Fermilab

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SBN Far Detector Building Status

S. Dixon

SBN Far Detector Readiness Review

17 March 2015

Agenda

- Environmental
- Technical Requirements
- Detector Installation
- Cost
- Schedule

Environmental

	Far Detector Building
National Environmental Policy Act	*Cx Approved on 10NOV14*
Wetland Delineation	*Complete of 11JUL14*
Illinois Department of Natural Resources	*Letter Stating No Permit Required, 09OCT14*
Kane/Dupage Soil and Water Conservation District	*Comments Received, 26JAN15*
US Army Corps of Engineers	*Permit Received, **03FEB15***
Wetland Credits	*Credits Purchased, 28JAN15*

Still notifications to do prior to start of construction, but no show stoppers

Technical Requirements

From C. Montanari' s presentation on 30APR14

- Dimensions of the detector envelope are 11m wide x 23.5m long x 6 m high;
- Dimensions of the LAr purification equipment are 11m wide x 3m long x 6m high;

From "Icarus Input to discussions" dated 29MAY14

(listed below is a summary of the building specific items)

- Heaviest weight of single piece is the aluminum cold vessels at 50 metric tons;
- Total weight of installed detector is 700 metric tons, but assume 1,000 metric tons for design purposes;
- No chilled water is required;
- The detector does not have any special temperature/humidity requirements, other than the space should be maintained above the dew point to avoid condensation;
- 2m-4m of space is needed above the detector;
- The Control Room requires an environment of 72 degree F (22c) +/- 5 degrees F, 30%-50% relative humidity;
- The Control Room requires a 20kw UPS unit for computers;
- The location of the Control Room is not critical.

Technical Requirements – SBN-doc-136

Far Detector (ICARUS)		
Technical Requirements		16-Mar-15
1.0	Detector Information	
1.1	Detector Size	(2) - 77'l x 18'w x 19.7' h
1.2	Detector Weight	110,230 pounds each
1.3	Installation	Top Loaded in Detector Enclosure
1.4	Clear Space Above Detector	9 feet (2.74 meters)
1.5	Clear Space Around Detector	5 feet (1.54 meters)
1.6	Centered on Beamline	Horizontal
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*
	Ventilation	*See Mechanical Criteria Sheet*
1.9	Installation Method	
	Horizontal Transport Through North Wall	
	Interior Movement Options	
	Option 1 - Two (2) Overhead Bridge Cranes	
	Option 2 - Exterior Cranes Through Roof Hatches	
	Option 3 - Gantry System	
2.0	Shielding Requirements	
2.1	Above	9 feet (2.74 meters)
2.2	Upstream	9 feet (2.74 meters)
2.3	Downstream	0 feet
2.4	East	9 feet (2.74 meters)
2.5	West	9 feet (2.74 meters)
3.0	Material Handling Requirement	
3.1	Interior	24'x24' Adjacent to Loading Dock
3.2	Loading Dock	Sized for Standard Truck
3.3	Crane (Capacity)	10 ton minimum - heaviest load likely to be shield block which will increase capacity
3.4	Crane (Coverage)	Loading Dock and Detector Area
3.5	Overhead Door	16'w x 14'l (4.87 meters x 4.26 meters)
3.6	Vertical Transport	Overhead Crane
4.0	Electronics Rack	
4.1	Quantity	(6)-42 "u"
4.2	Rack Size	36"w x 48"l
4.3	Electrical Requirements	(3) - 208v/30amp circuits per rack
4.4	Data Connection	10 computers per rack
4.5	Location Requirement	Detector Enclosure Level
4.6	Cooling Requirements	
4.7	Enviromental Conditions	"office" type conditions 78F +/- 5F, 55% RH (not controlled) no minimum RH
5.0	Detector Racks	
5.1	Quantity	
5.2	Electrical Requirements	*voltage/amps*
5.3	Data Connection	
5.4	Location Requirement	On top of Detector
5.5	Cooling Requirements	
6.0	Exterior Cyro Equipment	
6.1	LAr Tank Size	30,000 Liter *provided by CERN* *8'-2" diameter, 28'-6" long*
6.2	LN2 Tank Size	20,000 gallon *Tank 42 provided by Fermilab* *10' diameter, 51'-1" long*
6.3	Evaporator Size	
6.4	Piping	
6.5	Access	Adjacent to Road for filling
7.0	Interior Cyro Equipment	
7.1	Equipment Location	Detector Enclosure Level
7.2	Equipment Space Requirements	10'w x 36' w x 20' h
7.2	Electrical Requirement	*voltage,amps, location*
7.3	Ventilation Requirements	See mechanical requirements
7.4	Spill Containment Depth	2'-0"
7.5	Data Connection	*Quantity, location*
7.6	Generator Backed Requirement	No
8.0	Grounding	
8.1	Ufer Style Ground	See SBN-doc-134 #4/0 bare copper cable with ground rods at perimeter #4/0 bare copper exothermically welded to both layers of wall rebar #4/0 bare copper cable extended and exothermically welded to internal structural steel K-13 rated shield transformer
9.0	Construction Tolerances	
9.1	Concrete	Normal Construction

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5.1 Quantity		
5.2 Electrical Requirements		*voltage/amps*
5.3 Data Connection		
5.4 Location Requirement	On top of Detector	
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6.0 Exterior Cyro Equipment		
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6.2 LN2 Tank Size	20,000 gallon *10' diameter, 51'-1" long*	*Tank 42 provided by Fermilab*
6.3 Evaporator Size		
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7.6 Generator Backed Requirement	No	
8.0 Grounding		
8.1 Ufer Style Ground	See SBN-doc-134 #4/0 bare copper cable with ground rods at perimeter #4/0 bare copper exothermically welded to both layers of wall rebar #4/0 bare copper cable extended and exothermically welded to internal structural steel K-13 rated shield transformer	
9.0 Construction Tolerances		
9.1 Concrete	Normal Construction	

16-Mar-15

LOCATION	HVAC	LOADS	TEMPERATURE (SUMMER)	TEMPERATURE (WINTER)	HUMIDITY	PRESSURE	OCCUPANCY SCHEDULE	VENTILATION: People (Basis of design)	VENTILATION: SPECIAL VENTILATION
SBN FD									
DETECTOR SPACE (BELOW GRADE)	HVAC	DETECTOR RACKS & CRYO EQUIP? **Assume 40 kw of Heatload**	78F +/- 5F	60F min	55% RH max , No minimum RH	NO REMNT	DOES NOT APPLY BUT HAVE AVAILABLE IN HVAC SEQUENCE	**TBD**	**10,000 cfm ventilation for ODH. Assumes fans operate only in emergency conditions**
UPPER HIGHBAY	HVAC	RACKS? **TBD**	78F +/- 5F	65F min	55% RH max, No minimum RH	NO REMNT	DOES NOT APPLY BUT HAVE AVAILABLE IN HVAC SEQUENCE	**TBD**	
~~**PRESSURIZED VESTIBULE**~~	~~V~~	~~NONE~~	~~NONE~~	~~60F min~~	~~NO REQMNT~~	~~NO REMNT~~	~~DOES NOT APPLY~~		
STAIR	HV	NONE	NONE	60F min	NO REQMNT	0.1" WC	DOES NOT APPLY	NONE	**Stairs pressurized in emergency conditions only**
ELEC ROOM	HV	MISC	AMBIENT VENTILATION	65F min	NO REQMNT	NO REMNT	DOES NOT APPLY	NONE	NONE
MECH ROOM	HV	MISC	AMBIENT VENTILATION	65F min	NO REQMNT	NO REMNT	DOES NOT APPLY	NONE	NONE
COMPUTER ROOM (Mezzanine)	HVAC	19 Racks	78F +/- 5F	68F min	55% RH max , No minimum RH	NO REMNT	DOES NOT APPLY	NONE	NONE
SBN ND									
DETECTOR SPACE (BELOW GRADE)	HVAC	DETECTOR RACKS & CRYO EQUIP? **TBD**	78F +/- 5F	60F min	55% RH max , No minimum RH	NO REMNT	DOES NOT APPLY	**TBD**	**TBD cfm ventilation for ODH. Assumes fans operate only in emergency conditions**
UPPER / LOADING DOCK		? **TBD**	NONE	65F min	NONE	NO REMNT	DOES NOT APPLY	**NONE**	
~~**PRESSURIZED VESTIBULE**~~	~~V~~	~~NONE~~	~~NONE~~	~~60F min~~	~~NO REQMNT~~	~~NO REMNT~~	~~DOES NOT APPLY~~		
STAIR		NONE	NONE	60F min	NO REQMNT	0.1" WC	DOES NOT APPLY	NONE	**Stairs pressurized in emergency conditions only**
LarTF (reference)									
CYLINDER AREA	HVAC		78-80F	60F	55% RH max , No minimum RH		none	20 people	7500cfm under ODH accident (later a minimum flow was include)
STAIRWAYS	HVAC	NONE	60 to 80F	60F min	55% RH max , No minimum RH	0.5"WC to 1"WC			
LOADING DOCK	none	NONE	na	65F min					
COMPUTER ROOM	HVAC	12 racks @ 2.5kw/rack	72 to 75F		50% RH max, no min RH				

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7.5 Data Connection		*Quantity, location*
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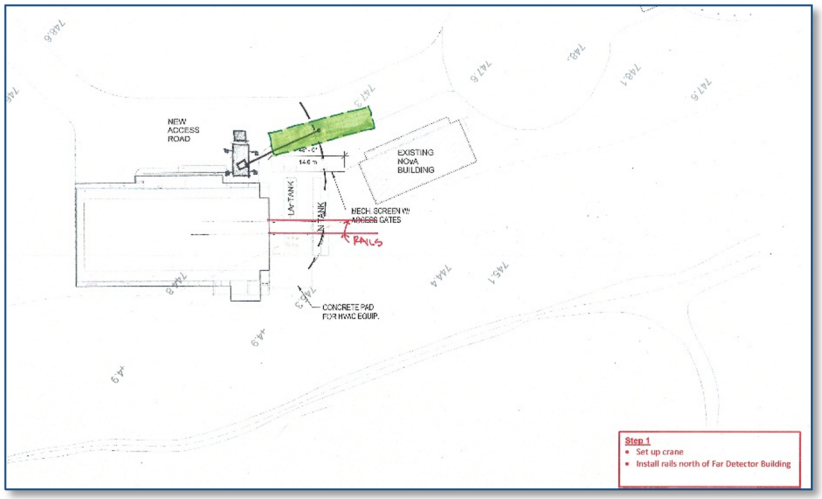
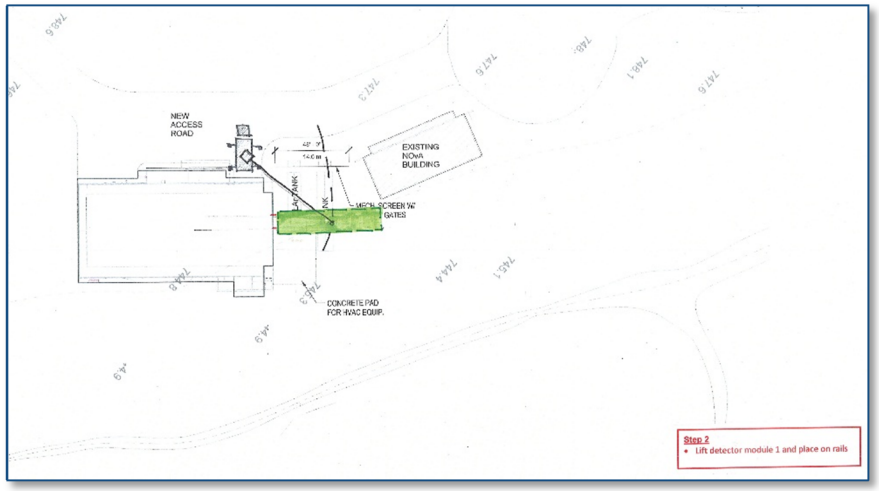
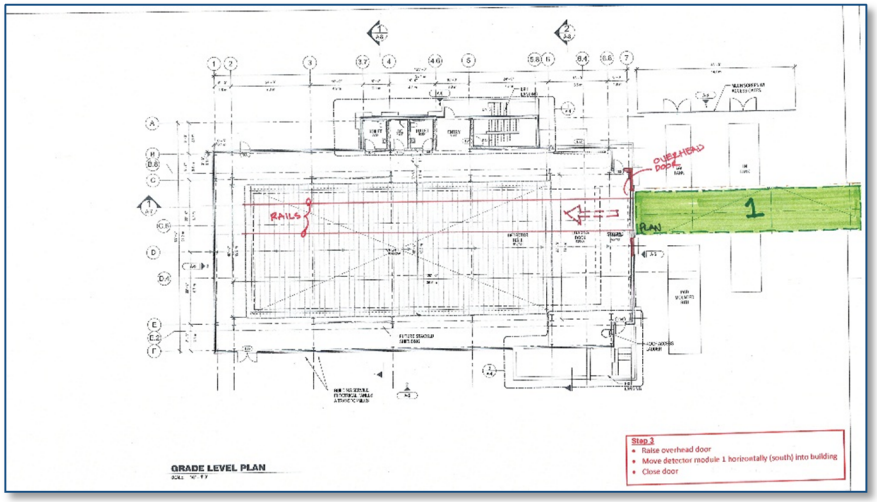
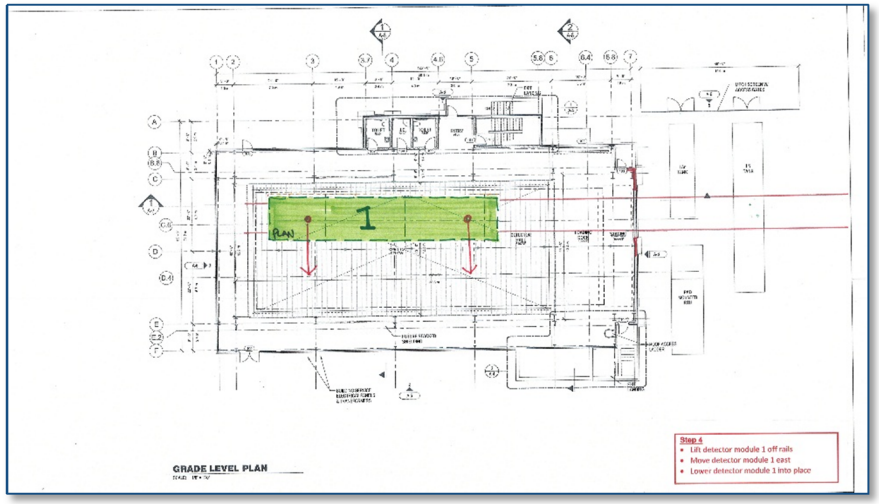
Detector Installation









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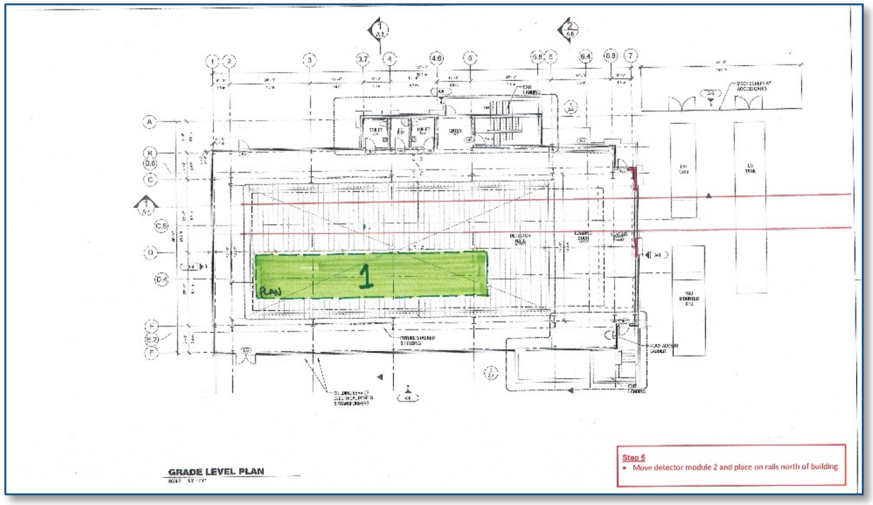
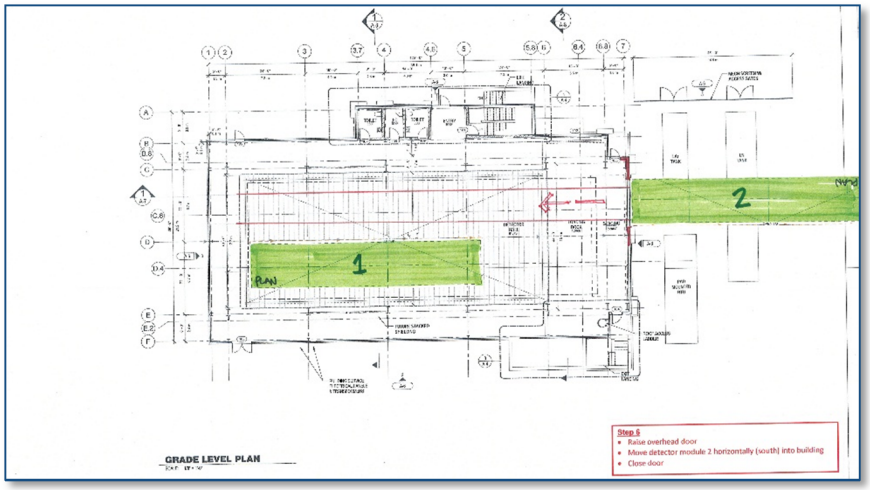
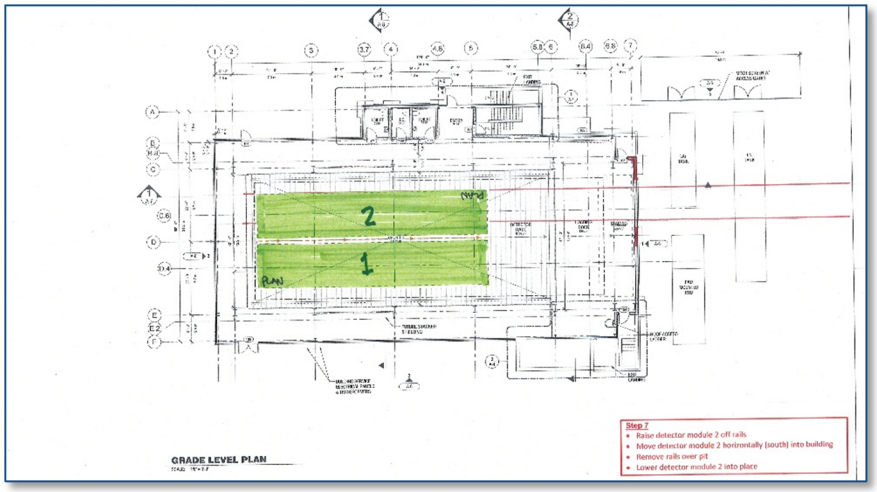
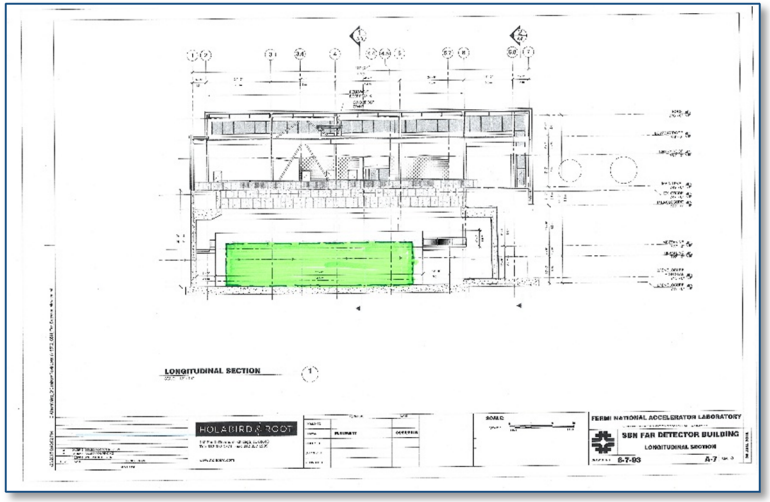
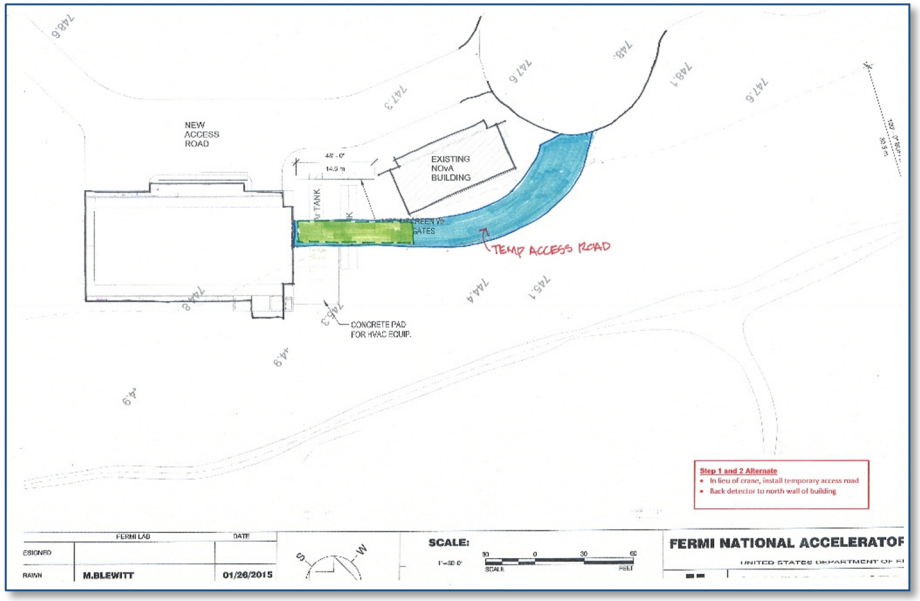








Detector Installation – Optional Delivery Method



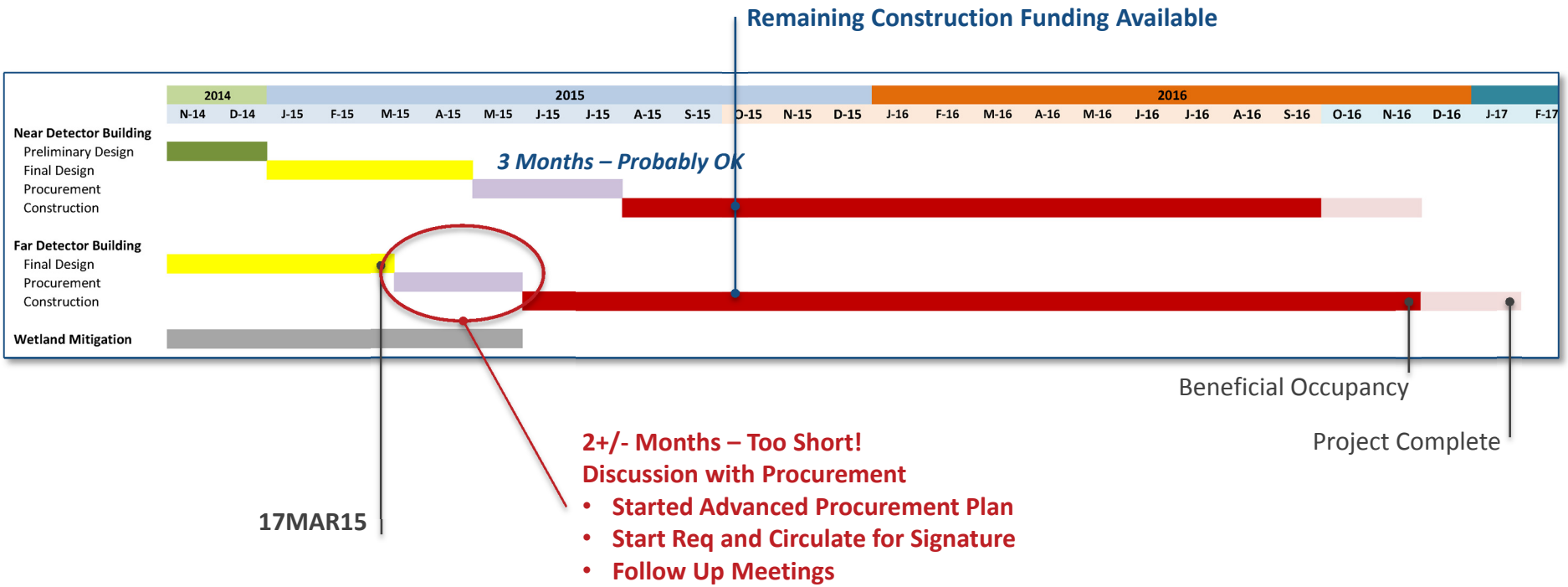
Cost Estimate

- Utilized external estimator (CCS in Oakbrook Terrace, IL.)
- Budget Target is $5.6m for Building, $525k for Site Work
- Three estimates during final design
  - 02FEB15: $6.73m (Building) and $767k (Site)
  - 17FEB15: $7.2m (Building) and $565k (Site)
  - Led to value engineering studies
    - (reduced enclosure level, no toilets, fixed roof, no mezzanine, reduced glazing)

Cost Estimate – 06MAR15

		SBN Far Detector Building		SBN FD Site Development	
	CCS Estimate 06MAR15	Base Bid Target	Adjusted Estimate	Base Bid Target	Adjusted Estimate
01-Foundations	$517,731		$517,731		
02-Substructure	$1,140,282		$1,140,282		
03-Superstructure	$880,557		$880,557		
04-Exterior Closure	$585,700		$585,700		
05-Roofing	$202,301		$202,301		
06-Interior Construction	$159,988		$159,988		
07-Conveying Systems	$35,000		$35,000		
08-Mechanical	$627,835		$627,835		
09-Electrical	$663,799		$663,799		
12-Sitework	$609,340				$609,340
Base Cost Subtotal	$5,422,534	$4,700,000	$4,813,195	$445,000	$609,340
3% Badging Premium	$162,676	$141,000	$144,396	$13,350	$18,280
12% General Conditons, OH&P	$670,225	$580,920	$594,911	$55,002	$75,314
3% Escalation	$187,663	*$178,080*	$166,575	*$11,648*	$21,088
Total	**$6,443,099**	**$5,600,000**	**$5,719,076**	**$525,000**	**$724,023**
Difference (Adjusted Estimate - Budget)			$119,077		$199,023
% Overage			2%		38%
Combined Budget	$6,125,000				
Combined Adjusted Estimate	$6,443,099				
Difference	$318,099				
% over Budget	5%				

Schedule


Remaining Construction Funding Available
2014
2015
2016
N-14 D-14 J-15 F-15 M-15 A-15 M-15 J-15 J-15 A-15 S-15 O-15 N-15 D-15 J-16 F-16 M-16 A-16 M-16 J-16 J-16 A-16 S-16 O-16 N-16 D-16 J-17 F-17
Near Detector Building
Preliminary Design
Final Design
Procurement
Construction
3 Months – Probably OK
Far Detector Building
Final Design
Procurement
Construction
Wetland Mitigation
Beneficial Occupancy
Project Complete
17MAR15
2+/- Months – Too Short!
Discussion with Procurement
• Started Advanced Procurement Plan
• Start Req and Circulate for Signature
• Follow Up Meetings

Questions