JCN – J5167

MONTHLY LETTER STATUS REPORT
For December 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)
Address:	PO Box 999, Mail Stop K2-18 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)

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 December PNNL staff performed the following:

- Using the most recent calc-pack from Transnuclear, additional TN-32 COBRA-SFS analyses were performed using identical boundary conditions and material properties. The results from this effort were provided to the Technical Monitor. Our results were similar to the initial TN calculations, however, their confirmatory analyses had a much lower Peak Clad Temperature, directly related to their increasing the contribution of natural convection to a level that PNNL staff believe to be impossible.

- On December 2, PNNL responded to NRC's request for proposal for Task 12, modification 2.

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TRAVEL

None.

REPORT, PAPERS, AND PUBLICATIONS

None.

ANTICIPATED AND ENCOUNTERED PROBLEM AREAS

None.

PLANS FOR NEXT REPORTING PERIOD

Additional funding expected in January will allow PNNL staff to support continuing BTF thermal needs and provide confirmatory analyses on designs on an as needed basis.

FINANCIAL STATUS AND VARIANCE ANALYSIS

Task ceiling was increased to $518.9K. NRC authorized additional $65K for this task. 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)

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 December PNNL staff performed the following:

- PNNL staff developed fracture toughness correlations designed to predict the fracture toughness of uniform hydrided zirconium cladding.
- PNNL staff finished compiling yield strength and ultimate tensile strength data for high burnup fuel and developed correlations with this data that can be directly applied to the current initiative.
- All correlations, associated databases, and source information were provided in draft form to the Technical Monitor electronically via email.

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 draft documentation of the correlations and begin model construction for the first of two identified SNF transport systems. Information concerning ductility as a function of burnup will also be assembled based on available literature.

FINANCIAL STATUS AND VARIANCE ANALYSIS

Task ceiling was increased to $368.4K. NRC authorized additional $40K for this task. 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)

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 December PNNL staff performed the following:

- Based on the 12/6/02 telephone conference, the importance of extending the solution to capture post-buckling behavior was realized and incorporated into current models.
- Multiple methods were evaluated for extending the solution to capture post-buckling behavior. A time-marching transient response method was adopted after the evaluation.
- 2D baseline evaluations involving a beam element model were performed successfully and results were compared to previously published findings. Information yielded from the comparison gave confidence that the 2D model was performing properly and that baseline results had been established that could later be used to judge the performance of the 3D solid element model.
- An extensive progress report including status and the latest set of models, and associated results were provided to the NRC Technical Monitor electronically via email.
- A 3D solid element model, including all spring elements and mating surface contact elements (fuel compartment wall), was completely constructed. It is currently being de-bugged and optimized to minimize computation time.

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 conduct discussions with the NRC Technical Monitor to maintain assurance that emphasis is being placed on items needed to enhance Argonne National Laboratory (ANL) high burnup testing results comparisons. Another progress report will be provided to the NRC Technical Monitor.

PNNL staff will also complete de-bugging and optimization of the 3D solid element model, complete a baseline comparison against the 2D beam element model results, and perform the intended sensitivity analyses.

FINANCIAL STATUS AND VARIANCE ANALYSIS

NRC authorized additional $32K for this task. 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.

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SPENT FUEL REVIEW ASSISTANCE

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

	Current Month	FYTD	Cumulative To Date
I. Direct Staff Labor Hours	499.5	1,146.0	15,880.8
II. Direct Salaries	28,490	66,387	832,906
Materials & Services (Excluding ADP)	43	85	14,591
ADP Support	0	0	0
Subcontracts	0	0	57,316
Travel Expenses	0	2,253	49,056
Indirect Labor Costs	12,992	31,267	370,198
Other Direct Costs	2,236	5,704	85,070
G&A, Nuclear, and Serv Assmt	19,528	47,175	613,731
Total PNNL Costs	$63,289	$152,872	$2,022,868
Percent Spent		57%	95%
Total Costs to NRC (Includes DOE Adder)	$65,188	$157,458	$2,087,332

III. Overall Funding Status

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

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

NRC Funding Provided to DOE

Total JCN Funding	Prior FY Carryover	FY03 Projected Funding Level	FY03 Funds Received to Date	FY03 Funding Bal. Needed
$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
12	518,900	503,786	315,000	305,825	18,327	257,054	48,772	203,900
13	368,400	357,670	90,000	87,379	29,187	53,358	34,021	278,400
14	62,000	60,194	62,000	60,194	15,775	30,101	30,093	0
Total	2,728,534	2,645,693	2,205,100	2,137,508	63,289	2,022,868	114,637	523,436

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)

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
$60,194	$60,194	$15,775	$30,101	50.0%

NRC Funding Provided to DOE

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
$62,000	$62,000	$16,248	$31,004	50.0%

2. Task Cost Status:

	Current Month	Fiscal Year to Date	Cumulative To Date
Direct Staff Labor Hours	141.5	243.0	243.0
Labor	$17,292	$30,101	$30,101
Travel Expenses	($1,517)	$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	$15,775	$30,101	$30,101
Total Costs to NRC (Includes DOE Adder)	$16,248	$31,004	$31,004

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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 Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
$357,670	$87,379	$29,187	$53,358	61.1%

NRC Funding Provided to DOE

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
$368,400	$90,000	$30,063	$54,960	61.1%

2. Task Cost Status:

	Current Month	Fiscal Year to Date	Cumulative To Date
Direct Staff Labor Hours	229.5	337.5	437.0
Labor	$27,637	$40,242	$51,568
Travel Expenses	$1,517	$1,517	$1,517
Service Equipment Centers	$33	$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	$29,187	$41,859	$53,358
Total Costs to NRC (Includes DOE Adder)	$30,063	$43,115	$54,960

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	$18,327	$257,054	84.1%

NRC Funding Provided to DOE

Authorized Cost Ceiling	Funding Obligation	Period Costs	Total Costs to Date	Cumulative Percent Spent
$518,900	315,000	$18,877	$264,766	84.1%

2. Task Cost Status:

	Current Month	Fiscal Year to Date	Cumulative To Date
Direct Staff Labor Hours	128.5	565.5	1,858.1
Labor	$18,278	$78,450	$241,077
Travel Expenses	$0	$1,912	$6,066
Service Equipment Centers	$0	$459	$632
Other Intermediate Costs	$0	$0	$0
Value Added Overheads	$0	$0	$0
Services - Other RL Contractors	$0	$0	$0
Procurements	$49	$92	$9,279
Subcontracts	$0	$0	$0
Total PNNL Costs	$18,327	$80,913	$257,054
Total Costs to NRC (Includes DOE Adder)	$18,877	$83,340	$264,766

DATE Dec 2002 NRC JOB CODE J5167 MONTHLY FORECAST VS ACTUAL - PNNL EXPENSE BY TASK

TASK #	TASK DESCRIPTION		Prior Years	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	FY04	TOTALS
	Inelastic Buckling Capacity of High Burn-up...	NRC $'s	0.0	4.9	20.6	18.5	3.1	3.1	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0
14	PROJECTED	PNNL $'s	0.0	4.8	20.0	18.0	3.0	3.0	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.2
	Inelastic Buckling Capacity of High Burn-up...	NRC $'s	0.0	5.0	9.8	16.2											31.0
14	ACTUAL	PNNL $'s	0.0	4.8	9.5	15.8											30.1

TASK #	TASK DESCRIPTION		Prior Years	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	FY04	TOTALS
	Dynamic Structural Analyses in Support of...	NRC $'s	11.8	2.5	15.5	18.5	16.5	14.4	18.5	15.5	16.3	18.5	16.5	18.5	17.0	0.0	200.0
13	PROJECTED	PNNL $'s	11.5	2.4	15.0	18.0	16.0	14.0	18.0	15.0	15.8	18.0	16.0	18.0	16.5	0.0	194.2
	Dynamic Structural Analyses in Support of...	NRC $'s	11.8	2.5	10.6	30.1											55.0
13	ACTUAL	PNNL $'s	11.5	2.4	10.3	29.2											53.4

TASK #	TASK DESCRIPTION		Prior Years	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	FY04	TOTALS
	DEV OF ANALYSIS OF SF & RADIOACTIVE...	NRC $'s	181.4	39.6	15.5	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250.0
12	PROJECTED	PNNL $'s	176.1	38.4	15.0	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	242.7
	DEV OF ANALYSIS OF SF & RADIOACTIVE...	NRC $'s	181.4	39.6	24.9	18.9											264.8
12	ACTUAL	PNNL $'s	176.1	38.4	24.2	18.3											257.1