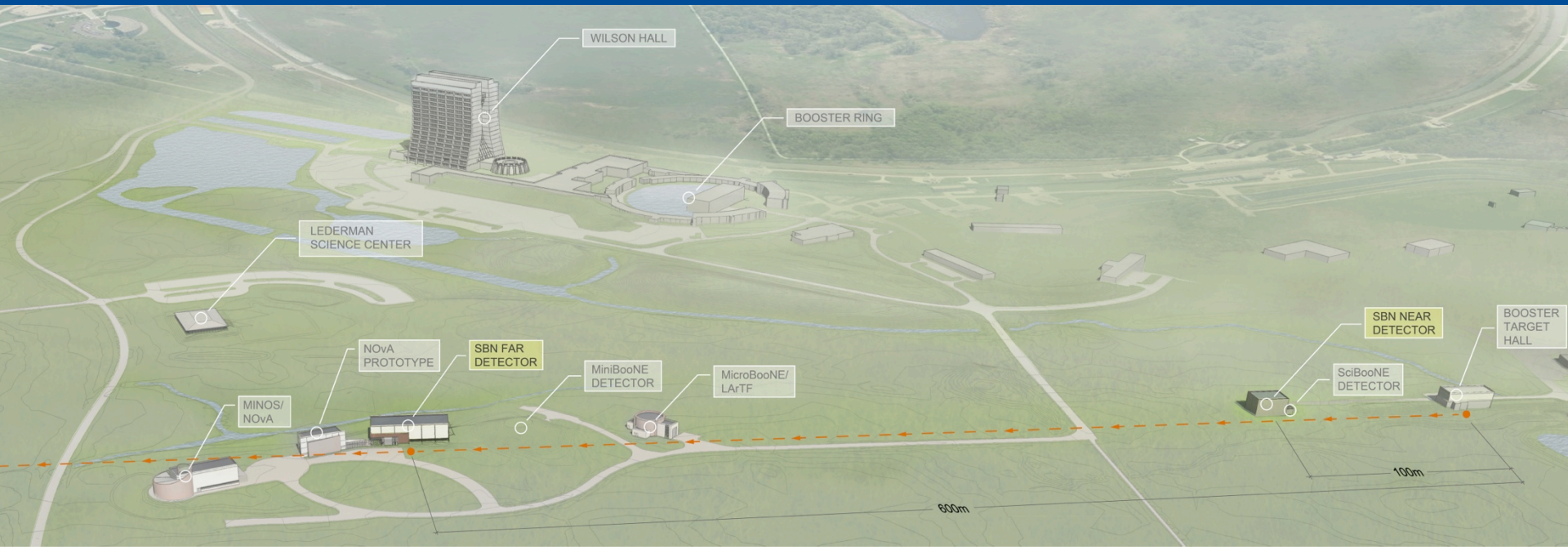


Conventional Construction for the Near and Far Detectors

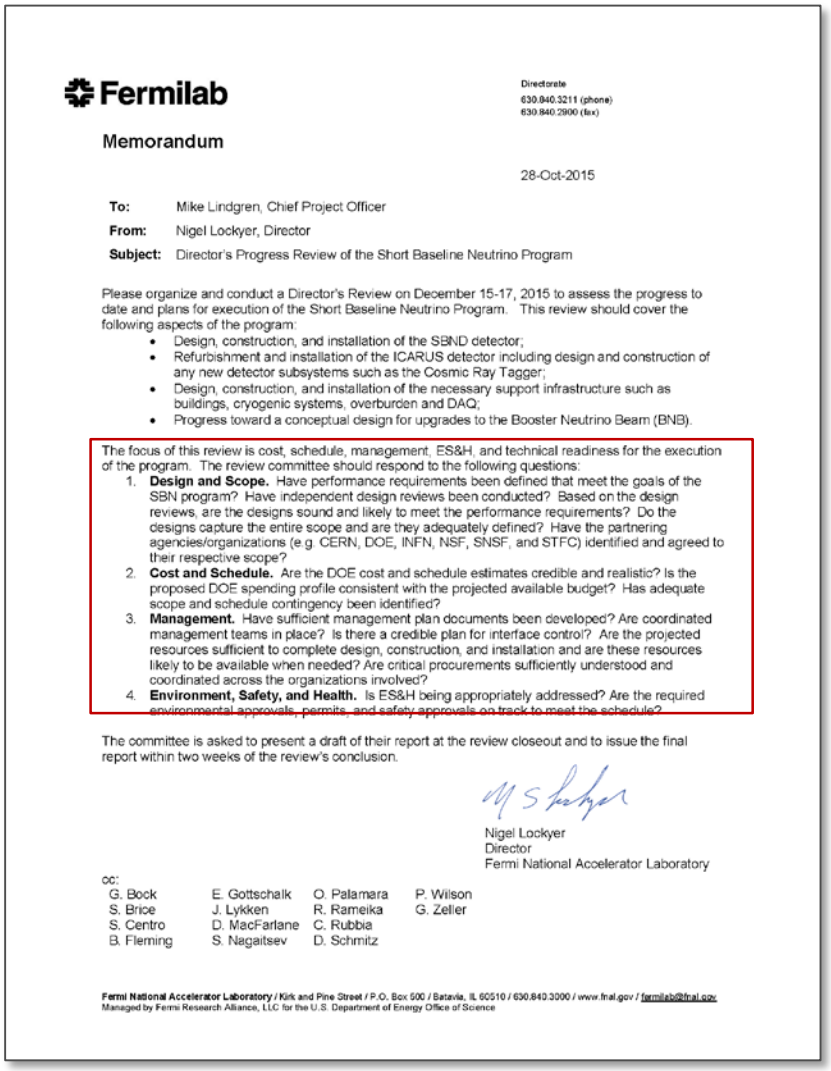
Steve Dixon

Director's Progress Review of SBN

15-17 December 2015

Format

- Focus on the Charge Questions
  - Overview
  - Interfaces
  - Resources/Funding Profile
  - Schedule
  - ES&H and QA
  - Response to Technical Review
  - Status



Fermilab

Directorate
630.840.3211 (phone)
630.840.2900 (fax)

Memorandum

28-Oct-2015

To: Mike Lindgren, Chief Project Officer

From: Nigel Lockyer, Director

Subject: Director's Progress Review of the Short Baseline Neutrino Program

Please organize and conduct a Director's Review on December 15-17, 2015 to assess the progress to date and plans for execution of the Short Baseline Neutrino Program. This review should cover the following aspects of the program:

- Design, construction, and installation of the SBND detector;
- Refurbishment and installation of the ICARUS detector including design and construction of any new detector subsystems such as the Cosmic Ray Tagger;
- Design, construction, and installation of the necessary support infrastructure such as buildings, cryogenic systems, overburden and DAQ;
- Progress toward a conceptual design for upgrades to the Booster Neutrino Beam (BNB).

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

1. **Design and Scope.** Have performance requirements been defined that meet the goals of the SBN program? Have independent design reviews been conducted? Based on the design reviews, are the designs sound and likely to meet the performance requirements? Do the designs capture the entire scope and are they adequately defined? Have the partnering agencies/organizations (e.g. CERN, DOE, INFN, NSF, SNSF, and STFC) identified and agreed to their respective scope?
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4. **Environment, Safety, and Health.** Is ES&H being appropriately addressed? Are the required environmental approvals, permits, and safety approvals on track to meet the schedule?

The committee is asked to present a draft of their report at the review closeout and to issue the final report within two weeks of the review's conclusion.

Nigel Lockyer
Director
Fermi National Accelerator Laboratory

cc:
G. Bock, S. Brice, S. Centro, B. Fleming, E. Gottschalk, J. Lykken, D. MacFarlane, S. Nagaitsev, O. Palamara, R. Rameika, C. Rubbia, D. Schmitz, P. Wilson, G. Zeller

Fermi National Accelerator Laboratory / Kirk and Pine Street / P.O. Box 500 / Batavia, IL 60510 / 630.840.3000 / www.fnal.gov / fermilab@fnal.gov
Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

GPP Projects

	SBN Site Development	SBN Near Detector Building	SBN Far Detector Building	Totals
	G12220	*G15219*	*G15218*	
Construction	$2,030,000	$4,138,000	$7,438,000	$13,606,000
EDIA	$120,000	$752,000	$1,508,323	$2,380,323
Indirect Costs	$50,000	$460,000	$853,677	$1,363,677
	$2,200,000	**$5,350,000**	**$9,800,000**	**$17,350,000**

General Plant Projects (GPP) provide the capital improvements to support Short Baseline Neutrino experiments.

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

1. **Design and Scope.** Have performance requirements been defined that meet the goals of the SBN program? Have independent design reviews been conducted? Based on the design reviews, are the designs sound and likely to meet the performance requirements? Do the designs capture the entire scope and are they adequately defined? Have the partnering agencies/organizations (e.g. CERN, DOE, INFN, NSF, SNSF, and STFC) identified and agreed to their respective scope?
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GPP Projects – Near Detector Site

SBN Near Detector Building Construction Package				
	SBN Site Development		SBN Near Detector Building	
	Budget	C+O	Budget	C+O
EDIA	$0	$0	$1,035,393	$409,829
Construction	$1,265,153	$300,000	$4,314,607	$1,285,839
Total	**$1,265,153**	**$300,000**	**$5,350,000**	**$1,695,668**
		24%		*32%*

Summary	
Budget	$6,615,153
Costs + Obligations	$1,995,668
Estimate To Complete	$4,123,187
Estimate At Completion	$6,118,856
Budget - EAC	$496,298
Budget-EAC / Budget	**8%**

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

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4. **Environment, Safety, and Health.** Is ES&H being appropriately addressed? Are the required environmental approvals, permits, and safety approvals on track to meet the schedule?

GPP Projects – Far Detector Site

SBN Far Detector Building Construction Package				
	SBN Site Development		SBN Far Detector Building	
	Budget	C+O	Budget	C+O
EDIA	$150,927	$71,423	$2,066,477	$1,009,387
Construction	$766,782	$766,782	$7,733,523	$6,817,831
Total	**$917,709**	**$838,205**	**$9,800,000**	**$7,827,218**
	91%			*80%*

Summary	
Budget	$10,717,709
Costs + Obligations	$8,665,423
Estimate To Complete	$1,375,241
Estimate At Completion	$10,040,665
Budget - EAC	$677,045
Budget-EAC / Budget	**6%**

Subcontractor has earned $1.71m so far, leaving ~8.8% contingency ($550k) on remaining work

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

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4. **Environment, Safety, and Health.** Is ES&H being appropriately addressed? Are the required environmental approvals, permits, and safety approvals on track to meet the schedule?

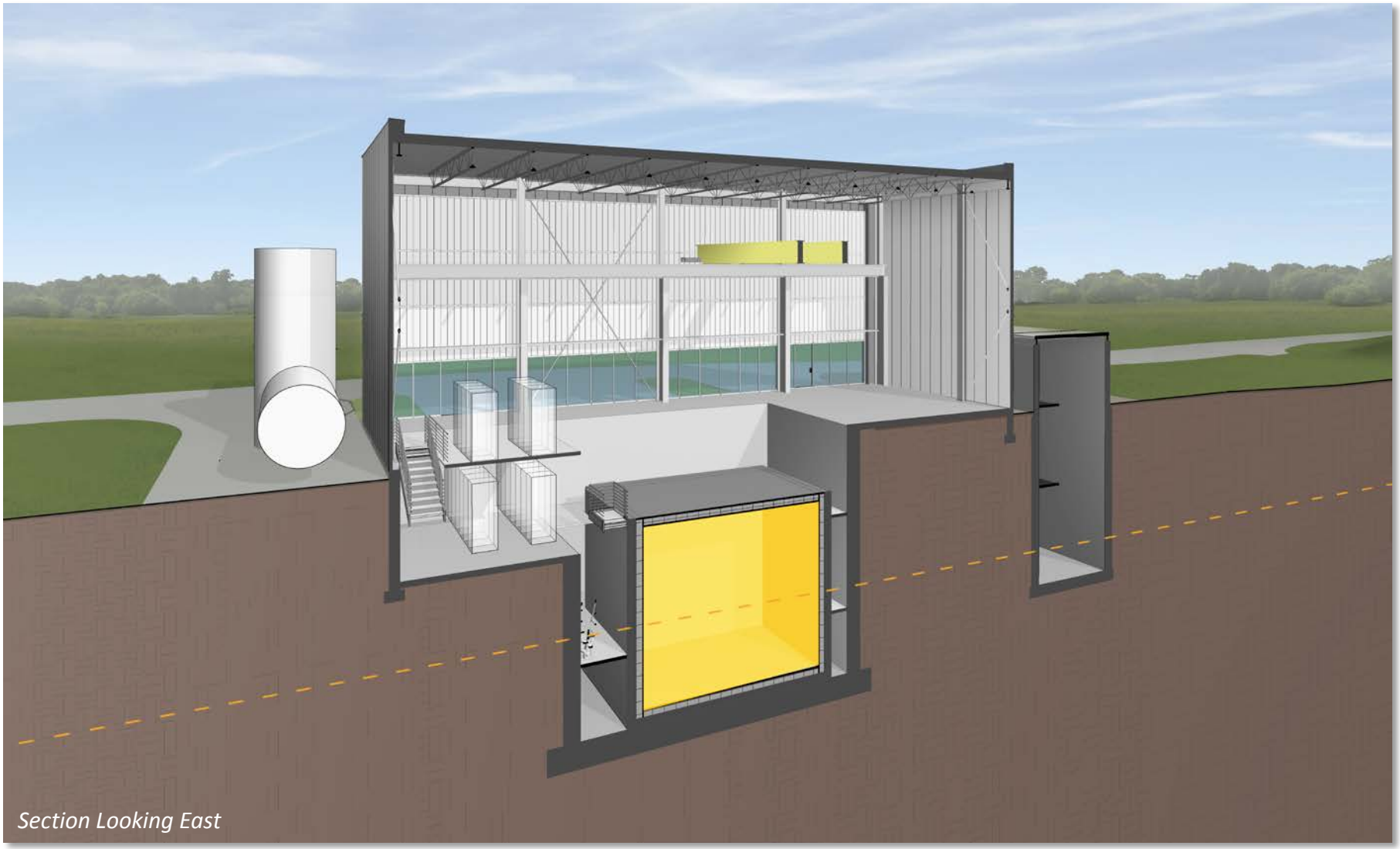
SBN Site Development (G15220)

- "*The objective of this project is to develop the existing site for the Short Baseline Neutrino program including wetland mitigation, extension of existing utilities and construction of road improvements.*" … from Approved GPP Project Plan
- Wetland Mitigation;
- Construction Packages:
  - SBN ND Site Preparation
  - SBN FD Site Preparation
- Common work that would benefit the overall SBN program.

SBN Near Detector Building (G15219)

"*The objective of this project is to construct the conventional facilities to support the installation and operation of a Near Detector for the Short Baseline Neutrino program.*" … from Approved GPP Project Plan

SBN Near Detector Building (G15219)



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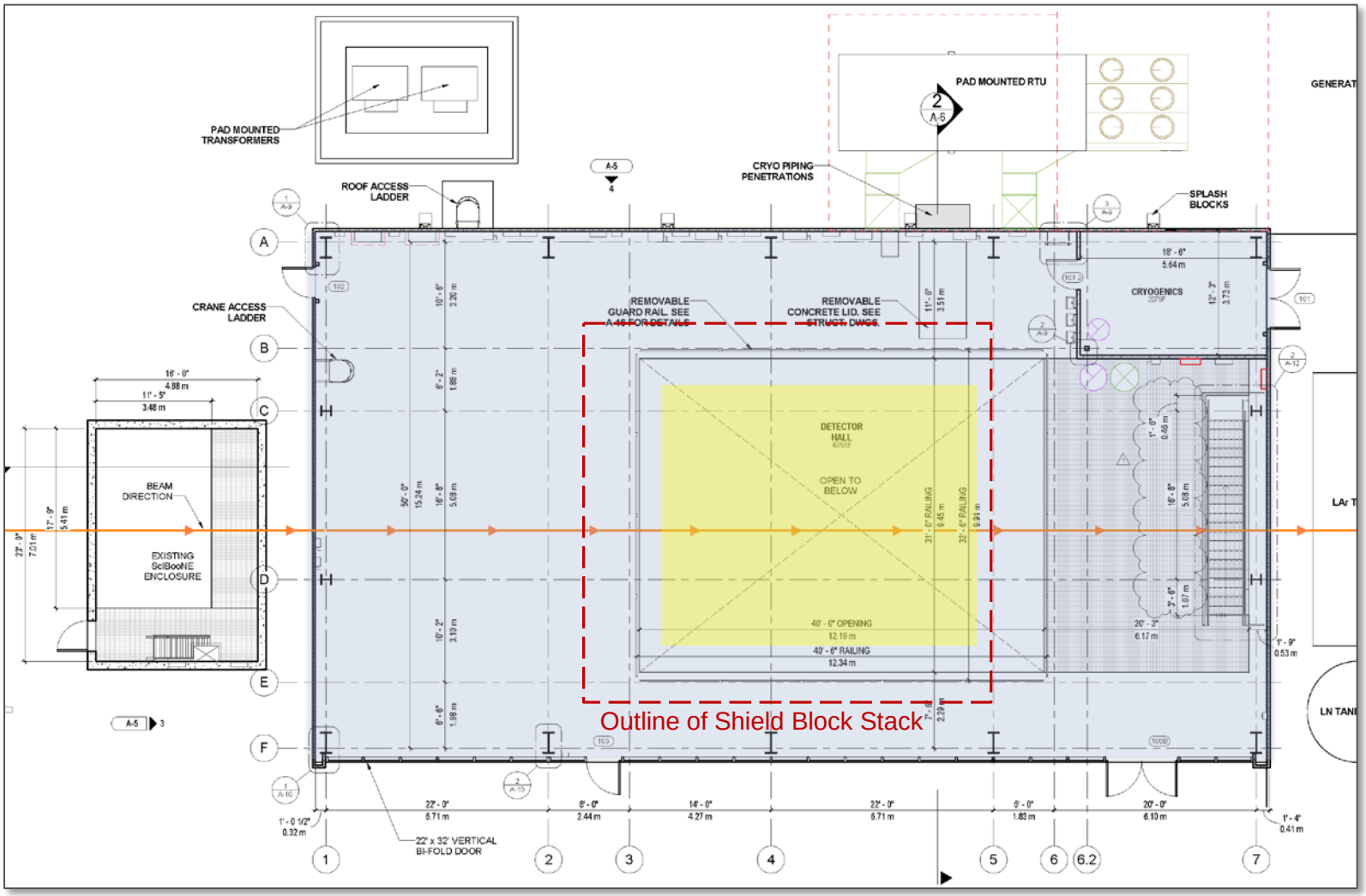
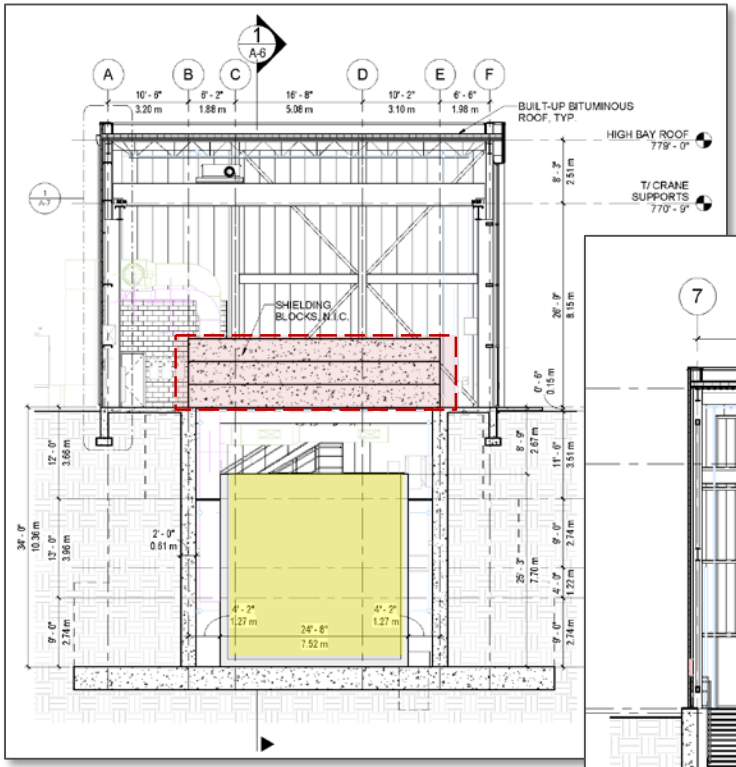
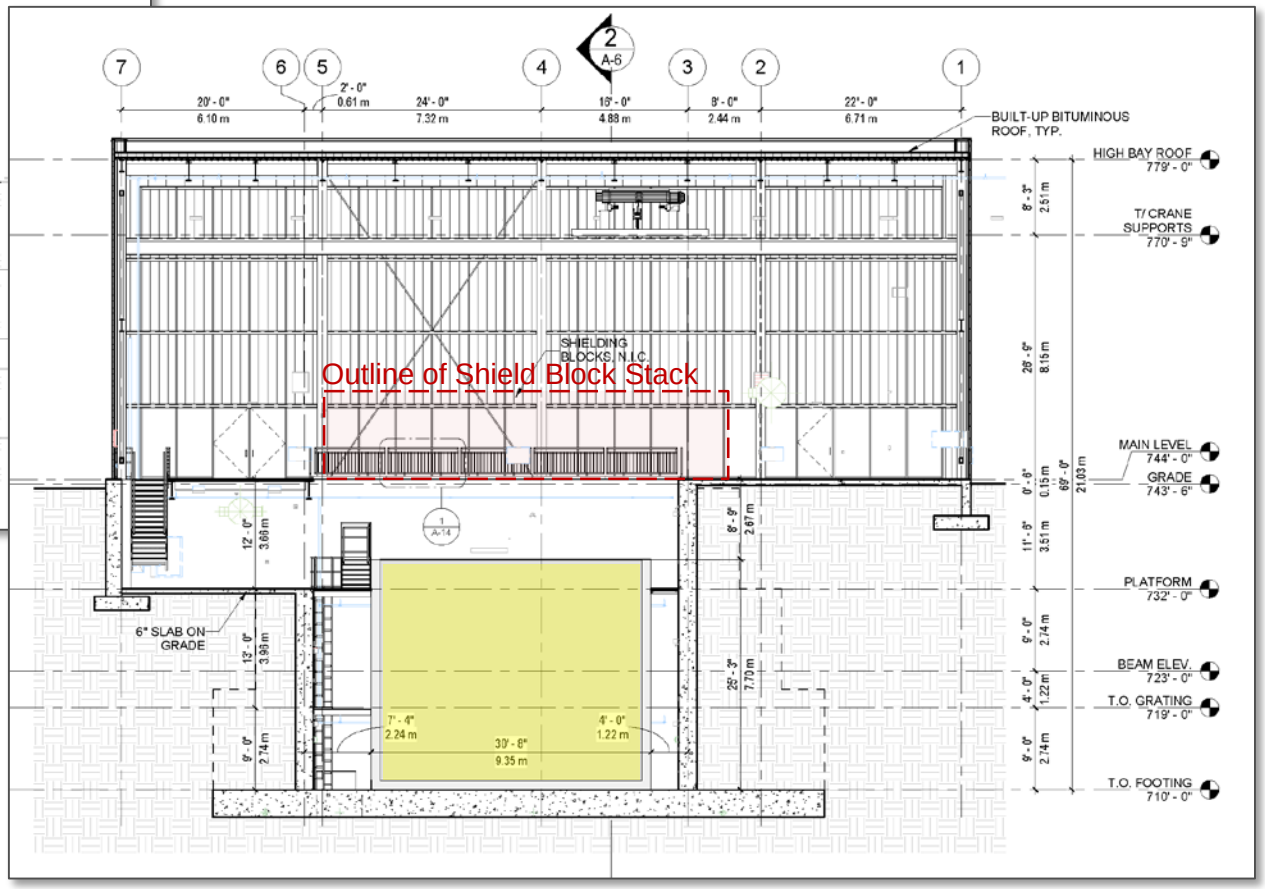


Plan at Grade Level

SBN Near Detector Building (G15219)



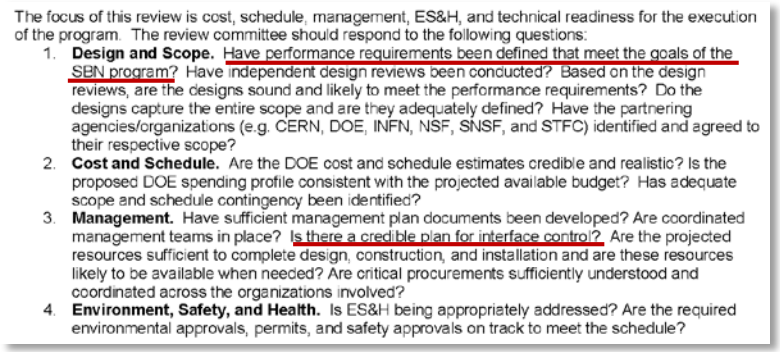
Section Looking South



Section Looking East

Interfaces - SBN Near Detector Building

- Final Design Team
  - Holabird & Root, KJWW and CMT
  - Internal Fermilab Personnel
  - Collaborators
- Meetings
  - SBND Technical Board (T. Miao)
  - SBND Installation (J. Howell)
- Interface Matrix (SBN-doc-135)



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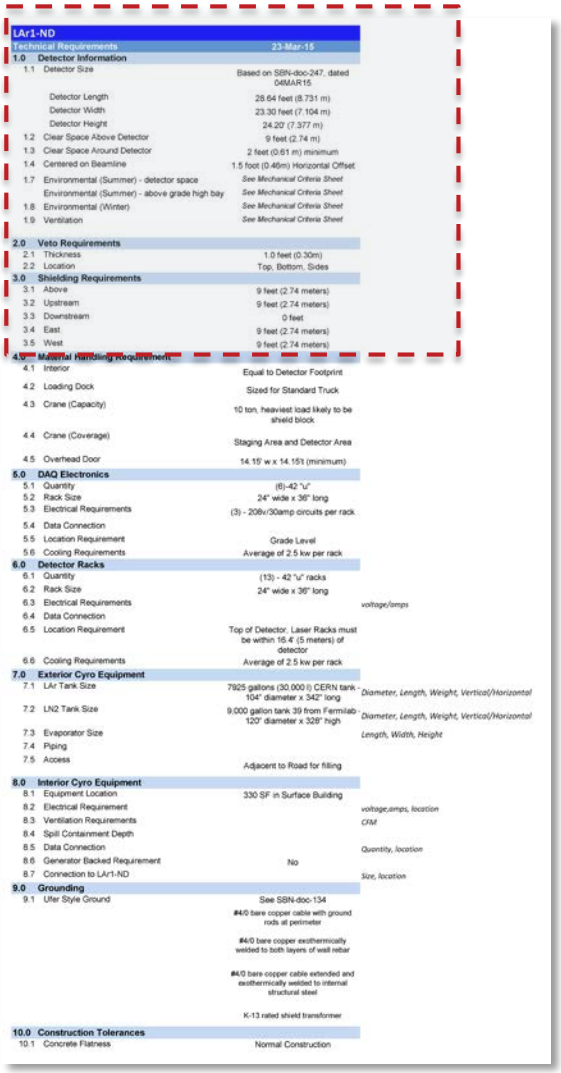
Charge Questions

Interfaces - SBN Near Detector Building



LAr1-ND		
Technical Requirements		23-Mar-15
1.0	Detector Information	
1.1	Detector Size	Based on SBN-doc-247, dated 04MAR15
	Detector Length	28.64 feet (8.731 m)
	Detector Width	23.30 feet (7.104 m)
	Detector Height	24.20' (7.377 m)
1.2	Clear Space Above Detector	9 feet (2.74 m)
1.3	Clear Space Around Detector	2 feet (0.61 m) minimum
1.4	Centered on Beamline	1.5 foot (0.46m) Horizontal Offset
1.7	Environmental (Summer) - detector space	*See Mechanical Criteria Sheet*
	Environmental (Summer) - above grade high bay	*See Mechanical Criteria Sheet*
1.8	Environmental (Winter)	*See Mechanical Criteria Sheet*
1.9	Ventilation	*See Mechanical Criteria Sheet*
2.0	Veto Requirements	
2.1	Thickness	1.0 feet (0.30m)
2.2	Location	Top, Bottom, Sides
3.0	Shielding Requirements	
3.1	Above	9 feet (2.74 meters)
3.2	Upstream	9 feet (2.74 meters)
3.3	Downstream	0 feet
3.4	East	9 feet (2.74 meters)
3.5	West	9 feet (2.74 meters)

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

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Charge Questions

Resources/Funding Profile - SBN Near Detector Building

- All funding for the GPP project is currently available.

		Initial Authorization	FY15 Authorization	FY15 (CCR No. 1)	FY16 (CCR No. 2)	Authorized Total	Obligations To Date
Construction		$71,000	$864,000	$350,000	$2,125,000	$3,410,000	$1,285,523
EDIA		$238,397	$0	$0	$426,603	$665,000	$391,745
Management Reserve		$48,930	$216,000	$0	$550,070	$815,000	
	Subtotal	$358,327	$1,080,000	$350,000	$3,101,673	$4,890,000	$1,677,268
Indirect Costs		$141,673	$120,000	$0	$198,327	$460,000	$18,400
	TOTAL	**$500,000**	**$1,200,000**	**$350,000**	**$3,300,000**	**$5,350,000**	**$1,695,668**

The focus of this review is cost, schedule, management, ES&H, and technical readiness for the execution of the program. The review committee should respond to the following questions:

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Charge Questions

Schedule - SBN Near Detector Building

Nov 2014 – GPP Project Approved

Jan 2015 – Final Design start

May 2015 - 60% Final Design complete

July 2015 – 90% Final Design review

Aug 2015 - Design complete

Sep 2015 – Issued for Proposals

Oct 2015 – Proposals Received

Dec 2015 – Notice To Proceed

Mar 2016 – Construction start

Nov 2016 - Substantial Completion

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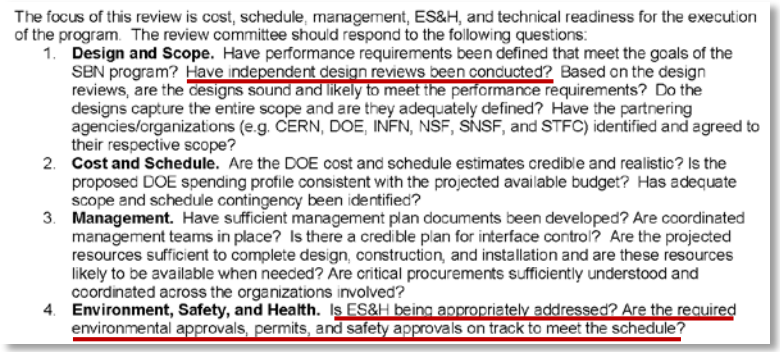
ES&H, QA - SBN Near Detector Building

- Comment and Compliance Review (CCR) during Project Plan development (SBN-doc-72)
- Life Safety Assessment during Final Design (SBN-doc-729)
- 60% Final Design CCR: SBN-doc-284-v6, SBN-doc-730
- 90% Final Design CCR: SBN-doc-284-v8
- Subcontract document includes ES&H requirements for construction;
- SWPPP Notice of Intent issued from State



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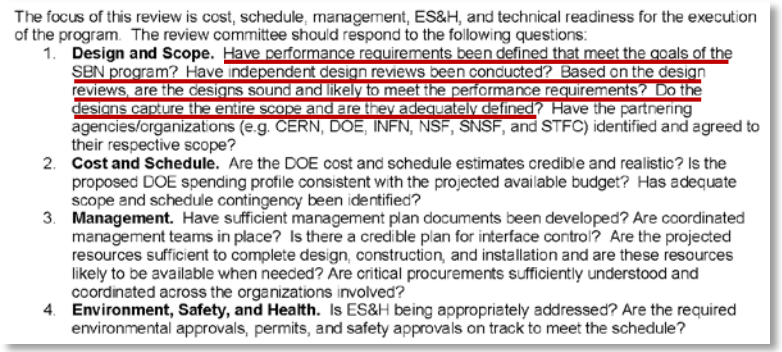
Response to Review Recommendations

- Technical Requirements Readiness Review
  - At completion of Final Design when issued for proposals
  - 30JUL15 (SBN-doc-546)
  - Issues – All addressed in Final Design:
    - Item 1 – Access From Mezzanine to Detector Hall
    - Item 2 – Truck Access
    - Item 3 – Detector Weight
    - Item 4 – Floor Flatness
    - Item 5 – Overhead Bridge Crane Capacity
    - Item 6 – UV Lights
    - Item 7 – Cryogenic Pipe Routing
    - Item 8 – Cryogenic Pump Alcove



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Status of Design - SBN Near Detector Building

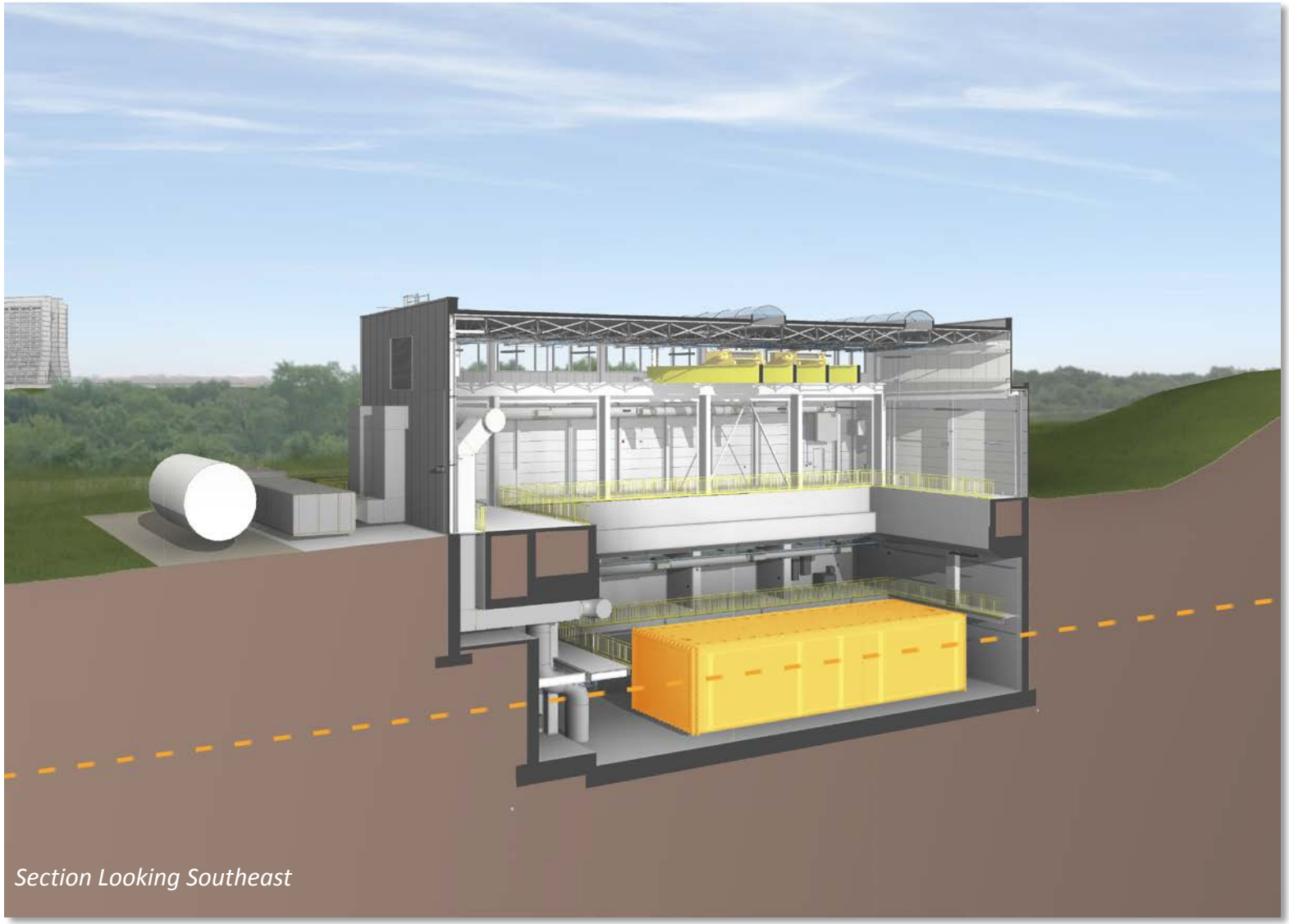
- Design is complete;
- Fixed price proposal is in hand;
- Expect Notice to Proceed in December 2015;
- Construction to begin in early 2016.

SBN Far Detector Building (G15218)

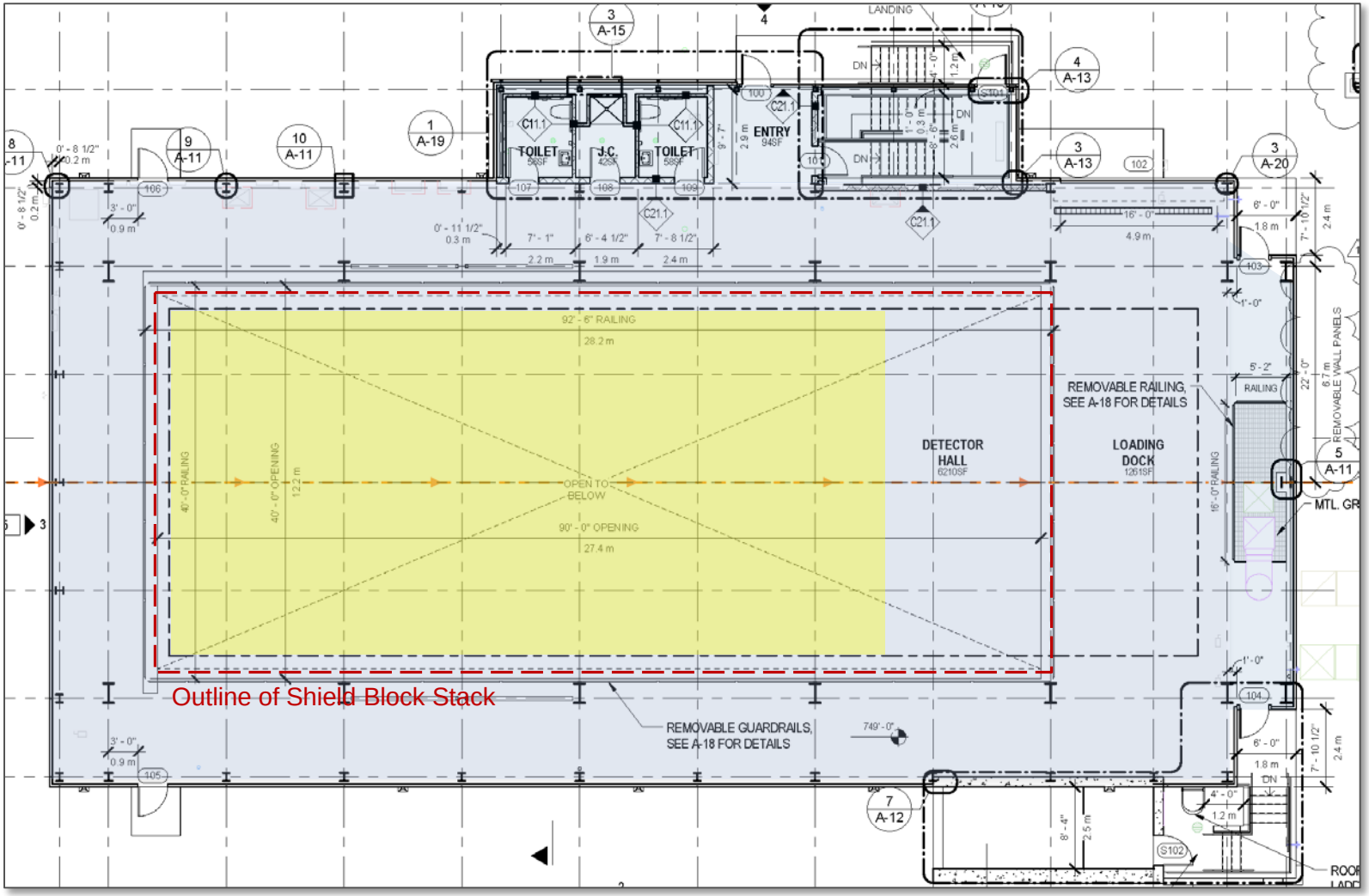
Exterior Looking Southeast

"*The objective of this project is to construct the conventional facilities to support the installation and operation of a Far Detector for the Short Baseline Neutrino program.*" … from Approved GPP Project Plan

SBN Far Detector Building (G15218)



SBN Far Detector Building (G15218)



Plan at Grade Level

SBN Far Detector Building (G15218)

Section Looking West

Interfaces - SBN Far Detector Building

- Final Design Team
  - Holabird & Root, KJWW and CMT
  - Internal Fermilab Personnel
  - Collaborators
- Interface Matrix (SBN-doc-135)

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Charge Questions

Resources/Funding Profile - SBN Far Detector Building

- All funding for the GPP project is currently available.

		Initial Authorization	FY15 Authorization	FY16 Authorization	Authorized Total	Obligations To Date
Construction		$0	$4,000,000	$1,746,000	$5,746,000	$6,699,617
EDIA		$755,000	$300,000	$151,000	$1,206,000	$821,878
Management Reserve		$45,000	$500,000	$1,450,000	$1,995,000	
	Subtotal	$800,000	$4,800,000	$3,347,000	$8,947,000	$7,521,495
Indirect Costs		$200,000	$498,000	$155,000	$853,000	$305,723
	TOTAL	**$1,000,000**	**$5,298,000**	**$3,502,000**	**$9,800,000**	**$7,827,218**

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Charge Questions

Schedule - SBN Far Detector Building

Oct 2014 – GPP Project Approved

Nov 2014– Final Design start

Apr 2015 – Issued for Proposals

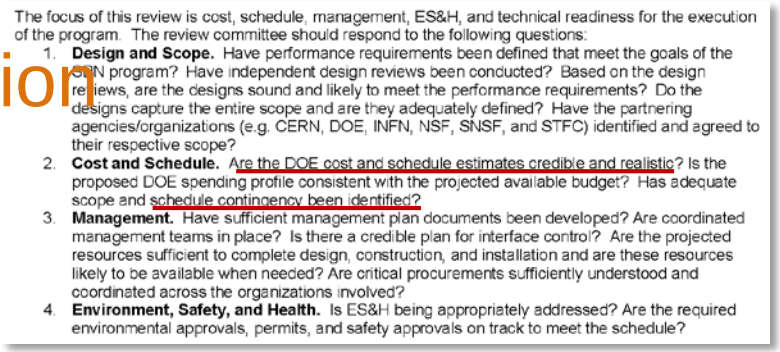
Jun 2015 – Proposals Received

Jul 2015 – Notice To Proceed

Jan 2016 – Concrete Complete

Jun 2016 – Building Envelope

Oct 2016 - Substantial Completion



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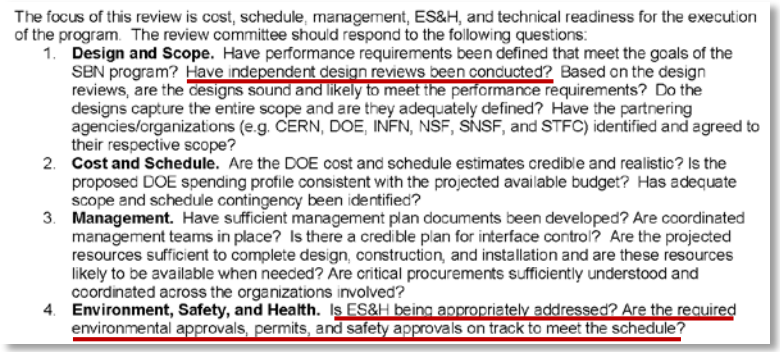
ES&H, QA - SBN Far Detector Building

- Comment and Compliance Review (CCR) during Project Plan development (SBN-doc-113)
- Life Safety Assessment during Final Design (SBN-doc-731)
- 60% Final Design CCR: SBN-doc-276-v3, SBN-doc-732
- Subcontract document includes ES&H requirements for construction;
- SWPPP Notice of Intent issued from State (SBN-doc-428)



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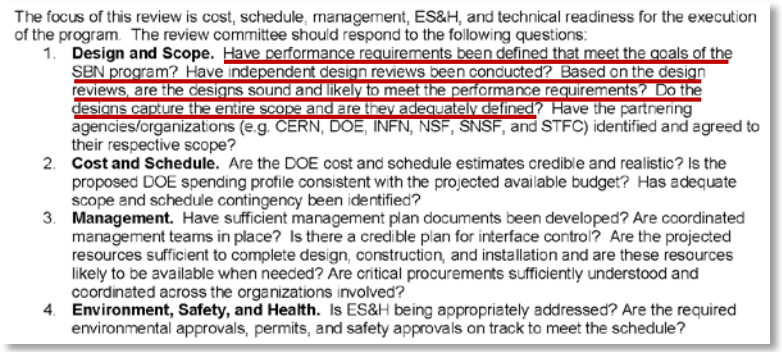
Response to Review Recommendations

- Technical Requirements Readiness Review
  - At completion of Final Design when issued for proposals
  - 17MAR15 (SBN-doc-380)
  - Issues – All addressed in Final Design:
    - Item 1 – Detector Envelope Size Increase
    - Item 2 – Detector Power and Heat Load Revision
    - Item 3 – Cryo Filter Regeneration Heat Load
    - Item 4 – Grounding Plan
    - Item 5 – Oxygen Hazard Preliminary Review
    - Item 6 – West Overhead Door Height
    - OTR – Cranes
    - OTR – Cooling Water
    - OTR – Separation Wall
    - OTR – ODH Mitigation
    - OTR – Control Room



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Status of Design - SBN Far Detector Building

- Design is complete;
- Fixed price proposal is in hand;
- Notice to Proceed in July 2015;
- Substantial Completion in October 2016.

Charge Questions Responses

Charge Question 1 - Design and Scope

“Have performance requirements been defined to meet the goals of the SBN program?”

Yes, through:

- Project Plan required for GPP authorization;
  - SBN Site Development: SBN-doc-162)
  - SBN Near Detector Building: SBN-doc-72)
  - SBN Far Detector Building: SBN-doc-113)
- Final Design coordination meetings;
- Requirements Reviews
  - SBN Near Detector Building: SBN-doc-546
  - SBN Far Detector Building: SBN-doc-380

Charge Question 1 - Design and Scope

"**Have independent design reviews been conducted**"– Yes

- SBN Site Development
  - Project Plan: SBN-doc-162
  - Final Design with building reviews
- SBN Near Detector Building
  - Project Plan: SBN-doc-72
  - Life Safety Review (11MAR15): SBN-doc-729
  - 60% Final Design (02MAR15): SBN-doc-284-v6, SBN-doc-730
  - 90% Final Design (24JUL15): SBN-doc-284-v8
- SBN Far Detector Building
  - Project Plan: SBN-doc-113
  - Life Safety Review (11MAR15): SBN-doc-731
  - 60% Final Design (27JAN15): SBN-doc-732

Charge Question 1 - Design and Scope

“Based on the design reviews are the design sound and likely to meet the performance requirements?”

Yes, based on the reviews by the project team, external reviewers and collaborators.

“Do the designs capture the entire scope and are they adequately defined?”

Yes, the scope definition contained in the approved Project Plans is the basis for the final design work.

Charge Question 2 - Cost and Schedule

"Are the DOE cost and schedule estimates credible and realistic?"

Yes, based on firm fixed price proposals in hand and modest contingency on remaining work.

"Is the DOE funding profile consistent with the projected available budget?"

Yes, all authorized funding has been provided.

"Has adequate scope and schedule contingency been identified?"

Yes, the Project Plan contain scope contingency.

Charge Question 3 - Management

“Have sufficient management plan documents been developed?”

Yes, all GPP projects have an approved Project Plan in place.

“Are coordinated management teams in place?”

Yes, each Project Plan has a Change Control Board.

“Is there a credible plan for interface control?”

Yes, through the technical requirements matrixes.

Charge Question 3 - Management

“Are the projected resources sufficient to complete design, construction and installation and are these resources likely to be available when needed?

Yes, Final Design is complete, Construction Phase resources have been identified and where needed, contracts are in place.

“Are critical procurements sufficiently understood and coordinated across organizations involved?”

Yes, long lead time items, such as overhead cranes, are known and we are working with Procurement to obtain these.

Charge Question 4 – ES&H

"Is ES&H being appropriately addressed?"

Yes, the subcontract document include ES&H requirements for fixed price construction.

"Are the required environmental approvals, permits and safety approvals on track to meet the schedule?"

Yes:

Wetland (4 permits/letters required) – All in hand (SBN-doc-43)

SWPPP – Far Detector Building permit in hand (SBN-doc-428)

SWPPP – Near Detector Building NOI obtained

Construction Photos – Near Detector Building Site

Construction Photos – Far Detector Building Site

Construction Photos – Far Detector Building Site