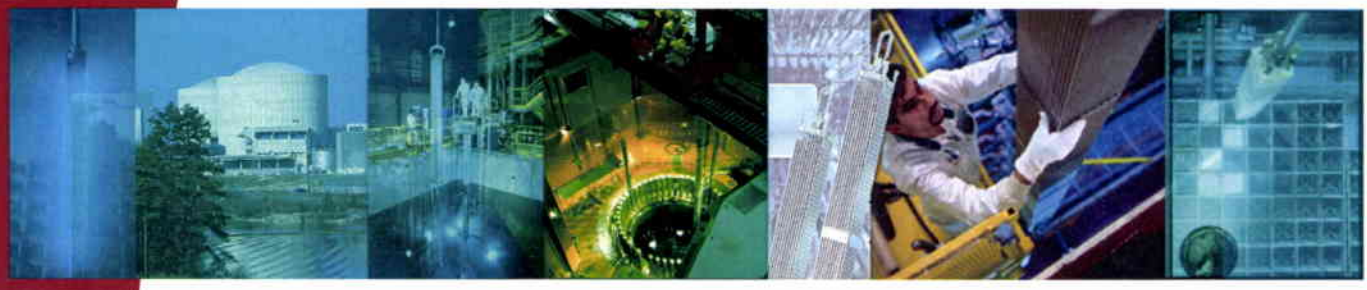


NGNP
Component Test Facility
Cost and Schedule Report

Battelle Energy Alliance, LLC
Idaho National Laboratory

SOW-6392, Revision 0
Contract # BEA 000 75310

May 1, 2009

AREVA

Title Page

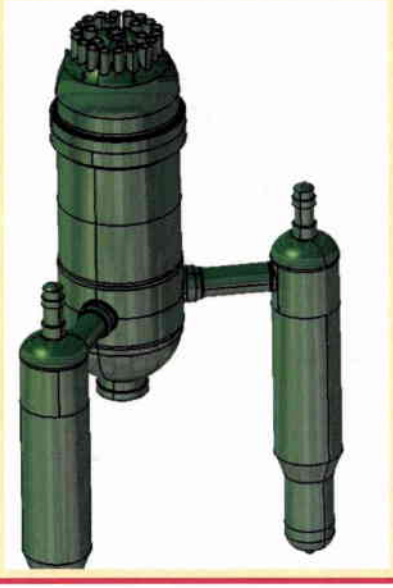
NGNP Component Test Facility Cost and Schedule Report

Document No. PD-3001289-001

Battelle Energy Alliance, LLC
SOW- 6392, Revision 0

May 1, 2009

AREVA High Temperature Reactor (NGNP)



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1.0 Executive Summary

In accordance with the SOW, AREVA has developed a cost estimate and schedule for the Component Test Facility (CTF), reference INL SOW-6392, Revision 0, "Statement of Work AREVA Component Test Facility Conceptual Design Studies for the NGNP with Hydrogen Production". In addition to the SOW and requirements and references included, AREVA used the INL report "Tailoring Strategy for the HTGR Component Test Facility Project" August 2008 draft document to establish the rationale for compliance with DOE O 413.3A Critical Decisions and major milestones. The AREVA NGNP Component Test Facility Pre-Conceptual Design Report, 12-9097512-001, was used as the technical bases for the development of the CTF cost and schedule.

The cost and schedule include activities necessary to complete the design, construction and initial operation of the CTF and to meet the requirements of DOE O 413.3A. A summary of the resulting cost and schedule are as follows. The total project duration is seven (7) years at a cost of $ $389 million dollars not including contingency or fee. Final Design will be complete on September 26, 2012, construction will be complete on October 24, 2014, and commissioning activities will be completed and the facility ready for operations on June 19, 2015.

The key assumptions used in the development of this report are:

- The work scope defined in the AREVA CTF test loop preconceptual design will not be modified.
- The Component Test Facility is considered a non-nuclear industrial test facility and the work will be performed under an industrial non-nuclear QA Program. Application of ASME NQA-1 is not required for the design and construction of the CTF, but will apply to the M&TE used to perform the tests and collect test data during CTF operation.
- Schedule and cost estimate for the 1MWt loop assumes obtaining the HELITE final design work package from AREVA NP SAS.
- DOE accepts AREVA and MHI terms and conditions for use of proprietary intellectual property (IP) before the start of work.
- Key milestones leading up to start of construction shall be in accordance with INL "Tailoring Strategy for the HTGR Component Test Facility Project" August 2008 draft document.

Upon completion of the development of the CTF schedule with the resulting operational date of June 19, 2015, the TDRM schedule was logically connected to determine if the TDRM tests schedules were impacted. (reference Technology Development Road Map Document, TDR-3001031-000, dated November 2008 and TDRM Cost and Schedule Estimate Report, PD-3001185-000, dated December 2008) These documents assumed the 1MWt Loop would be available on October 3, 2011; the 30MWt Loop would be available April 1, 2013, and the construction of the NGNP Plant would be completed by October 1, 2021; reference INL SOW-6636 Statement of Work AREVA FY09-1 Conceptual Design Work for the NGNP with Hydrogen Production. The evaluation of the integration of these schedules determined that a number of the TDRM tests could be delayed until the CTF is available if no mitigation is implemented. The critical tests affected are for the following components:

- Reactor Vessel Internals
- NHS Neutron Control System

- HTS Compact IHX
- HTS Helical Tube IHX
- Primary Loop Instrumentation
- Hot Gas Ducts
- Helical Tube Steam Generators
- High Temp Isolation Valve

Due to the potential delays to some TDRM tests consideration was given to possible mitigation strategies to minimize any impact to the TDRM Testing schedule revealed during this analysis. Details of this analysis are provided in section 2.3.

2.0 Cost and Schedule for CTF Test Loop Design and Facility Construction

In accordance with the requirements in the SOW for the CTF Pre-Conceptual Design, AREVA developed a resource loaded schedule for the design, construction and commissioning of the CTF. The basis of the cost and schedule includes parametric data from similar projects. In some cases it was necessary to rely on engineering judgment based on professional experience for purposes of estimating. The detailed resource loaded schedule and a roll-up is provided in Appendix 1. An annual spending plan is provided in Appendix 2 and the detailed cost information is in Appendix 3.

2.1 Cost and Schedule Development Basis

The AREVA CTF Team was able to use past project information and subject matter experts familiar with EPC for nuclear power plants and systems similar to the CTF test loops and facility. The team was assembled to develop the WBS structure, cost and schedule estimate.

The team evaluated the WBS provided by BEA and work identified in the pre-conceptual design report and expanded the WBS structure and prepared detailed WBS work sheets for each WBS element. The team, in consultation with support staff, reviewed prior work and called upon their prior experience in performance of similar work activities to assure that the WBS structure represented adequate activities for each phase of the project.

For the 1MWt test loop the required SSCs and design are based on the AREVA HELITE test loop. The schedule and the cost estimate for the 1MWt loop assumes obtaining the HELITE final design work package and performing the necessary conversion of the French design for use in the United States to meet applicable U.S.A. codes and standards. The design of the 30MWt test loop is a scaled version of the Japanese HENDEL loop which was used to test the components of the high temperature HTTR test reactor. The cost and schedule estimates developed for the CTF 30MWt test loop is based on the HENDEL experience with the necessary updates for compliance with the U.S.A. codes and standards.

The CTF test loop support systems and the test facility design and construction have been integrated into the cost and schedule based on a consolidated design and construction approach. The initial bases for the cost estimate and schedule was the high level cost and schedule estimate recently performed and reported in AREVA document 12-9076931-000, titled - "NGNP Component Test Facility - Conceptual Configuration, Cost, and Schedule Estimate."

After developing the CTF test loops and facility schedule logic and durations, resource loading was performed. Cost estimates were developed for each of the WBS elements. Parametric estimating and previous experience were the primary methods used to develop the estimates. When these methods could not be reasonably applied, a professional with experience in the area being estimated was used.

2.2 CTF Work Scope Schedule

High level work activities were defined for each WBS element. Duration and start dates were estimated and the activities were networked using Primavera Project Management scheduling software. Labor and ODC estimates were loaded into the schedule to produce a time-phase spending plan and a profile of the resource demand. Appendix 1 includes the resource loaded schedule.

The CTF design schedule was prepared to be used as the baseline for the conceptual, preliminary, and final design. The schedule also includes estimates of the time it will take for procurement of long lead items, facility construction, test loop installation and the test loop commissioning and turn-over. Following a contract award design engineers will detail the activities to enhance progress and earned value reporting. After commencement of CTF design, additional lower level tasks will be developed and added to the baseline schedule providing additional detail for EVMS. Table 1 below provides a summary of total man-hours by WBS.

Table 1: Man-hour Estimates

WBS ID	WBS Name	Budget Hours
1.1.1	Conceptual Design - 1MWt	5948
1.1.2	Preliminary Design - 1MWt	6606
1.1.3	Final Design - 1MWt	10446
1.1.4	Long Lead Procurement - 1MWt	4000
1.1.5	Construction - 1MWt	2044
1.2.1	Conceptual Design - 30MWt	52616
1.2.2	Preliminary Design - 30MWt	78404
1.2.3	Final Design - 30MWt	112340
1.2.4	Long Lead Procurement - 30MWt	3900
1.2.5	Construction - 30MWt	1736
1.3.1	Conceptual Design - CTF Building and BOP Systems	25454
1.3.2	Preliminary Design - CTF Building and BOP Systems	31050
1.3.3	Final Design - CTF Building and BOP Systems	44442
1.3.4	Construction - CTF Building and BOP Systems	3128
1.4	Commissioning – 1MWt and 30MWt CTF	22982
1.5	Project Management	211236

Key Milestones

There are six milestones identified in the schedule that reflect key dates for completion of activities. Design reviews at 50% and 90% of each design phase are established to ensure client and DOE input is

obtained at defined intervals during the conceptual, preliminary and final design process. The milestones are presented in Table 2 below.

Table 2: Key Milestones

Key Milestones		
Activity ID	**Activity**	**Due Date**
M0110	CTF Project Start	10/1/08
M0040	Begin Conceptual Design	10/1/08
M0140	CD-1 Approve Alternative and Cost Range	3/31/10
M0190	CD-2/3a Approval of Baseline/LL Procurement	9/30/11
M0320	CD-3b Approve Start of Construction	10/1/12
M0330	CD-4 Approve Start of Operations	6/19/15

2.3 CTF and TDRM Schedule Integration

Upon completion of the development of the CTF schedule with the resulting operational date of June 19, 2015, the TDRM schedule was logically connected to determine if the TDRM tests schedules were impacted. (reference Technology Development Road Map Document, TDR-3001031-000, dated November 2008 and TDRM Cost and Schedule Estimate Report, PD-3001185-000, dated December 2008) These documents assumed the 1MWt Loop would be available on October 3, 2011; the 30MWt Loop would be available April 1, 2013, and the construction of the NGNP Plant would be completed by October 1, 2021; reference INL SOW-6636 Statement of Work AREVA FY09-1 Conceptual Design Work for the NGNP with Hydrogen Production. The evaluation of the integration of these schedules determined that a number of the TDRM tests could be delayed until the CTF is available if no mitigation is implemented. The critical tests affected are for the following components:

- Reactor Vessel Internals
- NHS Neutron Control System
- HTS Compact IHX
- HTS Helical Tube IHX
- Primary Loop Instrumentation
- Hot Gas Ducts
- Helical Tube Steam Generators
- High Temp Isolation Valve

Due to this potential impact consideration was given to possible mitigation strategies to minimize any potential impact revealed during this analysis.

Table 3 below summarizes the TDRM tests to be performed at the CTF that were included in TDRM Cost and Schedule Report. Column 1 identifies the TDRM test as shown in the TDRM Cost and Schedule Report and which test loop is needed for that test. Column 2 identifies the tie between the test and the

NGNP Plant schedule and why the tie was chosen. Column 3 provides suggested mitigation strategies to minimize the impact. Some of these strategies assume that the test data can be obtained later than what was assumed during the original TDRM Study. This assumption will add risk to the project. Table 3 is organized by the greatest potential impact to the least impact in descending order.

Table 3: CTF Availability Impact to TDRM Test Schedule

TDRM TEST TEST LOOP NEEDED	RELATION TO NGNP PLANT SCHEDULE JUSTIFICATION FOR RELATION	MITIGATION OPTIONS
WBS 1.14.1 BOP Primary Loop Instrumentation TRL 6-7 1MWt Loop	Complete Test Prior to start of Final Design Data needed to confirm Design and Performance Requirements	Locate another Test Facility Accelerate 1MWt test loop completion by installing 1MWt Loop in an existing building
WBS 1.4.2 NHS Neutron Control System TRL 5-6 1MWt Loop	Predecessor to 1.4.3 Below Input for material properties to 1.4.3 below	Locate another Test Facility Accelerate 1MWt test loop completion by installing 1MWt Loop in an existing building
WBS 1.4.3 NHS Neutron Control System TRL 6-7 1MWt Loop	Complete Test Prior to end of Final Design Data needed for Safety Analysis and License application	Locate another Test Facility Accelerate 1MWt test loop completion by installing 1MWt Loop in an existing building
WBS 1.12.2 HTS Compact IHX TRL 5-6 1MWt Loop	Predecessor to 1.12.3 Below Input for material properties to 1.12.3 below	Locate another Test Facility Accelerate 1MWt test loop completion by installing 1MWt Loop in an existing building
WBS 1.12.3 HTS Compact IHX TRL 6-7 30MWt Loop	Complete Test Prior to end of Final Design Data needed to confirm Performance Requirements Data needed prior to fabrication	Locate another Test Facility Use supplemental analyses in lieu of testing and accept increased risk Have Equipment Supplier perform the test
WBS 1.8.1.4 Tube IHX Large Component Test 30MWt Loop	Complete Test 18 Months Prior to end of Final Design Data needed for Safety Analysis and License application Data needed to confirm Performance Requirements Data needed prior to fabrication	Locate another Test Facility Use supplemental analyses in lieu of testing and accept increased risk

TDRM TEST TEST LOOP NEEDED	RELATION TO NGNP PLANT SCHEDULE JUSTIFICATION FOR RELATION	MITIGATION OPTIONS
WBS 1.9.2.1 Primary Hot Gas Duct Engineering Scale Demo 30MWt Loop	Complete Test 18 Months Prior to end of Final Design Data needed for Safety Analysis and License application Data needed to confirm Performance Requirements Data needed prior to fabrication	Locate another Test Facility Use supplemental analyses in lieu of testing and accept increased risk
WBS 1.11.1.2 High Temp Isolation Valve TRL 6-7 30MWt Loop	Complete Test 18 Months Prior to end of Final Design	Locate another Test Facility Rely on Vendor Technology and Testing Experience Delay Installation and Proceed with NGNP Design and Construction. Until Valve is tested and installed use alternative loop operations and accept Licensing Risk
WBS 1.2.3.2 Reactor Vessel Internals Data collection for Conduction Cool down Analyses 1MWt Loop	Complete Test 18 Months Prior to end of Final Design Data needed for Safety Analysis and License application	Locate another Test Facility Accelerate 1MWt test loop completion by installing 1MWt Loop in an existing building
WBS 1.13.2.3 Helical Tube Steam Generator Engineering Scale Demo 30MWt Loop	Complete Test 18 Months Prior to end of Final Design Data needed to confirm Performance Requirements Data needed prior to fabrication	Locate another Test Facility Use supplemental analyses in lieu of testing and accept increased risk Have Equipment Supplier perform the test

The following is a summary of options that could mitigate the impacts of the schedule delays.

1. Separate the 1MWt test loop from the 30MWt loop and place them on separate funding paths where the 1MWt loop could be commissioned ahead of the 30MWt loop. This will result in only minor improvements and is not recommended.

2. Placing the 1MWt loop in an existing facility to accelerate the 1MWt loop availability. On its own this option only results in a 3 month improvement. If this option is taken and the milestones included in the Tailoring Strategy for the HTGR Component Test Facility Project are removed, the schedule can be improved by 23 Months for the 1MWt Loop test. The 1MWt Loop would be operational in July 2013. This still has the availability of the 1MWt Loop 21 months later than the October 2011 need date and does not provide any improvement in the 30MWt Loop schedule.

3. Privatize the test facility by awarding the contract for the tests to an entity that would be willing to use the contract award to provide the test facility outside of the DOE funding process.

4. Reevaluate the test data needs and test methodology to see if alternatives (i.e. analysis verses testing) can be identified that could be accomplished without the CTF.

5. Pursue alternate locations for the tests.

Options 3 and 5 provide the timeliest test information, but it is still an unknown if they could be put in place to support the estimated CTF needs dates. The probability of being able to implement option 3 is low. As a part of the TDRM Study alternate test facilities were considered. There is a higher probability that alternate test locations for the 1MWt test could be found inside and outside of the United States. There is a lower probability that an alternate test facility could be found for the critical tests scheduled for the 30MWt Loop and they would most likely be from foreign sources if they exist at all. Both of these add risk to the project of having to use outside sources rather than internal sources.

Option 4 could be done in a relatively short time and may prove beneficial in identifying alternates that may have been eliminated during the TDRM study, but now, while not ideal, may be more desirable than delaying the project.

2.4 CTF Work Scope Cost

The WBS tasks were evaluated to determine the skill sets, qualifications, and staffing levels required to execute the tasks. Based on the results of the evaluations the man-power loading was established and the resources were allocated accordingly into the schedule. In addition to the direct labor cost, ODCs including travel and miscellaneous ODCs were included in the estimate. This is a pre-conceptual cost estimate. The costs reflected in this report do not include contingency and fee. Appendix 3 includes the WBS Dictionary Element Definition sheets. The level of confidence with the cost estimates are identified in each WBS element sheet.

2.4.1 Basis of Estimate

2.4.1.1 1MWt Test Loop Installation Costs

For the 1MWt test loop major components were evaluated for method and difficulty of installation and then on an individual basis, an estimate of the labor and material costs needed for installation was developed. Based on the size, material, component type and complexity of installation, assumptions on craft labor, handling equipment, consumables, linear feet of pipe, number of pipe supports, number of welds, quantity of steel shapes and miscellaneous materials needed to install the component were made. ASME B31.3 and the IBC were used as the governing codes for installation.

The methodology used to estimate the installation cost was based on best-estimates for materials cost including anchors, weld filler materials, piping, bolting, steel structural shapes, etc.

The installation labor estimate included weld prepping of the special double wall insulated piping and fittings, weld fit-up, welding and Non-Destructive Testing (NDT) including Radiograph Testing, based requirements stated in ASME B31.3. The "Estimator's Piping Man-Hour Manual" Fifth Edition was used as practical with additional time based on estimator's experience of welding durations times while maintaining weld interpass temperatures throughout the welding process and field Radiography the weld joints. Support structures and piping supports have not been designed therefore engineering judgment was applied based on best-estimates from estimator's past experiences on similar components and piping. A correction factor of 1.25 was applied to the welding and NDT labor estimates to account for the

developmental cost associated with welding the double wall insulated piping and fittings and Radiographic processes.

The labor cost also included estimated effort and materials for transporting materials from delivery trucks to storage and from storage to the work site. Equipment rental costs (obtained from rental agency) such as scaffolding, personnel lifts, mobile cranes, fork lifts, etc. were also included. Labor to operate this equipment was estimated based on estimator's previous experiences. Costs were estimated for insulating and painting of carbon steel structures as appropriate. A labor rate of $120/hr was assumed.

2.4.1.2 30MWt Test Loop Installation Costs

For the 30MW test loop the detailed installation cost estimate for the 1MWt loop was used as a basis for installation costs as follows. Based on the 1MWt loop detailed estimate, a relative cost of installation verses component cost was calculated to be 70% This factor was evaluated for applicability to the 30MWt loop and it was determined that due to the high equipment cost the installation factor should be reduced to 50% for the 30MWt loop installation cost.

2.4.1.3 1MWt Test Loop Component Costs

The estimates of the 1MWt Test Loop component cost were developed using input from several sources. The costs for the major components are primarily based upon scaling of the SAS HELITE costs. Component costs from the HELITE design were scaled and adjusted to accommodate the CTF 1MWt design requirements and multipurpose configuration. The costs for the remaining smaller components and associated "off the shelf type" equipment is based on the required quantity or length, vendor quotes and or catalog pricing. Based on the quality of these inputs, the confidence level in these costs is relatively high.

2.4.1.4 30MWt Test Loop Component Costs

The 30MWt Test Loop Component costs include the costs for the forging, machining and final assembly of the major components as well as their associated control systems. The cost estimates were based on the supplier's experience and expertise in the design and manufacturing of components of similar scale and complexity. The following design considerations were used in the development of the component costs.

The estimates of the 30MWt Test Loop component cost were developed based on the following assumptions:

1. Sub-contracting: This vendor cost includes costs of sub-contractors for pressure vessels and attachments. The sub-contractor performs manufacturing design, procurement of materials, manufacturing, testing and inspection.
2. Assembly finishing and Fabrication: Final assembling of Heater element and internal parts of pressure vessel with inner insulation structure is performed. Final Machining of flanges of pressure vessel and final PWHT of pressure vessels are performed. These costs are included in this cost item.
3. Insulation (including liner): This cost includes material and manufacturing and assembling costs by sub-contractor.
4. Graphite cost of heater elements: Material cost and final machining cost by subcontractor are included in this cost.
5. Design, material procurement, and manufacturing for Control Equipment are performed by sub-contractor.
6. Export packing and Inland transportation: Export packing and Inland transportation cost for the Primary Hot Gas Ducts also includes the cost for the Secondary Hot Gas Ducts.

7. Design engineering: Project Management cost including travel expense is included in this cost item.
8. Assembly finishing and Fabrication at MHI's work shop: Common cost for the Quality Assurance (excluding quality control) and staff cost for manufacturing are included in this cost item.
9. Export packing and Inland Transportation: FOB cost for all the components is included in this cost item

2.4.1.5 CTF Building and Services

The CTF building cost estimate including construction labor, building materials and BOP equipment. The building cost was separated into three area costs; 1MWt, 30MWt and site improvements.

Included are site prep, foundation, building structure and systems such as Fire Protection, HVAC, cooling towers, lighting and electrical. A central control room for both loops was also estimated. The cost estimate was based on approximately 85% parametric data and 15% from RS Means. (reference Cost Estimate Support Data Recapitulation for the CTF, prepared by BREI, 3/18/08)

The total estimated CTF building cost of $ 67,113,284 includes $37,775,867 for construction labor and $29,337,439, for equipment and materials.

The facility layout for the test loops included consideration of the following items:

- The components which constitute the hot helium boundary are grouped within partitioned rooms to limit the consequences of a hot helium leak.
- The instrumentation and electric equipment which are sensitive to temperature are located within air-conditioned rooms. The rooms are located closely to each other to reduce the cable length.
- Monorail lines shall be laid down in the center of the buildings to provide transportation routes for the equipment which are brought into and out of the buildings when construction or maintenance operations are engaged.
- Components shall be installed on the first floor. They shall not be tiered
- Any components which are suitable for installation outdoors are located outdoors to reduce congestion and the size of the building.

The following estimating methodologies were used to define the activities, quantities, and resources used in the preparation of this cost estimate.

A. The project scope and methodologies for this estimate were prepared from pre-conceptual design documents.
B. An upper-level WBS was used to establish the structuring of the work.
C. The NGNP Preliminary Design estimate is the basis for the CTF. The CTF buildings are based on the NGNP Radwaste Building (concrete structure) and the NGNP Administration Building (metal sided structural steel). Quantities were scaled as necessary to suit the CTF design. Material costs from the NGNP estimate were escalated to current day dollars. Activity descriptions and costs are based upon these individual detailed item quantities.
D. Labor hours from the NGNP estimate were used as is. All were factored for productivity. Current labor rates were applied.
E. INL provided the craft wage rates in an April 18, 2007 e-mail. Wage rates are fully burdened with FICA, SUI, WC, etc and also include a $19.00 per diem cost. Rates are escalated to 2008.
F. Craft labor will work a 4-10's workweek.
G. Cost of overtime is not included.
H. Central Facility Area (CFA) at no cost to the project will accept excavated spoil.
I. Cost of defining, excavating and transporting contaminated soil is not included.
J. Fill material will be furnished to the project at no cost by CFA.
K. Unit pricing, as required, was obtained from RS Means cost data books, "Trade Services Pricing" book, vendor quotes, vendor price lists and historical data.

L. Local vendors were polled for preliminary quotes for supply of concrete, reinforcing steel and structural steel for NGNP.
M. Idaho Sales Tax of 6% is included for bulk materials and process equipment.
N. Freight of 5% is included for bulk materials and process equipment.
O. A design review was held March 17, 2008 with the AREVA PM to review and provide consensus of agreement as to the perceived scope of work, assumptions, risks, and costs as engineered and assembled by this estimate.

2.4.2 Cost of Money

All cost values are in 2008 dollars; no cost of money is planned for future dollar valuations.

2.4.3 Spending Plan

Appendix 2 provides the annual estimated costs by third level WBS.

2.4.4 Other Direct Costs (ODC)

ODCs are other costs that have not been included in proposed material, direct labor, indirect costs, or any other category of cost. ODCs include but are not limited to: travel expenses, temporary living expenses, relocation expenses, packaging and transportation costs, royalties, computer expenses, and reproduction costs. The following summarizes ODCs for the CTF Engineering design, facility construction, and loop installation and commissioning.

Travel

Travel costs include the costs of transportation, lodging, and meals and incidental expenses (M&IE) incurred by employees while on project required travel. Travel estimates are based on the potential number of trips as a factor of staff size and work activity durations and places to be visited (domestic or international). Travel costs associated with specific tasks are budgeted in ODCs within the specific WBS tasks.

Shipping Costs

A major part of these costs are an allowance for shipping of equipment from Japan and France. It also includes the transmittal of documents and other materials between design locations. It is assumed that most documents will be transmitted electronically and reproduced at the receiving location.

Reproduction Costs

These costs are an allowance for reproduction of programmatic documents, standards, drawings, and other items for dissemination and review among design team personnel.

2.4.5 Contingency

Contingency is not included in the resource loaded schedule. Based on the following risk items, AREVA believes an appropriate contingency would be 30%.

Risk Items for Completion of Component Test Facility:

- Availability of funding to proceed with all activities in the sequence as provided in the work plan.

- Changes in the CTF reference configuration as detailed in AREVA recommended CTF Test Loop Pre-Conceptual Design Report (12-9097512-001).
- Delay in completion of interface activities such as long lead component manufacturing and delivery.

2.4.6 Fee

There is no fee included in the estimated project cost.

2.4.7 Proprietary Intellectual Property (IP)

The use of IP associated with 1MWt test loop and the design of its key components (i.e. the circulator, leak tight seals, and Helium purification system) is limited to the NGNP component test facility. DOE may not resell, transfer, or license the 1MWt test loop design or its key components to a third party.

The 1MWt test loop cost estimate is based on these limited rights of use. The co-owners of the HELITE test loop (AREVA NP SAS and its partners) agreed in principle to sell the limited rights of use for the HELITE test loop design only. The ownership of the associated IP remains with AREVA. In addition, the IP associated with the manufacturing of the following key test loop components (i.e. the circulator, leak tight seals, and the helium purification system) is not transferred. For the remainder of the 1MWt test loop design package, DOE will have full rights of use such as for other applications and license to third parties.

AREVA proposes to sell the design and qualification data files for the amount estimated in this cost and schedule report. If unlimited full rights of use are requested by DOE the price must be renegotiated.

The use of IP by DOE associated with the 30MWt test loop is limited to the NGNP component test facility. DOE may not resell, transfer, or license the 30MWt test loop design or its key components to a third party. The ownership of the associated IP remains with Mitsubishi Heavy Industries, LTD. (MHI).

3.0 Assumptions

The following assumptions were made in the development of the Component Test Facility Cost and Schedule Report:

- Funding will be provided to meet the cash flow identified. Funding below that level will affect both the efficiency of performing the work tasks and the critical path schedule.
- Long lead procurement activities will begin in the preliminary design phase.
- The CTF will be built at the INL site.
- Costs are in 2008 dollars with no escalation.
- Financial conversion rates of $1.3/Euro and $.01/Yen.
- Average labor rates of $140/hour.
- No costs are included for installation of transmission lines to site.
- No costs are included for stand by power.

- 5 months has been allowed for completion of a contractor and DOE ORR. This time frame is significantly shorter than is typical for an ORR at a nuclear facility and assumes less rigor will be required for a facility like the CTF with only industrial hazards.
- The work scope defined in the AREVA CTF test loop preconceptual design will not be modified.
- Component Test Facility is considered a non-nuclear industrial test facility and the work will be performed under an industrial non-nuclear QA Program. Application of ASME NQA-1 is not required for the design and construction of the CTF, but will apply to the M&TE used to perform the tests and collect test data during CTF operation.
- Schedule and cost estimate for the 1MWt loop assumes obtaining the HELITE final design work package.
- Travel Cost per person is $1500 for domestic travel and $5000 for international travel.
- DOE accepts AREVA and MHI terms and conditions for use of proprietary intellectual property before the start of work.
- Key milestones shall be in accordance with INL "Tailoring Strategy for the HTGR Component Test Facility Project" August 2008 draft document.

4.0 Risk

Risk management is a continuous process that identifies, analyzes, prioritizes, mitigates and tracks project risks. The scope of risk management applies to all phases of the CTF project: design, construction, commissioning and turnover, and operation.

AREVA expects the risk associated with the construction of the CTF to be limited to normal construction and component manufacturing risks. The facility is a standard industrial non-nuclear facility that contains industrial type hazards (pressure & temperature) which will be factored into the facility design. The hazards are readily identifiable and do not require complex mitigation strategies.

The risks associated with the design and fabrication of the test loops and the test loop components are minimal. The 1MWt test loop is modeled after the HELITE test loop of similar configuration, which is designed to European standards. The cost estimate for the 1MWt loop was based on the cost to purchase the "design" from AREVA and the additional cost to Americanize and modify the design. The design documents must be translated into English. The design must then be updated to meet the applicable U.S. codes and standards, and modified to provide a second loop and additional test capabilities needed for the CTF application. The 30MWt test is similarly based on a HENDEL test loop design.

The design of test loop critical components has been established through internal R&D by AREVA and MHI during the development of the HELITE and HENDEL designs. These components, however, have been identified on the long lead components list and their manufacturing and fabrication must be started early to meet the proposed schedule requirements.

A lack of continuous project funding would result in an adverse schedule perturbation and possible loss of critical design team members.

Appendices

Appendix 1 – Resource Loaded Schedule
Appendix 2 – CTF Spending Plan
Appendix 3 – WBS Dictionary

Appendix 1 – Resource Loaded Schedule

NGNP Component Test Facility (CTF) | CTF Schedule | 3/30/09 13:18

Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
CTF1 NGNP Component Test Facility (CTF)		84m	10/1/08	9/16/15	0m	616332h	$388,750,943
CTF1.0 Major Milestones		84m	10/1/08	9/16/15	0m	0h	$0
M0110	CTF Project Start	0m	10/1/08		84m	0h	$0
M0040	Begin Conceptual Design	0m	10/1/08*		3m	0h	$0
M0140	CD-1 Approve Alternative and Cost Range	0m		3/31/10*	0m	0h	$0
M0190	CD-2/3a Approval of Baseline/LL Procurement (INL 9/30	0m		9/30/11*	0m	0h	$0
M0150	TDRM Early Need Date - 1MW CTF	0m		10/3/11*	48m	0h	$0
M0090	Begin Early Site Work - 1Mw	0m		10/3/11*	17m	0h	$0
M0320	CD-3b Approve Start of Construction (INL 9/30/2012)	0m		10/1/12*	3m	0h	$0
M0340	TDRM Early Need Date - 30MW CTF	0m		4/1/13*	30m	0h	$0
M0330	CD-4 Approve Start of Operations	0m		9/16/15	0m	0h	$0
CTF1.1 CTF 1MW		71m	10/1/08	7/24/14	14m	29044h	$26,259,227
CTF1.1.1 Conceptual Design - 1MW CTF		15m	10/1/08	12/28/09	3m	5948h	$3,102,312
S0500	Conceptual Design Summary - 1MW CTF	15m	10/1/08	12/28/09	3m	0h	$0
M0069	Complete Conceptual Design - 1MW	0m	12/28/09		3m	0h	$0
CTF1.1.1.1 1MW CTF Design Requirements		15m	10/1/08	12/25/09	3m	220h	$30,800
S0850	Conceptual Design Requirements Summary - 1MW CTF	15m	10/1/08	12/25/09	3m	220h	$30,800
1CD1150	Develop Design Requirements for Support Systems	15m	10/1/08	12/25/09	3m	0h	$0
1CD1011	Conceptual Design Interface w/R&D - 1MW CTF	15m	10/1/08	12/25/09	3m	0h	$0
1CD1001	Develop Design Requirements for 1MW CTF	15m	10/1/08	12/25/09	3m	0h	$0
CTF1.1.1.2 Primary and Secondary Loops 1MW		15m	10/1/08	12/25/09	3m	5070h	$2,979,292
S0940	Primary and Secondary Loop CD Summary - 1MW CTF	15m	10/1/08	12/25/09	3m	5070h	$2,979,292
1CD1180	Specification of Loop Components - 1MW	5m	10/1/08	2/27/09	13m	0h	$0
1CD1170	Develop Design Description for Primary Loop	5m	10/1/08	2/27/09	3m	0h	$0
1CD1140	Develop Design Description for Secondary Loop	5m	10/1/08	2/27/09	3m	0h	$0
1CD1100	Specifications for Low Temp Piping - 1MW	5m	10/1/08	2/27/09	13m	0h	$0
1CD1090	Design Description for Test Loop Configurations	5m	10/1/08	2/27/09	3m	0h	$0
1CD1050	Develop System Specification for Secondary Loop - 1MW	5m	10/1/08	2/27/09	8m	0h	$0
1CD1040	Develop System Specification for Primary Loop - 1MW	5m	10/1/08	2/27/09	8m	0h	$0
1CD1000	Develop Equipment Design Specifications	5m	10/1/08	2/27/09	13m	0h	$0
1CD1060	System Specification for Transients - 1MW	5m	2/27/09	7/28/09	8m	0h	$0
1CD1020	Develop P&IDs	10m	2/27/09	12/25/09	3m	0h	$0
1CD1010	Develop Process Flow Diagram	5m	2/27/09	7/28/09	3m	0h	$0
1CD1160	Perform Heat/Mass Balance - 1MW Loop	5m	7/29/09	12/25/09	3m	0h	$0
1CD1130	Preliminary Piping Layouts - 1MW	5m	7/29/09	12/25/09	3m	0h	$0
1CD1120	Layout for High Temp Piping - 1MW	5m	7/29/09	12/25/09	3m	0h	$0
CTF1.1.1.3 Instrument & Process Control 1MW		15m	10/1/08	12/25/09	3m	658h	$92,120
S0920	Instrument & Process Control CD Summary - 1MW CTF	15m	10/1/08	12/25/09	3m	658h	$92,120
1CD2000	CD for Data Collection and Storage System (common 1	15m	10/1/08	12/25/09	3m	0h	$0
1CD1780	CD for Flow Control	10m	2/27/09	12/25/09	3m	0h	$0
1CD1760	CD for Pressure Control	10m	2/27/09	12/25/09	3m	0h	$0
1CD1750	CD for Temperature Control	10m	2/27/09	12/25/09	3m	0h	$0
CTF1.1.2 Preliminary Design - 1MW CTF		11m	4/1/10	2/25/11	7m	66066h	$3,212,017
S0510	Preliminary Design Summary - 1MW CTF	11m	4/1/10	2/25/11	7m	0h	$0
M2240	Preliminary Design Complete - 1MW	0m		2/25/11	7m	0h	$0
CTF1.1.2.1 1MW CTF Design Requirements		10m	4/1/10	1/26/11	8m	220h	
S0900	Prelim Design Requirements Summary - 1MW CTF	10m	4/1/10	1/26/11	8m	220h	$30,800
1PD1470	Prelim Design Interface w/R&D - 1MW CTF	10m	4/1/10	1/26/11	8m	0h	$0
1PD1460	Update/Maintain Design Requirements Docs for Suppo	10m	4/1/10	1/26/11	8m	0h	$0
1PD1450	Update/Maintain Design Requirements Docs for 1MW	10m	4/1/10	1/26/11	8m	0h	$0
CTF1.1.2.2 Primary and Secondary Loops 1MW		11m	4/1/10	2/25/11	7m	5070h	$2,996,977
S0950	PD Primary and Secondary Loop Summary - 1MW CTF	11m	4/1/10	2/25/11	7m	5070h	$2,996,977
1PD2180	Prepare Drawings for Secondary Loop Piping - 1MW	6m	4/1/10	9/28/10	7m	0h	$0
1PD2170	Prepare Drawings for Primary Loop Piping - 1MW	6m	4/1/10	9/28/10	7m	0h	$0

Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

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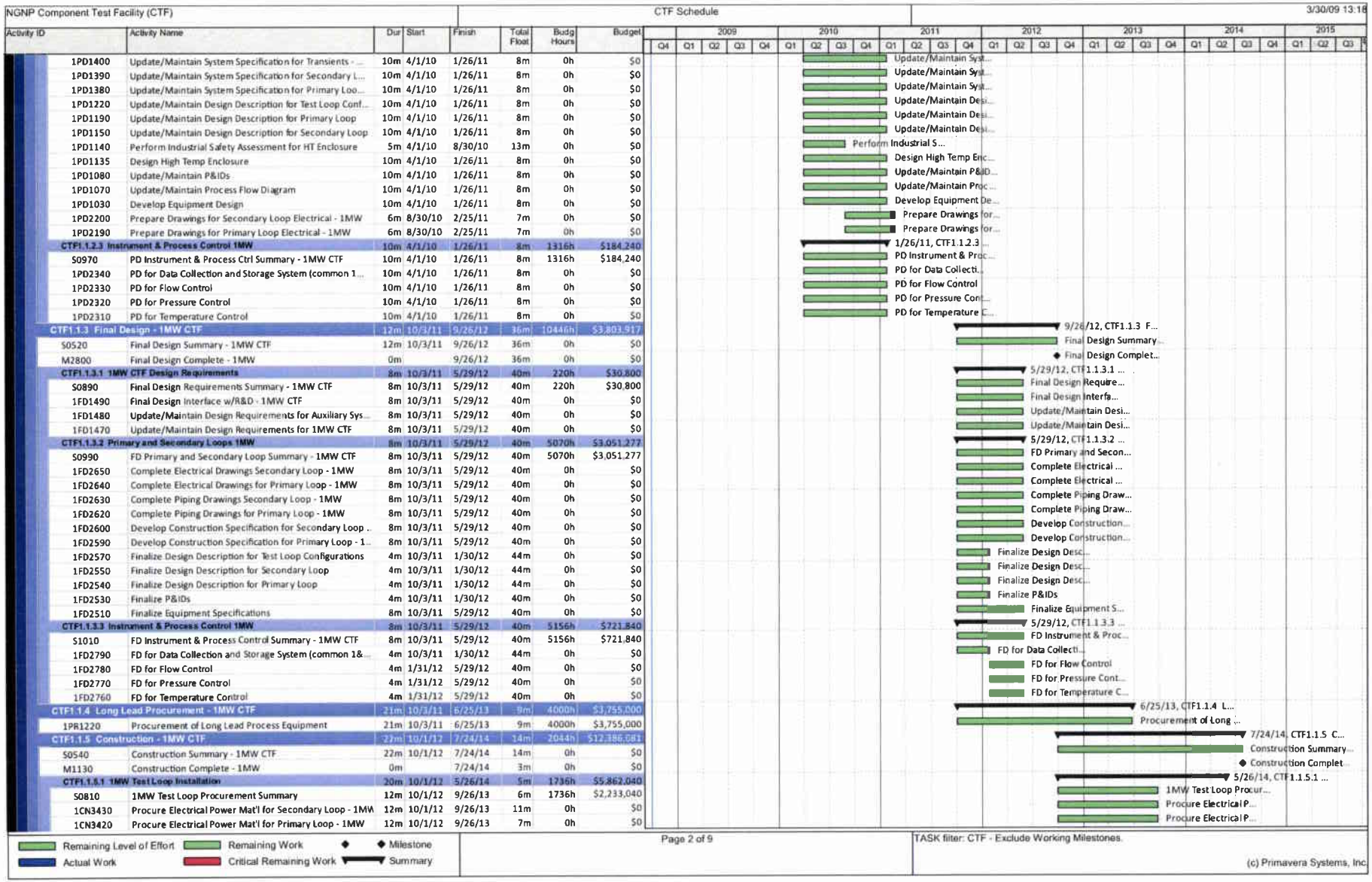
NGNP Component Test Facility (CTF)
CTF Schedule
3/30/09 13:18
Activity ID
Activity Name
Dur
Start
Finish
Total Float
Budg Hours
Budget
2009
2010
2011
2012
2013
2014
2015
Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3
1PD1400 Update/Maintain System Specification for Transients - ... 10m 4/1/10 1/26/11 8m 0h $0
1PD1390 Update/Maintain System Specification for Secondary L... 10m 4/1/10 1/26/11 8m 0h $0
1PD1380 Update/Maintain System Specification for Primary Loo... 10m 4/1/10 1/26/11 8m 0h $0
1PD1220 Update/Maintain Design Description for Test Loop Conf... 10m 4/1/10 1/26/11 8m 0h $0
1PD1190 Update/Maintain Design Description for Primary Loop 10m 4/1/10 1/26/11 8m 0h $0
1PD1150 Update/Maintain Design Description for Secondary Loop 10m 4/1/10 1/26/11 8m 0h $0
1PD1140 Perform Industrial Safety Assessment for HT Enclosure 5m 4/1/10 8/30/10 13m 0h $0
1PD1135 Design High Temp Enclosure 10m 4/1/10 1/26/11 8m 0h $0
1PD1080 Update/Maintain P&IDs 10m 4/1/10 1/26/11 8m 0h $0
1PD1070 Update/Maintain Process Flow Diagram 10m 4/1/10 1/26/11 8m 0h $0
1PD1030 Develop Equipment Design 10m 4/1/10 1/26/11 8m 0h $0
1PD2200 Prepare Drawings for Secondary Loop Electrical - 1MW 6m 8/30/10 2/25/11 7m 0h $0
1PD2190 Prepare Drawings for Primary Loop Electrical - 1MW 6m 8/30/10 2/25/11 7m 0h $0
CTF1.1.2.3 Instrument & Process Control 1MW 10m 4/1/10 1/26/11 8m 1316h $184,240
S0970 PD Instrument & Process Ctrl Summary - 1MW CTF 10m 4/1/10 1/26/11 8m 1316h $184,240
1PD2340 PD for Data Collection and Storage System (common 1... 10m 4/1/10 1/26/11 8m 0h $0
1PD2330 PD for Flow Control 10m 4/1/10 1/26/11 8m 0h $0
1PD2320 PD for Pressure Control 10m 4/1/10 1/26/11 8m 0h $0
1PD2310 PD for Temperature Control 10m 4/1/10 1/26/11 8m 0h $0
CTF1.1.3 Final Design - 1MW CTF 12m 10/3/11 9/26/12 36m 10446h $3,803,917
S0520 Final Design Summary - 1MW CTF 12m 10/3/11 9/26/12 36m 0h $0
M2800 Final Design Complete - 1MW 0m 9/26/12 36m 0h $0
CTF1.1.3.1 1MW CTF Design Requirements 8m 10/3/11 5/29/12 40m 220h $30,800
S0890 Final Design Requirements Summary - 1MW CTF 8m 10/3/11 5/29/12 40m 220h $30,800
1FD1490 Final Design Interface w/R&D - 1MW CTF 8m 10/3/11 5/29/12 40m 0h $0
1FD1480 Update/Maintain Design Requirements for Auxiliary Sys... 8m 10/3/11 5/29/12 40m 0h $0
1FD1470 Update/Maintain Design Requirements for 1MW CTF 8m 10/3/11 5/29/12 40m 0h $0
CTF1.1.3.2 Primary and Secondary Loops 1MW 8m 10/3/11 5/29/12 40m 5070h $3,051,277
S0990 FD Primary and Secondary Loop Summary - 1MW CTF 8m 10/3/11 5/29/12 40m 5070h $3,051,277
1FD2650 Complete Electrical Drawings Secondary Loop - 1MW 8m 10/3/11 5/29/12 40m 0h $0
1FD2640 Complete Electrical Drawings for Primary Loop - 1MW 8m 10/3/11 5/29/12 40m 0h $0
1FD2630 Complete Piping Drawings Secondary Loop - 1MW 8m 10/3/11 5/29/12 40m 0h $0
1FD2620 Complete Piping Drawings for Primary Loop - 1MW 8m 10/3/11 5/29/12 40m 0h $0
1FD2600 Develop Construction Specification for Secondary Loop .. 8m 10/3/11 5/29/12 40m 0h $0
1FD2590 Develop Construction Specification for Primary Loop - 1... 8m 10/3/11 5/29/12 40m 0h $0
1FD2570 Finalize Design Description for Test Loop Configurations 4m 10/3/11 1/30/12 44m 0h $0
1FD2550 Finalize Design Description for Secondary Loop 4m 10/3/11 1/30/12 44m 0h $0
1FD2540 Finalize Design Description for Primary Loop 4m 10/3/11 1/30/12 44m 0h $0
1FD2530 Finalize P&IDs 4m 10/3/11 1/30/12 40m 0h $0
1FD2510 Finalize Equipment Specifications 8m 10/3/11 5/29/12 40m 0h $0
CTF1.1.3.3 Instrument & Process Control 1MW 8m 10/3/11 5/29/12 40m 5156h $721,840
S1010 FD Instrument & Process Control Summary - 1MW CTF 8m 10/3/11 5/29/12 40m 5156h $721,840
1FD2790 FD for Data Collection and Storage System (common 1&... 4m 10/3/11 1/30/12 44m 0h $0
1FD2780 FD for Flow Control 4m 1/31/12 5/29/12 40m 0h $0
1FD2770 FD for Pressure Control 4m 1/31/12 5/29/12 40m 0h $0
1FD2760 FD for Temperature Control 4m 1/31/12 5/29/12 40m 0h $0
CTF1.1.4 Long Lead Procurement - 1MW CTF 21m 10/3/11 6/25/13 9m 4000h $3,755,000
1PR1220 Procurement of Long Lead Process Equipment 21m 10/3/11 6/25/13 9m 4000h $3,755,000
CTF1.1.5 Construction - 1MW CTF 22m 10/1/12 7/24/14 14m 2044h $12,386,081
S0540 Construction Summary - 1MW CTF 22m 10/1/12 7/24/14 14m 0h $0
M1130 Construction Complete - 1MW 0m 7/24/14 3m 0h $0
CTF1.1.5.1 1MW Test Loop Installation 20m 10/1/12 5/26/14 5m 1736h $5,862,040
S0810 1MW Test Loop Procurement Summary 12m 10/1/12 9/26/13 6m 1736h $2,233,040
1CN3430 Procure Electrical Power Mat'l for Secondary Loop - 1MW 12m 10/1/12 9/26/13 11m 0h $0
1CN3420 Procure Electrical Power Mat'l for Primary Loop - 1MW 12m 10/1/12 9/26/13 7m 0h $0
Update/Maintain Syst...
Update/Maintain Syst...
Update/Maintain Syst...
Update/Maintain Desi...
Update/Maintain Desi...
Update/Maintain Desi...
Perform Industrial S...
Design High Temp Enc...
Update/Maintain P&ID...
Update/Maintain Proc...
Develop Equipment De...
Prepare Drawings for...
Prepare Drawings for...
1/26/11, CTF1.1.2.3 ...
PD Instrument & Proc...
PD for Data Collecti...
PD for Flow Control
PD for Pressure Cont...
PD for Temperature C...
9/26/12, CTF1.1.3 F...
Final Design Summary
Final Design Complet...
5/29/12, CTF1.1.3.1 ...
Final Design Require...
Final Design Interfa...
Update/Maintain Desi...
Update/Maintain Desi...
5/29/12, CTF1.1.3.2 ...
FD Primary and Secon...
Complete Electrical ...
Complete Electrical ...
Complete Piping Draw...
Complete Piping Draw...
Develop Construction...
Develop Construction...
Finalize Design Desc...
Finalize Design Desc...
Finalize Design Desc...
Finalize P&IDs
Finalize Equipment S...
5/29/12, CTF1.1.3.3 ...
FD Instrument & Proc...
FD for Data Collecti...
FD for Flow Control
FD for Pressure Cont...
FD for Temperature C...
6/25/13, CTF1.1.4 L...
Procurement of Long ...
7/24/14, CTF1.1.5 C...
Construction Summary
Construction Complet...
5/26/14, CTF1.1.5.1 ...
1MW Test Loop Procur...
Procure Electrical P...
Procure Electrical P...
Remaining Level of Effort
Remaining Work
Milestone
Actual Work
Critical Remaining Work
Summary
Page 2 of 9
TASK filter: CTF - Exclude Working Milestones
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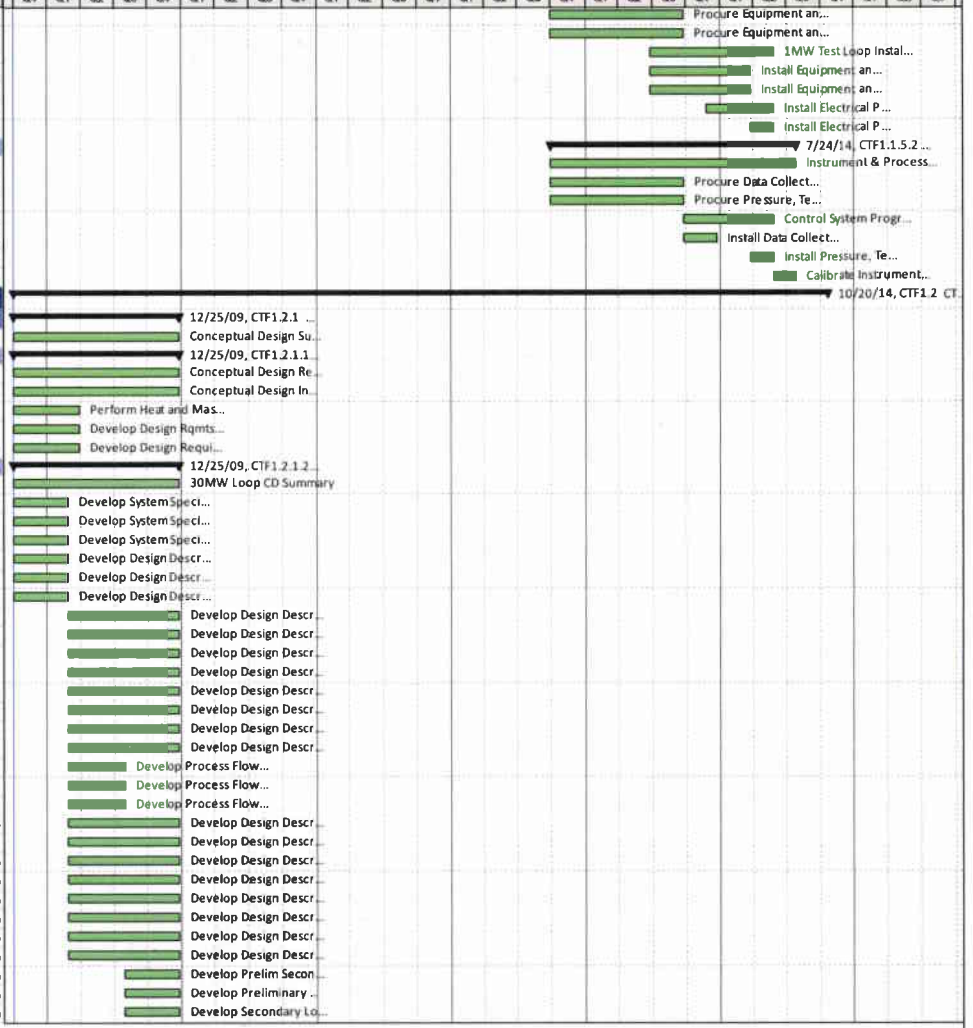
NGNP Component Test Facility (CTF) | CTF Schedule | 3/30/09 13:18

Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
1CN3230	Procure Equipment and Piping for Secondary Loop	12m	10/1/12	9/26/13	6m	0h	$0
1CN3220	Procure Equipment and Piping for Primary Loop	12m	10/1/12	9/26/13	6m	0h	$0
S0820	1MW Test Loop Installation Summary	11m	6/27/13	5/26/14	5m	0h	$3,629,000
1CN3260	Install Equipment and Piping for Secondary Loop	9m	6/27/13	3/26/14	3m	0h	$0
1CN3250	Install Equipment and Piping for Primary Loop	9m	6/27/13	3/26/14	3m	0h	$0
1CN3450	Install Electrical Power for Primary Loop - 1MW	6m	11/26/13	5/26/14	5m	0h	$0
1CN3460	Install Electrical Power for Secondary Loop - 1MW	2m	3/26/14	5/26/14	5m	0h	$0
CTF1.1.5.2	Instrument & Process Control 1MW	22m	10/1/12	7/24/14	14m	308h	$6,524,041
S1030	Instrument & Process Ctrl Install Summary - 1MW CTF	22m	10/1/12	7/24/14	14m	308h	$6,524,041
1CN3480	Procure Data Collection and Storage System (common ...	12m	10/1/12	9/26/13	6m	0h	$0
1CN3400	Procure Pressure, Temperature, Flow Instrumentation	12m	10/1/12	9/26/13	9m	0h	$0
1CN3570	Control System Programming	8m	9/26/13	5/26/14	16m	0h	$0
1CN3410	Install Data Collection and Storage System (common 1&...	3m	9/26/13	12/25/13	6m	0h	$0
1CN3380	Install Pressure, Temperature, Flow Instrumentation	2m	3/26/14	5/26/14	3m	0h	$0
1CN3390	Calibrate Instrumentation	2m	5/26/14	7/24/14	3m	0h	$0
CTF1.2	CTF 30MW	73m	10/1/08	10/20/14	11m	248996h	$239,736,761
CTF1.2.1	Conceptual Design - 30MW CTF	15m	10/1/08	12/25/09	69m	52616h	$7,695,090
S0570	Conceptual Design Summary - 30MW CTF	15m	10/1/08	12/25/09	69m	0h	$0
CTF1.2.1.1	30MW Design Requirements	15m	10/1/08	12/25/09	3m	680h	$99,450
S0740	Conceptual Design Requirements Summary - 30MW	15m	10/1/08	12/25/09	3m	680h	$99,450
2CD1305	Conceptual Design Interface w/R&D - 30MW	15m	10/1/08	12/25/09	3m	0h	$0
2CD1295	Perform Heat and Mass Balance - 30MW	6m	10/1/08	3/30/09	12m	0h	$0
2CD1236	Develop Design Rqmts for 30MW Support Systems	6m	10/1/08	3/30/09	12m	0h	$0
2CD1235	Develop Design Requirements for 30MW Loop	6m	10/1/08	3/30/09	12m	0h	$0
CTF1.2.1.2	30MW Loop CD	15m	10/1/08	12/25/09	69m	43280h	$6,329,700
S0750	30MW Loop CD Summary	15m	10/1/08	12/25/09	69m	0h	$0
2CD1365	Develop System Specification for Tertiary Loop - 30MW	5m	10/1/08	2/27/09	13m	0h	$0
2CD1310	Develop System Specification for Secondary Loop - 30MW	5m	10/1/08	2/27/09	18m	0h	$0
2CD1300	Develop System Specification for Primary Loop - 30MW	5m	10/1/08	2/27/09	18m	0h	$0
2CD1260	Develop Design Description for Tertiary Loop - 30MW	5m	10/1/08	2/27/09	4m	0h	$0
2CD1250	Develop Design Description for Secondary Loop - 30MW	5m	10/1/08	2/27/09	4m	0h	$0
2CD1240	Develop Design Description for Primary Loop - 30MW	5m	10/1/08	2/27/09	4m	0h	$0
2CD2020	Develop Design Description for Secondary Safety, Contr...	10m	2/27/09	12/25/09	69m	0h	$0
2CD1970	Develop Design Description for Primary Safety, Control,...	10m	2/27/09	12/25/09	69m	0h	$0
2CD1960	Develop Design Description/Schematic for Primary Mixi...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1950	Develop Design Description/Schematic for Secondary ...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1940	Develop Design Description/Schematic for Intermediat...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1930	Develop Design Description/Schematic for Hot Gas Duc...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1900	Develop Design Description/Schematic for Primary Heli...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1860	Develop Design Description/Schematic for Water Coole...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1800	Develop Process Flow for Tertiary Loop - 30MW	5m	2/27/09	7/28/09	8m	0h	$0
2CD1790	Develop Process Flow for Secondary Loop - 30MW	5m	2/27/09	7/28/09	8m	0h	$0
2CD1780	Develop Process Flow for Primary Loop - 30MW	5m	2/27/09	7/28/09	7m	0h	$0
2CD1430	Develop Design Description for Deaerator	10m	2/27/09	12/25/09	4m	0h	$0
2CD1420	Develop Design Description for Feed Water Heaters	10m	2/27/09	12/25/09	4m	0h	$0
2CD1410	Develop Design Description for Feed Water Pump	10m	2/27/09	12/25/09	4m	0h	$0
2CD1375	Develop Design Description/Schematic for Steam Gene...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1370	Develop Design Description/Schematic for Secondary H...	10m	2/27/09	12/25/09	4m	0h	$0
2CD1340	Develop Design Description for Condensate Water Tank	10m	2/27/09	12/25/09	4m	0h	$0
2CD1330	Develop Design Description for Condenser	10m	2/27/09	12/25/09	4m	0h	$0
2CD1320	Develop Design Description/Schematic for Heaters/Po...	10m	2/27/09	12/25/09	4m	43280h	$6,329,700
2CD1820	Develop Prelim Secondary Loop Piping/Equipment Layo...	5m	7/29/09	12/25/09	10m	0h	$0
2CD1810	Develop Preliminary Primary Loop Piping/Equip Layouts...	5m	7/29/09	12/25/09	7m	0h	$0
2CD1590	Develop Secondary Loop Piping Specifications	5m	7/29/09	12/25/09	69m	0h	$0



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

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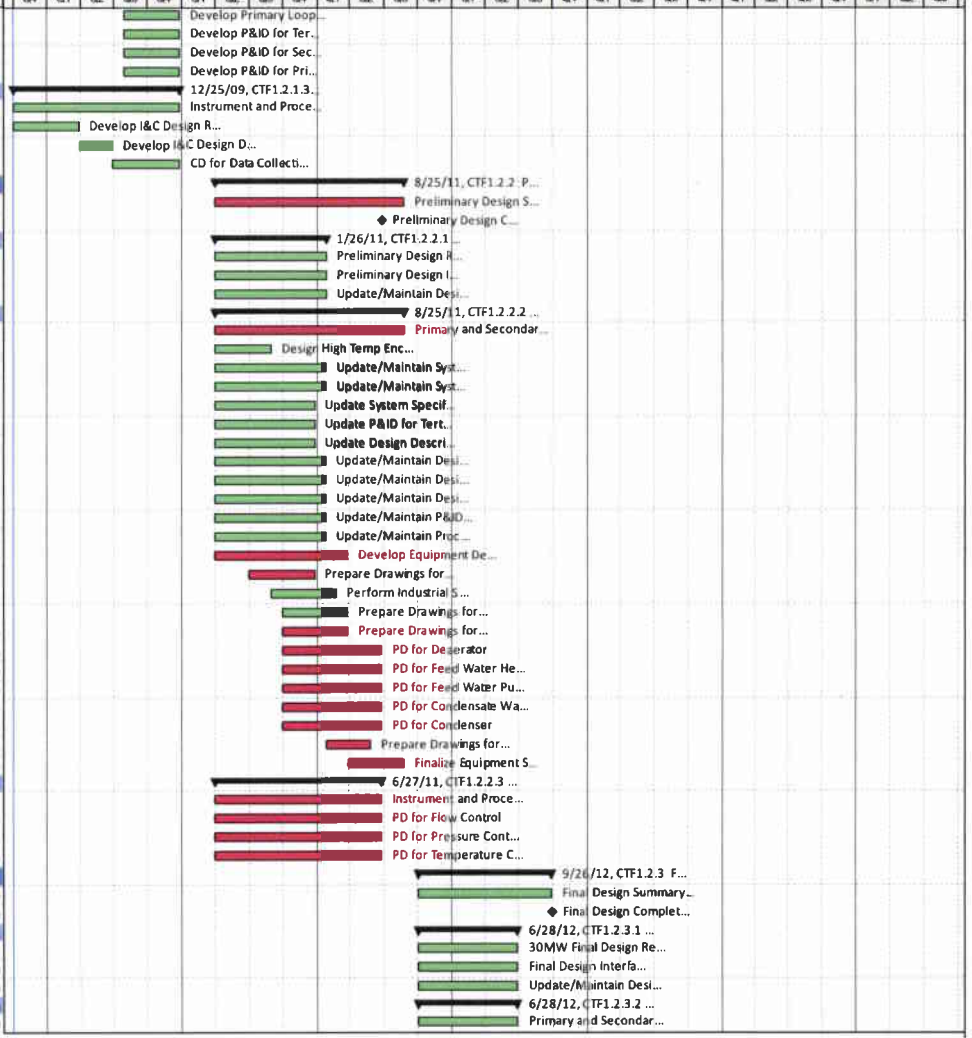
NGNP Component Test Facility (CTF) — CTF Schedule — 3/30/09 13:16

Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
2CD1360	Develop Primary Loop Piping Specifications - 30MW	5m	7/29/09	12/25/09	7m	0h	$0
2CD1290	Develop P&ID for Tertiary Loop - 30MW	5m	7/29/09	12/25/09	8m	0h	$0
2CD1280	Develop P&ID for Secondary Loop - 30MW	5m	7/29/09	12/25/09	8m	0h	$0
2CD1270	Develop P&ID for Primary Loop - 30MW	5m	7/29/09	12/25/09	7m	0h	$0
CTF1.2.1.3	Instrument & Process Control 30MW CD	15m	10/1/08	12/25/09	69m	8656h	$1,265,940
S0800	Instrument and Process Control Summary - 30MW CTF	15m	10/1/08	12/25/09	69m	8656h	$1,265,940
2CD1440	Develop I&C Design Requirements	6m	10/1/08	3/30/09	9m	0h	$0
2CD1480	Develop I&C Design Description	3m	3/31/09	6/29/09	9m	0h	$0
2CD1680	CD for Data Collection and Storage System - 30MW CTF	6m	6/29/09	12/25/09	69m	0h	$0
CTF1.2.2	Preliminary Design - 30MW CTF	17m	4/1/10	8/25/11	1m	78404h	$11,463,851
S0580	Preliminary Design Summary - 30MW CTF	17m	4/1/10	8/25/11	1m	0h	$0
M0640	Preliminary Design Complete - 30MW CTF	0m		6/27/11	0m	0h	$0
CTF1.2.2.1	30MW CTF Design Requirements	10m	4/1/10	1/26/11	5m	500h	$73,061
S0690	Preliminary Design Requirements Summary - 30MW CTF	10m	4/1/10	1/26/11	5m	500h	$73,061
2PD1530	Preliminary Design Interface w/R&D - 30MW	10m	4/1/10	1/26/11	5m	0h	$0
2PD1510	Update/Maintain Design Requirements Docs for 30MW...	10m	4/1/10	1/26/11	5m	0h	$0
CTF1.2.2.2	Primary Secondary Tertiary Loops 30MW	17m	4/1/10	8/25/11	1m	65920h	$9,632,325
S0700	Primary and Secondary Loop PD Summary - 30MW CTF	17m	4/1/10	8/25/11	1m	65920h	$9,632,325
2PD1500	Design High Temp Enclosure	5m	4/1/10	8/30/10	4m	0h	$0
2PD1420	Update/Maintain System Specification for Secondary L...	10m	4/1/10	1/26/11	5m	0h	$0
2PD1410	Update/Maintain System Specification for Primary Loo...	10m	4/1/10	1/26/11	5m	0h	$0
2PD1385	Update System Specification for Tertiary Loop - 30MW	9m	4/1/10	12/28/10	9m	0h	$0
2PD1380	Update P&ID for Tertiary Loop - 30MW	9m	4/1/10	12/28/10	9m	0h	$0
2PD1350	Update Design Description for Tertiary Loop - 30MW	9m	4/1/10	12/28/10	9m	0h	$0
2PD1240	Update/Maintain Design Description for Test Loop Conf...	10m	4/1/10	1/26/11	5m	0h	$0
2PD1210	Update/Maintain Design Description for Primary Loop	10m	4/1/10	1/26/11	5m	0h	$0
2PD1160	Update/Maintain Design Description for Secondary Loop	10m	4/1/10	1/26/11	5m	0h	$0
2PD1100	Update/Maintain P&IDs	10m	4/1/10	1/26/11	5m	0h	$0
2PD1090	Update/Maintain Process Flow Diagram	10m	4/1/10	1/26/11	5m	0h	$0
2PD1040	Develop Equipment Design	12m	4/1/10	3/28/11	1m	0h	$0
2PD2450	Prepare Drawings for Primary Loop Piping - 30MW	6m	6/30/10	12/28/10	1m	0h	$0
2PD1490	Perform Industrial Safety Assessment for HT Enclosure	6m	8/30/10	2/25/11	4m	0h	$0
2PD2470	Prepare Drawings for Primary Loop Electrical - 30MW	6m	9/29/10	3/28/11	3m	0h	$0
2PD2460	Prepare Drawings for Secondary Loop Piping - 30MW	6m	9/29/10	3/28/11	1m	0h	$0
2PD1540	PD for Deaerator	9m	9/29/10	6/27/11	1m	0h	$0
2PD1531	PD for Feed Water Heaters	9m	9/29/10	6/27/11	1m	0h	$0
2PD1501	PD for Feed Water Pump	9m	9/29/10	6/27/11	1m	0h	$0
2PD1400	PD for Condensate Water Tank	9m	9/29/10	6/27/11	1m	0h	$0
2PD1390	PD for Condenser	9m	9/29/10	6/27/11	1m	0h	$0
2PD2480	Prepare Drawings for Secondary Loop Electrical - 30MW	4m	1/27/11	5/26/11	1m	0h	$0
2FD2860	Finalize Equipment Specifications	5m	3/29/11	8/25/11	1m	0h	$0
CTF1.2.2.3	Instrument & Process Control 30MW	15m	4/1/10	6/27/11	0m	11984h	$1,758,465
S0720	Instrument and Process Control PD Summary - 30MW CTF	15m	4/1/10	6/27/11	0m	11984h	$1,758,465
2PD2610	PD for Flow Control	15m	4/1/10	6/27/11	0m	0h	$0
2PD2600	PD for Pressure Control	15m	4/1/10	6/27/11	0m	0h	$0
2PD2590	PD for Temperature Control	15m	4/1/10	6/27/11	0m	0h	$0
CTF1.2.3	Final Design - 30MW CTF	12m	10/3/11	9/26/12	3m	112340h	$16,492,225
S0590	Final Design Summary - 30MW CTF	12m	10/3/11	9/26/12	3m	0h	$0
M0650	Final Design Completed - 30MW CTF	0m		9/26/12	3m	0h	$0
CTF1.2.3.1	30MW CTF Design Requirements	9m	10/3/11	6/28/12	6m	500h	$73,125
S0640	30MW Final Design Requirements Summary - 30MW CTF	9m	10/3/11	6/28/12	6m	500h	$73,125
2FD1550	Final Design Interface w/R&D - 30MW	9m	10/3/11	6/28/12	6m	0h	$0
2FD1530	Update/Maintain Design Requirements for 30MW CTF	9m	10/3/11	6/28/12	6m	0h	$0
CTF1.2.3.2	Primary Secondary Tertiary Loops 30MW	9m	10/3/11	6/28/12	6m	93200h	$13,693,000
S0650	Primary and Secondary FD Summary - 30MW CTF	9m	10/3/11	6/28/12	6m	93200h	$13,693,000

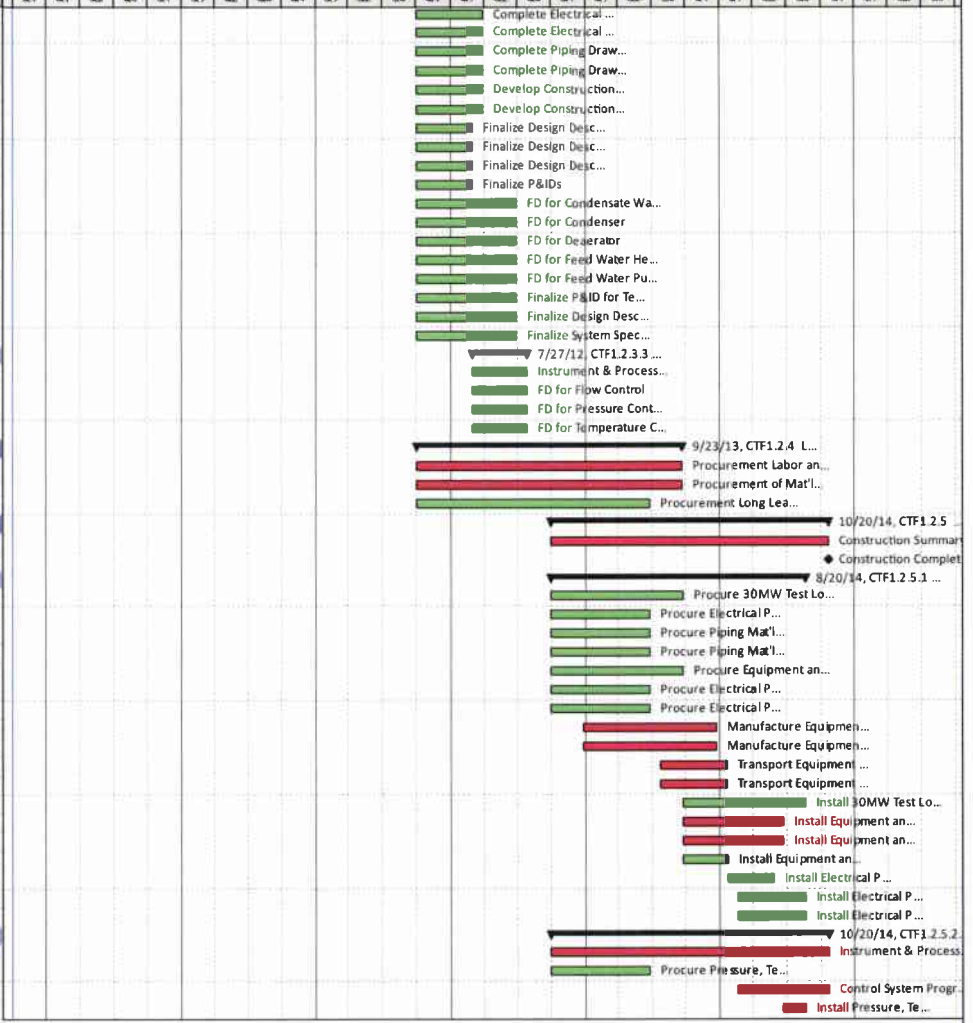


Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

(c) Primavera Systems, Inc.

Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
2FD3110	Complete Electrical Drawings Secondary Loop - 30MW	6m	10/3/11	3/29/12	9m	0h	$0
2FD3100	Complete Electrical Drawings for Primary Loop - 30MW	6m	10/3/11	3/29/12	9m	0h	$0
2FD2950	Complete Piping Drawings Secondary Loop - 30MW	6m	10/3/11	3/29/12	9m	0h	$0
2FD2940	Complete Piping Drawings for Primary Loop - 30MW	6m	10/3/11	3/29/12	9m	0h	$0
2FD2930	Develop Construction Specification for Secondary Loop ..	6m	10/3/11	3/29/12	9m	0h	$0
2FD2920	Develop Construction Specification for Primary Loop - 3..	6m	10/3/11	3/29/12	9m	0h	$0
2FD2910	Finalize Design Description for Test Loop Configurations	5m	10/3/11	2/29/12	10m	0h	$0
2FD2890	Finalize Design Description for Secondary Loop	5m	10/3/11	2/29/12	10m	0h	$0
2FD2880	Finalize Design Description for Primary Loop	5m	10/3/11	2/29/12	10m	0h	$0
2FD2870	Finalize P&IDs	5m	10/3/11	2/29/12	5m	0h	$0
2FD1770	FD for Condensate Water Tank	9m	10/3/11	6/28/12	6m	0h	$0
2FD1760	FD for Condenser	9m	10/3/11	6/28/12	6m	0h	$0
2FD1750	FD for Deaerator	9m	10/3/11	6/28/12	6m	0h	$0
2FD1740	FD for Feed Water Heaters	9m	10/3/11	6/28/12	6m	0h	$0
2FD1730	FD for Feed Water Pump	9m	10/3/11	6/28/12	6m	0h	$0
2FD1720	Finalize P&ID for Tertiary Loop - 30MW	9m	10/3/11	6/28/12	6m	0h	$0
2FD1710	Finalize Design Description for Tertiary Loop - 30MW	9m	10/3/11	6/28/12	6m	0h	$0
2FD1395	Finalize System Specification for Tertiary Loop - 30MW	9m	10/3/11	6/28/12	6m	0h	$0
CTF1.2.3.3	**Instrument & Process Control 30MW**	5m	2/29/12	7/27/12	5m	18640h	$2,726,100
S0670	Instrument & Process Control FD Summary - 30MW CTF	5m	2/29/12	7/27/12	5m	18640h	$2,726,100
2FD3080	FD for Flow Control	5m	2/29/12	7/27/12	5m	0h	$0
2FD3070	FD for Pressure Control	5m	2/29/12	7/27/12	5m	0h	$0
2FD3060	FD for Temperature Control	5m	2/29/12	7/27/12	5m	0h	$0
CTF1.2.4	**Long Lead Procurement - 30MW CTF**	24m	10/3/11	9/23/13	0m	3900h	$133,718,800
S0600	Procurement Labor and Transportation - 30MW CTF	24m	10/3/11	9/23/13	0m	3900h	$6,013,600
2PR1300	Procurement of Mat'l for Electric Heaters EH1, EH2	24m	10/3/11	9/23/13	0m	0h	$71,600,000
2PR1260	Procurement Long Lead Equipment for 30MW CTF	21m	10/3/11	6/25/13	3m	0h	$56,105,000
CTF1.2.5	**Construction - 30MW CTF**	25m	10/1/12	10/20/14	0m	1736h	$70,366,995
S0610	Construction Summary - 30MW CTF	25m	10/1/12	10/20/14	0m	0h	$0
M1140	Construction Complete - 30MW	0m		10/20/14	0m	0h	$0
CTF1.2.5.1	**30MW Test Loop Installation**	23m	10/1/12	8/20/14	2m	1736h	$69,581,040
S3910	Procure 30MW Test Loop Items (Summary)	12m	10/1/12	9/26/13	5m	1736h	$3,235,040
2CN3890	Procure Electrical Power Mat'l for Tertiary Loop - 30MW	9m	10/1/12	6/27/13	12m	0h	$0
2CN3870	Procure Piping Mat'l for Secondary Loop - 30MW	9m	10/1/12	6/27/13	8m	0h	$0
2CN3860	Procure Piping Mat'l for Primary Loop - 30MW	9m	10/1/12	6/27/13	8m	0h	$0
2CN3830	Procure Equipment and Piping Mat'l for Tertiary Loop - ...	12m	10/1/12	9/26/13	5m	0h	$0
2CN3750	Procure Electrical Power Mat'l for Secondary Loop - 30...	9m	10/1/12	6/27/13	10m	0h	$0
2CN3740	Procure Electrical Power Mat'l for Primary Loop - 30MW	9m	10/1/12	6/27/13	10m	0h	$0
2CN3290	Manufacture Equipment for Secondary Loop - 30MW	12m	12/26/12	12/23/13	0m	0h	$0
2CN3280	Manufacture Equipment for Primary Loop - 30MW	12m	12/26/12	12/23/13	0m	0h	$0
2CN3310	Transport Equipment for Secondary Loop - 30MW	6m	7/25/13	1/21/14	0m	0h	$0
2CN3300	Transport Equipment for Primary Loop - 30MW	6m	7/25/13	1/21/14	0m	0h	$0
S3920	Install 30MW Test Loop Items (Summary)	11m	9/24/13	8/20/14	2m	0h	$66,346,000
2CN3780	Install Equipment and Piping for Secondary Loop - 30MW	9m	9/24/13	6/20/14	0m	0h	$0
2CN3770	Install Equipment and Piping for Primary Loop - 30MW	9m	9/24/13	6/20/14	0m	0h	$0
2CN3840	Install Equipment and Piping for Tertiary Loop - 30MW	4m	9/26/13	1/24/14	5m	0h	$0
2CN3850	Install Electrical Power for Tertiary Loop - 30MW	4m	1/24/14	5/26/14	5m	0h	$0
2CN3810	Install Electrical Power for Secondary Loop - 30MW	6m	2/20/14	8/20/14	2m	0h	$0
2CN3800	Install Electrical Power for Primary Loop - 30MW	6m	2/20/14	8/20/14	2m	0h	$0
CTF1.2.5.2	**Instrument & Process Control 30MW**	25m	10/1/12	10/20/14	0m	0h	$785,955
S0840	Instrument & Process Ctrl Construction Summary - 30M...	25m	10/1/12	10/20/14	0m	0h	$785,955
2CN3735	Procure Pressure, Temperature, Flow Instrumentation	9m	10/1/12	6/27/13	12m	0h	$0
2CN3645	Control System Programming	8m	2/20/14	10/20/14	0m	0h	$0
2CN3765	Install Pressure, Temperature, Flow Instrumentation	2m	6/20/14	8/20/14	0m	0h	$0



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

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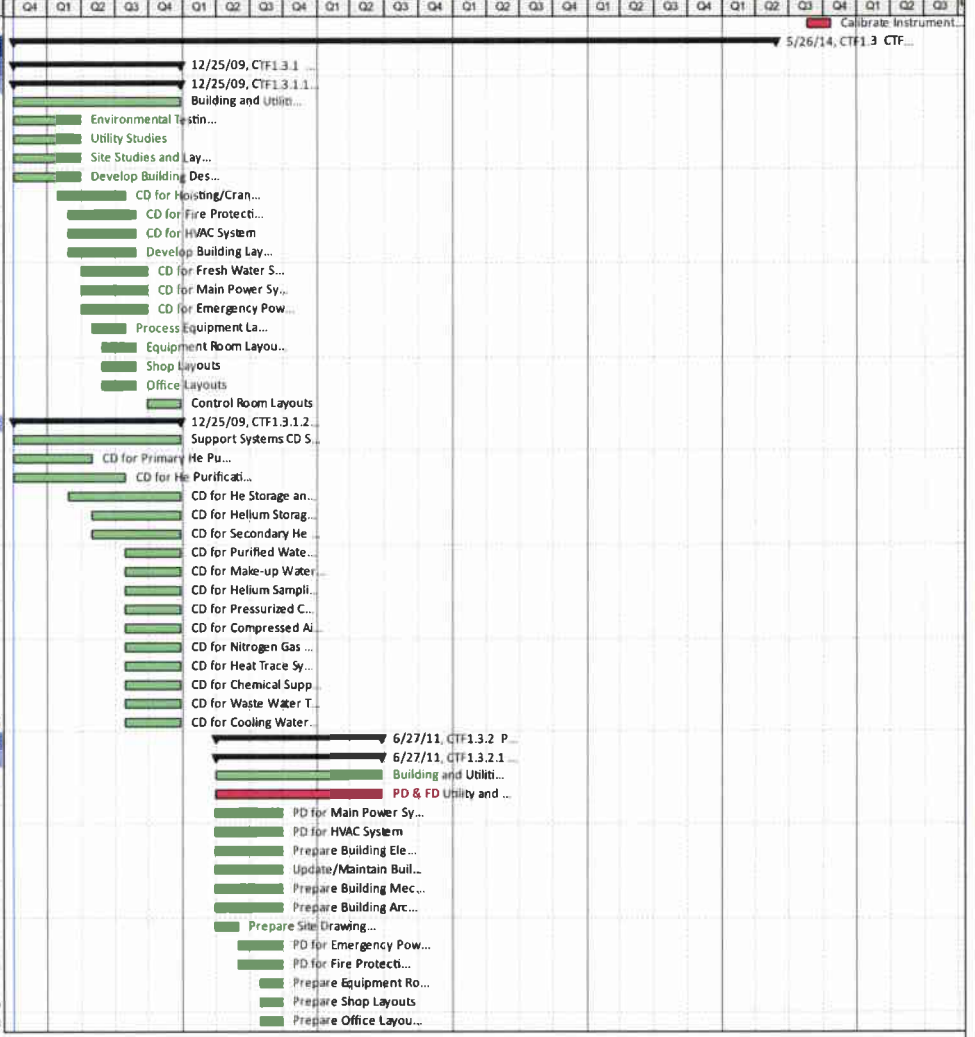
Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
2CN3775	Calibrate Instrumentation	2m	8/20/14	10/20/14	0m	0h	$0
CTF1.3 CTF Building and BOP Systems		69m	10/1/08	5/26/14	16m	104074h	$87,964,795
CTF1.3.1 Conceptual Design		15m	10/1/08	12/25/09	69m	25454h	$3,409,219
CTF1.3.1.1 Building and Utilities CD		15m	10/1/08	12/25/09	3m	14600h	$1,829,130
S0790	Building and Utilities CD Summary	15m	10/1/08	12/25/09	3m	14600h	$1,829,130
1CD1540	Environmental Testing	6m	10/1/08	3/30/09	12m	0h	$0
1CD1520	Utility Studies	6m	10/1/08	3/30/09	6m	0h	$0
1CD1510	Site Studies and Layout	6m	10/1/08	3/30/09	12m	0h	$0
1CD1500	Develop Building Design Requirements	6m	10/1/08	3/30/09	6m	0h	$0
1CD1740	CD for Hoisting/Cranes	6m	1/29/09	7/29/09	8m	0h	$0
1CD1890	CD for Fire Protection System	6m	2/27/09	8/27/09	7m	0h	$0
1CD1830	CD for HVAC System	6m	2/27/09	8/27/09	7m	0h	$0
1CD1530	Develop Building Layout	6m	2/27/09	8/27/09	6m	0h	$0
1CD1980	CD for Fresh Water Supply System	6m	3/31/09	9/25/09	6m	0h	$0
1CD1990	CD for Main Power System	6m	3/31/09	9/28/09	6m	0h	$0
1CD1870	CD for Emergency Power System	6m	3/31/09	9/28/09	6m	0h	$0
1CD1720	Process Equipment Layout	3m	4/29/09	7/29/09	6m	0h	$0
1CD1730	Equipment Room Layout	3m	5/29/09	8/27/09	7m	0h	$0
1CD1710	Shop Layouts	3m	5/29/09	8/27/09	7m	0h	$0
1CD1700	Office Layouts	3m	5/29/09	8/27/09	7m	0h	$0
1CD1690	Control Room Layouts	3m	9/28/09	12/25/09	3m	0h	$0
CTF1.3.1.2 Support Systems CD		15m	10/1/08	12/25/09	69m	10854h	$1,580,089
S0780	Support Systems CD Summary	15m	10/1/08	12/25/09	69m	10854h	$1,580,089
2CD1485	CD for Primary He Purification System 30MW Section (c...	7m	10/1/08	4/29/09	69m	0h	$0
1CD1210	CD for He Purification System (common 1&30MW)	10m	10/1/08	7/28/09	3m	0h	$0
1CD1230	CD for He Storage and Supply System (common 1&30M...	10m	2/27/09	12/25/09	3m	0h	$0
2CD1495	CD for Helium Storage and Supply System 30MW Sectio...	8m	4/29/09	12/25/09	69m	0h	$0
2CD1490	CD for Secondary He Purification System 30MW Section...	8m	4/29/09	12/25/09	69m	0h	$0
2CD1610	CD for Purified Water Production System	5m	7/29/09	12/25/09	69m	0h	$0
2CD1570	CD for Make-up Water System	5m	7/29/09	12/25/09	69m	0h	$0
2CD1470	CD for Helium Sampling System	5m	7/29/09	12/25/09	69m	0h	$0
2CD1450	CD for Pressurized Cooling Water System	5m	7/29/09	12/25/09	69m	0h	$0
1CD1920	CD for Compressed Air System (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
1CD1910	CD for Nitrogen Gas System (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
1CD1880	CD for Heat Trace System (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
1CD1850	CD for Chemical Supply System (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
1CD1820	CD for Waste Water Treatment (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
1CD1790	CD for Cooling Water System (common 1&30MW)	5m	7/29/09	12/25/09	3m	0h	$0
CTF1.3.2 Preliminary Design		15m	4/1/10	6/27/11	3m	31050h	$4,130,659
CTF1.3.2.1 Building and Utilities PD		15m	4/1/10	6/27/11	3m	17700h	$2,201,130
S0730	Building and Utilities PD Summary	15m	4/1/10	6/27/11	3m	17700h	$2,201,130
1PD2240	PD & FD Utility and Bldg Foundation for Early Sitework	15m	4/1/10	6/27/11	0m	0h	$0
1PD2160	PD for Main Power System	6m	4/1/10	9/28/10	12m	0h	$0
1PD2120	PD for HVAC System	6m	4/1/10	9/28/10	12m	0h	$0
1PD2050	Prepare Building Electrical Drawings	6m	4/1/10	9/28/10	12m	0h	$0
1PD2040	Update/Maintain Building Design Requirements	6m	4/1/10	9/28/10	12m	0h	$0
1PD2030	Prepare Building Mechanical Drawings	6m	4/1/10	9/28/10	12m	0h	$0
1PD2010	Prepare Building Architectural Drawings	6m	4/1/10	9/28/10	9m	0h	$0
1PD1770	Prepare Site Drawings	2m	4/1/10	5/31/10	16m	0h	$0
1PD2140	PD for Emergency Power System	4m	6/1/10	9/28/10	12m	0h	$0
1PD2130	PD for Fire Protection System	4m	6/1/10	9/28/10	12m	0h	$0
1PD2100	Prepare Equipment Room Layout	2m	7/30/10	9/28/10	9m	0h	$0
1PD2080	Prepare Shop Layouts	2m	7/30/10	9/28/10	9m	0h	$0
1PD2070	Prepare Office Layouts	2m	7/30/10	9/28/10	9m	0h	$0



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones.

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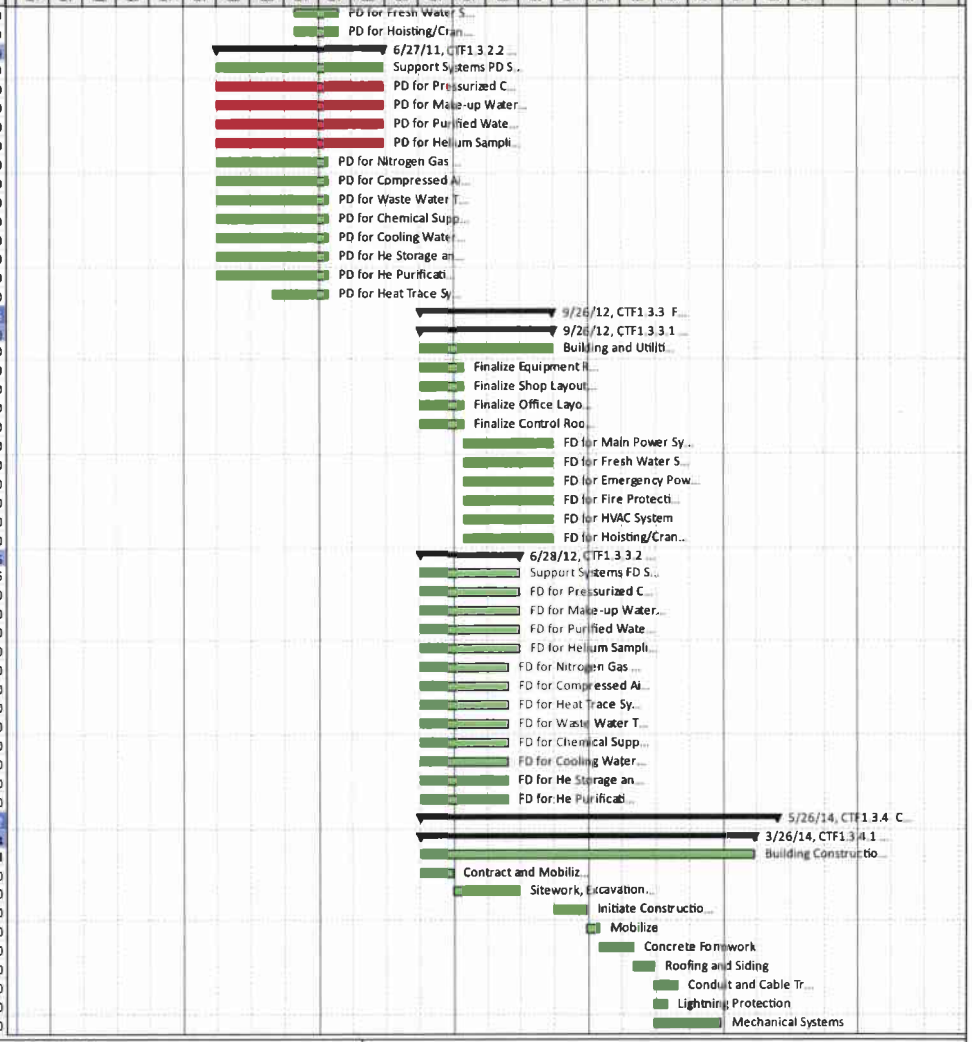
Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
1PD2150	PD for Fresh Water Supply System	4m	10/28/10	2/25/11	4m	0h	$0
1PD2110	PD for Hoisting/Cranes	4m	10/28/10	2/25/11	4m	0h	$0
CTF1.3.2.2	Support Systems PD	15m	4/1/10	6/27/11	3m	13350h	$1,929,529
S0710	Support Systems PD Summary	15m	4/1/10	6/27/11	3m	13350h	$1,929,529
2PD2530	PD for Pressurized Cooling Water System	15m	4/1/10	6/27/11	0m	0h	$0
2PD2520	PD for Make-up Water System	15m	4/1/10	6/27/11	0m	0h	$0
2PD1690	PD for Purified Water Production System	15m	4/1/10	6/27/11	0m	0h	$0
2PD1511	PD for Helium Sampling System	15m	4/1/10	6/27/11	0m	0h	$0
1PD2300	PD for Nitrogen Gas System (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2290	PD for Compressed Air System (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2270	PD for Waste Water Treatment (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2260	PD for Chemical Supply System (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2230	PD for Cooling Water System (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2220	PD for He Storage and Supply System (common 1&30M...	10m	4/1/10	1/26/11	8m	0h	$0
1PD2210	PD for He Purification System (common 1&30MW)	10m	4/1/10	1/26/11	8m	0h	$0
1PD2280	PD for Heat Trace System (common 1&30MW)	5m	8/30/10	1/26/11	8m	0h	$0
CTF1.3.3	Final Design	12m	10/3/11	9/26/12	36m	44442h	$5,897,255
CTF1.3.3.1	Building and Utilities FD	12m	10/3/11	9/26/12	3m	26100h	$3,242,000
S1020	Building and Utilities FD Summary	12m	10/3/11	9/26/12	3m	26100h	$3,242,000
1FD2440	Finalize Equipment Room Layout	4m	10/3/11	1/30/12	3m	0h	$0
1FD2420	Finalize Shop Layouts	4m	10/3/11	1/30/12	3m	0h	$0
1FD2410	Finalize Office Layouts	4m	10/3/11	1/30/12	3m	0h	$0
1FD2400	Finalize Control Room Layouts	4m	10/3/11	1/30/12	3m	0h	$0
1FD2500	FD for Main Power System	8m	1/31/12	9/26/12	3m	0h	$0
1FD2490	FD for Fresh Water Supply System	8m	1/31/12	9/26/12	3m	0h	$0
1FD2480	FD for Emergency Power System	8m	1/31/12	9/26/12	3m	0h	$0
1FD2470	FD for Fire Protection System	8m	1/31/12	9/26/12	3m	0h	$0
1FD2460	FD for HVAC System	8m	1/31/12	9/26/12	3m	0h	$0
1FD2450	FD for Hoisting/Cranes	8m	1/31/12	9/26/12	3m	0h	$0
CTF1.3.3.2	Support Systems FD	9m	10/3/11	6/28/12	39m	18342h	$2,655,255
S0660	Support Systems FD Summary - 30MW CTF	9m	10/3/11	6/28/12	39m	18342h	$2,655,255
2FD3000	FD for Pressurized Cooling Water System	9m	10/3/11	6/28/12	6m	0h	$0
2FD2990	FD for Make-up Water System	9m	10/3/11	6/28/12	6m	0h	$0
2CD1700	FD for Purified Water Production System	9m	10/3/11	6/28/12	6m	0h	$0
2CD1520	FD for Helium Sampling System	9m	10/3/11	6/28/12	6m	0h	$0
1FD2750	FD for Nitrogen Gas System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2740	FD for Compressed Air System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2730	FD for Heat Trace System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2720	FD for Waste Water Treatment (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2710	FD for Chemical Supply System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2680	FD for Cooling Water System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2670	FD for He Storage and Supply System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
1FD2660	FD for He Purification System (common 1&30MW)	8m	10/3/11	5/29/12	40m	0h	$0
CTF1.3.4	Construction	32m	10/3/11	5/26/14	5m	31288h	$74,527,663
CTF1.3.4.1	Building Construction	30m	10/3/11	3/26/14	5m	2380h	$67,446,484
S0830	Building Construction Summary	30m	10/3/11	3/26/14	5m	2380h	$67,446,484
1CN1015	Contract and Mobilize for Early Sitework	3m	10/3/11	12/30/11	6m	0h	$0
1CN1010	Sitework, Excavation, Backfill and Compaction	6m	12/30/11	6/28/12	6m	0h	$0
2CN1115	Initiate Construction and Installation Contracts	3m	10/1/12	12/28/12	3m	0h	$0
2CN1120	Mobilize	1m	12/28/12	1/29/13	3m	0h	$0
2CN1140	Concrete Formwork	3m	1/29/13	4/29/13	3m	0h	$0
2CN1150	Roofing and Siding	2m	4/29/13	6/27/13	3m	0h	$0
2CN1180	Conduit and Cable Tray	2m	6/27/13	8/27/13	5m	0h	$0
2CN1170	Lightning Protection	1m	6/27/13	7/29/13	13m	0h	$0
2CN1160	Mechanical Systems	6m	6/27/13	12/25/13	8m	0h	$0



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

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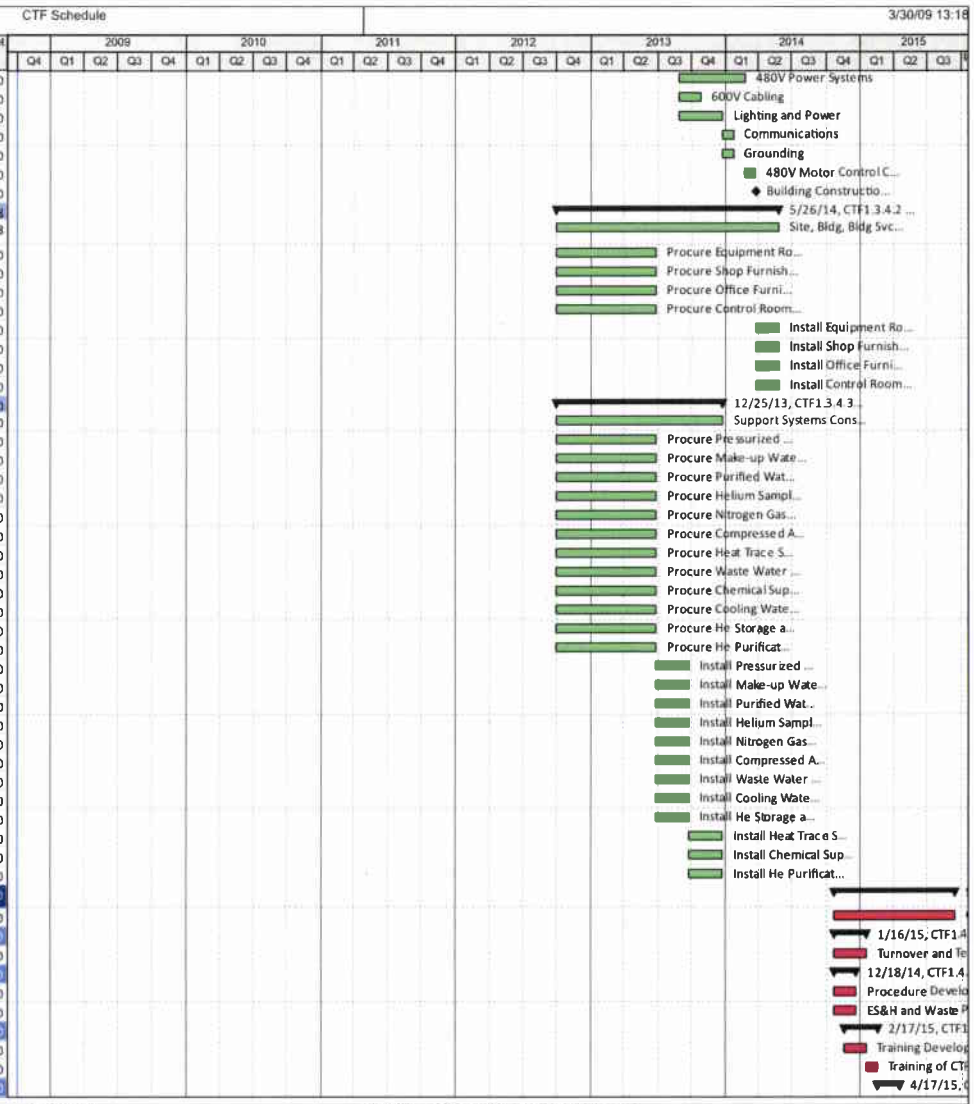
Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
2CN1210	480V Power Systems	6m	8/27/13	2/24/14	5m	0h	$0
2CN1200	600V Cabling	2m	8/27/13	10/25/13	10m	0h	$0
2CN1190	Lighting and Power	4m	8/27/13	12/25/13	7m	0h	$0
2CN1240	Communications	1m	12/25/13	1/24/14	7m	0h	$0
2CN1230	Grounding	1m	12/25/13	1/24/14	7m	0h	$0
2CN1220	480V Motor Control Center	1m	2/24/14	3/26/14	5m	0h	$0
M1250	Building Construction Complete	0m		3/26/14	5m	0h	$0
CTF1.3.4.2	Building Furnishings	20m	10/1/12	5/26/14	5m	440h	$603,958
S0880	Site, Bldg, Bldg Svcs Construction Summary	20m	10/1/12	5/26/14	5m	440h	$603,958
2CN3170	Procure Equipment Room Furnishings	9m	10/1/12	6/27/13	14m	0h	$0
2CN3160	Procure Shop Furnishings	9m	10/1/12	6/27/13	14m	0h	$0
2CN2740	Procure Office Furnishings	9m	10/1/12	6/27/13	14m	0h	$0
2CN2735	Procure Control Room Furnishings	9m	10/1/12	6/27/13	14m	0h	$0
2CN3190	Install Equipment Room Furnishings	2m	3/26/14	5/26/14	5m	0h	$0
2CN3180	Install Shop Furnishings	2m	3/26/14	5/26/14	5m	0h	$0
2CN2760	Install Office Furnishings	2m	3/26/14	5/26/14	5m	0h	$0
2CN2750	Install Control Room Furnishings	2m	3/26/14	5/26/14	5m	0h	$0
CTF1.3.4.3	Support Systems 1MW	15m	10/1/12	12/25/13	10m	308h	$6,477,220
S1040	Support Systems Construction Summary	15m	10/1/12	12/25/13	10m	308h	$6,477,220
2CN3165	Procure Pressurized Cooling Water System Mat'ls	9m	10/1/12	6/27/13	13m	0h	$0
2CN3155	Procure Make-up Water System Mat'ls	9m	10/1/12	6/27/13	13m	0h	$0
2CN1710	Procure Purified Water Production System Mat'ls	9m	10/1/12	6/27/13	13m	0h	$0
2CN1530	Procure Helium Sampling System Mat'ls	9m	10/1/12	6/27/13	13m	0h	$0
1CN3370	Procure Nitrogen Gas System (common 1&30MW)	9m	10/1/12	6/27/13	10m	0h	$0
1CN3360	Procure Compressed Air System (common 1&30MW)	9m	10/1/12	6/27/13	13m	0h	$0
1CN3350	Procure Heat Trace System (common 1&30MW)	9m	10/1/12	6/27/13	13m	0h	$0
1CN3340	Procure Waste Water Treatment (common 1&30MW)	9m	10/1/12	6/27/13	13m	0h	$0
1CN3330	Procure Chemical Supply System (common 1&30MW)	9m	10/1/12	6/27/13	13m	0h	$0
1CN3320	Procure Cooling Water System (common 1&30MW)	9m	10/1/12	6/27/13	10m	0h	$0
1CN3310	Procure He Storage and Supply System (common 1&30...	9m	10/1/12	6/27/13	10m	0h	$0
1CN3300	Procure He Purification System (common 1&30MW)	9m	10/1/12	6/27/13	13m	0h	$0
2CN3185	Install Pressurized Cooling Water System	3m	6/27/13	9/26/13	13m	0h	$0
2CN3175	Install Make-up Water System	3m	6/27/13	9/26/13	13m	0h	$0
2CN1715	Install Purified Water Production System	3m	6/27/13	9/26/13	13m	0h	$0
2CN1535	Install Helium Sampling System	3m	6/27/13	9/26/13	13m	0h	$0
1CN3560	Install Nitrogen Gas System (common 1&30MW)	3m	6/27/13	9/26/13	10m	0h	$0
1CN3550	Install Compressed Air System (common 1&30MW)	3m	6/27/13	9/26/13	13m	0h	$0
1CN3530	Install Waste Water Treatment (common 1&30MW)	3m	6/27/13	9/26/13	13m	0h	$0
1CN3510	Install Cooling Water System (common 1&30MW)	3m	6/27/13	9/26/13	10m	0h	$0
1CN3500	Install He Storage and Supply System (common 1&30MW)	3m	6/27/13	9/26/13	10m	0h	$0
1CN3540	Install Heat Trace System (common 1&30MW)	3m	9/26/13	12/25/13	10m	0h	$0
1CN3520	Install Chemical Supply System (common 1&30MW)	3m	9/26/13	12/25/13	10m	0h	$0
1CN3490	Install He Purification System (common 1&30MW)	3m	9/26/13	12/25/13	10m	0h	$0
CTF1.4	Commissioning - 1MW & 30MW CTF	11m	10/20/14	9/15/15	0m	22982h	$3,257,480
S0620	Commissioning Summary	11m	10/20/14	9/15/15	0m	0h	$0
CTF1.4.1	Facility Turnover and Testing	3m	10/20/14	1/16/15	0m	8000h	$1,160,000
2CM1220	Turnover and Testing	3m	10/20/14	1/16/15	0m	8000h	$1,160,000
CTF1.4.2	CTF Programs and Procedures	2m	10/20/14	12/18/14	0m	3600h	$904,000
2CM1620	Procedure Development for Operations & Maintenance	2m	10/20/14	12/18/14	0m	1800h	$252,000
2CM1600	ES&H and Waste Program Development	2m	10/20/14	12/18/14	0m	1800h	$252,000
CTF1.4.3	CTF Training	3m	11/19/14	2/17/15	0m	4592h	$642,880
2CM1590	Training Development for Operations	2m	11/19/14	1/16/15	0m	2000h	$280,000
2CM1610	Training of CTF Operators	1m	1/19/15	2/17/15	0m	2592h	$362,880
CTF1.4.4	Readiness Assessment	2m	2/17/15	4/17/15	0m	1940h	$271,600



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones.

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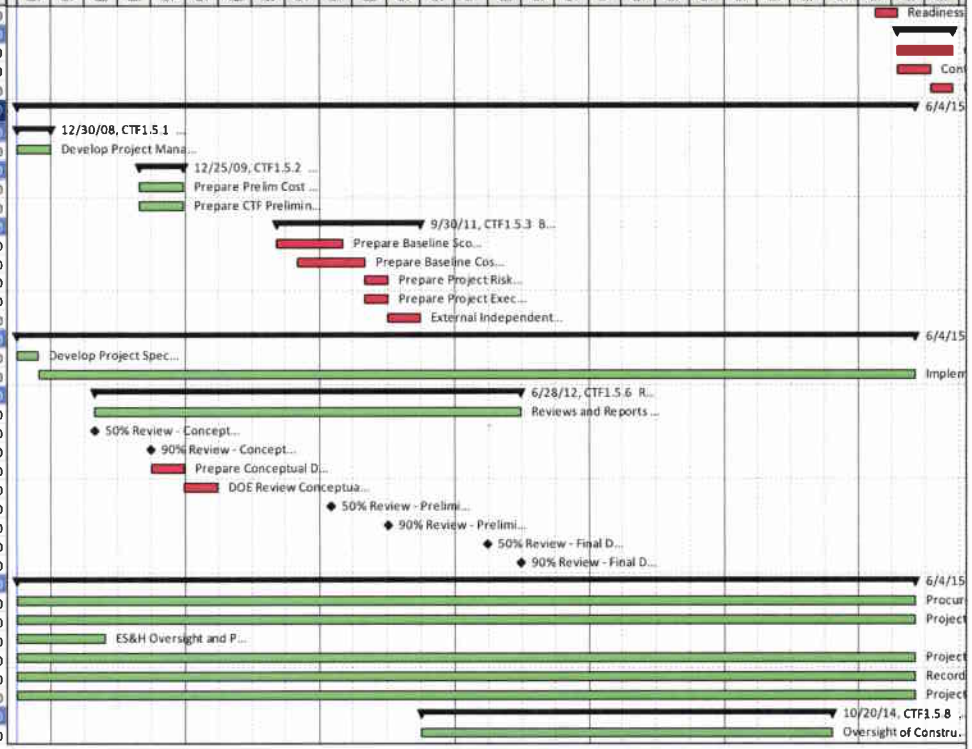
NGNP Component Test Facility (CTF) | CTF Schedule | 3/30/09 13:18

Activity ID	Activity Name	Dur	Start	Finish	Total Float	Budg Hours	Budget
2CM1250	Readiness Assessment and Corrective Actions	2m	2/17/15	4/17/15	0m	1940h	$271,600
CTF1.4.5	Operational Readiness Reviews	5m	4/17/15	9/15/15	0m	4850h	$679,000
S0630	ORR Summary	5m	4/17/15	9/15/15	0m	4850h	$679,000
2CM1260	Contractor ORR and Corrective Actions	3m	4/17/15	7/16/15	0m	0h	$0
2CM1270	DOE ORR and Corrective Actions	2m	7/17/15	9/15/15	0m	0h	$0
CTF1.5	Project Management	81m	10/1/08	6/4/15	3m	211236h	$31,532,680
CTF1.5.1	Project Management Plan	3m	10/1/08	12/30/08	14m	624h	$87,360
3PM960	Develop Project Management Plan	3m	10/1/08	12/30/08	14m	624h	$87,360
CTF1.5.2	Preliminary Schedule and Cost Estimates	4m	8/28/09	12/25/09	3m	2120h	$296,800
3PM995	Prepare Prelim Cost Estimate	4m	8/28/09	12/25/09	3m	1480h	$207,200
3PM980	Prepare CTF Preliminary Schedule	4m	8/28/09	12/25/09	3m	640h	$89,600
CTF1.5.3	Baseline Schedule and Cost Estimates	13m	9/6/10	9/30/11	0m	6716h	$958,040
3PM1000	Prepare Baseline Scope and Schedule	6m	9/6/10	3/4/11	0m	1920h	$268,800
3PM1280	Prepare Baseline Cost Estimate	6m	11/4/10	5/4/11	0m	3840h	$537,600
3PM1060	Prepare Project Risk Assessment (cost, schedule, perfor...	2m	5/4/11	7/4/11	0m	0h	$15,000
3PM1040	Prepare Project Execution Plan	2m	5/4/11	7/4/11	0m	776h	$108,640
3PM1050	External Independent Review and Corrective Actions	3m	7/4/11	9/30/11	0m	200h	$28,000
CTF1.5.5	Project QA Program	81m	10/1/08	6/4/15	3m	760h	$106,400
3PM965	Develop Project Specific QA Program	2m	10/1/08	11/28/08	3m	100h	$14,000
3PM1340	Implement QA Program	79m	12/1/08	6/4/15	3m	660h	$92,400
CTF1.5.6	Reviews and Reports	38m	4/30/09	6/28/12	39m	1076h	$205,640
S0680	Reviews and Reports Summary	38m	4/30/09	6/28/12	39m	0h	$58,000
M0260	50% Review - Conceptual Design	0m	4/30/09		77m	0h	$0
M0270	90% Review - Conceptual Design	0m	9/28/09		72m	0h	$0
3PM975	Prepare Conceptual Design Report	3m	10/1/09	12/30/09	0m	0h	$0
3PM1190	DOE Review Conceptual Design Report	3m	12/30/09	3/31/10	0m	1076h	$150,640
M0280	50% Review - Preliminary Design	0m	2/3/11		56m	0h	$0
M0290	90% Review - Preliminary Design	0m	7/4/11		51m	0h	$0
M0300	50% Review - Final Design	0m	3/30/12		42m	0h	$0
M0310	90% Review - Final Design	0m	6/28/12		39m	0h	$0
CTF1.5.7	Project Support	81m	10/1/08	6/4/15	3m	77280h	$11,881,800
3PM1370	Procurement, IT, Administrative Support	81m	10/1/08	6/4/15	3m	26880h	$3,763,200
3PM1360	Project Level ODCs and Travel	81m	10/1/08	6/4/15	3m	0h	$1,062,600
3PM1350	ES&H Oversight and Permitting	8m	10/1/08	5/28/09	76m	6720h	$940,800
3PM1330	Project Controls Support - Monitoring and Reporting	81m	10/1/08	6/4/15	3m	13440h	$1,881,600
3PM1320	Records Management Support	81m	10/1/08	6/4/15	3m	13440h	$1,881,600
3PM1260	Project Management Staff	81m	10/1/08	6/4/15	3m	16800h	$2,352,000
CTF1.5.8	Oversight of Construction	37m	10/3/11	10/20/14	0m	122640h	$17,993,640
2CN3173	Oversight of Construction	37m	10/3/11	10/20/14	0m	122640h	$17,993,640



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

TASK filter: CTF - Exclude Working Milestones

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Appendix 2 – CTF Spending Plan

CTF Spending Plan (excluding Operations)

WBS #	Title	Budgeted Labor Hours	Budgeted Total Cost	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015
1	NGNP Component Test Facility (CTF)	616332h	$388,750,943	$15,287,592	$13,699,838	$12,075,566	$238,492,331	$97,504,160	$7,213,759	$4,477,697
1.1	**CTF 1MW**	**29044h**	**$26,259,227**	**$2,948,578**	**$2,969,003**	**$396,648**	**$7,332,763**	**$12,593,273**	**$18,962**	
1.1.1	Conceptual Design - 1MW CTF	5948h	$3,102,212	$2,948,578	$153,634					
1.1.2	Preliminary Design - 1MW CTF	6606h	$3,212,017		$2,815,369	$396,648				
1.1.3	Final Design - 1MW CTF	10446h	$3,803,917				$3,803,917			
1.1.4	Long Lead Procurement - 1MW CTF	4000h	$3,755,000				$3,523,682	$231,318		
1.1.5	Construction - 1MW CTF	2044h	$12,386,081				$5,164	$12,361,955	$18,962	
1.2	**CTF 30MW**	**248996h**	**$239,736,761**	**$5,777,098**	**$6,467,944**	**$6,913,899**	**$149,949,940**	**$70,627,880**		
1.2.1	Conceptual Design - 30MW CTF	52616h	$7,695,090	$5,777,098	$1,917,992					
1.2.2	Preliminary Design - 30MW CTF	78404h	$11,463,851		$4,549,952	$6,913,899				
1.2.3	Final Design - 30MW CTF	112340h	$16,492,225				$16,492,225			
1.2.4	Long Lead Procurement - 30MW CTF	3900h	$133,718,600				$133,453,007	$265,593		
1.2.5	Construction - 30MW CTF	1736h	$70,366,995				$4,708	$70,362,287		
1.3	**CTF Building and BOP Systems**	**104074h**	**$87,964,795**	**$2,805,629**	**$2,375,593**	**$2,358,656**	**$73,148,396**	**$7,182,365**	**$94,156**	
1.3.1	Conceptual Design	25454h	$3,409,219	$2,805,629	$603,590					
1.3.2	Preliminary Design	31050h	$4,130,659		$1,772,003	$2,358,656				
1.3.3	Final Design	44442h	$5,897,255				$5,897,255			
1.3.4	Construction	3128h	$74,527,662				$67,251,141	$7,182,365	$94,156	
1.4	**Commissioning - 1MW & 30MW CTF**	**22982h**	**$3,257,480**							**$3,257,480**
1.4.1	Facility Turnover and Testing	8000h	$1,160,000							$1,160,000
1.4.2	CTF Programs and Procedures	3600h	$504,000							$504,000
1.4.3	CTF Training	4592h	$642,880							$642,880
1.4.4	Readiness Assessment	1940h	$271,600							$271,600
1.4.5	Operational Readiness Reviews	4850h	$679,000							$679,000
1.5	**Project Management**	**211236h**	**$31,532,680**	**$3,756,287**	**$1,887,298**	**$2,406,363**	**$8,061,232**	**$7,100,641**	**$7,100,641**	**$1,220,217**
1.5.1	Project Management Plan	624h	$87,360	$87,360						
1.5.2	Preliminary Schedule and Cost Estimates	2120h	$296,800	$89,730	$207,070					
1.5.3	Baseline Schedule and Cost Estimates	6736h	$958,040		$40,633	$917,407				
1.5.4	Reserved	0h	$0							
1.5.5	Project QA Program	760h	$106,400	$25,968	$14,144	$14,144	$14,416	$14,144	$14,144	$9,439
1.5.6	Reviews and Reports	1076h	$208,640	$58,000	$150,640					
1.5.7	Project Support	77280h	$11,881,800	$3,495,228	$1,474,811	$1,474,811	$1,503,173	$1,474,811	$1,474,811	$984,153
1.5.8	Oversight of Construction	122640h	$17,993,640				$6,543,643	$5,611,686	$5,611,686	$226,626

Appendix 3 – WBS Dictionary

WBS	WBS Name	Hours	$ Labor	$ Material	$ Equip.	$ SubCon	ODCs (includes travel)	Total
1	**NGNP Component Test Facility**	**616332**	**$ 85,118,480**	**$ 1,108,000**	**$ 38,598,226**	**$ 254,062,392**	**$ 9,863,844**	**$ 388,750,942**
1.1	**1MW**	**29044**	**$ 4,066,160**	**$ 262,045**	**$ 8,517,868**	**$ 13,015,008**	**$ 398,145**	**$ 26,259,226**
1.1.1	Conceptual Design - 1MWt CTF	5948	$ 832,720	$ -	$ -	$ 2,166,667	$ 102,825	$ 3,102,212
1.1.1.1	1MWt CTF Design Requirements	220	$ 30,800	$ -	$ -	$ -	$ -	$ 30,800
1.1.1.2	Primary and Secondary Loops 1MW	5070	$ 709,800	$ -	$ -	$ 2,166,667	$ 102,825	$ 2,979,292
1.1.1.3	Instrument & Process Control 1MW	658	$ 92,120	$ -	$ -	$ -	$ -	$ 92,120
1.1.2	Preliminary Design - 1MWt CTF	6606	$ 924,840	$ -	$ -	$ 2,166,667	$ 120,510	$ 3,212,017
1.1.2.1	1MWt CTF Design Requirements	220	$ 30,800	$ -	$ -	$ -	$ -	$ 30,800
1.1.2.2	Primary and Secondary Loops 1MW	5070	$ 709,800	$ -	$ -	$ 2,166,667	$ 120,510	$ 2,996,977
1.1.2.3	Instrument & Process Control 1MW	1316	$ 184,240	$ -	$ -	$ -	$ -	$ 184,240
1.1.3	Final Design - 1MWt CTF	10446	$ 1,462,440	$ -	$ -	$ 2,166,667	$ 174,810	$ 3,803,917
1.1.3.1	1MWt CTF Design Requirements	220	$ 30,800	$ -	$ -	$ -	$ -	$ 30,800
1.1.3.2	Primary and Secondary Loops 1MW	5070	$ 709,800	$ -	$ -	$ 2,166,667	$ 174,810	$ 3,051,277
1.1.3.3	Instrument & Process Control 1MW	5156	$ 721,840	$ -	$ -	$ -	$ -	$ 721,840
1.1.4	Long Lead Procurement - 1MWt CTF	4000	$ 560,000	$ -	$ 3,195,000	$ -	$ -	$ 3,755,000
								$ -
1.1.5	Construction - 1MWt CTF	2044	$ 286,160	$ 262,045	$ 5,322,868	$ 6,515,008	$ -	$ 12,386,081
1.1.5.1	1MWt Test Loop Installation	1736	$ 243,040	$ -	$ 1,990,000	$ 3,629,000	$ -	$ 5,862,040
1.1.5.2	Instrument and Process Control 1 & 30 MWt	308	$ 43,120	$ 262,045	$ 3,332,868	$ 2,886,008	$ -	$ 6,524,041
1.2	**30MW**	**248996**	**$ 34,859,440**	**$ 785,955**	**$ 25,792,000**	**$ 171,251,000**	**$ 7,048,366**	**$ 239,736,761**
1.2.1	Conceptual Design - 30MWt CTF	52616	$ 7,366,240	$ -	$ -	$ -	$ 328,850	$ 7,695,090
1.2.1.1	30MWt Design Requirements	680	$ 95,200	$ -	$ -	$ -	$ 4,250	$ 99,450
1.2.1.2	Conceptual Design - 30MWt CTF Primary/Secondary/Tertiary Test Loops	43280	$ 6,059,200	$ -	$ -	$ -	$ 270,500	$ 6,329,700
1.2.1.3	Instrument & Process Control 30MWt CD	8656	$ 1,211,840	$ -	$ -	$ -	$ 54,100	$ 1,265,940
1.2.2	Preliminary Design - 30MWt CTF	78404	$ 10,976,560	$ -	$ -	$ -	$ 487,291	$ 11,463,851
1.2.2.1	30MWt CTF Design Requirements	500	$ 70,000	$ -	$ -	$ -	$ 3,061	$ 73,061
1.2.2.2	Primary Secondary Tertiary Loops 30MW	65920	$ 9,228,800	$ -	$ -	$ -	$ 403,525	$ 9,632,325
1.2.2.3	Instrument & Process Control 30MW	11984	$ 1,677,760	$ -	$ -	$ -	$ 80,705	$ 1,758,465
1.2.3	Final Design - 30MWt CTF	112340	$ 15,727,600	$ -	$ -	$ -	$ 764,625	$ 16,492,225
1.2.3.1	30MWt CTF Design Requirements	500	$ 70,000	$ -	$ -	$ -	$ 3,125	$ 73,125
1.2.3.2	Primary Secondary Tertiary Loops 30MW	93200	$ 13,048,000	$ -	$ -	$ -	$ 645,000	$ 13,693,000
1.2.3.3	Instrument & Process Control 30MW	18640	$ 2,609,600	$ -	$ -	$ -	$ 116,500	$ 2,726,100
1.2.4	Long Lead Procurement - 30MWt	3900	$ 546,000	$ -	$ 22,800,000	$ 104,905,000	$ 5,467,600	$ 133,718,600
								$ -
1.2.5	Construction - 30MWt	1736	$ 243,040	$ 785,955	$ 2,992,000	$ 66,346,000	$ -	$ 70,366,995
1.2.5.1	30MWt Test Loop Installation	1736	$ 243,040	$ -	$ 2,992,000	$ 66,346,000	$ -	$ 69,581,040
1.2.5.2	Instrument & Process Control 30MW	0	$ -	$ 785,955	$ -	$ -	$ -	$ 785,955
1.3	**CTF Building and BOP Systems**	**104074**	**$ 13,402,360**	**$ 20,000**	**$ 4,288,358**	**$ 69,781,384**	**$ 472,693**	**$ 87,964,795**
1.3.1	Conceptual Design	25454	$ 3,271,560	$ -	$ -	$ -	$ 137,659	$ 3,409,219
1.3.1.1	Building and Utilities CD	14600	$ 1,752,000	$ -	$ -	$ -	$ 77,130	$ 1,829,130
1.3.1.2	Support Systems CD	10854	$ 1,519,560	$ -	$ -	$ -	$ 60,529	$ 1,580,089
1.3.2	Preliminary Design	31050	$ 3,993,000	$ -	$ -	$ -	$ 137,659	$ 4,130,659
1.3.2.1	Building and Utilities PD	17700	$ 2,124,000	$ -	$ -	$ -	$ 77,130	$ 2,201,130
1.3.2.2	Support Systems PD	13350	$ 1,869,000	$ -	$ -	$ -	$ 60,529	$ 1,929,529
1.3.3	Final Design	44442	$ 5,699,880	$ -	$ -	$ -	$ 197,375	$ 5,897,255
1.3.3.1	Building and Utilities FD	26100	$ 3,132,000	$ -	$ -	$ -	$ 110,000	$ 3,242,000
1.3.3.2	Support Systems FD	18342	$ 2,567,880	$ -	$ -	$ -	$ 87,375	$ 2,655,255
1.3.4	Construction	3128	$ 437,920	$ 20,000	$ 4,288,358	$ 69,781,384	$ -	$ 74,527,662
1.3.4.1	Building Construction	2380	$ 333,200	$ -	$ -	$ 67,113,284	$ -	$ 67,446,484
1.3.4.2	Building Furnishings	440	$ 61,600	$ 20,000	$ 508,358	$ 14,000	$ -	$ 603,958
1.3.4.3	Support Systems	308	$ 43,120	$ -	$ 3,780,000	$ 2,654,100	$ -	$ 6,477,220
1.4	**Commissioning - 1MWt & 30MWt CTF**	**22982**	**$ 3,217,480**	**$ 40,000**	**$ -**	**$ -**	**$ -**	**$ 3,257,480**
1.4.1	Facility Turnover and Testing	8000	$ 1,120,000	$ 40,000	$ -	$ -	$ -	$ 1,160,000
1.4.2	CTF Programs and Procedures	3600	$ 504,000	$ -	$ -	$ -	$ -	$ 504,000
1.4.3	CTF Training	4592	$ 642,880	$ -	$ -	$ -	$ -	$ 642,880
1.4.4	Readiness Assessment	1940	$ 271,600	$ -	$ -	$ -	$ -	$ 271,600
1.4.5	ORR	4850	$ 679,000	$ -	$ -	$ -	$ -	$ 679,000
1.5	**Project Management**	**211236**	**$ 29,573,040**	**$ -**	**$ -**	**$ 15,000**	**$ 1,944,640**	**$ 31,532,680**
1.5.1	Project Management Plan	624	$ 87,360	$ -	$ -	$ -	$ -	$ 87,360
1.5.2	Preliminary Schedule and Cost Estimates	2120	$ 296,800	$ -	$ -	$ -	$ -	$ 296,800
1.5.3	Baseline Schedule and Cost Estimates	6736	$ 943,040	$ -	$ -	$ 15,000	$ -	$ 958,040
1.5.4	Reserved		$ -	$ -	$ -	$ -	$ -	$ -
1.5.5	Project QA Program	760	$ 106,400	$ -	$ -	$ -	$ -	$ 106,400
1.5.6	Reviews and Reports	1076	$ 150,640	$ -	$ -	$ -	$ 58,000	$ 208,640
1.5.7	Project Support	77280	$ 10,819,200	$ -	$ -	$ -	$ 1,062,600	$ 11,881,800
1.5.8	Oversight of Construction	122640	$ 17,169,600	$ -	$ -	$ -	$ 824,040	$ 17,993,640
1.6	**CTF Operations (not included in total)**	**82000**	**$ 57,400,000**	**$ -**	**$ -**	**$ -**	**$ 34,750,000**	**$ 92,150,000**
							Project Cost	**$ 388,750,942**

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.1	Conceptual Design - 1MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 1 MW CTF Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail (Activity S0500). The design information will include further developed system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. Equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Major equipment and support systems includes: Primary/Secondary Test Loops, First/Second Stage Electric Heater, Recuperator Heat Exchangers, High/Medium/Low Temperatur Heat Exchangers, Circulators, Connecting Pipe/Duct; Control, Isolation, Check and Relief Valves; Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services. Update the associated hardware / equipment cost estimate.

Key Assumptions: It is assumed that the conceptual design of the NGNP indirect steam cycle is developed to the point that the TDRM and test plans for th compact IHX are finalized and that there are no major changes to the CTF design requirements. It is assumed that the revised test conditions (temperature and pressure) will not exceed the design limits in the CTF Preconceptual Design report. It is assumed that the hazards associated with injecting chemicals an dust into the test sections designed for environmental testing of the compact IHX and Helium Purification System can be mitigated without major changes to the CTF Preconceptual Design. Travel costs assume $1500/domestic trip, $5000/international trip.

Risk Elements: Programmatic changes, such as a DOE decision to stop development of the NGNP indirect steam cycle, may eliminate the need for a 1 MW CTF test loop. AREVA and DOE are unable to resolve contract issues related to IP rights.

9. Basis of Estimate

Methodology: Summarize estimates for lower tier WBS elements.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
WBS CTF 1.1.1.1 1MWt Design Requirements	220	$30,800					
WBS CTF 1.1.1.2 Primary and Secondary Loops 1MWt	5070	$709,800			$2,166,667		
WBS CTF 1.1.1.3 Instrument & Process Control 1MWt	658	$92,120					

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.1.1	1MWt CTF Design Requirements		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Update the design requirements developed during the Initial Conceptual Design Phase for the 1 MW CTF Primary and Secondary Test Loops [Activity 1CD1001] and support systems [Activity 1CD1150]. Provide traceability to revised TDRM test plan requirements and MW test loop qualification test requirements [Activity 1CD1011]. Define test section design and interface requirements.

Key Assumptions: This cost and schedule estimate is based on the TDRMs for the indirect heat transfer configuration, which uses an IHX and secondary helium heat transfer loop to a power conversion loop or hydrogen production process. It is assumed that the NGNP indirect steam cycle is developed to the point that the TDRM and IHX test plans can be finalized. It is assumed that the revised test plans do not require redesign of the test loop (e.g., heater vessel to keep the operating conditions (temperature, pressure, chemistry) within the design code limits for the materials identified in the CTF Preconceptual Desigr report. It is also assumed that the design of the IHX and Helium Purification test sections chemical and dust injection systems can meet DOE safety requirements and do not require significant changes to the CTF Conceptual Design. It is assumed that qualification testing of 30 MW test loop equipment does not require operating the 1 MW test loop outside of the operating range identified in the CTF PCDR.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements.
The CTF design requirements may be impacted by the technology development and qualification needs of the baseline configuration, which may not include an IHX. Work on the IHXs (compact one for the hydrogen production loop and tubular for the power conversion loop) may no longer be funded.

9. Basis of Estimate

Methodology: Labor estimate for the conceptual design requirements is based on the level of effort preparing the PCDR requirements document.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Update the CTF System Requirements document							
Principal Engineer	200	$28,000					4
Senior Engineer							
Engineer							
Designer							
Administrative Professionals	20	$2,800					4

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.1.2	Primary and Secondary Loops 1MW		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: The following activities will be accomplished; Develop Equipment Specifications, Develop Process Flow Diagram, Develop P&IDs, Develop Design Description for Primary Loop, Develop Design Description for Secondary Loop, Design Description for Test Sections, Design Description for Test Loop Configurations, Perform Heat/Mass Balance, Develop System Specification for Primary Loop, Develop System Specification for Secondary Loop, System Specification for Transients, Layout for High Temp Piping, Specifications for Low Temp Piping, Preliminary Piping Layouts, Specification of Loop Components.

The $2.16M subcontract cost represent 1/3 of the $6.5M cost to acquire the design rights of the HELITE Loop from AREVA SAS. The $709,800 labor costs includes translation, update to U.S. codes & standards, and modification of original design to include a second loop and provide multiple, parallel test capabilities.

Key Assumptions: The NGNP indirect steam cycle is developed to the point that TDRM and compact IHX test plans can be finalized and test mock-ups and test sections can be designed. It is assumed that the finalized test plans do not specify operating conditions or transients that exceed the design limits identified in the CTF Preconceptual Design report. It is also assumed that the design of the IHX and Helium Purification System test sections chemical and dust injection systems can meet DOE safety requirements without major changes to the CTF Preconceptual Design concept.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements and design.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Principal Engineer	600	$84,000					4
Senior Engineer	1670	$233,800					4
Engineer	1670	$233,800					4
Designer	750	$105,000					4
Administrative Professionals	380	$53,200					4
Travel						$102,825	4
Sub-Contractor Cost (Helite Design)					$2,166,667		4

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.1.3	Instrument and Process Control 1 MW		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Provide conceptual design for temperature, pressure and flow control and monitoring for 1 MW test loop and test sections. This will also include other loop parameters that will need control and monitoring.

Provide conceptual design for computer and data collection and storage system.

Key Assumptions:

1. Commercially available instruments can be used and no R&D is required.
2. Temperature, pressure and flow instruments on the test sections is not provided. They will be provided by the supplier of the test sections.

Risk Elements:

We may not be able to find commercially available instruments for high temperature helium gas application.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task 1CD1750, 1CD1760, 1CD1780, CD2000							
Principal Engineer	158	$22,120					4
Senior Engineer	200	$28,000					4
Engineer	300	$42,000					4
Designer							
Administrative Professionals							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.2	Preliminary Design - 1MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 1 MW CTF Preliminary Design by using the design developed during the Conceptual Design phase to further develop the design requirements and detail [Activity S0510]. The design information will include component level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, validation of the hazards analysis, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the equipment specifications further developed. Equipment, component, component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be refined. Major equipment and support systems includes: First/Second Stage Electric Heater, Recuperator Heat Exchangers, High/Medium/Low Temperature Heat Exchangers, Circulators, Connecting Pipe/Duct; Control, Isolation, Check and Relief Valves; Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services. Update the associated hardware / equipment cost estimate.

Key Assumptions: AREVA SAS supplies the high temperature piping, circulator, and heater design and equipment. Revisions to NGNP TDRMs do not have a significant impact on CTF design requirements.

Risk Elements: Negotiation of mutually acceptable terms and conditions between DOE and AREVA SAS for single source equipment.

9. Basis of Estimate

Methodology: Summarize estimates for lower tier WBS elements.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
WBS CTF 1.1.2.1 1MWt CTF Design Requirements	220	$30,800					
WBS CTF 1.1.2.2 Primary & Secondary Loops 1MWt	5070	$709,800			$2,166,667		
WBS CTF 1.1.2.3 Instrument & Process Control 1MWt	1316	$184,240					

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.1.2.1	1MWt CTF Design Requirements		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Update the design requirements developed during the Conceptual Design Phase for the 1 MW CTF Primary and Secondary Test Loops and support systems. Update requirements based on revised TDRM test plan requirements and 1 MW test loop qualification test requirements. Update test mock-up interface requirements.

Key Assumptions: This cost and schedule estimate is based on the TDRMs for the indirect heat transfer configuration, which uses an IHX and secondary helium heat transfer loop to a power conversion loop or hydrogen production process. It is assumed that the NGNP indirect steam cycle is developed to the point that TDRM and test plans can be finalized and the critical SSCs are defined well enough to design the test mock-ups and test sections. It is assumed that the revised test plans for the compact IHX do not require redesign of the test loop (e.g., heater vessel) to keep the operating conditions (temperature, pressure, chemistry) within the design code limits for the materials identified in the CTF Preconceptual Design report. It is also assumed that the design of the test sections which will inject chemicals and dust for environmental testing of the compact IHX and Helium Purification System can meet DOE safety requirements without major changes to the CTF Conceptual Design.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements.
The NGNP baseline reactor heat transfer loop configuration is subject to change. The design of the CTF may be impacted by the technology development and qualification needs of the baseline configuration, which may not include an IHX or secondary helium heat transfer loop. The compact IHX is being developed to provide high temperature heat to the hydrogen process as part of the nuclear hydrogen initiative. The NGNP project may defer work supporting the hydrogen initiative and focus on a lower temperature reactor that requires less R&D.

9. Basis of Estimate

Methodology: Labor estimate for the preliminary design requirements is based on the level of effort preparing the PCDR requirements document.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Update CTF systems requirements document							
Principal Engineer	200	$28,000					4
Senior Engineer							
Engineer							
Designer							
Administrative Professionals	20	$2,800					4

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.2.2	Primary and Secondary Loops 1MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: The following activities will be accomplished; Perform Industrial Safety Assessment for HT Enclosure, Design High Temp Enclosure, Develop Equipment Design, Update/Maintain Process Flow Diagram, Update/Maintain P&IDs, Update/Maintain Design Description for Primary Loop, Update/Maintain Design Description for Secondary Loop, Update/Maintain Design Description for Test Sections, Update/Maintain Design Description for Test Loop Configuration, Update/Maintain System Specification for Primary Loop, Update/Maintain System Specification for Secondary Loop, Update/Maintain System Specification for Transients, Prepare Drawings for Primary Loop Piping, Prepare Drawings for Secondary Loop Piping, Prepare Drawings for Primary Loop Electrical, Prepare Drawings for Secondary Loop Electrical

The $2.16M subcontract cost represents 1/3 of the $6.5M cost to acquire the design rights of the HELITE Loop from AREVA SAS. The $709,800 labor costs includes updating to U.S. codes & standards, and modification of original design to include a second loop and provide multiple, parallel test capabilities.

Key Assumptions: The NGNP indirect steam cycle is developed to the point that TDRM and compact IHX test plans can be finalized and test mock-ups and test sections can be designed. It is assumed that the finalized test plans do not specify operating conditions or transients that exceed the design limits identified in the CTF Preconceptual Design report. It is also assumed that the design of the IHX and Helium Purification System test sections chemical and dust injection systems can meet DOE safety requirements without major changes to the CTF Preconceptual Design concept.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements and design.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	600	$84,000					4
Senior Engineer	1670	$233,800					4
Engineer	1670	$233,800					4
Designer	750	$105,000					4
Administrative Professionals	380	$53,200					4
Travel						$120,510	4
Sub-Contractor Cost (Helite Design)					$2,166,667		4

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.2.3	Instrument and Process Control 1MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Provide preliminary design for temperature, pressure and flow control and monitoring for 1 MW test loop and test sections. This will also include other loop parameters that will need control and monitoring.

Provide preliminary design for computer and data collection and storage system.

Key Assumptions:

1. Commercially available instruments can be used and no R&D is required.
2. Temperature, pressure and flow instruments on the test sections are not provided. They will be provided by the supplier of the test sections.

Risk Elements:

We may not be able to find commercially available instruments for high temperature helium gas application.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task 1PD2310, 1PD2320, 1PD2330, 1PD2340							
Principal Engineer	300	$42,000					4
Senior Engineer	316	$44,240					4
Engineer	700	$98,000					4
Designer							
Administrative Professionals							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.3	Final Design - 1MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 1 MW CTF Final Design by using the design developed during the Preliminary Design phase to finalize and approve the design requirements and documents [Activity S0520]. The design information will include component level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be finalized. The equipment/component specifications will be finalized to establish the procurement requirements. Building, component, and equipment handling and installation requirements will be finalized. The instrumentation and control systems design and process and data acquisition software will be finalized and approved. Major equipment and support systems includes: First/Second Stage Electric Heater, Recuperator Heat Exchangers, High/Medium/Low Temperature Heat Exchangers, Circulators, Connecting Pipe/Duct; Control, Isolation, Check and Relief Valves; Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services. Update the associated hardware / equipment cost estimate.

Key Assumptions: The CTF was designed to support the development of a high temperature indirect steam cycle NGNP which supports the national nuclear hydrogen initiative. The CTF test loops are designed with flexibility to test critical components of other NGNP heat transfer loop configurations, including a lower temperature NGNP. It is assumed that future revisions to the NGNP TDRMs and test plans, which may include heat transfer configurations that do not use an IHX, do not have a significant impact on CTF design requirements.

Risk Elements: Programmatic changes to the NGNP mission plan. The baseline NGNP configuration is under review. The NGNP R&D needs and test requirements are subject to change and could change the CTF design requirements and impact the design. Development and testing of the IHX may no longer be funded.

9. Basis of Estimate

Methodology: Summarize estimates for lower tier WBS elements.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
WBS CTF 1.1.3.1 1MWt CTF Design Requirements	220	$30,800					
WBS CTF 1.1.3.2 Primary & Secondary Loops 1MW	5070	$709,800			$2,166,667		
WBS CTF 1.1.3.3 Instrument & Process Control 1MW	5156	$721,840					

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.1.3.1	1MWt CTF Design Requirements		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Update the design requirements developed during the Preliminary Design Phase for the 1 MW CTF Primary and Secondary Test Loops and support systems. Update requirements based on revised TDRM test plan requirements and 30 MW test loop qualification test requirements. Update test mock-up interface requirements.

Key Assumptions: It is assumed that the NGNP indirect steam cycle conceptual design is developed to the point that NGNP TDRM and IHX test plans and the design of the IHX is complete enough to order a mock-up and finalize the design requirements for the IHX test section. It is assumed that the final IHX test plans do not include test conditions that would require operating the heater above the temperature limits identified in the CTF Preconceptual Design report. It i also assumed that the design of the IHX and Helium Purification System test section chemical and dust injection systems meet DOE safety requirements.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements.

9. Basis of Estimate

Methodology: Labor estimate for the final design requirements is based on the level of effort preparing the PCDR requirements document.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Update CTF systems requirements document							
Principal Engineer	200	$28,000					4
Senior Engineer							
Engineer							
Designer							
Administrative Professionals	20	$2,800					4

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.3.2	Primary and Secondary Loops 1MW		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: The following activities will be accomplished; Finalize Equipment Specifications, Finalize P&IDs, Finalize Design Description for Primary Loop, Finalize Design Description for Secondary Loop, Finalize Design Description for Test Sections, Finalize Design Description for Test Loop Configurations, Develop Construction Specification for Primary Loop, Develop Construction Specification for Secondary Loop, Complete Piping Drawings for Primary Loop, Complete Piping Drawings Secondary Loop, Complete Electrical Drawings for Primary Loop, Complete Electrical Drawings Secondary Loop

The $2.16M subcontract cost represents 1/3 of the $6.5M cost to acquire the design rights of the HELITE Loop from AREVA SAS. The $709,800 labor cost includes updating to U.S. codes & standards, and modification of original design to include a second loop and provide multiple, parallel test capabilities.

Key Assumptions: The NGNP indirect steam cycle is developed to the point that TDRM and compact IHX test plans can be finalized and test mock-ups and test sections can be designed. It is assumed that the finalized test plans do not specify operating conditions or transients that exceed the design limits identified in the CTF Preconceptual Design report. It is also assumed that the design of the IHX and Helium Purification System test sections chemical and dust injection systems can meet DOE safety requirements without major changes to the CTF Preconceptual Design concept.

Risk Elements: Changes to the NGNP mission and technology development plans could impact the CTF design requirements and design.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Principal Engineer	600	$84,000					4
Senior Engineer	1670	$233,800					4
Engineer	1670	$233,800					4
Designer	750	$105,000					4
Administrative Professionals	380	$53,200					4
Travel						$174,810	3
Sub-Contractor Cost (Helite Design)					$2,166,667		4

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.3.3	Instrument and Process Control 1MW		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Provide final design for temperature, pressure and flow control and monitoring for 1 MW test loop and test sections. This will also include other loop parameters that will need control and monitoring.

Provide final design for computer and data collection and storage system.

Key Assumptions:

1. Commercially available instruments can be used and no R&D is required.
2. Temperature, pressure and flow instruments on the test sections are not provided. They will be provided by the supplier of the test sections.

Risk Elements:

We may not be able to find commercially available instruments for high temperature helium gas application.

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	956	$133,840					4
Senior Engineer	1200	$168,000					4
Engineer	3000	$420,000					4
Designer							
Administrative Professionals							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.4	Long Lead Procurement - 1MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: In order to meet the CTF schedule, equipment with long lead times for delivery must be identified and procured during the 1MW Conceptual Design Phase. This activity will include the development of the procurement specifications and procurement packages, evaluation and approval of suppliers, obtaining BEA and DOE approval, and award of the contracts. The items that have been identified as long lead items for the 1MW CTF include the circulators, hot gas piping, IHX heat exchanger, and electrical transformers rated 1 MVA or higher, Computer & Data Acquisition System, PI system and Simulator

Key Assumptions: Funding for long lead procurements will be available during the Conceptual Design Phase. Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the specifications for the long lead procurement items.

Risk Elements: Funding for long lead procurements is not available when needed. Programmatic changes may make the long lead items obsolete.

9. Basis of Estimate

Methodology: Estimate based on experience from previous projects and preliminary cost information from potential suppliers.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Procurement of Long Lead Items							
Principal Engineer	400	$56,000					3
Senior Engineer	800	$112,000					3
Engineer	1200	$168,000					3
Designer							
Project Manager							
Quality Assurance	100	$14,000					3
Administrative Professionals							
Project Controls							
Records/Document Management	200	$28,000					3
ES&H	300	$42,000					3
Procurement	1000	$140,000					3
1 MWt Loop Equipment Costs (2008 USD)							
Primary Gas Circulator				$500,000			4
Secondary Gas Circulator				$500,000			4
First Stage Heater				$700,000			4
Second Stage Heater				$500,000			4
High Temp HX (Qty-2)				$200,000			4
Low Temp HX (Qty-2)				$50,000			4
Medium Temp HX				$50,000			4
Recuperator (Qty-2)				$100,000			4
Valves (primary & secondary loops)				$300,000			4
Piping (primary & secondary loops)				$80,000			4
Electrical Transformers rated 1MVA or higher				$215,000			4

low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.5	Construct - 1MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Develop the procurement packages, evaluate and approve the suppliers, obtain BEA and DOE approval, and award the contracts to procure the services of the constructor(s), to procure the equipment, components, and materials to install 1 MW Primary and Secondary Test Loops and Instrumentation and Control Systems.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: Summarize estimates for lower tier WBS elements.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
1.1.5.1 1MWt Test Loop Installation	1736	$243,040	$0	$1,990,000	$3,629,000	$0	
1.1.5.2 Instrumentation and Process Control	308	$43,120	$262,045	$3,332,868	$2,886,008	$0	

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.5.1	1MWt Test Loop Installation		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Procure and install the equipment, piping, and electrical power for the 1 MW Primary and Secondary Test Loops.

Activities: procure Primary Loop process equipment and piping; procure Secondary Loop process equipment and piping; procure Test Section process equipment and piping; procure Primary Loop electrical power mat'l; procure Secondary Loop electrical power mat'l; procure Test Section electrical power mat'l.

Activities: install Primary Loop process equipment and piping; install Secondary Loop process equipment and piping; install Test Section process equipment and piping; install electrical power for Primary Loop; install electrical power for Secondary Loop.

Key Assumptions: It is assumed that programmatic changes and changes to the NGNP baseline do not have a significant impact on the NGNP TDRMs and test plans, CTF design requirements, or equipment specifications. Funding is assumed to be available as needed to support the schedule. Major Equipment is provided by the project.

Risk Elements: NGNP mission needs, priorities, and funding are revised annually.

Methodology: Estimate based on experience from previous projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Procurement of 1 MWt Test Loop Constructors							
Principal Engineer	80	$11,200					4
Senior Engineer	80	$11,200					4
Engineer	688	$96,320					4
Designer							
Project Manager							
Quality Assurance	40	$5,600					4
Administrative Professionals							
Project Controls							
Records/Document Management	80	$11,200					4
ES&H	80	$11,200					4
Procurement	688	$96,320					4
Major Equipment Excluding Long Lead Equipment				$1,990,000			4
Installation of 1 MWt Test Loop Items							
Mechanical Constructor					$2,360,000		4
Electrical Constructor					$1,269,000		4

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.1.5.2	Instrument and Process Control 1 & 30 MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Procure materials and contractor to install the computer and data collection and storage system, temperature, pressure and flow control and monitoring for the 1 and 30 MW test loop and test sections. This will also include other loop parameters that will need control and monitoring.

Key Assumptions:

1. Commercially available instruments can be used and no R&D is required.
2. Temperature, pressure and flow instruments on the test sections is not provided. They will be provided by the supplier of the test sections.
3. Major Equipment Provided by the Project.

Risk Elements:

We may not be able to find commercially available instruments for high temperature helium gas application.
Process temperature will need to be reduced to the levels acceptable by the instruments proposed.

9. Basis of Estimate

Methodology: Estimates based on RS Means, experience from previous projects and preliminary cost information from potential suppliers.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Procurement of 1 & 30 MWt I&C Installer							
Principal Engineer	20	$2,800					4
Senior Engineer	40	$5,600					4
Engineer	100	$14,000					4
Designer							
Project Manager							
Quality Assurance	16	$2,240					4
Administrative Professionals							
Project Controls							
Records/Document Management	16	$2,240					4
ES&H	16	$2,240					4
Procurement	100	$14,000					4
MATERIAL							
Temperature elements			$38,625				3
Pressure transmitters			$73,750				3
Flow elements			$149,670				3
Computer & Data Collection System (Shared)							
T3000 DCS Equipment & Engineering				$2,260,980			4
PI System for 3000 IO Points				$371,888			4
Simulator				$700,000			4
I&C Installer					$2,886,008		4

Confidence Level

How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	4. WBS Element Title		
1.2.1	Conceptual Design - 30MWt CTF		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters; High/Low Pressure Heat Exchangers, Hot Gas Mixing Tank, Primary/Secondary Hot Gas Ducts; Water Coolers; Circulators; Control, Isolation, Check and Relief Valves; Nitrogen Supply System, Purified Water System, Make Up Water System, Chemical Supply Systems, Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.
The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp
Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Conceptual Design							
1.2.1.1 30MWt Design Requirements	680	$95,200				$4,250	
1.2.1.2 30MWt Loop CD	43280	$6,059,200				$270,500	
1.2.1.3 Instrument & Process Control 30MWt CD	8656	$1,211,840				$54,100	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.1.1	30MWt CTF Design Requirements		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Further develop and update the 30 MWt CTF Design requirements for the Primary/Secondary/Tertiary Test Loops and support systems that were developed during the Pre-Conceptual Design phase. Also as a part of this activity there is an interface with the TDRM validation to confirm the assumptions made for the testing to be performed at the CTF are still valid or to make adjustments in the CTF design.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Conceptual Design Requirements							
Principal Engineer	40	$5,600					3
Senior Engineer	80	$11,200					3
Engineer	400	$56,000					3
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals	80	$11,200					3
Project Controls							
Records/Document Management							
ES&H	80	$11,200					3
Procurement							
Travel						$4,250	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	4. WBS Element Title		
1.2.1.2	Conceptual Design - 30MWt CTF Primary/Secondary/Tertiary Test Loops		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Conceptual Design for the Primary/Secondary/Tertiary Test Loops by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters; High/Low Pressure Heat Exchangers, Hot Gas Mixing Tank, Primary/Secondary Hot Gas Ducts; Water Coolers; and primary/secondary Circulators.

Key Assumptions: Test Loop Design Duration is 15 Months

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Conceptual Design							
Principal Engineer (1)	960	$134,400					4
Senior Engineer (3)	2880	$403,200					4
Engineer (30)	28800	$4,032,000					4
Designer (9)	8720	$1,220,800					4
Project Manager							
Quality Assurance							
Administrative Professionals	960	$134,400					4
Project Controls							
Records/Document Management	960	$134,400					4
ES&H							
Procurement							
Travel						$270,500	4

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.1.3	Conceptual Design - 30MWt CTF Instrument & Process Control		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Instrument & Process Control Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Major equipment includes: I&C and Data Acquisition systems.

Key Assumptions: Instrument & Process Control Design Duration is 15 Months.

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Conceptual Design							
Principal Engineer							
Senior Engineer (2)	1920	$268,800					4
Engineer (4)	3846	$538,440					4
Designer (2)	1920	$268,800					4
Project Manager							
Quality Assurance							
Administrative Professionals	470	$65,800					4
Project Controls							
Records/Document Management	500	$70,000					4
ES&H							
Procurement							
Travel						$54,100	4

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.2	Preliminary Design - 30MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Preliminary Design by using the design developed during the Conceptual Design phase to further develop the design requirements and detail. The design information will include component level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the equipment specifications updated. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, and instrumentation and control systems, and process and data acquisition software requirements will be refined. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters, IHX Heat Exchanger, Steam Generator, High/Low Pressure Heat Exchangers, Circulators, Control, Isolation, Check and Relief Valves; Purified Water System, Make Up Water System, Helium Sampling System, Pressurized Cooling Water System, Electrical Power System, Building and Building Services.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is also as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.
The basis of the cost estimation are as follows:
(1) MHI input and experience
(2) Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Preliminary Design							
1.2.2.1 30MWt CTF Design Requirements	500	$70,000	0	$0	$0	$0	
1.2.2.2 Primary, Secondary and Tertiary Loops 30MW	65920	$9,228,800	0	$0	$0	$0	
1.2.2.3 Instrument & Process Control 30MW	11984	$1,677,760	0	$0	$0	$0	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.2.1	30MWt CTF Design Requirements		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Further develop and update the 30 MWt CTF Preliminary Design requirements for the Primary/Secondary/Tertiary Test Loops and support systems that were developed during the Conceptual Design phase. Also as a part of this activity there is an interface with the TDRM validation to confirm the assumptions made for the testing to be performed at the CTF are still valid or to make adjustments in the CTF design.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Conceptual Design Phase Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Conceptual Design Requirements							
Principal Engineer	40	$5,600					3
Senior Engineer	40	$5,600					3
Engineer	300	$42,000					3
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals	40	$5,600					3
Project Controls							
Records/Document Management							
ES&H	80	$11,200					3
Procurement							
Travel						$3,061	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.2.2	Primary/Secondary/Tertiary Test Loops 30MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Preliminary Design for the Primary/Secondary/Tertiary Test Loops by using the design developed during the Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters; High/Low Pressure Heat Exchangers, Hot Gas Mixing Tank, Primary/Secondary Hot Gas Ducts; Water Coolers; and primary/secondary Circulators.

Key Assumptions: Test Loop Design Duration is 17 Months

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Conceptual Design Phase. Man-hour cost is momentary value as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Principal Engineer	1462	$204,705					3
Senior Engineer	4387	$614,116					3
Engineer	43865	$6,141,161					3
Designer	13281	$1,859,407					3
Project Manager							
Quality Assurance							
Administrative Professionals	1462	$204,705					4
Project Controls							
Records/Document Management	1462	$204,705					4
ES&H							
Procurement							
Travel						$403,525	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.2.3	Instrument & Process Control 30MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Instrument & Process Control Preliminary Design by using the design developed during the Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Major equipment includes: I&C and Data Acquisition systems.

Key Assumptions: Instrument & Process Control Design Duration is 15 Month.

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Conceptual Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
Conceptual Design							
Principal Engineer							
Senior Engineer	2658	$372,146					3
Engineer	5325	$745,456					3
Designer	2658	$372,146					3
Project Manager							
Quality Assurance							
Administrative Professionals	651	$91,098					4
Project Controls							
Records/Document Management	692	$96,913					4
ES&H							
Procurement							
Travel						$80,705	3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.3	Final Design - 30MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Final Design by using the design developed during the Preliminary Design phase to finalize the design requirements and documents. The design information will include component level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be finalized. The equipment/component specifications will be finalized to establish the procurement requirements. Building, equipment, and component handling and installation requirements, and instrumentation and control systems, and process and data acquisition software requirements will be finalized and approved. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters, IHX Heat Exchanger, Steam Generator, High/Low Pressure Heat Exchangers, Circulators, Control, Isolation, Check and Relief Valves; Purified Water System, Make Up Water System, Helium Sampling System, Pressurized Cooling Water System, Electrical Power System, and Building and Building Services.

Key Assumptions:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Preliminary Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is also as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.
The basis of the cost estimation are as follows:
(1) MHI input and experience
(2) Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Final Design							
1.2.3.1 30MWt CTF Design Requirements	500	$70,000	$0	$0	$0	$0	
1.2.3.2 Primary, Secondary and Tertiary Loops 30MW	93200	$13,048,000	$0	$0	$0	$582,500	
1.2.3.3 Instrument & Process Control 30MW	18640	$2,609,600	$0	$0	$0	$116,500	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.3.1	Conceptual Design - 30MWt CTF Design Requirements		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Further develop and update the 30 MWt CTF Design requirements for the Primary/Secondary/Tertiary Test Loops and support systems that were developed during the Pre-Conceptual Design phase. Also as a part of this activity there is an interface with the TDRM validation to confirm the assumptions made for the testing to be performed at the CTF are still valid or to make adjustments in the CTF design.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Conceptual Design Requirements							
Principal Engineer	40	$5,600					3
Senior Engineer	40	$5,600					3
Engineer	300	$42,000					3
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals	40	$5,600					4
Project Controls							
Records/Document Management							
ES&H	80	$11,200					4
Procurement							
Travel						$3,125	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.3.2	Primary/Secondary/Tertiary Test Loops 30MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Final Design for the Primary/Secondary/Tertiary Test Loops by using the design developed during the Preliminary Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Primary/Secondary/Tertiary Test Loops, First/Second Stage Electric Heaters; High/Low Pressure Heat Exchangers, Hot Gas Mixing Tank, Primary/Secondary Hot Gas Ducts; Water Coolers; and primary/secondary Circulators.

Key Assumptions: Test Loop Design Duration is 9 Months.

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Preliminary Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Preliminary Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	2067	$289,420					3
Senior Engineer	6202	$868,259					3
Engineer	62018	$8,682,588					3
Designer	18778	$2,628,895					3
Project Manager							
Quality Assurance							
Administrative Professionals	2067	$289,420					4
Project Controls							
Records/Document Management	2067	$289,420					4
ES&H							
Procurement							
Travel						$645,000	3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.3.3	Instrument & Process Control 30MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform 30 MWt CTF Instrument & Process Control Final Design by using the design developed during the Preliminary Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Major equipment includes: I&C and Data Acquisition systems.

Key Assumptions: Instrument & Process Control Design Duration is 5 Month.

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Preliminary Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Preliminary Design Phase.

The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Principal Engineer							
Senior Engineer	4135	$578,839					3
Engineer	8282	$1,159,487					3
Designer	4135	$578,839					3
Project Manager							
Quality Assurance							
Administrative Professionals	1012	$141,695					4
Project Controls							
Records/Document Management	1077	$150,739					4
ES&H							
Procurement							
Travel						$116,500	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.4	Long Lead Procurement - 30MWt CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: In order to meet the CTF schedule, equipment with long lead times for delivery must be identified and procured during the 30MWt Conceptual Design Phase. This activity will include the development of the procurement specifications and procurement packages, evaluation and approval of suppliers, obtaining BEA and DOE approval, and award of the contracts. The items that have been identified as long lead items for the 30MWt CTF include the circulators, hot gas piping, steam generator, IHX heat exchanger, and electrical transformers 1 MVA or higher. (additional cost details for the 30MWt CTF Heaters are provided on the following supplemental WBS Sheet, 1.2.4(S).)

Key Assumptions: Funding for Long Lead Procurement will be made available during the Preliminary Design Phase.

Risk Elements: Material cost escalation, unavailability of funds, unavailability of workshop.

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Initial Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is also as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Initial Conceptual Design Phase. Material cost is included in the SubCon column because final shaped material or rough machined material will be delivered to MHI and MHI will perform final machining and assembling.
The bases of the cost estimation are as follows:
(1) Price of material : Current Price as of December, 2008
(2) Exchange rate : ¥100/US$
(3) Delivery conditions: FOB Japan (does not include cost of overseas transportation, construction, licensing/ permitting, start up and testing)
(4) Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp
Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	M$ Final Machining & Assembling	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	400	$56,000					3
Senior Engineer	800	$112,000					3
Engineer	1200	$168,000					3
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals							
Project Controls							
Records/Document Management	200	$28,000					3
ES&H	300	$42,000					3
Procurement	1000	$140,000					3
Components:							
Electric Heater (EH1)				$2,900,000	$29,500,000		3
Electric Heater (EH2)				$2,800,000	$36,400,000		3
Water Cooler (WC1)				$1,600,000	$3,100,000		3
Water Cooler (WC2)				$1,700,000	$3,600,000		3
Primary Helium Circulator (PHC)				$1,700,000	$4,500,000		3
Secondary Helium Circulator (SHC)				$1,500,000	$4,200,000		3
Primary Hot Gas Ducts				$6,000,000	$13,600,000		3
Secondary Hot Gas Ducts				$1,600,000	$3,600,000		3
Hot Gas Mixing Tank				$1,200,000	$2,800,000		3
Common Cost				$1,800,000	$500,000		3
International Transportation						$5,467,600	3
Electrical Transformers 1MVA or higher					$3,105,000		3

low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA		2/12/2009	1/16/2009
3. WBS Number	**4. WBS Element Title**		
1.2.4 Supplemental	Long Lead Procurement - 30MWt CTF Heater Cost Details		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: This sheet provides additional cost detail for the 30MWt CTF Heaters included in previous WBS sheet 1.2.4.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Initial Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is also as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Initial Conceptual Design Phase. Material cost is included in the SubCon column because final shaped material or rough machined material will be delivered to MHI and MHI will perform final machining and assembling.
The basis of the cost estimation are as follows:
(1) Price of material : Current Price as of December, 2008
(2) Exchange rate : ¥100/US$
(3) Delivery conditions: FOB Japan (does not include cost of overseas transportation, construction, licensing/ permitting, start up and testing)
(4) Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp
Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	$ Insulation	$ Heater Element	$ Graphite	M$ Final Machining & Assembling	$ Control Board	$ Control High Frequency Filter	$ SubCon	$ Total	Conf. Lvl.
Components:									
Electric Heater (EH1)	2300000	$5,800,000		$2,900,000	$7,300,000	$6,500,000	$7,600,000	$32,400,000	3
Electric Heater (EH2)	2900000	$5,900,000	$6,000,000	$2,800,000	$7,300,000	$6,500,000	$7,800,000	$39,200,000	3

low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.2.5	Construction - 30MWt Test Loop		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: ???????

Key Assumptions: Funding for procurement and installation will be available during the construction phase. Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF System Requirements or equipment specifications.

Risk Elements: NGNP mission, priorities, and funding are revised annually.

9. Basis of Estimate

Methodology: Estimate based on experience from previous projects

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
1.2.5.1 30MWt Test Loop Installation	1736	$243,040	$0	$2,992,000	$66,346,000	$0	
1.2.5.2 Instrument & Process Control 30MW	0	$0	$785,955	$0	$0	$0	
How good is the basis of estimate	low 1	2	3	4	5 high confidence		

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.2.5.1	30MWt Test Loop Installation		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Procure and install the equipment, piping, and electrical power for the 30 MWt Primary and Secondary Test Loops. Activities: procure Primary Loop process equipment and piping; procure Secondary Loop process equipment and piping; procure Test Section process equipment and piping; procure Tertiary Loop process equipment and piping; procure Primary Loop electrical power mat'l; procure Secondary Loop electrical power mat'l; procure Test Section electrical power mat'l.
Activities install Primary Loop process equipment and piping; install Secondary Loop process equipment and piping; install Test Section process equipment and piping; install electrical power for Primary Loop; install electrical power for Secondary Loop; install electrical power for Test Section; install electrical power for Tertiary Loop.

Key Assumptions: Funding for procurement and installation will be available during the construction phase. Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF System Requirements or equipment specifications. Assumed 2 construction contractors (Mechanical and Electrical) will be used. Major equipment will be provided to the constructors. The material (pipe, cable, steel, bolting, etc.), tools, equipment, and labor needed to install the components and construct the building are included in the constructor subcontract cost.

Risk Elements: NGNP mission, priorities, and funding are revised annually.

9. Basis of Estimate

Methodology: Estimate based on experience from previous projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Procurement of 30 MWt Test Loop Constructors							
Principal Engineer	80	$11,200					3
Senior Engineer	80	$11,200					3
Engineer	688	$96,320					3
Designer							
Project Manager							
Quality Assurance	40	$5,600					3
Administrative Professionals							
Project Controls							
Records/Document Management	80	$11,200					3
ES&H	80	$11,200					3
Procurement	688	$96,320					3
Installation of 30 MWt Test Loop Items							
Mechanical Constructor					$42,773,500		3
Electrical Constructor					$23,572,500		3
Non-long lead equipment cost				$2,992,000			3
How good is the basis of estimate	low 1	2	3	4	5 high confidence		

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.2.5.2	Instrumentation and Process Control 30MWt		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:
Procure materials and contractor to install the computer and data collection and storage system, temperature, pressure and flow control and monitoring for the 1 and 30 MWt test loop and test sections. This will also include other loop parameters that will need control and monitoring.

Key Assumptions:
1. Commercially available instruments can be used and no R&D is required.
2. Temperature, pressure and flow instruments on the test sections is not provided. They will be provided by the supplier of the test sections.
3. Major Equipment Provided by the Project.
4. Installation Costs for this element are included in 1.1.5.2.

Risk Elements:
We may not be able to find commercially available instruments for high temperature helium gas application.
Process temperature will need to be reduced to the levels acceptable by the instruments proposed.

9. Basis of Estimate

Methodology: Estimates based on RS Means, experience from previous projects and preliminary cost information from potential suppliers.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
MATERIAL							
Temperature elements			$161,375				3
Pressure transmitters			$244,250				3
Flow elements			$380,330				3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	4. WBS Element Title		
1.3.1	Conceptual Design - Building and BOP Systems		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Perform Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Water Coolers; Circulators; Control, Isolation, Check and Relief Valves; Nitrogen Supply System, Purified Water System, Make Up Water System, Chemical Supply Systems, Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.
The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp
Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
1.3.1.1 Building and Utilities CD	14600	$1,636,800	$0	$0	$0	$0	
1.3.1.2 Support System CD	10854	$1,519,560	0	$0	$0	$0	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.1.1	Building and Utilities CD		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF Site, Building, and Building Services Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include further developed system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Equipment and component handling and installation requirements, instrumentation and control systems, requirements will be further developed. Major equipment and support systems includes: Main Electrical Power System, HVAC, and Building and Building Services. Cooling Water Towers, Emergency Power System, Storm Water, Sanitary Water, Fresh Water, Fire Protection.

Key Assumptions: Conceptual Design - Site, Building, and Building Services Duration is 15 Months

Risk Elements:

9. Basis of Estimate

Methodology: Use of RS Means and past project experience, A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase are filled into the table. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase. The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
Principal Engineer	640	$76,800					
Senior Engineer	2400	$288,000					3
Engineer	7040	$844,800					3
Designer	3520	$422,400					3
Project Manager							
Quality Assurance							
Administrative Professionals	680	$81,600					3
Project Controls							
Records/Document Management	320	$38,400					3
ES&H							
Procurement							
Travel						$77,130	3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.1.2	Support Systems CD		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF Support Systems Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Purified Water System, Make Up Water System, Helium Sampling System, Pressurized Cooling Water System, He Purification System, He Storage and Supply System, Cooling Water System, Chemical Supply System, Waste Water Treatment, Heat Trace System, Compressed Air System, Nitrogen Gas System

Key Assumptions: Support System Design Duration is 15 Months.

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Pre-Conceptual Design Phase. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Pre-Conceptual Design Phase.
The basis of the cost estimation are as follows:
MHI input and experience
Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp
Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
Conceptual Design							
Principal Engineer							
Senior Engineer (2)	1042	$145,880					3
Engineer (12)	5040	$705,600					3
Designer (4)	2572	$360,080					3
Project Manager	1200	$168,000					3
Quality Assurance							
Administrative Professionals	320	$44,800					3
Project Controls	360	$50,400					3
Records/Document Management	320	$44,800					3
ES&H							
Procurement							
Travel						$60,529	3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.2	Preliminary Design - Building and BOP Systems		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform Preliminary Design by using the design developed during the Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed. Water Coolers; Circulators; Control, Isolation, Check and Relief Valves; Nitrogen Supply System, Purified Water System, Make Up Water System, Chemical Supply Systems, Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Conceptual Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Conceptual Design Phase.

The basis of the cost estimation are as follows:

MHI input and experience

Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
1.3.2.1 Building and Utilities PD	17700	$2,124,000	$0	$0	$0	$0	
1.3.2.2 Support Systems PD	13350	$1,869,000	0	$0	$0	$0	

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.2.1	Building and Utilities PD		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Perform CTF Site, Building, and Building Services Preliminary Design by using the design developed during the Conceptual Design phase to further develop the design requirements and detail. Includes Final design for underground utilities and building foundations in support of CD-2/3A submittal. The design information will include further developed system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Equipment and component handling and installation requirements, instrumentation and control systems, requirements will be further developed. Major equipment and support systems includes: Main Electrical Power System, HVAC, and Building and Building Services, Cooling Water Towers, Emergency Power System, Storm Water, Sanitary Water, Fresh Water, and Fire Protection.

Key Assumptions:

Preliminary Design - Site, Building, and Building Services Duration is 15 Months.

Risk Elements:

9. Basis of Estimate

Methodology: Use of RS Means and past project experience.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task							
Principal Engineer							3
Senior Engineer	1041	$124,941					3
Engineer	11106	$1,332,706					3
Designer	5553	$666,353					
Project Manager							
Quality Assurance							
Administrative Professionals							
Project Controls							
Records/Document Management							
ES&H							
Procurement							
Travel						$77,130	3

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.2.2	Support Systems PD		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Perform CTF Support Systems Conceptual Design by using the design developed during the Pre-Conceptual Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Purified Water System, Make Up Water System, Helium Sampling System, Pressurized Cooling Water System, He Purification System, He Storage and Supply System, Cooling Water System, Chemical Supply System, Waste Water Treatment, Heat Trace System, Compressed Air System, Nitrogen Gas System

Key Assumptions: Duration is 15 Months.

Risk Elements:

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Principal Engineer	1230	$172,246					3
Senior Engineer	3673	$514,168					3
Engineer	3673	$514,168					3
Designer	3673	$514,168					3
Administrative Professionals	1102	$154,250					3
Travel						$60,529	3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / MHI			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.3	Final Design - Buildings and Support Systems		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform Final Design by using the design developed during the Preliminary Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements, instrumentation and control systems, and process and data acquisition software requirements will be further developed.

Water Coolers; Circulators; Control, Isolation, Check and Relief Valves; Nitrogen Supply System, Purified Water System, Make Up Water System, Chemical Supply Systems, Helium Purification System, Helium Supply and Storage System, Cooling Water System, Compressed Air System, Electrical Power System, I&C and Data Acquisition, and Building and Building Services.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: A rough estimation value based on the result of the design developed during the Preliminary Design Phase are filled into the table. Material price is as of December 2008 and any escalation is not taken into account. Man-hour cost is as of December 2008 and estimated based on the work volume assumed in accordance with the result of the design developed during the Preliminary Design Phase.

The basis of the cost estimation are as follows:

MHI input and experience

Design code of Pressure Vessel: ASME Sec. VIII Div.1, U-stamp

Note: This cost estimation is on a non-binding basis and submitted only for the purpose of the technical evaluation. Quotation is to be re-estimated at the bidding stage in accordance with material market, final design, and general terms and conditions.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
1.3.3.1 Building and Utilities FD	26100	$3,132,000	$0	$0	$0	$0	
1.3.3.2 Support Systems FD	18342	$2,567,880	$0	$0	$0	$0	

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.3.3.1	Building and Utilities FD		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done:

Perform CTF Site, Building, and Building Services Final Design by using the design developed during the Preliminary Design phase to further develop the design requirements and detail. The design information will include further developed system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Equipment and component handling and installation requirements, instrumentation and control systems, requirements will be further developed. Major equipment and support systems includes: Main Electrical Power System, HVAC, and Building and Building Services, Cooling Water Towers, Emergency Power System, Storm Water, Sanitary Water, Fresh Water, and Fire Protection.

Key Assumptions:

Final Design - Site, Building, and Building Services Duration is 8 Months.

Risk Elements:

9. Basis of Estimate

Methodology: Use of RS Means and past project experience.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task							
Principal Engineer							
Senior Engineer	3930	$471,642					3
Engineer	15721	$1,886,569					3
Designer	5896	$707,464					3
Project Manager							
Quality Assurance							
Administrative Professionals	553	$66,325					3
Project Controls							
Records/Document Management							
ES&H							
Procurement							
Travel						$110,000	3

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.3.2	Support Systems FD		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

Perform CTF Support Systems Final Design by using the design developed during the Preliminary Design phase to further develop the design requirements and detail. The design information will include updated system level equipment lists, design specifications, PFDs and P&IDs, schematics and layouts, and appropriate details of major systems. The technical and functional requirements for performance test (e.g. flow induced vibration, materials performance, and seals leak rates) instrumentation will be updated and the initial equipment specifications developed. Included in the conceptual test loop design will be the identification of any R&D needed for the test loop components. The equipment and component handling and installation requirements will be further developed. Major equipment includes: Purified Water System, Make Up Water System, Helium Sampling System, Pressurized Cooling Water System, He Purification System, He Storage and Supply System, Cooling Water System, Chemical Supply System, Waste Water Treatment, Heat Trace System, Compressed Air System, Nitrogen Gas System.

Key Assumptions: Duration is 9 months.

Risk Elements:

9. Basis of Estimate

Methodology: Use customary and standard engineering practices.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	1690	$236,655					3
Senior Engineer	5046	$706,432					3
Engineer	5046	$706,432					3
Designer	5046	$706,432					3
Administrative Professionals	1514	$211,930					3
Travel						$87,375	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.4	Construction - Building and Support Systems		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Develop the procurement packages, evaluate and approve the suppliers, obtain BEA and DOE approval, and award the contracts to procure the services of the constructor(s), and to procure the equipment, components, and materials to prepare the site, construct the building, install the utilities; fabricate and install the building services, and CTF support systems; and to complete the parking and grounds.
Prepare the site, construct the building, install the utilities; fabricate and install the building services, CTF support systems; and to complete the parking and grounds. Perform testing and turnover of the building, building services, utilities, CTF support systems to confirm the design and procurement requirements have been satisfied.During the construction phase there will be project oversight/support of the construction activities. These include engineering/design change control, Construction Management, ES&H, QA, Project Controls, Administrative Support, Procurement, Records/Document Management, and Information Technology.

Key Assumptions: 30MWt Construction phase overlaps 1MWt Construction Phase, 30MWt Construction Phase goes 17 Months after 1MWt Construction Phase ends

Risk Elements:

9. Basis of Estimate

Methodology: 1.The project scope and methodologies for this estimate were prepared from pre-conceptual design documents and input from project team. 2.The NGNP Preliminary Design estimate is the basis for the CTF. 3.The CTF buildings are based on the NGNP Radwaste Building (concrete structure) and the NGNP Administration Building (metal sided structural steel).4. Quantities were scaled as necessary to suit the CTF design. 5.Material costs from the NGNP estimate were escalated to current day dollars. 6.Labor hours from the NGNP estimate were used as is. All were factored for productivity. Current labor rates were applied. 7. INL provided the craft wage rates in an April 18, 2007 e-mail. 8. Craft labor will work a 4-10's workweek. 9.Cost of overtime is not included. Central Facility Area (CFA) at no cost to the project will accept excavated spoil. Cost of defining, excavating and transporting contaminated soil is not included. 10. Fill material will be furnished to the project at no cost by CFA. 11. Unit pricing, as required, was obtained from RS Means cost data books, "Trade Services Pricing" book, vendor quotes, vendor price lists and historical data. 12. Local vendors were polled for preliminary quotes for supply of concrete, reinforcing steel and structural steel for NGNP.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
1.3.4.1 Building Construction	2380	$333,200	$0	$0	$67,325,806	$0	
1.3.4.2 Building Furnishings	440	$61,600	$20,000	$508,358	$14,000	$0	
1.3.4.3 Support Systems	308	$43,120	$0	$3,780,000	$2,654,100	$0	

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.4.1	Building Construction		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done:

The scope consists of the construction of the Facility Foundation, Excavation & Backfill, C.I.P. Concrete, Metals, Architectural/Interior Finishes, Mechanical, Electrical and site Improvements.

Key Assumptions: 1. The proposed work scope will not exceed the activities and/or quantities as shown on the cost estimating detail sheets.
2. The technical and functional requirements (T&FR's) are included in this cost estimate for this work.
3. All costs are March 2008 dollars.
4. No allowance is included for any unknown existing underground utilities.
5. Landscaping is not included.
6. No allowances for complications due to extreme weather have been included in this estimate.
7. This estimate assumes that a general contractor will be the prime contractor on the project and will subcontract scope as needed.
8. A subsistence allowance is included based on approximately 60% of craft as "travelers".
9. Costs are not included for the removal, testing, boxing and transporting of contaminated soil to the CFA.
10. It has been assumed only one mobilization and demobilization will be needed with no interruption.
11. No monies are included for any governmental fees or permits.
12. Facility power will be taken from local sources.

Risk Elements: A. No detailed design exists for this project. B. Subsurface rock elevations have not been fully identified. Should rock be found in the areas where only soil is assumed to be, this will increase the construction and oversight costs and performance period. C. This project is heavily dependent on cement, steel, copper, and petroleum products.

9. Basis of Estimate

Methodology: 1.The project scope and methodologies for this estimate were prepared from pre-conceptual design documents and input from project team. 2.The NGNP Preliminary Design estimate is the basis for the CTF. 3.The CTF buildings are based on the NGNP Radwaste Building (concrete structure) and the NGNP Administration Building (metal sided structural steel).4. Quantities were scaled as necessary to suit the CTF design. 5.Material costs from the NGNP estimate were escalated to current day dollars. 6.Labor hours from the NGNP estimate were used as is. All were factored for productivity. Current labor rates were applied. 7. INL provided the craft wage rates in an April 18, 200 e-mail. 8. Craft labor will work a 4-10's workweek. 9.Cost of overtime is not included. Central Facility Area (CFA) at no cost to the project will accept excavated spoil. Cost of defining, excavating and transporting contaminated soil is not included. 10. Fill material will be furnished to the project at no cost by CFA. 11. Unit pricing, as required, was obtained from RS Means cost data books, "Trade Services Pricing" book, vendor quotes, vendor price lists and historical data. 12. Local vendors were polled for preliminary quotes for supply of concrete, reinforcing steel and structural steel for NGNP.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Procurement of Building Constructors							
Principal Engineer	80	$11,200					3
Senior Engineer	80	$11,200					3
Engineer	1000	$140,000					3
Designer							
Project Manager							
Quality Assurance	40	$5,600					3
Administrative Professionals							
Project Controls							
Records/Document Management	80	$11,200					3
ES&H	100	$14,000					3
Procurement	1000	$140,000					3
Construction of Building & Building Services							
Foundation, Excavation & Backfill					$620,364		3
C.I.P. Concrete					$39,478,213		3
Metals					$2,922,970		3
Architectural/Interior Finishes					$2,235,439		3
Mechanical					$6,062,629		3
Electrical					$14,765,138		3
Site Improvements					$1,028,531		3

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.3.4.2	Building Furnishings		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Procure and install facility furnishings in the CTF facility.

Key Assumptions: CTF staff consists of ~41 FTEs. One time cost for office furniture, small appliances, shelving, storage cabinets etc. Small tools and equipment are not included in this element.

Risk Elements:

9. Basis of Estimate

Methodology:
RS Means source for office furnishings costs (desks, chairs, file cabinets, PCs etc.).

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Procurement of CTF Furnishings							
Principal Engineer							
Senior Engineer							
Engineer	40	$5,600					3
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals							
Project Controls							
Records/Document Management	80	$11,200					3
ES&H							
Procurement	320	$44,800					3
Procure Control Room Furnishings			$10,000	$5,000			2
Procure Office Furnishings & computers			$2,000	$132,858			2
Procure Shop Furnishings			$6,000	$360,000			2
Procure Equipment Room Furnishings			$2,000	$10,500			2
Install Control Room Furnishings					$1,000		2
Install Office Furnishings					$1,000		2
Install Shop Furnishings					$2,000		2
Install Equipment Room Furnishings					$10,000		2

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.3.4.3	Support Systems		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Procure and install support systems consisting of He purification and storage, chemical supply, heat trace, compressed air, nitrogen gas, make-up water, pressurized cooling water, helium sampling, and purified water production, Primary Helium Purification System; Secondary Helium Purification System, Helium Storage and Supply, Cooling Water System, and Waste Water System. Procure and install electrical connection devices such as variable speed drives, motor starters and disconnects for pump motors, fan motors, compressor motors, and heat trace self regulating cable. Install and connect applicable fluid and gas piping. Provide design support to support both procurement and installation as well as producing design change paper for field modifications.

Key Assumptions: Some of the off-the-shelf equipment/systems may come with their own motor/pump/fan control panels making electrical connections straight forward. Support Systems Installation Duration is 15 Months. Major equipment provided by the project.

Risk Elements: Material cost escalation, unavailability of funds, time to deliver greater than 6 months.

9. Basis of Estimate

Methodology: Estimate based on experience from previous projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer	20	$2,800					3
Senior Engineer	40	$5,600					3
Engineer	100	$14,000					3
Designer							
Project Manager							
Quality Assurance	16	$2,240					3
Administrative Professionals							
Project Controls							
Records/Document Management	16	$2,240					3
ES&H	16	$2,240					3
Procurement	100	$14,000					3
Mechanical Equipment				$3,780,000			2
Mechanical Support Systems Installer					$1,727,665		2
Electrical Support Systems Installer					$926,435		2

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.4.1	CTF - Facility Turnover and Testing		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF turnover and testing activities of the 1MWt and 30MWt Test Loops

Key Assumptions: Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF Mission Requirements. Turnover and testing duration is 3 Months.

Risk Elements: NGNP mission needs, priorities, and funding are revised annually. Late changes to CTF mission needs or design requirements will impact pre-operational testing.

9. Basis of Estimate

Methodology: Experience with similar projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Facility Turnover and Testing of the 1 MWt and 30 MWt Test							
Principal Engineer	80	$11,200					3
Senior Engineer	240	$33,600					3
Engineer (4)	1920	$268,800					3
Tech Specialist (4)	1920	$268,800					3
Mechanics	960	$134,400					3
Electricians	960	$134,400					3
Electrical Foreman	480	$67,200					3
Mechanical foreman	480	$67,200					3
I&C technicians	960	$134,400					3
Materials			$40,000				2

Confidence Level

How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.4.2	CTF Programs and Procedures		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF Programs and Procedures activities including development of ES&H and Waste programs and procedure development for operations.

Key Assumptions: Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF Mission Requirements.

Risk Elements: NGNP mission needs, priorities, and funding are revised annually. Late changes to CTF mission needs or design requirements will impact the number and scope of procedure development.

9. Basis of Estimate

Methodology: Experience with similar projects.

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Develop ES&H and Waste Programs							
Principal Engineer	80	$11,200					3
Senior Engineer	160	$22,400					3
Engineer							
Administrative Professionals	80	$11,200					3
ES&H	320	$44,800					3
Develop Procedures for Operations & Maintenance							
Principal Engineer	80	$11,200					3
Senior Test Engineer	320	$44,800					3
Test Engineer	320	$44,800					3
Administrative Professionals	320	$44,800					3
Plant Engineer	640	$89,600					3
IT	320	$44,800					3
QA	320	$44,800					3
Senior Operator	640	$89,600					3

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	4. WBS Element Title		
1.4.3	CTF Training		
5. Index Line No.	6. Revision No.		7. Revision Date
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF Training activities including development of training for test loop operations and training of test loop operators.

Key Assumptions: Programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF Mission or the number and types of tests planned for the facility.

Risk Elements: NGNP mission needs, priorities, and funding are revised annually. Late changes to CTF mission needs, design or test requirements may impact the training requirements.

9. Basis of Estimate

Methodology: Experience with similar projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Training development for operations							
Principal Engineer	160	$22,400					3
Senior Engineer	640	$89,600					3
Engineer							
Administrative Professionals	160	$22,400					3
Training of CTF operators							
Facility Manager	80	$11,200					3
Senior Test Engineer	160	$22,400					3
Test Engineer	640	$89,600					3
Superintendent	160	$22,400					3
Plant Engineer	160	$22,400					3
Administrative Professionals	32	$4,480					3
Technical Specialist	320	$44,800					3
Maintenance	640	$89,600					3
Operators	960	$134,400					3
IT	160	$22,400					3
QA	160	$22,400					3
ESH	160	$22,400					3

Confidence Level						
How good is the basis of estimate	low 1	2	3	4	5 high confidence	

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.4.4	Readiness Assessment		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform CTF Internal Readiness Assessment.

Key Assumptions: Assumed one month for readiness review (internal preparation, facility inspection, review meeting, and comment resolution) and one month to close corrective actions.

Risk Elements:

9. Basis of Estimate

Methodology: Experience with similar projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Assess 1 & 30MWt Test Loop Readiness							
Principal Engineer	320	$44,800					3
Senior Engineer	500	$70,000					3
Engineer	500	$70,000					3
Senior Operator	500	$70,000					3
Administrative Professionals	120	$16,800					3

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.4.5	Operational Readiness Review		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Provide support for Contractor and DOE Operational Readiness Reviews.
Independent evaluation of the readiness of completed facilities, systems, equipment, procedures, personnel, and supporting and interfacing systems and organizations to begin facility operation. The review focuses on the readiness details associated with turning the facility over to the user, including final startup, testing and balancing mechanical systems.

Key Assumptions: The CTF is not a nuclear or a High Hazard Facility and therefore a modified ORR will be performed.

Risk Elements:

9. Basis of Estimate

Methodology: Experience with similar projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Assess 1 & 30MWt Test Loop Readiness							
Principal Engineer	800	$112,000					3
Senior Engineer	1250	$175,000					3
Engineer	1250	$175,000					3
Senior Operator	1250	$175,000					3
Administrative Professionals	300	$42,000					3

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.1	CTF Project Management Plan		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Fundamental project management principles provide a framework for successful project execution and assuring compliance with DOE O 413.1A. A key element in establishing those principles is the Project Management Plan. This task is to develop, issue, and maintain the CTF Project Management Plan. It includes develop the Project Management Plan and have project team review comments and submit the plan for BEA review and approval, approve the plan, and implement it through the various project procedures. The plan will be updated as needed throughout the life of the project.

Key Assumptions:

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Principal Engineer	24	$3,360					4
Senior Engineer	24	$3,360					4
Engineer	360	$50,400					4
Designer							
Project Manager							
Quality Assurance	24	$3,360					4
Administrative Professionals	80	$11,200					4
Project Controls	24	$3,360					4
Records/Document Management	40	$5,600					4
ES&H	24	$3,360					4
Procurement	24	$3,360					4

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.2	Preliminary Schedule and Cost Estimates		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: This task is to develop cost and schedule estimates from information generated during conceptual design of the 1MWt CTF and the 30MWt CTF facilities. As conceptual design proceeds design engineers will develop estimates for equipment costs and equipment delivery time frames as part of the design process (i.e. Cost engineers will not estimate equipment costs). Cost engineers will estimate the length of pipe and utility runs etc. based on preliminary building and equipment layouts and standard estimating tools such as MEANS. The deliverable is the schedule and cost estimates for the recommended alternative in the conceptual design report and other alternatives that may be presented in the conceptual design report as required by DOE 413.3a. A life-cycle cost estimate will be prepared for the recommended alternative and the other alternatives if that analysis is necessary to support the recommendation.

Key Assumptions: Due to the amount of pre-conceptual design already performed for CTF the alternative evaluation will be minimal. An allowance of 100 hours is assumed for evaluation of alternative cost and schedule.

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Principal Engineer							
Senior Engineer							
Engineer							
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals	200	$28,000					3
Project Controls	1920	$268,800					3
Records/Document Management							
ES&H							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.3	Baseline Schedule and Cost Estimates		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: This task is to develop the baseline cost estimate, resource loaded schedule, and project risk evaluation for the CTF facility as required by DOE 413.3a to support the submittal for CD-2/3A and 3B. Design engineers will provide equipment costs, procurement time frames, and detailed design drawings to the cost engineers who will use construction cost estimating standards such as MEANS to develop detailed estimates to complete the design and construction of the CTF facility. The baseline schedule will use the preliminary schedule as a starting point. The WBS structure and schedule of planned activities will be modified to align with the design phase plans. Cost estimates will be updated to reflect the current design and construction plans. Cost estimates and resources will be loaded into the schedule to determine whether leveling of resources and adjustment of the schedule is necessary and to establish a spending profile for the CTF. A risk evaluation will be performed and contingencies recommended. The deliverables for this task are: 1) a resource loaded schedule, 2) a spending profile by fiscal year, and 3) a risk evaluation and contingency recommendation.

Key Assumptions: Due to the extensive amount of pre-conceptual design effort, the design and associated cost are presumed to be well understood. Design and construction of the 1MWt and 30MWt
loops will be concurrent , co-located, and managed as a single project, requiring a single CD-1, CD-2/3a, CD-3b, and CD4 for the combined test loops.

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
Principal Engineer							
Senior Engineer	400	$56,000					3
Engineer							
Designer							
Project Manager							
Quality Assurance							
Administrative Professionals	576	$80,640					3
Project Controls	5760	$806,400			$15,000		3
Records/Document Management							
ES&H							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.5	CTF Project QA Program		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Fundamental project management principles provide a framework for successful project execution and assuring compliance with DOE O 413.1A. A key element in establishing those principles is the Project Quality Assurance Plan. The CTF Facility and Test Loops themselves are not considered quality affecting. The quality level of test data collected from the operation of the CTF will vary depending on the test, test purpose, and how the test data will be used. The test data collection system will use appropriately calibrated M&TE to ensure the validity of the data. A Project QA Plan was developed during the preparation for the Initial Conceptual Design Phase. This activity is to maintain, update, and implement as necessary through the project life.

Key Assumptions: The CTF Facility and Test Loops are not quality affecting.

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Task #1							
Principal Engineer							
Senior Engineer							
Engineer							
Designer							
Project Manager							
Quality Assurance	600	$84,000					4
Administrative Professionals	160	$22,400					4
Project Controls							
Records/Document Management							
ES&H							

Confidence Level

How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.6	CTF Project Management Reviews and Reports		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: A primary deliverable of the Conceptual Design Phase is the Conceptual Design Report. This task includes the collection of the technical design, schedule, and cost data to develop the Conceptual Design Report. It includes the development of the report, internal project review and comment resolution, submittal to BEA for comment, resolution of BEA comments, and final approval and submittal of the report. Support for Project Review/Interface Meetings for the 50% and 90% design reviews.

Key Assumptions: The CTF Facility and Test Loops are not quality affecting, Project Duration is 82 Months.

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Prepare CD Report							
Principal Engineer	120	$16,800					4
Senior Engineer	120	$16,800					4
Engineer	300	$42,000					4
Designer	160	$22,400					4
Project Manager							
Quality Assurance	24	$3,360					4
Administrative Professionals	160	$22,400					4
Project Controls	120	$16,800					4
Records/Document Management	24	$3,360					4
ES&H	24	$3,360					4
Procurement	24	$3,360					4
Travel for 50 & 90% review meetings						$58,000	4

Confidence Level
How good is the basis of estimate — low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.7	CTF Project Support		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Fundamental project management principles provide a framework for successful project execution and assuring compliance with DOE O 413.1A.. The Project Management/Oversight activities establishes a core staff to provide oversight for the CTF design, construction, commissioning, and turnover. This task includes the following functions: ES&H, Project Controls, contract and subcontract management, project accounting/reporting, records/document management, and Quality Assurance. This activity includes: (1) Development and implementation of the Project Management, ISMS, and Quality Assurance Plans; (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. This also captures the Project Level Travel and ODCs.

Key Assumptions: Project Duration is 82 Months; Construction Duration is 43 Months.

Risk Elements:

9. Basis of Estimate

Methodology: Estimate based on experience from other projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Cont. Lvl.
Task #1							
Principal Engineer							
Senior Engineer							
Engineer							
Designer							
Project Manager	13440	$1,881,600					3
Quality Assurance	3360	$470,400					3
Administrative Professionals	13440	$1,881,600					3
Project Controls	13440	$1,881,600					3
Records/Document Management	13440	$1,881,600					3
ES&H	6720	$940,800					3
Procurement	6720	$940,800					3
IT	6720	$940,800					3
Travel						$1,062,600	3

Confidence Level

How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.5.8	Construct - CTF Oversight		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: During the construction phase there will be project oversight/support of the construction activities. These include engineering/design change control, Construction Management, ES&H, QA, Project Controls, Administrative Support, Procurement, Records/Document Management, and Information Technology.

Key Assumptions: The Construction Phase is 43 Months, No Overtime/backshift is assumed, 6 people will be on temporary living expenses. The remaining will be local personnel.

Risk Elements: NGNP mission, priorities, and funding are revised annually. Severe weather.

9. Basis of Estimate

Methodology: Estimate based on experience from previous projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Principal Engineer							
Senior Engineer	6720	$940,800					3
Engineer (3)	20160	$2,822,400					3
Designer	6720	$940,800					3
Construction Manager	6720	$940,800					3
Construction Superintendent/Engineer (3)	20160	$2,822,400					3
Administrative Professionals(2)	13440	$1,881,600					3
Records/Document Management	6720	$940,800					3
ES&H (2)	13440	$1,881,600					3
QA	1680	$235,200					3
IT	6720	$940,800					3
Procurement (2)	13440	$1,881,600					3
Project Controls	6720	$940,800					3
Temporary living expenses						$824,040	3

Confidence Level
How good is the basis of estimate low 1 2 3 4 5 high confidence

WORK BREAKDOWN STRUCTURE DICTIONARY
WBS ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT			2. Date of Preparation
NGNP CTF / AREVA			2/12/2009
3. WBS Number	**4. WBS Element Title**		
1.6	Operate - CTF		
5. Index Line No.	**6. Revision No.**		**7. Revision Date**
	Rev. 0		

8. Work Statement

Work to be done: Perform NGNP test activities using the 1MWt and 30MWt Test Loops

Key Assumptions: It is assumed that programmatic changes and revisions to the NGNP TDRMs and test plans do not have a significant impact on the CTF Mission. It is assumed that utilization of the 30 MW test loop is front loaded with demonstration tests of critical long lead items.

Risk Elements: NGNP mission needs, priorities, and funding are revised annually.

9. Basis of Estimate

Methodology: Experience with similar projects.

10. Estimate Detail

Description of work	Hours	$ Labor Cost	$ Material	$ Equip.	$ SubCon	$ ODCs	Conf. Lvl.
Operate FY1 [Activity 2OP1640]							
Facility Manager	2000	$280,000					2
Superintendent (2)	4000	$560,000					2
Plant Engineer	2000	$280,000					2
Senior Test Engineer	2000	$280,000					2
Test Engineer (8)	16000	$2,240,000					2
Tech Specialist (4)	8000	$1,120,000					2
Maintenance (8)	16000	$2,240,000					2
Operators (6)	12000	$1,680,000					2
Custodial (4)	8000	$1,120,000					2
ES&H	2000	$280,000					2
QA	2000	$280,000					2
IT	4000	$560,000					2
Administrative	4000	$560,000					2
Equipment, Computers, Calibration Services						$6,950,000	2
FY1 Total $18,430,000							
Operate FY2 [Activity 2OP1650]		$11,480,000				$6,950,000	2
Operate FY3 [Activity 2OP1660]		$11,480,000				$6,950,000	2
Operate FY4 [Activity 2OP1670]		$11,480,000				$6,950,000	2
Operate FY5 [Activity 2OP1680]		$11,480,000				$6,950,000	2

Confidence Level

How good is the basis of estimate low 1 2 3 4 5 high confidence