



WBS 121.5 – Conventional Facilities

CD-1 Documentation

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PIP-II DOE Independent Project Review

12-14 December 2017

In partnership with:

India/DAE

Italy/INFN

UK/STFC

France/CEA/Irfu, CNRS/IN2P3

Charge Questions

Charge Question	Presentation
1. Has the project team documented a carefully considered analysis of alternates that supports the preferred alternate?	Plenary and Design and Scope Breakout
2. Does the conceptual design satisfy the performance requirements?	Design and Scope Breakout
3. Does the conceptual design report and supporting documentaton adequately justify the stated cost range and project duration?	Cost and Schedule Breakout
4. Does the project team have adequate management experience, design skills, and laboratory support to manage all aspects of this project and produce a credible technical, cost, and schedule baseline?	Management Breakout
5. Are the ES&H aspects of the project being properly addressed and is the ES&H planning currently sufficient for this stage of the project?	Plenary
6. Is the documentation required by DOE O413.b for CD-1 approval complete and in good order?	CD-1 Documentation Breakout
7. Is the allocation of the technical scope that will be contributed by international partners sufficiently understood and documented such that the conceptual design and cost range can be relied on?	Plenary
8. Has the project satisfactorily responded to the recommendations from previous reviews?	Plenary

Outline

- CD-1 Requirements
 - One-for-One Replacement Strategy
 - DOE Guiding Principles Strategy
- CD-2 Requirements
 - Project Definition Rating Index (PDRI)

CD-1 Requirements – 413.3B

Prior to CD-1	Approval Authority ²
<ul style="list-style-type: none"> Develop a <u>Risk Management Plan</u> (RMP) and complete an initial risk assessment of a recommended alternative. This may be included in the PEP. For evaluating the Safety-in-Design Strategy, prepare Risk and Opportunity Assessments for input to the RMP. (Refer to DOE G 413.3-7A and DOE-STD-1189-2008.) 	
For projects with a TPC ≥ \$100M, PM will develop an <u>Independent Cost Estimate</u> and/or conduct an <u>Independent Cost Review</u> , as they deem appropriate.	
For projects with a TPC ≥ \$100M, the PMRC will review and analyze the CD and make recommendations to the ESAAB, CF, or PME, as applicable, before approval.	CE ≥ \$750M PME < \$750M
Comply with the <u>One-for-One Replacement</u> legislation (excess space/offset requirement) as mandated in House Report 109-86. (Refer to DOE O 430.1B.)	
For Major System Projects, develop a <u>Design Management Plan</u> that establishes design maturity targets at critical milestones through final design.	
Complete a <u>Conceptual Design</u> .	
<ul style="list-style-type: none"> Document Guiding Principles for Federal Leadership in <u>High Performance and Sustainable Building</u> provisions per EO 13693, Section 3(h), <u>support for the Site or Strategic Sustainability Plan(s)</u> per DOE O 436.1 and/or other sustainability considerations planned in the Conceptual Design Report, Acquisition Strategy, and/or PEP, as appropriate. (Refer to DOE G 413.3-6A.) Conduct a <u>Design Review</u> of the conceptual design with reviewers external to the project. <i>For Hazard Category 1, 2, and 3 nuclear facilities, a <u>Code of Record</u> shall be initiated during the conceptual design.</i> Complete a <u>Conceptual Design Report</u>. Refer to Appendix C, Paragraph 8. 	
Conduct an <u>Analysis of Alternatives</u> (AoA) that is independent of the contractor organization responsible for managing the construction or constructing the capital asset project, for projects with an estimated TPC greater than or equal to the minor construction threshold. For projects with an estimated top-end range less than \$50M, the AoA shall be commensurate with the project cost and complexity. Refer to GAO-15-37.	PME
For Major System Projects, or first-of-a-kind engineering endeavors, conduct a <u>Technology Readiness Assessment</u> and develop a <u>Technology Maturation Plan</u> , as appropriate. At this stage, each critical technology item or system shall achieve a Technology Readiness Level-4 (TRL-4). (Refer to DOE G 413.3-4A.)	PME
Prepare a <u>Preliminary Hazard Analysis Report</u> (PHAR) for facilities that are below the Hazard Category 3 nuclear facility threshold as defined in 10 CFR Part 830, Subpart B.	Field Organization
Develop and implement an <u>Integrated Safety Management Plan</u> into management and work process planning at all levels per DOE G 450.4-1C.	
Establish a <u>Quality Assurance Program</u> (QAP). (Refer to 10 CFR Part 830, Subpart A, DOE O 414.1D, and DOE G 413.3-2.) <i>For nuclear facilities, the applicable national consensus standard shall be NQA-1-2008 (Edition) and NQA-1a-2009 (Addenda).</i>	

CF included in Cost and Schedule Breakout Talk

PIP-II-doc-163

This talk

Separate Breakout Talk

This talk

P2MAC – April 2017

PIP-II-doc-113

PIP-II-doc-107

PIP-II-doc-140

PIP-II-doc-141

PIP-II-doc-142

CD-1 Requirements – 413.3B

Table 2.1 CD-1 Requirements¹

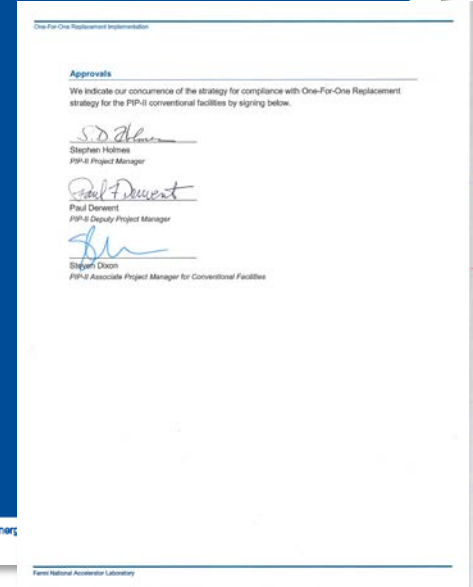
Prior to CD-1	Approval Authority ²
Identify general <u>Safeguards and Security</u> requirements for the recommended alternative. (Refer to DOE O 470.4B, Change 1, and DOE G 413.3-3A.)	
Complete a <u>National Environmental Policy Act (NEPA) Strategy</u> by issuing a determination (e.g., Environmental Assessment), as required by DOE O 451.1B. Prepare an <u>Environmental Compliance Strategy</u> , to include a schedule for timely acquisition of required permits and licenses.	
Update <u>Project Data Sheet</u> , or other funding documents for MIE and OE projects, and A-11 Business Case, if applicable. This must contain an estimate of the required amount of PED funds to execute the planning and design portion of a project (period from CD-1 to completion of the project's design). (Refer to DOE CFO Budget Call for PDS and Business Case Template.)	
<i>For Hazard Category 1, 2, and 3 nuclear facilities, prepare a <u>Safety Design Strategy (SDS)</u>, with the concurrence of the CNS or with written advice of the CDNS, as appropriate, for projects subject to DOE-STD-1189-2008.</i>	SBAA and FPD
<i>For Hazard Category 1, 2, and 3 nuclear facilities, conduct an <u>Independent Project Review (IPR)</u> to ensure early integration of safety into the design process. (Refer to DOE G 413.3-9 and DOE-STD-1189-2008.)</i>	PSO
<i>Prepare a <u>Conceptual Safety Design Report (CSDR)</u>³ for Hazard Category 1, 2, and 3 nuclear facilities, including preliminary hazard analysis. For a project involving a major modification of an existing facility, the SDS must address the need for a CSDR, as well as the required PDSA. (Refer to DOE-STD-1189-2008.)</i>	SBAA via the CSVr
<i>Prepare a <u>Conceptual Safety Validation Report (CSVr)</u>, with concurrence from the FPD, on the DOE review of the CSDR for Hazard Category 1, 2, and 3 nuclear facilities. (Refer to DOE-STD-1189-2008.)</i>	SBAA
Post CD-1 Approval	
Submit all CD documents to PM.	
Begin expenditure of PED, MIE, or OE funds for the project design.	
Develop an Acquisition Plan, if applicable.	
Continue monthly PARS II reporting (excluding earned value). FPD, Program Manager and PM will provide monthly assessments, as appropriate.	
Annually conduct project peer reviews of active projects when the top-end range is \$100M or greater.	
Continue QPRs with the PME of their designee.	
<i>For nuclear facilities, develop a <u>Checkout, Testing and Commissioning Plan</u> in preparation for acceptance and turnover of the structures, systems and components at CD-4. (Refer to DOE-STD-1189-2008.)</i>	

T. Dykhuis Breakout

T. Dykhuis Breakout

One-For-One Replacement Strategy

- 2006: House Report 109-06 and DOE Order 430.1;
- Requirement that new construction of DOE-owned building area be offset with a declaration of excess or demolition of building area of an equivalent or greater size;
- 2006-Current: Changes in reporting and the tracking of the space usage/demolition;



One-For-One Replacement Strategy

The design of the PIP-II conventional facilities will follow DOE Order 430.1C, *Real Property Asset Management*, requirements including:

- Ensuring construction or renovation of DOE-owned buildings above 5,000 gross square feet meet federal sustainability principles and building efficiency requirements; **(HPSB)**
- Ensure facilities regardless of ownership comply with applicable federal metering requirements; **(HPSB)**
- Ensure newly constructed, renovated or leased building area designated for office does not exceed the Department's office space design standard. **(180 sf/person maximum)**

One-For-One Replacement Strategy

The design of PIP-II conventional facilities will comply with the **FY 2017 Real Property Data Related to Operations and Maintenance Guidance** by:

- Optimizing space for functionality;
- Increasing density; **(180 sf/person maximum)**
- Eliminating old, expensive, and difficult to maintain facilities;
- Constructing modern, flexible, collaborative and efficient space in accordance with sustainable practices. **(HPSB)**

One-For-One Replacement Strategy

- The PIP-II project will track and report the anticipated and actual square footage of the conventional facilities throughout the project life cycle;
- FESS will use existing methods to report totals to DOE (AAIM and FIMS) *;
- Approach was approved in November 2017;
- PIP-II-doc-1064

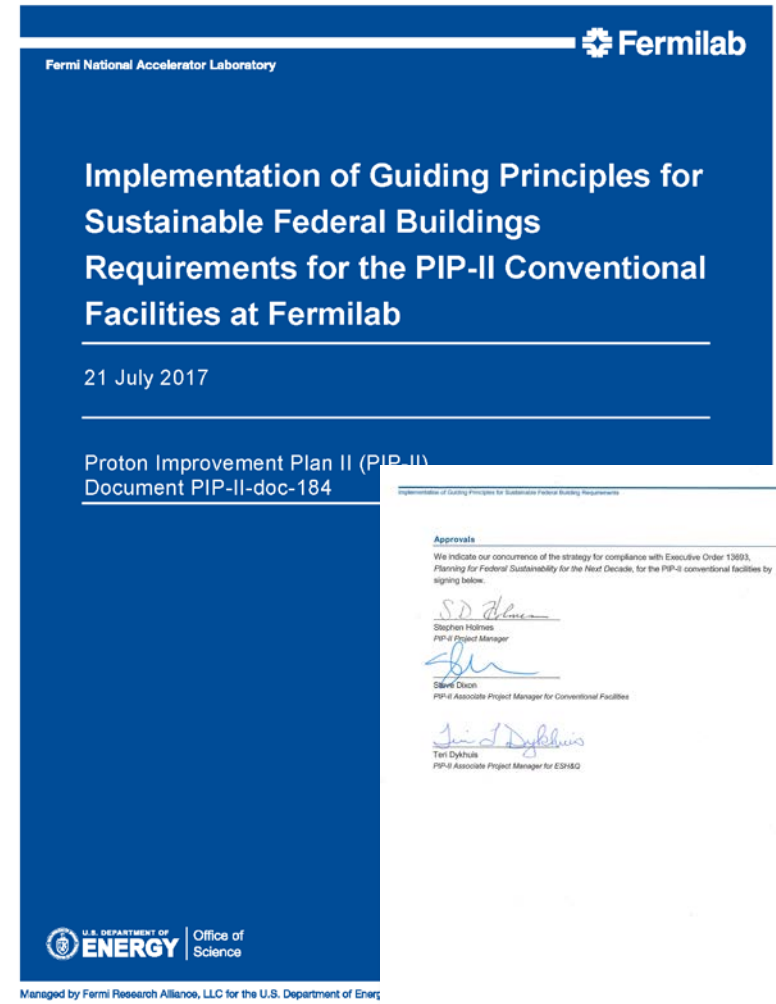
		November 2017							
		Buildings		Enclosures		FIMS Usage Code	B.O. Year (Anticipated)	Initial Acquisition Cost	Funding Type
		Gross SF	Usable SF	Gross SF	Usable SF				
121.5.3	Cryo Plant Building	23,245	20,921			694 Other Service Buildings	2022	\$12,906,000	Line Item
121.5.4	Utility Plant Building	7,995	7,196			694 Other Service Buildings	2024	\$6,018,000	Line Item
121.5.5	High Bay Building	21,275	19,148			785 Accelerator Building	2023	\$12,882,000	Line Item
121.5.6	Linac Tunnel			19,935	18,938	785 Accelerator Building	2024	\$8,918,000	Line Item
121.5.7	Linac Gallery	32,905	29,615			785 Accelerator Building	2026	\$13,549,000	Line Item
121.5.8	Beam Transfer Line			14,435	13,713	785 Accelerator Building	2025	\$8,771,000	Line Item
121.5.9	Booster Connection			7,750	7,363	785 Accelerator Building	2027	\$4,147,000	Line Item
		85,420	76,878	42,120	40,014				

* AAIM = Anticipated Asset Information Module

FIMS = Facilities Infrastructure Management System

Guiding Principles for Sustainable Federal Buildings

- Requirements:
 - Executive Order 13963
 - Guiding Principles for Sustainable Federal Buildings;
- Compliance with 20 metrics required for new buildings;
- Does not include process loads
- Implementation process through design and construction;
- Strategy document was signed in July 2017;
- PIP-II-doc-184



Guiding Principles for Sustainable Federal Buildings

Energy Goal:

Energy performance goal is to achieve at least 30% better than ASHRAE baseline

- to the facilities in Wilson Hall.
- b. **Integrated Design:** The integrated project team has developed performance goals for the PIP-II conventional facilities which are contained in the attached Guiding Principles Implementation Plan. The items listed below expand on the information contained in the plan
 - a. The PIP-II project site is adjacent to a restored prairie. As such site restoration and landscaping choices will be designed with the input of Fermilab subject matter experts including plant selection, pollinator habitat and wildfire management strategies.
 - b. The energy performance goal is to achieve at least 30% better than the ASHRAE baseline as calculated in accordance with 10CFR433.5
 - c. Fermilab currently has two (2) electric vehicle charging stations. During the design phase, the project team will seek input from Fermilab to determine if the PIP-II location would be appropriate for an electric charging station;
 - c. **Commissioning:** The PIP-II project will include initial commissioning of the building

From the text portion of the Strategy Document

Implementation of Guiding Principles for Sustainable Federal Building Requirements

3.0 Preliminary Guiding Principles Assessment

As part of the conceptual design development, the PIP-II conventional facilities team reviewed the relevant Guiding Principles requirements and developed a preliminary assessment of the guiding principles categories including project goals and objectives based on the facility type and intended use. The Guiding Principles Implementation Plan is a companion to the information listed below for each of the Guiding Principle category.

Employ Integrated Design Principles

- a. **Sustainable Locations:** The integrated project team considered the environmental impact and balanced that potential impact against the overall project goals and objectives when siting of the PIP-II conventional facilities. The considerations included access to adjacent existing utilities, roadways, shared parking as well walking distances to the facilities in Wilson Hall.
- b. **Integrated Design:** The integrated project team has developed performance goals for the PIP-II conventional facilities which are contained in the attached Guiding Principles Implementation Plan. The items listed below expand on the information contained in the plan
 - a. The PIP-II project site is adjacent to a restored prairie. As such site restoration and landscaping choices will be designed with the input of Fermilab subject matter experts including plant selection, pollinator habitat and wildfire management strategies.
 - b. The energy performance goal is to achieve at least 30% better than the ASHRAE baseline as calculated in accordance with 10CFR433.5
 - c. Fermilab currently has two (2) electric vehicle charging stations. During the design phase, the project team will seek input from Fermilab to determine if the PIP-II location would be appropriate for an electric charging station;
- c. **Commissioning:** The PIP-II project will include initial commissioning of the building systems to optimize and verify performance. The plan for the initial commissioning will be developed during the design phase and implemented during the construction phase by an independent commissioning agent. Recommissioning will be the responsibility of Fermilab following the policies and procedures of FESS.

Optimize Energy Performance

- a. **Energy Efficiency:** The integrated project team will employ design strategies that reduce energy loads including the use of energy efficient products where applicable.
- b. **Renewable and Clean Energy:** The PIP-II project is part of the Fermilab campus and relies on Fermilab Energy Manager procurement of energy and renewable energy credits.

Guiding Principles for Sustainable Federal Buildings

Metering Goal

Install building level meters for electricity, industrial cooling water, natural gas and chilled water.

4.1	Consider long-term off-site renewable sources and renewable energy certificates (RECs)	RECs are purchased thru Fermilab Energy Manager to meet the job's several sustainability goals that require RECs purchase
4.2	Utilize clean and alternative energy where possible	Fermilab has installed several PV generating sources in remote locations where supplying conventional power would be very expensive. A 2016 study by NREL suggests that larger PV and/or wind generating projects are not cost effective for Fermilab where conventional power is available due to insufficient available resources (wind, sun) coupled with low electrical energy prices.
4.3	Install building level electricity meters, natural gas, and steam	Goal: Install building level meters for electricity, industrial cooling water, natural gas and chilled water
4.4	Install advanced or standard meters as appropriate	Goal: Install meters
4.5	Benchmark building performance of least annually	

Goal

A/E firm responsibilities

Subcontractor responsibilities

Simplified Description		Conceptual	Design	Final Design	Construction	Post-Construction	15%	
1	Integrated Design	Consider the environmental impact of all decisions and use an integrated project team to:	<ul style="list-style-type: none"> Establish energy performance goals in design process Establish environmental performance goals in design process Follow sustainable landscape design principles Provide electric vehicle charging needs Consider design choices that improve environmental performance, support health and wellness of building occupants and consider alternate site including water Consider all stages of the building life cycle 					IN PROGRESS
	Commissioning	Commission and documentation of all energy & water systems building performance using commissioning agents who are independent of the design and construction or operating team	Commissioning by Fermilab	Commissioning by Fermilab	Commissioning by Fermilab	Commissioning by Fermilab	Commissioning by Fermilab	IN PROGRESS
	Efficiency	Improve energy efficiency to 30% better than the "current" ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
		Use energy efficient products as required by statute	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
	Sustainable and Energy	Provide and implement clean operations, life-cycle cost effective renewable energy projects on-site	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
Utilize clean and alternative energy where possible		ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
IN P	Install building level electricity meters, natural gas, and steam	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
	Install advanced or standard meters as appropriate	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
7	Indoor Water Use	Regularly monitor building energy performance against energy performance data and save buildings	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
	Use water efficient products	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
	Install high level water meters	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
	Optimize cooling tower operations	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
	Eliminate single pass cooling	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
8	Outdoor Water	Replenish water used for irrigation systems greater than 25,000 sq ft	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
	Use water efficient landscaping	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS	
9	Alternative Water	Consider alternative sources of water where cost-effective and permitted by local laws and regulations	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS
	Stormwater Management	For new construction, meet or exceed ILLA section 612 stormwater management requirements	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	ASHRAE 91.1	IN PROGRESS

From the Implementation Plan portion of the Strategy Document

Guiding Principles for Sustainable Federal Buildings

- Conceptual Phase
 - Established Goals;
 - Assigned Responsibilities;
 - Reviewed and approved strategy;
- Currently **~15%** complete with compliance;
- Next Steps:
 - Goals and Expectations will be included in both architect/engineer (A/E) and construction subcontracts;
 - Periodic updates to the implementation plan;

CD-2 Requirements

Prior to CD-2	Approval Authority ²
<p>Perform a <u>Performance Baseline External Independent Review</u> (EIR) or an <u>Independent Project Review</u> (IPR). PM will conduct EIRs to validate the PB for projects with a TPC ≥ \$100M. PM must issue a Performance Baseline Validation Letter to the PSO that describes the cost, schedule, and scope being validated. PMSO will conduct IPRs to validate the PB for projects with a TPC < \$100M. (Refer to DOE G 413.3-9)</p> <p>For projects with a TPC ≥ \$100M, PM will develop an <u>Independent Cost Estimate</u> (ICE). The ICE will support validation of the PB.</p>	<p>PM ≥ \$100M PMSO < \$100M</p>
<p>Complete a <u>Preliminary and/or Final Design</u>. <i>Hazard Category 1, 2, and 3 nuclear facilities shall achieve at least 90% design completion prior to CD-2 approval. Non-nuclear project designs shall be sufficiently mature to prepare a project baseline with 80-90% confidence prior to CD-2 approval. (See Appendix C, Paragraph 6a for definition of 90% design complete.)</i></p>	
<ul style="list-style-type: none"> Incorporate the Guiding Principles for Federal Leadership in <u>High Performance and Sustainable Buildings</u> per EO 13693, Section 3(h), sustainability requirements per DOE O 436.1, and/or other sustainability considerations into the preliminary design and design review. (Refer to DOE G 413.3-6A.) 	
<ul style="list-style-type: none"> Conduct a <u>Design Review</u> of the preliminary and final designs. 	
<ul style="list-style-type: none"> <i>For Hazard Category 1, 2, and 3 nuclear facilities, design reviews should include a focus on safety and security systems. Additionally, the Code of Record shall be placed under configuration control during preliminary design. It is controlled during final design and construction with a process for reviewing and evaluating new and revised requirements. New or modified requirements are implemented if technical evaluations determine that there is a substantial increase in the overall protection of the worker, public or environment, and that the direct and indirect costs of implementation are justified in view of this increased protection.</i> 	
<ul style="list-style-type: none"> Complete a <u>Preliminary Design Report</u>. 	
<p>For projects with a TPC ≥ \$100M, the PMRC will review and analyze the CD and make recommendations to the ESAAB, CE, or PME, as applicable, before approval.</p>	<p>CE ≥ \$750M PME < \$750M</p>
<p>Conduct a <u>Project Definition Rating Index Analysis</u>, as appropriate, for projects with a TPC ≥ \$100M. PM will review as part of the EIR. (Refer to DOE G 413.3-12.)</p>	<p>FPD</p>
<p>For major system projects, or first-of-a-kind engineering endeavors, conduct a <u>Technology Readiness Assessment</u> and develop a <u>Technology Maturation Plan</u>, as appropriate. At this stage, each critical technology item or system shall achieve a Technology Readiness Level-7 (TRL-7). (Refer to DOE G 413.3-4A.)</p>	<p>None</p>
<p>Employ an <u>Earned Value Management System</u> compliant with EIA-748C, or as required by the contract. This is performed by the contractor. (Refer to DOE G 413.3-10A.)</p>	
<p>Prepare a <u>Hazard Analysis Report</u> for facilities that are below the Hazard Category 3 nuclear facility threshold as defined in 10 CFR Part 830, Subpart B by updating the PHAR based on new hazards and design information.</p>	<p>Field Organization</p>
<p>Determine that the <u>Quality Assurance Program</u> is acceptable and continues to apply. (Refer to 10 CFR Part 830, Subpart A, DOE O 414.1D, and DOE G 413.3-2.)</p>	
<p>Conduct a <u>Preliminary Security Vulnerability Assessment</u>, if necessary. (Refer to DOE O 470.4B, Change 1, and DOE G 413.3-3A.)</p>	

Plan in place

Implementation Plan in place

Reviews included in plan

Underway

DOE G413.3-12

“a project management tool designed to increase the likelihood of project success by improving project scope definition, specifically by identifying deficiencies in scope definition early during the front-end planning process”

Project Definition Rating Index Analysis

- Project Management Tool
 - DOE Guide 413.3-12 *Project Definition Rating Index Guide for Traditional Nuclear and Non-Nuclear Construction Projects*;
 - Based on numerical project management tool developed by Construction Industry Institute;
 - Measures the degree of scope development for traditional construction projects;
- Tool:
 - **5** major elements;
 - **73** scope definition sub-elements;

Project Definition Rating Index Analysis

- First Pass
 - PIP-II project office;
 - Scored **613** at CD-1 level

area	items	element	score CD-0	score CD-1	score CD-2	score CD-3
A	7	COST	0	86	0	0
B	7	SCHEDULE	0	107	0	0
C	34	SCOPE/TECHNICAL	0	166	0	0
D	21	MANAGEMENT PLANNING & CONTROL	0	123	0	0
E	4	SAFETY	0	132	0	0
	73	TOTAL	0	613	0	0
		Recommend Moving to Next CD	NO	YES	NO	NO

- PIP-II-doc-1230
- Next Steps
 - Review with the A/E project team;
 - Continue to review throughout project life cycle;

Summary

- Path to CD-1
 - Conceptual Design - **Complete;**
 - Conceptual Design Report - **Complete;**
 - Design Review - **Complete;**
 - One-for-One Replacement Strategy - **Complete;**
 - HPSB Documentation - **Complete;**
- CD-2 Requirements
 - Complete Preliminary and/or Final Design – **Plan in place**
 - HPSB Implementation – **Executing Plan**
 - Design Reviews – **Plan in place**
 - Project Definition Rating Index – **1st pass complete**

Questions