------|-----------------|-----------------------------------|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 6. Irradiation Coordination | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | | 1/4/00 | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) | |
| | | | | | | | | | | | | | | | | | | 187 | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) | |
| | | | | | | | | | | | | | | | | | | 17 | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 10 | 9 | 10 | 10 | 10 | 15 | 20 | 23 | 30 | 11 | 11 | 11 | 11 | 0 | | | | |
| | ACTUAL | 16 | 9 | 9 | 9 | 10 | 7 | 4 | 16 | 8 | 3 | 9 | | | | | | | |
| | EARNED | 15 | 10 | 9 | 11 | 12 | 12 | 11 | 11 | 13 | 12 | 13 | | | | | | | |
| | CUM. PLAN. | 16 | 25 | 35 | 45 | 55 | 70 | 90 | 113 | 143 | 154 | 165 | 176 | 187 | 187 | | | | |
| | CUM. ACT. | 16 | 25 | 34 | 43 | 53 | 60 | 64 | 80 | 88 | 91 | 100 | | | | | | | |
| | CUM. EARN. | 15 | 25 | 34 | 45 | 57 | 69 | 80 | 91 | 104 | 116 | 129 | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|--|----------|-----------------|--|--|
| 1. CONTRACT REPORTING ELEMENT HSSI - 7. Embrittlement DB & Dosimetry Evaluation | | | | | | | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | | 3. JCN NO. W6953 | | | | |
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | | | | | | | 5. CONTRACT PERIOD FY 1999-2000 | | | | | 6. ACTIVITY NUMBER 41 W6 95 3W 1 | | | | |
| | | | | | | | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | | 8. DOE B&R NO. 40 10 01 06 | | | | |
| 9. MONTHS | | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | COST PLAN DATES | | |
| 10. COST STATUS (\$K) | | | | | | | | | | | | | | | | | | 1/4/00 | |
| 400 | | | | | | | | | | | | | | | | | | PLANNED COSTS FOR ELEMENT (\$K) 26 | |
| 300 | | | | | | | | | | | | | | | | | | | |
| PLANNED COSTS (BCWS) | | | | | | | | | | | | | | | | | | ELEMENT COSTS FOR PRIOR FYS (\$K) 1 | |
| 200 | | | | | | | | | | | | | | | | | | | |
| ACTUAL COSTS (ACWP) | | | | | | | | | | | | | | | | | | 1 | |
| 100 | | | | | | | | | | | | | | | | | | | |
| EARNED VALUE (BCWP) | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| ACCRUED COSTS (\$K) | PLANNED | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | | | | |
| | ACTUAL | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 12 | 7 | 2 | 0 | | | | | | | |
| | EARNED | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 8 | 9 | 0 | 0 | | | | | | | |
| | CUM. PLAN. | 0 | 1 | 1 | 1 | 1 | 1 | 6 | 11 | 16 | 21 | 26 | 26 | 26 | 26 | | | | |
| | CUM. ACT. | 0 | 1 | 1 | 1 | 1 | 1 | 8 | 20 | 27 | 29 | 29 | | | | | | | |
| | CUM. EARN. | 0 | 1 | 1 | 1 | 1 | 1 | 9 | 17 | 26 | 26 | 26 | | | | | | | |
| 11. REMARKS: | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 1. Program Management | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|----|---|----------------|----------------|----------------|---------|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | 5. CONTRACT PERIOD FY 1998-2001 | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | | | | | |
| | | 7. NRC B&R NO. 860 15 21 20 05 | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | FY 2000 | | | | FY 2001 | | | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | |
| 1. 1. A. | Issue Project & Budget Proposal | | ▲ | ◆ ⁹ | ◆ ¹ | ◆ ² | ◆ ³ | ▲ | | | | | | | | | | | | | | | | | |
| 1. 1. B. | Select and Administer Subcontracts | ▼ | | | | | | ▼ | | | | | | | | | | | | | | | | | |
| 1. 2. A. | Issue Earned Value Based Monthly Management Reports (by the end of subsequent month) | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 2. B. | Ensure QA Requirements are met | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 3. A. | Participate in Appropriate Codes and Standards Committees | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 3. B. | Participate in NRC-Sponsored Meetings and Discussions | | ▼ | | | | | | | | | | | | | | | | | | | | | | ▼ |
| 1. 3. C. | Coordinate NRC and Internal Reviews | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 3. D. | Coordinate Domestic and Foreign Information Exchange as Approved by NRC-RES | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 3. E. | Coordinate HSSI Letter and NUREG Reports | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. 3. F. | Document the Historical Information Generated by the Old HSSI Program | | | | | | | | | | | | | | | | | | | | | | | | ▲ |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 2. Fracture Toughness Transition & MC Methodology | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|----|---|----|----|---|---------|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | 5. CONTRACT PERIOD FY 1998-2001 | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | | | | | |
| | | 7. NRC B&R NO. 860 15 21 20 05 | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | FY 2000 | | | | FY 2001 | | | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | |
| 2. 1. A. | Complete Draft NUREG Report on Comparison of CVN and Fracture Toughness Shifts | █▲ | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 2. A. | Sample Preparation and Irradiation for Master Curve | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| 2. 2. B. | Receive Specimens | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 2. C. | Test Unirradiated & Irradiated Master Curve Specimens | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 2. D. | Draft Letter and NUREG Reports | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 3. A. | Design, Fabrication, Calibration, Evaluation and NUREG Report for Phase I | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| 2. 4. A. | Mid and Weld Evaluations | █▲ | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 4. B. | Pressure Vessel and Piping (ASME) Report | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 5. A. 1. | Test Mid and Crack Arrest Specimens | █▲ | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 5. A. 2. | Analyze Crack Arrest Data & Draft NUREG | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 5. B. | Prepare a Comprehensive NUREG | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 6. A. | IG Fracture Obtain & Machine HT Pieces | █▲ | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 2. Fracture Toughness Transition & MC Methodology | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | | | | |
|--|---|---|----|---|----|----|---|---------|---|-----|---|---------|---|-----|---|---|---|---|---|---|---|---|---|------|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | 5. CONTRACT PERIOD FY 1998-2001 | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | | | | |
| | | 7. NRC B&R NO. 860 15 21 20 05 | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | FY 2000 | | | | FY 2001 | | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 2. 6. B. | Age & Evaluate by CVN | ■ | | ▼ | | | | | | | | | | | | | | | | | | | | |
| 2. 6. C. | Machine C(T)s and Test | ■ | | ▼ | | | | | | | | | | | | | | | | | | | | |
| 2. 6. D. | MC Impact Evaluations | ■ | | ▼ | | | | | | | | | | | | | | | | | | | | |
| 2. 6. E. | Reports and Administration | ■ | | ■ | | | | ■ | | | | ◊ 12 | | ◊ 4 | | ◊ | | | | | | | | |
| 2. 7. A. | Complete Fabrication and Preliminary Testing of Subsize Specimen | | | | | ■ | | ■ | | ◊ 7 | | ◊ 2 | | | | | | | | | | | | |
| 2. 7. B. | Complete Testing of Subsize Specimens | | | | | | | | | | ■ | ■ | | ▼ | | | | | | | | | | |
| 2. 7. C. | Complete NUREG Report on Results of Subsize Specimen Fracture Toughness Tests | | | | | | | | | | | | | | | | | | | | | | | ▲ |
| 2. 7. D. | Fabricate A302B PCVNs from 3 Heats | | | | | | | | | | ■ | ▲ | | | | | | | | | | | | |
| 2. 7. E. | Test and Analyze | | | | | | | | | | | | | | | | | | | | | | | ◊ 10 |
| 2. 7. F. | Prepare Letter Report | | | | | | | | | | | | | | | | | | | | | | | ◊ 10 |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 2. Fracture Toughness Transition & MC Methodology | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | |
|---|---|---------|----|--|----|----|---|----------------------------------|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 2. 8. A. | Complete Plan for Assembly and Compilation of Surrogate Materials Data Base | █ | | | | | | | | | | | | | | | | | | | | | | |
| 2. 8. B. | Complete Assembly and Compilation for Unirradiated Materials | | █ | | | | | | | | | | | | | | | | | | | | | |
| 2. 8. C. | Complete Statistical Analyses of Data Base for Unirradiated Materials | | | | █ | | | | | | | | | | | | | | | | | | | |
| 2. 8. D. | Complete Draft NUREG Report on Guidelines for use of Surrogate Materials to Establish | | | | | | | | | | | █ | | | | | | | | | | | | |
| 2. 8. E. | Complete Assembly and Compilation for Irradiated Materials | | | | | | | | | | | | | | | | | | | | | | | |
| 2. 8. F. | Complete Statistical Analysis of Data Base for Irradiated materials | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 3. Irradiation Embrittlement of RPV Steel | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|----|---|----|----|---|---------|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | 5. CONTRACT PERIOD FY 1998-2001 | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | | | | | | |
| | | 7. NRC B&R NO. 860 15 21 20 05 | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | FY 2000 | | | | FY 2001 | | | | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | | |
| 3. 1. A. | Age HAZ Materials | ▽ ⁶ | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. B. | Machine CVN Specimens | | ▾ | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. C. | Evaluate Results and Prepare Letter Report | | ▬ | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. D. | Irradiate Capsules | | | ▬ | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. E. | Ship Specimens | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. F. | Test Specimens | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 1. G. | NUREG Report | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 2. A. | NUREG on IA Work to Date | | ▬ | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 2. B. | Dosimetry of 30 CVNs | | ▾ | ▬ | | | | | | | | | | | | | | | | | | | | | | |
| 3. 2. C. | NUREG on 30 CVNs (IAR) | | ▬ | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 2. D. | Test Plan for Critical Materials | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. 2. E. | IAR of Critical Materials | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 3. Irradiation Embrittlement of RPV Steel | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | |
|--|---|---------|----|---|----|----|---|---|---------|---|---|---|----------------|-----------------|---|---|---|---|---|---|---|---|---|---|--|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | |
| 3.3.A. | Ship JRQ Specimens From PSI to ORNL | | | | | | | | | | | ▽ | ◇ ⁹ | ◇ ¹⁰ | | | | | | | | | | | |
| 3.3.B. | Complete Test Plan | | | | | | | | | | | ▽ | ◇ ⁹ | ◇ ¹¹ | | | | | | | | | | | |
| 3.3.C. | Complete JRQ Specimen Testing | | | | | | | | | | | | | | | | | | | | | | | ▽ | |
| 3.3.D. | Complete Draft NUREG Report on IAR Results of JRQ | | | | | | | | | | | | | | | | | | | | | | | ▽ | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 4. Validation of Irradiated and Aged Materials | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | |
|--|--|--|----|---|----|----|---|---|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 4. 1. 1. A. | JPDR Information Exchange with JAERI | [Gantt bar spanning from Q3 FY 1998 to Q2 FY 2000] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 1. 1. B. | Machining & Inspection of JPDR | [Gantt bar spanning from Q4 FY 1998 to Q3 FY 1999] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 1. 1. C. | Testing, Letter & NUREG Report | [Gantt bar spanning from Q4 FY 1998 to Q3 FY 2000] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 1. 3 | Maine Yankee RPV Feasibility Study | [Gantt bar spanning from Q3 FY 1999 to Q2 FY 2001] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 3. B. | Complete Draft NUREG Report on Thermal Aging of SS Welds | [Gantt bar spanning from Q3 FY 1998 to Q3 FY 1999] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 4. A. | Complete Preparation of List of Anticipated Foreign Travel | [Gantt bar spanning from Q4 FY 1998 to Q3 FY 2000] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 4. B. | Participate in Periodic Meetings of IGRDM | [Gantt bar spanning from Q1 FY 1999 to Q3 FY 2000] | | | | | | | | | | | | | | | | | | | | | | |
| 4. 4. C. | Complete Progress Reports of Collaboration Activities | [Gantt bar spanning from Q4 FY 1998 to Q3 FY 2000] | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 4. Validation of Irradiated and Aged Materials | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | |
|--|--|---------|----|---|----|------|-----|---|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 4.5.A. | Complete Plans for Testing of Specimens in MEA Capsule, Procurement and Testing of Palisades Capsule & Evaluation of PWHT Sheets | ■ | | | | | | | | | | | | | | | | | | | | | | |
| 4.5.B. | Complete Letter Report Regarding RPV Materials Available for Irradiation Study | | | | | ◇ 12 | ◇ 4 | | | | | | | | | | | | | | | | | |
| 4.5.D. | Complete Letter Report on Test results From MEA Capsule | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 5. Modeling & Microstructural Analysis | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | |
|--|--|---------|----|---|----|----------------|---|---|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|----------------|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| 5. 1. A. | Development and Predictive use of Embrittlement Model | | | | ▽ | ◇ ¹ | | | | | | | | | | | | | | | | | | △ |
| 5. 1. B. | Model Validation and Data Analysis | | | | | | | | | | | | | | | | | | | | | | | |
| 5. 2. A. | Coordinate and Analyze APFIM/SANS/FEGSTEM Round Robin Experiment | | | △ | | | | | | | | | | | | | | | | | | | | ◇ ¹ |
| 5. 2. B. | APFIM Characterization | | | | △ | | | | | | | | | | | | | | | | | | | ◇ ⁵ |
| 5. 3. A. | Conduct and Coordinate Experiments in HFIR, HFBR, and FNR | | | | ▽ | | | | | | | | | | | | | | | | | | | |
| 5. 3. B. | High-Flux Irradiation-Annealing-Reirradiation in HFIR | | | | | | | | | | | | | | | | | | | | | | | |
| 5. 4 | Administration of Task Activities | | | | | | | | | | | | | | | | | | | | | | | ▽ |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 6. Irradiation Coordination | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | |
|--|--|---------|----|---|----|----|---|---|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|--|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | |
| 6. 1. A. | Coordinate the Operation, Data Collection, and Maintenance of the HSSI IAR Facility | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. 1. B. | Comprehensive Report on Reusable Irradiation Facilities | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. 2. A. | Coordinate the Operation, Data Collection, and Maintenance of the UCSB Irrad. Facility | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | |

| 1. CONTRACT REPORTING ELEMENT HSSI - 7. Embrittlement DB & Dosimetry Evaluation | | | | 2. REPORTING PERIOD 7/24/00 - 8/27/00 | | | | 3. JCN NO. W6953 | | | | | | | | | | | | | | | | | |
|--|---|---------|----|---|----|----|---|---|---------|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|--|
| 4. CONTRACTOR (NAME AND ADDRESS) OAK RIDGE NATIONAL LABORATORY P.O. BOX 2008 OAK RIDGE, TN 37831 | | | | 5. CONTRACT PERIOD FY 1998-2001 | | | | 6. ACTIVITY NO. 41 W6 95 3W 1 | | | | | | | | | | | | | | | | | |
| | | | | 7. NRC B&R NO. 860 15 21 20 05 | | | | 8. DOE B&R NO. 40 10 01 06 | | | | | | | | | | | | | | | | | |
| 9. MILESTONE IDEN. NO. | 10. MILESTONE DESCRIPTION | FY 1998 | | FY 1999 | | | | | FY 2000 | | | | | FY 2001 | | | | | | | | | | | |
| | | Q3 | Q4 | Q1 | Q2 | Q3 | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | |
| 7. 1. A. | Evaluate and Input Surveillance Reports into Embrittlement Database | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. 1. B. | Complete Update 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. 1. C. | Complete Update 11 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | |