J5160

Sandia National Laboratories
Albuquerque, NM 87185-0718

David Tiktinsky
Mail Stop T-8-A-23
Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Tiktinsky:

Enclosed is the Monthly Status Report for March 1997 for the Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates Program (JCN J5160). The items included in the financial report meet the financial status requirements of Directive 11.7 consistent with Sandia's financial information system. If you have questions or comments, please phone, fax, or E-mail me at the numbers given below.

Sincerely,

Jeremy L. Sprung

Jeremy L. Sprung, DMTS
Transportation Systems Analysis
Department 6641
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Enclosure: Monthly Report

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DOE/AL J. D. Chavez
USNRC DCPM, Office of Administration
USNRC J. R. Cook, MS 0-6-F-18
USNRC E. Easton, MS 0-6-F-18
USNRC R. Thompson, MS T-7-I-2
SNL R. E. Luna, MS 0715
SNL J. E. Kelly, MS 0742
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A134

Monthly Letter Status Report

Reporting Period	March 1997
Name and Address	Organization 6641, Mail Stop 0718 Sandia National Laboratories P. O. Box 5800 Albuquerque, NM 87185-0718
JCN	J5160
Title	Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates
Principal Investigator	Jeremy L. Sprung
Project Period of Performance	November 1996 through May 1999

Objective

This study has three objectives:

Estimation of the radiological and non-radiological, routine and accident, transportation risks associated with the anticipated spent fuel shipments and determination of whether those risks are bounded by the estimates and projections of spent fuel shipment risks reached in NUREG-0170.

Examination of any outstanding spent fuel transportation issues or environmental concerns not resolved by NUREG-0170 and the Modal Study.

Documentation of the approach, data, and computational methods used to reestimate spent fuel transportation risks in detail sufficient to allow other transportation experts to fully understand the analyses performed, and preparation of brief and detailed summaries of the results in a form accessible to concerned citizens.

Technical Progress

Experimental Design. The experimental design was discussed in detail with Jon Helton, the LHS consultant for this program. Dr. Helton noted that because estimates are not available for the likelihood that a specific cask or route will be used to transport spent commercial reactor fuel, the risk estimates developed by this study can not be absolute risks. Instead they will be relative risks that depict how current risk estimates differ from those of original NUREG-0170 and how the range of the new estimates varies with transport cask and route characteristics.

Release Fractions. Work continued on the set of equations developed to allow accident release fractions and the conditional probability of the release given an accident of any severity. A way to use these equations to develop distributions of accident release fractions for each cask/accident type combination was developed. This analysis defines how Modal Study event trees for truck and train accidents will be combined with the dependence of cask failure areas on accident conditions and with simple models of accident release fractions to develop release probabilities.

Updated Truck and Train Accident Statistics. Review of available truck accident data confirmed that the dependence of accident rates on link population density is not directly available from the data. Instead, a model of the dependence of accident rates on population density must be assumed in order to divide overall accident rates into the rates applicable to urban, suburban, and rural aggregate route segments (links). A method for doing this was developed. The method is described in the initial draft of Section 3.0, Truck and Train Accident Statistics, that was submitted to NRC at the close of March.

Rail Shipment Risks. Because DOT's Volpe Center staff have agreed to support this study by developing current train accident statistics using their train accident data base and train accident models, completion of the train accident statistics portion of Task Ib, originally scheduled for completion at the end of March, has been delayed until the end of June so as to conform to DOT Volpe schedules for the analysis of train accidents.

Milestone Table

No.	Task	MW		Start Date		Finish date		
		Sch	Act	Scheduled	Actual	Scheduled	Projected	Actual
	Phase I							
Ia	Review of RADTRAN Input Parameters	8	4.6	10/96	11/96	12/96	12/96	12/96
b	Updated Truck and Train Accident Statistics	5	5.8	01/97	01/97	03/97	03/97	
c	Route Characteristics	7	1.0	04/97	02/97	06/97	06/97	
d	Representative Casks	5		06/97		07/97		
e	Impact Methodology	6		07/97		08/97		
f	Revised Proposal	1		09/97		09/97		
	Phase II							
IIa	Cask Mechanical Response Model	10		10/97		01/98		
b	Simple Cask Thermal Response Model	3		01/98		02/98		
c	Accident Source Terms	8	1.0	02/98		04/98		
d	RADTRAN LHS Calculations	7	1.0	03/98		09/98		
	Phase III							
IIIa	Other Topics	5		10/98		12/98		
b	Final Report	10		01/99		05/99		

Sch = Scheduled, Act = Actual, Actual means "to date" for tasks underway. During March two man-weeks of effort were devoted to the development of an experimental design for the analysis. As most of this effort supports Tasks IIc and IId, Accident Source Terms and RADTRAN LHS Calculations, one man-week of effort has been attributed to each of these tasks.

Anticipated or Encountered Problem Areas

None

Plans for Next Reporting Period

Work on Task Ib, Updated Truck and Train Accident Statistics will continue. Specifically, cooperative development of train accident statistics by SNL and DOT's Volpe Center will continue. Work on Task Ic, Route Characteristics will be initiated.

Property Acquired

No equipment with a value greater than $500 was purchased during the current month.

Travel

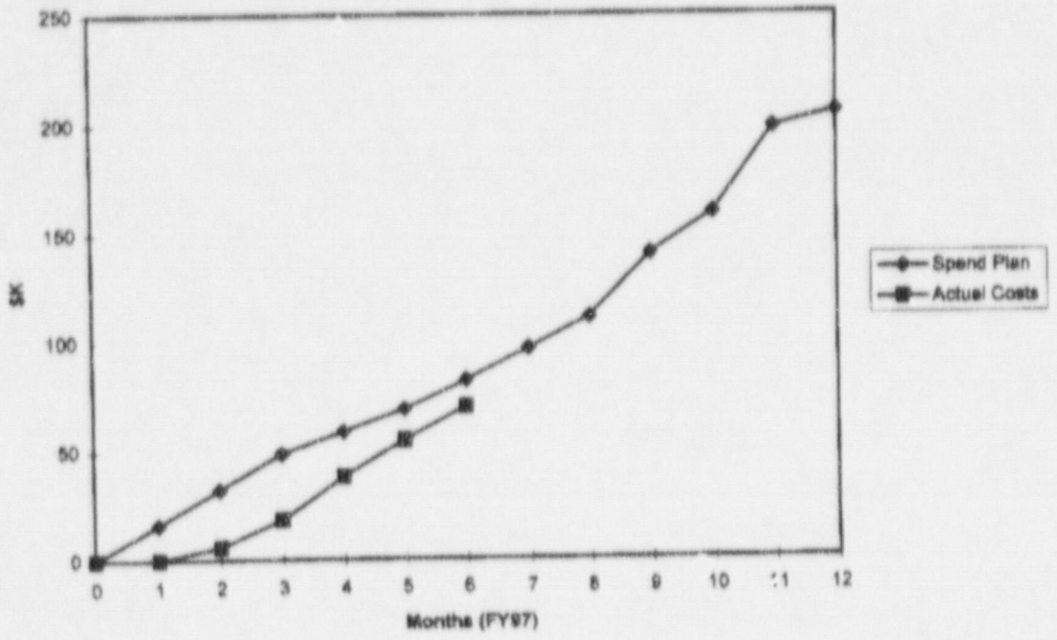
None.

Budget Status

The financial reporting for this month is based on the 189 submitted in October 1996. Please note that for FY97 the labor rate has decreased but the corporate rate has increased. Changes to SNL's FY97 rate structure are summarized on the next page.

Variance Analysis

The following graph compares actual costs to the spend plan submitted in October 1996. $15.4K was spent in March. Total costs to date are $70.0K.



FY97

DESCRIPTION OF TERMS USED IN MLSR FINANCIAL STATUS REPORT

3/6/97

MLSR TERM (order follows MLSR Financial Status Report Format)	HOW MLSR TERM IS COMPUTED *NOTE: ALL AMOUNTS INCLUDE DOE ADDER*
Total Project Authorized Amount	Life-to-date PLANNED FUNDING for the project. Sum of funds received through FY95 plus funding requested for FY96 and all subsequent fiscal years as shown on NRC Form 189.
Total Funds Obligated to Date	Life-to-date funds received at DOE for SNL.
Total Current Fiscal Year Authorized Amount	Current NRC Form 189 FY97 "Total DOE Project Cost"
Total Funds Obligated Current Fiscal Year	FY97 funds received at DOE for SNL.
DIRECT STAFF EFFORT: In Actual Hours Worked	Actual SNL Hours worked on the project. Does NOT contain subcontractor hours. The cumulative number was derived by taking previous fiscal year FTEs from FY94 forward and computing hours worked in each fiscal year.
Note: *Although SNL is providing Direct Staff Effort (Hours) on the mastercase for all JCNs, the computation will not be done for Individual Task Orders, because the calculation must be done manually and is possible at the mastercase level, but too cumbersome for Individual Task Orders, because subcases are subject to frequent change. At the END of each Fiscal Year, it is possible to multiply the FTE number by 1768 to get actual SNL hours worked for each Task Order, however, the hours will NOT include subcontractors. This calculation should only be done at the END of the Fiscal Year, since the SNL financial system averages FTEs throughout the year.*	
Total Uncosted Amount	Life-to-date funds received minus Life-to-date costs.
FY97 Commitments	Purchasing/Service Center commitments in SNL system for FY97. No DOE Added Factor, if applicable, is included in this number.
Total FY97 Uncommitted Amount	"Total Uncosted Amount" minus "FY97 Commitments." Since no DOE Added Factor is included in the "FY97 Commitments," this number serves as an indicator of approximate unencumbered funds for the current fiscal year. Subsequent FY commitments should be dealt with in narrative section of MLSR.
Percentage of Available Cumulative Funds Costed	Life-to-date costs divided by Life-to-date funds received.
Percentage of Available Current Fiscal Year Funds Costed	Current FY Costs divided by current FY funds available. Current FY funds available consists of new money received current FY plus actual carryover to FY97.
FY96 Carryover to FY97	Both the Actual Carryover and the 189 Planned Carryover from the Form 189 are shown here. However, the 189 Planned Carryover is the number used to compute the FY97 Funding Balance Needed.
FY97 Project Funding Level	Funds requested from NRC for FY97.
FY97 Funds Received to Date	See "Total funds Obligated Current Fiscal Year" above.
FY97 Funding Balance Needed	Balance of FY97 funding needed (from 189). Sum of (1) funds received through FY96, (2) FY95 funding differences from funding requested, (3) funding requested for FY 97. *Minus* (3) total funds received to date.
Projected Carryover to FY98	Planned carryover to FY98 (from 189).
Total Estimated Project Amount	See "Total Project Authorized Amount" above.
Total Project Cumulative Amount Obligated	See "Total Funds Obligated to Date" above.
Total Project Balance Needed	Balance of funding needed for the life of the project. Sum of (1) funds received through FY96, (2) FY96 funding differences from funding requested, (3) Funding requested FY97 and subsequent FYs (from 189), *Minus* (3) total funds received to date.
Total Project Cumulative Amount Costed	Life-to-date costs for the project.

JCN:J5160
Date Printed: 4/2/97

PI: SPRUNG, J.L.
ORG: 06641 MS0718

MLSR Financial Status Report
MARCH 1997

Job Code #: J5160 SNL Case # 2390 NRC Office: NMSS/SFPO
TITLE: REVALIDATION OF NUREG-0170 SPENT FUEL SHIPMENT RISK ESTIMATES

Project Period of Performance for this report: From 2/28/97 To 3/28/97
(See note in box below)

Life of Project (from Form 189) Proj. Start Date: 10/10/96
Proj. End Date: 5/31/99

No Cost Extension Date: No Cost Ext Date:

Total Project Authorized Amount:	$	492,000
Total Funds Obligated to Date:	$	220,000
Total Current Fiscal Year Authorized Amount:	$	205,000
Total Funds Obligated Current Fiscal Year:	$	220,000

	Current Month	Fiscal Year To Date	Cumulative(1) Project To Date
DIRECT STAFF EFFORT (HOURS) (Note: This includes SNL personnel, but not subcontractors)	122.60	636.80	636.80

Current Cost Incurred Status to the Actual Dollar

	Current Month	FY97 to Date	Cumulative(1) Project to Date (starting with FY94)
Direct Labor (Includes Overhead)	8,380.56	38,037.53	38,037.53
Materials and Services (Inc. "Other")	24.00	24.00	24.00
Travel Expenses	0.00	172.00	172.00
Subcontracts/Consultants	0.00	0.00	0.00
General and Administrative	6,392.03	28,843.61	28,843.61
Subtotal	14,796.59	67,077.14	67,077.14
DOE Added Factor (see note below)	636.25	2,884.32	2,884.32
Total Costs (Includes DOE Adder Factor)	15,432.84	69,961.46	69,961.46

Note: If the DOE Added Factor for Current Month is not 4.3% of the Subtotal, this JCN has a waiver from the adder. Due to the fact that this has become a case-by-case manual calculation, errors are possible on the MLSRs. Therefore, you should rely on the actual billings to verify DOE Added Factor for each month. The costs through "Subtotal" above are correct as reflected in the SNL Financial System.

Total Uncosted Amount	150,038.54	
FY97 Commitments		*Note: Due to changes in the SNL financial system, these numbers can exist in different*
Total FY97 Uncommitted Amount		*tables and can no longer be downloaded. Manual computation is required.*
Percentage of available cumulative funds costed	31.80%	
Percentage of available current fiscal year funds costed	31.80%	
Foreign Funds(2)		

(1) Categorized amounts are cumulative from FY94 to date. Breakdown from previous FY's is not available in our system.
(2) Portion of Total Costs charged to Foreign Funds is not available in our system. If applicable, it will be covered in Financial Status section of the narrative portion of this report one month later, since our billings reports become available in our system approximately two weeks after financial costing information is available.

JCN: J5160
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ORG: 06641 MS0718

MARCH 1997

Cost Totals By Project Task

TASK	Estimated Cost

NOT YET BEING REPORTED UNTIL FURTHER DIRECTION RECEIVED FROM NRC.

Monthly Spending Plan Update
(See Attached 189 Page 3 Format)

(THIS FORM WILL BE ATTACHED TO THE INITIAL MLSR FOR PROPOSALS CONVERTED TO THE NRC DIRECTIVE 11.7, AND WHEN CUMULATIVE-TO-DATE COSTS VARY BY 20% OR MORE FROM PLANNED SPENDING FOR PROPOSALS WHICH ARE IN THE 11.7 FORMAT)

Overall Funding Status (in actual dollars)

FY96 Carryover to FY97	FY 97 Project Funding Level	FY 97 Funds Received to Date	FY 97 Funding Balance Needed	Projected Carryover To FY 98
Actual: $0.00				
Plan (189): $0	$270,000	$220,000	$50,000	$65,000

Total Estimated Project Amount	Total Project Cumulative Amount Obligated	Total Project Balance Needed	Total Project Cumulative Amount Costed
$492,000	$220,000	$272,000	$69,961.46

NOTE: FOR TASK ORDERING AGREEMENTS: Individual reports for Task Orders under Task-Ordering Agreements are attached for those projects which have appropriate case structures for this type of reporting.

atories
185-0718

April 6, 1996

David Tiktinsky
Mail Stop T-8-A-23
Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Tiktinsky:

Enclosed is a preliminary draft of Section 3.0, Truck and Train Accident Statistics, of what will become the final report for the NRC project titled "Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates Program" (JCN J5160). This submission fulfills the second milestone for this program, completion of Phase I, Task b, Truck and Train Accident Statistics.

Submission of this draft section confirms that the work called for by the task that this section documents has been completed. Please note that as other program tasks are completed, more work may need to be done on the tasks documented by this draft which would necessitate revision of this draft.

If you have questions or comments about this submission, please phone, fax, or E-mail me at the numbers given below.

Sincerely,

Jeremy L. Sprung

Jeremy L. Sprung, DMTS
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JLS:6641:JLS

Enclosure: Milestone Submission
Copy to (w/encl.):
USNRC J. R. Cook, MS 0-6-F-18
SNL R. E. Luna, MS 0715
SNL R. Yoshimura, MS 0718

3.0 Truck and Train Accident Statistics

3.1 Introduction

Table 2-1 in Chapter 2 indicates that one of the key (important) parameters in calculating accident risks is the Link Accident RATe (LARAT). RADTRAN determines the probability of an accident occurring on a particular truck- or train-route link by computing the product of the length (in kilometers) and the accident rate (number of accidents per vehicle-kilometer) for that link. In general, accident rates vary with highway or rail line classification, e.g., Interstate, US and State highways or Main and Branch rail lines. Also, RADTRAN (in conformity with NUREG-0170) distinguishes between Rural, Suburban and Urban links, as defined by the population density bordering the link. For maximum specificity, specific accident-rate values would be assigned to these distinct portions of a route as well; in reality, such detailed data are not available and more generalized accident rates must be used. Regulations for transport of spent nuclear fuel (SNF) by truck specify that Interstate highways (HM-164) be used exclusively, except where not available. Therefore, Interstate highway accident rates are of primary interest for the truck transport portion of this study.

In compilations of accident statistics by the U.S. Department of Transportation (DOT), Interstate accident rates are subdivided into accidents occurring in Urban and Rural areas but the criterion does not correlate with those used in RADTRAN or NUREG-0170. The DOT distinction is between inside and outside city limits while the definitions for RADTRAN are 0 to 66, 67 to 1670, and greater than 1670 persons/km^2 for Rural, Suburban and Urban areas, respectively. In general, these definitions do not agree since there can be Suburban (or even Rural) population densities within city limits or Suburban population densities outside city limits. Past practice has been to use the DOT Urban accident rate for Interstate highway links identified as Urban in RADTRAN and to use the DOT Rural accident rate for Interstate highway links identified as Suburban or Rural in RADTRAN.

The intent of this study is to represent accident rates, over the entire set of routes to be analyzed, with cumulative probability distributions from which samples will be selected, using LHS, to provide values for input to RADTRAN calculations. This approach permits an approximate, statistical separation of the tabulated DOT data into Rural, Suburban and Urban accident rates for Interstate highways which will be presented in section 3.2.

Available rail accident data have been even more generalized in the past than highway accident data although volumes of rail accident descriptive reports have been collected by various agencies. In an effort to improve the specificity of rail accident-rate data, a cooperative study of rail transport data compiled by the Volpe National Transportation Systems Center of the DOT was initiated. Rail accident-rate values obtained in this supplemental study are presented in section 3.3.

3.2 Truck Accident Data

Over the years since NUREG-0170 was published, several studies of truck accident rates were performed by the DOT, the DOE or their contractors and the results published in formats that are more or less applicable to the needs of this present study. These studies are describe briefly in chronological order in Section 3.2.1.

3.2.1 Sources of Available Data

Urban Study

This was an investigation of actual accident experience in an urban area (New York City) performed to answer criticisms of the single, point-estimate accident rate used in NUREG-0170. The data were gathered in mid-1970's and the results were published in 1980 (Finley, 1980). The accident rates obtained are not applicable to Interstate highways but are included here to indicate a potential upper limit to be reached by accident-rate distributions employed in the current study.

California Highway Department Study

Highway accident rates for three truck types and several highway types were derived from California collision reports. Data for 1980 and 1981 were collected by the State of California Department of Transportation in response to a request from SNL and the results published in a SNL report (Smith & Wilmot, 1982).

Modal Study

Lawrence Livermore National Laboratory (LLNL) performed an analysis of SNF truck transport (Fischer et. al, 1987) in which truck accident rates were derived from three sources of data: DOT Bureau of Motor Carrier Safety (BMCS; now Office of Motor Carriers), American Petroleum Institute (API), and Calif. Dept. of Transportation. While LLNL chose the API value on the basis of tanker-truck similarity to trucks transporting SNF casks, the BMCS data are judged more applicable to the present study on the basis of a better match to the predominant highway types included.

SIS Project EIS

The DOE published an Environmental Impact Statement on the Special Isotope Separation Project in which a national average accident rate for combination trucks (tractor/trailers) on Interstate highways was derived from DOT data (DOE, 1988). Average accident rates for the specific routes considered in the EIS were also calculated and found to be nearly the same as the national average (48 states).

BMCS Data

Four years of accident data derived from reports submitted to the DOT by commercial carriers have been tabulated for Interstate highways inside and outside city limits (Urban and Rural by DOT definition) for each of the 48 contiguous United States. Three of the years were collected in a study performded by Argonne National Laboratory (ANL) for the DOE (Saricks & Kvitek, 1994). BMCS data are biased (toward more severe accidents

than total accident statistics) by the reporting criteria imposed by the DOT but they apply most specifically to the vehicle and highway types employed in SNF truck shipments.

Truck accident rates and the years from which data were obtained in these various reports are presented in Table 3-1 together with the value quoted in NUREG-0170.

Table 3-1 Truck Accident Rates (Accidents per Million Vehicle-Kilometers)

Source	Date	Urban or Total*	Non-Urban	Comments
NUREG-0170	pre-1975	0.46		
Urban Study (NY City)	1978 (?)	7.2 - 91		Depends on time of day
		15		Total Accid's. per Total Veh. km
Calif. Hwy. Dept.	1980	0.8	1.1	Truck/Trailers on Freeways; Total Accidents
	1981	0.7	1.0	
Modal Study				
BMCS	1960-72	1.6		Reportable Accid's.
Am. Petrol. Inst.	1968-81	4.0		Rate Selected
Calif. Hwy. Dept.	1981-83	0.6		Limited Access
		3.1		4-Lane
SIS Project**	1984	0.31		Tractor-Trailers
BMCS**	1984	0.20	0.28	Interstate Hwys.
ANL Long. Rev.	1986-88	0.36	0.20	Interstate Hwys.

* Urban rate if distinguished, otherwise Urban and Non-Urban rate combined

** Average over 48 states

It should be noted that these values are not based on the same accident type, truck type, highway type or equal sample sizes. However, they give an indication of the range of values that pertain to different types of highways, different demographic areas and different points in time. The latter difference was of particular concern because nearly all of these data were collected during the nationally-imposed 55 mph speed limit which has recently been canceled. In order to evaluate the effect on future accident rates, the history of accident rates, before and after the 55 mph speed limit, was examined. Table 3-2 lists truck accident data for various severities of accidents as compiled by the DOT for an applicable class of vehicles over several years spanning the speed limit change. Comparing an average of the rates for 1965 and 1970 with that for 1975 and 1980 suggests that the accident rate decreased a factor of approximately 2 as a result of the 55 mph speed limit. Since there are not yet any data which reflect the effect on accident rate of current (higher) Interstate highway speed limits (typically 65 to 75 mph), the available 1980's data may be doubled to provide conservative estimates of accident rates for the near future.

Table 3-2 DOT Accident Data for Motor Carriers of Property (Primarily Combination, Truck/Trailer, Vehicles)

Year	Motor Carriers of Property			Comb. Truck Veh. Mi.	Accident Rate
	Accidents	Fatalities	Injuries		
1965	31,132	1,603	18,737	3.25E+10	9.58E-07
1970	40,233	1,367	18,122	3.51E+10	1.15E-06
1975	24,274	2,232	26,374	4.67E+10	5.2E-07
1980	31,391	2,528	27,147	6.87E+10	4.57E-07
1985	29,068	2,646	28,988	7.96E+10	3.65E-07
1990	35,885	3,309	34,348	9.64E+10	3.72E-07
1991	34,405	3,036	32,889	9.69E+10	3.55E-07
1992	33,965	2,657	31,597		
Average	32,544			6.51E+10	5.96E-07
Std. Dev.	4,774			2.74E+10	3.22E-07
	14.67%			42.12%	53.93%

3.2.2 Truck Accident-Rate Distributions

The most comprehensive and recent of the data sets listed in Section 3.2.1 are the BMCS accident-rate listings for all 48 states which relate directly to combination truck accidents on Interstate highways. However, they are not separated into accidents within Rural, Suburban and Urban portions of the Interstate highway system, as required for RADTRAN input, but are distinguished only according to whether accidents occured inside (Urban) or outside city limits ("Rural"). This problem was resolved in NUREG-0170 by defining three accident severity weightings to distinguish the frequency of accident severities for each of the three population density ranges (NUREG-0170, p. 5-11). The probability of an accident of a given severity in a particular population density zone was then computed as the product of the Overall Accident Rate, the Accident Severity Fractional Occurance, the Population Density Zone Fractional Occurance, and the length of route within that Zone. Further development of RADTRAN has led to a more general, but conceptually similar method which employs distinct Rural, Suburban and Urban accident rates, and renormalized combinations of the Accident Severity Fractional Occurances with the Population Density Zone Fractional Occurances into Accident Severity Fractions for each of the population density zones. Accident probabilities are then computed as products of these Accident Severity Fractions, the Zone Accident Rates and the route lengths within the population density Zones.

Typically, separate accident rates for the population density zones are not available but can be derived from an Overall Accident Rate by a procedure which was developed for this study. The procedure employs the same set of severity fractional occurances found in NUREG-0170 but the population density fractions are derived taking into consideration various constraints imposed by normalization and the defining characteristics of the available accident data. Table 3-3 presents the results from an iterative spreadsheet calculation which was used to provide renormalized Severity Fractions, Population Density Zone Accident Rates; associated values relating to the constraints are also shown.

Table 3-3 Calculation of Accident Severity Fractions and Accident Rates by Population Density Zone

Severity Frac. Oc.	Rural Frac. Oc.	Product*	Suburban Frac. Oc.	Product*	Urban Frac. Oc.	Product*	Sum of Frac.Oc.
0.55	0.2	0.11	0.2	0.11	0.6	0.33	1.00
0.36	0.25	0.09	0.25	0.09	0.5	0.18	1.00
0.07	0.3	0.021	0.3	0.021	0.4	0.028	1.00
0.016	0.5	0.008	0.3	0.0048	0.2	0.0032	1.00
0.0028	0.6	0.00168	0.3	0.00084	0.1	0.00028	1.00
0.0011	0.7	0.00077	0.2	0.00022	0.1	0.00011	1.00
8.50E-05	0.8	0.000068	0.1	8.5E-06	0.1	8.5E-06	1.00
1.50E-05	0.9	1.35E-05	0.1	1.5E-06	0	0	1.00
Sum of 8 Products+		0.2315		0.2269		0.5416	
Frac. of Veh-km.**		0.5		0.3		0.2	
"Accident Rate"++		0.4631		0.7562		2.708	
Ratios of Accident Rates		R/U:	0.1710	S/U:	0.2793		

* Product of Severity and Population Density Zone Fractional Occurances.

\+ Proportional to the Population Density Zone number of accidents.

** Fraction of total vehicle-kilometers occuring in each of the Population Density Zones.

\+\+ Ratio of "Sum of 8 Products" to "Frac. of Veh-km"; proportional to the Population Density Zone Accident Rate.

The constraints imposed on the choices of Population Density Zone Fractional Occurances were:

1) High-severity accidents predominate in Rural areas (Smith & Wilmot, 1982)
2) Low-severity accidents predominate in Urban areas (Smith & Wilmot, 1982)
3) For each severity level, the Zone Fractional Occurances must sum to 1.0
4) Fraction of Veh-km. must be consistent with the values in the ANL Long. Review
5) Accident Rates are proportional to nominal traffic densities

Values for "Fraction of Veh-km." (constraint 4) were chosen to reflect a value of 26% "Urban", determined from the national totals for all three years in the ANL Long. Review (part of this fraction is suburban by the RADTRAN definition). Proportioning of the remaining 80% was based on the predominance of Rural over Suburban fractions for

typical routes in this study and better progression of Population Density Zone Fractional Occurance values with Accident Severity Category. The point estimate values for traffic density (470, 780 and 2800 vehicles per hour for Rural, Suburban and Urban, respectively) were applied in constraint number 5.

Table 3-4 presents the set of Severity Fractions obtained from Table 3-3 by dividing the "Product" values by the "Sum of 8 Products" for each population density zone in Table 3-3.

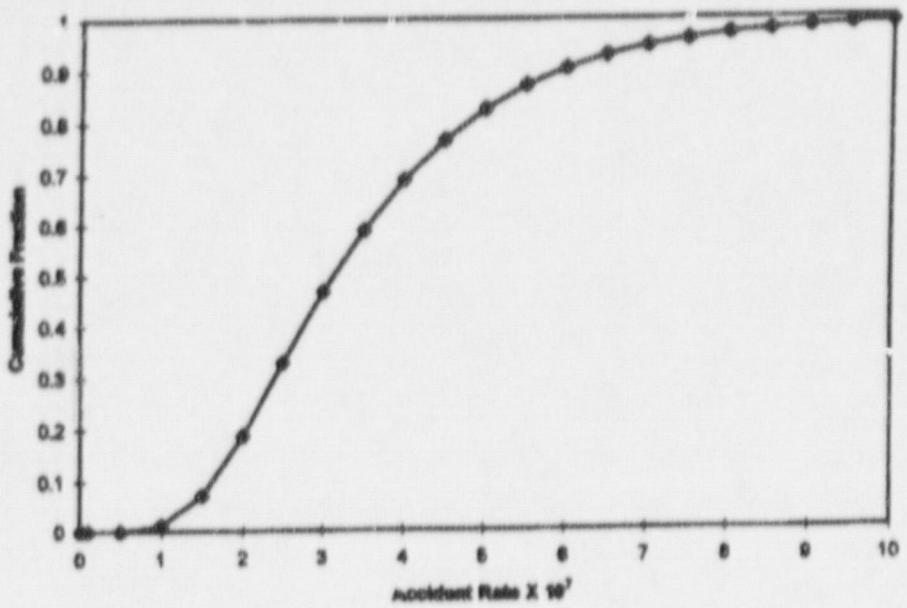
Table 3-4 Accident Severity Fractions Derived from Table 3-3

Severity Category	Severity Frac. Oc.	Rural Severity Fraction	Suburban Severity Fraction	Urban Severity Fraction
I	0.55	0.475	0.485	0.609
II	0.36	0.389	0.397	0.332
III	0.07	0.0907	0.0926	0.0517
IV	0.016	0.0346	0.0212	0.00591
V	0.0028	0.00726	0.00370	0.000517
VI	0.0011	0.00333	0.000970	0.000203
VII	8.50E-05	0.000294	3.75E-05	1.57E-05
VIII	1.50E-05	5.83E-05	6.61E-06	0

An Overall Accident Rate was determined from the ANL Long. Rev. by summing the national accident totals on Interstate highways (USA FAI) over all three years and dividing by the sum of national vehicle-km on Interstate highways over all three years; the value obtained was 2.43E-7 accidents per vehicle-km. This accident rate may be multiplied by the "Accident Rate" values in Table 3-3 to obtain Population Density Zone Accident Rates for use in point-estimate calculation of accident probabilities.

For the LHS calculations in this study, the Overall Accident Rate was replaced by an Overall Accident Rate Distribution. Figure 3-1 presents an Overall Accident Rate Distribution, based on the ANL Long. Rev. data, which is a cumulative lognormal distribution whose mode (peak of the frequency distribution) is 2.43E-7 and has values of 0.826 at 5.0E-7 (≈ 2 X mode) and 0.960 at 7.5 (≈ 3 X mode). A lognormal distribution was selected on the basis of the asymetry of maximum and minimum values relative to the mean of each of the two data sets. This distribution was judged a conservative representation of the range of accident rates tabulated by state in the ANL Long. Rev., i.e., the largest Interstate highway accident rate for any state was 4.24E-7 per veh-km. Independent samples from this distribution (LHS) were multiplied by 0.46, 0.76 and 2.71 to create Rural, Suburban and Urban accident rates, respectively, for the RADTRAN input files.

Figure 3-1 Overall Accident Rate Distribution



3.3 Train Accident Data

Sources of accident-rate data for rail transport which have become available since NUREG-0170 was published are not as numerous as for truck transport. Those that have been included in this study come from a subset of the sources described in Section 3.2.1; the values and their dates are tabulated in Table 3-3.

Table 3-5 Train Accident Rates

Source	Date	Urban or Total*	Comments
NUREG-0170	pre-1975	0.9E-6	Per Car km
Modal Study			
Fed. Rail Admin.	1975-82	7.5E-6	Per Train km All trains & tracks
ANL Long. Rev.**	1985-88	0.06E-6	Per Car km, All tracks
		0.03E-6	Per Car km, Main Line Only

* Urban rate if distinguished, otherwise Urban and Non-Urban rate combined

** Average over 48 States

Note that the rate from the Modal Study is per *train*-km which must be corrected to car-km for comparison to the other values. Comparing car-miles to train-miles on Class I railroads for 1980 and 1990, as obtained from the DOT Internet Web page, indicates that the approximate number of cars per train is 68. This value leads to a Modal Study

accident rate of 0.11E-6 per car-km which lies between the NUREG-0170 and ANL values.

In order to obtain a larger and more specific database on which to base rail accidentr-rate distributions

References

Engelmann, R. J., "Effectiveness of Sheltering in Buildings and Vehicles for Plutonium," DOE/EH-0159T, US DOE, Washington, DC (1990)

EPA (U.S. Environmental Protection Agency). "Proposed Guidance on Dose Limits for Persons Exposed to Transuranic Elements in the General Environment," EPA 520/4-77-016, U.S. EPA, Washington, DC (1977).

Finley, N. C., Aldrich, D. C., Daniel, S. L., Ericson, D. M., Hennig-Sachs, C., Koestner, P. C., Ortiz, N. R., Sheldon, D. D., Taylor, J. M., and Herreid, S. F., "Transportation of Radionuclides in Urban Environs: Draft Environmental Assessment," NUREG/CR-0743, SAND79-0369, Sandia National laboratories, Albuquerque, NM (1980).

Finley, N. C., McClure, J. D., and Reardon, P. C., "An Analysis of the Risks and Consequences of Accidents Involving Shipments of Multiple Type A Radioactive Material Packages," SAND88-1915, Sandia National Laboratories Albuquerque, NM (1988).

ICRP (International Commission on Radiological Protection), Task Group Report on Reference Man, Publication 23, Oxford, England: Pergamon Press (1975).

Madsen, M. M. and E. L. Wilmot, "Truck Transportation of Spent Fuel," PATRAM ???

Mills, G. S., Neuhauser, K. S., and Kanipe, F. L. "RADTRAN 4 Truck Accident Risk Sensitivity Analysis," Proceedings of Waste Management 95, WM Symposia, Tucson, AZ (1995a).

Mills, G. S., and Neuhauser, K. S. "Sensitivity Analysis for RADTRAN 4 Input Parameters," 88th Annual Meeting of the Air & Waste Management Assoc., San Antonio, TX (1995)

Mills, G. S., Neuhauser, K. S., and Kanipe, F. L., "Application of Latin Hypercube Sampling to RADTRAN 4 Truck Accident-Risk Sensitivity Analysis," Proceedings of PATRAM 95, Las Vegas, NV(1995b).

Neuhauser, K. S., Reardon, P. C., "A Demonstration Sensitivity Analysis for RADTRAN III," SAND85-1001, Sandia National Laboratories, Albuquerque, NM (1986).

Neuhauser, K. S. and R. F. Weiner, "Intermodal Transfer of Spent Fuel," SAND91-2602C, Sandia National Labs, Albuquerque, NM (1991).

NRC (U.S. Nuclear Regulatory Commission), "Final Environmental Statement on the Transportation of Radioactive material by Air and Other Modes," NUREG-0170, U.S. NRC, Washington DC (1977).

PROJECT ADMINISTRATION PLAN

JCN No J5160 Work Order/RFPA (Contract or PO) or Task Order No. _____

Contractor/Lab: SNL

Project Title: Rebuild of NRC 0170- SPENT FUEL

Task Manager: J. COURT Contract Specialist:

Is the project a part of a larger program area or is it a "stand alone" project? ( ) Yes (X) No If Yes - describe:

If the project is part of a larger program area, indicate how is it related to other projects in the program in terms of objectives, phasing or other applicable information.

Indicate priority, if any, given to this project by the Office Director and/or Division or indicate none:

Is there Government furnished property: ( ) Yes (X) No

Is there Contractor acquired property: ( ) Yes (X) No

Is capitalized software involved: ( ) Yes (X) No

Estimated Cost of the Work Order/Contract or PO/Task: $ 482K + mod

Funding: ___Fully Funded X Incrementally Funded expected to carry through 1/15 (indicate period).

Are options to extend the period of performance included? ( ) Yes ( ) No N/A
If yes, when does the notice to exercise need to be sent to DC/lab? _____

Checkpoint proposals in SOW

Is the effort proceeding on schedule and within costs? (X) Yes ( ) No
If no, discuss including steps taken or to be taken for corrective action:

Discuss any budgetary implications/concerns:

N/A

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Describe in-house actions in progress, brief description of work, potential problems/concerns or other pertinent information and the status e.g., issued proposal to PNL on 3/14/97, proposal due on 4/14/97, no problems/concerns OR RFPA sent to DC on 3/14, DC Issued proposal on 3/20, proposal due on 4/20, if action not awarded by 5/20 may have to reduce the funding level to meet the 45 day carry-over commitment OR need to prepare NRC Form 17 to accept TO2, Subtask B revision:

A ~~mod~~ request for mod was sent 3/20/97, ~~Contract~~ Funds, Came from Add. funding request (30K).

Describe proposed actions that are in the planning stages and not in-house yet (brief description of work, potential problems/concerns or other pertinent information and status:

N/A

Discuss any other information that will assist the new TAPM in minimizing transitioning downtime and to adequately administer this effort:

work closely with John Cook and NRC involved in points where new proposals are necessary.

On _____ the individuals below met and discussed the above.

N/A
Dave Tiktinsky

Date 4/17/97

R. TM
(indicate new TAPM)

Date 4/17/97

JCN J5160

Sandia National Laboratories (SNL)

Modification to Project Entitled
"Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates"
Job Code J5160

Modification Title
"Development of Highway and Rail Route Parameter Distributions"
(Reference NRC request for a preliminary proposal dated March 20, 1996)

1.0 INTRODUCTION

A. Background

The program plan for the "Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates" program that Sandia National Laboratories (SNL) is performing for the Nuclear Regulatory Commission (NRC) states that characteristic data will be developed for the routes over which commercial power reactor spent fuel might be shipped from operating reactors to interim storage and permanent disposal sites. This data, which is required input to the RADTRAN radioactive material (RAM) transportation risk assessment code, is usually developed by performing HIGHWAY code calculations for truck routes and INTERLINE code calculations for rail routes.

Because there are a great many possible routes from operating reactor sites to the set of possible interim and permanent storage sites, the revalidation program plan specified that the characteristics of the range of possible routes would be developed in the form of histograms of route data drawn from previous studies, principally the Multi-Purpose Canister Environmental Impact Statement (MPC EIS) recently prepared by Argonne National Laboratory (ANL). ANL has informed SNL that the HIGHWAY and INTERLINE data used in the MPC EIS can not be provided to SNL. Therefore, SNL must develop the needed data by combining route data developed to support prior SNL transportation risk studies with new route data developed by the performance of HIGHWAY and INTERLINE calculations for the highway and rail routes that connect current operating reactors to representative sets of candidate interim and permanent spent fuel storage sites.

B. Objective

The objective of this new program task is to develop distributions for the input parameters used by the RADTRAN code to specify the characteristics of the transportation routes examined by RADTRAN radioactive material transportation risk calculations.

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C. Purpose

The purpose of this subtask is to ensure that representative route data is used to support the revalidation program RADTRAN spent fuel transportation risk calculations.

2.0 SUMMARY OF PRIOR EFFORTS

SNL has previously examined the risks associated with the transport of spent power reactor fuel from operating reactor sites to nine candidate permanent repository sites. The results of that study were documented in a report titled "Transportation Impacts of the Commercial Radioactive Waste Management Program." [Cashwell et al., 1986, SAND85-2715]. Values for the following RADTRAN input parameters were developed by performing HIGHWAY and INTERLINE calculations for each route examined during that study: urban, suburban, and rural route segment lengths and population densities.

3.0 WORK TO BE PERFORMED AND EXPECTED RESULTS

A. Scope of Work

The set of HIGHWAY and INTERLINE calculations that will be performed will develop values for the following RADTRAN route input parameters, urban, suburban, and rural route segment lengths and population densities. Values will be developed for the shortest interstate truck and mainline rail routes that connect the 73 operating reactor sites to a representative set of possible interim storage sites and the representative set of interim storage sites to a representative set of possible permanent repository sites.

B. Approach

The locations of previously proposed interim and permanent storage sites for spent power reactor fuel will be identified. From each set of proposed locations, a representative set of locations will be selected. The sites that enter the representative sets will include all proposed sites that are still actively being considered supplemented by enough other locations to ensure that the sets of routes that connect these sites provide extensive coverage of the entire set of interstate highways and the entire set of main line railways. HIGHWAY and INTELINE calculations will be performed for each truck and rail route that connects the 73 currently operating reactor sites to the representative set of possible interim storage site locations and the set of possible interim storage site locations to the representative set of possible permanent storage site locations. Distributions of the urban, suburban, and rural route segment lengths and populations densities will be constructed using the output of the HIGHWAY and INTERLINE calculations performed to examine each individual truck or rail route. These distributions will be compared to the distributions developed for these parameters using data taken from SAND85-2715. Because both sets of distributions will be based on comprehensive sets of interstate and main line rail routes within the continental United States, the distributions based on data from SAND85-2715 and the distributions constructed from the results of the new HIGHWAY and INTERLINE

calculations are expected to be quite similar. If, as expected, this prove to be true, ten the underlying data will be pooled before the final distributions needed by the revalidation program RADTRAN calculations are constructed.

Route parameter distributions will be constructed using the results of the very large number of HIGHWAY and INTERLINE calculations that have been performed to support past RADTRAN calculations, including if possible those recently performed by ANL as part of the MPC EIS. Truck and train accident rates will be developed from literature data, especially from the state-level accident data published by ANL.

C. Tasks

This section describes each program task, specifies the task deliverable, and presents estimates of the task completion date and of the level of effort required to complete the task.

Task 1: Representative Sets of Possible Interim and Permanent Storage Sites (1 man-week)

The locations of previously proposed interim and permanent storage sites will be identified. Sites will be divided into two groups, sites still under active consideration and all other sites. Representative set of interim storage sites and permanent storage sites will be selected. Each representative set will contain all sites still under active consideration supplemented by enough other sites to ensure that the routes that connect the 73 operating reactor sites to the representative set of interim storage sites and the interim storage sites to the representative permanent storage sites provide extensive coverage of the interstate highway and main line rail transportation systems in the continental United States.

Deliverable: Letter report
Completion Date: May 12, 1997

Task 2: HIGHWAY and INTERLINE Calculations (3 man-weeks)

HIGHWAY and INTERLINE calculations will be performed for each truck or rail route that connects the 73 operating reactor sites to the representative set of interim storage sites and the interim storage sites to the representative permanent storage sites.

Deliverable: Letter report
Completion Date: June 2, 1997

Task 3: RADTRAN Route Parameter Distributions (1 man-week)

Distributions of the urban, suburban, and rural route segment lengths and population densities will be constructed using the output of the HIGHWAY and INTERLINE calculations performed for the preceding task. The resulting distributions will be compared to the comparable distributions developed using HIGHWAY and INTELINE output previously reported in SAND85-2715. If, as expected, the distributions are quite similar, the underlying data will be

pooled and then used to construct final distributions. The results of these three tasks will be documented in a draft of a chapter that will be included in the report that will document the results of the revalidation of NUREG-0170 spent fuel shipment risk estimates.

Deliverable: Chapter Draft
Completion Date: June 16, 1997

D. Completion Date

The proposed completion date for this program is June 30, 1999. Revisions to program tasks or schedule could cause this date to change.

4.0 PROPOSED PERSONNEL

A. NRC

John Cook is the NMSS Technical Monitor for this program. Technical instructions may be issued by Mr. Cook from time to time during the performance of this program. Technical instructions shall not constitute new task assignments, or changes to existing task assignments that alter program costs or schedules. If task revisions are required that entail additional work or changes in program schedules, these revisions will be made by submission by SNL for approval by NRC of a revised program proposal. Directions for changes in scope of work, cost, or period of performance will be coordinated through the NMSS Project Manager, David Tiktinsky.

B. SNL

The technical lead for this program will be J. L. Sprung. Dr. Sprung is a Ph.D. chemistry graduate of UCLA with 20 years of experience at Sandia National Laboratories managing and performing radioactive material safety, risk, and consequence assessments. Major assignments performed by Dr. Sprung include assessment of fission product transport models for the development of the MELCOR code, direction of the consequence calculations performed for NUREG-1150, and assessment of the risks associated with ship accidents that occur in ports that was performed for the Foreign Research Reactor Spent Fuel EIS.

J. D. Smith, a software engineer in SNL's Mission Analysis and Simulation Department, will perform the HIGHWAY and INTERLINE calculations required by this study. Mr. Smith holds degrees in Applied Mathematics (BS, New Mexico Institute of Mining and Technology, 1977) and Nuclear Engineering (MS, University of New Mexico, 1982). Mr. Smith has 20 years of experience in analytical and computational criticality analysis and radiological inventory source term development. For the past five years, Mr. Smith has performed most of the HIGHWAY and INTERLINE code calculations that supported SNL radioactive material transportation risk analyses. As a part of these analyses, Mr. Smith developed the input data required by each code, performed the code calculations, analyzed the computational results, and co-authored the EAs and EISs that these routing calculations supported.

G. S. Mills will construct the distributions of route parameter values. Dr. Mills, a Ph.D. physics graduate of the University of Texas, has 30 years of experience in transportation risk analysis and applied physics research and development. His experience in transportation risk analysis includes work on numerous radioactive material EAs and EISs (e.g., Foreign Research Reactor Spent Fuel EA, Sapphire II EA, Plutonium Disposition EA). In addition, he has applied the Latin Hypercube Sampling technique to sensitivity studies of accident-risk input variables and demonstrated the improvements in risk estimates obtainable from application of LHS to important input parameters. Other, transportation risk-related, development work has included acquisition of data for improved definition of input parameters and distribution functions. Before working in transportation risk analysis, he supported underground nuclear effects testing with radiation diagnostic development, fielding, and radiation transport/material interaction modeling

This preliminary Proposal designates Key Personnel on NRC Form 189, Part 1. During project negotiations, Sandia National Laboratories (SNL) and the Nuclear Regulatory Commission (NRC) will finalize the list of "Key Personnel" which will be documented in the Final Proposal. However, it should be clear that SNL can remove any personnel from an NRC work order, including "Key Personnel," without NRC approval, but the NRC must approve any proposed substitution for those "Key Personnel" identified on the Final Proposal.

5.0 MEETINGS/TRAVEL

It is not anticipated that any travel will be required to support the performance of tasks specified in Section 4.0 above. Therefore, this study is also not anticipated to require any foreign travel. An Outside Continental United States (OCONUS) activity form will be submitted to DOE with this proposal for any anticipated foreign travel. An NRC Form 445 will be processed 40 days prior to OCONUS travel.

Deviations from the travel submitted as part of NRC Form 189 and accepted by issuance of an NRC Form 173 will be coordinated with the NRC project manager as soon as the need for such a deviation is identified to ensure it will not interfere with the timely completion of proposed work.

6.0 NRC FURNISHED MATERIALS

No program tasks are expected to require materials that must be furnished by the NRC in order to be performed. The final report for this program will be published by NRC.

7.0 RELATIONSHIP TO OTHER PROJECTS

SNL projects that are developing risk assessment methods or data pertinent to this program include: Development of RADTRAN 5.0; periodic updates of the RMIR and RAMPOST databases; development of GIS-based route-analysis methodology with environmental justice applications (proposed for FY97); and publication of RADTRAN 5.0 sensitivity analyses that parallel earlier analyses performed for RADTRAN 4 and RADTRAN III as part of on-going code QA and applications efforts.

8.0 REPORTING REQUIREMENTS AND SCHEDULE

A. Deliverables

The chapter draft that documents the results of this study will also be the initial draft of the chapter in the final report of the revalidation program that describes and discusses the data gathered, analyses performed, and results generated to complete Subtask Ic, Route Characteristics, of the revalidation program.

No more than 30 copies of any interim report will be furnished to the NRC project manager.

N. R. Ortiz, Director, Nuclear Energy Technology, Organization 6400, Sandia National Laboratories, Albuquerque, NM, has been designated as the authorizing official for publications of NRC Form 426A.

B. Monthly Letter Status Report (MLSR)

If acceptable to NRC, the results of work on this modification of the original program plan for the program titled "Revalidation of NUREG-0170 Spent Fuel Shipment Risk Estimates" will be reported in that program's Monthly Letter Status Report (MSLR). If a separate MSLR is needed for this program modification, then a Monthly Letter Status Report, following the Management Directive 11.7 instructions, will be submitted to NRC by the 20th of each month. The MLSR shall be delivered to the David Tiktinsky, the NMSS Project Manager for this program, and to the Division of Contracts and Property Management (DCPM), Office of Administration. Additional distribution will be made to John Cook, the Technical Monitor for this program, and to Earl Easton, both of NMSS. The Financial Status section of the MLSR will follow NRC Management Directive 11.7's MLSR Financial Status Report format to the extent permitted by the current SNL Financial System.

C. Milestone Chart

The following Milestone Chart summarizes the estimates of task schedules and costs. Task costs are based on estimates of $5.9 per man-week of effort (including computing, support services, and management but not travel costs or DOE Albuquerque overhead) for fiscal year 97. Timelines in the Milestone chart depict elapsed time, not man-weeks of work.

Milestone Chart

Task	MW	k$	FY97 M---J---
Representative Sites	1	4	->
HIGHWAY and INTERLINE Calculations	3	15	->
Distributions and Draft Chapter	1	5	->
FY97 Labor	5	24	
DOE Overhead (at 4.3 %)		1	
FY97 Cost		25	

D. Level of Effort (estimated at $5900 per man-week for FY97)

	Level of Effort (man-weeks)	Estimated NRC Cost
Representative Sites	1	$4,000
HIGHWAY and INTERLINE Calculations	3	15,000
Distributions and Draft Chapter	1	5,000
Labor Subtotal	5	$24,000
DOE Overhead (at 4.3 %)		1,000
Total Cost		$25,000

9.0 SUBCONTRACTOR/CONSULTANT INFORMATION

Use of subcontractors or consultants on this study is not presently anticipated. Needed technical support that might require the use of subcontractors or consultants will be first discussed with the NRC Technical Monitor in order to establish technical requirements and then with the NRC Project Manager to identify any impacts on program funding or schedules.

Resumes for proposed subcontractors, if applicable, have been provided under Section 4 of this proposal. Acceptance of this proposal indicates approval of personnel proposed herein. Subsequent subcontractor efforts not described in this proposal will be managed per NRC Directive 11.7, Part X(B)(e)(page 61). conflict of interest issues are covered in section 11 of this proposal which considers all proposed personnel, including subcontractors.

10.0 SPECIAL FACILITIES, IF REQUIRED

This study is not expected to require any special facilities.

11.0 CONFLICT-OF-INTEREST INFORMATION

No significant contractual or organizational relationships of Sandia National Laboratories, its employees, or anticipated subcontractors and/or consultants exist with industries regulated by NRC and suppliers thereof that might give rise to an apparent or actual conflict of interest.

US Nuclear Regulatory Commission (NRC) recognizes that Sandia National laboratories will perform the work assigned to DOE under this project pursuant to the "Non-Department of Energy Funded Work" provision of the DOE/Sandia Corporation contract for the management and operation of Sandia National Laboratories.

The DOE-approved Sandia Corporation OCI Management Plan governing access to and flow of information between Sandia Corporation and its Lockheed Martin affiliated organizations will apply to all work performed under the terms of this project. This Sandia Corporation OCI Management Plan and the procedures resulting form the plan are subject to DOE audit at all

times. A copy of the Sandia Corporation OCI Management Plan is available upon request to Ken Haug, Contracts Center, M/S 0185, Sandia National Laboratories, Albuquerque, NM 87185-0185, (505) 845-7750).

In accordance with the Organizational Conflicts of Interest terms of the DOE/Sandia Corporation contract, Sandia Corporation, including any of its officials who may acquire information as part of their management responsibilities, is prohibited from further disseminating any third-party proprietary data or government sensitive data or information (as indicated by restrictive markings identifying the data and information so protected) to its Lockheed Martin affiliated organizations.

In view of the above, the NRC hereby agrees that Lockheed Martin affiliates of Sandia Corporation shall not be restrained or restricted from competing for any related follow-on contracts or subcontracts to be awarded by the NRC that relate to work under this project.

12.0 CLASSIFICATION OR SENSITIVITY, IF APPLICABLE

This study is not expected to produce any classified or sensitive information or material.

13.0 ADDENDUM COST AND SCHEDULE INFORMATION

n/a

14.0 Spending Plan (k$)

A Spending Plan, NRC Form 189 (Part 3), is included.

15.0 DOE OVERHEAD

DOE departmental overhead charges of 4.3 percent for FY97 and subsequent years will be added on all billings.

16.0 DOE-ACQUIRED MATERIAL

No property purchases over $500 are currently planned.

Purchases of items $500 or greater not identified in this proposal will be requested separately in writing. When property is purchased, it will be reported in the MLSR. Property will only be tracked at the $5000 or greater level by DOE, or if property is sensitive.

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*   User Name:    BORENER(101)                  Queue:  VNTSC_DTS-70/HPLASER  *
*   File Name:                                  Server: VNTSC_DTS-70          *
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*   Description: Statistics for Dataview Merged                               *
*   Queued:       APRIL 21, 97                  17:34:56                      *
*   Printed:      APRIL 21, 97                  17:34:59                      *
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*                  B   B O   O R   R E     NN  N E     R   R                *
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*                  BBBB   OOO  R   R EEEEE N   N EEEEE R   R                *
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*                                                                           *
*                        L      SSS  TTTTT   ::                            *
*                        L     S   S   T     ::                            *
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FIELD	COUNT	SUM	MINIMUM	MAXIMUM	MEAN	STD DEV
IP	1305	2250000071.000000	135324.000000	3808432.000000	1724437.98544061	1060806.1442
LENGTH	1305	5426.321987	0.006483	82.614876	4.15810108	6.2210
DIR	1305	0.000000	0.000000	0.000000	0.00000000	0.0000
DATA	1305	2044216339.000000	1345. ´90000	3436740.000000	1566449.30191571	953140.8930
[DATA:1]	1305	13085574689.000000	30027! ,00000	10117314.000000	10027260.29808429	436270.1071
[VNTSC ID]	1305	6180122429.000000	1000154.000000	10020195.000000	4735725.99923372	2829681.2333
CORR_ID	772	78776.000000	2.000000	1170.000000	102.04145078	135.3071
[AB Cars]	1305	192015276.000000	0.000000	1475415.000000	147138.14252874	212137.4816
[BA Cars]	1305	162168396.000000	0.000000	871606.000000	124266.97011494	171115.0988
[Total Cars]	1305	354183672.000000	0.000000	2092006.000000	271405.11264368	347955.6909
[AB Flammable Tons]	1305	172503771.000000	0.0000.0	1635104.000000	132186.79770115	198680.7284
[BA Flammable Tons]	1305	182236877.000000	0.000000	1817032.000000	139640.51877395	218658.2193
[Total Flammable Tons]	1305	354734648.000000	0.000000	2078624.000000	271827.31647510	343340.9696
[AB Poison Tons]	1305	39382456.000000	0.000000	454360.000000	30178.12720307	56568.3530
[BA Poison Tons]	1305	37256592.000000	0.000000	548480.000000	28549.11264368	59219.7493
[Total Poison Tons]	1305	76639048.000000	0.000000	863720.000000	58727.23984674	96120.9592
[AB Radioactive Tons]	1305	365040.000000	0.000000	14720.000000	279.72413793	1500.0560
[BA Radioactive Tons]	1305	311440.000000	0.000000	14720.000000	238.65134100	1298.0772
[Total Radioactive Tons]	1305	676480.000000	0.000000	14720.000000	518.37547893	1969.2423
[AB Corrosive Tons]	1305	87086260.000000	0.000000	1110220.000000	66732.76628352	125981.0872
[BA Corrosive Tons]	1305	92719372.000000	0.000000	2163072.000000	71049.3272037	154314.6162
[Total Corrosive Tons]	1305	179805632.000000	0.000000	2329404.000000	137782.09348659	219317.2361
[AB Other HazMat Tons]	1305	5?,40147.000000	0.000000	1054665.000000	43938.80996169	92898.6357
[BA Other HazMat Tons]	1305	55468826.000000	0.000000	1058585.000000	42504.84750958	92801.8813
[Total Other HazMat Tons]	1305	112808973.000000	0.000000	1223357.000000	86443.65747126	140735.8264
[AB Mixed HazMat Tons]	1305	83952896.000000	0.000000	1177584.000000	64331.72107280	167087.3467
[BA Mixed HazMat Tons]	1305	89085254.000000	0.000000	1006824.000000	68264.56245211	162260.8895
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[AB Bulk Tons]	1305	4419058339.000000	0.000000	33888618.000000	3386251.60076628	5361725.8835
[BA Bulk Tons]	1305	3484309452.000000	0.000000	22186416.000000	2669968.92873563	3559620.5537
[Total Bulk Tons]	1305	7903367791.000000	0.000000	35167095.000000	6056220.52950192	6926135.4907
[AB Other Tons]	1305	550474199?.000000	0.000000	116603?91.000000	4218193.09195402	11364868.0058
[BA Other Tons]	1305	3090537993.000000	0.000000	25329026.000000	2368228.34712644	3680899.1851
[Total Other Tons]	1305	8595279978.000000	0.000000	116629021.000000	6586421.43908046	12274505.4508
[Total Tons]	1305	17396350700.000000	0.000000	144586443.000000	13330536.93486590	18143230.9037
[Number of Routes]	1305	2081.000000	1.000000	12.000000	1.59463602	1.0386
[#Class100_Switches]	869	664.000000	0.000000	18.000000	0.76409666	1.2730
[#Class200_Switches]	869	375.000000	0.000000	7.000000	0.43153049	0.7674
[#Class300_Switches]	869	125.000000	0.000000	3.000000	0.14384350	0.4360
[#Class400_Switches]	869	0.000000	0.000000	0.000000	0.00000000	0.0000
[#Class500_Switches]	869	374.000000	0.000000	12.000000	0.43037975	1.0555
[#Class600_Switches]	869	0.000000	0.000000	0.000000	0.00000000	0.0000
[Total #Switches]	869	1538.000000	1.000000	25.000000	1.76985040	2.0086
[Number of Tracks]	1249	1684.000000	1.000000	5.000000	1.?~327862	0.5601
[Count(Curve Radius (deg))]	841	7625.000000	1.000000	132.000000	9.06658740	12.0352
[SumWeights(Curve Radius (deg))]	841	1143.143961	0.010000	37.497452	1.35926749	2.0962
[Sum(Curve Radius (deg))]	841	23128.583427	0.033333	611.316650	27.50128826	52.6365
[Sum2(Curve Radius (deg))]	841	112436.046130	0.001111	5484.925781	133.69327721	390.5466
[Sum3(Curve Radius (deg))]	841	766114.818592	0.000037	55806.988281	910.95697811	3871.8735
[Sum4(Curve Radius (deg))]	841	6599044.881708	0.000001	679437.250000	7846.66454424	44743.0327
[WSum(Curve Radius (deg))]	841	3524.327868	0.002195	337.477081	4.19063956	15.3184
[WSum2(Curve Radius (deg))]	841	18399.970789	0.000156	3037.293701	21.87868107	134.8311
[WSum3(Curve Radius (deg))]	841	131031.150294	0.000395	27335.642578	155.80398370	1217.8630
[WSum4(Curve Radius (deg))]	841	2102330.501519	0.000000	246020.796875	1310.73781393	11180.8589
[#Start(Curve Radius (deg))]	841	7613.000000	0.000000	132.000000	9.052?1867	12.0453
[#End(Curve Radius (deg))]	841	7568.000000	0.000000	132.000000	8.9 ,1094	12.0412
[Count(Grade (%))]	1198	18937.000000	1.000000	235.000000	15.80717863	21.5548
[SumWeights(Grade (%))]	1198	4358.848542	0.011972	30.299999	3.?3843785	3.9379

FIELD	COUNT	SUM	MINIMUM	MAXIMUM	MEAN	STD DEV
[Sum(Grade (%))]	1198	1205.269985	-151.629959	212.929940	1.00606843	14.5612
[Sum2(Grade (%))]	1198	9744.196743	0.000000	418.714539	8.13372615	25.9123
[Sum3(Grade (%))]	1198	787.302997	1277.452393	605.972046	0.59048317	61.3954
[Sum4(Grade (%))]	1198	30480.395648	0.000000	9580.412109	25.37596629	300.6809
[WSum(Grade (%))]	1198	187.993792	-15.649902	23.454912	0.15692383	2.1203
[WSum2(Grade (%))]	1198	1656.198428	0.000000	36.044266	1.38246947	3.1773
[WSum3(Grade (%))]	1198	-28.534248	-272.582184	61.662815	-0.02381824	9.5206
[WSum4(Grade (%))]	1198	4989.939717	0.000000	2279.691139	4.16522514	66.8333
[Low(Grade (%))]	1198	-409.940001	-8.300000	2.650000	-0.34218698	0.6304
[High(Grade (%))]	1198	539.550001	0.000000	3.000000	0.45062604	0.4731
[Count(Maximum Speed (mph))]	1221	18477.000000	1.000000	235.000000	15.13267813	21.4217
[SumWeights(Maximum Speed (mph))]	1221	4723.650442	0.013434	79.534645	3.86867358	5.2918
[Sum(Maximum Speed (mph))]	1221	739388.000000	6.000000	7050.000000	605.55937756	80[illegible].40
[Sum2(Maximum Speed (mph))]	1221	32948498.000000	36.000000	267300.000000	26984.84684685	37240.6515
[Sum3(Maximum Speed (mph))]	1221	1583632172.000000	216.000000	12096000.000000	1296996.04586405	1924445.3444
[Sum4(Maximum Speed (mph))]	1221	80576044187.000000	1296.000000	725760000.000000	65991846.18099918	106844694.8244
[WSum(Maximum Speed (mph))]	1221	200587.454985	0.130500	3579.059082	164.28128991	227.2633
[WSum2(Maximum Speed (mph))]	1221	9490305.039286	0.782999	161057.656250	7772.56759974	11715.4287
[WSum3(Maximum Speed (mph))]	1221	423046865.202122	4.697995	8748000.000000	395615.77821632	665720.2471
[WSum4(Maximum Speed (mph))]	1221	25954195781.845620	28.187967	524880000.000000	21256587.60183916	40374063.6308
[Low(Maximum Speed (mph))]	1221	48171.000000	5.000000	79.000000	39.45208845	14.8050
[High(Maximum Speed (mph))]	1221	51342.000000	5.000000	79.000000	42.04914005	14.7885
[Count(MAXSPEED_P)]	12	12.000000	1.000000	1.000000	1.00000000	0.0000
[Low(MAXSPEED_P)]	12	360.000000	5.000000	45.000000	30.00000000	12.6131
[High(MAXSPEED_P)]	12	360.000000	5.000000	45.000000	30.00000000	12.6131
[Count(Control 1)]	611	7507.000000	1.000000	93.000000	12.28641571	16.4361
[First(Control 1)]	1155	198751.000000	100.000000	500.000000	172.36733068	57.4802
[Count(PSignal 1)]	619	7747.000000	1.000000	235.000000	12.51534733	18.3393
[First(Signal 1)]	1256	367080.000000	200.000000	400.000000	292.26114650	75.6693
CR_PAX	63	1551123634.770000	51184.000000	158741025.620000	24621013.87571428	35368304.6454
AMTK_PAX	243	35394804.000000	6060.000000	2136300.000000	145657.62962963	232305.8889
[Count(PPA99)]	1305	1951.000000	1.000000	9.000000	1.49501916	0.8262
[Sum(UID)]	1305	21535168.000000	6.000000	103946.000000	16502.04444444	14862.1666
[High(UID)]	1305	14495266.000000	6.000000	22594.000000	11107.48352490	6606.9958
[Low(UID)]	1305	13617748.000000	6.000000	22594.000000	10435.05593870	6497.3028
[Avg(UID)]	1305	14041508.883333	6.000000	22594.000000	10759.77692209	6428.8941
[Sum(LONGITUD)]	1305	101704587116.000000	0.000000	851840775.000000	77934549.51417625	83672974.9775
[High(LONGITUD)]	1305	67892175333.000000	0.000000	99965025.000000	52024655.42758621	40669455.6188
[Low(LONGITUD)]	1305	67182913542.000000	0.000000	99965025.000000	51481159.80229885	40752150.1372
[Avg(LONGITUD)]	1305	67523116820.083340	0.000000	99965025.000000	51741851.96941252	40576520.4257
[Sum(LATITUDE)]	1305	65700543156.000000	0.000000	351666189.000000	50345243.79770115	39230417.1597
[High(LATITUDE)]	1305	43011742735.000000	0.000000	48882871.000000	32959[illegible].83524904	14984824.6998
[Low(LATITUDE)]	1305	42702002822.000000	0.000000	48882371.000000	32721841.24291188	15191743.6934
[Avg(LATITUDE)]	1305	42859546075.466680	0.000000	48882871.000000	32842564.04258320	15020678.7028
[Sum(LONGIT1)]	1305	101704587116.000000	0.000000	851840775.000000	77934549.51417625	83672974.9775
[High(LONGIT1)]	1305	67892175333.000000	0.000000	99965025.000000	52024655.42758621	40669455.6188
[Low(LONGIT1)]	1305	67182913542.000000	0.000000	99965025.000000	51481159.80229885	40752150.1372
[Avg(LONGIT1)]	1305	67523116820.083340	0.000000	99965025.000000	51741851.96941252	40576520.4257
[Sum(LATIT1)]	1305	65700543156.000000	0.000000	351666189.000000	50345243.79770115	39230417.1597
[High(LATIT1)]	1305	43011742735.000000	0.000000	48882871.000000	32959[illegible].83524904	14984824.6998
[Low(LATIT1)]	1305	42702002822.000000	0.000000	48882871.000000	32721841.24291188	15191743.6934
[Avg(LATIT1)]	1305	42859546075.466680	0.000000	48882871.000000	32842564.04258320	15020678.7028
[Sum(CARS)]	1305	2781.000000	0.000000	95.000000	2.13103448	7.4647
[High(CARS)]	1305	2661.000000	0.000000	95.000000	2.03908046	7.3428
[Low(CARS)]	1305	1352.000000	0.000000	76.000000	1.03601533	4.7717
[Avg(CARS)]	1305	1952.183333	0.000000	76.000000	1.49592593	5.4345
[Sum(CARSDMG)]	1305	[illegible]000000	0.000000	16.000000	0.32337165	1.3571
[High(CARSDMG)]	1305	405000	0.000000	16.000000	0.31877395	1.3383

FIELD	COUNT	SUM	MINIMUM	MAXIMUM	MEAN	STD DEV
[Low(CARSDMG)]	1305	265.000000	0.000000	16.000000	0.20306513	1.1019
[Avg(CARSDMG)]	1305	328.483333	0.000000	16.000000	0.25171137	1.1499
[Sum(CARSHZD)]	1305	96.000000	0.000000	6.000000	0.07356322	0.4541
[High(CARSHZD)]	1305	94.000000	0.000000	6.000000	0.07203065	0.4493
[Low(CARSHZD)]	1305	67.000000	0.000000	6.000000	0.05134100	0.3990
[Avg(CARSHZD)]	1305	77.416667	0.000000	6.000000	0.05932312	0.4064
[Sum(EVACUATE)]	1305	31998.000000	0.000000	20000.000000	24.51954023	573.9190
[High(EVACUATE)]	1305	31998.000006	0.000000	20000.000000	24.51954023	573.9190
[Low(EVACUATE)]	1305	26534.000000	0.000000	20000.000000	20.33256705	564.8870
[Avg(EVACUATE)]	1305	28169.833333	0.000000	20000.000000	21.58607918	565.5476
[Sum(EQPDMG)]	1305	259510621.000000	0.000000	9717621.000000	198858.71340996	562732.8238
[High(EQPDMG)]	1305	224294230.000000	0.000000	9717621.000000	171872.97318008	489220.2820
[Low(EQPDMG)]	1305	125552251.000000	0.000000	9717621.000000	96208.62145594	360634.7197
[Avg(EQPDMG)]	1305	169547091.361111	0.000000	9717621.000000	129921.14280545	394269.5584
[Sum(TRKDMG)]	1305	40650008.000000	0.000000	2450428.000000	31149.43141762	96350.9418
[High(TRKDMG)]	1305	38337596.000000	0.000000	2450428.000000	29377.46819923	93776.1178
[Low(TRKDMG)]	1305	25513765.000000	0.000000	2450428.000000	19550.77777778	83270.3035
[Avg(TRKDMG)]	1305	30848943.822222	0.000000	2450428.000000	23639.83741166	84171.1516
[Sum(YR)]	1305	178023.000000	88.000000	797.000000	136.41609195	76.8046
[High(YR)]	1305	119107.000000	88.000000	95.000000	91.26973180	2.3230
[Low(YR)]	1305	118801.000000	88.000000	95.000000	91.03524904	2.2664
[Avg(YR)]	1305	118947.822222	88.000000	95.000000	91.14775649	2.2502
[Sum(MH)]	1305	13271.000000	1.000000	68.000000	10.16934866	7.9380
[High(MH)]	1305	9117.000000	1.000000	12.000000	6.98620690	3.4824
[Low(MH)]	1305	8642.000000	1.000000	12.000000	6.62222222	3.5234
[Avg(MH)]	1305	8879.738889	1.000000	12.000000	6.80439762	3.4320
[Sum(DY)]	1305	30582.000000	1.000000	135.000000	23.43448276	18.7253
[High(DY)]	1305	21041.000000	1.000000	31.000000	16.12337165	8.7283
[Low(DY)]	1305	19301.000000	1.000000	31.000000	14.79003831	8.6511
[Avg(DY)]	1305	20175.077778	1.000000	31.000000	15.45982971	8.4320
[Sum(CASKLDRR)]	1305	55.000000	0.000000	5.000000	0.04214559	0.3238
[High(CASKLDRR)]	1305	53.000000	0.000000	4.000000	0.04061303	0.3044
[Low(CASKLDRR)]	1305	9.000000	0.000000	2.000000	0.00689655	0.1079
[Avg(CASKLDRR)]	1305	27.816667	0.000000	2.500000	0.02131545	0.1697
[Sum(CASINJRR)]	1305	588.000000	0.000000	16.000000	0.45057471	1.2700
[High(CASINJRR)]	1305	568.000000	0.000000	16.000000	0.43524904	1.2219
[Low(CASINJRR)]	1305	128.000000	0.000000	9.000000	0.09808429	0.4856
[Avg(CASINJRR)]	1305	322.527778	0.000000	9.000000	0.24714772	0.7041
[Sum(CASKLD)]	1305	11.000000	0.000000	7.000000	0.00842912	0.2052
[High(CASKLD)]	1305	11.000000	0.000000	7.000000	0.00842912	0.2052
[Low(CASKLD)]	1305	3.000000	0.000000	2.000000	0.00229885	0.0619
[Avg(CASKLD)]	1305	6.750000	0.000000	3.500000	0.00517241	0.1151
[Sum(CASINJ)]	1305	205.000000	0.000000	107.000000	0.15708812	3.1331
[High(CASINJ)]	1305	205.000000	0.000000	107.000000	0.15708812	3.1331
[Low(CASINJ)]	1305	130.000000	0.000000	107.000000	0.09961686	2.9783
[Avg(CASINJ)]	1305	159.500000	0.000000	107.000000	0.12222222	2.9994
[First(LINKNUM)]	1305	2044216339.000000	134536.000000	3436740.000000	1566449.30191571	953140.8930

REPORT ID: C0440
RUN DATE: 04/03/97

U.S. NUCLEAR REGULATORY COMMISSION
APPROVAL FORM FOR INTERAGENCY BILLING-DOE
ACCOUNTING PERIOD MARCH FY 97

A/39

DIVISION: NMSS Huang
PROGRAM OFFICE CONTACT: ~~IIKINSKY, DAVID~~
JOB: J5160

JOB	B&R	OBLIGATION DOCUMENT	BILLING OFFICE	BILL #	DESCRIPTION	CURRENT AMOUNT	DIRECT DISBURSEMENT	
J5160	7-5015-221000	DE J51607	DOEAL	1	7FEB COSTS	16,532.52	EO 97020322	001
EVAL NUREG0170 SP FUEL SHIP RI			ALBUQUERQUE/SANDIA NAT'L LAB					
CURRENT AMOUNT TOTAL						16,532.52		

I HAVE REVIEWED PAYMENT OF THESE CHARGES TO DETERMINE IF THEY ARE REASONABLE AND WITHIN THE PARAMETERS OF THE STATEMENT OF WORK. APPROVED CHARGES ARE SUPPORTED BY THE WORK PERFORMED, DELIVERABLES RECEIVED, STATUS REPORTS, OR OTHER APPLICABLE DOCUMENTS.

REVIEWED BY: Daniel T. Huang 4/23/97
SIGNATURE DATE

TAPM
TITLE-PROJECT MANAGER

CHECK ONE:
V I APPROVE IN FULL.
___ I DISAPPROVE IN FULL AND REQUEST A CHARGEBACK. PROVIDE AN EXPLANATION.
___ I DISAPPROVE PART OF THE CHARGES. INDICATE LINES DISAPPROVED AND PROVIDE AN EXPLANATION. I REQUEST A CHARGEBACK IN THE AMOUNT OF: _____

EXPLANATION FOR THE CHARGEBACK:

IF AN AMOUNT IS DISAPPROVED:

I HAVE DISCUSSED THIS ISSUE WITH _____ (OTHER AGENCY CONTACT), _____ (TELEPHONE NUMBER). _____ (DATE OF NOTIFICATION). AND INFORMED THIS PERSON THAT A CHARGEBACK WILL BE TAKEN BY THE NRC.

ALL FORMS MUST BE SIGNED AND RETURNED TO THE FINANCIAL OPERATIONS BRANCH, MAILSTOP T-9H4, IN A TIMELY MANNER TO ENSURE PROPER FINANCIAL CONTROL.