

JCN - J5167

**MONTHLY LETTER STATUS REPORT
For January 2003**

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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Richland, WA 99352
Facsimile: 509-375-6605
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)

PERIOD OF PERFORMANCE: 4/4/02 - 12/31/03

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 January PNNL staff performed the following:

- Reconstructed the 2D Baltimore Tunnel Fire (BTF) model to accept a revised 30 hour data stream recently provided by NIST. The purpose of this task is to obtain and contribute additional information concerning the ramping and cool-down nature of the SNF after cessation of the fire. Preliminary results have been provided to the technical monitor. Additional (more formal) results will be provided to the technical monitor as they become available.
- PNNL staff simulated the vacuum transient in the TN-24.

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TRAVEL

None.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

None.

PLANS FOR NEXT REPORTING PERIOD

PNNL staff will support thermal analysis needs in February on an "as required" or highest priority basis as designated by the NRC technical lead. PNNL staff will travel to NRC headquarter in February to provide a program update and assist with modeling efforts using the NRC computational resources.

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.

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)

PERIOD OF PERFORMANCE: 7/11/02 - 12/31/03

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 January PNNL staff performed the following:

- Investigated applicability/validity of correlations, associated databases, and source information concerning fracture toughness, yield, & ultimate strength models and associated databases were provided in draft form to the Technical Monitor electronically via email.
- Initiated development of explicit SNF LS-DYNA subcomponents to be used in the explicit modeling of an entire SNF assembly for the two SNF transport systems to be modeled. Scoping sensitivity analyses were performed using beam and shell elements for determining the most suitable element types to add and maintain effective computational speed.
- Provided an alternate form of the ductility/strain data as a function of hydrogen content brought on by burnup duration at the NRC staff's request.
- Continued development of flaw size and fracture data collection related to high burnup SNF for further development of a predictive material failure model.

TRAVEL

None.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

None.

PLANS FOR NEXT REPORTING PERIOD

Additional funding expected in February/March time frame is required to continue model construction of the first of two identified SNF transport systems. Continuing support on CSED will be provided if needed. Support will also be provided on the topic of moderator exclusion if necessary.

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.

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)

PERIOD OF PERFORMANCE: 10/17/02 - 3/31/03

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 January PNNL staff performed the following:

- PNNL staff conducted discussions with the NRC Technical Monitor on a weekly basis to maintain assurance that emphasis is being placed on items and information of highest priority. Progress and informal parametric sensitivity results have been communicated as they become available. This reporting approach was chosen over providing a formal progress report to expedite parametric sensitivity evaluations.
- The 3D solid element model (time-marching transient response model) was de-bugged and optimized to minimize computation time. The results yielded by this model were less accurate than originally anticipated when compared to previous 2D findings and required much more time than originally anticipated (22-26 hours). This model was dropped in favor of developing a more rigorous 3D solid and 3D shell element explicit dynamic LS-DYNA model. This path was selected because of the ability of the explicit dynamic LS-DYNA model to compute ductility requirements more accurately and require much less time per run (2-6 hours).
- De-bugging and optimization of the 3D solid and 3D shell element explicit LS-DYNA models was completed and baseline comparisons against previously published findings were performed. Information yielded from the comparison gave confidence that these models were performing properly.

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 conduct discussions with the NRC Technical Monitor to maintain assurance that emphasis is being placed on appropriate items. Parameter sensitivity analyses will continue to be investigated at the NRC technical monitors request. The original parametric investigation will be performed, and a draft report is anticipated to be completed by the end of the next reporting period.

FINANCIAL STATUS AND VARIANCE ANALYSIS

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.

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SPENT FUEL REVIEW ASSISTANCE

M. A. Khaleel
(509) 375-2438
January 2003

	<u>Current Month</u>	<u>FYTD</u>	<u>Cumulative To Date</u>
I. Direct Staff Labor Hours	213.0	1,359.0	16,093.8
II. Direct Salaries	12,139	78,526	845,045
Materials & Services (Excluding ADP)	0	85	14,591
ADP Support	0	0	0
Subcontracts	0	0	57,316
Travel Expenses	0	2,253	49,056
Indirect Labor Costs	5,463	36,730	375,661
Other Direct Costs	1,031	6,735	86,101
G&A, Nuclear, and Serv Assmt	8,323	55,497	622,054
Total PNNL Costs	<u>\$26,956</u>	<u>\$179,827</u>	<u>\$2,049,824</u>
Percent Spent		67%	96%
Total Costs to NRC (Includes DOE Adder)	<u>\$27,765</u>	<u>\$185,222</u>	<u>\$2,115,096</u>

III. Overall Funding Status

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

<u>Total JCN Funding</u>	<u>Prior FY Carryover</u>	<u>FY03 Projected Funding Level</u>	<u>FY03 Funds Received to Date</u>	<u>FY03 Funding Bal. Needed</u>
\$2,137,508	\$56,832	\$582,524	\$210,680	\$371,845

NRC Funding Provided to DOE

<u>Total JCN Funding</u>	<u>Prior FY Carryover</u>	<u>FY03 Projected Funding Level</u>	<u>FY03 Funds Received to Date</u>	<u>FY03 Funding Bal. Needed</u>
\$2,205,100	\$58,537	\$600,000	\$217,000	\$383,000

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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
TO 12	518,900	503,786	315,000	305,825	5,352	262,406	43,420	203,900
TO 13	368,400	357,670	90,000	87,379	14,251	67,609	19,770	278,400
TO 14	62,000	60,194	62,000	60,194	7,353	37,454	22,740	0
Total	2,728,534	2,645,693	2,205,100	2,137,508	26,956	2,049,824	87,681	523,436

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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>Funding</u>		<u>Total</u>	<u>Cumulative</u>
<u>Cost Ceiling</u>	<u>Obligation</u>	<u>Period Costs</u>	<u>Costs to Date</u>	<u>Percent Spent</u>
\$60,194	\$60,194	\$7,353	\$37,454	62.2%

NRC Funding Provided to DOE

<u>Authorized</u>	<u>Funding</u>		<u>Total</u>	<u>Cumulative</u>
<u>Cost Ceiling</u>	<u>Obligation</u>	<u>Period Costs</u>	<u>Costs to Date</u>	<u>Percent Spent</u>
\$62,000	\$62,000	\$7,574	\$38,578	62.2%

2. Task Cost Status:

	<u>Current</u>	<u>Fiscal</u>	<u>Cumulative</u>
	<u>Month</u>	<u>Year to Date</u>	<u>To Date</u>
Direct Staff Labor Hours	63.5	306.5	306.5
Labor	\$7,353	\$37,454	\$37,454
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	<u>\$7,353</u>	<u>\$37,454</u>	<u>\$37,454</u>
Total Costs to NRC	<u>\$7,574</u>	<u>\$38,578</u>	<u>\$38,578</u>

(Includes DOE Adder)

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**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)

Authorized <u>Cost Ceiling</u>	Funding <u>Obligation</u>	<u>Period Costs</u>	Total <u>Costs to Date</u>	Cumulative <u>Percent Spent</u>
\$357,670	\$87,379	\$14,251	\$67,609	77.4%

NRC Funding Provided to DOE

Authorized <u>Cost Ceiling</u>	Funding <u>Obligation</u>	<u>Period Costs</u>	Total <u>Costs to Date</u>	Cumulative <u>Percent Spent</u>
\$368,400	\$90,000	\$14,679	\$69,638	77.4%

2. Task Cost Status:

	<u>Current Month</u>	<u>Fiscal Year to Date</u>	<u>Cumulative To Date</u>
Direct Staff Labor Hours	109.5	447.0	546.5
Labor	\$14,251	\$54,493	\$65,819
Travel Expenses	\$0	\$1,517	\$1,517
Service Equipment Centers	\$0	\$94	\$267
Other Intermediate Costs	\$0	\$0	\$0
Value Added Overheads	\$0	\$0	\$0
Services - Other RL Contractors	\$0	\$0	\$0
Procurements	\$0	\$6	\$6
Subcontracts	\$0	\$0	\$0
Total PNNL Costs	<u>\$14,251</u>	<u>\$56,110</u>	<u>\$67,609</u>
Total Costs to NRC	<u>\$14,679</u>	<u>\$57,793</u>	<u>\$69,638</u>

(Includes DOE Adder)

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**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
\$503,786	\$305,825	\$5,352	\$262,406	85.8%

NRC Funding Provided to DOE

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
\$518,900	315,000	\$5,513	\$270,279	85.8%

2. Task Cost Status:

	Current Month	Fiscal Year to Date	Cumulative To Date
Direct Staff Labor Hours	40.0	605.5	1,898.1
Labor	\$5,217	\$83,667	\$246,294
Travel Expenses	\$0	\$1,912	\$6,066
Service Equipment Centers	\$135	\$594	\$767
Other Intermediate Costs	\$0	\$0	\$0
Value Added Overheads	\$0	\$0	\$0
Services - Other RL Contractors	\$0	\$0	\$0
Procurements	\$0	\$92	\$9,279
Subcontracts	\$0	\$0	\$0
Total PNNL Costs	\$5,352	\$86,265	\$262,406
Total Costs to NRC (Includes DOE Adder)	\$5,513	\$88,853	\$270,279

MONTHLY FORECAST VS ACTUAL - PNNL EXPENSE BY TASK

[illegible]