

**LOCKHEED MARTIN**



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May 6, 2005

SPP-SRS-0007

B-MER(RS)PAS-1818

The Manager  
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U. S. Department of Energy  
Schenectady, New York 12309

The Manager  
Pittsburgh Naval Reactors Office  
U. S. Department of Energy  
West Mifflin, Pennsylvania 15122-0109

Purpose: Reactor Safety Planning for the Prometheus Project, For NR Information

Dear Sir:

The purpose of this letter is to submit to Naval Reactors the initial plan for the Prometheus project Reactor Safety work. The Prometheus project is currently developing plans for cold physics experiments and reactor prototype tests. These tests and facilities may require safety analysis and siting support. In addition to the ground facilities, the flight reactor units will require unique analyses to evaluate the risk to the public from normal operations and credible accident conditions. This letter outlines major safety documents that will be submitted with estimated deliverable dates. Included in this planning is the reactor servicing documentation and shipping analysis that will be submitted to Naval Reactors.

#### **Background**

Reactor safety representatives from Bettis, KAPL and Naval Reactors met at Bettis to discuss a reactor safety analysis task plan for the Prometheus Project. These organizations were supported by representatives from Fuel Handling, Refueling, Shipping, Reactor Design, Ground Testing, and Environmental Affairs. After a day-long meeting and discussion on April 5, 2005, a tentative reactor safety tasking schedule was drafted. This tasking schedule was then presented to NR during the evening of April 6, 2005. This letter documents the tasking schedule that was presented and addresses Naval Reactors comments and concerns discussed during the April 6 meeting.

The reactor safety plans contained in this letter are based upon the planning assumptions in the SRPE issued in early April 2005. These are initial plans which must be integrated with overall Prometheus plans. In addition, the functions and plans for facilities must still be established and these more detailed plans may effect the timing and scope of safety analysis work being described.

### **Cold Physics Experiments**

Space Engineering - Physics is currently evaluating the need to perform cold physics experiments. Based on limited experience with reactor designs having neutron energy spectrums in the range of the proposed Prometheus designs, it is expected that the recommendation will be to perform some cold physics experiments. A formal recommendation on the need for cold physics experiments will be made to Naval Reactors in October of 2005. Several sites have been evaluated to perform the cold physics experiments; additional sites are also under consideration. Two sites, the Device Assembly Facility (DAF) at the Nevada Test Site and the Zero Power Physics Reactor (ZPPR) at the Idaho National Laboratory (INL) were discussed during the planning meeting with Naval Reactors. If DAF facility is selected, NRPCT would review the current site Safety Analysis Report (SAR) and National Environmental Policy Act (NEPA) documentation to ensure that the physics experiments would be covered by the analyses contained in these documents. The ZPPR facility may require an Environmental Impact Statement (EIS) and a Safety Analysis Report (SAR) in order to be restarted for this work. Current assumptions are that INL personnel would be contracted to generate these documents with review and approval by the NRPCT and NR. Based on planning estimates this work would have to be completed by November of 2007 in order to support the cold critical test.

### **Ground Test Reactor Safety Work**

A Ground Test Reactor (GTR) facility is currently under consideration. Current assumptions are that this facility would be used for hot operational testing of two test reactors, GTR-1 and GTR-2. In addition it is assumed that all flight units would be shipped to the GTR facility for zero power critical testing to check for gross manufacturing errors before shipment to Kennedy Space Center (KSC) for integration with the spacecraft.

Table 1 presents the milestones for three areas, Ground Test Reactor Design Support, Ground Test Reactor SAR and Ground Test Reactor EIS. The GTR will require NRC review. The historical step of issuing an Updated Ground Test Reactor SAR has been eliminated from the GTR SAR process in order to meet the identified GTR-1 criticality need date. This will require close coordination within the NRPCT and NR, but is considered to be acceptable.

### **Flight Reactor Safety Work**

Currently two flight units are planned -- Prometheus-1 and Prometheus-2. Each mission that uses a Prometheus reactor will require an Interagency Nuclear Safety Review Panel

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(INSRP) / NRC review. Table 2 presents the major milestones and delivery dates for the Reactor Safety portion of the Launch SAR and EIS. In addition, this table identifies when Naval Reactors will receive a test and methods development plan.

## Reactor Servicing and Shipping

Figure 1 was developed to follow the flow of the reactors from production to disposal in order to ensure all operations are covered by a safety analysis. The origin of the core fabrication is assumed to be BWXT. Currently BWXT maintains a Nuclear Regulatory Commission (NRC) site license under 10CFR70 for the handling of special nuclear materials. It is assumed that BWXT will perform any nuclear safety analysis work necessary for their operations or any modifications to their NRC license, but still within 10CFR70 regulations. Consistent with Navy work, no significant overchecks of this effort by the NRPCT or NR is included in the plan.

Once the GTR and Prometheus cores are fabricated, they are loaded into a shipping container at BWXT. A Safety Analysis Report for Packaging (SARP) will cover shipment of the core to the Ground Test Reactor facility. Because of possible differences in the four core designs (GTR-1, GTR-2, P-1, and P-2) separate SARPs may be required for each core. Two reactor module designs (GTR-1 and a second for GTR-2, P-1, and P-2) were assumed for the shipping and reactor servicing elements of the SRPE. Once these cores arrive at the GTR facility, a Reactor Servicing Safety Report (RSSR) will evaluate nuclear safety during reactor servicing operations, which are controlled by a Nuclear Reactor Servicing Manual (NRSM).

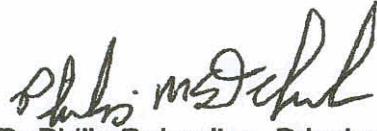
The operation of the reactors at the GTR facility will be covered by a SAR. Once the Ground Test Reactors have been utilized, they will be held at the GTR facility pending preparation for possible expended core examination and final disposal at some undetermined facility. The planning for this has not yet been included in the planning assumptions. The flight units will be shipped to KSC. Both Prometheus-1 and Prometheus-2 will have a zero power critical test at the GTR test facility. These tests will only increase the source strength a small amount above the intrinsic source and should be accounted for in the SARPs covering the shipment from BWXT to the GTR facility. This would allow for shipment under the same SARP to Kennedy Space Center. The reactor power unit then is integrated with the spaceship at the assembly building. Current planning shows no critical reactor operations at the KSC. KSC work with the reactor will be covered under a Reactor Servicing Safety Report (RSSR) and performed utilizing a Nuclear Reactor Servicing Manual (NRSM) in this building. Once the power unit / spaceship assembly is complete, it will be transported to the KSC mating facility for placement on the launch vehicle. The launch SAR bounds all casualties from loading of the reactor on a truck at the assembly building to launch.

Table 3 presents a list of the milestones for the reactor servicing and shipping analyses.

**Division of Responsibilities**

In addition to Tables 1 through 3, cognizant individuals, a detailed work breakdown and inter-relationships between the work tasks for the safety evaluations are presented in Figures 1 through 3. Additional external support will be requested in specific areas.

Very truly yours,



Dr Philip Delmolino, Principal Engineer  
FSO Space Reactor Safety

PMD for JS. via Email  
Joseph Semancik, Advisory Engineer  
MER Plant Analysis Support

Approved by,



Paul Dietersagen, Manager  
FSO Reactor Safety Engineering

PMD for DL via Email

Don Lawson, Manager  
MER Reactor Safety

**Table 1**  
**Reactor Safety Tasks for the Ground Test Reactor Facility**

Milestone	End Date	Cognizance
<b>Ground Test Reactor Design Support</b>		
GTR Facility Pre-Conceptual Design	10/2005	Lawson Niznik
GTR1 Final Design	02/2008	Lawson McCoy Eshelman
<b>Ground Test Reactor Safety Analysis Report</b>		
Reactor Safety Plan – Tier 3 <i>(Same time as Prototype recommendation (Niznik))</i>	~09/2005	Lawson
Methods Development Test Plan	06/2006	Lawson
Draft Technical Basis to Naval Reactors	02/2007	Lawson
Reactor Safety Technical Basis	11/2007	Lawson
Draft SAR to Naval Reactors <i>(Assumes Reactor Design 02/2008 (Eshelman))</i> <i>(Assumes Facility Design 09/2008(Niznik))</i>	10/2008	Lawson Dietershagen
Detailed Test Evaluation Report	06/2009	Lawson
Updated SAR to Naval Reactors	N/A	N/A
Final SAR to Naval Reactors	02/2010	Lawson Dietershagen
SAR to NRC	04/2010	NR
NRC Issue SER	10/2011	NRC
GTR-1 Criticality	02/2012	McCoy
GTR-2 SAR Addendum if Needed (Info Letter)	12/2012	Lawson Dietershagen
<b>Ground Test Reactor EIS</b>		
EIS Notice of Intent <i>(Assumes Site Evaluation is 03/2006 (Clark))</i>	06/2006	Smith
Draft EIS	05/2007	Smith
Final Prototype EIS	01/2008	Smith
EIS Record of Decision	03/2008	Smith

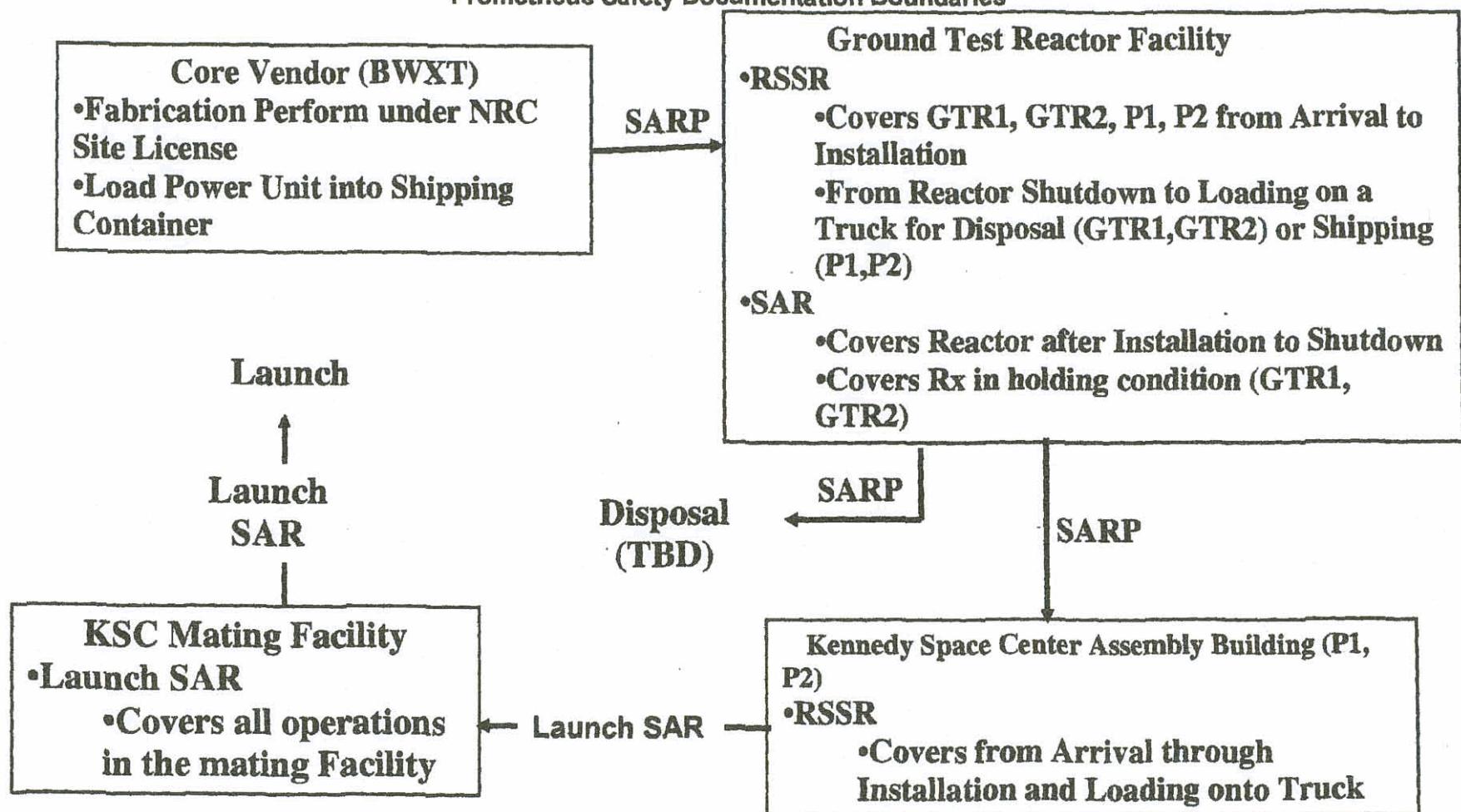
**Table 2**  
**Reactor Safety Tasks for the Flight Units**

Milestone	End Date	Cognizance
<b>Flight Unit Design Support</b>		
Pre-conceptual Design	09/2005	Dietershagen, McCoy, Eshelman
Conceptual Design	02/2008	Dietershagen, McCoy, Eshelman
Prometheus-1 Final Design	07/2010	Dietershagen, McCoy, Eshelman
<b>Launch Safety Analysis Report</b>		
Launch Reactor Safety Plan	09/2005	Dietershagen
Methods and Test Program Definition	12/2005	Dietershagen
Outline for Launch SAR	03/2007	Dietershagen, Lawson
Reactor Safety Technical Basis	02/2008	Dietershagen
Draft SAR to Naval Reactors	08/2009	Dietershagen, Lawson
Test Evaluation Report	03/2010	Dietershagen
Updated SAR to Naval Reactors	10/2011	Dietershagen, Lawson
Naval Reactors Forwards SAR to NASA	12/2011	NR
FSAR to Naval Reactors	09/2012	Dietershagen, Lawson
SAR to NRC/INSRP/NASA	11/2012	NR
SER Issued	05/2014	NRC/INSRP
Prometheus-1 Launch Approval	09/2014	Office of the President
<b>Launch EIS (Estimated NASA dates)</b>		
EIS Notice of Intent	10/2010	NASA, Smith
Draft Launch EIS	10/2011	NASA, Smith
Final Launch EIS	05/2012	NASA, Smith
EIS Record of Decision	07/2012	NASA, Smith

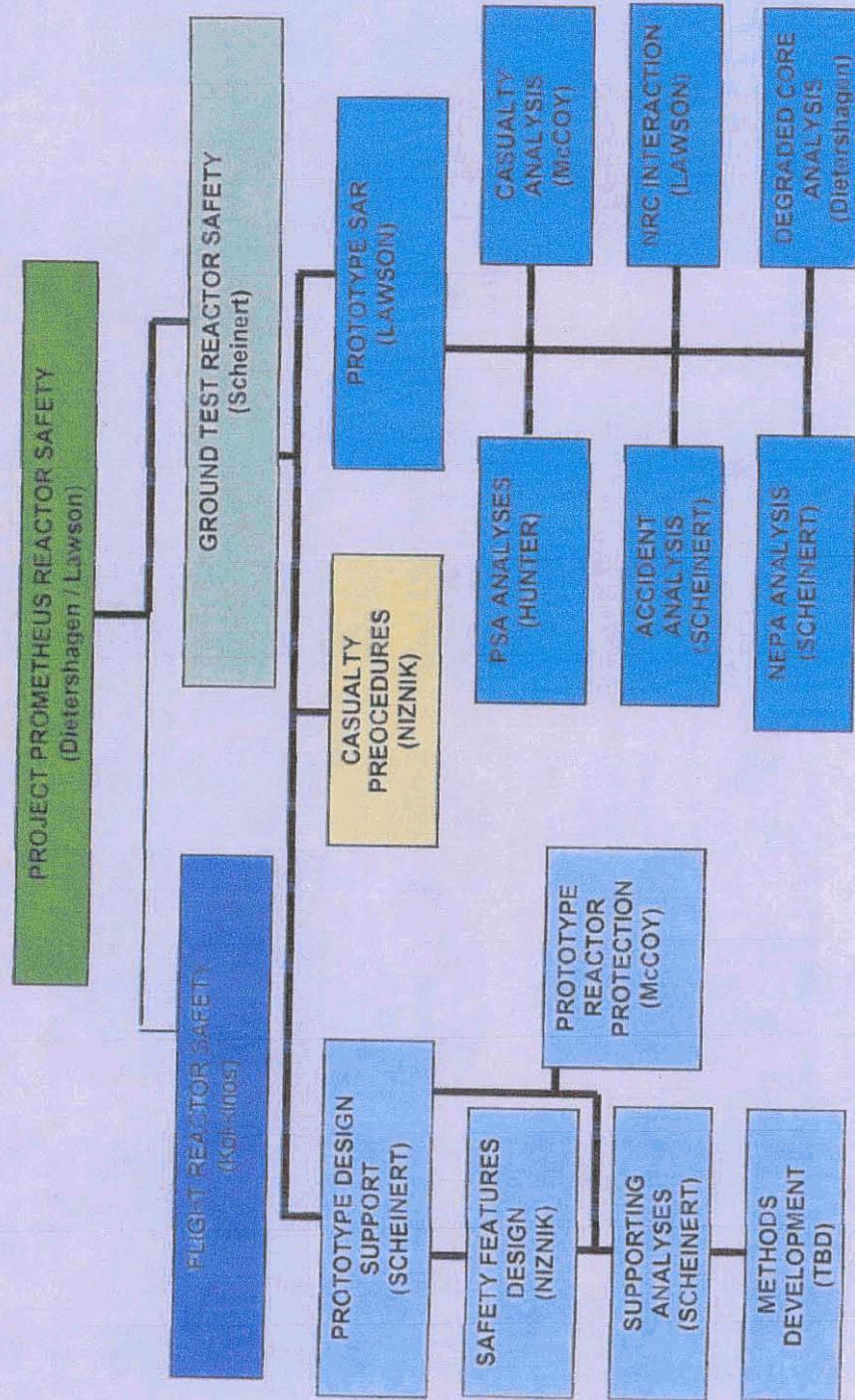
**Table 3**  
**Prometheus Project Reactor Servicing and Shipping**

Milestone	End Date	Cognizance
<b>Ground Test Reactor 1 (GTR-1)</b>		
SARP to Naval Reactors	05/2009	Wade
Reactor Servicing Safety Report (RSSR)	05/2009	Fischer
SARP to NRC	02/2010	NR
Nuclear Reactor Servicing Manual (NRSM)	05/2010	Fischer
Certificate of Compliance (COC)	04/2011	NR
Ship GTR-1 to Ground Test Reactor Facility	05/2011	PNR
<b>Ground Test Reactor 2 (GTR-2)</b>		
SARP to Naval Reactors	06/2011	Wade
RSSR	06/2011	Fischer
SARP to NRC	03/2012	NR
NRSM	06/2012	Fischer
COC	05/2013	NR
Ship GTR-2 to Ground Test Reactor Facility	06/2013	PNR
<b>Ground Prototype Post Operational SARP</b>	TBD	Wade
<b>Prometheus-1 and Prometheus-2 Reactors</b>		
SARP to Naval Reactors (P-1 and P-2 may require separate SARPs) (SARP covers shipment of pre and post cold critical)	12/2011	Wade
RSSR	12/2011	Fischer
SARP to NRC	09/2012	NR
NRSM	12/2012	Fischer
COC	11/2013	NR
Prometheus-1 Shipped to GTR Facility	12/2013	PNR
Prometheus-1 Shipped to KSC	03/2014	PNR
<b>Assembly Building at Kennedy Space Center</b>		
RSSR (Covers all Reactor evolutions at the Assembly Building)	03/2011	Fischer
NRSM	03/2013	Fischer
Prometheus-1 Power Unit Delivery to KSC	03/2014	PNR

Figure 1  
Prometheus Safety Documentation Boundaries

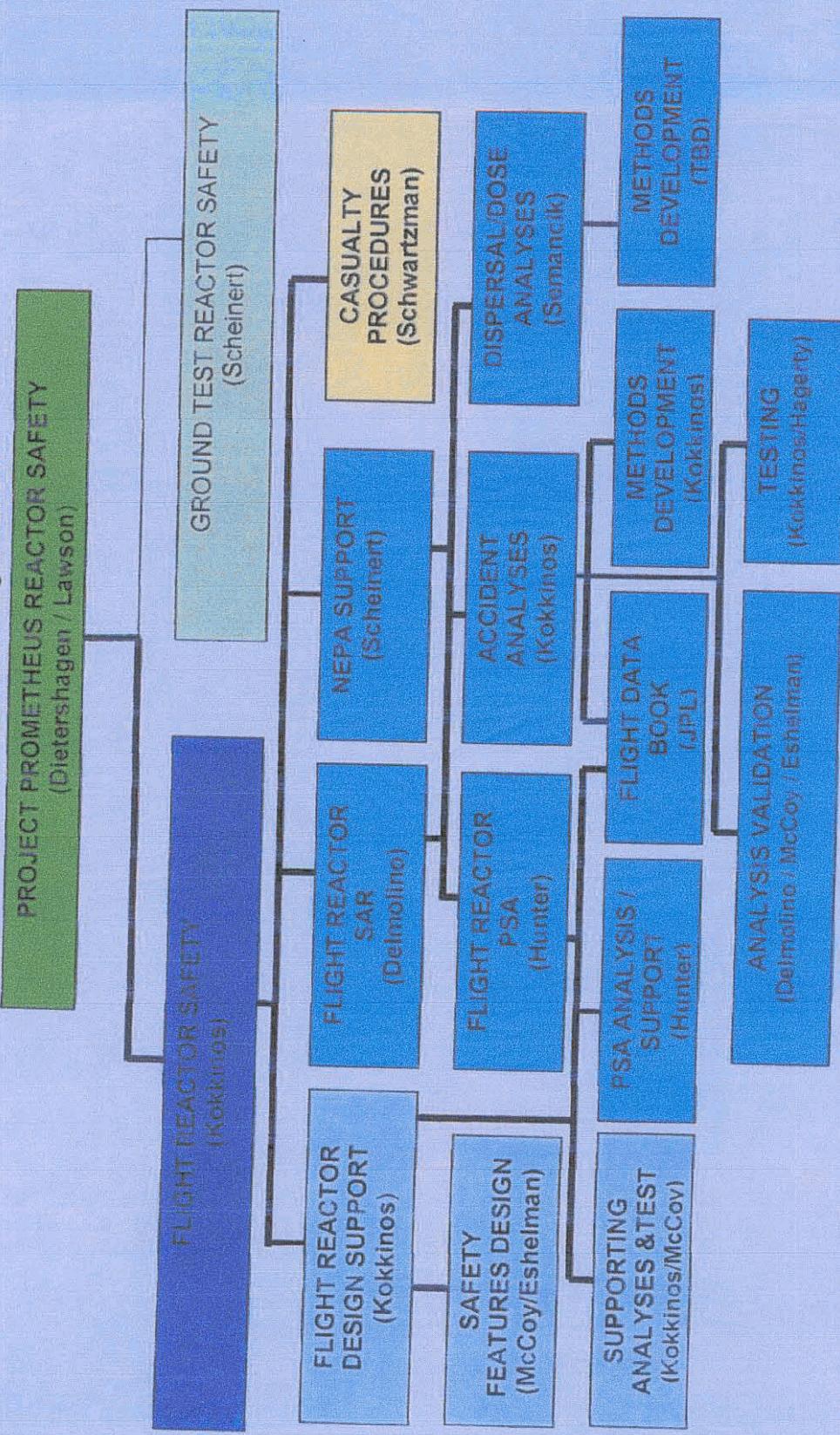


**Figure 2**  
**Divisions of Responsibility for Ground Test Reactor**



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**Figure 3**  
**Divisions of Responsibility for Flight Reactor**



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CONCURRENCE/DESIGN CHECK FORM FOR DOCUMENT NO. SPP-SRS-0007, B-MER(RS)PAS-1818 Date: 5/2/05DOCUMENT TITLE: Safety Planning for the Prometheus Project, For NR Information

REFERENCES

ENCLOSURES:

1. ADSARS: PERMANENT RECORD: Yes X No \_\_\_\_\_ Repository MFLIB Corporate Author: KAPL NR PROGRAM \_\_\_\_\_Key Words: Space, Reactor Safety, Planning

Need to Know Categories \_\_\_\_\_

Available Sites: \_\_\_\_\_

Design File Location(s): \_\_\_\_\_

## 2. DESIGN CHECK

Type of Check	Signature(s)	Comments: (Including Reference to Check Document If Appropriate)
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C. Checked calculations made		
D. Checked computer input and/or output		
E. Computer Programs approved/qualified		
F. Performed independent audit		
G. Spot checked significant points	<i>JK</i>	
H. Reviewed methods used		
I. Reviewed results for reasonableness		
J. Comparison with test data		
K. Reviewed vs. drawings		
L. Verified procedures		
M. Technical content reviewed		
N. Management verification of adequate review by others	<i>BO</i>	
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P. Used Measurement Uncertainty Methods		
Q. Other Checks (Describe)		

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REACTOR EQUIPMENT	TO	QA
SPP MECHANICAL	RSO	OTHER
SPP ELECTRICAL	FSO	BETTIS
FINANCE	MDO	BPMI
PROJECT OFFICE	ARP	ADMIN REVIEW
ENERGY CONVERSION		

Cognizant Manager

(Must Be Subsection or Higher for External Letters)

4. AUTHORIZED CLASSIFIER: Reviewed By: \_\_\_\_\_ CLASSIFICATION: \_\_\_\_\_

5. RELATED SUBJECTS: Commitment Made (Y/N) N Commitment Complete (Y/N) N  
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