NGNP
TDRM Schedule and Cost Estimate

December 2008

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BEA Contract No. 75310

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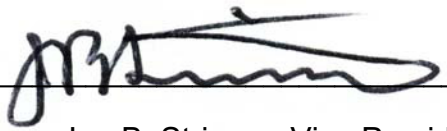
APPROVAL:  DATE 12/5/08

Joe B. Stringer, Vice President

1.0 EXECUTIVE SUMMARY

In the INL SOW-6392, Revision 0, 6/04/08, “Statement of Work AREVA Component Test Facility Conceptual Design Studies for the NGNP with Hydrogen Production”; Appendix B, section 2.1.2; AREVA was directed to perform a Test Plan Facility Coordination and Integration Critical SSC Test Schedule Study. This document represents the results of that study.

The results from this activity show that the testing activity will take over six (6) years to complete at of a cost of approximately $300 Million dollars and will require the participation of a large number of entities. This activity also has shown the integration between the tests, design and licensing activities, vendors, and the test facilities is complex and will be a challenging task to successfully implement to meet the October 1, 2021 initial criticality date.

Initial technology development road maps (TDRMs) were developed for all critical plant, area, systems, structures and components (PASSCs) for the NGNP plant with a reactor outlet temperature of 900ºC. The roadmaps and associated test plans were issued under the Technology Development Road Map Document, TDR-30001031-00, in November 2008.

Additional data was collected to further develop the test processes by identifying test facilities and cost required to implement the test identified in the TDRMs. As indicated in the TDRM Report, the design of the NGNP reactor is in the earliest phase of conceptual design. As such, many of the plant configuration and detailed component design decisions have yet to be made. On one hand, this makes it the ideal time to begin detailed technology development planning, when the process can have the most benefit to R&D planning. On the other hand, the planning is constrained by the immature state of the design to be general in nature. It is essential that the process which was begun in this work is reviewed and updated with more detail as it becomes available in the design process. This fact also highlights the need for maximum flexibility in new test facilities that will be built to support NGNP R&D and component qualification. As the design matures, the needs for the anticipated test facilities and cost will become better defined.

2.0 ACRONYMS

CPA	Construction Permit Application
HPS	Hydrogen Production System
HTGR	High Temperature Gas-cooled Reactor
HTS	Heat Transport System
HTTR	High Temperature Test Reactor
IHX	Intermediate Heat Exchanger
INL	Idaho National Lab
KVK	Component Test Loop (German)
LCF	Low Cycle Fatigue

MHTGR	Modular High Temperature Gas-cooled Reactor
MPa	Megapascal
MWe	Megawatt electric
NDE	Non-destructive examination
NGNP	Next Generation Nuclear Plant
NHSS	Nuclear Heat Supply System
NRC	Nuclear Regulatory Commission
ODS	Oxide Dispersive Strengthened
ORNL	Oak Ridge National Laboratory
PASSC	Plant, Area, System, Structure, & Component
PCS	Power Conversion System
PHGD	Primary Hot Gas Duct
PHTS	Primary Heat Transport System
PNNL	Pacific Northwest National Laboratory
R&D	Research & Development
RCCS	Reactor Cavity Cooling System
RPV	Reactor Pressure Vessel
RV	Reactor Vessel
RVI	Reactor Vessel Internals
SCS	Shutdown Cooling System
SG	Steam Generator
SiC/SiC	Silicon Carbide/Silicon Carbide
TDRM	Technology Development Road Map
TFCI	Testing Facility Coordination and Integration
TRL	Technology Readiness Level
TP	Test Plan
VS	Vessel System

3.0 INTRODUCTION

The US Department of Energy (DOE), through the Next Generation Nuclear Plant (NGNP) project, is developing a High Temperature Gas-cooled Reactor (HTGR) to be used as a heat source for a variety of process heat applications (e.g. hydrogen production, coal to liquids, tar sands oil recovery, electricity production, etc.). When this task was initiated, this HTGR was envisioned as providing a reactor outlet temperature of 900ºC and will be operational by October 1, 2021. In order to meet these ambitious goals, a focused Research and Development (R&D) initiative is required. AREVA has previously developed Initial Technology Development Road Maps (TDRMs) and associated Initial Test Plans (TPs) for the NGNP high temperature and critical Plant, Area, Systems, Structures and Components (PASSCs). As a part of this study additional data was collected to identify the test facilities and cost to implement the test plans.

This work included the review and incorporation of previous AREVA NGNP pre-conceptual and conceptual design work to date and the TDRM Document and Test Plans. Various test facilities including National Laboratories, Commercial Test Laboratories, and Universities were contacted to better understand their capabilities and to determine high level cost for them to perform test such as the ones identified in the test plans. Where direct cost correlation could be obtained from existing NGNP documents or from the test facilities this was used to estimate the cost. Where this information could not be obtained the cost was extrapolated using the information that was available for similar types of test and previous experience. Due to this methodology the cost data provided has a high level of uncertainty.

The schedules that were developed in the TDRM Report Test Plans were combined into an integrated TDRM Testing Schedule. The test plans were evaluated to determine the proper sequencing of the test to establish the start and stop dates to support related test, design and licensing activities, and component fabrication. Due to the uncertainty of when test would be funded, lack of specific data, and unknown design parameters it was impossible to establish definitive dates that the test facilities could perform the test. Due to this the schedule data provided also has a high degree of uncertainty. The resources required to implement the test were determined and were added to create a resource loaded schedule as well as the potential testing locations for the test. This schedule is shown in Appendix A. The back up information that was used to develop the cost is found in Appendix B.

4.0 SCOPE

The TDRM TFCI effort is focused on the activities that require testing. Where design activities were shown in the TDRMs they are shown in the schedule with the appropriate ties to the NGNP design and related test activities. The cost for these design activities were assumed to be included in the plant design cost and were not included in the TDRM testing cost estimates contained in this report. The level of detail and certainty in this document is limited by the current state of the NGNP design and uncertainty of when the tests will be funded. There is a large amount of testing that is needed. The schedule to perform this testing to support the design and licensing processes within the timing needed to meet the 2021 start-up date is extremely tight. This creates a high risk factor to the successful implementation of the schedule since there is considerable data and design information needed to develop the test parameters that are currently not available. If this information is not available when needed for the test the schedule will obviously slip and put the 2021 date in jeopardy.

The best purpose of the current work is to establish a baseline process by which R&D identified within this document can be budgeted and planned. The information developed here will require review and update on a regular basis as increasing levels of detail are developed during design of NGNP. As a part of the implementation strategy, a milestone was established halfway through Conceptual Design to perform a formal validation effort on the TDRMs using the latest design and project information available. A schedule constraint was established to restrain the start of the tests relying on design information coming out of conceptual design from starting until after the validation was completed and the TDRMs revised as needed. Information from Conceptual and Preliminary design activities must be monitored and integrated into the test plans, schedule, and cost estimates as an ongoing part of the TDRM testing process. The cost and schedule does not include the work related to the graphite program, fuel program, and the ASME, LLC activities.

5.0 METHODOLOGY

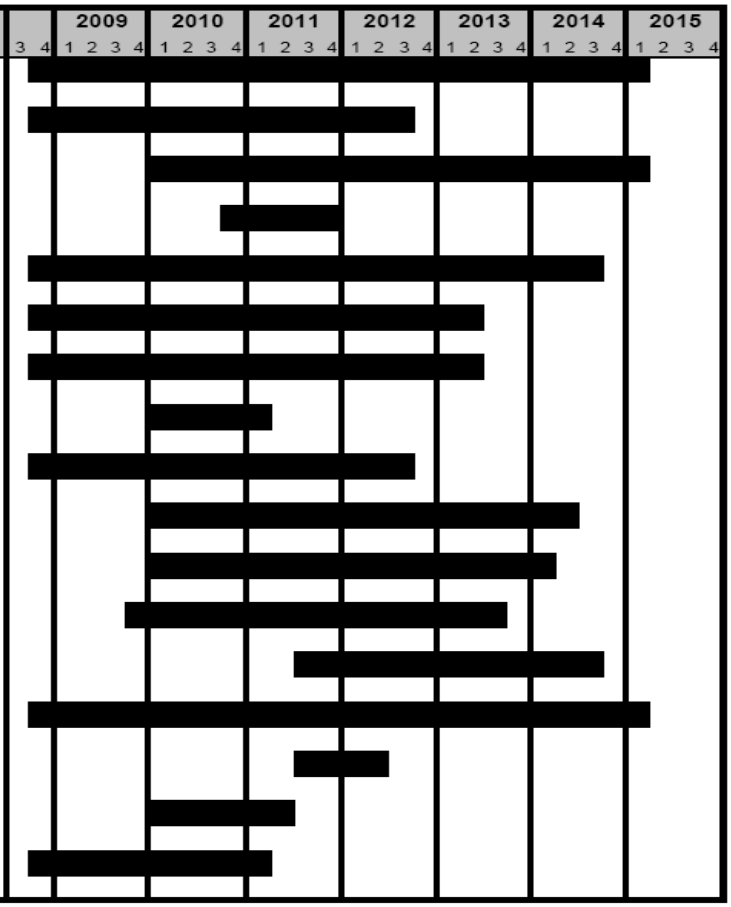
The methodology and/or process employed to develop the information contained in the report is discussed below. The methodology can be broken down into the following steps:

1) Determine related test
2) Determine project milestones related to the test
3) Identify possible test facilities
4) Estimate test cost
5) Develop an integrated resource loaded schedule

6.0 SCHEDULE ROLL-UP

The schedule below shows, at the component level, the start and finish dates of the tests required to obtain a Technology Readiness Level of 7 for that component. The full resource loaded schedule is included as Attachment A.

WBS	Description	Start	Finish
1.0	TDRM Test Management	10/1/08	1/16/15
1.1	NHS Vessel	10/1/08	9/11/12
1.2	NHS Vessel Internals	1/25/10	1/7/15
1.3	NHS Reactor Core	10/4/10	12/9/11
1.4	NHS Neutron Control System	10/1/08	7/15/14
1.5	NHS RCCS	10/1/08	5/13/13
1.6	HTS Primary Gas Circulator	10/1/08	5/24/13
1.7	HTS High Temp Flapper Valve	1/25/10	2/2/11
1.8	HTS Helical Tube IHX	10/1/08	8/7/12
1.9	HTS Primary Hot Gas Duct	1/25/10	5/9/14
1.10	HTS Secondary Gas Circulator	1/25/10	2/7/14
1.11	HTS High Temp Isolation Valve	10/1/09	9/3/13
1.12	HTS Compact IHX	10/1/08	9/9/14
1.13	PCS Helical Tube Steam Generator	10/1/08	1/16/15
1.14	Primary Loop Instrumenation	7/11/11	5/11/12
1.15	BOP Fuel Handling Mach	1/25/10	6/10/11
1.16	HTS IHX Materials and Coatings	10/1/08	2/1/11



7.0 COST SUMMARY

The table below shows the cost, at the component level, to implement the TDRM test plans for that component. The detailed cost estimates that identify costs for each test and a cost summary for all the tests are included in Appendix B. The costs are listed for Project/Test Management labor, travel for the project personnel, facility costs, and test specimen costs. A roll-up of cost by WBS is included in Appendix A.

TDRM Test Component	Total Cost
TDRM Test Management	$ 7,706,400
NHS Vessel System	$44,512,600
NHS Vessel Internals	$ 78,547,100
NHS Reactor Core Design Features	$ 23,776,700
NHS Neutron Control System	$ 15,955,500
NHS RCCS	$ 6,422,400
HTS Primary Gas Circulator	$ 22,650,100
HTS High Temp Flapper Valve	$ 1,096,900
HTS Helical Tube IHX	$ 12,157,300
HTS Primary Hot Gas Duct	$ 10,637,200
HTS Secondary Gas Circulator	$ 20,741,300
HTS High Temp Isolation Valve	$ 1,634,400
HTS Compact IHX	$ 11,513,600
PCS Steam Generator	$ 28,316,600
BOP Primary Loop Instruments	$ 2,319,900
BOP Fuel Handling Machine	$ 4,674,200
HTS IHX Material & Coatings	$ 3,396,400
TOTAL	**$ 296,058,600**

8.0 ASSUMPTIONS/RISK

8.1 Schedule is based on licensing the NGNP under 10 CFR 50.

8.2 Cost and schedule are high level based on the preliminary information currently available and will require periodic review and update as the design of the project progresses.

8.3 The schedule included in this document assumes the design input needed to develop the test is available when needed to start the test.

8.4 Due to the early stage of technology development planning and limited availability of test facility cost data, it was necessary to extrapolate test facility costs from past experience and estimate using several key assumptions, as listed here.

8.5 The estimated cost for the TDRM testing does not include costs for risk, contingency and fee.

8.6 It is assumed the selection of the test facilities will be through competitive procurements. The TDRM Test Plans will require updating as the test are funded to be included in Request for Proposals to select and award contracts to Test Facilities

8.7 The cost and schedule are based on a success driven approach where the activities are assumed to proceed from phase to phase with minimal interruption due to unforeseen or negative results that will require additional R&D to resolve or the identification of new R&D needs.

8.8 The costs were developed using a typical AREVA project structure as if the overall TDRM testing coordination and implementation would be an AREVA project task.

8.9 Test Facility Costs are assumed to include all labor and materials required to develop and fabricate test rigs/mock-ups, develop test procedures, to perform the test(s) and produce the reports. The costs for the test specimen(s) are listed separately.

8.10 Test specific assumptions are listed in the cost detail description sheets

8.11 TDRMs test plans were developed for all critical plant, area, systems, structures and components (PASSCs) for the NGNP plant with a reactor outlet temperature of 900ºC.

8.12 A composite labor rate of $140/Hr was applied to all labor hours.

8.13 TDRM activities for analysis or design were assumed to be performed under a design task. No cost were developed for those activities, but were shown on the schedule with the appropriate ties to the design activity and related test activity.

8.14 The schedule reflects the following assumed milestone dates:

- TDRM Test – Start 10/1/08 Finish 1/16/15
- Conceptual Design - Start 10/1/08 Finish 10/1/10
- Preliminary Design – Start 10/1/10 Finish 9/28/12
- Final Design – Start 10/1/12 Finish 9/30/15
- CTF 1MWt Test Loop Operational 10/3/11
- CTF 30 MWt Test Loop Operational 4/1/13
- Issue CPA 10/1/13
- Construction – Start 10/1/15 Finish 10/1/21

9.0 REFERENCES

[1] 51-9072396-000, “NGNP Conceptual Design Studies Baseline Document for Indirect Steam Cycle Configuration”

[2] 12-9076324-001, “RPV and IHX Pressure Vessel Alternatives”

[3] 12-9051191-001, “NGNP with Hydrogen Production Pre-conceptual Design Studies Report”

[4] TDR-3000807, “NGNP Composites R&D Technical Issues Study”

[5] TDR-30001031-00, “NGNP Technology Development Road Mapping Report”

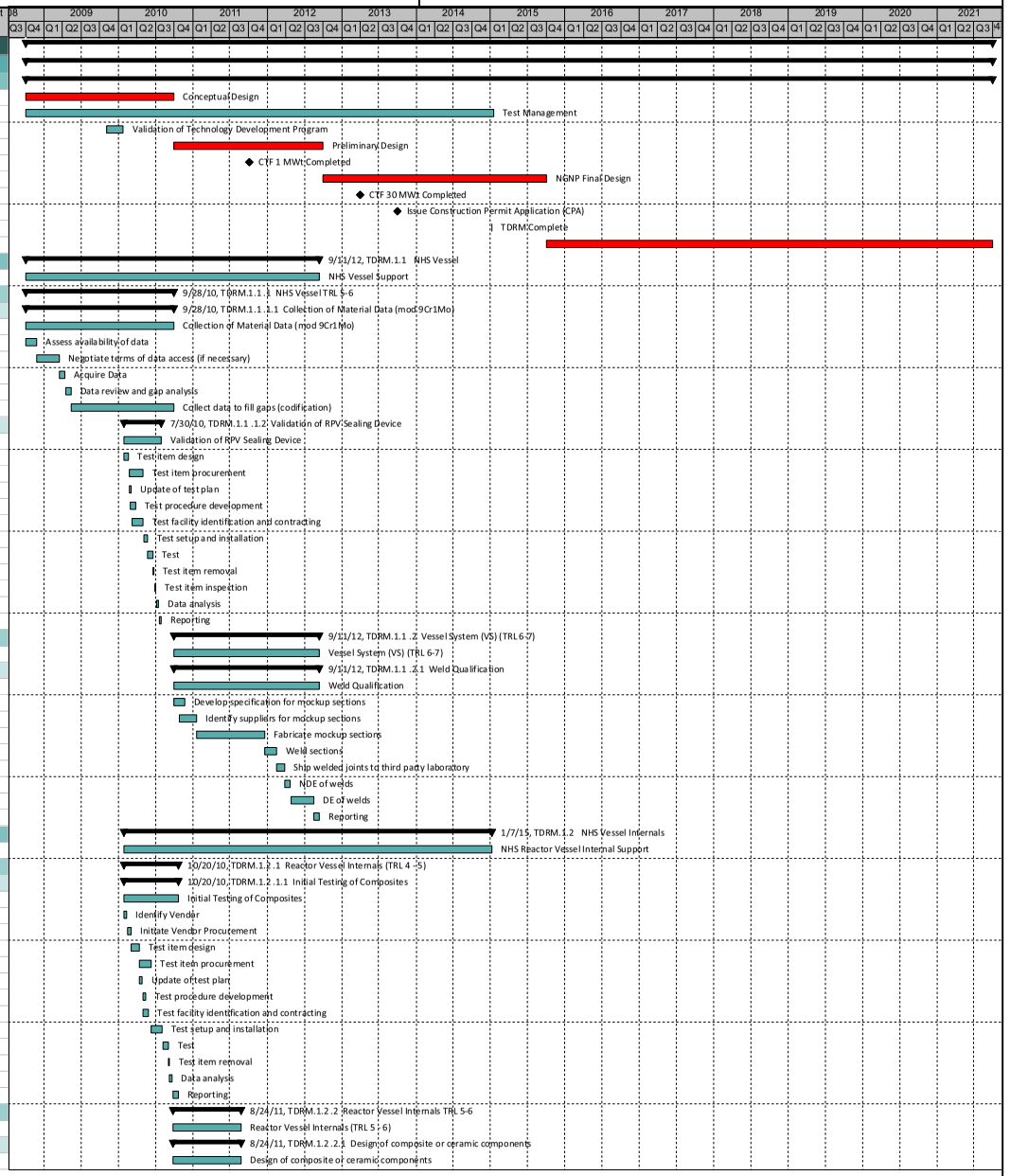
[6] 12-9072397-00, “ High Temperature Gas Reactor Component Test Facility - Mission, Needs, and Requirements Document”

[7] INL SOW-6392, Revision 0, 6/04/08, “Statement of Work AREVA Component Test Facility Conceptual Design Studies for the NGNP with Hydrogen Production”

APPENDIX A: TDRM TEST SCHEDULE

Technology Development Road Map Test Schedule

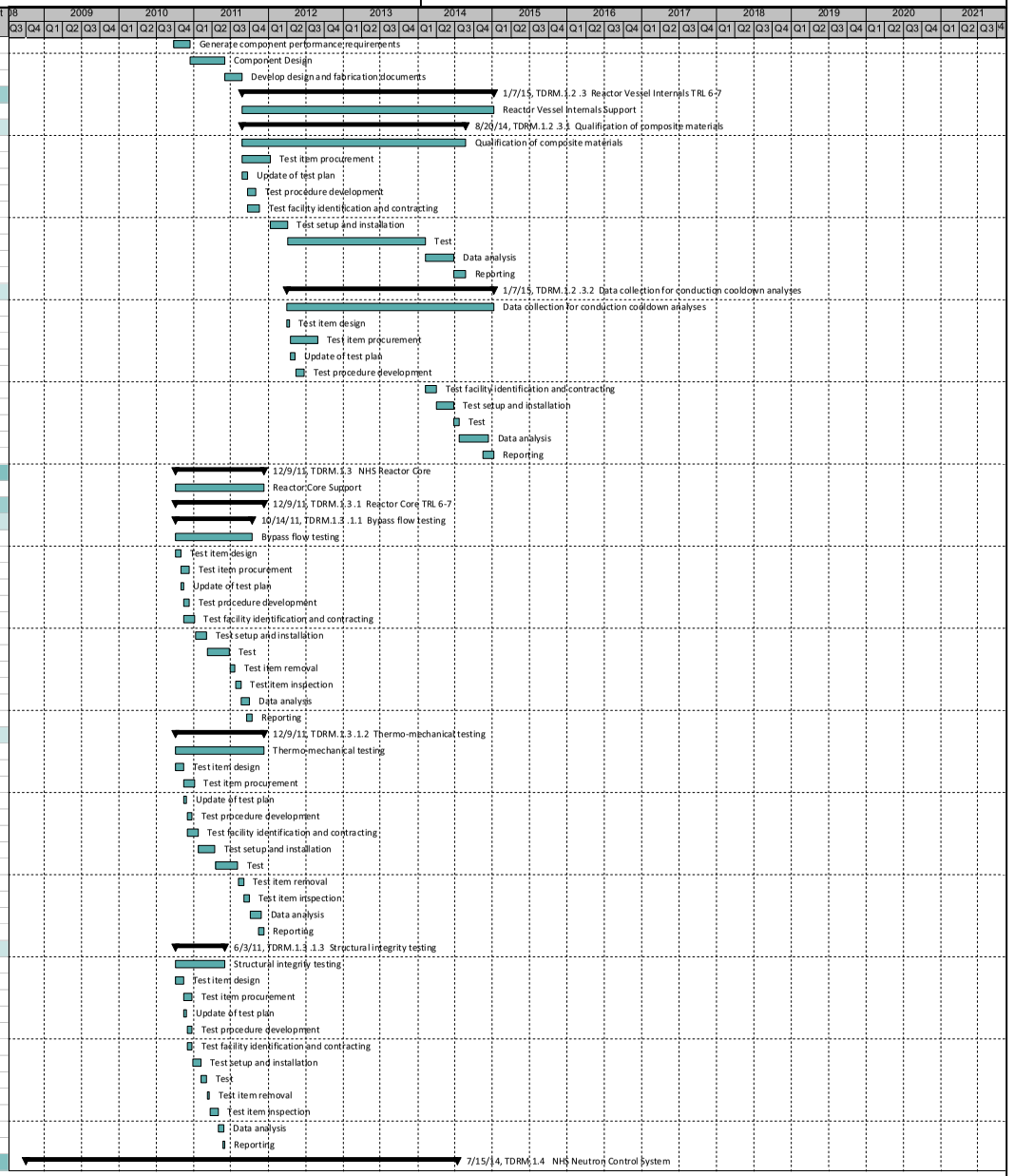
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
TDRM	TDRM Test Facility Plan Coord and Integ	3376	10/1/08	10/1/21	0	$296,058,600		
TDRM.1	TDRM Test Facility Plan Coord and Integ	3376	10/1/08	10/1/21	0	$296,058,600		
TDRM.1.0	TDRM Test Management	3376	10/1/08	10/1/21	0	$7,706,400		
1	Conceptual Design	523	10/1/08	10/1/10*	-1	$0		
8	Test Management	1643	10/1/08*	1/16/15	1750	$7,706,400		
9	Validation of Technology Development Program	60	11/2/09	1/22/10	65	$0		
2	Preliminary Design	521	10/1/10	9/28/12*	0	$0		
4	CTF 1 MWt Completed	0	10/3/11*		100	$0		
3	NGNP Final Design	783	10/1/12	9/30/15*	0	$0		
5	CTF 30 MWt Completed	0	4/1/13*		783	$0		
6	Issue Construction Permit Application (CPA)	0	10/1/13*		2089	$0		
76	TDRM Complete	0	1/8/15	1/8/15	1757	$0		
7	Construction	1567	10/1/15	10/1/21*	0	$0		
TDRM.1.1	NHS Vessel	1013	10/1/08	9/11/12	2363	$44,512,600		
S503	NHS Vessel Support	1030	10/1/08	9/11/12	2363	$600,400		
TDRM.1.1 .1	NHS Vessel TRL 5-6	503	10/1/08	9/28/10	2873	$42,036,200		
TDRM.1.1 .1.1	Collection of Material Data (mod 9Cr...	503	10/1/08	9/28/10	13	$5,030,400		
5(	Collection of Material Data (mod 9Cr1Mo)	520	10/1/08	9/28/10	13	$5,030,400	ORNL	USC
5(	Assess availability of data	40	10/1/08	11/25/08	13	$0	ORNL	USC
5(	Negotiate terms of data access (if necessary)	80	11/26/08	3/17/09	13	$0	ORNL	USC
5(	Acquire Data	20	3/18/09	4/14/09	13	$0	ORNL	USC
5(	Data review and gap analysis	20	4/15/09	5/12/09	13	$0	ORNL	USC
5(	Collect data to fill gaps (codification)	360	5/13/09	9/28/10	13	$0	ORNL	USC
TDRM.1.1 .1.2	Validation of RPV Sealing Device	135	1/25/10	7/30/10	2915	$37,005,800		
51	Validation of RPV Sealing Device	135	1/25/10	7/30/10	2915	$37,005,800		
51	Test item design	20	1/25/10	2/19/10	1708	$0		
51	Test item procurement	50	2/22/10	4/30/10	1708	$0		
51	Update of test plan	10	2/22/10	3/5/10	1708	$0		
51	Test procedure development	20	3/1/10	3/26/10	3005	$0		
51	Test facility identification and contracting	40	3/8/10	4/30/10	1708	$0		
51	Test setup and installation	15	5/3/10	5/21/10	1708	$0		
51	Test	20	5/24/10	6/18/10	1708	$0		
51	Test item removal	5	6/21/10	6/25/10	1708	$0		
51	Test item inspection	5	6/28/10	7/2/10	1708	$0		
5:	Data analysis	10	7/5/10	7/16/10	1708	$0		
5:	Reporting	10	7/19/10	7/30/10	1708	$0		
TDRM.1.1 .2	Vessel System (VS) (TRL 6-7)	510	9/29/10	9/11/12	13	$1,876,000		
522	Vessel System (VS) (TRL 6-7)	510	9/29/10	9/11/12	13	$0		
TDRM.1.1 .2.1	Weld Qualification	510	9/29/10	9/11/12	13	$1,876,000		
5:	Weld Qualification	510	9/29/10	9/11/12	13	$1,876,000	BATC	ARVC
5:	Develop specification for mockup sections	40	9/29/10	11/23/10	13	$0	BATC	ARVC
5:	Identify suppliers for mockup sections	60	10/27/10	1/18/11	13	$0	BATC	ARVC
5:	Fabricate mockup sections	240	1/19/11	12/20/11	13	$0	BATC	ARVC
5:	Weld sections	40	12/21/11	2/14/12	13	$0	BATC	ARVC
5:	Ship welded joints to third party laboratory	30	2/15/12	3/27/12	13	$0	BATC	ARVC
5:	NDE of welds	20	3/28/12	4/24/12	13	$0	BATC	ARVC
5:	DE of welds	80	4/25/12	8/14/12	13	$0	BATC	ARVC
5:	Reporting	20	8/15/12	9/11/12	13	$0	BATC	ARVC
TDRM.1.2	NHS Vessel Internals	1293	1/25/10	1/7/15	1757	$78,547,100		
464	NHS Reactor Vessel Internal Support	1293	1/25/10	1/7/15	1757	$1,080,000		
TDRM.1.2 .1	Reactor Vessel Internals (TRL 4 - 5)	193	1/25/10	10/20/10	2857	$15,620,800		
TDRM.1.2 .1.1	Initial Testing of Composites	193	1/25/10	10/20/10	2857	$15,620,800		
4(	Initial Testing of Composites	193	1/25/10	10/20/10	2857	$15,620,800	LIV	
4(	Identify Vendor	14	1/25/10	2/11/10	1130	$0	LIV	
4(	Initiate Vendor Procurement	14	2/12/10	3/3/10	1130	$0	LIV	
4(	Test item design	30	3/4/10	4/14/10	1130	$0	LIV	
4(	Test item procurement	40	4/15/10	6/9/10	1130	$0	LIV	
4:	Update of test plan	10	4/15/10	4/28/10	1140	$0	LIV	
4:	Test procedure development	10	4/29/10	5/12/10	2972	$0	LIV	
4:	Test facility identification and contracting	20	4/29/10	5/26/10	1140	$0	LIV	
4:	Test setup and installation	40	6/10/10	8/4/10	1130	$0	LIV	
4:	Test	20	8/5/10	9/1/10	1130	$0	LIV	
4:	Test item removal	5	9/2/10	9/8/10	1130	$0	LIV	
4:	Data analysis	10	9/9/10	9/22/10	1130	$0	LIV	
4:	Reporting	20	9/23/10	10/20/10	2857	$0	LIV	
TDRM.1.2 .2	Reactor Vessel Internals TRL 5-6	240	9/23/10	8/24/11	1757	$0		
478	Reactor Vessel Internals (TRL 5 - 6)	240	9/23/10	8/24/11	1757	$0		
TDRM.1.2 .2.1	Design of composite or ceramic com...	240	9/23/10	8/24/11	1757	$0		
4:	Design of composite or ceramic components	240	9/23/10	8/24/11	1757	$0		



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

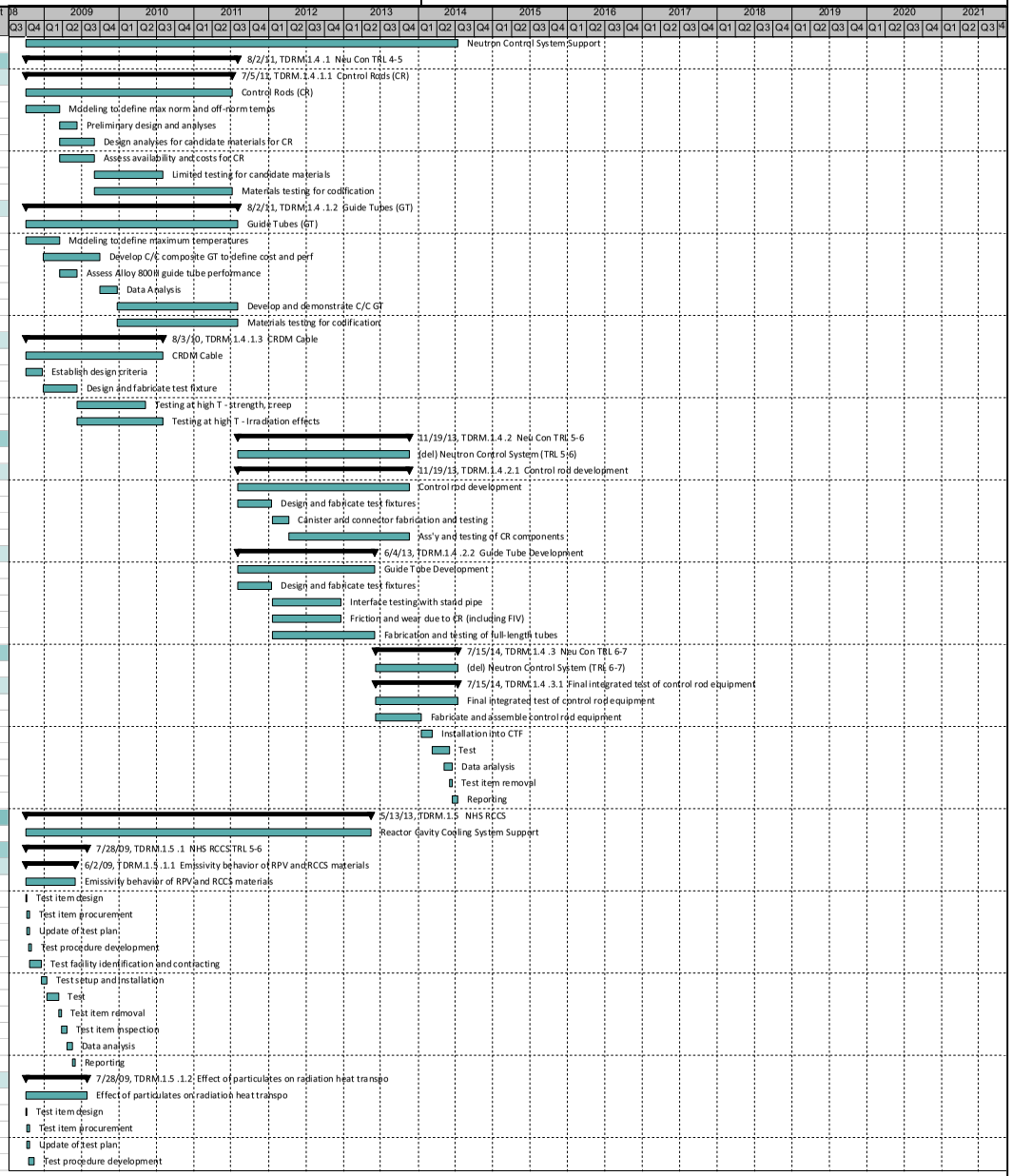
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
4(	Generate component performance requireme...	60	9/23/10	12/15/10	1130	$0		
4(	Component Design	120	12/16/10	6/1/11	1130	$0		
4(	Develop design and fabrication documents	60	6/2/11	8/24/11	1757	$0		
TDRM.1.2 .3	**Reactor Vessel Internals TRL 6-7**	880	8/25/11	1/7/15	1757	$61,846,300		
483	Reactor Vessel Internals Support	880	8/25/11	1/7/15	1757	$0		
TDRM.1.2 .3.1	**Qualification of composite materials**	780	8/25/11	8/20/14	1857	$40,511,000		
4(	Qualification of composite materials	780	8/25/11	8/20/14	1857	$40,511,000	LIV	FRA
4(	Test item procurement	100	8/25/11	1/11/12	1757	$0	LIV	FRA
4(	Update of test plan	20	8/25/11	9/21/11	1797	$0	LIV	FRA
4(	Test procedure development	30	9/22/11	11/2/11	2587	$0	LIV	FRA
4(	Test facility identification and contracting	40	9/22/11	11/16/11	1797	$0	LIV	FRA
4(	Test setup and installation	60	1/12/12	4/4/12	1757	$0	LIV	FRA
4(	Test	480	4/5/12	2/5/14	1757	$0	LIV	FRA
4(	Data analysis	100	2/6/14	6/25/14	1857	$0	LIV	FRA
4(	Reporting	40	6/26/14	8/20/14	1857	$0	LIV	FRA
TDRM.1.2 .3.2	**Data collection for conduction coold...**	723	4/2/12	1/7/15	1757	$21,335,300		
4(	Data collection for conduction cooldown analy..	723	4/2/12	1/7/15	1757	$21,335,300	CTF	
4(	Test item design	10	4/2/12*	4/13/12	2170	$0	CTF	
4(	Test item procurement	100	4/16/12	8/31/12	2170	$0	CTF	
4(	Update of test plan	20	4/16/12	5/11/12	2420	$0	CTF	
4(	Test procedure development	30	5/14/12	6/22/12	2420	$0	CTF	
4(	Test facility identification and contracting	40	2/6/14	4/2/14	1757	$0	CTF	
4(	Test setup and installation	60	4/3/14	6/25/14	1757	$0	CTF	
5(	Test	20	6/26/14	7/23/14	1757	$0	CTF	
5(	Data analysis	100	7/24/14	12/10/14	1757	$0	CTF	
5(	Reporting	40	11/13/14	1/7/15	1757	$0	CTF	
TDRM.1.3	**NHS Reactor Core**	310	10/4/10	12/9/11	2560	$23,776,700		
427	Reactor Core Support	310	10/4/10	12/9/11	2560	$391,300		
TDRM.1.3 .1	**Reactor Core TRL 6-7**	310	10/4/10	12/9/11	2560	$23,385,400		
TDRM.1.3 .1.1	**Bypass flow testing**	270	10/4/10	10/14/11	2600	$3,144,900		
4(	Bypass flow testing	270	10/4/10	10/14/11	2600	$3,144,900	ORNL	
4(	Test item design	20	10/4/10	10/29/10	250	$0	ORNL	
4(	Test item procurement	30	11/1/10	12/10/10	2820	$0	ORNL	
4(	Update of test plan	10	11/1/10	11/12/10	250	$0	ORNL	
4(	Test procedure development	20	11/15/10	12/10/10	2820	$0	ORNL	
4(	Test facility identification and contracting	40	11/15/10	1/7/11	250	$0	ORNL	
4(	Test setup and installation	40	1/10/11	3/4/11	250	$0	ORNL	
4(	Test	80	3/7/11	6/24/11	250	$0	ORNL	
4(	Test item removal	20	6/27/11	7/22/11	250	$0	ORNL	
4(	Test item inspection	20	7/25/11	8/19/11	250	$0	ORNL	
4(	Data analysis	30	8/22/11	9/30/11	250	$0	ORNL	
4(	Reporting	20	9/19/11	10/14/11	250	$0	ORNL	
TDRM.1.3 .1.2	**Thermo-mechanical testing**	310	10/4/10	12/9/11	2560	$12,622,500		
4(	Thermo-mechanical testing	310	10/4/10	12/9/11	2560	$12,622,500	PNNL	ORNL
4(	Test item design	30	10/4/10	11/12/10	590	$0	PNNL	ORNL
4(	Test item procurement	40	11/15/10	1/7/11	2800	$0	PNNL	ORNL
4(	Update of test plan	10	11/15/10	11/26/10	590	$0	PNNL	ORNL
4(	Test procedure development	20	11/29/10	12/24/10	2810	$0	PNNL	ORNL
4(	Test facility identification and contracting	40	11/29/10	1/21/11	590	$0	PNNL	ORNL
4(	Test setup and installation	60	1/24/11	4/15/11	590	$0	PNNL	ORNL
4(	Test	80	4/18/11	8/5/11	590	$0	PNNL	ORNL
4(	Test item removal	20	8/8/11	9/2/11	590	$0	PNNL	ORNL
4(	Test item inspection	20	9/5/11	9/30/11	590	$0	PNNL	ORNL
4(	Data analysis	40	10/3/11	11/25/11	590	$0	PNNL	ORNL
4(	Reporting	20	11/14/11	12/9/11	590	$0	PNNL	ORNL
TDRM.1.3 .1.3	**Structural integrity testing**	175	10/4/10	6/3/11	2695	$7,618,000		
4(	Structural integrity testing	175	10/4/10	6/3/11	2695	$7,618,000	PNNL	ORNL
4(	Test item design	30	10/4/10	11/12/10	2695	$0	PNNL	ORNL
4(	Test item procurement	30	11/15/10	12/24/10	2810	$0	PNNL	ORNL
4(	Update of test plan	10	11/15/10	11/26/10	2695	$0	PNNL	ORNL
4(	Test procedure development	20	11/29/10	12/24/10	2810	$0	PNNL	ORNL
4(	Test facility identification and contracting	20	11/29/10	12/24/10	2695	$0	PNNL	ORNL
4(	Test setup and installation	30	12/27/10	2/4/11	2695	$0	PNNL	ORNL
4(	Test	20	2/7/11	3/4/11	2695	$0	PNNL	ORNL
4(	Test item removal	10	3/7/11	3/18/11	2695	$0	PNNL	ORNL
4(	Test item inspection	30	3/21/11	4/29/11	2695	$0	PNNL	ORNL
4(	Data analysis	20	5/2/11	5/27/11	2695	$0	PNNL	ORNL
4(	Reporting	10	5/23/11	6/3/11	2695	$0	PNNL	ORNL
TDRM.1.4	**NHS Neutron Control System**	1493	10/1/08	7/15/14	1883	$15,955,500		



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

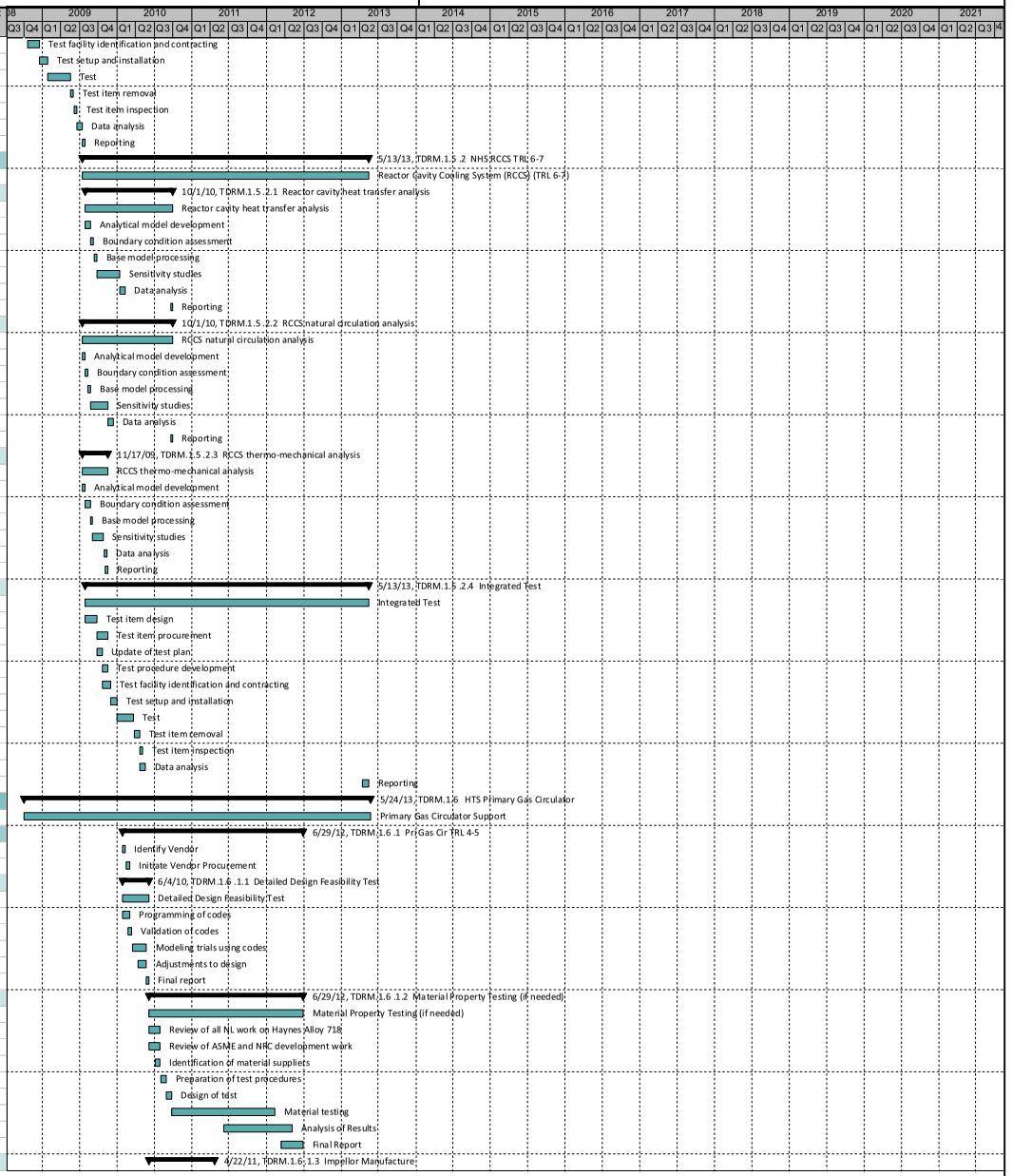
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
330	Neutron Control System Support	1510	10/1/08	7/15/14	1883	$1,795,000		
TDRM.1.4 .1 Neu Con TRL 4-5		723	10/1/08	8/2/11	2653	$9,040,800		
TDRM.1.4 .1.1 Control Rods (CR)		703	10/1/08	7/5/11	323	$3,276,500		
3[illegible]	Control Rods (CR)	720	10/1/08	7/5/11	323	$3,276,500	INL	ORNL
3[illegible]	Modeling to define max norm and off-norm te...	120	10/1/08	3/17/09	282	$0	INL	ORNL
3[illegible]	Preliminary design and analyses	60	3/18/09	6/9/09	623	$0	INL	ORNL
3[illegible]	Design analyses for candidate materials for CR	120	3/18/09	9/1/09	282	$0	INL	ORNL
3[illegible]	Assess availability and costs for CR	120	3/18/09	9/1/09	563	$0	INL	ORNL
3[illegible]	Limited testing for candidate materials	240	9/2/09	8/3/10	563	$0	INL	ORNL
3[illegible]	Materials testing for codification	480	9/2/09	7/5/11	323	$0	INL	ORNL
TDRM.1.4 .1.2 Guide Tubes (GT)		723	10/1/08	8/2/11	2653	$3,676,500		
3[illegible]	Guide Tubes (GT)	740	10/1/08	8/2/11	2653	$3,676,500	ORNL	PNNL
3[illegible]	Modeling to define maximum temperatures	120	10/1/08	3/17/09	262	$0	ORNL	PNNL
3[illegible]	Develop C/C composite GT to define cost and ...	200	12/24/08	9/29/09	262	$0	ORNL	PNNL
3[illegible]	Assess Alloy 800H guide tube performance	60	3/18/09	6/9/09	342	$0	ORNL	PNNL
3[illegible]	Data Analysis	60	9/30/09	12/22/09	303	$0	ORNL	PNNL
3[illegible]	Develop and demonstrate C/C GT	420	12/23/09	8/2/11	2653	$0	ORNL	PNNL
3[illegible]	Materials testing for codification	420	12/23/09	8/2/11	303	$0	ORNL	PNNL
TDRM.1.4 .1.3 CRDM Cable		463	10/1/08	8/3/10	2913	$2,087,800		
3[illegible]	CRDM Cable	480	10/1/08	8/3/10	2913	$2,087,800	ORNL	INL
3[illegible]	Establish design criteria	60	10/1/08	12/23/08	342	$0	ORNL	INL
3[illegible]	Design and fabricate test fixture	120	12/24/08	6/9/09	342	$0	ORNL	INL
3[illegible]	Testing at high T - strength, creep	240	6/10/09	5/11/10	2973	$0	ORNL	INL
3[illegible]	Testing at high T - Irradiation effects	300	6/10/09	8/3/10	563	$0	ORNL	INL
TDRM.1.4 .2 Neu Con TRL 5-6		600	8/3/11	11/19/13	2053	$3,778,800		
350	(del) Neutron Control System (TRL 5-6)	600	8/3/11	11/19/13	2053	$0		
TDRM.1.4 .2.1 Control rod development		600	8/3/11	11/19/13	2053	$3,778,800		
3[illegible]	Control rod development	600	8/3/11	11/19/13	2053	$3,778,800	CTF1MW	INL
3[illegible]	Design and fabricate test fixtures	120	8/3/11	1/17/12	2053	$0	CTF1MW	INL
3[illegible]	Canister and connector fabrication and testing	60	1/18/12	4/10/12	2053	$0	CTF1MW	INL
3[illegible]	Ass'y and testing of CR components	420	4/11/12	11/19/13	2053	$0	CTF1MW	INL
TDRM.1.4 .2.2 Guide Tube Development		480	8/3/11	6/4/13	2173	$0		
3[illegible]	Guide Tube Development	480	8/3/11	6/4/13	2173	$0	CTF1MW	INL
3[illegible]	Design and fabricate test fixtures	120	8/3/11	1/17/12	1276	$0	CTF1MW	INL
3[illegible]	Interface testing with stand pipe	240	1/18/12	12/18/12	2293	$0	CTF1MW	INL
3[illegible]	Friction and wear due to CR (including FIV)	240	1/18/12	12/18/12	2293	$0	CTF1MW	INL
3[illegible]	Fabrication and testing of full-length tubes	360	1/18/12	6/4/13	1276	$0	CTF1MW	INL
TDRM.1.4 .3 Neu Con TRL 6-7		290	6/5/13	7/15/14	1883	$1,340,900		
360	(del) Neutron Control System (TRL 6-7)	290	6/5/13	7/15/14	1883	$0		
TDRM.1.4 .3.1 Final integrated test of control rod e...		290	6/5/13	7/15/14	1883	$1,340,900		
3[illegible]	Final integrated test of control rod equipment	290	6/5/13	7/15/14	1883	$1,340,900	CTF1MW	INL
3[illegible]	Fabricate and assemble control rod equipment	160	6/5/13	1/14/14	1276	$0	CTF1MW	INL
3[illegible]	Installation into CTF	40	1/15/14	3/11/14	1276	$0	CTF1MW	INL
3[illegible]	Test	60	3/12/14	6/3/14	1276	$0	CTF1MW	INL
3[illegible]	Data analysis	30	5/7/14	6/17/14	1276	$0	CTF1MW	INL
3[illegible]	Test item removal	10	6/4/14	6/17/14	1903	$0	CTF1MW	INL
3[illegible]	Reporting	20	6/18/14	7/15/14	1276	$0	CTF1MW	INL
TDRM.1.5 NHS RCCS		1187	10/1/08	5/13/13	2189	$6,422,400		
368	Reactor Cavity Cooling System Support	1204	10/1/08	5/13/13	2189	$549,800		
TDRM.1.5 .1 NHS RCCS TRL 5-6		205	10/1/08	7/28/09	3171	$2,104,700		
TDRM.1.5 .1.1 Emissivity behavior of RPV and RCCS...		166	10/1/08	6/2/09	3210	$915,400		
3[illegible]	Emissivity behavior of RPV and RCCS materials	175	10/1/08	6/2/09	3218	$915,400	USC	ORNL
3[illegible]	Test item design	5	10/1/08	10/7/08	1248	$0	USC	ORNL
3[illegible]	Test item procurement	10	10/8/08	10/21/08	3378	$0	USC	ORNL
3[illegible]	Update of test plan	10	10/8/08	10/21/08	1248	$0	USC	ORNL
3[illegible]	Test procedure development	10	10/15/08	10/28/08	3373	$0	USC	ORNL
3[illegible]	Test facility identification and contracting	40	10/22/08	12/16/08	1248	$0	USC	ORNL
3[illegible]	Test setup and installation	20	12/17/08	1/13/09	1248	$0	USC	ORNL
3[illegible]	Test	40	1/14/09	3/10/09	1248	$0	USC	ORNL
3[illegible]	Test item removal	10	3/11/09	3/24/09	1248	$0	USC	ORNL
3[illegible]	Test item inspection	20	3/25/09	4/21/09	1248	$0	USC	ORNL
3[illegible]	Data analysis	20	4/22/09	5/19/09	1248	$0	USC	ORNL
3[illegible]	Reporting	10	5/20/09	6/2/09	1248	$0	USC	ORNL
TDRM.1.5 .1.2 Effect of particulates on radiation he...		205	10/1/08	7/28/09	3171	$1,189,300		
3[illegible]	Effect of particulates on radiation heat transpo	215	10/1/08	7/28/09	3178	$1,189,300	ORNL	
3[illegible]	Test item design	5	10/1/08	10/7/08	748	$0	ORNL	
3[illegible]	Test item procurement	10	10/8/08	10/21/08	3378	$0	ORNL	
3[illegible]	Update of test plan	10	10/8/08	10/21/08	748	$0	ORNL	
3[illegible]	Test procedure development	20	10/15/08	11/11/08	3363	$0	ORNL	



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

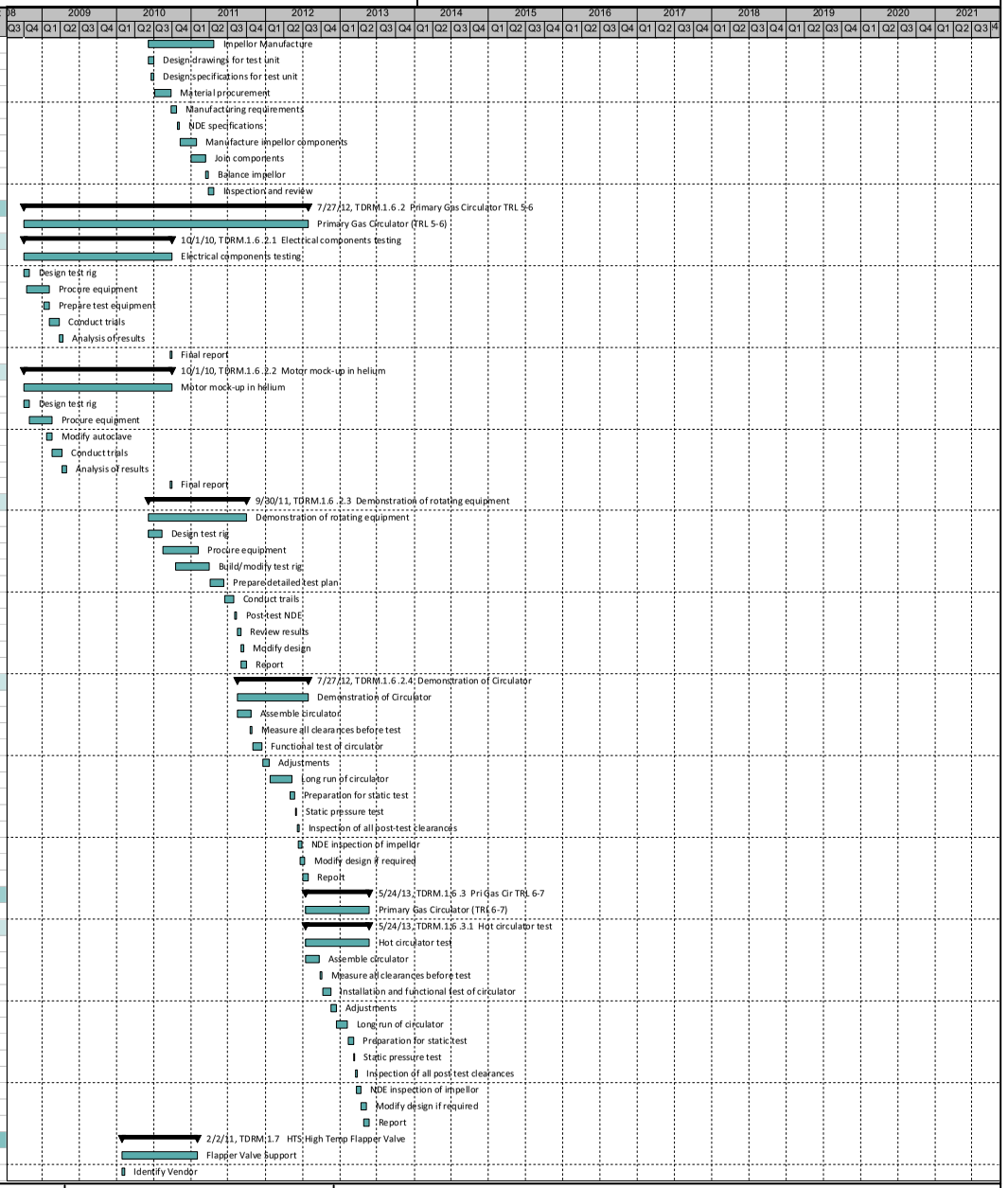
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
3(	Test facility identification and contracting	40	10/22/08	12/16/08	748	$0	ORNL	
3(	Test setup and installation	30	12/17/08	1/27/09	748	$0	ORNL	
3(	Test	80	1/28/09	5/19/09	748	$0	ORNL	
3(	Test item removal	10	5/20/09	6/2/09	748	$0	ORNL	
3(	Test item inspection	10	6/3/09	6/16/09	748	$0	ORNL	
3(	Data analysis	20	6/17/09	7/14/09	748	$0	ORNL	
3(	Reporting	10	7/15/09	7/28/09	3033	$0	ORNL	
TDRM.1.5 .2 NHS RCCS TRL 6-7		992	7/15/09	5/13/13	2189	$3,767,900		
393	Reactor Cavity Cooling System (RCCS) (TRL 6-7)	999	7/15/09	5/13/13	2189	$0		
TDRM.1.5 .2.1 Reactor cavity heat transfer analysis		301	7/29/09	10/1/10	2870	$0		
3(	Reactor cavity heat transfer analysis	308	7/29/09	10/1/10	2870	$0		
3(	Analytical model development	20	7/29/09	8/25/09	3033	$0		
3(	Boundary condition assessment	10	8/26/09	9/8/09	3033	$0		
3(	Base model processing	10	9/9/09	9/22/09	3033	$0		
3(	Sensitivity studies	80	9/23/09	1/12/10	3033	$0		
3(	Data analysis	20	1/13/10	2/9/10	3033	$0		
4(	Reporting	10	9/20/10	10/1/10	2870	$0		
TDRM.1.5 .2.2 RCCS natural circulation analysis		311	7/15/09	10/1/10	2870	$0		
4(	RCCS natural circulation analysis	318	7/15/09	10/1/10	2870	$0		
4(	Analytical model development	10	7/15/09	7/28/09	2958	$0		
4(	Boundary condition assessment	10	7/29/09	8/11/09	3073	$0		
4(	Base model processing	10	8/12/09	8/25/09	3073	$0		
4(	Sensitivity studies	60	8/26/09	11/17/09	3073	$0		
4(	Data analysis	20	11/18/09	12/15/09	3073	$0		
4(	Reporting	10	9/20/10	10/1/10	2870	$0		
TDRM.1.5 .2.3 RCCS thermo-mechanical analysis		89	7/15/09	11/17/09	742	$0		
4(	RCCS thermo-mechanical analysis	90	7/15/09	11/17/09	748	$0		
4(	Analytical model development	10	7/15/09	7/28/09	748	$0		
4(	Boundary condition assessment	20	7/29/09	8/25/09	748	$0		
4(	Base model processing	5	8/26/09	9/1/09	748	$0		
4(	Sensitivity studies	40	9/2/09	10/27/09	748	$0		
4(	Data analysis	10	10/28/09	11/10/09	748	$0		
4(	Reporting	10	11/4/09	11/17/09*	748	$0		
TDRM.1.5 .2.4 Integrated Test		982	7/29/09	5/13/13	2189	$3,767,900		
4(	Integrated Test	989	7/29/09	5/13/13	2189	$3,767,900	ANL	
4(	Test item design	40	7/29/09	9/22/09	2958	$0	ANL	
4(	Test item procurement	40	9/23/09	11/17/09	3098	$0	ANL	
4(	Update of test plan	20	9/23/09	10/20/09	2958	$0	ANL	
4(	Test procedure development	20	10/21/09	11/17/09	3098	$0	ANL	
4(	Test facility identification and contracting	30	10/21/09	12/1/09	2958	$0	ANL	
4(	Test setup and installation	20	12/2/09	12/29/09	2958	$0	ANL	
4(	Test	60	12/30/09	3/23/10	2958	$0	ANL	
4(	Test item removal	20	3/24/10	4/20/10	2958	$0	ANL	
4(	Test item inspection	10	4/21/10	5/4/10	2978	$0	ANL	
4(	Data analysis	20	4/21/10	5/18/10	2958	$0	ANL	
4(	Reporting	20	4/16/13	5/13/13	2189	$0	ANL	
TDRM.1.6 HTS Primary Gas Circulator		1196	10/1/08	5/24/13	2180	$22,650,100		
220	Primary Gas Circulator Support	1213	10/1/08	5/24/13	2180	$815,000		
TDRM.1.6 .1 Pri Gas Cir TRL4-5		635	1/25/10	6/29/12	2415	$3,827,800		
221	Identify Vendor	14	1/25/10	2/11/10	112	$0		
222	Initiate Vendor Procurement	14	2/12/10	3/3/10	3022	$0		
TDRM.1.6 .1.1 Detailed Design Feasibility Test		95	1/25/10	6/4/10	65	$0		
2(	Detailed Design Feasibility Test	95	1/25/10	6/4/10	65	$0		
2(	Programming of codes	30	1/25/10	3/5/10	65	$0		
2(	Validation of codes	15	2/22/10	3/12/10	65	$0		
2(	Modeling trials using codes	50	3/15/10	5/21/10	65	$0		
2(	Adjustments to design	30	4/12/10	5/21/10	65	$0		
2(	Final report	10	5/24/10	6/4/10	65	$0		
TDRM.1.6 .1.2 Material Property Testing (if needed)		540	6/7/10	6/29/12	2415	$2,610,400		
2(	Material Property Testing (if needed)	540	6/7/10	6/29/12	2415	$2,610,400	USC	ORNL
2(	Review of all NL work on Haynes Alloy 718	40	6/7/10	7/30/10	2915	$0	USC	ORNL
2(	Review of ASME and NRC development work	40	6/7/10	7/30/10	65	$0	USC	ORNL
2(	Identification of material suppliers	20	7/5/10	7/30/10	65	$0	USC	ORNL
2(	Preparation of test procedures	20	8/2/10	8/27/10	65	$0	USC	ORNL
2(	Design of test	20	8/30/10	9/24/10	65	$0	USC	ORNL
2(	Material testing	360	9/27/10	2/10/12	65	$0	USC	ORNL
2(	Analysis of Results	240	6/6/11	5/4/12	65	$0	USC	ORNL
2(	Final Report	80	3/12/12	6/29/12	65	$0	USC	ORNL
TDRM.1.6 .1.3 Impellor Manufacture		230	6/7/10	4/22/11	2725	$1,217,400		



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

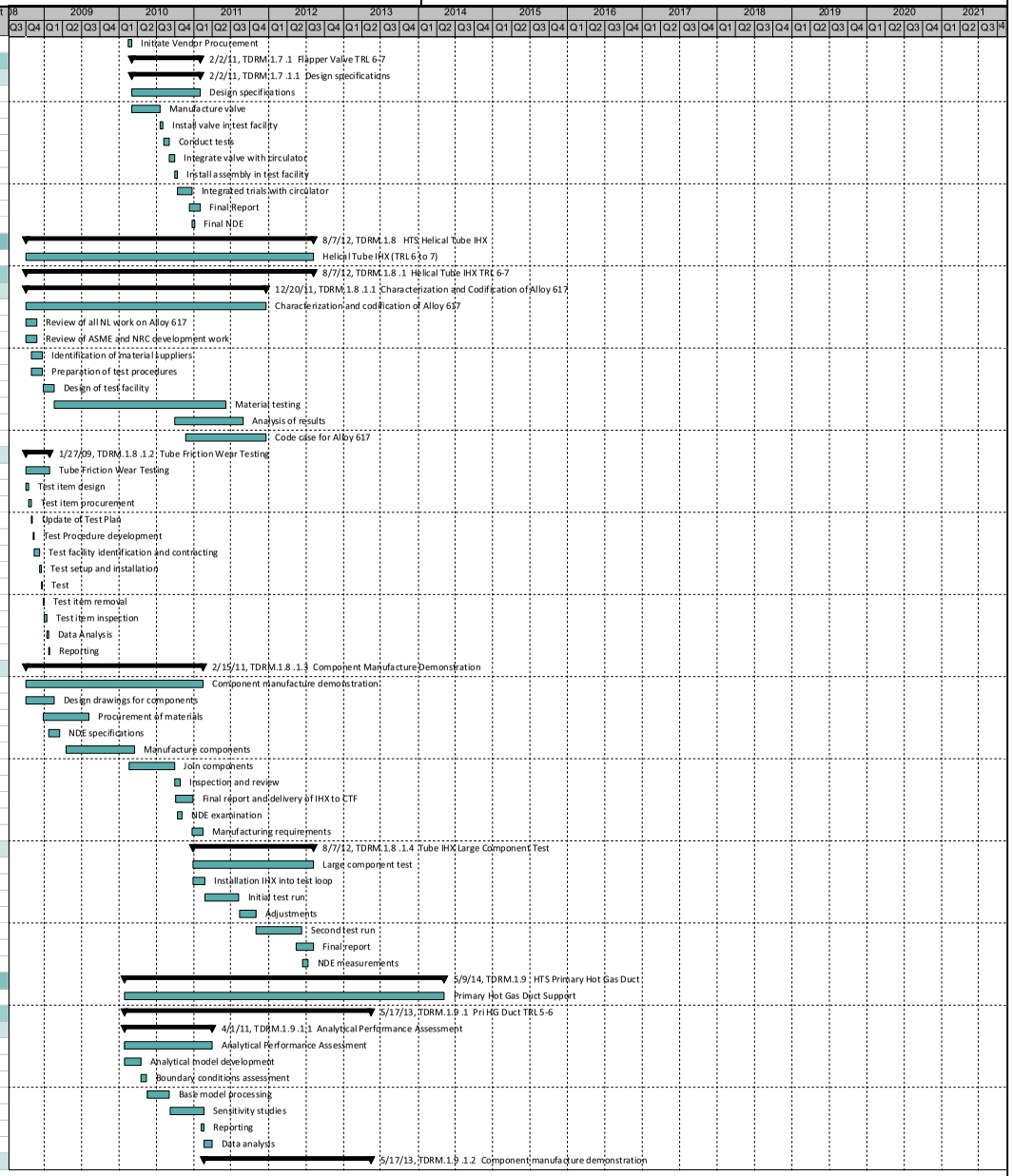
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
2	Impellor Manufacture	230	6/7/10	4/22/11	2725	$1,217,400	ARV VEN	
2	Design drawings for test unit	20	6/7/10	7/2/10	2725	$0	ARV VEN	
2	Design specifications for test unit	10	6/21/10	7/2/10	2725	$0	ARV VEN	
2	Material procurement	60	7/5/10	9/24/10	2725	$0	ARV VEN	
2	Manufacturing requirements	20	9/27/10	10/22/10	2725	$0	ARV VEN	
2	NDE specifications	10	10/25/10	11/5/10	2725	$0	ARV VEN	
2	Manufacture impellor components	60	11/8/10	1/28/11	2725	$0	ARV VEN	
2	Join components	50	1/3/11	3/11/11	2725	$0	ARV VEN	
2	Balance impellor	10	3/14/11	3/25/11	2725	$0	ARV VEN	
2	Inspection and review	20	3/28/11	4/22/11	2725	$0	ARV VEN	
TDRM.1.6 .2	**Primary Gas Circulator TRL 5-6**	981	10/1/08	7/27/12	2395	$16,860,300		
248	Primary Gas Circulator (TRL 5-6)	998	10/1/08	7/27/12	2395	$0		
TDRM.1.6 .2.1	**Electrical components testing**	506	10/1/08	10/1/10	2870	$1,317,400		
2	Electrical components testing	523	10/1/08	10/1/10	2870	$1,317,400	ARV VEN	SRNL
2	Design test rig	20	10/1/08	10/28/08	3233	$0	ARV VEN	SRNL
2	Procure equipment	80	10/15/08	2/3/09	3243	$0	ARV VEN	SRNL
2	Prepare test equipment	20	1/7/09	2/3/09	3243	$0	ARV VEN	SRNL
2	Conduct trials	35	2/4/09	3/24/09	3243	$0	ARV VEN	SRNL
2	Analysis of results	15	3/25/09	4/14/09	3243	$0	ARV VEN	SRNL
2	Final report	10	9/20/10	10/1/10	2870	$0	ARV VEN	SRNL
TDRM.1.6 .2.2	**Motor mock-up in helium**	506	10/1/08	10/1/10	2870	$1,946,500		
2	Motor mock-up in helium	523	10/1/08	10/1/10	2870	$1,946,500		SRNL
2	Design test rig	20	10/1/08	10/28/08	3233	$0		SRNL
2	Procure equipment	80	10/29/08	2/17/09	3233	$0		SRNL
2	Modify autoclave	20	1/21/09	2/17/09	3233	$0		SRNL
2	Conduct trials	35	2/18/09	4/7/09	3233	$0		SRNL
2	Analysis of results	15	4/8/09	4/28/09	3233	$0		SRNL
2	Final report	10	9/20/10	10/1/10	2870	$0		SRNL
TDRM.1.6 .2.3	**Demonstration of rotating equipment**	345	6/7/10	9/30/11	2610	$2,069,000		
2	Demonstration of rotating equipment	345	6/7/10	9/30/11	2610	$2,069,000	ZITG	TBD
2	Design test rig	50	6/7/10	8/13/10	2180	$0	ZITG	TBD
2	Procure equipment	125	8/16/10	2/4/11	2180	$0	ZITG	TBD
2	Build/modify test rig	120	10/18/10	4/1/11	2180	$0	ZITG	TBD
2	Prepare detailed test plan	50	4/4/11	6/10/11	2180	$0	ZITG	TBD
2	Conduct trails	35	6/13/11	7/29/11	2180	$0	ZITG	TBD
2	Post-test NDE	10	8/1/11	8/12/11	2180	$0	ZITG	TBD
2	Review results	15	8/15/11	9/2/11	2610	$0	ZITG	TBD
2	Modify design	10	9/5/11	9/16/11	2610	$0	ZITG	TBD
2	Report	20	9/5/11	9/30/11	2610	$0	ZITG	TBD
TDRM.1.6 .2.4	**Demonstration of Circulator**	250	8/15/11	7/27/12	2395	$11,527,400		
2	Demonstration of Circulator	250	8/15/11	7/27/12	2395	$11,527,400	ARV VEN	
2	Assemble circulator	50	8/15/11	10/21/11	2180	$0	ARV VEN	
2	Measure all clearances before test	10	10/17/11	10/28/11	2180	$0	ARV VEN	
2	Functional test of circulator	35	10/31/11	12/16/11	2180	$0	ARV VEN	
2	Adjustments	25	12/19/11	1/20/12	2180	$0	ARV VEN	
2	Long run of circulator	80	1/23/12	5/11/12	2180	$0	ARV VEN	
2	Preparation for static test	20	4/30/12	5/25/12	2180	$0	ARV VEN	
2	Static pressure test	5	5/28/12	6/1/12	2180	$0	ARV VEN	
2	Inspection of all post-test clearances	10	6/4/12	6/15/12	2180	$0	ARV VEN	
2	NDE inspection of impellor	15	6/11/12	6/29/12	2415	$0	ARV VEN	
2	Modify design if required	20	6/18/12	7/13/12	2180	$0	ARV VEN	
2	Report	20	7/2/12	7/27/12	2395	$0	ARV VEN	
TDRM.1.6 .3	**Pri Gas Cir TRL 6-7**	225	7/16/12	5/24/13	2180	$1,147,000		
285	Primary Gas Circulator (TRL 6-7)	225	7/16/12	5/24/13	2180	$0		
TDRM.1.6 .3.1	**Hot circulator test**	225	7/16/12	5/24/13	2180	$1,147,000		
2	Hot circulator test	225	7/16/12	5/24/13	2180	$1,147,000	ARV VEN	CTF30
2	Assemble circulator	50	7/16/12	9/21/12	2180	$0	ARV VEN	CTF30
2	Measure all clearances before test	10	9/24/12	10/5/12	2180	$0	ARV VEN	CTF30
2	Installation and functional test of circulator	30	10/8/12	11/16/12	2180	$0	ARV VEN	CTF30
2	Adjustments	20	11/19/12	12/14/12	2180	$0	ARV VEN	CTF30
2	Long run of circulator	40	12/17/12	2/8/13	2180	$0	ARV VEN	CTF30
2	Preparation for static test	20	2/11/13	3/8/13	2180	$0	ARV VEN	CTF30
2	Static pressure test	5	3/11/13	3/15/13	2180	$0	ARV VEN	CTF30
2	Inspection of all post test clearances	10	3/18/13	3/29/13	2180	$0	ARV VEN	CTF30
2	NDE inspection of impellor	15	3/25/13	4/12/13	2180	$0	ARV VEN	CTF30
2	Modify design if required	20	4/15/13	5/10/13	2180	$0	ARV VEN	CTF30
2	Report	20	4/29/13	5/24/13	2180	$0	ARV VEN	CTF30
TDRM.1.7	**HTS High Temp Flapper Valve**	268	1/25/10	2/2/11	2782	$1,096,900		
208	Flapper Valve Support	268	1/25/10	2/2/11	2782	$1,096,900		
209	Identify Vendor	14	1/25/10	2/11/10	2667	$0		



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

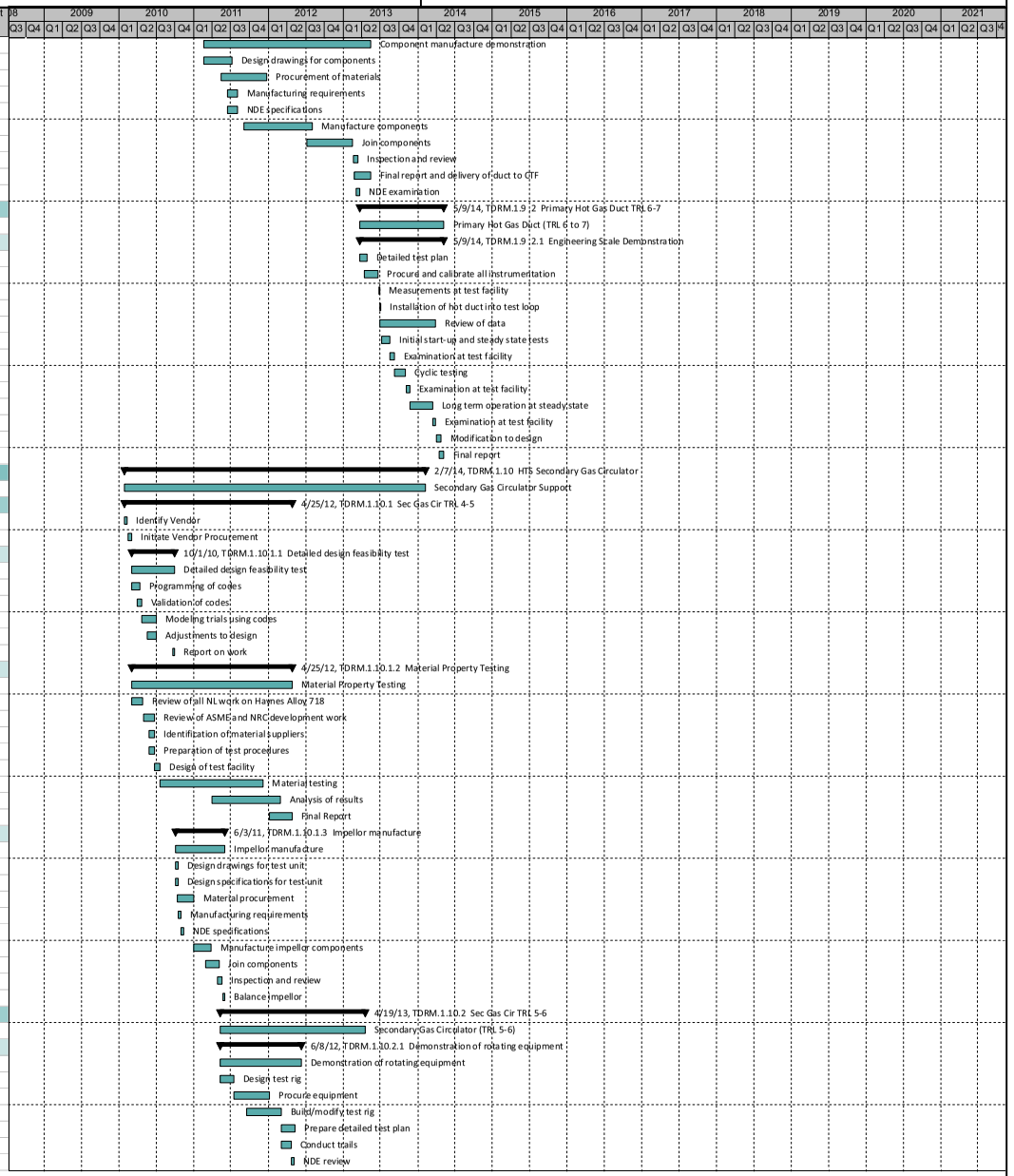
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
210	Initiate Vendor Procurement	14	2/12/10	3/3/10	2667	$0		
TDRM.1.7 .1 Flapper Valve TRL 6-7		240	3/4/10	2/2/11	2782	$0		
TDRM.1.7 .1.1 Design specifications		240	3/4/10	2/2/11	2782	$0		
21	Design specifications	240	3/4/10	2/2/11	2782	$0	ARV VEN	CTF30
21	Manufacture valve	100	3/4/10	7/21/10	2667	$0	ARV VEN	CTF30
21	Install valve in test facility	10	7/22/10	8/4/10	2667	$0	ARV VEN	CTF30
21	Conduct tests	20	8/5/10	9/1/10	2667	$0	ARV VEN	CTF30
21	Integrate valve with circulator	20	9/2/10	9/29/10	2667	$0	ARV VEN	CTF30
21	Install assembly in test facility	10	9/30/10	10/13/10	2782	$0	ARV VEN	CTF30
21	Integrated trials with circulator	50	10/14/10	12/22/10	2782	$0	ARV VEN	CTF30
21	Final Report	40	12/9/10	2/2/11	2782	$0	ARV VEN	CTF30
21	Final NDE	10	12/23/10	1/5/11	2782	$0	ARV VEN	CTF30
TDRM.1.8 HTS Helical Tube IHX		988	10/1/08	8/7/12	2388	$12,157,300		
114	Helical Tube IHX (TRL 6 to 7)	1005	10/1/08	8/7/12	2388	$1,138,800		
TDRM.1.8 .1 Helical Tube IHX TRL 6-7		988	10/1/08	8/7/12	2388	$11,018,500		
TDRM.1.8 .1.1 Characterization and Codification of ...		823	10/1/08	12/20/11	2553	$0		
11	Characterization and codification of Alloy 617	840	10/1/08	12/20/11	2553	$0		
11	Review of all NL work on Alloy 617	40	10/1/08	11/25/08	3353	$0		
11	Review of ASME and NRC development work	40	10/1/08	11/25/08	203	$0		
11	Identification of material suppliers	40	10/29/08	12/23/08	3333	$0		
11	Preparation of test procedures	40	10/29/08	12/23/08	203	$0		
12	Design of test facility	40	12/24/08	2/17/09	203	$0		
12	Material testing	600	2/18/09	6/7/11	203	$0		
12	Analysis of results	240	9/29/10	8/30/11	203	$0		
12	Code case for Alloy 617	280	11/24/10	12/20/11	203	$0		
TDRM.1.8 .1.2 Tube Friction Wear Testing		79	10/1/08	1/27/09	947	$7,748,000		
12	Tube Friction Wear Testing	85	10/1/08	1/27/09	958	$7,748,000	TBD	
12	Test item design	10	10/1/08	10/14/08	958	$0	TBD	
12	Test item procurement	10	10/15/08	10/28/08	958	$0	TBD	
12	Update of Test Plan	5	10/29/08	11/4/08	958	$0	TBD	
12	Test Procedure development	5	11/5/08	11/11/08	958	$0	TBD	
12	Test facility identification and contracting	20	11/12/08	12/9/08	958	$0	TBD	
12	Test setup and installation	5	12/10/08	12/16/08	958	$0	TBD	
12	Test	5	12/17/08	12/23/08	958	$0	TBD	
12	Test item removal	5	12/24/08	12/30/08	958	$0	TBD	
12	Test item inspection	10	12/31/08	1/13/09	958	$0	TBD	
12	Data Analysis	5	1/14/09	1/20/09	958	$0	TBD	
12	Reporting	5	1/21/09	1/27/09	958	$0	TBD	
TDRM.1.8 .1.3 Component Manufacture Demonstr...		603	10/1/08	2/15/11	2773	$816,100		
12	Component manufacture demonstration	620	10/1/08	2/15/11	2773	$816,100	TBD	
12	Design drawings for components	100	10/1/08	2/17/09	433	$0	TBD	
14	Procurement of materials	160	12/24/08	8/4/09	433	$0	TBD	
12	NDE specifications	40	1/21/09	3/17/09	3273	$0	TBD	
14	Manufacture components	240	4/15/09	3/16/10	433	$0	TBD	
14	Join components	160	2/17/10	9/28/10	433	$0	TBD	
14	Inspection and review	20	9/29/10	10/26/10	433	$0	TBD	
14	Final report and delivery of IHX to CTF	60	10/6/10	12/28/10	433	$0	TBD	
14	NDE examination	15	10/13/10	11/2/10	433	$0	TBD	
12	Manufacturing requirements	40	12/22/10	2/15/11	2773	$0	TBD	
TDRM.1.8 .1.4 Tube IHX Large Component Test		420	12/29/10	8/7/12	433	$2,454,400		
14	Large component test	420	12/29/10	8/7/12	433	$2,454,400	CTF30MW	
14	Installation IHX into test loop	40	12/29/10	2/22/11	433	$0	CTF30MW	
14	Initial test run	120	2/23/11	8/9/11	433	$0	CTF30MW	
14	Adjustments	60	8/10/11	11/1/11	433	$0	CTF30MW	
15	Second test run	160	11/2/11	6/12/12	433	$0	CTF30MW	
15	Final report	60	5/16/12	8/7/12	433	$0	CTF30MW	
15	NDE measurements	20	6/13/12	7/10/12	433	$0	CTF30MW	
TDRM.1.9 HTS Primary Hot Gas Duct		1120	1/25/10	5/9/14	1930	$10,637,200		
298	Primary Hot Gas Duct Support	1120	1/25/10	5/9/14	1930	$494,800		
TDRM.1.9 .1 Pri HG Duct TRL 5-6		865	1/25/10	5/17/13	2185	$3,398,000		
TDRM.1.9 .1.1 Analytical Performance Assessment		310	1/25/10	4/1/11	723	$3,398,000		
25	Analytical Performance Assessment	310	1/25/10	4/1/11	723	$3,398,000		
3(	Analytical model development	60	1/25/10	4/16/10	723	$0		
3(	Boundary conditions assessment	20	4/19/10	5/14/10	723	$0		
3(	Base model processing	80	5/17/10	9/3/10	723	$0		
3(	Sensitivity studies	120	9/6/10	2/18/11	723	$0		
3(	Reporting	10	2/7/11	2/18/11	723	$0		
3(	Data analysis	30	2/21/11	4/1/11	723	$0		
TDRM.1.9 .1.2 Component manufacture demonstr...		585	2/21/11	5/17/13	2185	$0		



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

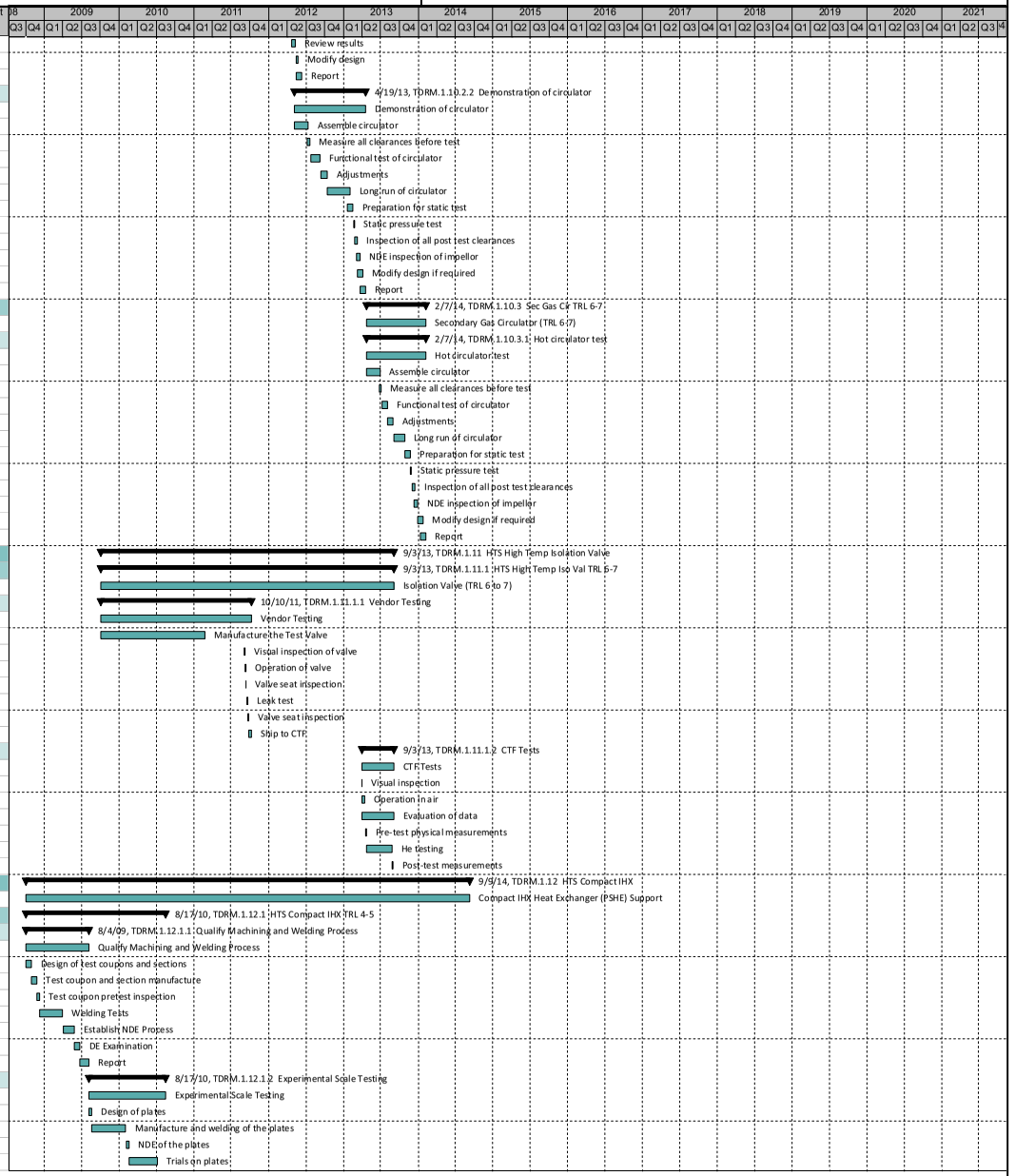
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
3(	Component manufacture demonstration	585	2/21/11	5/17/13	2185	$0	TBD	
3(	Design drawings for components	100	2/21/11	7/8/11	723	$0	TBD	
3!	Procurement of materials	160	5/16/11	12/23/11	723	$0	TBD	
3(	Manufacturing requirements	40	6/13/11	8/5/11	2650	$0	TBD	
3(	NDE specifications	40	6/13/11	8/5/11	2650	$0	TBD	
3!	Manufacture components	240	9/5/11	8/3/12	723	$0	TBD	
3!	Join components	160	7/9/12	2/15/13	723	$0	TBD	
3!	Inspection and review	20	2/18/13	3/15/13	723	$0	TBD	
3!	Final report and delivery of duct to CTF	60	2/25/13	5/17/13	2185	$0	TBD	
3!	NDE examination	15	3/4/13	3/22/13	723	$0	TBD	
TDRM.1.9 .2	**Primary Hot Gas Duct TRL 6-7**	295	3/25/13	5/9/14	1930	$6,744,400		
316	Primary Hot Gas Duct (TRL 6 to 7)	295	3/25/13	5/9/14	1930	$6,744,400		
TDRM.1.9 .2.1	**Engineering Scale Demonstration**	295	3/25/13	5/9/14	1930	$0		
3!	Detailed test plan	25	3/25/13*	4/26/13	723	$0	CTF30MW	
3!	Procure and calibrate all instrumentation	50	4/15/13	6/21/13	723	$0	CTF30MW	
3!	Measurements at test facility	5	6/24/13	6/28/13	723	$0	CTF30MW	
3;	Installation of hot duct into test loop	5	7/1/13	7/5/13	1960	$0	CTF30MW	
3;	Review of data	195	7/1/13	3/28/14	723	$0	CTF30MW	
3;	Initial start-up and steady state tests	30	7/8/13	8/16/13	1960	$0	CTF30MW	
3;	Examination at test facility	15	8/19/13	9/6/13	1960	$0	CTF30MW	
3;	Cyclic testing	40	9/9/13	11/1/13	1960	$0	CTF30MW	
3;	Examination at test facility	15	11/4/13	11/22/13	1960	$0	CTF30MW	
3;	Long term operation at steady state	80	11/25/13	3/14/14	1960	$0	CTF30MW	
3;	Examination at test facility	10	3/17/14	3/28/14	1960	$0	CTF30MW	
3;	Modification to design	20	3/31/14	4/25/14	723	$0	CTF30MW	
3;	Final report	20	4/14/14	5/9/14	723	$0	CTF30MW	
TDRM.1.10	**HTS Secondary Gas Circulator**	1055	1/25/10	2/7/14	1995	$20,741,300		
553	Secondary Gas Circulator Support	1055	1/25/10	2/7/14	1995	$726,300		
TDRM.1.10.1	**Sec Gas Cir TRL 4-5**	588	1/25/10	4/25/12	2462	$3,812,800		
554	Identify Vendor	14	1/25/10	2/11/10	112	$0		
555	Initiate Vendor Procurement	14	2/12/10	3/3/10	112	$0		
TDRM.1.10.1.1	**Detailed design feasibility test**	152	3/4/10	10/1/10	1995	$0		
5!	Detailed design feasibility test	152	3/4/10	10/1/10	1995	$0		
5!	Programming of codes	30	3/4/10	4/14/10	2052	$0		
5!	Validation of codes	15	4/1/10	4/21/10	2052	$0		
5!	Modeling trials using codes	50	4/22/10	6/30/10	2052	$0		
5!	Adjustments to design	30	5/20/10	6/30/10	2052	$0		
5!	Report on work	10	9/20/10	10/1/10	1995	$0		
TDRM.1.10.1.2	**Material Property Testing**	560	3/4/10	4/25/12	2462	$2,600,400		
5!	Material Property Testing	560	3/4/10	4/25/12	2462	$2,600,400	USC	ORNL
5!	Review of all NL work on Haynes Alloy 718	40	3/4/10	4/28/10	112	$0	USC	ORNL
5!	Review of ASME and NRC development work	40	4/29/10	6/23/10	112	$0	USC	ORNL
5!	Identification of material suppliers	20	5/27/10	6/23/10	2942	$0	USC	ORNL
5!	Preparation of test procedures	20	5/27/10	6/23/10	112	$0	USC	ORNL
5!	Design of test facility	20	6/24/10	7/21/10	112	$0	USC	ORNL
5!	Material testing	360	7/22/10	12/7/11	112	$0	USC	ORNL
5!	Analysis of results	240	3/31/11	2/29/12	112	$0	USC	ORNL
5;	Final Report	80	1/5/12	4/25/12	112	$0	USC	ORNL
TDRM.1.10.1.3	**Impellor manufacture**	175	10/4/10	6/3/11	2695	$1,212,400		
5;	Impellor manufacture	175	10/4/10	6/3/11	2695	$1,212,400	TBD	
5;	Design drawings for test unit	10	10/4/10	10/15/10	1995	$0	TBD	
5;	Design specifications for test unit	10	10/4/10	10/15/10	1995	$0	TBD	
5;	Material procurement	60	10/11/10	12/31/10	1995	$0	TBD	
5;	Manufacturing requirements	10	10/18/10	10/29/10	2030	$0	TBD	
5;	NDE specifications	10	11/1/10	11/12/10	2030	$0	TBD	
5;	Manufacture impellor components	60	1/3/11	3/25/11	1995	$0	TBD	
5;	Join components	50	2/28/11	5/6/11	1995	$0	TBD	
5;	Inspection and review	20	4/25/11	5/20/11	2695	$0	TBD	
5!	Balance impellor	10	5/23/11	6/3/11	2695	$0	TBD	
TDRM.1.10.2	**Sec Gas Cir TRL 5-6**	510	5/9/11	4/19/13	2205	$15,198,300		
581	Secondary Gas Circulator (TRL 5-6)	510	5/9/11	4/19/13	2205	$0		
TDRM.1.10.2.1	**Demonstration of rotating equipment**	285	5/9/11	6/8/12	2430	$3,602,400		
5!	Demonstration of rotating equipment	285	5/9/11	6/8/12	2430	$3,602,400	ZITG	TBD
5!	Design test rig	50	5/9/11	7/15/11	1995	$0	ZITG	TBD
5!	Procure equipment	125	7/18/11	1/6/12	1995	$0	ZITG	TBD
5!	Build/modify test rig	120	9/19/11	3/2/12	1995	$0	ZITG	TBD
5!	Prepare detailed test plan	50	3/5/12	5/11/12	2450	$0	ZITG	TBD
5!	Conduct trails	35	3/5/12	4/20/12	1995	$0	ZITG	TBD
5!	NDE review	10	4/23/12	5/4/12	1995	$0	ZITG	TBD



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

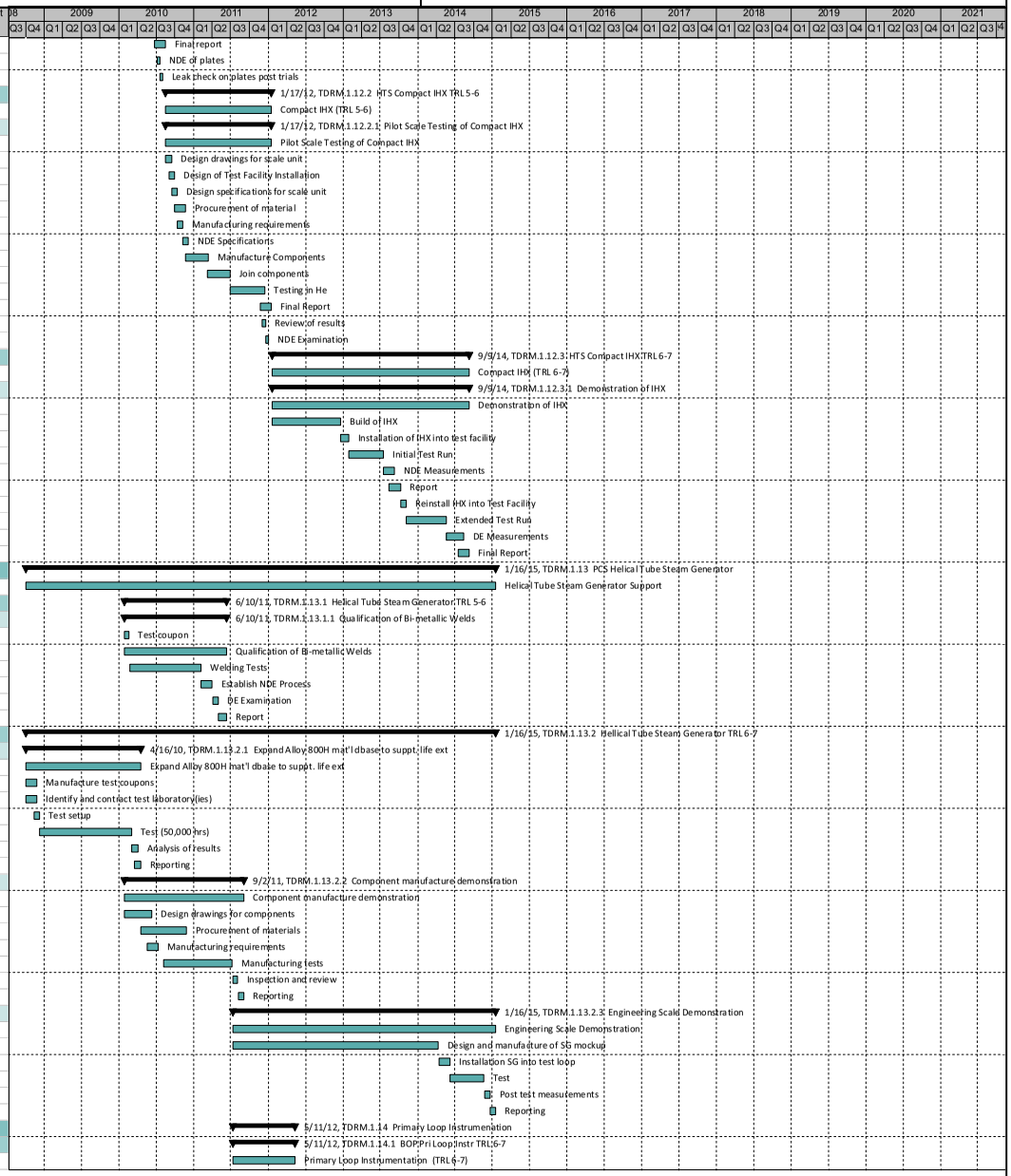
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
5(	Review results	15	4/23/12	5/11/12	2430	$0	ZITG	TBD
5(	Modify design	10	5/14/12	5/25/12	2430	$0	ZITG	TBD
5(	Report	20	5/14/12	6/8/12	2430	$0	ZITG	TBD
	TDRM.1.10.2.2 Demonstration of circulator	250	5/7/12	4/19/13	2205	$11,595,900		
5(	Demonstration of circulator	250	5/7/12	4/19/13	2205	$11,595,900	TBD	
5(	Assemble circulator	50	5/7/12	7/13/12	1995	$0	TBD	
5(	Measure all clearances before test	10	7/9/12	7/20/12	1995	$0	TBD	
5(	Functional test of circulator	35	7/23/12	9/7/12	1995	$0	TBD	
5(	Adjustments	25	9/10/12	10/12/12	1995	$0	TBD	
5(	Long run of circulator	80	10/15/12	2/1/13	1995	$0	TBD	
5(	Preparation for static test	20	1/21/13	2/15/13	1995	$0	TBD	
5(	Static pressure test	5	2/18/13	2/22/13	1995	$0	TBD	
6(	Inspection of all post test clearances	10	2/25/13	3/8/13	1995	$0	TBD	
6(	NDE inspection of impellor	15	3/4/13	3/22/13	2225	$0	TBD	
6(	Modify design if required	20	3/11/13	4/5/13	1995	$0	TBD	
6(	Report	20	3/25/13	4/19/13	1995	$0	TBD	
	TDRM.1.10.3 Sec Gas Cir TRL 6-7	210	4/22/13	2/7/14	1995	$1,003,900		
604	Secondary Gas Circulator (TRL 6-7)	210	4/22/13	2/7/14	1995	$1,003,900		
	TDRM.1.10.3.1 Hot circulator test	210	4/22/13	2/7/14	1995	$0		
6(	Hot circulator test	210	4/22/13	2/7/14	1995	$0	CTF30MW	
6(	Assemble circulator	50	4/22/13	6/28/13	1995	$0	CTF30MW	
6(	Measure all clearances before test	10	6/24/13	7/5/13	1995	$0	CTF30MW	
6(	Functional test of circulator	20	7/8/13	8/2/13	1995	$0	CTF30MW	
6(	Adjustments	20	8/5/13	8/30/13	1995	$0	CTF30MW	
6(	Long run of circulator	40	9/2/13	10/25/13	1995	$0	CTF30MW	
6(	Preparation for static test	20	10/28/13	11/22/13	1995	$0	CTF30MW	
6(	Static pressure test	5	11/25/13	11/29/13	1995	$0	CTF30MW	
6(	Inspection of all post test clearances	10	12/2/13	12/13/13	1995	$0	CTF30MW	
6(	NDE inspection of impellor	15	12/9/13	12/27/13	1995	$0	CTF30MW	
6(	Modify design if required	20	12/30/13	1/24/14	1995	$0	CTF30MW	
6(	Report	20	1/13/14	2/7/14	1995	$0	CTF30MW	
	TDRM.1.11 HTS High Temp Isolation Valve	1018	10/1/09	9/3/13	2108	$1,634,400		
	TDRM.1.11.1 HTS High Temp Iso Val TRL 6-7	1018	10/1/09	9/3/13	2108	$1,634,400		
192	Isolation Valve (TRL 6 to 7)	1024	10/1/09	9/3/13	2108	$1,634,400		
	TDRM.1.11.1.1 Vendor Testing	522	10/1/09	10/10/11	2604	$0		
1(	Vendor Testing	528	10/1/09	10/10/11	2604	$0	TBD	CTF30
1(	Manufacture the Test Valve	365	10/1/09*	2/23/11	2767	$0	TBD	CTF30
1(	Visual inspection of valve	2	9/5/11	9/6/11	2492	$0	TBD	CTF30
1(	Operation of valve	4	9/7/11	9/12/11	2492	$0	TBD	CTF30
1(	Valve seat inspection	2	9/13/11	9/14/11	2492	$0	TBD	CTF30
1(	Leak test	6	9/15/11	9/22/11	2492	$0	TBD	CTF30
1(	Valve seat inspection	2	9/23/11	9/26/11	2492	$0	TBD	CTF30
2(	Ship to CTF	10	9/27/11	10/10/11	2492	$0	TBD	CTF30
	TDRM.1.11.1.2 CTF Tests	112	4/1/13	9/3/13	2108	$0		
2(	CTF Tests	112	4/1/13	9/3/13	2108	$0	TBD	CTF30
2(	Visual inspection	2	4/1/13	4/2/13	2108	$0	TBD	CTF30
2(	Operation in air	10	4/3/13	4/16/13	2108	$0	TBD	CTF30
2(	Evaluation of data	110	4/3/13	9/3/13	2108	$0	TBD	CTF30
2(	Pre-test physical measurements	4	4/17/13	4/22/13	2110	$0	TBD	CTF30
2(	He testing	90	4/23/13	8/26/13	2110	$0	TBD	CTF30
2(	Post-test measurements	4	8/27/13	8/30/13	2110	$0	TBD	CTF30
	TDRM.1.12 HTS Compact IHX	1533	10/1/08	9/9/14	1843	$11,513,600		
63	Compact IHX Heat Exchanger (PSHE) Support	1550	10/1/08	9/9/14	1843	$1,655,000		
	TDRM.1.12.1 HTS Compact IHX TRL 4-5	473	10/1/08	8/17/10	2903	$1,579,400		
	TDRM.1.12.1.1 Qualify Machining and Welding Pro...	210	10/1/08	8/4/09	75	$309,500		
64	Qualify Machining and Welding Process	220	10/1/08	8/4/09	76	$309,500	TBD	
65	Design of test coupons and sections	20	10/1/08	10/28/08	76	$0	TBD	
66	Test coupon and section manufacture	20	10/29/08	11/25/08	76	$0	TBD	
67	Test coupon pretest inspection	10	11/26/08	12/9/08	76	$0	TBD	
68	Welding Tests	80	12/10/08	3/31/09	76	$0	TBD	
69	Establish NDE Process	40	4/1/09	5/26/09	76	$0	TBD	
70	DE Examination	20	5/27/09	6/23/09	76	$0	TBD	
71	Report	30	6/24/09	8/4/09	76	$0	TBD	
	TDRM.1.12.1.2 Experimental Scale Testing	263	8/5/09	8/17/10	2903	$1,269,900		
81	Experimental Scale Testing	270	8/5/09	8/17/10	2903	$1,269,900	ORNL	PNNL
82	Design of plates	10	8/5/09	8/18/09	76	$0	ORNL	PNNL
83	Manufacture and welding of the plates	120	8/19/09	2/2/10	76	$0	ORNL	PNNL
84	NDE of the plates	10	2/3/10	2/16/10	76	$0	ORNL	PNNL
85	Trials on plates	100	2/17/10	7/6/10	76	$0	ORNL	PNNL



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

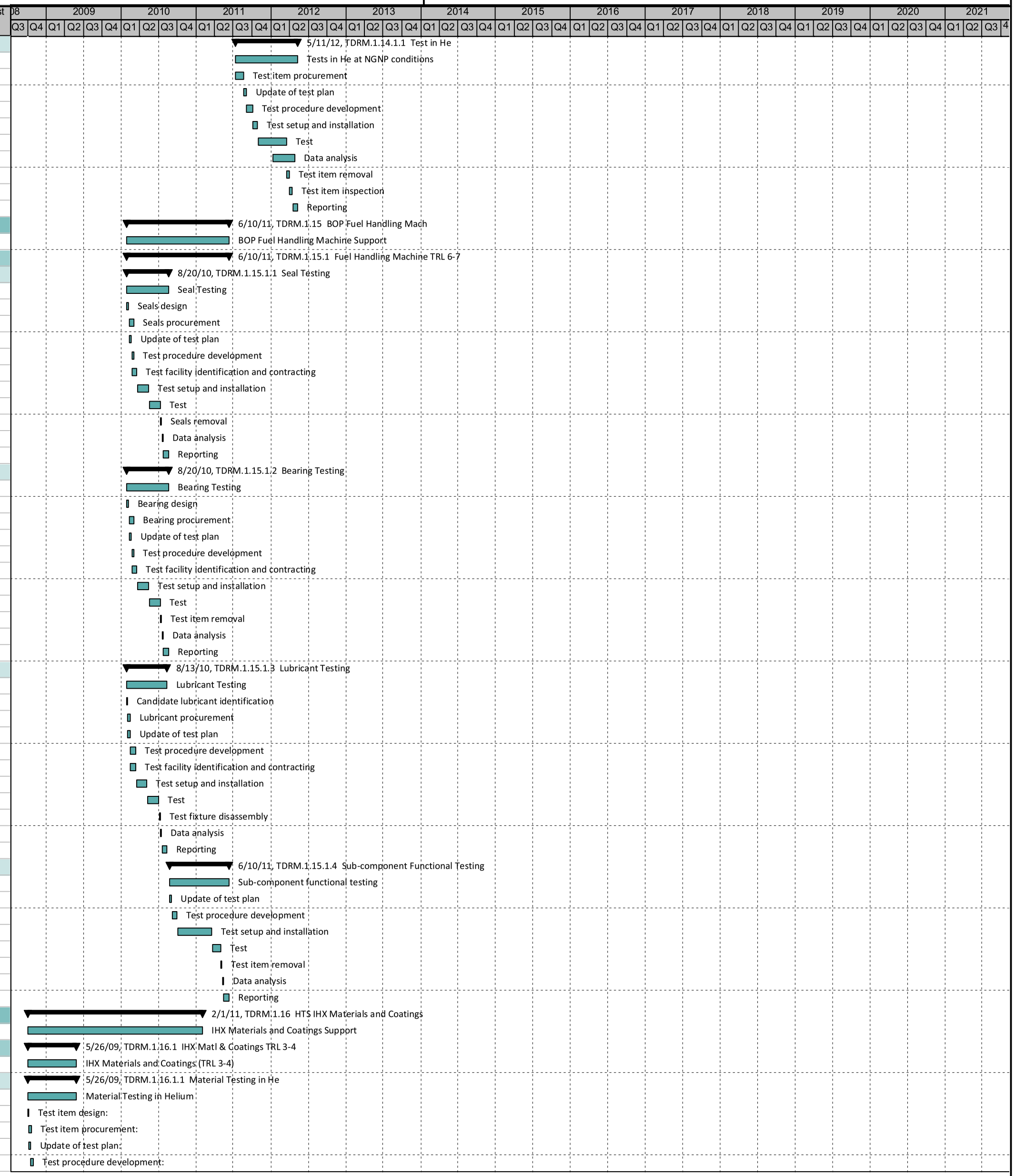
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
88	Final report	40	6/23/10	8/17/10	76	$0	ORNL	PNNL
86	NDE of plates	10	7/7/10	7/20/10	76	$0	ORNL	PNNL
87	Leak check on plates post trials	10	7/21/10	8/3/10	2913	$0	ORNL	PNNL
TDRM.1.12.2 HTS Compact IHX TRL 5-6		370	8/18/10	1/17/12	2533	$1,947,900		
89	Compact IHX (TRL 5-6)	370	8/18/10	1/17/12	2533	$0		
TDRM.1.12.2.1 Pilot Scale Testing of Compact IHX		370	8/18/10	1/17/12	2533	$1,947,900		
90	Pilot Scale Testing of Compact IHX	370	8/18/10	1/17/12	2533	$1,947,900	CTF1MW	
91	Design drawings for scale unit	20	8/18/10	9/14/10	76	$0	CTF1MW	
95	Design of Test Facility Installation	20	9/1/10	9/28/10	2873	$0	CTF1MW	
92	Design specifications for scale unit	20	9/15/10	10/12/10	76	$0	CTF1MW	
96	Procurement of material	40	9/29/10	11/23/10	76	$0	CTF1MW	
93	Manufacturing requirements	20	10/13/10	11/9/10	2823	$0	CTF1MW	
94	NDE Specifications	20	11/10/10	12/7/10	2823	$0	CTF1MW	
97	Manufacture Components	80	11/24/10	3/15/11	76	$0	CTF1MW	
98	Join components	80	3/9/11	6/28/11	76	$0	CTF1MW	
99	Testing in He	120	6/29/11	12/13/11	76	$0	CTF1MW	
1(	Final Report	40	11/23/11	1/17/12	76	$0	CTF1MW	
1(	Review of results	15	11/30/11	12/20/11	76	$0	CTF1MW	
1(	NDE Examination	10	12/21/11	1/3/12	76	$0	CTF1MW	
TDRM.1.12.3 HTS Compact IHX TRL 6-7		690	1/18/12	9/9/14	76	$6,331,300		
103	Compact IHX (TRL 6-7)	690	1/18/12	9/9/14	76	$0	CTF30MW	
TDRM.1.12.3.1 Demonstration of IHX		690	1/18/12	9/9/14	76	$6,331,300		
1(	Demonstration of IHX	690	1/18/12	9/9/14	76	$6,331,300		
1(	Build of IHX	240	1/18/12	12/18/12	76	$0	CTF30MW	
1(	Installation of IHX into test facility	30	12/19/12	1/29/13	76	$0	CTF30MW	
1(	Initial Test Run	120	1/30/13	7/16/13	76	$0	CTF30MW	
1(	NDE Measurements	40	7/17/13	9/10/13	76	$0	CTF30MW	
1(	Report	40	8/14/13	10/8/13	76	$0	CTF30MW	
1!	Reinstall IHX into Test Facility	20	10/9/13	11/5/13	76	$0	CTF30MW	
1!	Extended Test Run	140	11/6/13	5/20/14	76	$0	CTF30MW	
1!	DE Measurements	60	5/21/14	8/12/14	76	$0	CTF30MW	
1!	Final Report	40	7/16/14	9/9/14	76	$0	CTF30MW	
TDRM.1.13 PCS Helical Tube Steam Generator		1626	10/1/08	1/16/15	1750	$28,316,600		
532	Helical Tube Steam Generator Support	1643	10/1/08	1/16/15	1750	$529,300		
TDRM.1.13.1 Helical Tube Steam Generator TRL 5-6		360	1/25/10	6/10/11	2690	$656,000		
TDRM.1.13.1.1 Qualification of Bi-metallic Welds		360	1/25/10	6/10/11	2690	$656,000		
6!	Test coupon	20	1/25/10	2/19/10	2690	$0	TBD	
6!	Qualification of Bi-metallic Welds	360	1/25/10	6/10/11	2690	$656,000		
6!	Welding Tests	250	2/22/10	2/4/11	2690	$0	TBD	
6!	Establish NDE Process	40	2/7/11	4/1/11	2690	$0	TBD	
6!	DE Examination	20	4/4/11	4/29/11	2690	$0	TBD	
6!	Report	30	5/2/11	6/10/11	2690	$0	TBD	
TDRM.1.13.2 Helical Tube Steam Generator TRL 6-7		1626	10/1/08	1/16/15	1750	$27,131,300		
TDRM.1.13.2.1 Expand Alloy 800H mat'l dbase to s...		386	10/1/08	4/16/10	2991	$956,000		
5!	Expand Alloy 800H mat'l dbase to suppt. life ext	403	10/1/08	4/16/10	2991	$956,000	ORNL	INL
5!	Manufacture test coupons	40	10/1/08	11/25/08	3353	$0	ORNL	INL
5!	Identify and contract test laboratory(ies)	40	10/1/08	11/25/08	1021	$0	ORNL	INL
5!	Test setup	20	11/12/08	12/9/08	1021	$0	ORNL	INL
5!	Test (50,000 hrs)	323	12/10/08	3/5/10	1021	$0	ORNL	INL
5!	Analysis of results	20	3/5/10	4/2/10	1021	$0	ORNL	INL
5!	Reporting	20	3/19/10	4/16/10	1021	$0	ORNL	INL
TDRM.1.13.2.2 Component manufacture demonstr...		420	1/25/10	9/2/11	2630	$3,699,400		
5(	Component manufacture demonstration	420	1/25/10	9/2/11	2630	$3,699,400	TBD	MHI
5(	Design drawings for components	100	1/25/10	6/11/10	543	$0	TBD	MHI
5(	Procurement of materials	160	4/19/10	11/26/10	543	$0	TBD	MHI
5(	Manufacturing requirements	40	5/17/10	7/9/10	2930	$0	TBD	MHI
5(	Manufacturing tests	240	8/9/10	7/8/11	543	$0	TBD	MHI
5(	Inspection and review	20	7/11/11	8/5/11	2630	$0	TBD	MHI
5(	Reporting	20	8/8/11	9/2/11	2630	$0	TBD	MHI
TDRM.1.13.2.3 Engineering Scale Demonstration		920	7/11/11	1/16/15	543	$22,475,900		
5(	Engineering Scale Demonstration	920	7/11/11	1/16/15	543	$22,475,900	CTF30MW	
5(	Design and manufacture of SG mockup	720	7/11/11*	4/11/14	543	$0	CTF30MW	
5(	Installation SG into test loop	40	4/14/14	6/6/14	543	$0	CTF30MW	
5!	Test	120	6/9/14	11/21/14	543	$0	CTF30MW	
5!	Post test measurements	20	11/24/14	12/19/14	543	$0	CTF30MW	
5!	Reporting	20	12/22/14	1/16/15	543	$0	CTF30MW	
TDRM.1.14 Primary Loop Instrumenation		220	7/11/11	5/11/12	2450	$2,319,900		
TDRM.1.14.1 BOP Pri Loop Instr TRL 6-7		220	7/11/11	5/11/12	2450	$2,319,900		
10	Primary Loop Instrumentation (TRL 6-7)	220	7/11/11	5/11/12	2450	$2,319,900		



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Summary

TASK filter: All Activities

Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
TDRM.1.14.1.1	**Test in He**	220	7/11/11	5/11/12	2450	$0		
11	Tests in He at NGNP conditions	220	7/11/11	5/11/12	2450	$0	CTF1MW	
12	Test item procurement	30	7/11/11	8/22/11	2640	$0	CTF1MW	
13	Update of test plan	10	8/22/11	9/5/11	2630	$0	CTF1MW	
14	Test procedure development	20	9/5/11	10/3/11	2610	$0	CTF1MW	
15	Test setup and installation	20	10/3/11	10/28/11	100	$0	CTF1MW	
16	Test	100	10/31/11	3/16/12	100	$0	CTF1MW	
19	Data analysis	80	1/9/12	4/27/12	100	$0	CTF1MW	
17	Test item removal	10	3/19/12	3/30/12	2470	$0	CTF1MW	
18	Test item inspection	10	4/2/12	4/13/12	2470	$0	CTF1MW	
20	Reporting	20	4/16/12	5/11/12	100	$0	CTF1MW	
TDRM.1.15	**BOP Fuel Handling Mach**	360	1/25/10	6/10/11	2690	$4,674,200		
21	BOP Fuel Handling Machine Support	360	1/25/10	6/10/11	2690	$445,800		
TDRM.1.15.1	**Fuel Handling Machine TRL 6-7**	360	1/25/10	6/10/11	2690	$4,228,400		
TDRM.1.15.1.1	**Seal Testing**	150	1/25/10	8/20/10	2900	$574,000		
22	Seal Testing	150	1/25/10	8/20/10	2900	$574,000	TBD	PNNL
23	Seals design	10	1/25/10*	2/5/10	289	$0	TBD	PNNL
24	Seals procurement	20	2/8/10	3/5/10	289	$0	TBD	PNNL
25	Update of test plan	10	2/8/10	2/19/10	289	$0	TBD	PNNL
26	Test procedure development	10	2/22/10	3/5/10	3020	$0	TBD	PNNL
27	Test facility identification and contracting	20	2/22/10	3/19/10	289	$0	TBD	PNNL
28	Test setup and installation	40	3/22/10	5/14/10	289	$0	TBD	PNNL
29	Test	40	5/17/10	7/9/10	289	$0	TBD	PNNL
30	Seals removal	5	7/12/10	7/16/10	289	$0	TBD	PNNL
31	Data analysis	5	7/19/10	7/23/10	289	$0	TBD	PNNL
32	Reporting	20	7/26/10	8/20/10*	289	$0	TBD	PNNL
TDRM.1.15.1.2	**Bearing Testing**	150	1/25/10	8/20/10	2900	$574,000		
33	Bearing Testing	150	1/25/10	8/20/10	2900	$574,000	TBD	PNNL
34	Bearing design	10	1/25/10	2/5/10	550	$0	TBD	PNNL
35	Bearing procurement	20	2/8/10	3/5/10	550	$0	TBD	PNNL
36	Update of test plan	10	2/8/10	2/19/10	550	$0	TBD	PNNL
37	Test procedure development	10	2/22/10	3/5/10	3020	$0	TBD	PNNL
38	Test facility identification and contracting	20	2/22/10	3/19/10	550	$0	TBD	PNNL
39	Test setup and installation	40	3/22/10	5/14/10	550	$0	TBD	PNNL
40	Test	40	5/17/10	7/9/10	550	$0	TBD	PNNL
41	Test item removal	5	7/12/10	7/16/10	550	$0	TBD	PNNL
42	Data analysis	5	7/19/10	7/23/10	550	$0	TBD	PNNL
43	Reporting	20	7/26/10	8/20/10	550	$0	TBD	PNNL
TDRM.1.15.1.3	**Lubricant Testing**	145	1/25/10	8/13/10	2905	$484,000		
44	Lubricant Testing	145	1/25/10	8/13/10	2905	$484,000	TBD	PNNL
45	Candidate lubricant identification	5	1/25/10	1/29/10	555	$0	TBD	PNNL
46	Lubricant procurement	10	2/1/10	2/12/10	555	$0	TBD	PNNL
47	Update of test plan	10	2/1/10	2/12/10	555	$0	TBD	PNNL
48	Test procedure development	20	2/15/10	3/12/10	3015	$0	TBD	PNNL
49	Test facility identification and contracting	20	2/15/10	3/12/10	555	$0	TBD	PNNL
50	Test setup and installation	40	3/15/10	5/7/10	555	$0	TBD	PNNL
51	Test	40	5/10/10	7/2/10	555	$0	TBD	PNNL
52	Test fixture disassembly	5	7/5/10	7/9/10	555	$0	TBD	PNNL
53	Data analysis	5	7/12/10	7/16/10	555	$0	TBD	PNNL
54	Reporting	20	7/19/10	8/13/10	555	$0	TBD	PNNL
TDRM.1.15.1.4	**Sub-component Functional Testing**	210	8/23/10	6/10/11	1603	$2,596,400		
55	Sub-component functional testing	210	8/23/10	6/10/11	1603	$2,596,400	TBD	
56	Update of test plan	10	8/23/10	9/3/10	1603	$0	TBD	
57	Test procedure development	20	9/6/10	10/1/10	1603	$0	TBD	
58	Test setup and installation	120	10/4/10	3/18/11	1603	$0	TBD	
59	Test	30	3/21/11	4/29/11	1603	$0	TBD	
60	Test item removal	5	5/2/11	5/6/11	1603	$0	TBD	
61	Data analysis	5	5/9/11	5/13/11	1603	$0	TBD	
62	Reporting	20	5/16/11	6/10/11	1603	$0	TBD	
TDRM.1.16	**HTS IHX Materials and Coatings**	593	10/1/08	2/1/11	2783	$3,396,400		
153	IHX Materials and Coatings Support	610	10/1/08	2/1/11	2783	$314,400		
TDRM.1.16.1	**IHX Matl & Coatings TRL 3-4**	161	10/1/08	5/26/09	3215	$843,000		
503	IHX Materials and Coatings (TRL 3-4)	170	10/1/08	5/26/09	3223	$843,000		
TDRM.1.16.1.1	**Material Testing in He**	161	10/1/08	5/26/09	3215	$0		
1[illegible]	Material Testing in Helium	170	10/1/08	5/26/09	3223	$0		
1[illegible]	Test item design:	5	10/1/08	10/7/08	2773	$0		
1[illegible]	Test item procurement:	10	10/8/08	10/21/08	3378	$0		
1[illegible]	Update of test plan:	5	10/8/08	10/14/08	2773	$0		
1[illegible]	Test procedure development:	10	10/15/08	10/28/08	3373	$0		



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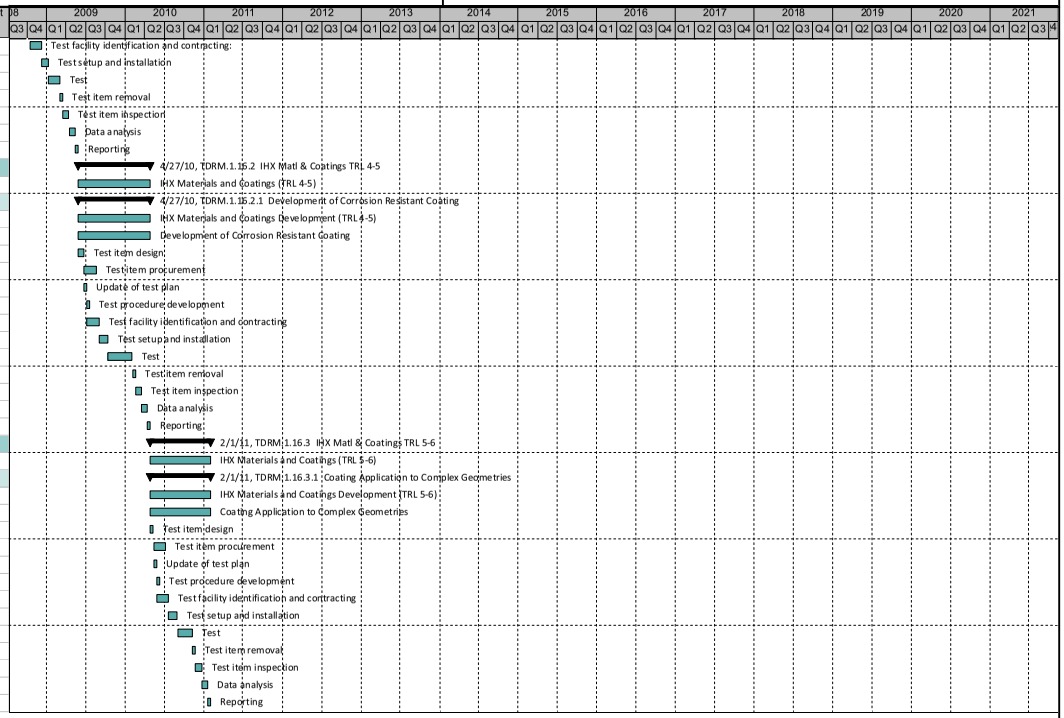
Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost	Test Facility	Backup Test Facility
1!	Test facility identification and contracting:	40	10/15/08	12/9/08	2773	$0		
1!	Test setup and installation	20	12/10/08	1/6/09	2773	$0		
1!	Test	40	1/7/09	3/3/09	2773	$0		
1!	Test item removal	10	3/4/09	3/17/09	2773	$0		
1!	Test item inspection	20	3/18/09	4/14/09	2773	$0		
1!	Data analysis	20	4/15/09	5/12/09	2773	$0		
1!	Reporting	10	5/13/09	5/26/09	2773	$0		
TDRM.1.16.2 IHX Matl & Coatings TRL 4-5		232	5/27/09	4/27/10	2983	$1,244,500		
623	IHX Materials and Coatings (TRL 4-5)	240	5/27/09	4/27/10	2983	$1,244,500		
TDRM.1.16.2.1 Development of Corrosion Resistan...		232	5/27/09	4/27/10	2983	$0		
1!	IHX Materials and Coatings Development (TRL ..	240	5/27/09	4/27/10	2983	$0	TBD	
1!	Development of Corrosion Resistant Coating	240	5/27/09	4/27/10	2983	$0	TBD	
1!	Test item design	20	5/27/09	6/23/09	2773	$0	TBD	
1!	Test item procurement	40	6/24/09	8/18/09	3163	$0	TBD	
1!	Update of test plan	10	6/24/09	7/7/09	2773	$0	TBD	
1!	Test procedure development	10	7/8/09	7/21/09	3183	$0	TBD	
1!	Test facility identification and contracting	40	7/8/09	9/1/09	2773	$0	TBD	
1!	Test setup and installation	30	9/2/09	10/13/09	2773	$0	TBD	
1!	Test	80	10/14/09	2/2/10	2773	$0	TBD	
1!	Test item removal	10	2/3/10	2/16/10	2773	$0	TBD	
1!	Test item inspection	20	2/17/10	3/16/10	2773	$0	TBD	
1!	Data analysis	20	3/17/10	4/13/10	2773	$0	TBD	
1!	Reporting	10	4/14/10	4/27/10	2773	$0	TBD	
TDRM.1.16.3 IHX Matl & Coatings TRL 5-6		200	4/28/10	2/1/11	2783	$994,500		
633	IHX Materials and Coatings (TRL 5-6)	200	4/28/10	2/1/11	2783	$994,500		
TDRM.1.16.3.1 Coating Application to Complex Ge...		200	4/28/10	2/1/11	2783	$0		
1!	IHX Materials and Coatings Development (TRL ..	200	4/28/10	2/1/11	2783	$0	TBD	
1!	Coating Application to Complex Geometries	200	4/28/10	2/1/11	2783	$0	TBD	
1!	Test item design	10	4/28/10	5/11/10	2773	$0	TBD	
1!	Test item procurement	40	5/12/10	7/6/10	2933	$0	TBD	
1!	Update of test plan	10	5/12/10	5/25/10	2773	$0	TBD	
1!	Test procedure development	10	5/26/10	6/8/10	2953	$0	TBD	
1!	Test facility identification and contracting	40	5/26/10	7/20/10	2773	$0	TBD	
1!	Test setup and installation	30	7/21/10	8/31/10	2773	$0	TBD	
1!	Test	50	9/1/10	11/9/10	2773	$0	TBD	
1!	Test item removal	10	11/10/10	11/23/10	2773	$0	TBD	
1!	Test item inspection	20	11/24/10	12/21/10	2773	$0	TBD	
1!	Data analysis	20	12/22/10	1/18/11	2773	$0	TBD	
1!	Reporting	10	1/19/11	2/1/11	2783	$0	TBD	



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TASK filter: All Activities

Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Budgeted Total Cost		2008	2009				2010				2011				2012				2013				2014				2015			
								Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TDRM	**TDRM Test Facility Plan Coord and Integ**	3376	10/1/08	10/1/21	0	$296,058,600	Budgeted Total ...	$26,853,549	$1,465,791	$2,428,805	$5,897,184	$2,810,031	$65,760,493	$7,975,386	$7,891,371	$27,866,117	$1,755,917	$4,958,272	$80,296,976	$1,349,771	$7,195,947	$33,602,099	$2,032,527	$1,031,787	$7,516,460	$2,790,487	$999,901	$961,978	$828,636	$746,350	$553,325	$421,611	$67,827			
							Cum Budgeted ...	$26,853,549	$28,319,341	$30,748,146	$36,645,330	$39,455,361	$105,215,854	$113,191,240	$121,082,610	$148,948,727	$150,704,644	$155,662,916	$235,959,892	$237,309,663	$244,505,610	$278,107,710	$280,140,237	$281,172,024	$288,688,484	$291,478,971	$292,478,872	$293,440,850	$294,269,487	$295,015,837	$295,569,162	$295,990,773	$296,058,600	$296,058,600	$296,058,600	$296,058,600
TDRM.1	**TDRM Test Facility Plan Coord and Integ**	3376	10/1/08	10/1/21	0	$296,058,600	Budgeted Total ...	$26,853,549	$1,465,791	$2,428,805	$5,897,184	$2,810,031	$65,760,493	$7,975,386	$7,891,371	$27,866,117	$1,755,917	$4,958,272	$80,296,976	$1,349,771	$7,195,947	$33,602,099	$2,032,527	$1,031,787	$7,516,460	$2,790,487	$999,901	$961,978	$828,636	$746,350	$553,325	$421,611	$67,827			
							Cum Budgeted ...	$26,853,549	$28,319,341	$30,748,146	$36,645,330	$39,455,361	$105,215,854	$113,191,240	$121,082,610	$148,948,727	$150,704,644	$155,662,916	$235,959,892	$237,309,663	$244,505,610	$278,107,710	$280,140,237	$281,172,024	$288,688,484	$291,478,971	$292,478,872	$293,440,850	$294,269,487	$295,015,837	$295,569,162	$295,990,773	$296,058,600	$296,058,600	$296,058,600	$296,058,600
TDRM.1.0	**TDRM Test Management**	3376	10/1/08	10/1/21	0	$7,706,400	Budgeted Total ...	$482,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$297,758	$297,758	$297,758	$297,758	$302,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$302,339	$54,971			
							Cum Budgeted ...	$482,339	$775,516	$1,073,273	$1,375,612	$1,677,951	$1,971,127	$2,268,885	$2,571,224	$2,873,563	$3,166,739	$3,464,497	$3,766,836	$4,064,594	$4,362,351	$4,660,109	$4,957,867	$5,260,205	$5,553,382	$5,851,140	$6,153,479	$6,455,817	$6,748,994	$7,046,752	$7,349,091	$7,651,429	$7,706,400	$7,706,400	$7,706,400	$7,706,400
1	Conceptual Design	523	10/1/08	10/1/10*	-1	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
8	Test Management	1643	10/1/08*	1/16/15	1750	$7,706,400	Budgeted Total ...	$482,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$297,758	$297,758	$297,758	$297,758	$302,339	$293,177	$297,758	$302,339	$302,339	$293,177	$297,758	$302,339	$302,339	$54,971			
							Cum Budgeted ...	$482,339	$775,516	$1,073,273	$1,375,612	$1,677,951	$1,971,127	$2,268,885	$2,571,224	$2,873,563	$3,166,739	$3,464,497	$3,766,836	$4,064,594	$4,362,351	$4,660,109	$4,957,867	$5,260,205	$5,553,382	$5,851,140	$6,153,479	$6,455,817	$6,748,994	$7,046,752	$7,349,091	$7,651,429	$7,706,400	$7,706,400	$7,706,400	$7,706,400
9	Validation of Technology Development Program	60	11/2/09	1/22/10	65	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
2	Preliminary Design	521	10/1/10	9/28/12*	0	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
4	CTF 1 MWt Completed	0	10/3/11*		100	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
3	NGNP Final Design	783	10/1/12	9/30/15*	0	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
5	CTF 30 MWt Completed	0	4/1/13*		783	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
6	Issue Construction Permit Application (CPA)	0	10/1/13*		2089	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
76	TDRM Complete	0		1/16/15	1750	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
7	Construction	1567	10/1/15	10/1/21*	0	$0	Budgeted Total ...																													
							Cum Budgeted ...																													
TDRM.1.1	**NHS Vessel**	1013	10/1/08	9/11/12	2363	$44,512,600	Budgeted Total ...	$4,638,354	$99,253	$100,803	$102,354	$102,354	$37,031,070	$156,077	$1,869,586	$53,625	$52,000	$52,812	$53,625	$52,812	$52,812	$52,812	$42,250													
							Cum Budgeted ...	$4,638,354	$4,737,607	$4,838,410	$4,940,764	$5,043,119	$42,074,189	$42,230,266	$44,099,852	$44,153,477	$44,205,477	$44,258,289	$44,311,914	$44,364,726	$44,417,538	$44,470,350	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600	$44,512,600
TDRM.1.2	**NHS Vessel Internals**	1293	1/25/10	1/7/15	1757	$78,547,100	Budgeted Total ...						$15,603,530	$91,447	$92,854	$61,924	$51,972	$52,784	$40,091,558	$93,618	$93,618	$21,133,318	$122,818	$124,708	$120,929	$122,818	$124,708	$124,708	$120,929	$122,818	$106,490	$83,246	$6,307			
							Cum Budgeted ...						$15,603,530	$15,694,978	$15,787,832	$15,849,756	$15,901,728	$15,954,512	$56,046,070	$56,139,688	$56,233,305	$77,366,623	$77,489,441	$77,614,149	$77,735,078	$77,857,896	$77,982,603	$78,107,311	$78,228,240	$78,351,058	$78,457,547	$78,540,793	$78,547,100	$78,547,100	$78,547,100	$78,547,100
TDRM.1.3	**NHS Reactor Core**	310	10/4/10	12/9/11	2560	$23,776,700	Budgeted Total ...									$23,214,785	$174,557	$165,125	$137,772	$84,462																
							Cum Budgeted ...									$23,214,785	$23,389,342	$23,554,466	$23,692,238	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700	$23,776,700
TDRM.1.4	**NHS Neutron Control System**	1493	10/1/08	7/15/14	1883	$15,955,500	Budgeted Total ...	$7,183,701	$289,649	$294,175	$298,701	$298,701	$289,649	$294,175	$255,581	$230,941	$223,943	$227,442	$3,271,949	$146,918	$146,918	$146,918	$146,918	$149,178	$144,658	$1,177,925	$224,373	$191,333	$147,088	$149,386	$25,281					
							Cum Budgeted ...	$7,183,701	$7,473,350	$7,767,526	$8,066,227	$8,364,928	$8,654,577	$8,948,752	$9,204,333	$9,435,274	$9,659,217	$9,886,659	$13,158,608	$13,305,525	$13,452,443	$13,599,361	$13,746,279	$13,895,457	$14,040,114	$15,218,040	$15,442,412	$15,633,745	$15,780,833	$15,930,219	$15,955,500	$15,955,500	$15,955,500	$15,955,500	$15,955,500	$15,955,500
TDRM.1.5	**NHS RCCS**	1187	10/1/08	5/13/13	2189	$6,422,400	Budgeted Total ...	$1,956,638	$124,255	$110,837	$3,563,514	$46,694	$45,279	$45,986	$46,694	$46,694	$45,279	$45,986	$46,694	$45,986	$45,986	$45,986	$45,986	$46,694	$45,279	$21,932										
							Cum Budgeted ...	$1,956,638	$2,080,893	$2,191,730	$5,755,244	$5,801,938	$5,847,217	$5,893,203	$5,939,897	$5,986,591	$6,031,870	$6,077,856	$6,124,550	$6,170,536	$6,216,523	$6,262,509	$6,308,495	$6,355,189	$6,400,468	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400	$6,422,400
TDRM.1.6	**HTS Primary Gas Circulator**	1196	10/1/08	5/24/13	2180	$22,650,100	Budgeted Total ...	$2,117,945	$213,280	$216,612	$219,945	$219,945	$213,280	$5,393,674	$363,172	$187,821	$179,514	$135,790	$11,462,028	$137,816	$137,816	$137,816	$1,025,911	$111,709	$108,324	$67,703										
							Cum Budgeted ...	$2,117,945	$2,331,224	$2,547,837	$2,767,781	$2,987,726	$3,201,006	$8,594,680	$8,957,852	$9,145,673	$9,325,187	$9,460,977	$20,923,005	$21,060,821	$21,198,637	$21,336,452	$22,362,364	$22,474,073	$22,582,397	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100	$22,650,100
TDRM.1.7	**HTS High Temp Flapper Valve**	268	1/25/10	2/2/11	2782	$1,096,900	Budgeted Total ...						$1,021,049	$22,410	$22,755	$22,755	$7,930																			
							Cum Budgeted ...						$1,021,049	$1,043,460	$1,066,215	$1,088,970	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900	$1,096,900
TDRM.1.8	**HTS Helical Tube IHX**	988	10/1/08	8/7/12	2388	$12,157,300	Budgeted Total ...	$8,446,031	$220,683	$81,107	$82,355	$82,355	$79,859	$81,107	$82,355	$2,097,515	$142,648	$140,180	$142,337	$140,180	$140,180	$140,180	$58,229													
							Cum Budgeted ...	$8,446,031	$8,666,714	$8,747,821	$8,830,176	$8,912,531	$8,992,390	$9,073,497	$9,155,851	$11,253,366	$11,396,014	$11,536,194	$11,678,531	$11,818,711	$11,958,891	$12,099,071	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300	$12,157,300
TDRM.1.9	**HTS Primary Hot Gas Duct**	1120	1/25/10	5/9/14	1930	$10,637,200	Budgeted Total ...						$3,211,275	$85,685	$87,003	$87,003	$84,366	$27,878	$27,390	$26,975	$26,975	$26,975	$26,975	$27,390	$6,542,499	$78,182	$79,385	$79,385	$76,979	$34,881						
							Cum Budgeted ...						$3,211,275	$3,296,960	$3,383,962	$3,470,965	$3,555,332	$3,583,210	$3,610,600	$3,637,575	$3,664,550	$3,691,525	$3,718,500	$3,745,890	$10,288,389	$10,366,571	$10,445,955	$10,525,340	$10,602,319	$10,637,200	$10,637,200	$10,637,200	$10,637,200	$10,637,200	$10,637,200	$10,637,200
TDRM.1.10	**HTS Secondary Gas Circulator**	1055	1/25/10	2/7/14	1995	$20,741,300	Budgeted Total ...						$2,350,639	$80,788	$82,031	$1,157,151	$159,417	$3,527,914	$139,092	$136,984	$136,984	$11,449,930	$117,422	$119,228	$115,615	$875,909	$120,531	$120,531	$51,134							
							Cum Budgeted ...						$2,350,639	$2,431,427	$2,513,457	$3,670,608	$3,830,025	$7,357,939	$7,497,031	$7,634,015	$7,771,000	$19,220,930	$19,338,352	$19,457,580	$19,573,196	$20,449,104	$20,569,635	$20,690,166	$20,741,300	$20,741,300	$20,741,300	$20,741,300	$20,741,300	$20,741,300	$20,741,300	$20,741,300
TDRM.1.11	**HTS High Temp Isolation Valve**	1018	10/1/09	9/3/13	2108	$1,634,400	Budgeted Total ...					$1,534,858	$6,650	$6,754	$6,858	$6,858	$6,650	$6,754	$6,858	$6,754	$6,754	$6,754	$6,754	$6,858	$6,650	$6,754	$4,884									
							Cum Budgeted ...					$1,534,858	$1,541,508	$1,548,262	$1,555,120	$1,561,977	$1,568,627	$1,575,381	$1,582,239	$1,588,993	$1,595,747	$1,602,501	$1,609,255	$1,616,113	$1,622,763	$1,629,516	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400	$1,634,400
TDRM.1.12	**HTS Compact IHX**	1533	10/1/08	9/9/14	1843	$11,513,600	Budgeted Total ...	$344,655	$99,059	$100,607	$1,213,443	$108,253	$104,972	$106,612	$1,888,551	$97,523	$94,568	$96,046	$97,523	$96,046	$6,026,684	$106,026	$106,026	$107,657	$104,395	$106,026	$107,657	$107,657	$104,395	$106,026	$83,190					
							Cum Budgeted ...	$344,655	$443,714	$544,321	$1,757,764	$1,866,017	$1,970,989	$2,077,601	$3,966,152	$4,063,675	$4,158,244	$4,254,289	$4,351,813	$4,447,859	$10,474,543	$10,580,569	$10,686,595	$10,794,253	$10,898,648	$11,004,674	$11,112,331	$11,219,989	$11,324,384	$11,430,410	$11,513,600	$11,513,600	$11,513,600	$11,513,600	$11,513,600	$11,513,600
TDRM.1.13	**PCS Helical Tube Steam Generator**	1626	10/1/08	1/16/15	1750	$28,316,600	Budgeted Total ...	$881,815	$42,002	$42,659	$43,315	$43,315	$4,082,629	$83,128	$80,345	$80,345	$77,910	$73,683	$22,316,022	$35,480	$35,480	$35,480	$35,480	$36,026	$34,934	$35,480	$36,026	$36,026	$34,934	$35,480	$36,026	$36,026	$6,550			
							Cum Budgeted ...	$881,815	$923,817	$966,476	$1,009,791	$1,053,106	$5,135,735	$5,218,862	$5,299,207	$5,379,552	$5,457,463	$5,531,146	$27,847,168	$27,882,648	$27,918,128	$27,953,609	$27,989,089	$28,025,115	$28,060,050	$28,095,530	$28,131,556	$28,167,583	$28,202,517	$28,237,997	$28,274,024	$28,310,050	$28,316,600	$28,316,600	$28,316,600	$28,316,600
TDRM.1.14	**Primary Loop Instrumenation**	220	7/11/11	5/11/12	2450	$2,319,900	Budgeted Total ...												$2,201,790	$47,982	$47,982	$22,146														
							Cum Budgeted ...												$2,201,790	$2,249,772	$2,297,754	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900	$2,319,900
TDRM.1.15	**BOP Fuel Handling Mach**	360	1/25/10	6/10/11	2690	$4,674,200	Budgeted Total ...						$1,358,374	$299,777	$2,632,329	$139,920	$135,680	$108,120																		
							Cum Budgeted ...						$1,358,374	$1,658,151	$4,290,480	$4,430,400	$4,566,080	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200	$4,674,200
TDRM.1.16	**HTS IHX Materials and Coatings**	593	10/1/08	2/1/11	2783	$3,396,400	Budgeted Total ...	$802,072	$84,433	$1,184,247	$71,219	$71,219	$69,061	$930,006	$78,919	$78,919	$26,306																			
							Cum Budgeted ...	$802,072	$886,505	$2,070,752	$2,141,971	$2,213,190	$2,282,250	$3,212,256	$3,291,175	$3,370,094	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400	$3,396,400

APPENDIX B: TDRM COST ESTIMATE DETAILS

Technology Development Road Map Test Cost Estimate Details

TDRM Summary Cost								
WBS		Hours	Labor Cost	Travel	Test Facility Costs	Test Specimen Cost	Total	Component Total
1	**TDRM Test Facility Plan Coord and Integ**							
1.0	**TDRM TEST Management**	53,760	$ 7,526,400	$ 180,000	$ -	$ -	$ 7,706,400	**$ 7,706,400**
1.1	**NHS Vessel System**	4,160	$ 582,400	$ 18,000	$ -	$ -	$ 600,400	**$44,512,600**
1.1.1.1	NHS Vessel TRL 5 to 6 Test # 1	3,660	$ 512,400	$ 18,000	$ 4,050,000	$ 450,000	$ 5,030,400	
1.1.1.2	NHS Vessel TRL 5 to 6 Test # 2	820	$ 114,800	$ 6,000	$ 36,485,000	$ 400,000	$ 37,005,800	
1.1.2.1	NHS Vessel TRL 6 to 7	900	$ 126,000	$ 15,000	$ 1,725,000	$ 10,000	$ 1,876,000	
1.2	**NHS Vessel Internals**	7,500	$ 1,050,000	$ 30,000	$ -	$ -	$ 1,080,000	**$ 78,547,100**
1.2.1.1	Internals TRL 4 to 5 Test # 2	820	$ 114,800	$ 6,000	$ 10,000,000	$ 5,500,000	$ 15,620,800	
1.2.3.1	Internals TRL 6 to 7 Test # 1	3,500	$ 490,000	$ 21,000	$ 30,000,000	$ 10,000,000	$ 40,511,000	
1.2.3.2	Internals TRL 6 to 7 Test # 2	2,320	$ 324,800	$ 10,500	$ 15,000,000	$ 6,000,000	$ 21,335,300	
1.3	**NHS Reactor Core Design Features**	2,720	$ 380,800	$ 10,500	$ -	$ -	$ 391,300	**$ 23,776,700**
1.3.1.1	NHS Reactor Core Test # 1	960	$ 134,400	$ 10,500	$ 2,250,000	$ 750,000	$ 3,144,900	
1.3.1.2	NHS Reactor Core Test # 2	800	$ 112,000	$ 10,500	$ 9,250,000	$ 3,250,000	$ 12,622,500	
1.3.1.3	NHS Reactor Core Test # 3	800	$ 112,000	$ 6,000	$ 5,625,000	$ 1,875,000	$ 7,618,000	
1.4	**NHS Neutron Control System**	12,500	$ 1,750,000	$ 45,000	$ -	$ -	$ 1,795,000	**$ 15,955,500**
1.4.1.1	Neu Con TRL 4 to 5 Test # 1	6,100	$ 854,000	$ 22,500	$ 1,900,000	$ 500,000	$ 3,276,500	
1.4.1.2	Neu Con TRL 4 to 5 Test # 2	6,100	$ 854,000	$ 22,500	$ 2,600,000	$ 200,000	$ 3,676,500	
1.4.1.3	Neu Con TRL 4 to 5 Test # 3	3,520	$ 492,800	$ 15,000	$ 1,500,000	$ 80,000	$ 2,087,800	
1.4.2.1/2	Neu Con TRL 5 to 6 Test # 1	4,720	$ 660,800	$ 18,000	$ 2,100,000	$ 1,000,000	$ 3,778,800	
1.4.3.1	Neu Con TRL 6 to 7 Test # 1	2,360	$ 330,400	$ 10,500	$ 1,000,000	$ -	$ 1,340,900	
1.5	**NHS RCCS**	3,820	$ 534,800	$ 15,000	$ -	$ -	$ 549,800	**$ 6,422,400**
1.5.1.1	NHS RCCS TRL 5 to 6 Test # 1	960	$ 134,400	$ 6,000	$ 675,000	$ 100,000	$ 915,400	
1.5.1.2	NHS RCCS TRL 5 to 6 Test # 2	1,120	$ 156,800	$ 7,500	$ 825,000	$ 200,000	$ 1,189,300	
1.5.2.4	NHS RCCS TRL 6 to 7 Test # 4	1,860	$ 260,400	$ 7,500	$ 2,500,000	$ 1,000,000	$ 3,767,900	
1.6	**HTS Primary Gas Circulator**	5,500	$ 770,000	$ 45,000	$ -	$ -	$ 815,000	**$ 22,650,100**
1.6.1.2	Pri Gas Cir TRL 4 to 5 Test # 2	2,360	$ 330,400	$ 15,000	$ 2,250,000	$ 15,000	$ 2,610,400	
1.6.1.3	Pri Gas Cir TRL 4 to 5 Test # 3	1,560	$ 218,400	$ 9,000	$ 975,000	$ 15,000	$ 1,217,400	
1.6.2.1	Pri Gas Cir TRL 5 to 6 Test # 1	460	$ 64,400	$ 3,000	$ 600,000	$ 650,000	$ 1,317,400	
1.6.2.2	Pri Gas Cir TRL 5 to 6 Test # 2	300	$ 42,000	$ 4,500	$ 600,000	$ 1,300,000	$ 1,946,500	
1.6.2.3	Pri Gas Cir TRL 5 to 6 Test # 3	1,500	$ 210,000	$ 9,000	$ 1,200,000	$ 650,000	$ 2,069,000	
1.6.2.4	Pri Gas Cir TRL 5 to 6 Test # 4	1,560	$ 218,400	$ 9,000	$ 900,000	$ 10,400,000	$ 11,527,400	
1.6.3.1	Pri Gas Cir TRL 6 to 7 Test # 1	1,700	$ 238,000	$ 9,000	$ 900,000	$ -	$ 1,147,000	
1.7	**HTS High Temp Flapper Valve**	660	$ 92,400	$ 4,500	$ -	$ 1,000,000	$ 1,096,900	**$ 1,096,900**
1.8	**HTS Hel Tube IHX**	7,920	$ 1,108,800	$ 30,000	$ -	$ -	$ 1,138,800	**$ 12,157,300**
1.8.1.3	Tube IHX TRL 6 to 7 Test #2	4,500	$ 630,000	$ 18,000	$ 2,100,000	$ 5,000,000	$ 7,748,000	
1.8.1.2	Tube IHX TRL 6 to 7 Test #3	640	$ 89,600	$ 1,500	$ 225,000	$ 500,000	$ 816,100	
1.8.1.4	Tube IHX TRL 6 to 7 Test #4	3,160	$ 442,400	$ 12,000	$ 1,500,000	$ 500,000	$ 2,454,400	
1.9	**HTS Primary Hot Gas Duct**	3,320	$ 464,800	$ 30,000	$ -	$ -	$ 494,800	**$ 10,637,200**
1.9.1.2	Pri HG Duct TRL 5 to 6 Test # 1	2,000	$ 280,000	$ 18,000	$ 2,100,000	$ 1,000,000	$ 3,398,000	
1.9.2.1	Pri HG Duct TRL 6 to 7	1,660	$ 232,400	$ 12,000	$ 1,500,000	$ 5,000,000	$ 6,744,400	
1.10	**HTS Secondary Gas Circulator**	4,920	$ 688,800	$ 37,500	$ -	$ -	$ 726,300	**$ 20,741,300**
1.10.1.2	Sec Gas Cir TRL 4 to 5 Test # 2	2,360	$ 330,400	$ 15,000	$ 2,250,000	$ 5,000	$ 2,600,400	
1.10.1.3	Sec Gas Cir TRL 4 to 5 Test # 3	1,560	$ 218,400	$ 9,000	$ 975,000	$ 10,000	$ 1,212,400	
1.10.2.1	Sec Gas Cir TRL 5 to 6 Test # 1	1,760	$ 246,400	$ 6,000	$ 750,000	$ 2,600,000	$ 3,602,400	
1.10.2.2	Sec Gas Cir TRL 5 to 6 Test # 2	2,060	$ 288,400	$ 7,500	$ 900,000	$ 10,400,000	$ 11,595,900	
1.10.3.1	Sec Gas Cir TRL 6 to 7	1,760	$ 246,400	$ 7,500	$ 750,000	$ -	$ 1,003,900	
1.11	**HTS Hi Temp Iso Val TRL 6 to 7**	760	$ 106,400	$ 3,000	$ 525,000	$ 1,000,000	$ 1,634,400	**$ 1,634,400**
1.12	**HTS Compact IHX**	11,500	$ 1,610,000	$ 45,000	$ -	$ -	$ 1,655,000	**$ 11,513,600**
1.12.1.1	HTS CIHX TRL 4 to 5 Test # 1	800	$ 112,000	$ 7,500	$ 170,000	$ 20,000	$ 309,500	
1.12.1.2	HTS CIHX TRL 4 to 5 Test # 2	1,160	$ 162,400	$ 7,500	$ 1,000,000	$ 100,000	$ 1,269,900	
1.12.2.1	HTS CIHX TRL 5 to 6 Test # 2	1,160	$ 162,400	$ 10,500	$ 1,275,000	$ 500,000	$ 1,947,900	
1.12.3.1	HTS CIHX TRL 6 to 7 Test	2,920	$ 408,800	$ 22,500	$ 2,400,000	$ 3,500,000	$ 6,331,300	
1.13	**PCS Steam Generator**	3,620	$ 506,800	$ 22,500	$ -	$ -	$ 529,300	**$ 28,316,600**
1.13.1.1	SG TRL 5 to 6 Test # 1	1,000	$ 140,000	$ 6,000	$ 500,000	$ 10,000	$ 656,000	
1.13.2.1	SG TRL 6 to 7 Test # 1	1,000	$ 140,000	$ 6,000	$ 800,000	$ 10,000	$ 956,000	
1.13.2.2	SG TRL 6 to 7 Test # 2	1,560	$ 218,400	$ 6,000	$ 1,350,000	$ 2,125,000	$ 3,699,400	
1.13.2.3	SG TRL 6 to 7 Test # 3	1,560	$ 218,400	$ 7,500	$ 1,000,000	$ 21,250,000	$ 22,475,900	
1.14	**BOP Pri Loop Instr TRL 6 to 7**	1,160	$ 162,400	$ 7,500	$ 2,000,000	$ 150,000	$ 2,319,900	**$ 2,319,900**
1.15	**BOP Fuel Handling Mach**	3,120	$ 436,800	$ 9,000	$ -	$ -	$ 445,800	**$ 4,674,200**
1.15.1.1	Fuel Hand TRL 6 to 7 Test # 1	1,200	$ 168,000	$ 6,000	$ 300,000	$ 100,000	$ 574,000	
1.15.1.2	Fuel Hand TRL 6 to 7 Test # 2	1,200	$ 168,000	$ 6,000	$ 300,000	$ 100,000	$ 574,000	
1.15.1.3	Fuel Hand TRL 6 to 7 Test # 3	1,200	$ 168,000	$ 6,000	$ 300,000	$ 10,000	$ 484,000	
1.15.1.4	Fuel Hand TRL 6 to 7 Test # 4	1,360	$ 190,400	$ 6,000	$ 400,000	$ 2,000,000	$ 2,596,400	
1.16	**HTS IHX Material & Coatings**	2,160	$ 302,400	$ 12,000	$ -	$ -	$ 314,400	**$ 3,396,400**
1.16.1.1	IHX Mat & Coatings TRL 3 to 4	1,000	$ 140,000	$ 3,000	$ 675,000	$ 25,000	$ 843,000	
1.16.2.1	IHX Mat & Coatings TRL 4 to 5	1,000	$ 140,000	$ 4,500	$ 1,000,000	$ 100,000	$ 1,244,500	
1.16.3.1	IHX Mat & Coatings TRL 5 to 6	1,000	$ 140,000	$ 4,500	$ 750,000	$ 100,000	$ 994,500	
	TOTALS	**220,440**	**$ 30,861,600**	**$ 1,032,000**	**$ 162,705,000**	**$ 101,460,000**	**$ 296,058,600**	**$296,058,600**

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.0	NGNP TDRM Test Management	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

This activity is to implement the TDRM testing that was identified in the Technology Development Road Mapping Report. This capture the overall Project Management activities that are common to all of these task

The Project Management/Oversight activities establishes a core staff to oversee the performance the tests and includes: (1) Development and implementation of a Project Management Plan; (2) Review Procurement Packages and Contracts; (3) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contracts; (4) Review and approval of contractor invoices; (5) Development of Weekly/Monthly Status reports, invoices, attend periodic project meetings; (6) Selection, approval, and oversight of contractors; (7) Coordinate testing, review of test procedures, and analyze results. (8) Periodically validate TDRM data, cost, and schedule against the developing design data and revise as needed.

9. Cost Content

Position	Hours	Cost
Project Mgr	1800	$252,000
Principal Engineer	12000	$1,680,000
Sr Eng	960	$134,400
Quality Eng	5000	$700,000
Admin	12000	$1,680,000
Project Controls	12000	$1,680,000
Senior Subcontract Administrato	10000	$1,400,000
Total Labor	53760	$7,526,400
Travel		$180,000
Test Facility Cost		
Test Specimen Cost		
Totals		$7,706,400

10. Assumptions

Overall TDRM Testing has 76 Month Duration

Principle Engineer is TDRM Testing Task Leader Reporting to AREVA NGNP Project Manager

Travel Based on 60 Trips for two people at $3000/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.1	NHS Vessel System	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The technology development needs for the vessel system are summarized as follows: (Test # 1) Collect available information on mod 9Cr1Mo steel – All of the information necessary to qualify this material for use at NGNP conditions may already exist in the European program. This data must be collected, reviewed and any data gaps identified. Limited testing may be required to fill identified data gaps. (Test # 2) Validate the RPV sealing device – Flexible metallic seals have been used routinely in light water reactors and gas reactors. However, the increased size of the vessel for NGNP warrants validation of the seals performance prior to installation in the NGNP. (Test # 3) Weld qualification – Although extensive work has been essentially completed on welding of mod 9Cr1Mo steel, final qualification of the welding process is required.

The Project Management/Oversight activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	4000	$560,000
Eng	0	$0
Designer	0	$0
Project Controls	0	$0
Subcontract Administrator	160	$22,400
Total Labor	4160	$582,400
Travel		$18,000
Test Facility Cost		
Test Specimen Cost		
Totals		$600,400

10. Assumptions

Overall NHS Vessel Test has 24 Month Duration

Sr Eng NHS Vessel Test Task Lead

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.1.1.1	NHS Vessel System TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate that the NGNP Vessel System materials meet the minimum material requirements in performance of their function as the primary system boundary and to gather sufficient data to validate the down-selection of mod 9Cr1Mo steel. Material test data must be gathered for mod 9Cr1Mo and SA 508 grade 3. Extensive work has been completed in Europe under the RAPHAEL program for mod9Cr1Mo. Creep fatigue, creep rupture, and aging tests have all been completed. Some emissivity testing has been completed, but further work is needed to narrow the range of the data. If the NGNP program can access the data gathered from the work done there, the testing required will be reduced, saving time and money by eliminating duplicated effort. The test data that is required can be divided into the following 5 categories: (1) Irradiation tests on representative test coupons and toughness specimens; (2) Creep and creep fatigue testing; (3) Aging tests with cyclic loading; (4) Emissivity tests in air and He Environment; (4) Corrosion tests in He environment

The activities to perform this test includes: (1) Collection, review, and gap analysis of existing test data; (1000 Hrs) (2) Develop additional data needs based on Gap analysis (500 Hrs); (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens; (160 Hrs) (4) Review and approval of test procedures and test reports (1000 Hrs) (5) Periodic trips to the test facility to witness test/review current status and progress (1000 Hrs) (6) Perform test and issue report ($4.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr		$0
Principal Engineer	0	$0
Sr Eng	2500	$350,000
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	3660	$512,400
Travel		$18,000
Test Facility Cost		$4,050,000
Test Specimen Cost		$450,000
Totals		$5,030,400

10. Assumptions

Data Collection and Gap Analysis is performed by AREVA

Test Duration is 24 Months

Gap Analysis identifies Limited Supplemental Testing is Required

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.1.1.2	NHS Vessel System TRL 5 to 6 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to validate the performance of the metallic sealing device used to seal the RPV Upper Closure Head to the RPV Main Vessel. Although similar seals are used in pressurized water reactors, there are two differences that require validation of the seal performance. First, the diameter of the NGNP RPV is much larger than that of pressurized water reactors. Second, the seal will be required to seal against He rather than water.

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for RPV Closure Head to Main Vessel metallic seals; (160 Hrs) (2) Review and approval of test procedures and test reports (500 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (160 Hrs) (4) Perform test and issue report ($36.9M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	660	$92,400
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	820	$114,800
Travel		$6,000
Test Facility Cost		$36,485,000
Test Specimen Cost		$400,000
Totals		$37,005,800

10. Assumptions

Test Duration is 7 Months		
Travel Based on 4 Trips at $1500/Trip		
Assumed 1 set of O-rings $100K, Assumed 4 Sets needed and Full Size Test Mock-up		
Total finished vessel weight	1,400,000 lb	
Raw material need is 1.6 finish	2,352,000 lb	
Cost of material is $4.0 per lb for	$9,408,000	
Cost to produce a finished product is 2.5 times material cost	$23,520,000	
Total Cost Estimate for Mock Up Vessel included in Test Facility Cost $32,928,000		

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.1.2.1	NHS Vessel System TRL 6 to 7 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

Extensive work has been conducted on welding of mod 9Cr1Mo steel. Acceptable welding techniques have been developed and weld filler materials have been identified for welding thick sections. The objective of this test is to qualify the weld process for large representative-sized welds. Some of the welds for the NGNP vessel system will be field welds. These include welding of the RV together and connection of the RV to the CV's and the CV's to the IHX Vessels. Heat treatment of these welds could be difficult due to the geometrical constraints in the plant.

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for the material coupons; (160 Hrs) (2) Review and approval of qualification procedures and reports (500 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (240 Hrs) (4) Perform test and issue report ($1.7M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	740	$103,600
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	900	$126,000
Travel		$15,000
Test Facility Cost		$1,725,000
Test Specimen Cost		$10,000
Totals		$1,876,000

10. Assumptions

Test Duration is 23 Months

Travel Based on 10 Trips at $1500/Trip

Assumed 10 weld coupons were needed

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.2	NHS Reactor Vessel Internals	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of these test for The Reactor Vessel Internals include: Selection of a material design for the Lower Floor Blocks, qualification of a new graphite supply to replace the historical H451 graphite grade (Not under AREVA Scope), and selection and qualification of a composite design for those components which require such material. Specific selection and qualification activities for each composite material component will be developed for each such component due to the design dependent nature of composite material properties. In general required material testing conditions will include room temperature tests, operating temperature tests, and accident temperature tests in both air and helium atmospheres. In addition, some tests will also consider irradiation behavior. In order to fully qualify a single component, many thousands of samples will be required to meet statistical qualification criteria.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	7000	$980,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	7500	$1,050,000
Travel		$30,000
Test Facility Cost		
Test Specimen Cost		
Totals		$1,080,000

10. Assumptions

Test Duration is 44 Months

Testing to move from TRL 6 to 7 is constrained by the completion of the design for each composite component

Travel Based on 20 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.2.1.1	NHS Reactor Vessel Internals TRL 4 to 5 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test series is to develop and initially test a composite material for use in several reactor vessels internals components. Since the material properties for each composite component will be a strong function of the geometry of the final design of the component, this series of tests and development activities is only conducted to provide a reasonable expectation that the selected material and fiber architecture will eventually be able to successfully meet the material properties requirements when tested as a final component.

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens; (160 Hrs) (2) Review and approval of test procedures and test reports (500 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (160 Hrs) (4) Perform test and issue report ($2.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	660	$92,400
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	820	$114,800
Travel		$6,000
Test Facility Cost		$10,000,000
Test Specimen Cost		$5,500,000
Totals		$15,620,800

10. Assumptions

Test Duration is 8 Months

Testing to move from TRL 6 to 7 is constrained by the completion of the design for each composite component

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.2.3.1	NHS Reactor Vessel Internals TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test series is to provide sufficient mechanical behavior information about the selected composite materials to adequately model their behavior in appropriate design calculations and to support codification of the material.

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens; (500 Hrs) (2) Review and approval of test procedures and test reports (1500 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (1500 Hrs) (4) Perform test and issue report ($10M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	3000	$420,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	3500	$490,000
Travel		$21,000
Test Facility Cost		$30,000,000
Test Specimen Cost		$10,000,000
Totals		$40,511,000

10. Assumptions

Test Duration is 36 Months

Testing to move from TRL 6 to 7 is constrained by the completion of the design for each composite component

Travel Based on 14 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.2.3.2	NHS Reactor Vessel Internals TRL 6 to 7 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test series is to provide sufficient thermal-hydraulic data regarding the radial heat path from the core region to the reactor pressure vessel to support completion of required conduction cooldown analyses

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens; (320 Hrs) (2) Review and approval of test procedures and test reports (1000 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (1000 Hrs) (4) Perform test and issue report ($4.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2000	$280,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	2320	$324,800
Travel		$10,500
Test Facility Cost		$15,000,000
Test Specimen Cost		$6,000,000
Totals		$21,335,300

10. Assumptions

Test Duration is 15 Months

Testing to move from TRL 6 to 7 is constrained by the completion of the design for each composite component

Travel Based on 7 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.3	NHS Reactor Core	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of these test for these tests include: (Test # 1) Bypass flow – The bypass flow is a key parameter and is a complex value to determine. Bypass through the gaps between block columns and in the horizontal gap between the blocks within a column must be characterized. This must be done at cold and hot conditions with blocks that simulate both unirradiated and irradiated; conditions.(Test # 2) Thermo-mechanical performance – The stresses that the blocks will experience due to thermo-mechanical stresses may be close to the structural limits of the graphite material. Testing is needed to quantify the stresses that will be generated in the block during operation; and (Test # 3) Structural performance of core blocks –It must be demonstrated that the blocks will not be damaged during loading and unloading maneuvers and that the alignment pins will survive stressed induced from seismic loads.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	2400	$336,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	2720	$380,800
Travel		$10,500
Test Facility Cost		
Test Specimen Cost		
Totals		$391,300

10. Assumptions

Test Duration is 15 Months

Travel Based on 7 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.3.1.1	NHS Reactor Core Design Features TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the bypass flow behavior of the coolant within the core structure and establish the ranges of bypass flow expected in the NGNP. The results of the test will be used to validate the thermal-hydraulic design codes used to establish the core performance of the initial and subsequent core loadings.

The activities to perform this test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens; (160 Hrs) (2) Review and approval of test procedures and test reports (600 Hrs) (3) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (4) Perform test and issue report ($3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	800	$112,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	960	$134,400
Travel		$10,500
Test Facility Cost		$2,250,000
Test Specimen Cost		$750,000
Totals		$3,144,900

10. Assumptions

Test Duration is 13 Months

Same Test Engineer will follow all three Core Design test

Travel Based on 7 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.3.1.2	NHS Reactor Core Design Features TRL 6 to 7 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the thermo-mechanical behavior of the prismatic core blocks to be used in the NGNP. The heat and stress distributions within a core block for both symmetric and asymmetric heating profiles will be investigated. The results of these tests will be used to verify that material property limits of the graphite will not be violated and to validate the thermo-mechanical design codes used to establish the core performance of the initial and subsequent core loadings.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (600 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Perform test and issue report ($12.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	800	$112,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	800	$112,000
Travel		$10,500
Test Facility Cost		$9,250,000
Test Specimen Cost		$3,250,000
Totals		$12,622,500

10. Assumptions

Test Duration is 15 Months

Same Test Engineer will follow all three Core Design test

Travel Based on 7 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.3.1.3	NHS Reactor Core Design Features TRL 6 to 7 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this testing is to determine the structural behavior of the prismatic core blocks to be used in the NGNP. There are two main concerns: 1) Potential block damage during loading and unloading; 2) Survival of alignment pins during seismic events. The results of these tests will be used to verify that the block design is sufficiently robust that damage to the blocks will not occur during routine maneuvers and that the overall core geometry will not be disrupted during a seismic event.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (600 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Perform test and issue report ($7.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	800	$112,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	800	$112,000
Travel		$6,000
Test Facility Cost		$5,625,000
Test Specimen Cost		$1,875,000
Totals		$7,618,000

10. Assumptions

Test Duration is 9 Months

Same Test Engineer will follow all three Core Design test

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4	NHS Neutron Control System	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these test required to mature the neutron control technology are as follows: (1) Modeling to define maximum normal and off-normal temperatures; (2) Design analyses to determine Alloy 800H performance envelope in NGNP temperature conditions; (3) Separate effects testing for C/C and SiC/SiC base materials and composites to obtain data for analyses; (4) Design analyses for C/C and SiC/SiC composite components; (5) Further development for selected material to demonstrate control rod elements; (6) Further actions are required to develop a suitable CRDM cable which include establishing design criteria and perform tests for candidate materials at reactor operating conditions.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	12000	$1,680,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	12500	$1,750,000
Travel		$45,000
Test Facility Cost		
Test Specimen Cost		
Totals		$1,795,000

10. Assumptions

Test Duration is 74 Months

Travel Based on 30 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4.1.1	NHS Neutron Control System TRL 4 to 5 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these tests are to develop and demonstrate the control rod canisters and articulating connector for the NGNP Control Rod Equipment, the following activities and tests must be conducted: (1) Perform modeling of the reactor to define the maximum normal and off-normal temperatures for the operating control rods. (2) Perform design analyses for Alloy 800H control rods to define their performance envelope, including exposure to off-normal conditions. (3) Conduct limited testing for C/C and SiC/SiC composites to obtain the necessary data to support design analyses. (4) Perform conceptual design and analyses for C/C and/or SiC/SiC composite control rods. (5) Survey potential component manufacturers to assess availability and costs for control rods produced from each material. (6) Further develop and demonstrate control rod elements for the selected material.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (3500 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (2100 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (500 Hrs); (4) Perform test and issue report ($2.4M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	5600	$784,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	6100	$854,000
Travel		$22,500
Test Facility Cost		$1,900,000
Test Specimen Cost		$500,000
Totals		$3,276,500

10. Assumptions

Test Duration is 35 Months

Travel Based on 15 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4.1.2	NHS Neutron Control System TRL 4 to 5 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these tests are to develop and demonstrate guide tubes for control rods, the following activities and tests must be conducted: (1) Modeling to define the maximum temperatures for guide tubes during off-normal conditions. (2) Perform design analyses for Alloy 800H guide tubes to define their performance envelope, including exposure to accident conditions. (3) If C/C composites are selected, further develop and demonstrate guide tubes including: (a) Conduct limited testing for C/C composites to obtain the necessary data to support conceptual design analyses; (b) Preliminary design and analysis for guide tubes.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (3500 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (2100 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (500 Hrs); (4) Perform test and issue report ($2.8M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	5600	$784,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	6100	$854,000
Travel		$22,500
Test Facility Cost		$2,600,000
Test Specimen Cost		$200,000
Totals		$3,676,500

10. Assumptions

Test Duration is 35 Months

Travel Based on 15 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4.1.3	NHS Neutron Control System TRL 4 to 5 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these tests are to evaluate candidate materials and select a cable material for the control rod drive mechanism, the following activities and tests must be performed: (1) Establish design criteria and selected candidate cable materials; (2) Perform testing of candidate materials to determine high-temperature strength, creep behavior and environmental stability; (3) Perform testing of candidate materials to assess irradiation effects on high-temperature strength, creep and environmental stability

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (2500 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (700 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (320 Hrs); (4) Perform test and issue report ($1.6M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	3200	$448,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	3520	$492,800
Travel		$15,000
Test Facility Cost		$1,500,000
Test Specimen Cost		$80,000
Totals		$2,087,800

10. Assumptions

Test Duration is 20 Months

Travel Based on 10 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4.2.1&2	NHS Neutron Control System TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these test are to develop and demonstrate the NGNP Control Rod Equipment including: (1) Development and demonstration of control rod elements (canister and connectors). (2) Development and demonstration of guide tubes

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (3400 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (1000 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (320 Hrs); (4) Perform test and issue report ($3.1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	4400	$616,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	4720	$660,800
Travel		$18,000
Test Facility Cost		$2,100,000
Test Specimen Cost		$1,000,000
Totals		$3,778,800

10. Assumptions

Test Duration is 28 Months

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.4.3.1	NHS Neutron Control System TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these test are to qualify the Control Rod Equipment for use in the NGNP reactor, the following activities and tests must be conducted: (1) Fabricate and test control rod elements to verify design (loads, temperature, helium atmosphere); (2) Fabricate, test and qualify Control Rod Equipment under anticipated normal and off-normal conditions.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1500 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (700 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2200	$308,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	2360	$330,400
Travel		$10,500
Test Facility Cost		$1,000,000
Test Specimen Cost		
Totals		$1,340,900

10. Assumptions

Test Duration is 14 Months

Travel Based on 7 Trips at $1500/Trip

Assumed Test Specimen from preceding test is used

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.5	NHS Reactor Cavity Cooling System	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of these test are to characterize the emissivity of both the RPV and RCCS panel materials over the range of conditions experienced during normal and accident operation. Any possible degradation of the emissivity over time or due to particulate in the reactor cavity must also be assessed. Perform analytical modeling and possible validation testing of natural convection within the reactor cavity and within the tube panels, piping and the water storage tank. Perform analytical modeling and possible validation testing of the thermo-mechanical performance of the RCCS cooler panels is important for defining the lifetime of the RCCS.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	3500	$490,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	3820	$534,800
Travel		$15,000
Test Facility Cost		
Test Specimen Cost		
Totals		$549,800

10. Assumptions

Test Duration is 22 Months

Travel Based on 10 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.5.1.1	NHS Reactor Cavity Cooling System TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the long term emissivity behavior of the NGNP Reactor Pressure Vessel (RPV) and Reactor Cavity Cooling System (RCCS) materials, since this parameter is critical to the thermal design of the RCCS. The results of these tests will establish the guidelines used for the analytical design of the RCCS components.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (700 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (100 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($775K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	800	$112,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	960	$134,400
Travel		$6,000
Test Facility Cost		$675,000
Test Specimen Cost		$100,000
Totals		$915,400

10. Assumptions

Test Duration is 9 Months

Same Test Engineer will follow both TRL 5 to 6 Test

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.5.1.2	NHS Reactor Cavity Cooling System TRL 5 to 6 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the effects of particulate, dust or steam in the reactor cavity on radiation heat transfer. There are two main concerns with particulates: (1) The particulate can scatter radiant energy and act as a participating medium, and (2) The particles may plate out on the cooler surface of the RCCS panels reducing the emissivity of the panels. The testing must establish whether these concerns are justifiable and characterize the overall effect on the heat transfer from the RPV to the RCCS.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (800 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (160 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	960	$134,400
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1120	$156,800
Travel		$7,500
Test Facility Cost		$825,000
Test Specimen Cost		$200,000
Totals		$1,189,300

10. Assumptions

Test Duration is 11 Months

Same Test Engineer will follow both TRL 5 to 6 Test

Travel Based on 5 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.5.2.4	NHS Reactor Cavity Cooling System TRL 6 to 7 Test # 4	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to validate the overall integrated performance of the RCCS. While the general phenomena involved in the heat removal path can be calculated analytically piecewise it is necessary that the entire system as a whole performs in an acceptable manner.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (500 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($2M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1700	$238,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1860	$260,400
Travel		$7,500
Test Facility Cost		$2,500,000
Test Specimen Cost		$1,000,000
Totals		$3,767,900

10. Assumptions

Test Duration is 11 Months

Same Test Engineer will follow both TRL 5 to 6 Test

Travel Based on 5 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6	HTS Primary Gas Circulator	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The main items requiring further technology development related to the Primary Gas Circulator are as follows: (1) Characterization of Haynes Alloy 718, (2) Fabrication techniques of the impeller using Haynes Alloy 718 (forming, welding, etc.) will have to be developed and verified for an impeller fabricated of this material, (3) High voltage electrical penetrations and motor windings design and confirmatory testing are required for high voltage applications in a helium atmosphere, (4) Verification of circulator performance is necessary due to the increased scale of the circulator from previously employed devices.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Coordinate testing, review of test procedures, and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	5000	$700,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	5500	$770,000
Travel		$45,000
Test Facility Cost		
Test Specimen Cost		
Totals		$815,000

10. Assumptions

Test Duration is 63 Months

Travel Based on 30 Trips at $1500/Trip

The same person will follow the Primary and Secondary Circulator Test since most are done in parellel for both components

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.1.2	HTS Primary Gas Circulator TRL 4 to 5 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to measure material properties of Haynes Alloy 718 including fatigue strength, ductility, and corrosion rates over the range of expected design temperatures (350°C to 550°C). Higher temperature tests to monitor behavior during transients of the reactor may also be conducted. This data will be used to assess the design and operating limits of the material for the circulator impeller. For example, creep fatigue endurance data shall be sufficient to estimate the expected design life.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1400 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (800 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report (2.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2200	$308,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	2360	$330,400
Travel		$15,000
Test Facility Cost		$2,250,000
Test Specimen Cost		$15,000
Totals		$2,610,400

10. Assumptions

Test Duration is 24 Months

Same Test engineer will follow all three TRL 4 to 5 tests

Travel Based on 10 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.1.3	HTS Primary Gas Circulator TRL 4 to 5 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the manufacturing processes for the impeller fabricated from Haynes Alloy 718. Testing will include demonstrating and optimizing forming and welding processes. Successful completion of this test will provide assurance that the impeller can be manufactured in compliance with the specifications for the overall assembly. The processes include forming, assembling and welding the impeller sections. These tests are necessary to validate the capability for manufacturing both individual impeller parts and final assembly.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1400	$196,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1560	$218,400
Travel		$9,000
Test Facility Cost		$975,000
Test Specimen Cost		$15,000
Totals		$1,217,400

10. Assumptions

Test Duration is 13 Months

Same Test engineer will follow all three TRL 4 to 5 tests

Travel Based on 6 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.2.1	HTS Primary Gas Circulator TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to validate the performance of candidate electrical high voltage motor and bearing power penetrations in helium at the most severe combinations of pressure, temperature and depressurization.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (220 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (80 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($1.25M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	300	$42,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	460	$64,400
Travel		$3,000
Test Facility Cost		$600,000
Test Specimen Cost		$650,000
Totals		$1,317,400

10. Assumptions

Test Duration is 6 Months

Same Test engineer will follow all four TRL 5 to 6 tests

Travel Based on 2 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.2.2	HTS Primary Gas Circulator TRL 5 to 6 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to verify that candidate motor windings perform acceptably in helium at the most severe combinations of pressure, temperature and depressurization.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (220 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (80 Hrs); (3) Perform test and issue report ($1.9M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	300	$42,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	300	$42,000
Travel		$4,500
Test Facility Cost		$600,000
Test Specimen Cost		$1,300,000
Totals		$1,946,500

10. Assumptions

Test Duration is 13 Months

Same Test engineer will follow all four TRL 5 to 6 tests

Travel Based on 3 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.2.3	HTS Primary Gas Circulator TRL 5 to 6 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the performance of the magnetic bearings as part of the integrated rotating equipment assembly (motor, bearings, and rotor) over the full range of operating conditions. The test results will be used to revise the bearing and rotor design if resonant vibration occurs. A second objective is to demonstrate that state of the art inverters and input power transformer rectifiers can operate at the frequencies required to control the motor without having an adverse impact on the supply currents.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (300 Hrs); (3) Perform test and issue report ($1.9M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1500	$210,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1500	$210,000
Travel		$9,000
Test Facility Cost		$1,200,000
Test Specimen Cost		$650,000
Totals		$2,069,000

10. Assumptions

Test Duration is 16 Months

Same Test engineer will follow all four TRL 5 to 6 tests

Travel Based on 6 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.2.4	HTS Primary Gas Circulator TRL 5 to 6 Test # 4	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the behavior of the assembled circulator, examining and characterizing the key aspects of the unit while the unit is running in air at ambient temperature and pressure. The circulator performance curves will be generated during this test to confirm the design and operation of the circulator. Leakage rates of the He from the unit will be measured during static testing of the circulator. The final test will be NDE of the system as it is dismantled to monitor clearances and individual measurement of the component parts to monitor changes in physical dimensions.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs); (3) Perform test and issue report ($11.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1400	$196,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1560	$218,400
Travel		$9,000
Test Facility Cost		$900,000
Test Specimen Cost		$10,400,000
Totals		$11,527,400

10. Assumptions

Test Duration is 12 Months

Same Test engineer will follow all four TRL 5 to 6 tests

Travel Based on 6 Trips at $1500/Trip

Full Size Circulator is used for the test and components from the previous tests are used

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.6.3.1	HTS Primary Gas Circulator TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate integrated operation of circulator assembly [housing and cooling system, impeller and barrier plate, electric motor and power supply, bearings, rotor, power supply, and housing] under both start-up (100ºC and 0.1 MPa), normal (490°C and 5.0 MPa) and transient conditions using air. Impeller and diffuser aerodynamic performance and blower acoustic frequency response of the final design in air at design pressures will be characterized. Confirmation of the performance and design of the individual components of the circulator will be obtained. Similarity laws will be used to predict the performance of the circulator in He based on the test results.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1300 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (400 Hrs); (3) Perform test and issue report ($900K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1700	$238,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator		$0
Total Labor	1700	$238,000
Travel		$9,000
Test Facility Cost		$900,000
Test Specimen Cost		
Totals		$1,147,000

10. Assumptions

Test Duration is 12 Months

Travel Based on 6 Trips at $1500/Trip

Assumed Test Specimen from previous test is used

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.7	HTS High Temperature Flapper Valve TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

To reach the next TRL Level tests will be performed that initially test the operation of the valve in air at standard temperature and pressure (STP) followed by a demonstration of the valve operation under simulated plant conditions. These integrated tests will cover reactor start-up conditions, steady state conditions and reactor shut down and should ideally be conducted while the valve is connected to the circulator to ensure that no interference of the circulator operation occurs during valve operation. All of the proposed testing is manufacturer's testing that are normally performed by circulator vendors.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	500	$70,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	660	$92,400
Travel		$4,500
Test Facility Cost		
Test Specimen Cost		$1,000,000
Totals		$1,096,900

10. Assumptions

Test Duration is 12 Months

Travel Based on 3 Trips at $1500/Trip

Test Facility Cost Captured in Circulator Test Details

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.8	HTS Helical Tube IHX	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The conceptual design studies baseline for an indirect steam cycle configuration of the NGNP proposed by AREVA utilizes two helical tube intermediate heat exchangers (IHX) to transfer the heat energy from the primary to secondary coolant in the Heat Transport System (HTS). The fundamental difference between the NGNP helical tube IHX design and that of previous designs from Germany in the 1980s is the power handling capability of 290 MWth for NGNP versus the 125 MWth capability tested in Germany. Some of the parameters that must be characterized are thermal effectiveness, thermo-mechanical performance, material properties, manufacturability of the design, and long term operation at elevated temperatures (900 °C).

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	7600	$1,064,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	7920	$1,108,800
Travel		$30,000
Test Facility Cost		
Test Specimen Cost		
Totals		$1,138,800

10. Assumptions

Test Duration is 48 Months

Travel Based on 20 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
	HTS Helical Tube IHX TRL 6 to 7 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
1.8.1.3	Original	

8. Work Statement

This is a manufacturing development effort to qualify a hot header manufacturing process, a tube bundle assembly process and the welding techniques necessary to fabricate a helical tube IHX of the scale required for NGNP.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (3000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (1000 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (500 Hrs); (4) Perform test and issue report ($7.1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	4000	$560,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	4500	$630,000
Travel		$18,000
Test Facility Cost		$2,100,000
Test Specimen Cost		$5,000,000
Totals		$7,748,000

10. Assumptions

Test Duration is 28 Months

Same Test Engineer will follow all the Helical Tube IHX Test

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.8.1.2	HTS Helical Tube IHX TRL 6 to 7 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate an acceptable tube to tube support connection that limits the amount of tube friction.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (400 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (80 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($2.7M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	480	$67,200
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	640	$89,600
Travel		$1,500
Test Facility Cost		$225,000
Test Specimen Cost		$500,000
Totals		$816,100

10. Assumptions

Test Duration is 3 Months

Same Test Engineer will follow all the Helical Tube IHX Test

Travel Based on 1 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.8.1.4	HTS Helical Tube IHX TRL 6 to 7 Test # 4	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the performance of the unit under typical operating conditions and measure the effectiveness and durability of the unit. The thermal-hydraulic and thermo-mechanical performance, as well as dust susceptibility, of the IHX will be determined to support validation of analytical design modeling and predictions. This test must be an integrated test with the primary hot gas duct and include not just the tube bundle but the associated insulation, supports, baffles, shroud, hot duct connections and vessel.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (2000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (1000 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($26.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	3000	$420,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	3160	$442,400
Travel		$12,000
Test Facility Cost		$1,500,000
Test Specimen Cost		$500,000
Totals		$2,454,400

10. Assumptions

Test Duration is 19 Months

Same Test Engineer will follow all the Helical Tube IHX Test

Travel Based on 8 Trips at $1500/Trip

Assumed 1/2 size IHX is used for the test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.9	HTS Primary Hot Gas Duct	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

In order to be ready to fabricate a production hot gas duct unit for the NGNP the following actions are required: (1) Develop and qualify manufacturing processes to build the components of the hot gas ducts as well as to assemble the unit. These processes include manufacturing of the ceramic liner and metallic support tube as well as assembly of the duct. (2) Analytical performance assessment calculations are necessary to assess the thermal-hydraulic and structural performance of the hot duct. Some of the items to be assessed are the heat transfer through the duct wall, temperature profiles within the hot duct during transients, structural performance during a depressurization, and overall lifetime predictions. (3) Engineering scale demonstration is necessary to validate the analytical performance assessments and demonstrate the integrated design in representative environment and conditions.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	3000	$420,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	3320	$464,800
Travel		$30,000
Test Facility Cost		
Test Specimen Cost		
Totals		$494,800

10. Assumptions

Test Duration is 47 Months

Same Test Engineer will follow all the Helical Tube IHX Test

Travel Based on 20 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.9.1.2	HTS Primary Hot Gas Duct TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

This is a manufacturing development effort to qualify the manufacturing processes for the composite ceramic (C-C) liner and the assembly of the PHGD.

The activities to perform this test includes: (1) Review of manufacturing and design documents (1500 Hrs) (2) Periodic trips to the test facility to review current status and progress (500 Hrs) (3) Perform qualification, assemble HC Duct and supply associated documentation ($2.6M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2000	$280,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	2000	$280,000
Travel		$18,000
Test Facility Cost		$2,100,000
Test Specimen Cost		$1,000,000
Totals		$3,398,000

10. Assumptions

Test Duration is 28 Months

Same Test Engineer will follow all the Primary Hot Gas Duct Test

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.9.2.1	HTS Primary Hot Gas Duct TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the performance of the hot gas duct under typical operating conditions and measure the effectiveness and durability of the unit. The thermal-hydraulic and thermo-mechanical performance will be determined to support validation of analytical design modeling and predictions. This test must be an integrated test with the helical tube IHX.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (500 Hrs) (3) Perform test and issue report ($17.1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1500	$210,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1660	$232,400
Travel		$12,000
Test Facility Cost		$1,500,000
Test Specimen Cost		$5,000,000
Totals		$6,744,400

10. Assumptions

Test Duration 19 Months

Same Test Engineer will follow all the Primary Gas Circulator Tests

Travel Based on 8 Trips at $1500/Trip

Assumed Full size duct is used for test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10	HTS Secondary Gas Circulator	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of the Secondary Gas Circulator test include: (1) Characterization of Haynes Alloy 718 for the impeller due to its excellent creep and fatigue properties over the temperature range and stresses expected to be encountered in the NGNP configuration. (2) Fabrication techniques of the impeller using Haynes Alloy 718 will have to be developed and verified for an impeller fabricated of this material. (3) Development of He:Air seal is necessary to assure a low helium leak rate from the secondary system to the environment. (4) Verification of circulator performance is necessary due to the increased scale of the circulator from previously employed devices.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	4600	$644,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	4920	$688,800
Travel		$37,500
Test Facility Cost		
Test Specimen Cost		
Totals		$726,300

10. Assumptions

Test Duration 58 Months

Travel Based on 25 Trips at $1500/Trip

The same person will follow the Primary and Secondary Circulator Test since most are done in parellel for both components

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10.1.2	HTS Secondary Gas Circulator TRL 4 to 5 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to measure material properties of Haynes Alloy 718 including fatigue strength, ductility, and corrosion rates over the range of expected design temperatures (350°C to 550°C). Higher temperature tests to monitor behavior during transients of the reactor may also be conducted. This data will be used to assess the design and operating limits of the material for the circulator impeller. For example, creep fatigue endurance data shall be sufficient to estimate the expected design life.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1400 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (800 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($2.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2200	$308,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	2360	$330,400
Travel		$15,000
Test Facility Cost		$2,250,000
Test Specimen Cost		$5,000
Totals		$2,600,400

10. Assumptions

Test Duration 28 Months

Test Done in Parallel with Primary Gas Circulator

Same Test Engineer will follow all Secondary Gas Circulator Test

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10.1.3	HTS Secondary Gas Circulator TRL 4 to 5 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the manufacturing processes for the impeller fabricated from Haynes Alloy 718. Testing will include demonstrating and optimizing forming and welding processes. Successful completion of this test will provide assurance that the impeller can be manufactured in compliance with the specifications for the overall assembly. The processes include forming, assembling and welding the impeller sections. These tests are necessary to validate the capability for manufacturing both individual impeller parts and final assembly.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract for test specimens (160 Hrs); (4) Perform test and issue report ($1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1400	$196,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1560	$218,400
Travel		$9,000
Test Facility Cost		$975,000
Test Specimen Cost		$10,000
Totals		$1,212,400

10. Assumptions

Test Duration 28 Months

Test Done in Parallel with Primary Gas Circulator

Same Test Engineer will follow all Secondary Gas Circulator Test

Travel Based on 12 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10.2.1	HTS Secondary Gas Circulator TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the performance of the magnetic bearings as part of the rotating equipment assembly (motor, bearings, rotor, and impeller) over the full range of operating conditions. The accuracy of the calculated natural frequencies and critical speed of the impeller will be determined and the adequacy of design margins will be evaluated. The test results will be used to revise the bearing and rotor design if resonant vibration occurs. A second objective is to demonstrate that state of the art inverters and input power transformer rectifiers can operate at the frequencies required to control the motor without having an adverse impact on the supply currents.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (600 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($3.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1600	$224,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1760	$246,400
Travel		$6,000
Test Facility Cost		$750,000
Test Specimen Cost		$2,600,000
Totals		$3,602,400

10. Assumptions

Test Duration 10 Months

Same Test Engineer will follow all Secondary Gas Circulator Tests

Travel Based on 4 Trips at $1500/Trip

Test Done in Parallel with Primary Gas Circulator

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10.2.2	HTS Secondary Gas Circulator TRL 5 to 6 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the behavior of the assembled circulator, examining and characterizing the following key aspects of the unit while the unit is running in air at ambient temperature and pressure. The circulator performance curves will be generated during this test to confirm the design and operation of the circulator. Static testing of the circulator using He will be conducted to measure leakage rates of gas from the housing and through the rotor seal. The final test will be NDE of the system as it is dismantled to monitor clearances and individual measurement of the component parts to monitor changes in physical dimensions. Particular attention will be given to the motor housing and rotor seal.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1300 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (600 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($11.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1900	$266,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	2060	$288,400
Travel		$7,500
Test Facility Cost		$900,000
Test Specimen Cost		$10,400,000
Totals		$11,595,900

10. Assumptions

Test Duration 12 Months

Same Test Engineer will follow all Secondary Gas Circulator Tests

Travel Based on 5 Trips at $1500/Trip

Assumed full size circulator used for test and components used from previous tests

Test Done in Parallel with Primary Gas Circulator

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.10.3.1	HTS Secondary Gas Circulator TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

A single integrated test of the gas circulator assembled with the circulator shut-off valve and a mock-up of the secondary heat transport system interface in high temperature air is required to validate the circulator design and operation. The circulator must start-up under the load of the shut-off valve while operating at low pressure and temperature and operate efficiently over a wide range of flow conditions. The performance of the components near the limit of their design envelope must be confirmed.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1200 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (400 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($750K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1600	$224,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1760	$246,400
Travel		$7,500
Test Facility Cost		$750,000
Test Specimen Cost		
Totals		$1,003,900

10. Assumptions

Test Duration 10 Months

Same Test Engineer will follow all Secondary Gas Circulator Tests

Travel Based on 5 Trips at $1500/Trip

Assumed Test Specimen from previous test used

Test Done in Parallel with Primary Gas Circulator

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.11	HTS High Temperature Isolation Valve TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate that the valve is suitable for NGNP service conditions and will meet all specified functional and operational requirements, such as pressure drop, leak rate, and the open/close cycle time for the life of the plant.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (500 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (100 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($1.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	600	$84,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	760	$106,400
Travel		$3,000
Test Facility Cost		$525,000
Test Specimen Cost		$1,000,000
Totals		$1,634,400

10. Assumptions

Test Duration 7 Months

Travel Based on 2 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.12	HTS Compact IHX	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

In order to be ready to fabricate a production IHX unit for NGNP the following actions are required: (1) Characterization and codification of Inconel Alloy 617. (2) Determine if corrosion resistant coating is needed at temperatures above 750ºC. (3) Manufacturability processes must be developed and qualified to stamp and weld the plates that form the heat exchanger cores as well as assembling the cores into an integrated IHX unit. (4) Experimental, Pilot, and engineering scale demonstration is required to establish the basic thermal hydraulic and thermo-mechanical performance of the basic heat exchanger core as well as establish effects of integration with the secondary header piping.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	11000	$1,540,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	500	$70,000
Total Labor	11500	$1,610,000
Travel		$45,000
Test Facility Cost		
Test Specimen Cost		
Totals		$1,655,000

10. Assumptions

Test Duration 71 Months

Travel Based on 30 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.12.1.1	HTS Compact IHX TRL 4 to 5 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

To develop and qualify the manufacturing process for a PSHE core made from Inconel Alloy 617 the following engineering tests must be conducted. (1) Qualify a stamping process for Alloy 617 plates, (2) Qualify a welding process for welding of plates, (3) Develop an NDE method for inspection of the welds

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (600 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($190K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	800	$112,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	800	$112,000
Travel		$7,500
Test Facility Cost		$170,000
Test Specimen Cost		$20,000
Totals		$309,500

10. Assumptions

Test Duration 10 Months

Travel Based on 5 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.12.1.2	HTS Compact IHX TRL 4 to 5 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the thermal-hydraulic and thermo-mechanical performance of the PSHE core, which will be used to create analytical models that will be used to predict the performance of a larger scale unit.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (800 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($2M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1160	$162,400
Travel		$7,500
Test Facility Cost		$1,000,000
Test Specimen Cost		$100,000
Totals		$1,269,900

10. Assumptions

Test Duration 13 Months

Travel Based on 5 Trips at $1500/Trip

Assumed 1/50 scale of CIHX used for test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.12.2.1	HTS Compact IHX TRL 5 to 6 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to validate the analytical models used in the design of the compact IHX and determine the effects of integrating the secondary header pipes on the thermal-hydraulic and structural performance of the heat exchanger core. Dust susceptibility of the heat exchanger core design will be addressed as well. All of these tests will be conducted in helium.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($11.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1160	$162,400
Travel		$10,500
Test Facility Cost		$1,275,000
Test Specimen Cost		$500,000
Totals		$1,947,900

10. Assumptions

Test Duration 17 Months

Travel Based on 7 Trips at $1500/Trip

Assumed 1/5 scale of the CIHX is used for the test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.12.3.1	HTS Compact IHX TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine the thermal-hydraulic and thermo-mechanical performance of the IHX to confirm performance of the final compact IHX design and validate the analytical design models and codes.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (2000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (600 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (320 Hrs); (4) Perform test and issue report ($27.4M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	2600	$364,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	2920	$408,800
Travel		$22,500
Test Facility Cost		$2,400,000
Test Specimen Cost		$3,500,000
Totals		$6,331,300

10. Assumptions

Test Duration 33 Months

Travel Based on 15 Trips at $1500/Trip

Assumed 1/2 size CIHX is used for test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.13	Power Conversion System Steam Generator	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

There are a total of four tests recommended for the SG to achieve a TRL of 7. These tests are as follows: (1) Qualification of the Bi-matelic weld, (2) Characterization and Codification of Alloy 800H; (3) Component Manufacturability Development; (4) Testing of Engineering Scale Prototype

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	3300	$462,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	3620	$506,800
Travel		$22,500
Test Facility Cost		
Test Specimen Cost		
Totals		$529,300

10. Assumptions

Test Duration 42 Months

Travel Based on 15 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.13.1.1	Power Conversion System Steam Generator TRL 5 to 6 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to characterize the properties of the bi-metallic welds at the evaporator and super heater tube bundle.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (800 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Perform test and issue report ($500K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1000	$140,000
Travel		$6,000
Test Facility Cost		$500,000
Test Specimen Cost		$10,000
Totals		$656,000

10. Assumptions

Test Duration 18 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.13.2.1	Power Conversion System Steam Generator TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to expand the material data base on Alloy 800H to meet the requirements for NGNP

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (800 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Perform test and issue report ($800K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1000	$140,000
Travel		$6,000
Test Facility Cost		$800,000
Test Specimen Cost		$10,000
Totals		$956,000

10. Assumptions

Test Duration 18 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.13.2.2	Power Conversion System Steam Generator TRL 6 to 7 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate that the forging process for the ring-shaped hot header for the steam generator is adequate.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (400 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($3.5M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1400	$196,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1560	$218,400
Travel		$6,000
Test Facility Cost		$1,350,000
Test Specimen Cost		$2,125,000
Totals		$3,699,400

10. Assumptions

Test Duration 18 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.13.2.3	Power Conversion System Steam Generator TRL 6 to 7 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to demonstrate the performance of the unit under typical operating conditions and measure the effectiveness and durability of the unit. The following objectives will be achieved by this test: (1) Thermal hydraulic performance test of SG; (2) Flow stability and controllability test of water and steam system; (3) Analytical estimation and validation of flow induced vibration behavior of the tube bundle; (4) ISI test with trial ISI equipment of tubes (if the ISI of tubes required)

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (1000 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (400 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($22.3M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1400	$196,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1560	$218,400
Travel		$7,500
Test Facility Cost		$1,000,000
Test Specimen Cost		$21,250,000
Totals		$22,475,900

10. Assumptions

Test Duration 12 Months

Travel Based on 5 Trips at $1500/Trip

Assumed 1/2 size SG used for test

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.14	BOP Primary Loop Instrumentation TRL 6 to 7	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

To reach the next TRL level tests will be performed in helium under simulated plant conditions. Tests need to be performed at expected reactor start-up conditions, normal operating conditions, shut-down conditions and expected off-normal operating conditions. Two tests are required for each component.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (800 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (200 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160 Hrs); (4) Perform test and issue report ($2.1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1160	$162,400
Travel		$7,500
Test Facility Cost		$2,000,000
Test Specimen Cost		$150,000
Totals		$2,319,900

10. Assumptions

Test Duration 10 Months

Travel Based on 5 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.15	BOP Fuel Handling Machine	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The following tests are necessary for the Fuel Handling Machine: (1) Seal selection test; (2) Bearing selection test; (3) Lubricant selection test; (4) Component functional and endurance tests. In addition, each major Fuel Handling System subcomponent (Fuelling Adaptor, Fuel Elevator, Fuel Handling machine, Fuel Server) must be functionally and endurance tested to assure compliance with design and operational requirements before being assembled at the NGNP site. This testing includes both the physical operation of the sub-component as well as all controlling electronics and computer coding.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	2800	$392,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	320	$44,800
Total Labor	3120	$436,800
Travel		$9,000
Test Facility Cost		
Test Specimen Cost		
Totals		$445,800

10. Assumptions

Test Duration 18 Months

Travel Based on 6 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.15.1.1	BOP Fuel Handling Machine TRL 6 to 7 Test # 1	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of the first test is to identify a suitable material, or set of materials, for use in the various soft seals within the fuel handling system and perform tests to verify expected performance. As currently configured, the Fuel Handling System contains the following soft seals: a) Fuelling Adaptor-to-Control Rod/Instrumentation Penetrations; b) Fuel Elevator-to-Fuelling Adaptor; c) Fuel Handling Machine-to-Fuelling Adaptor; d) Fuel Server-to-Fuel Handling Machine; and e) Near Module Spent Fuel Storage-to-Fuel Server.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (300 Hrs) (3) Perform test and issue report ($400K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1200	$168,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1200	$168,000
Travel		$6,000
Test Facility Cost		$300,000
Test Specimen Cost		$100,000
Totals		$574,000

10. Assumptions

Test Duration 8 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.15.1.2	BOP Fuel Handling Machine TRL 6 to 7 Test # 2	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this activity is to identify a suitable material for use in the various bearings within the fuel handling system and perform appropriate tests to verify expected performance. A second objective is to identify those bearings which require lubrication. The bearings considered in this activity are those that are within the helium boundary of the fuel handling system.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (300 Hrs) (3) Perform test and issue report ($400K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1200	$168,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1200	$168,000
Travel		$6,000
Test Facility Cost		$300,000
Test Specimen Cost		$100,000
Totals		$574,000

10. Assumptions

Test Duration 8 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.15.1.3	BOP Fuel Handling Machine TRL 6 to 7 Test # 3	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to verify the expected performance of the lubricants selected for use in the bearings within the fuel handling system. Performance parameters considered include both the lubricating function as well as potential for contamination of the primary system with lubricant. The lubricants considered in this activity are those that are required for bearings within the helium boundary of the fuel handling system.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (300 Hrs) (3) Perform test and issue report ($310K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1200	$168,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1200	$168,000
Travel		$6,000
Test Facility Cost		$300,000
Test Specimen Cost		$10,000
Totals		$484,000

10. Assumptions

Test Duration 8 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
	BOP Fuel Handling Machine TRL 6 to 7 Test # 4	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The object of these tests is to assure that each Fuel Handling System subcomponent operates as designed prior to shipment to the NGNP site and assembly into an integrated system. Specific design requirements for each portion of the fuel handling system will be developed during the initial phase of the detailed design activities for this system. Operational testing plans will be developed based on these design requirements.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (300 Hrs) (3) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract (160Hrs); (4) Perform test and issue report ($2.4M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1200	$168,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	1360	$190,400
Travel		$6,000
Test Facility Cost		$400,000
Test Specimen Cost		$2,000,000
Totals		$2,596,400

10. Assumptions

Test Duration 8 Months

Travel Based on 4 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.16	HTS IHX Materials and Coatings	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The first priority of development is to assess the corrosion performance of the Alloy 617 under NGNP conditions. If the corrosion performance is adequate with the IHX designs chosen then no further development is necessary. If, however, the corrosion performance is found to be unacceptable then a coating material and application process will need to be developed for the IHX designs.

The Project Management/Oversight activities to perform these test includes: (1) Development of the request for proposal procurement package, review and negotiation of the proposals, and award of contract; (2) Review of weekly/monthly contractor status reports, attend contractor meetings, and administer contract; (3) Review and approval of contractor invoices; (4) Development of Weekly/Monthly Status reports, attend periodic project meetings; (5) Review of test procedures and analyze results.

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	2000	$280,000
Eng	0	$0
Designer	0	$0
Admin	0	$0
Subcontract Administrator	160	$22,400
Total Labor	2160	$302,400
Travel		$12,000
Test Facility Cost		
Test Specimen Cost		
Totals		$314,400

10. Assumptions

Test Duration 32 Months

Travel Based on 8 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
	HTS IHX Materials and Coatings TRL 3 to 4	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objectives of this test to quantify the interactions between the IHX materials and the impurities found in the helium gas over a range of impurity levels. This test should include: a) Determination of oxide layer behavior; b) Corrosion; c) Carburization/decarburization; d) Helium permeability. The testing should define acceptable ranges for helium impurities that will minimize these identified issues and determine the specification for the helium purity control system for NGNP.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (100 Hrs); (3) Perform test and issue report ($700K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1000	$140,000
Travel		$3,000
Test Facility Cost		$675,000
Test Specimen Cost		$25,000
Totals		$843,000

10. Assumptions

Test Duration 9 Months

Travel Based on 2 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.16.2.1	HTS IHX Materials and Coatings TRL 4 to 5	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to determine appropriate types of corrosion resistant coatings for application to the IHX designs used in the NGNP. Such coatings must provide the necessary level of corrosion resistance, remain intact over the life of the IHX, and exhibit good thermal conductivity so not to degrade the effectiveness of the IHX.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (100 Hrs) (3) Perform test and issue report ($1.1M)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1000	$140,000
Travel		$4,500
Test Facility Cost		$1,000,000
Test Specimen Cost		$100,000
Totals		$1,244,500

10. Assumptions

Test Duration 12 Months

Travel Based on 3 Trips at $1500/Trip

WORK BREAKDOWN STRUCTURE DICTIONARY

WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT		2. Date of Preparation
NGNP / TDRM TEST		11/8/2008
3. WBS Number	**4. WBS Element Title**	
1.16.3.1	HTS IHX Materials and Coatings TRL 5 to 6	
5. Index Line No.	**6. Revision No.**	**7. Revision Date**
	Original	

8. Work Statement

The objective of this test is to validate that the chosen coating material and application process is applicable in the various complex geometries of the IHX designs used in the NGNP.

The activities to perform this test includes: (1) Review and approval of test procedures and test reports (900 Hrs) (2) Periodic trips to the test facility to witness test/review current status and progress (100 Hrs) (3) Perform test and issue report ($850K)

9. Cost Content

Position	Hours	Cost
Project Mgr	0	$0
Principal Engineer	0	$0
Sr Eng	0	$0
Eng	1000	$140,000
Designer	0	$0
Admin	0	$0
Subcontract Administrator	0	$0
Total Labor	1000	$140,000
Travel		$4,500
Test Facility Cost		$750,000
Test Specimen Cost		$100,000
Totals		$994,500

10. Assumptions

Test Duration 10 Months

Travel Based on 3 Trips at $1500/Trip