

JCN - J5167

MONTHLY LETTER STATUS REPORT
For October 2002

Project Title: Spent Fuel Review Assistance
Period of Performance: February 3, 1997 - December 31, 2003
JCN: J5167
PNNL Project Manager: M. A. Khaleel (509-375-2438)
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NRC Project Manager: P. Kinney (301-415-7805)
NRC Technical Monitor: C. Bajwa (301-415-1237)

Project Objective: The objective of this project is to conduct safety and environmental reviews and development of regulatory guidance related to Independent Spent Fuel Storage Installations and Dry Cask Storage facilities.

Task Orders 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 COMPLETED

Task #12

Title: Development and Analysis of Spent Fuel and Radioactive Material Cask Models for Casework Evaluations

JCN: J5167

PNNL Task Manager: T. E. Michener (509-375-2162)
NRC Technical Monitor: C. Bajwa (301-415-1237)

OBJECTIVE

The objective of this task order is to provide package analyses in support of ongoing casework using the ANSYS, ANSYS LS-DYNA FEA, COBRA-SFS, and Star-CD packages.

PROGRESS DURING REPORTING PERIOD

In October PNNL staff performed the following:

- PNNL staff participated in a one week long QA inspection of the TN West, Fremont facility. A number of corrective actions were issued during this inspection as well as the disclosure of new information not originally included in the submitted SAR documentation.
- Revised the TN32PT and TN24PHB cask models to include high-emissivity Aluminum plates. Revised the TN-24PT & 32PHB fuel assembly models to represent 17x17 fuel (as worst case), rather than the 15x15 fuel. Also continued to support the TN32PT and TN24PHB review efforts via additional COBRA-SFS confirmatory analyses and investigations into the ANSYS modeling approach used by the applicant (TN West). These additional evaluations were triggered by QA

A/4

JCN - J5167

inspection findings and new information provided by the applicant at the time of the inspection (information not included in the TN-32PT SAR documentation).

- PNNL staff developed/computed effective SNF thermal conductivities for B&W 15x15 and WE 17x17 for the purpose of providing verification of DOE/TRW published effective fuel thermal conductivity results and values submitted by TN West. This involved running COBRA-SFS simulations with the "current" TN information and using the temperature distributions as boundary conditions for ANSYS simulations to determine appropriate Keffs.
- The 3D ANSYS Baltimore Tunnel Fire (BTF) transient model is in the process of being constructed. Requested input information was provided by NIST regarding associated boundary conditions and was built into the BTF model. Preliminary results have not been obtained yet due to conflicts between model execution size and available computational resources. Also, PNNL staff were unexpectedly diverted by NRC to support the TN West onsite Inspection. Preliminary 3-D results are now anticipated in November.
- Due to the evolving support requirements for the TN-32PT and the BTF analyses, thermal modeling support for the MP-197/DSC 61BT and DSC 52BT were postponed.

TRAVEL

Tom Michener and Harold Adkins traveled to San Jose to participate in an inspection of the TN West, Fremont facility.

Tom Michener traveled to NRC HQ to consult on all ongoing efforts with NRC staff.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

- The unexpected/unplanned size of effort required to support the TN-32PT submittal and the BTF analyses has impacted the funding requirements for Task 12. We will require additional funding on the order of 10 staff weeks for this task.
- Preliminary results for the 3D BTF simulation have not been obtained yet due to conflicts between model execution size and available computational resources. Steps will be taken in the near future to reduce the model to a reasonable size without compromising prediction capability and accuracy.

PLANS FOR NEXT REPORTING PERIOD

PNNL staff will continue to support the TN24PHB review efforts via COBRA-SFS confirmatory analyses and investigations into the ANSYS modeling approach used by the applicant. The associated SAR documentation will also continue to be reviewed for consistency, accuracy, and completeness. It is anticipated that additional COBRA-SFS and ANSYS modeling efforts will be necessary as new information is provided by TN West.

PNNL staff will continue to develop the MP 197 transport package, construct the 52BT NUHOMS

JCN - J5167

evaluation model, and review of the TN24PHB SAR.

Tom Michener will attend the public meeting on ongoing transportation related efforts on November 19, 2002. This was possible at minimum cost, since he is attending a conference in the DC area during this period.

FINANCIAL STATUS AND VARIANCE ANALYSIS

See attached financial status report. The cost and funding information reported on the Cost Status by Element Table includes the necessary adjustments to account for the DOE Adder. All other cost information reflects only the Pacific Northwest National Laboratory costs and does not include the DOE Adder.

PROPERTY AND SOFTWARE

PNNL procured a workstation computer to support current and future tasks performed under the JCN J5167 project. For compatibility, a Dell 2 CPU workstation model PWS 530 configured to match the NRC SFPO machine was selected. The machine was received, installed, and is currently supporting tasks.

Task #13

Title: Dynamic Structural Analyses in Support of Risk-Informing 10 CFR Part 71

JCN: J5167

PNNL Task Manager:	H. E. Adkins	(509-372-6629)
NRC Technical Monitor:	D. T. Huang	(301-415-3381)

OBJECTIVE

The objectives of this task are to: 1) compare the structural analyses results of NUREG-6672 using the ANSYS LS-DYNA FEA packages with selected spent fuel transportation packages currently certified by the NRC; 2) determine the deformed geometry and cladding integrity of three selected pressurized water reactors (PWR) high burn-up (50, 60, and 75 GWD/MTU) spent nuclear fuel assemblies suitable for transport in the systems identified; 3) train selected NRC staff members in the use of ANSYS LS-DYNA in cask analyses; 4) provide continued support on high burn-up material and thermal issues.

PROGRESS DURING REPORTING PERIOD

In October PNNL staff performed the following:

- PNNL staff continued to review the NRC document NUREG 6672.
- PNNL staff reviewed a proposed Critical Strain Energy Density (CSED) methodology, regarding evaluation of SNF high burnup cladding, presented by EPRI. Extensive comments were provided to representatives at the NRC.

JCN - J5167

- PNNL staff postponed the beginning of construction of the first of two ANSYS/LS-DYNA models of SNF transport systems until obtaining approval of modification 1 to this task. Approval is still pending.

TRAVEL

Harold Adkins traveled to Washington DC in October to participate in discussions with the NRC regarding EPRI's CSED evaluation methodology of high burnup SNF.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

None.

PLANS FOR NEXT REPORTING PERIOD

After obtaining approval from the NRC on modification 1 of this task, it is anticipated that PNNL staff will be able to begin construction of the first of two identified SNF transport systems. In the mean time, PNNL staff will begin to assemble material property databases to be incorporated into the ANSYS/LS-DYNA structural response models.

FINANCIAL STATUS AND VARIANCE ANALYSIS

See attached financial status report. The cost and funding information reported on the Cost Status by Element Table includes the necessary adjustments to account for the DOE Adder. All other cost information reflects only the Pacific Northwest National Laboratory costs and does not include the DOE Adder.

PROPERTY AND SOFTWARE

An annual LS-DYNA license was obtained for use to perform the remainder of this task.

Task #14

Title: Inelastic Buckling Capacity of High Burn-up Fuel Subject to End Impact Loads

JCN: J5167

PNNL Task Manager: H. E. Adkins (509-372-6629)
NRC Technical Monitor: D. T. Tang (301-415-8535)

OBJECTIVE

The objectives of this task are to: 1) Compute inelastic buckling capacity and corresponding strain ductility demands for selected PWR spent fuel clads under simulated cask handling or drop accidents, using the ANSYS computer code; 2) Train selected NRC staff members in the use of ANSYS for fuel clad inelastic buckling analyses.

PROGRESS DURING REPORTING PERIOD

In October PNNL staff performed the following:

- Constructed an initial ANSYS input deck for elastic Euler buckling of a homogenous end-supported column using beam elements.
- Verified Euler buckling results against theoretical predictions.
- Defined solution control procedures and convergence criteria to automatically identify the onset of buckling behavior using the large-deformation nonlinear buckling method in ANSYS.
- Began integrating spacer grid supports and alternative end boundary conditions into the model.

TRAVEL

None.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

None.

PLANS FOR NEXT REPORTING PERIOD

Over the next reporting period PNNL staff will continue to integrating spacer grid supports and representative end boundary conditions into the model. In addition, nonlinear material properties will be obtained and incorporated.

FINANCIAL STATUS AND VARIANCE ANALYSIS

See attached financial status report. The cost and funding information reported on the Cost Status by Element Table includes the necessary adjustments to account for the DOE Adder. All other cost information reflects only the Pacific Northwest National Laboratory costs and does not include the DOE Adder.

PROPERTY AND SOFTWARE

None.

SPENT FUEL REVIEW ASSISTANCE

M. A. Khaleel
(509) 375-2438
October 2002

	<u>Current Month</u>	<u>FYTD</u>	<u>Cumulative To Date</u>
I. Direct Staff Labor Hours	309.5	309.5	15,044.3
II. Direct Salaries	19,119	19,119	785,637
Materials & Services (Excluding ADP)	38	38	14,543
ADP Support	0	0	0
Subcontracts	0	0	57,316
Travel Expenses	1,256	1,256	48,059
Indirect Labor Costs	9,269	9,269	348,200
Other Direct Costs	1,894	1,894	81,260
G&A, Nuclear, and Serv Assmt	14,088	14,088	580,645
Total PNNL Costs	\$45,664	\$45,664	\$1,915,660
Percent Spent		34%	96%
Total Costs to NRC (Includes DOE Adder)	\$47,034	\$47,034	\$1,976,908

III. Overall Funding Status

PNNL Available Funding (Adjusted: Reflects DOE Adder Initiated in FY92)

<u>Total ICN Funding</u>	<u>Prior FY Carrvoer</u>	<u>FY03 Projected Funding Level</u>	<u>FY03 Funds Received to Date</u>	<u>FY03 Funding Bal. Needed</u>
\$2,004,498	\$56,832	\$582,524	\$77,670	\$504,854

NRC Funding Provided to DOE

<u>Total ICN Funding</u>	<u>Prior FY Carrvoer</u>	<u>FY03 Projected Funding Level</u>	<u>FY03 Funds Received to Date</u>	<u>FY03 Funding Bal. Needed</u>
\$2,068,100	\$58,537	\$600,000	\$80,000	\$520,000

JCN - J5167

JCN - J5167

Task Funding Status (PNNL dollars)

Task No.	NRC \$ Task Funds	PNNL \$ Task Funds	NRC Funds Rec To Date	PNNL Funds Rec. To Date	Monthly Costs	Cumulative Costs	Remaining Funds	Additional NRC Funds Requested
Completed Tasks	1,779,234	1,724,043	1,738,100	1,684,106	0	1,682,355	1,751	41,136
12	250,000	242,718	250,000	242,718	38,421	214,564	28,155	0
13	200,000	194,175	50,000	48,544	2,395	13,894	34,650	150,000
14	62,000	60,194	30,000	29,126	4,848	4,848	24,278	32,000
Total	2,291,234	2,221,130	2,068,100	2,004,498	45,664	1,915,660	88,834	223,136

JCN - J5167

Task 14 - Inelastic Buckling Capacity of High Burn-up Fuel Subject to End Impact Loads

1. Financial Summary

PNNL Available Funding (Adjusted: Reflects DOE Adder Initiated in FY92)

<u>Authorized</u> <u>Cost Ceiling</u>	<u>Funding</u> <u>Obligation</u>	<u>Period Costs</u>	<u>Total</u> <u>Costs to Date</u>	<u>Cumulative</u> <u>Percent Spent</u>
\$60,194	\$29,126	\$4,848	\$4,848	16.6%

NRC Funding Provided to DOE

<u>Authorized</u> <u>Cost Ceiling</u>	<u>Funding</u> <u>Obligation</u>	<u>Period Costs</u>	<u>Total</u> <u>Costs to Date</u>	<u>Cumulative</u> <u>Percent Spent</u>
\$62,000	\$30,000	\$4,993	\$4,993	16.6%

2. Task Cost Status:

	<u>Current</u> <u>Month</u>	<u>Fiscal</u> <u>Year to Date</u>	<u>Cumulative</u> <u>To Date</u>
Direct Staff Labor Hours	39.5	39.5	39.5
Labor	\$4,848	\$4,848	\$4,848
Travel Expenses	\$0	\$0	\$0
Service Equipment Centers	\$0	\$0	\$0
Other Intermediate Costs	\$0	\$0	\$0
Value Added Overheads	\$0	\$0	\$0
Services - Other RL Contractors	\$0	\$0	\$0
Procurements	\$0	\$0	\$0
Subcontracts	\$0	\$0	\$0
Total PNNL Costs	\$4,848	\$4,848	\$4,848
Total Costs to NRC	\$4,993	\$4,993	\$4,993

(Includes DOE Adder)

JCN - J5167

Task 13 - Dynamic Structural Analyses in Support of Risk-Informing
10 CFR Part 71

1. Financial Summary

PNNL Available Funding (Adjusted: Reflects DOE Adder Initiated in FY92)

<u>Authorized</u> <u>Cost Ceiling</u>	<u>Funding</u> <u>Obligation</u>	<u>Period Costs</u>	<u>Total</u> <u>Costs to Date</u>	<u>Cumulative</u> <u>Percent Spent</u>
\$194,175	\$48,544	\$2,395	\$13,894	28.6%

NRC Funding Provided to DOE

<u>Authorized</u> <u>Cost Ceiling</u>	<u>Funding</u> <u>Obligation</u>	<u>Period Costs</u>	<u>Total</u> <u>Costs to Date</u>	<u>Cumulative</u> <u>Percent Spent</u>
\$200,000	\$50,000	\$2,467	\$14,312	28.6%

2. Task Cost Status:

	<u>Current</u> <u>Month</u>	<u>Fiscal</u> <u>Year to Date</u>	<u>Cumulative</u> <u>To Date</u>
Direct Staff Labor Hours	18.5	18.5	118.0
Labor	\$2,395	\$2,395	\$13,721
Travel Expenses	\$0	\$0	\$0
Service Equipment Centers	\$0	\$0	\$173
Other Intermediate Costs	\$0	\$0	\$0
Value Added Overheads	\$0	\$0	\$0
Services - Other RL Contractors	\$0	\$0	\$0
Procurements	\$0	\$0	\$0
Subcontracts	\$0	\$0	\$0
Total PNNL Costs	<u>\$2,395</u>	<u>\$2,395</u>	<u>\$13,894</u>
Total Costs to NRC	<u>\$2,467</u>	<u>\$2,467</u>	<u>\$14,312</u>

(Includes DOE Adder)

JCN - J5167

Task 12 - Development of Analysis of Spent Fuel & Radioactive Material Cask
Cask Models for Casework Evaluations

1. Financial Summary

PNNL Available Funding (Adjusted: Reflects DOE Adder Initiated in FY92)

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
\$242,718	\$242,718	\$38,421	\$214,564	88.4%

NRC Funding Provided to DOE

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
\$250,000	250,000	\$39,574	\$221,000	88.4%

2. Task Cost Status:

	Current Month	Fiscal Year to Date	Cumulative To Date
Direct Staff Labor Hours	251.5	251.5	1,544.1
Labor	\$36,008	\$36,008	\$198,635
Travel Expenses	\$1,912	\$1,912	\$6,066
Service Equipment Centers	\$459	\$459	\$632
Other Intermediate Costs	\$0	\$0	\$0
Value Added Overheads	\$0	\$0	\$0
Services - Other RL Contractors	\$0	\$0	\$0
Procurements	\$43	\$43	\$9,230
Subcontracts	\$0	\$0	\$0
Total PNNL Costs	\$38,421	\$38,421	\$214,564
Total Costs to NRC (Includes DOE Adder)	\$39,574	\$39,574	\$221,000

