Cryogenics Plant Building (WBS 121.06.03)

Breakout Session

Steve Dixon

PIP-II IPR

4-6 December 2018

In partnership with:
India/DAE
Italy/INFN
UK/STFC
France/CEA/Irfu, CNRS/IN2P3

Charge Questions Addressed

1. Is the project making adequate technical progress to ensure that the completed project will perform as planned and meet the key performance parameters?
2. Will execution of PIP II design plans and planned R&D program activities ensure most major technical risks will be appropriately mitigated or retired prior to CD-3?
3. Has the project made adequate progress on its resource-loaded schedule to complete it by the time of CD-2?
4. Are preparations for defining, documenting, and managing the international in-kind contributions suitable to ensure their timely delivery and technical fidelity?
5. Is the proposed CD-2 timeline reasonable and consistent with the current project status?
6. Is ESH&Q being handled appropriately?
7. Are the proposed risk mitigation strategies reasonable and are the proposed contingencies acceptable?
8. Has the project satisfactorily responded to the recommendations from previous reviews?
9. Are there any other significant issues that require HEP or project's attention?

Outline

- Scope/Deliverables
- Requirements
- Interfaces
- Preliminary Design, Maturity
- Technical Progress to Date
- ESH&Q
- Risks and Mitigations
- Summary

About Me:

- PIP-II Level 2 Manager for Conventional Facilities
- Relevant Experience
  - Licensed Architect;
  - Project Management Professional (PMP);
  - LEED Accredited Professional;
  - 26+ years at Fermilab;
  - NOvA Project L2 Manager for Site and Buildings;
    - 2014 CD-4
    - 2015 U.S. DOE Secretary's Award for Excellence
  - General Plant Project Manager for 15+ years
    - Short Baseline Neutrino (SBN) Near Detector Building;
    - Short Baseline Neutrino (SBN) Far Detector Building;
    - Experimental Operations Center;

Scope and Deliverables [1]

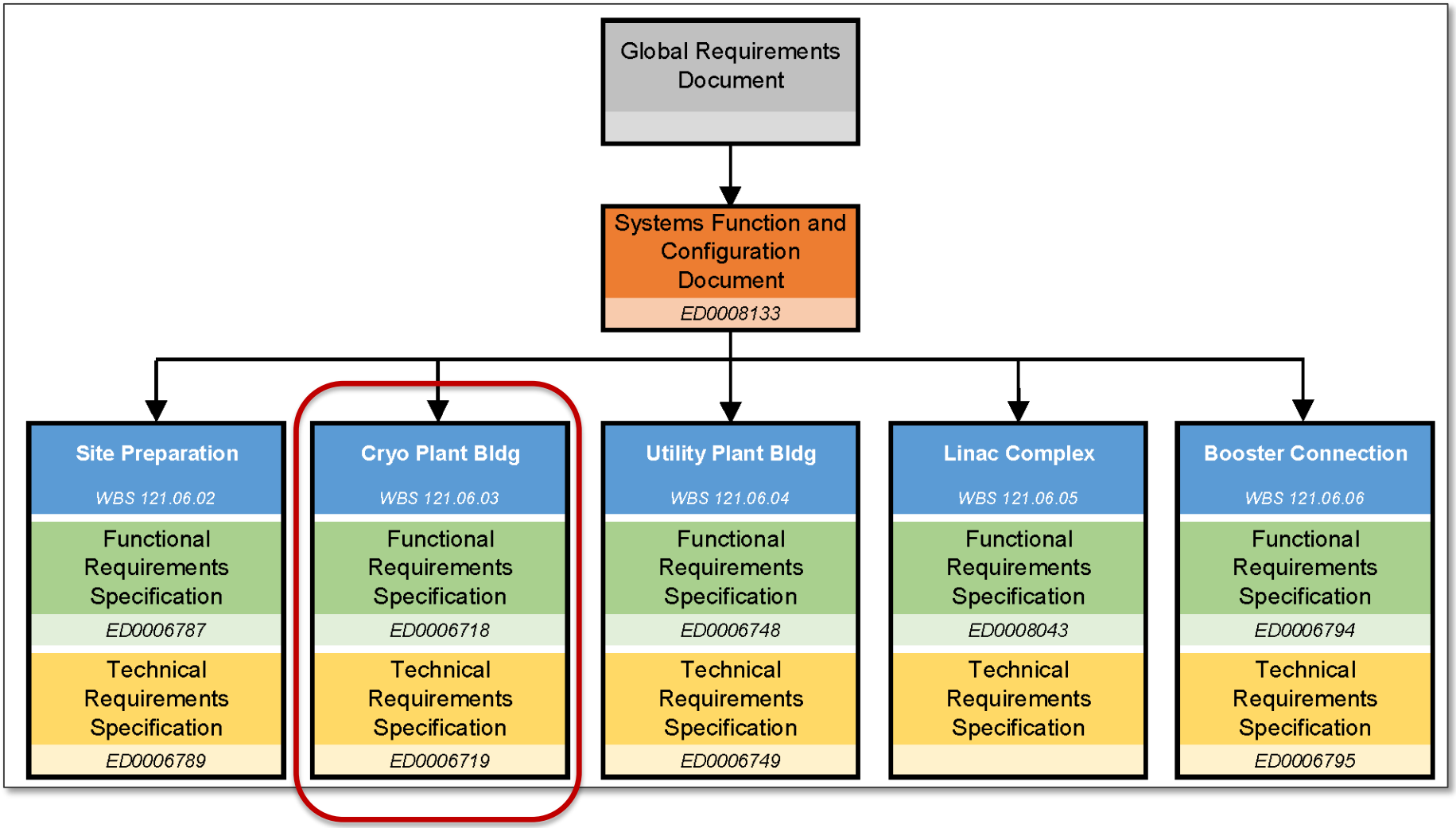
Charge #2

- **WBS 121.06.03.01 – Project Management and Coordination**
  Project management for the Cryoplant Building including the oversight and coordination of the technical effort, project planning and scheduling, cost estimating, risk and contingency analysis, and reporting. Includes travel costs for management, technical coordination, and vendor visits.
- **WBS 121.06.03.02 – Detailed and Final Design**
  Services needed for the design of the Cryo Plant Building work scope. It describes the labor resources, materials and services, including architectural/engineering services, necessary for planning, oversight and engineering and design.
- **WBS 121.06.03.03 – Construction on Site**
  Procurement and management for all contracted labor, materials, tools, equipment, and services needed for the construction of the Cryo Plant Building work scope. It describes the labor resources, materials and services necessary organization, planning, oversight and engineering, design, inspection and administration (EDIA) of the construction work on the Fermilab site.

[1] Definitions from WBS Dictionary, PIP-II-doc-599

WBS L3 System Requirements

Charge #2



Functional Requirements Specification [1]

Charge #2

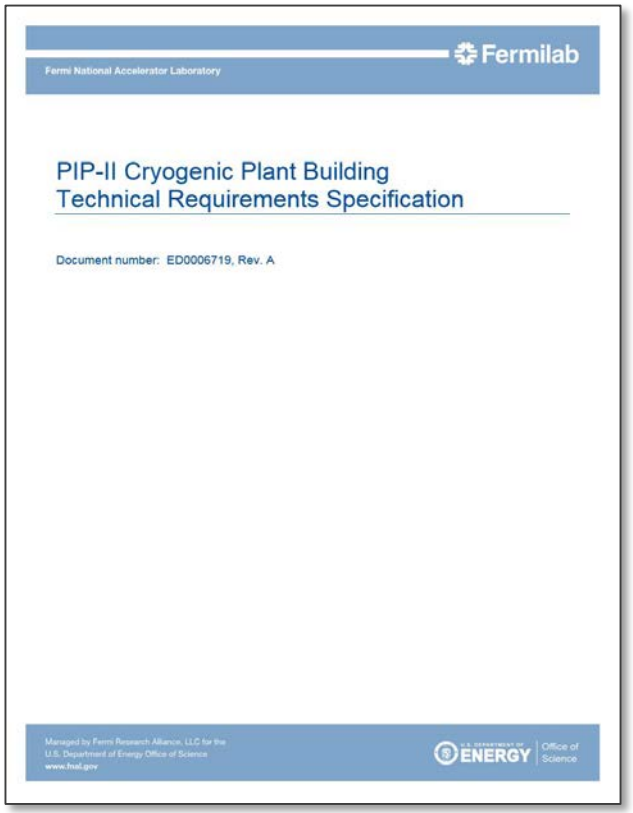
Requirement #	Requirement Statement
F-121.06.03-A001	The CPB shall provide a safe environment for employees and the public.
F-121.06.03-A002	The CPB shall provide space and infrastructure with the proper floor load rating for the warm compressors.
F-121.06.03-A003	The CPB shall provide space and infrastructure with the proper floor load rating for the cold box.
F-121.06.03-A004	The CPB shall provide space and infrastructure for unloading/loading activities
F-121.06.03-A005	The CPB shall provide exterior space for storage tanks/dewars.
F-121.06.03-A006	The CPB shall provide space for operating the cryoplant including control room space, meeting/planning space and support space.
F-121.06.03-A007	The CPB shall comply with the overall character of the PIP-II campus and applicable portions of the Fermilab Campus Plan.
F-121.06.03-A008	The CPB shall connect to existing Fermilab infrastructure. This includes electrical, domestic water, industrial cooling water, sanitary sewer, chilled water and data/communication.
F-121.06.03-A009	The CPB shall be located adjacent to the PIP-II Linac Complex such that the cryogenic distribution system feeds the front end of the Linac.
F-121.06.03-A010	The CPB shall provide foundations for gaseous helium storage tanks.
F-121.06.03-A011	The CPB shall provide foundations for a liquid helium dewar.
F-121.06.03-A012	The CPB shall provide foundations for a liquid nitrogen dewar.
F-121.06.03-A013	The CPB shall provide truck access for helium and nitrogen deliveries.
F-121.06.03-A014	The CPB shall provide space and infrastructure to support a 4.5 K cold box upgrade option

[1] See TeamCenter Document ED0006718

Technical Requirements Specification [1]

Charge #2

Requirement ID	FRS Reference	Requirement Statement
General		
T-121.06.03-A001	*F-121.06.03-A009*	The CPB shall be located at the upstream end of the Linac Complex
Architectural		
T-121.06.03-B001	*F-121.06.03-A007*	The CPB shall be developed based on the 2018 Fermilab Campus Master Plan including the desire that the "design of buildings and open spaces should encourage interaction, creating the settings to bring staff, users and visitors together, becoming vibrant centers of laboratory life." To this end, the CPB will incorporate the appropriate portions of the design guidelines including: • Entrances and ground floors that are welcoming and provide an opportunity for interactions; • Entrances that are evident in the daytime and at night; • The ground floor will emphasize transparency; • Service and utilities areas will be located so as to not negatively affect pedestrian paths or building entrances; • Provide long term flexibility and life cycle value; and • Uphold the unique character of Fermilab.
Cold Box Station		
T-121.06.03-C001	*F-121.06.03-A004*	The Cold Box Station (CBS) shall be include an overhead bridge crane with the following criteria: • Capacity of 25 tons (50,000 pounds); • Hook limits to provide coverage for the major equipment and loading dock; • Hook height of 20 feet above finished floor;
T-121.06.03-C002	*F-121.06.03-A004*	The CBS shall include at grade loading dock space to accommodate a standard 55-foot-long semi-trailer.
T-121.06.03-C003	*F-121.06.03-A004*	The CBS shall include, as a minimum, a 16-foot-wide by 16-foot-tall overhead door;
T-121.06.03-C004	*F-121.06.03-A003*	The flatness and levelness of the new floor slabs built as part of the conventional facilities shall be designed for normal construction tolerances and a ASTM E1155 floor flatness value of F(F) 25 and a floor levelness F(L) of 20.


Fermilab

Fermi National Accelerator Laboratory

PIP-II Cryogenic Plant Building
Technical Requirements Specification

Document number: ED0006719, Rev. A

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U.S. DEPARTMENT OF ENERGY | Office of Science

[1] See TeamCenter Document ED0006719

Interfaces

Charge #2

- Project Interfaces *(Managed through PIP-II processes)* [1]
  - ED0007698 – Interface Control Document
  - WBS 121.02 - SRF & Cryo Systems
    - WBS 121.02.05 – Cryo Plant (B. Hansen)
    - WBS 121.02.06 – Cryogenic Distribution (A. Dalesandro)
- Fermilab Interfaces
  - Infrastructure Connections *(Managed through FESS processes)*
  - General Plant Projects *(Managed through FESS processes)*
- International Interface *(Managed through WBS 121.02)*
  - Cryogenic plant is Indian partner deliverable

FESS is the Facilities Engineering Services Section

[1] See PIP-II Systems Engineering Management Plan at PIP-II-doc-1539

Preliminary Design and Design Maturity

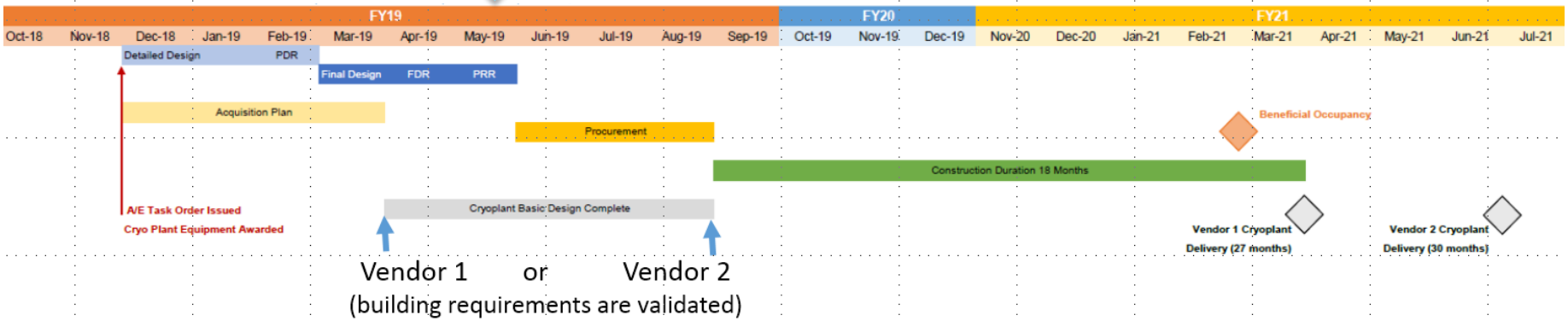
Charge #2

- Technical Requirements Phase
  - Started in May 2018;
  - Completed in September 2018;
- Detailed/Final Design
  - Goal is to start in December 2018
  - Complete in May 2019
  - Dependent on architect/engineer award;
- Goal: **90% Design Maturity by CD-3A Review**

Schedule Detail

Charge #2

Cryo Plant Building and Site Preparation
Design Complete
Schedule and Cost Known

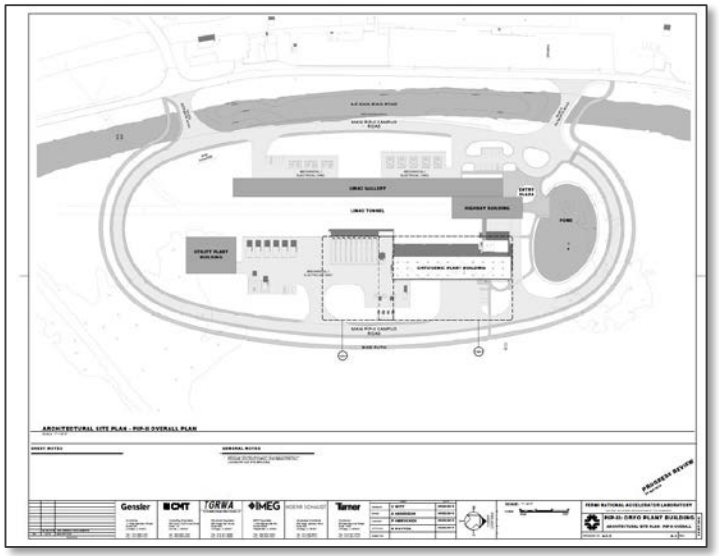


From 18OCT18 Integrated Project Team Meeting

Progress to Date

Charge #1

- Developed preliminary shielding strategy with 121.03 (Accelerator Systems)
- Requirement and Specification Review [1]
- Industrial Cooling Water Quality Testing Complete [2]
- Technical Requirements Phase (40% Design) [3]

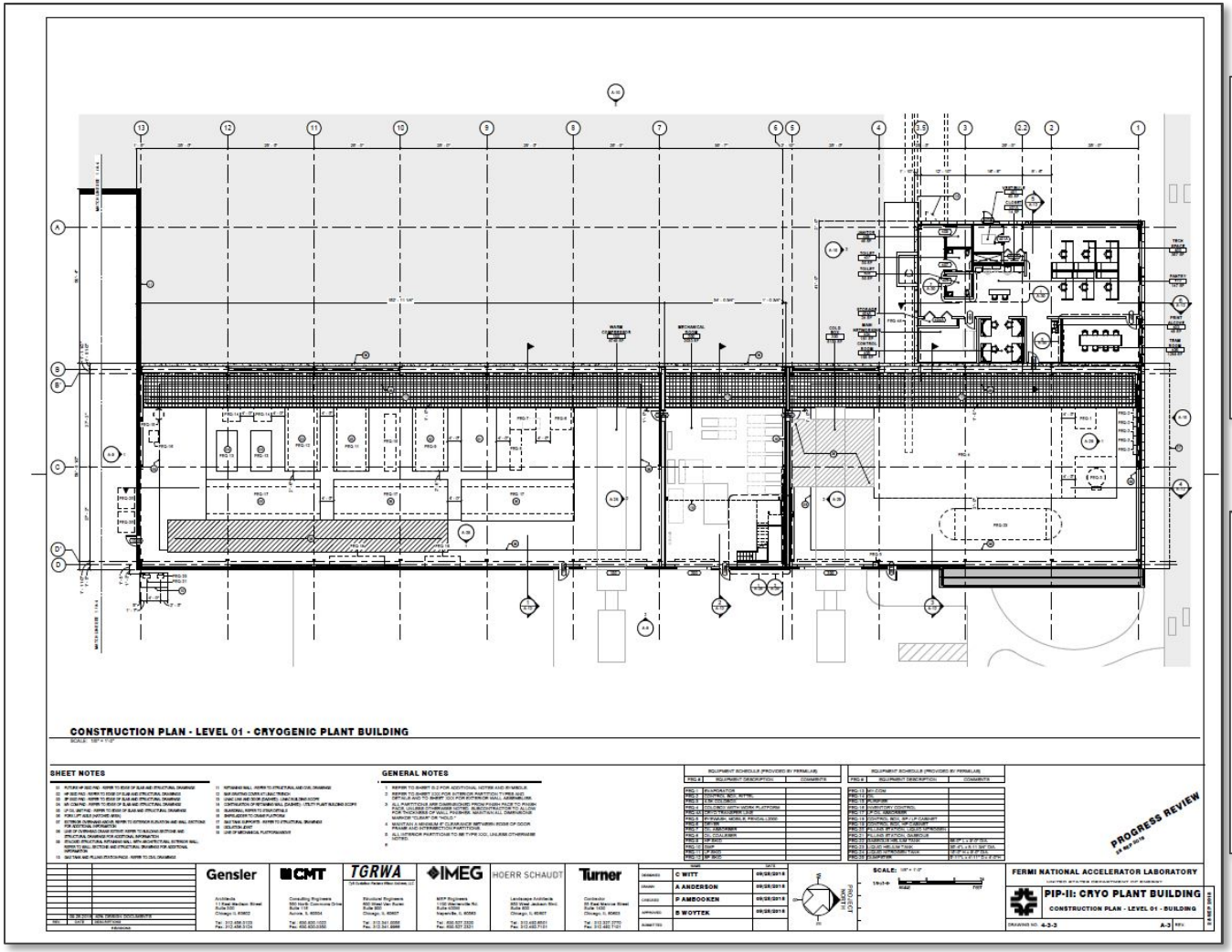


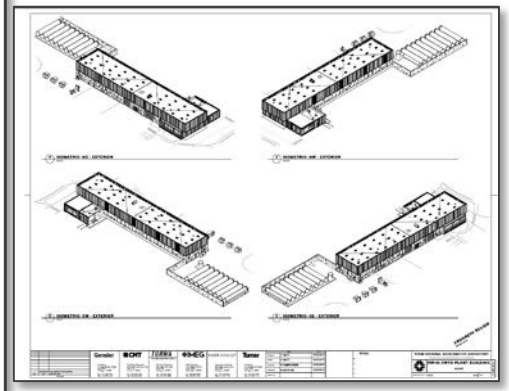
From TeamCenter Document ED0008373

[1] See TeamCenter ED0008588
[2] See PIP-II-doc-155
[3] See TeamCenter ED0008373

Progress to Date

Charge #1





From TeamCenter Document ED0008373

Environment Safety and Health (ES&H)

Charge #6

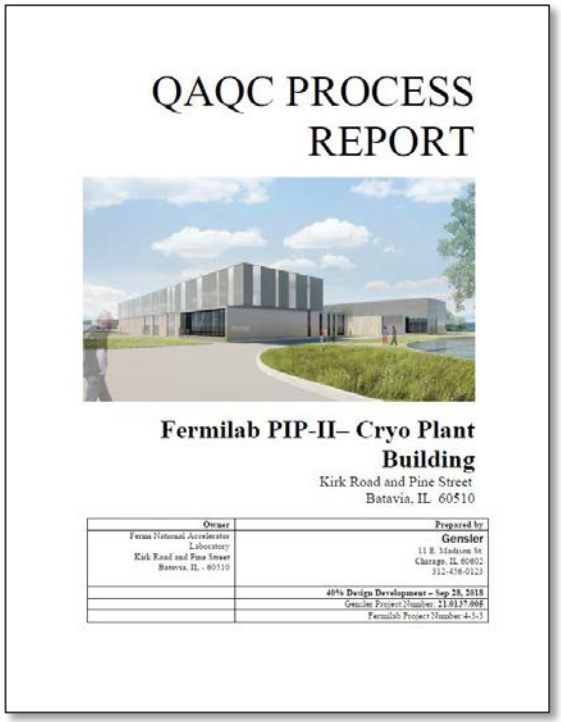
- Design Phase Incorporates:
  - Architect/Engineer selection included ES&H considerations;
  - Life Safety Assessment requirements; [1]
  - Safety By Design process;
  - Input from Tritium Task Force;
  - Input from Hazard Analysis Report (HAR) hazards [2]

[1] Life Safety Analysis can be found at PIP-II-doc-120
[2] Hazard Analysis Report can be found at PIP-II-doc-140

Quality Management

Charge #6

- Process to date include:
  - Requirement and Specification Review (PIP-II process)
  - Comment and Compliance Review (FESS/E process)
  - QAQC Process Report (A/E process)

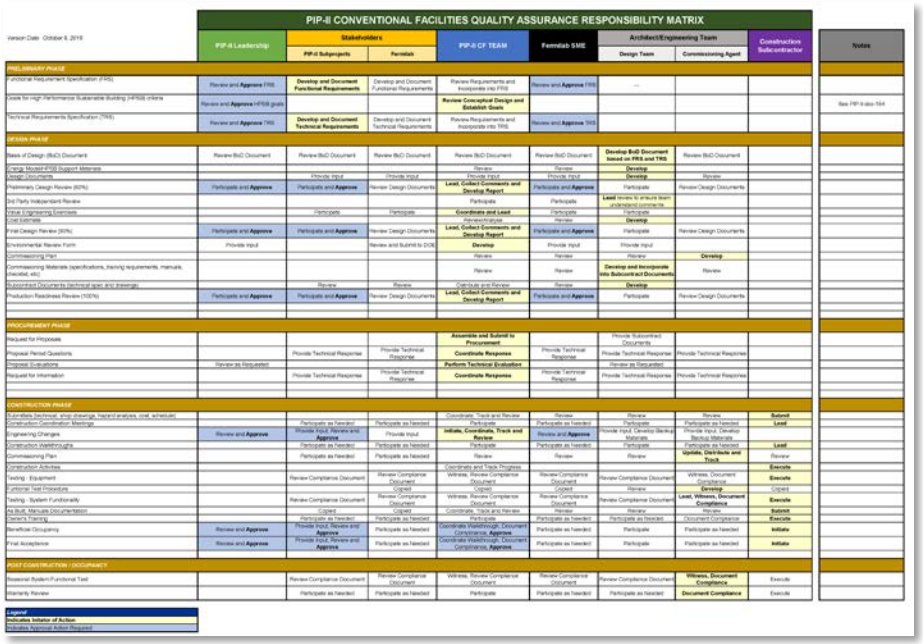


QAQC PROCESS REPORT

Fermilab PIP-II– Cryo Plant Building

Kirk Road and Pine Street
Batavia, IL 60510

Owner	Prepared by
Fermi National Accelerator Laboratory Kirk Road and Pine Street Batavia, IL - 60510	**Gensler** 11 E. Madison St Chicago, IL 60602 312-456-0123
	40% Design Development – Sep 28, 2018
	Gensler Project Number: 21.0137.005
	Fermilab Project Number 4-3-3



PIP-II CONVENTIONAL FACILITIES QUALITY ASSURANCE RESPONSIBILITY MATRIX

	PIP-II Leadership	Stakeholders		PIP-II CF TEAM	Fermilab SME	Architect/Engineering Team		Construction Subcontractor	Notes
		PIP-II Subprojects	Fermilab			Design Team	Commissioning Agent		
PRELIMINARY PHASE									
Functional Requirement Specification (FRS)	Review and Approve FRS	Develop and Document Functional Requirements	Develop and Document Functional Requirements	Review Requirements and Incorporate into FRS	Review and Approve FRS	...			
Goals for High Performance Sustainable Building (HPSB) criteria	Review and Approve HPSB goals			Review Conceptual Design and Establish Goals					See PIP-II doc-164
Technical Requirements Specification (TRS)	Review and Approve TRS	Develop and Document Technical Requirements	Develop and Document Technical Requirements	Review Requirements and Incorporate into TRS	Review and Approve TRS				
DESIGN PHASE									
Basis of Design (BoD) Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Develop BoD Document based on FRS and TRS	Review BoD Document		
Energy Model (HPSB Support Materials)				Review	Review	Develop			
Design Documents		Provide Input	Provide Input	Develop FESS	Provide Input	Develop	Review		
Preliminary Design Review (60%)	Participate and Approve	Participate and Approve	Review Design Documents	Lead, Collect Comments and Develop Report	Participate and Approve	Participate	Review Design Documents		
3rd Party Independent Review				Participate	Participate	Lead reviews to ensure team understand comments			
Value Engineering Exercises		Participate	Participate	Coordinate and Lead	Participate	Participate			
Cost Estimate				Review/Analyze	Review	Develop			
Final Design Review (90%)	Participate and Approve	Participate and Approve	Review Design Documents	Lead, Collect Comments and Develop Report	Participate and Approve	Participate	Review Design Documents		
Environmental Review Form	Provide Input		Review and Submit to DOE	Develop	Provide Input	Provide Input			
Commissioning Plan				Review	Review	Review	Develop		
Commissioning Materials (specifications, training requirements, manuals, checklist, etc)				Review	Review	Develop and Incorporate into Subcontract Documents	Review		
Subcontract Documents (technical spec and drawings)		Review	Review	Distribute and Review	Review	Develop			
Production Readiness Review (100%)	Participate and Approve	Participate and Approve	Review Design Documents	Lead, Collect Comments and Develop Report	Participate and Approve	Participate	Review Design Documents		
PROCUREMENT PHASE									
Request for Proposals				Assemble and Submit to Procurement		Provide Subcontract Documents			
Proposal Period Questions		Provide Technical Response	Provide Technical Response	Coordinate Response	Provide Technical Response	Provide Technical Response	Provide Technical Response		
Proposal Evaluations	Review as Requested			Perform Technical Evaluation		Review as Requested			
Request for Information		Provide Technical Response	Provide Technical Response	Coordinate Response	Provide Technical Response	Provide Technical Response	Provide Technical Response		
CONSTRUCTION PHASE									
Submittals (technical, shop drawings, hazard analysis, cost, schedules)				Coordinate, Track and Review	Review	Review	Review	Submit	
Construction Coordination Meetings		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate	Participate as Needed	Lead	
Engineering Changes	Review and Approve	Provide Input, Review and Approve	Provide Input	Initiate, Coordinate, Track and Review	Review and Approve	Provide Input, Develop Backup Materials	Provide Input, Develop Backup Materials		
Construction Walkthroughs		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate	Participate as Needed	Lead	
Commissioning Plan		Participate as Needed	Participate as Needed	Review	Review	Review	Update, Distribute and Track	Review	
Construction Activities				Coordinate and Track Progress				Execute	
Testing - Equipment		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	Witness, Document Compliance	Execute	
Functional Test Procedure			Copied	Copied	Review	Review	Develop	Copied	
Testing - System Functionality		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	Lead, Witness, Document Compliance	Execute	
As-Built, Manuals Documentation		Copied	Copied	Coordinate, Track and Review	Review	Review	Review	Submit	
Owner's Training		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate as Needed	Document Compliance	Execute	
Beneficial Occupancy	Review and Approve	Provide Input, Review and Approve	Participate as Needed	Coordinate Walkthrough, Document Compliance, Approve	Participate as Needed	Participate	Participate as Needed	Initiate	
Final Acceptance	Review and Approve	Provide Input, Review and Approve	Participate as Needed	Coordinate Walkthrough, Document Compliance, Approve	Participate as Needed	Participate	Participate as Needed	Initiate	
POST CONSTRUCTION / OCCUPANCY									
Seasonal System Functional Test		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	Witness, Document Compliance	Execute	
Warranty Review		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate as Needed	Document Compliance	Execute	

Legend
Indicates Initiator of Action
Indicates Approval Action Required

Risk Management

Charge #2,7

Cryogenic Plant Building Related Risks

- RT-121-06-001 – Subproject Requirement Change
- RT-121-06-003 – Construction Bids Exceed Estimates
- RT-121-06-005 – Cryoplant Design Requirements
- RT-121-06-008 – Cryoplant Cooling Water
- RT-121-06-039 – Cryogenic Plant Building BO Delayed

Steps to CD-3A (Cryogenics Plant Building)

- Complete the Construction Package
  - Design complete;
  - Specifications complete;
  - Updated cost/schedule estimate
  - Anticipated for May 2019
- Favorable EA FONSI
  - Anticipated in December 2018;
- Procurement Process
  - Advanced Acquisition Plan (start in January 2019)
  - Subcontractor Outreach Program

EA is Environmental Assessment
FONSI is Finding Of No Significant Impact

Summary

- Cryogenics Plant Building is a CD-3A request;
- Good progress on the design since CD-1;
- Design of the Cryogenic Plant Building is based on the requirements from two potential cryogenics plant vendors;
- On track for a CD-3A Review in Q3 FY19;
- On track to achieving the goal of having the building and supporting infrastructure ready in advance of cryogenic equipment arrival;
- Thanks for your time.

END