FSCF Changes into Final Design

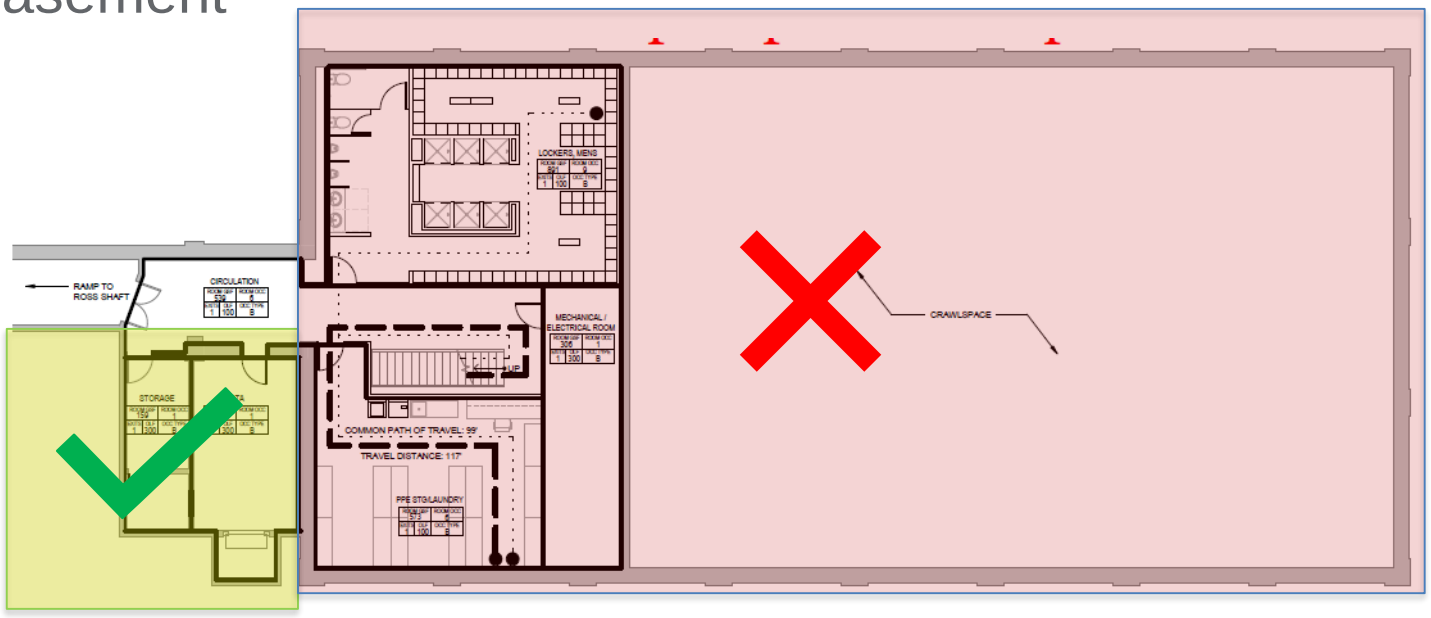
Slides from Arup Final Design Kick-Off Meeting (11/7/17)

April 11, 2018

BSI Scope Design Changes

Surface Architectural - Ross Dry Renovations

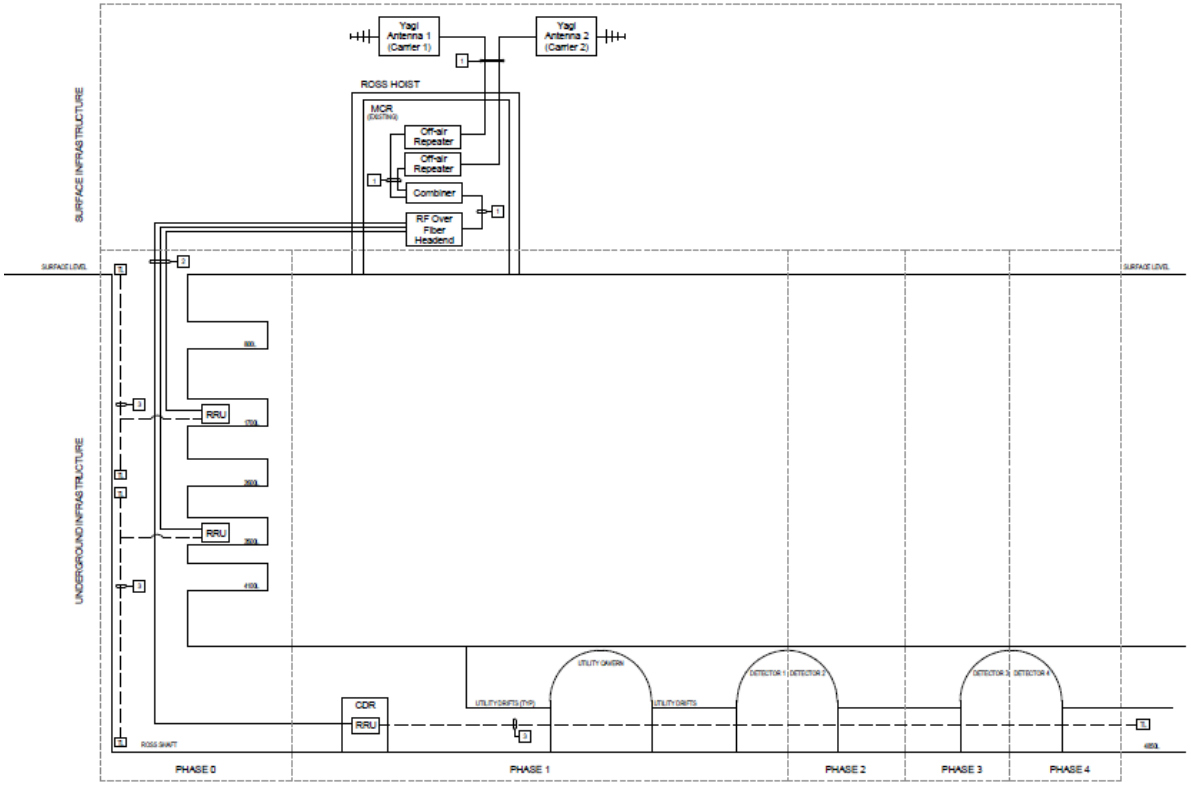
- Previously identified as a “Scope Option” with Control room kept in Scope
- Current scope does not include any renovations or Control Room construction except that which is required for fiber in the basement



BSI Scope Design Changes

Underground Communications

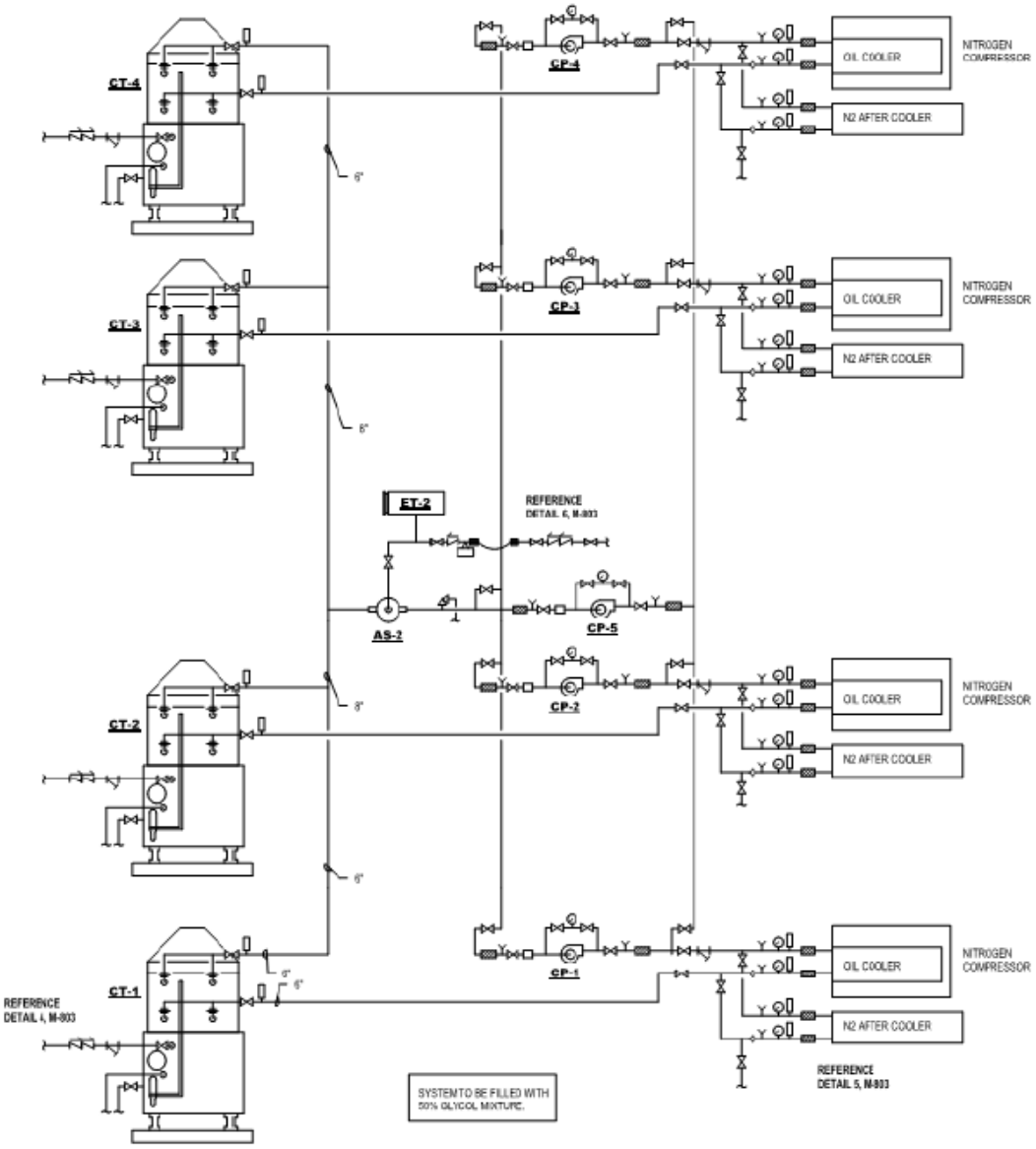
- Preliminary Design Scope for Leaky Feeder System – Scope Option
- Final Design Scope – To remain as a Scope Option



BSI Scope Design Changes

Surface Mechanical

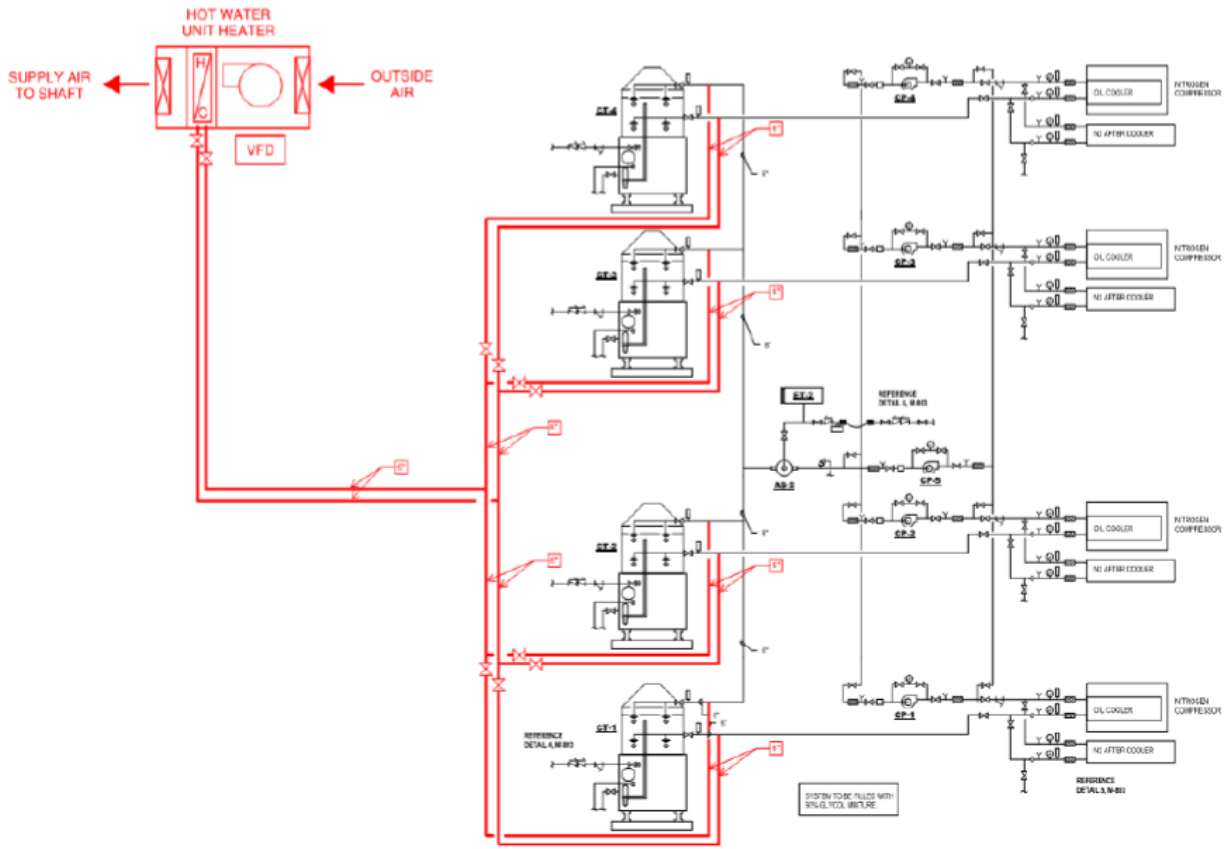
- Current Preliminary Design utilizes Cooling Towers for 100% Heat Rejection



BSI Scope Design Changes

Surface Mechanical

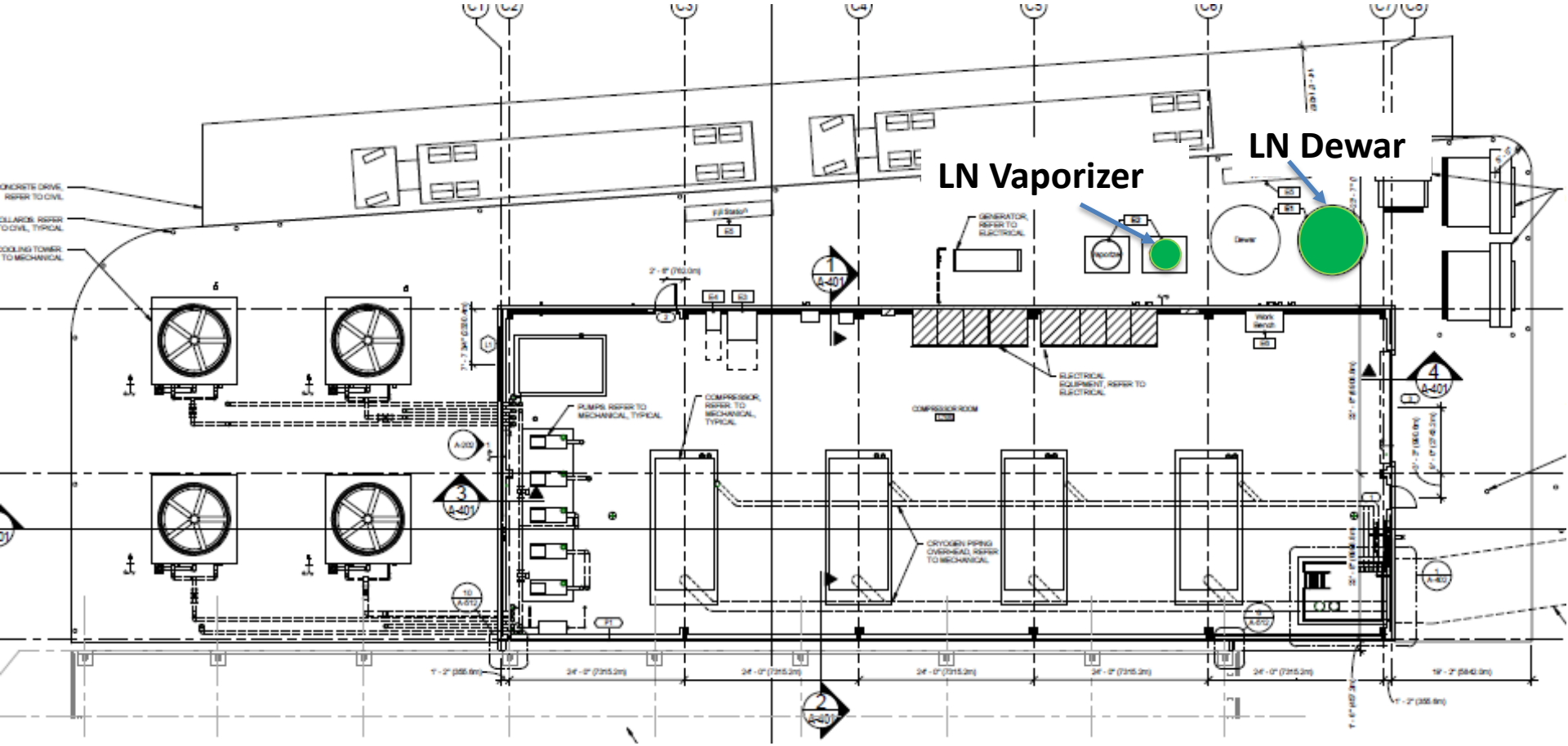
- Incorporate the plan from the Advanced Preliminary Design task for utilization of waste heat from the Cryogen compressors to heat the Intake Air for the Ross Shaft
- Cooling Towers are to remain to provide cooling during warm periods where Shaft Intake air does not require heating



BSI Scope Design Changes

Surface Civil – Cryogen Building

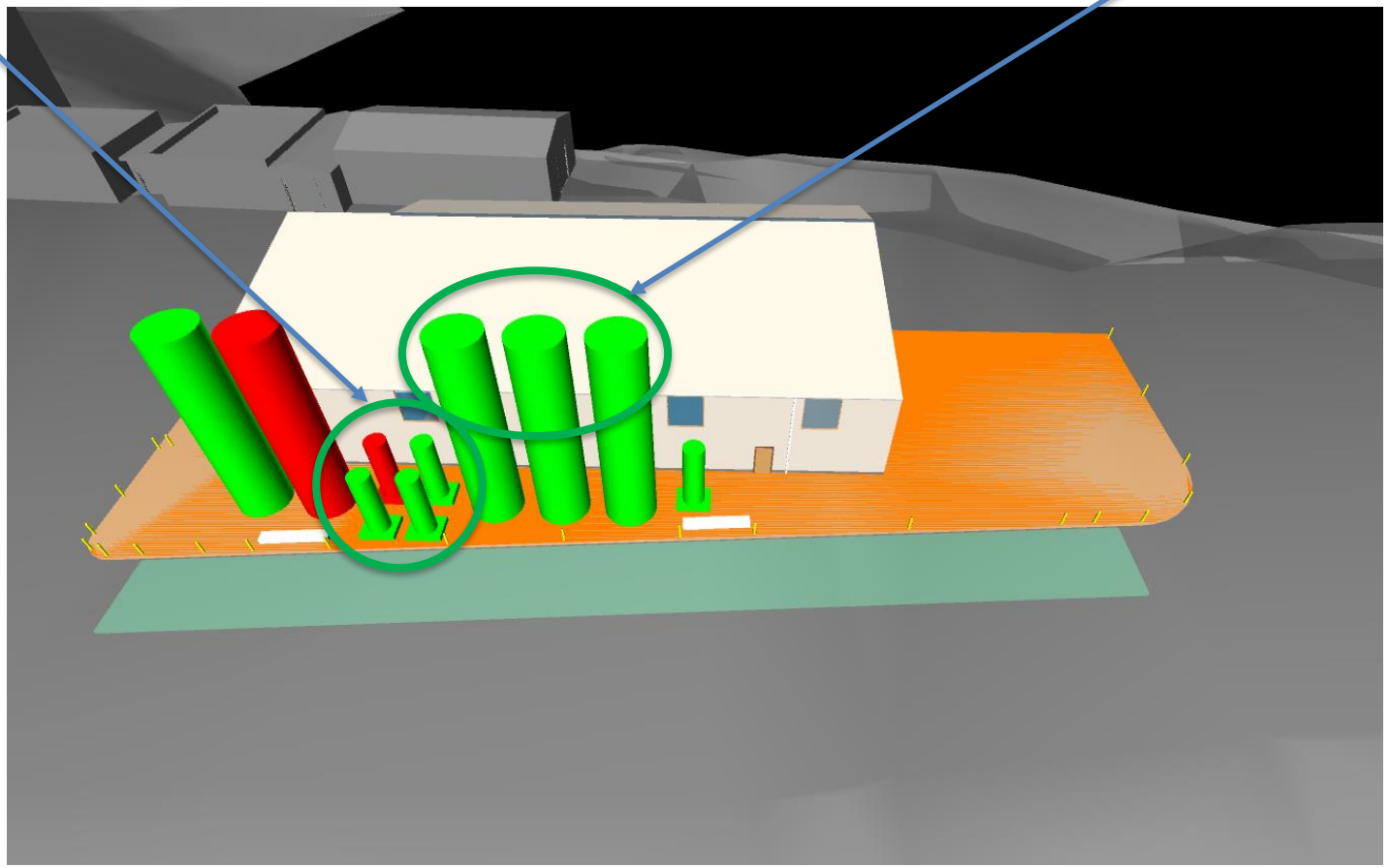
- Preliminary Design for the Cryogen Building considered only 1 Liquid Argon Storage Dewar and 1 Vaporizer



BSI Scope Design Changes

Surface Civil – Cryogen Building

- Final Design for the Cryogen must incorporate an additional 3 Liquid Argon storage dewars into the design
- Also need 3 additional Liquid Argon Vaporizers



BSI Scope Design Changes

Underground Mechanical

- Preliminary Design requirement for minimum Cavern Temperature – 40º F
- Final Design Change – minimum 67º F

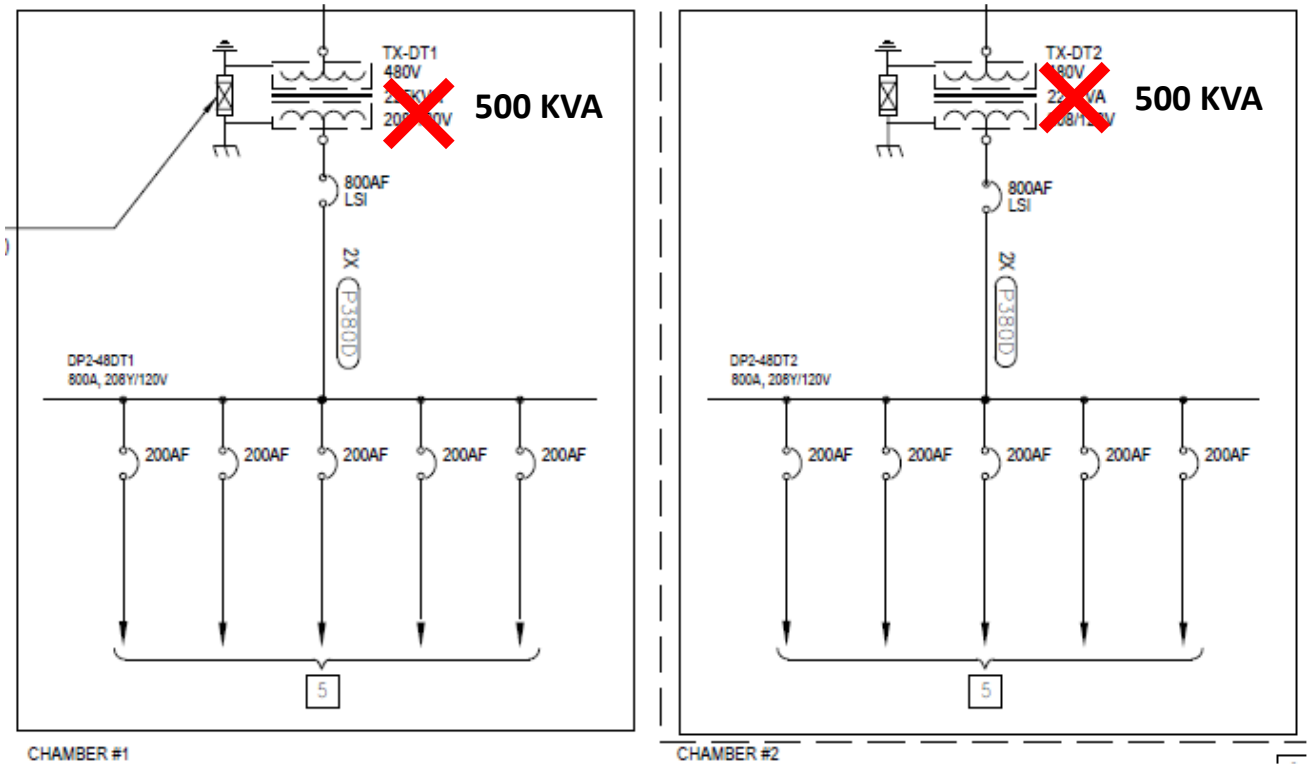
Table 6.13: Indoor Design Conditions by Space Type. [6] [21]

	DBT Minimum/ Maximum	RH Minimum/ Maximum	DPT Maximum	Minimum Ventilation Rate	Occupancy Assembly / Operation
Space Type	[°F] ([°C])	[%]	[°F] ([°C])	[-]	[#]
.01 ACCESS DRIFTS- 4850 LEVEL	40.0 / 104.0 (4.4 / 40.0)	Not Controlled	Not Controlled	Based on face velocity of 4m/s	0 / 0
.02 OTHER EXCAVATIONS	40.0 / 104.0 (4.4 / 40.0)	Not Controlled	Not Controlled	-	0 / 0
.03 CRYOSTAT/UTILITY CAVERNS	40.0 / 85.0 (4.4 / 29.4) **67.0/85.0**	15 / 85	48.0 (8.9)	Greater of 1 Air Change Per Hour or Oxygen Deficiency Hazard Limit	50 / 4

BSI Scope Design Changes

Underground Electrical - Detector Electronics

- Preliminary Design requirement for Detector Electronics – 225 KVA Transformers
- Final Design Change – 500 KVA Transformers



BSI Scope Design Changes

Underground Electrical - Detector Electronics

- Preliminary Design requirement assumption for heat generated from Detector Electronics – 3 KW per Rack
- Final Design Change – TBD

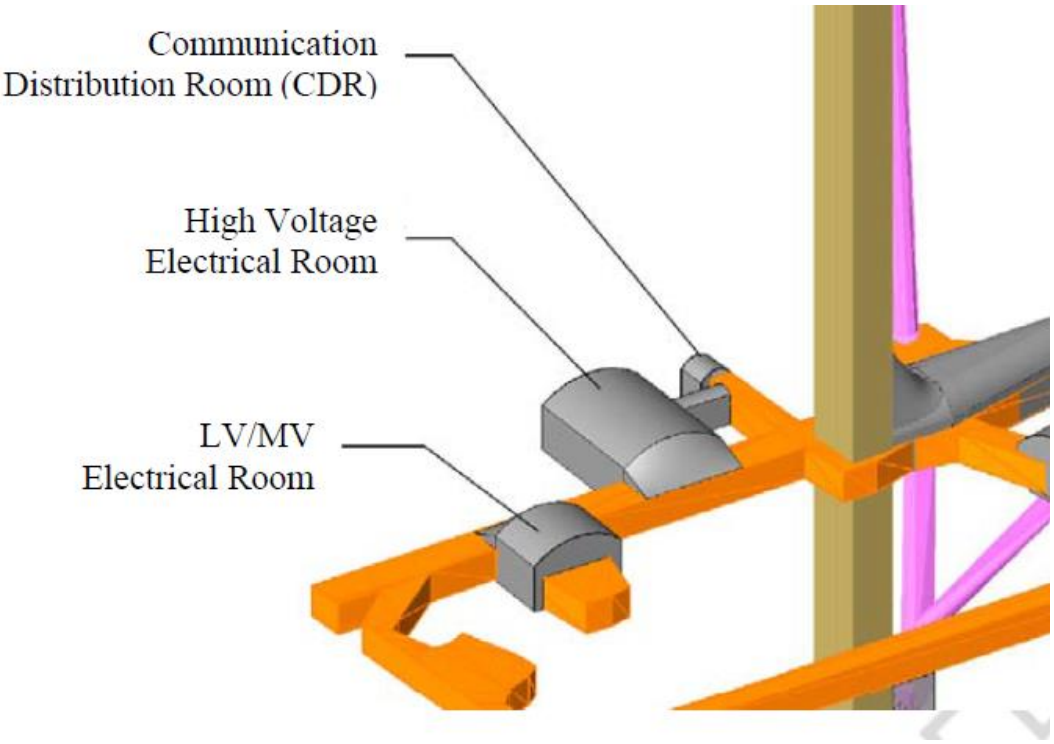
Equipment [-]	Quantity [#]	Quantity Duty [#]	Power [W]	Electrical Heat Gain [W]	Mechanical Heat Gain [W]	Total Airside Heat Gain [W]	Total Waterside Heat Gain [W]
RP-48AS	1.00	1.00	0.00	0.00		0.00	0.00
10kT Cryostat	1.00	1.00			-32,100.00	-32,100.00	0.00
Detector Electronics Racks	77.00	77.00			3,0[illegible].00	231,[illegible]0.00	0.00

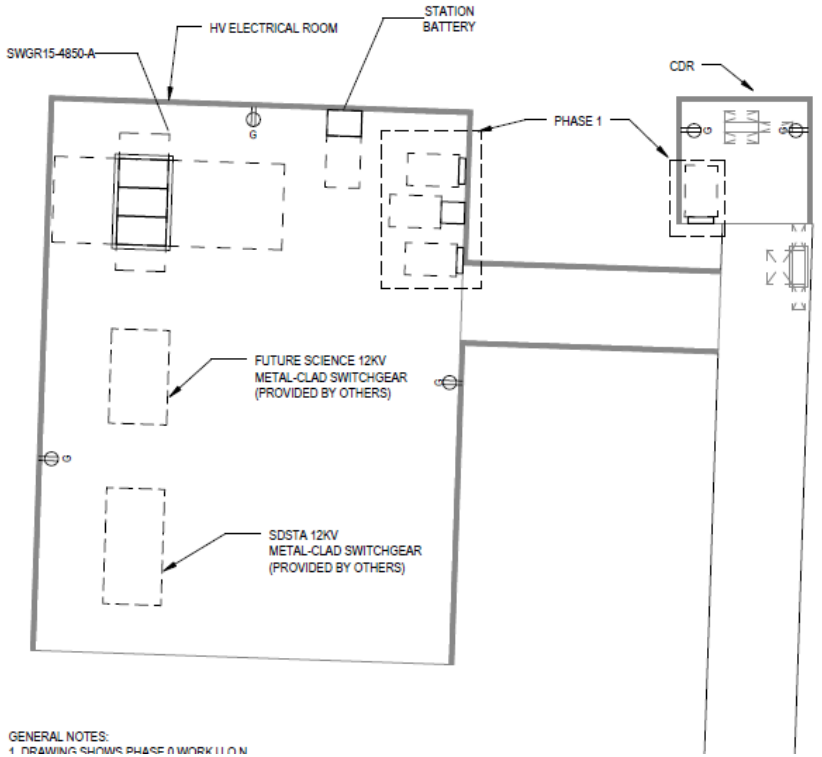
TBD TBD

BSI Scope Design Changes

Underground Electrical

- Design for Underground Substation to be updated as per Advanced Preliminary Design Concept

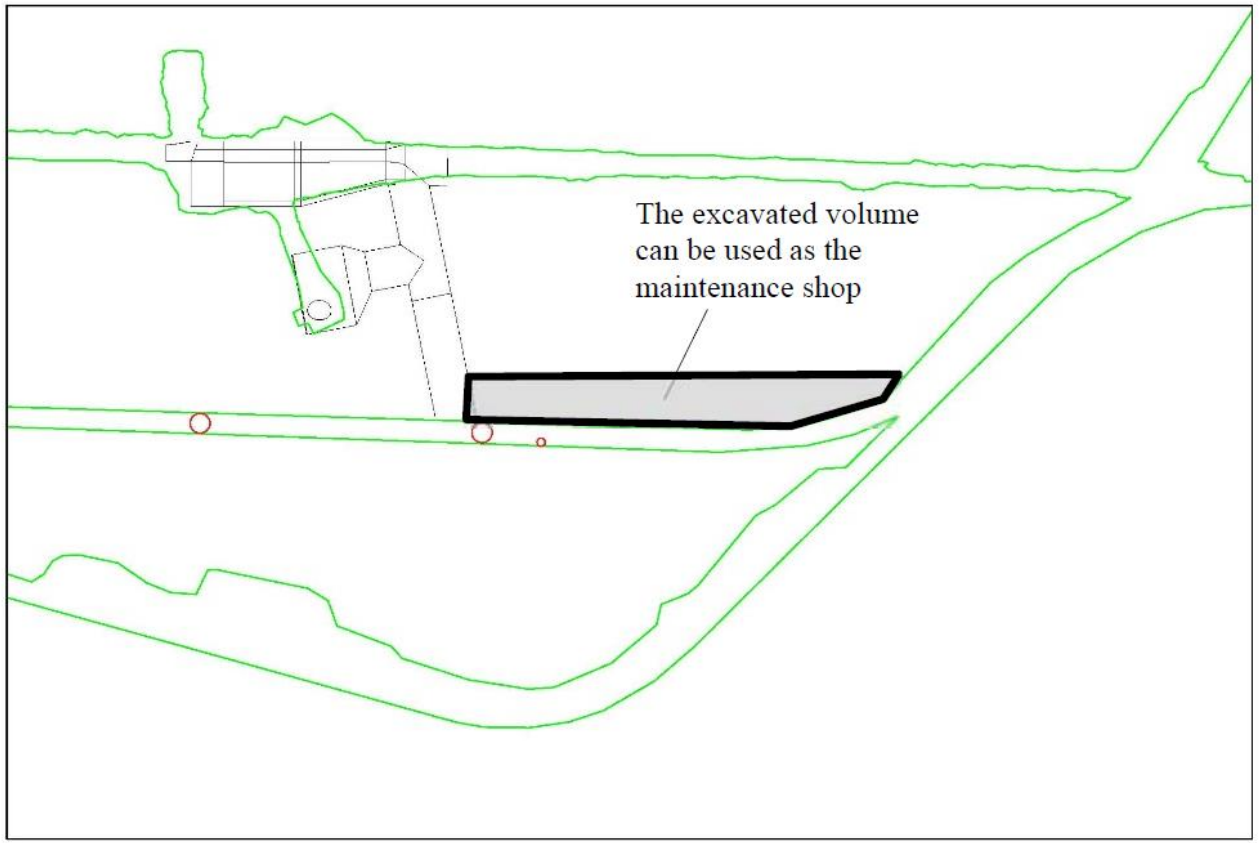




Current 100% Preliminary Design

Changes to EXC scope – Infrastructure – 4850L Ross Shaft Brow & Access Drift Design

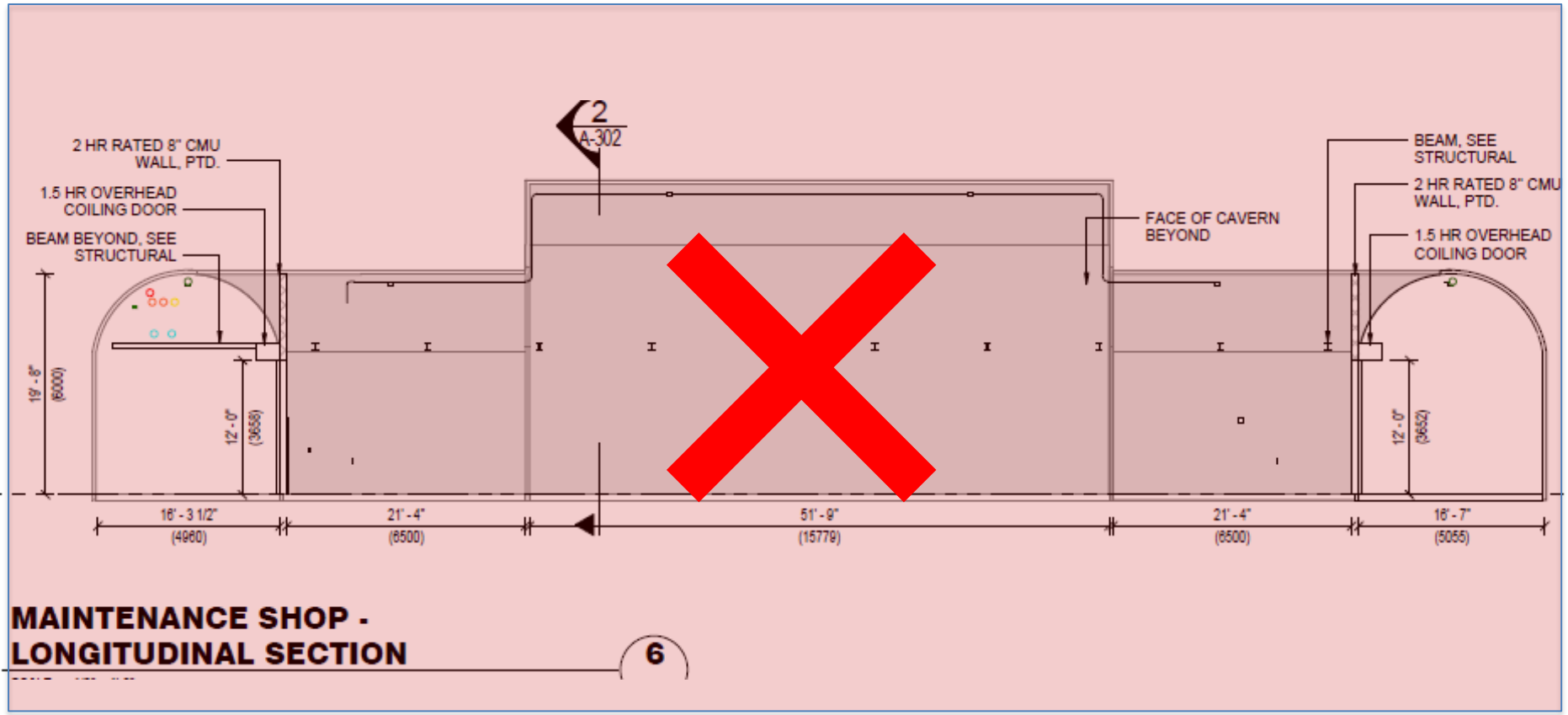
- **The Final EXC Design shall include the findings of the Underground Electrical Substation Relocation Feasibility Study/Conceptual Design.**
- **Will also provide space for equipment maintenance initially**



BSI Scope Design Changes

Underground Architectural/Electrical/Mechanical

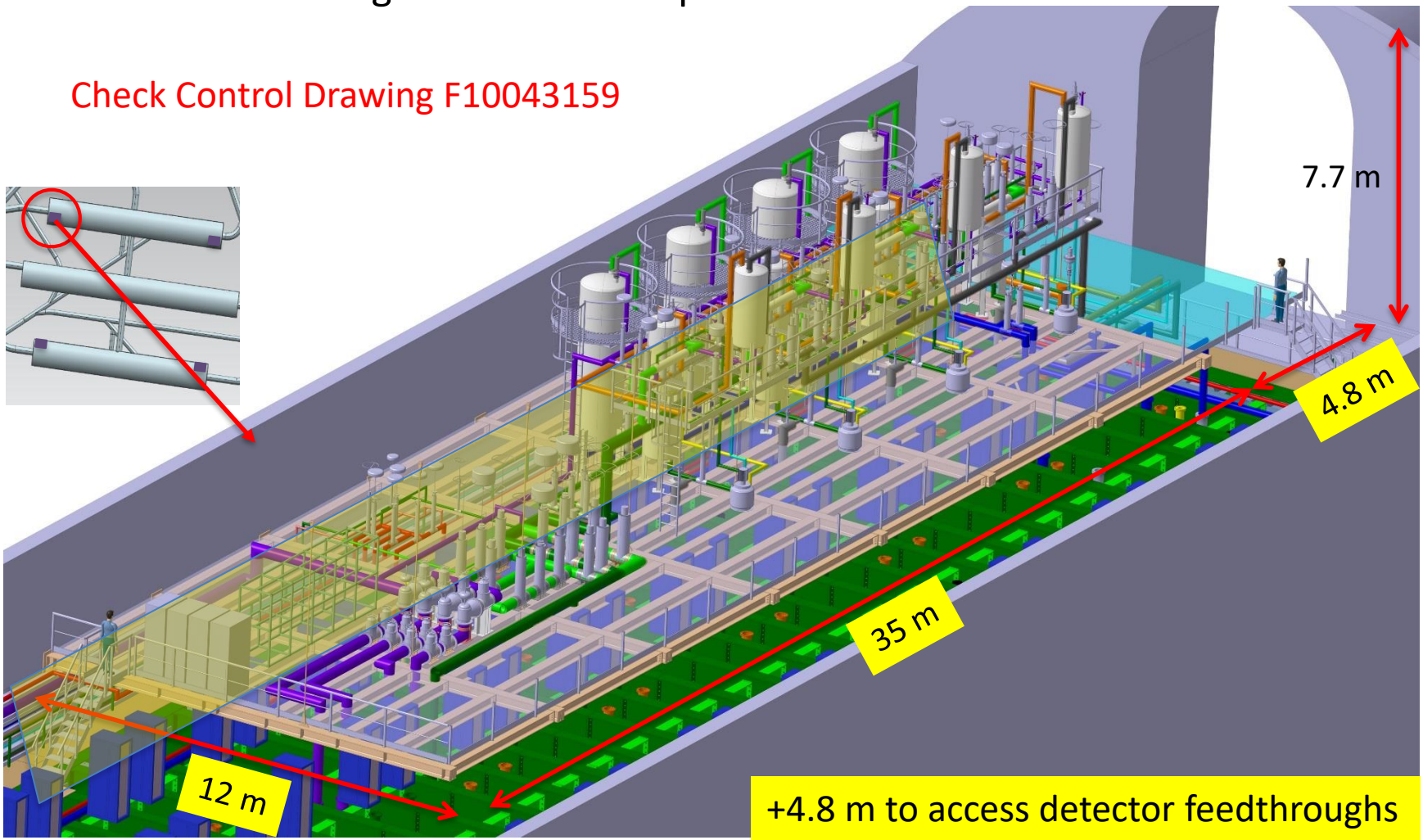
- Separate Maintenance Shop no longer required.



EXC Scope Changes – Underground Structural

Add anchors on ceiling and wall for suspension of mezzanine

Check Control Drawing F10043159



Changes to EXC scope – Cavern Design – Mezzanines

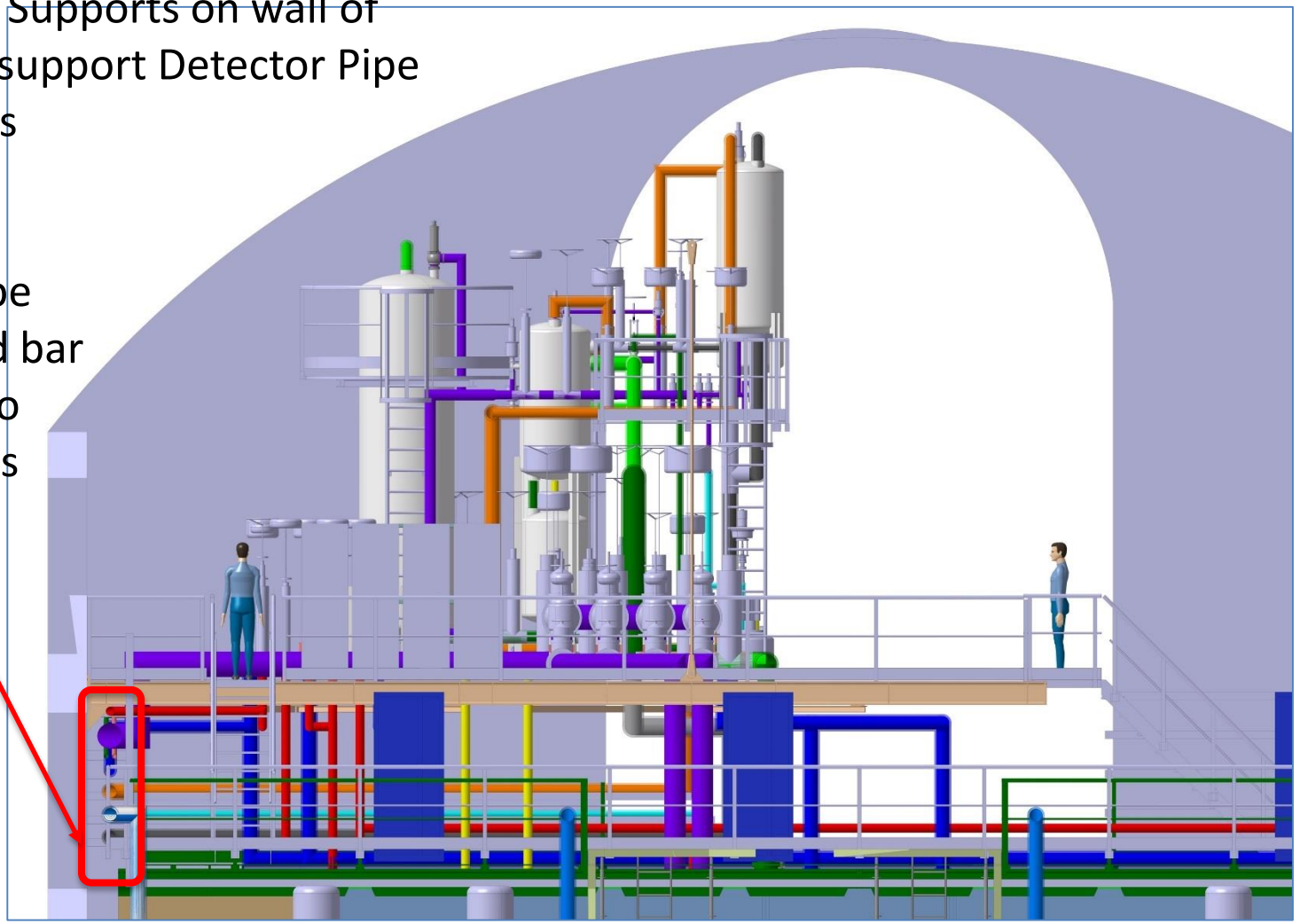
- **The Final EXC Design shall include addition of connections/supports and wall mounted supports design for 10m x 35m mezzanines on the CUC side of each detector chamber.**
- **The Final EXC Design shall include a pattern of ten – 100 metric ton capacity lifting eyes above each mezzanine, and two – 100 metric ton capacity lifting eyes above each cryostat bridge, for material lifting at each location.**
- **Each anchorage (lifting eye) to be designed and installed to provide 100 metric ton capacity.**

Check Control Drawing F10043159

BSI Scope Changes – Underground Structural

- Add Vertical Supports on wall of chamber to support Detector Pipe and Conduits

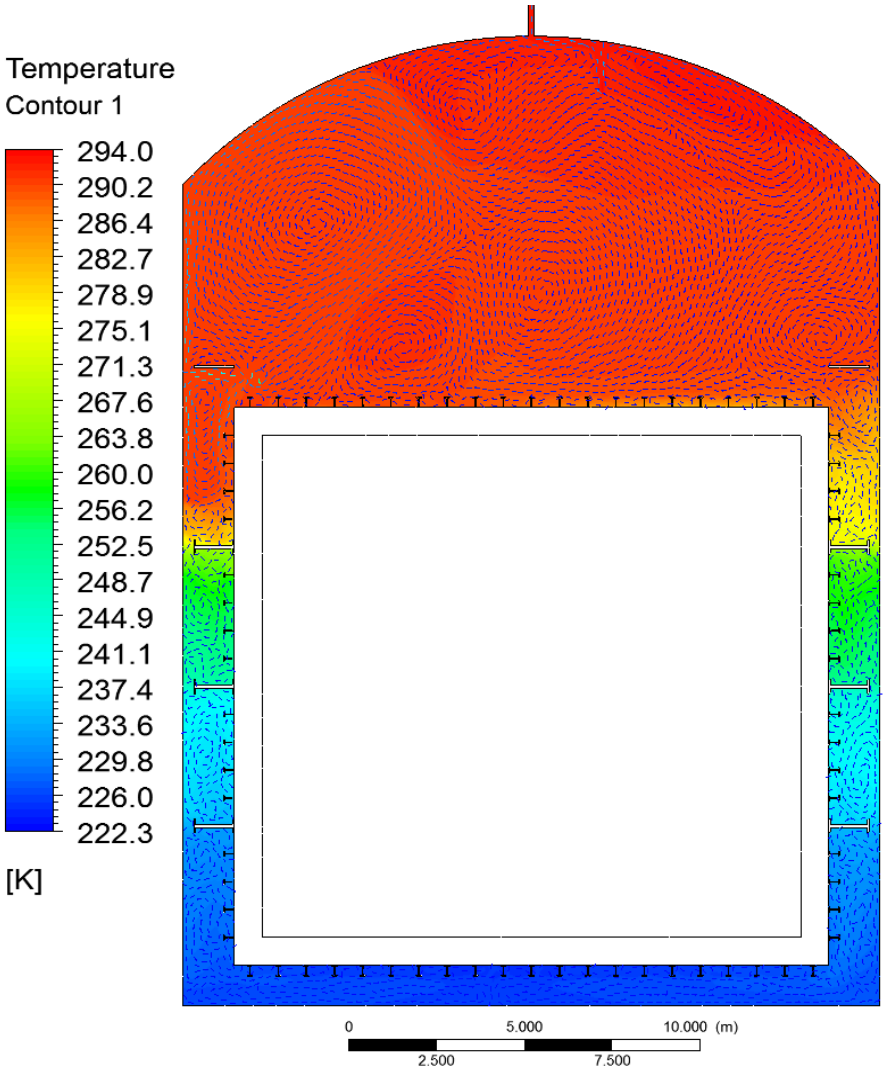
- Height of Support to be from ground bar to as close to spring line as possible



BSI Scope Design Changes

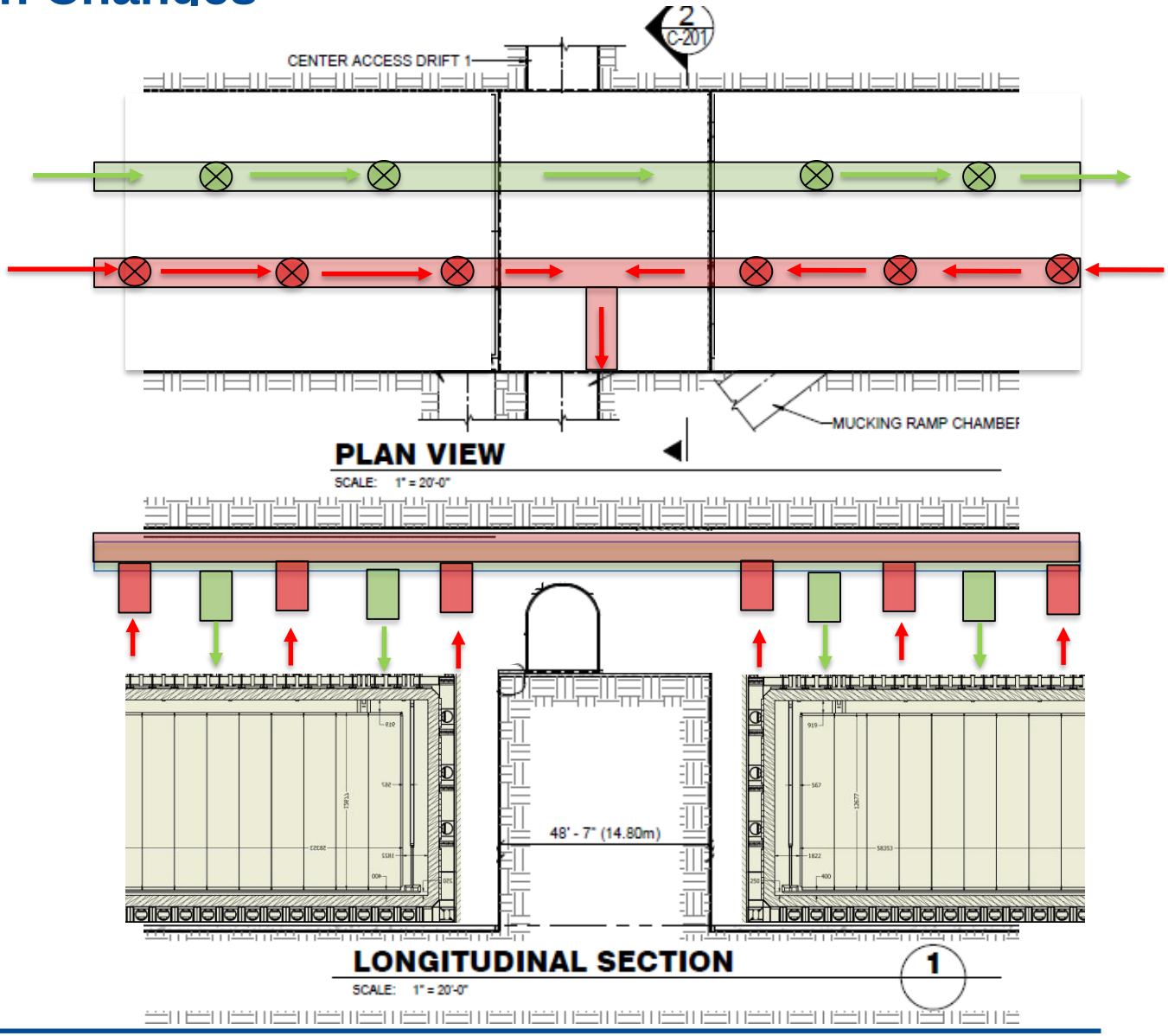
Underground Mechanical – Cryostat Ventilation

- A condensation analysis has been performed which has determined that the current Preliminary design for Cryostat ventilation does not provide for adequate circulation to prevent condensation from occurring



BSI Scope Design Changes

- **Preliminary Design**

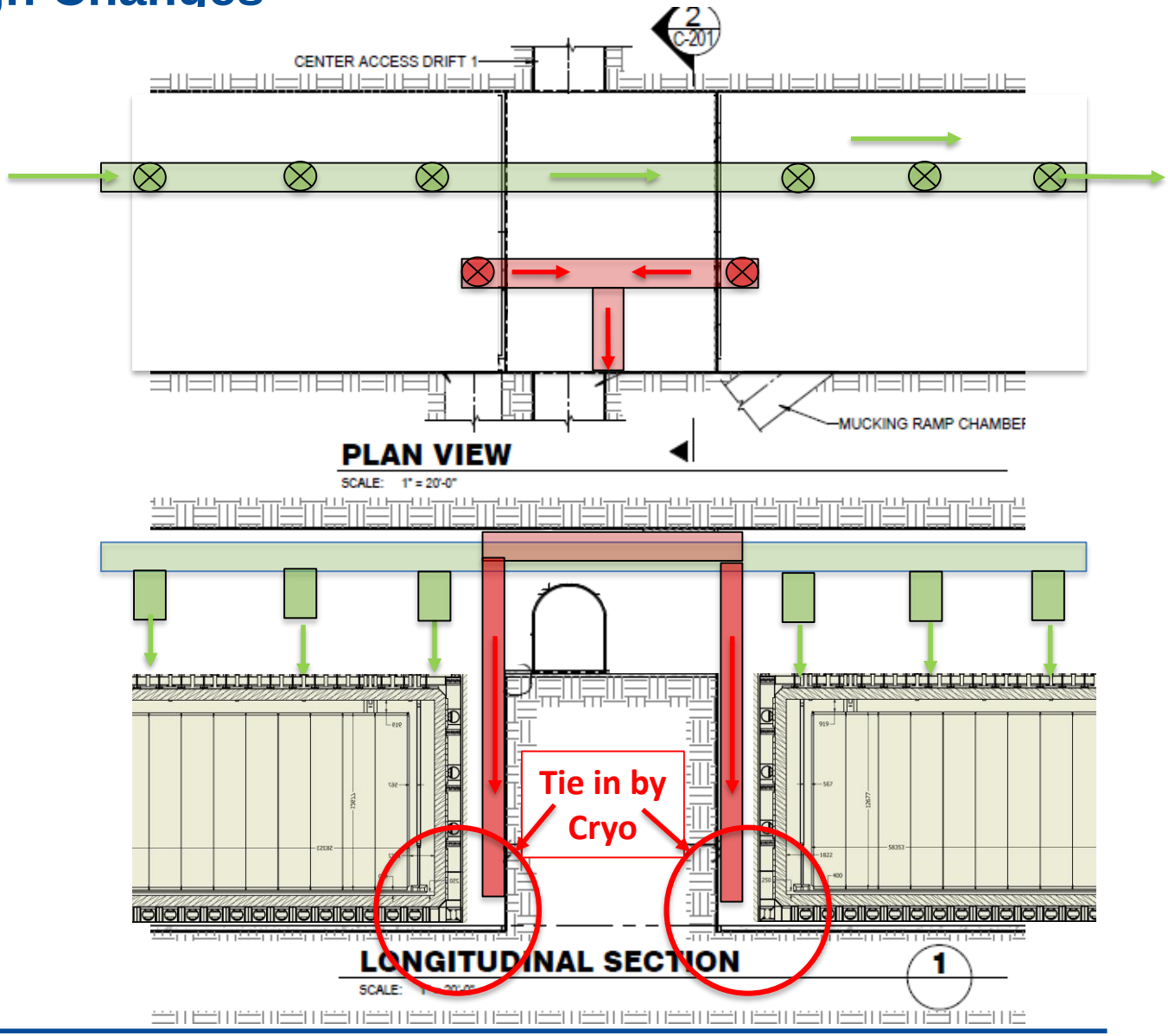


Intake Air

Exhaust Air

BSI Scope Design Changes

- **Required Final Design Arrangement**
- Required for all 4 Cryostat Chambers



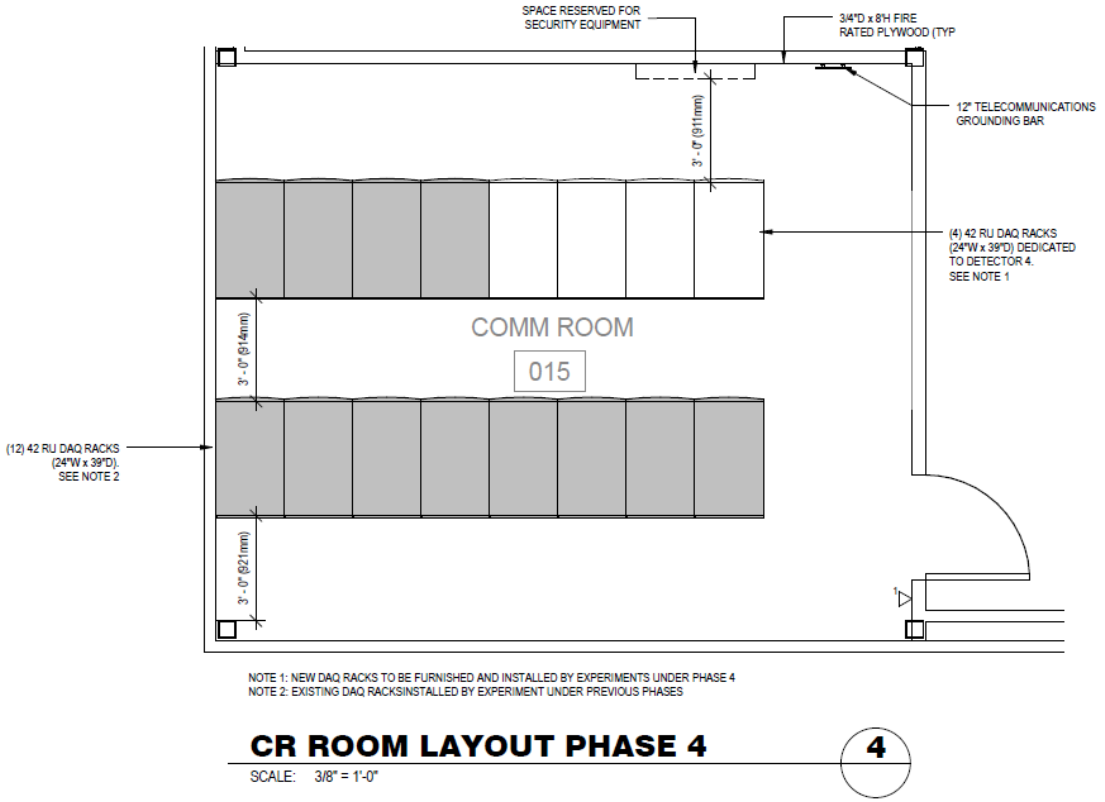
Intake Air

Exhaust Air

BSI Scope Design Changes

Underground Communications

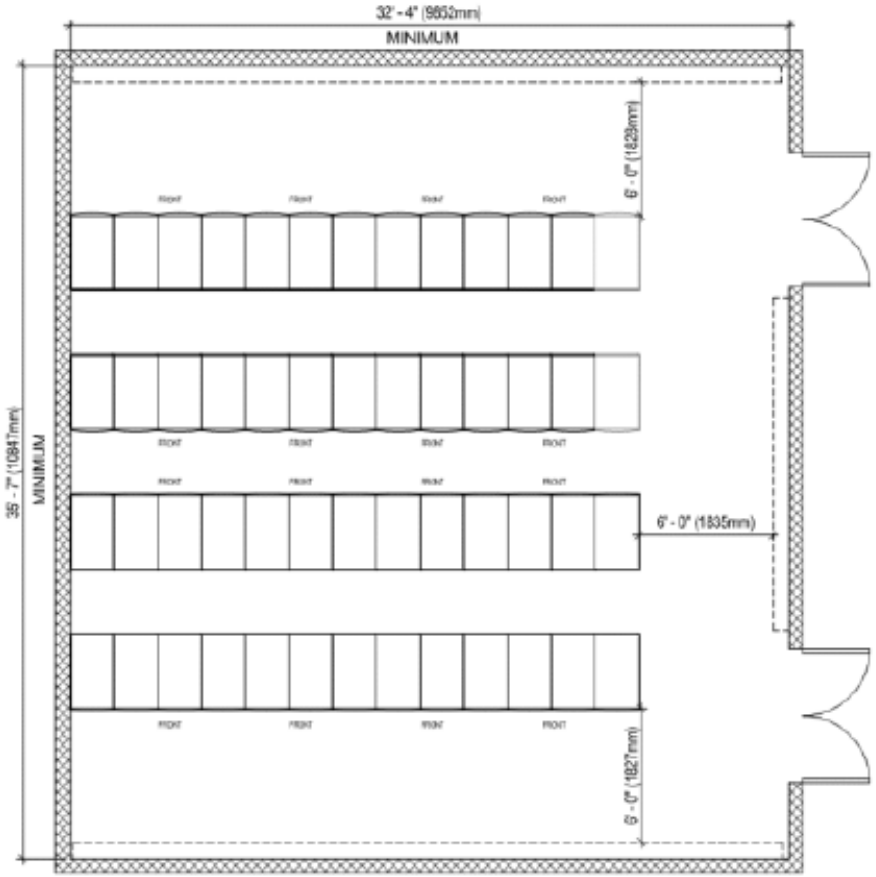
- The Preliminary Design calls for a total of 16 racks in the CUC Communication room



BSI Scope Design Changes

Underground Communications

- The Final Design requires a total of 52 racks in the CUC Communication room



BSI Scope Design Changes

Potential Changes

Potential Change Description	Status
1. Electrical/Data Support for Infrared Cameras to Monitor Cryostat Performance	Waiting for Clarification from Cryostat Group
2. Emergency Shut off Switches for Power Distribution. Could be for CF as well as EXP	Waiting for further clarification
3. Connections for Lighting and Fire Protection below the Mezzanine Level	Requirement Definition Required
4. Piping and Electrical run through a trench in the Septum	Requires Trade Study
5. Integration of Access Control System	Under Investigation
6. Industrial Water, Compressed Air and Emergency Communications at the Chamber bottom	Requirement Definition Required
7. Addition of temporary grounding network to the bottom of each Detector Pit	Requirement Definition Required

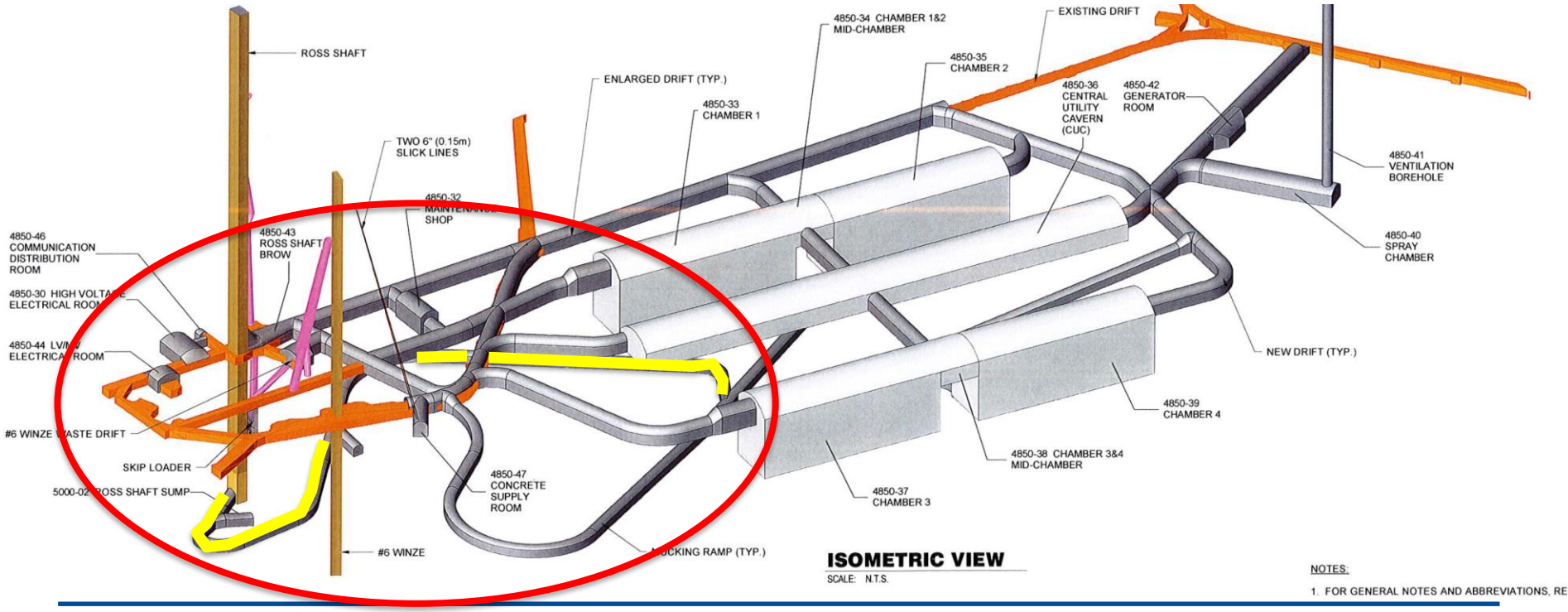
BSI Scope Design Changes

Potential Changes Cont'd

Potential Change Description	Status
8. Infirmary and Recreation Room in CUC	Special Committee set up to determine if required
9. Machine Shop for Cryostat Construction	Further Clarification Required

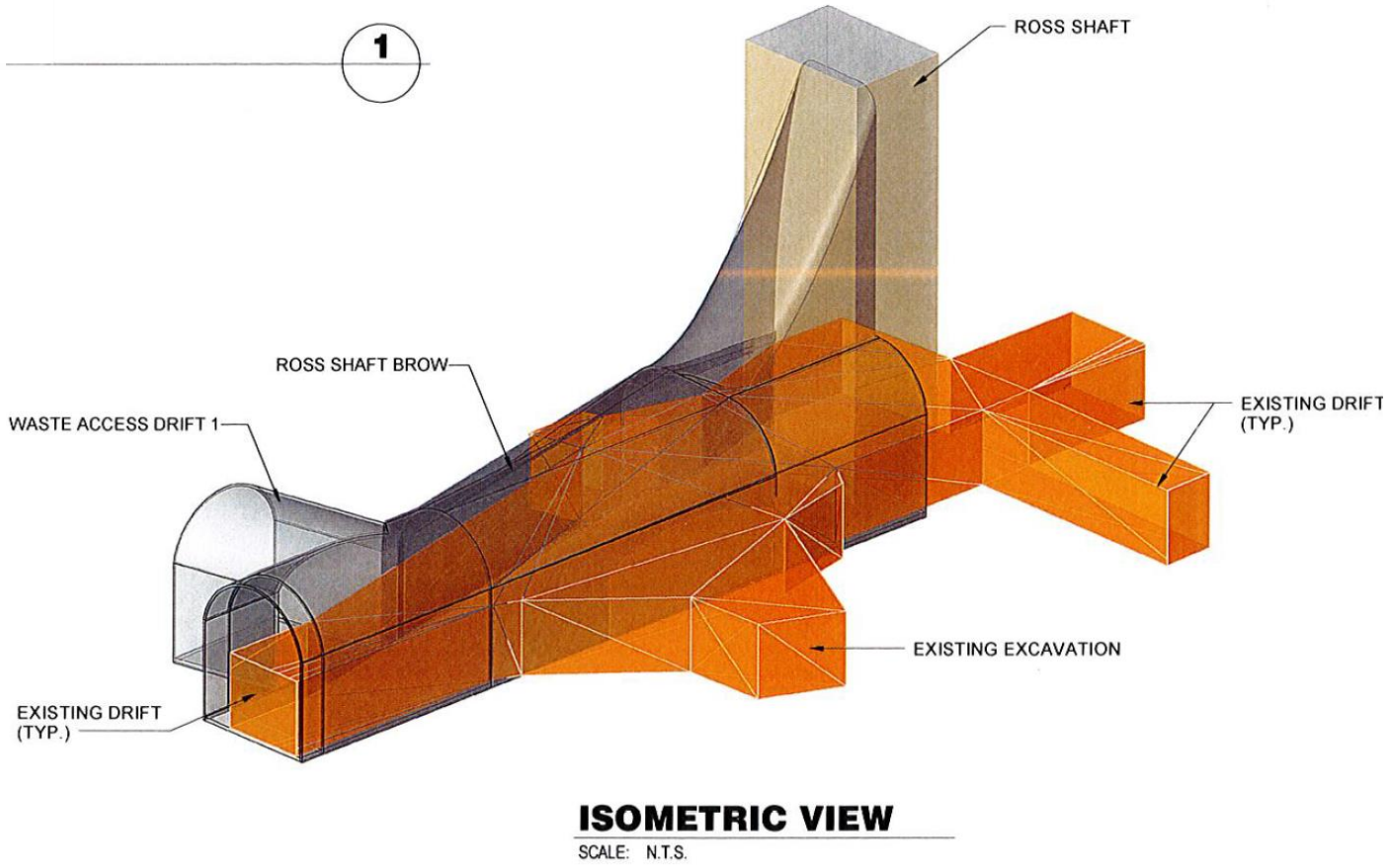
Changes to EXC scope – Infrastructure – 5000L Decline Drift

- **The installed Ross Shaft collection system will eliminate the 5000L decline drift previously included in the PDR and may influence ventilation design.**
- **The Final EXC Design shall remove the 5000L decline drift from the scope of work.**
- **The Final EXC Design shall include a water management system to replace the collection system included into the 5000L ramp.**



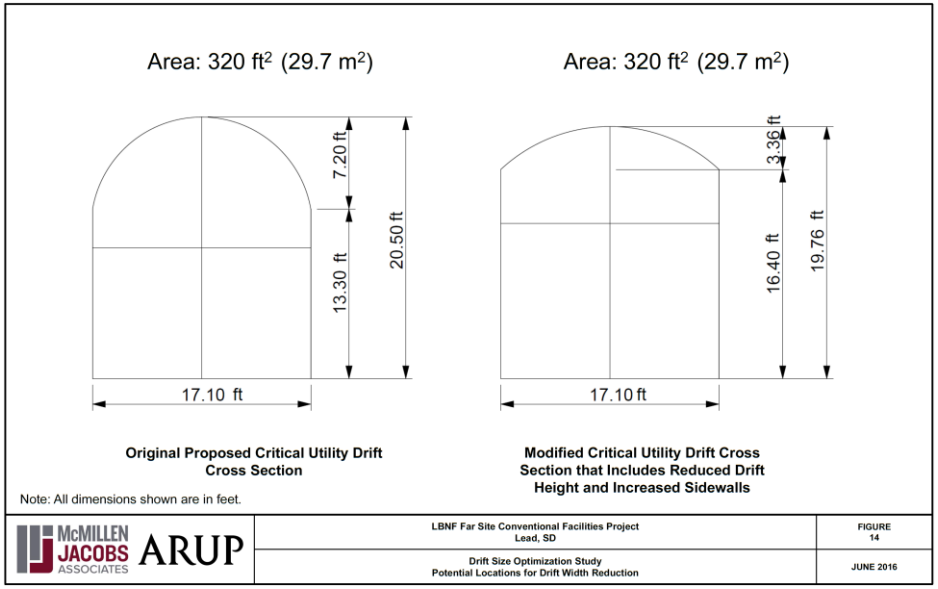
Changes to EXC scope – Infrastructure – 4850L Ross Shaft Brow & Access Drift Design

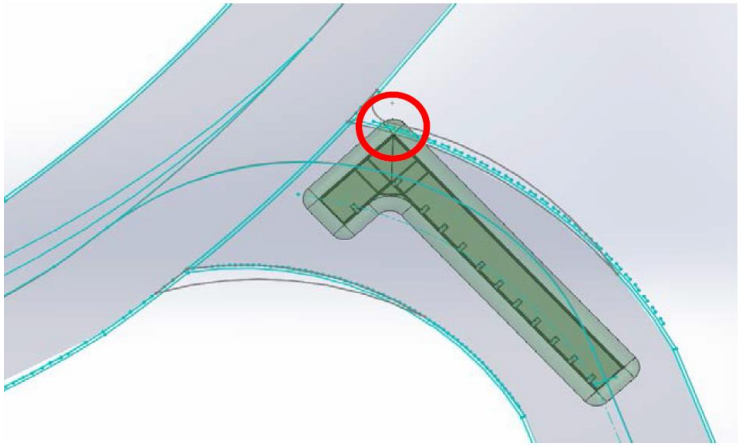
- **The Final EXC Design shall include the findings of the Ross Shaft Brow Isolation and Drift Optimization Studies. KAJV to provide input.**



Changes to EXC scope – Infrastructure – 4850L Ross Shaft Brow & Access Drift Design

- **The Final EXC Design shall include the findings of the Ross Shaft Brow Isolation and Drift Optimization Studies.**
- **"It is recommended that the critical utility drift cross section shown in Figure 14 be considered going forward to improve drift stability. Further, it is recommended that a five ft. (1.5m) radius is adopted for pillar chamfers and minor modifications needed made to cure radii at intersections to accommodate transportation of beams." KAJV to provide input.**



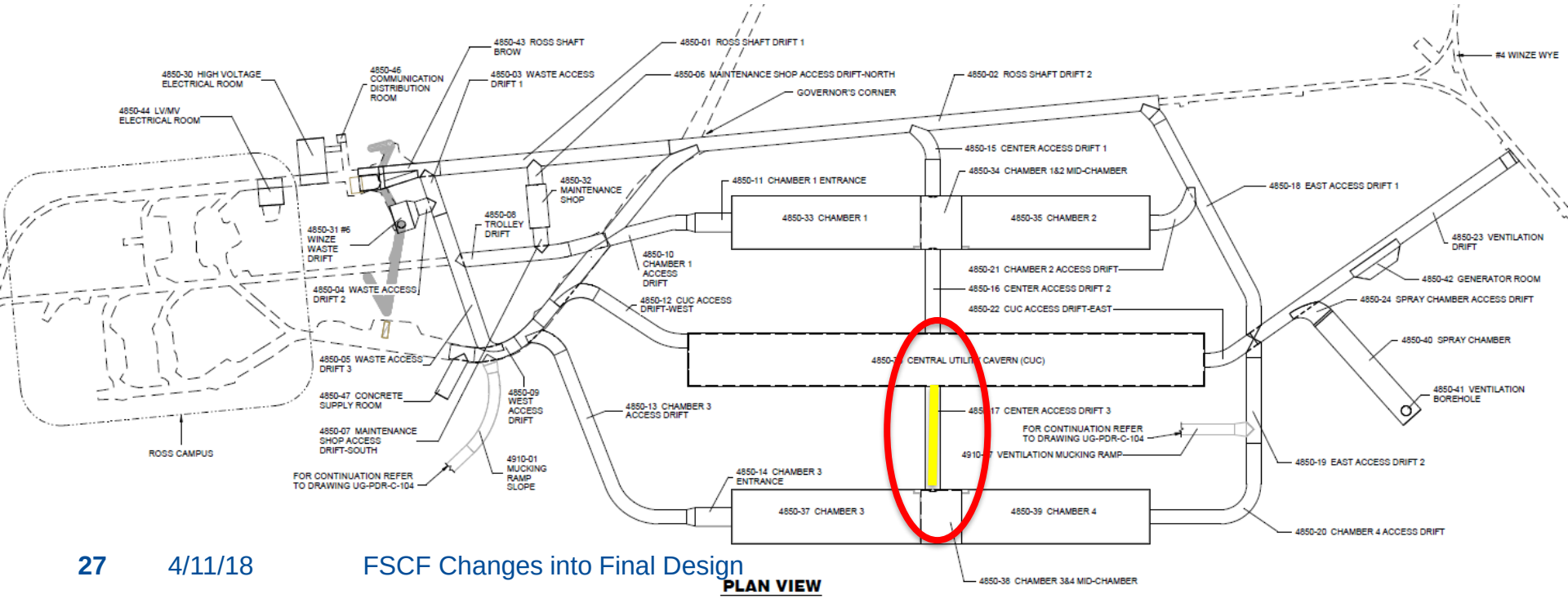


Corner Beam Transported through Intersection 12 on Side. Sidewall of drift encroaches into 1.5-foot clearance envelope.

Changes to EXC scope – Cavern Design – Chamber 3 & 4 Bulkhead & Mid-Cavern Access Drift

- **The Preliminary Design includes a bulkhead between Chambers 3 and 4 to allow construction of a cryostat structure with concurrent excavation of chamber 4. This bulkhead required the access drift to be designed with an offset from the center alignment of the septum pillar.**

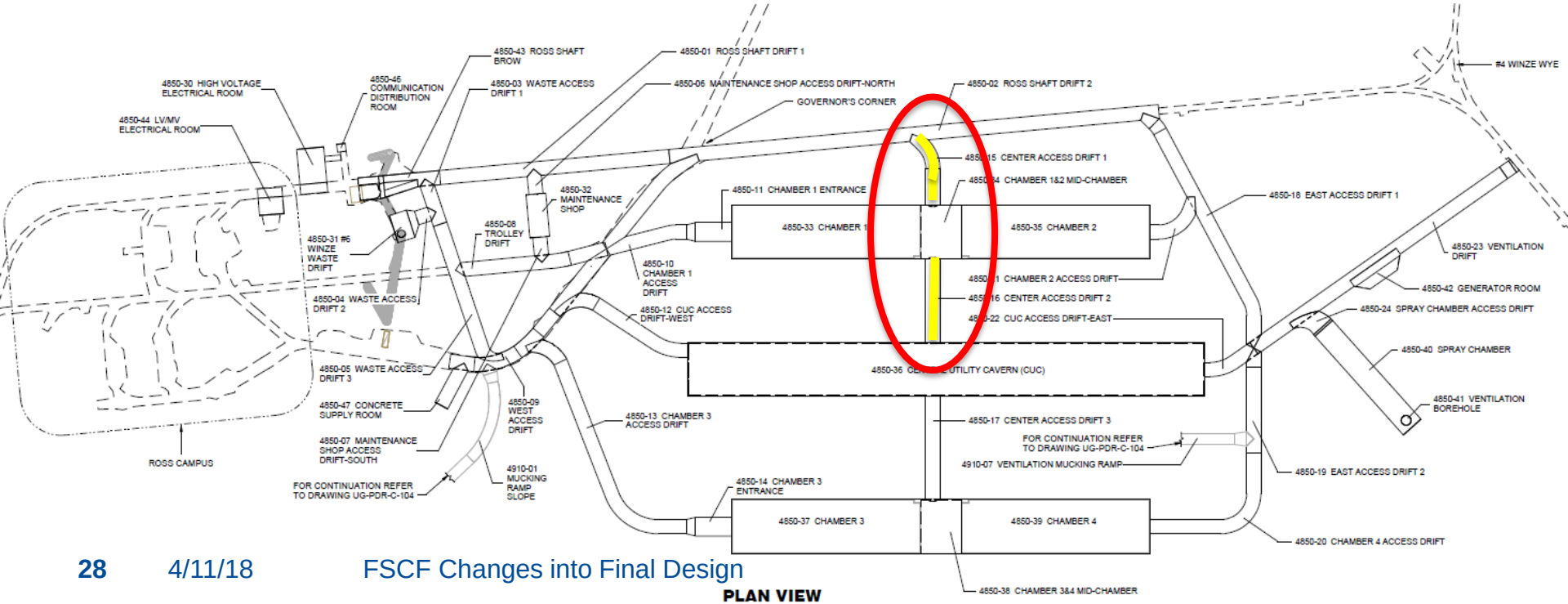
- **The Final Design shall remove this bulkhead design from the scope of work and include a shift of the center line for the mid-cavern access drift to the center of the septum pillar.**



Changes to EXC scope – Cavern Design – Chamber 1 & 2 Bulkhead & Mid-Cavern Access Drift

- **The Preliminary Design includes a bulkhead between Chambers 1 and 2 to allow construction of a cryostat structure with concurrent excavation of chamber 2. This bulkhead required the access drift to be designed with an offset from the center alignment with the septum pillar.**

- **The Final Design shall remove the bulkhead design from the scope of work and include a shift of the center line for the mid-cavern access drift to the center of the septum pillar.**



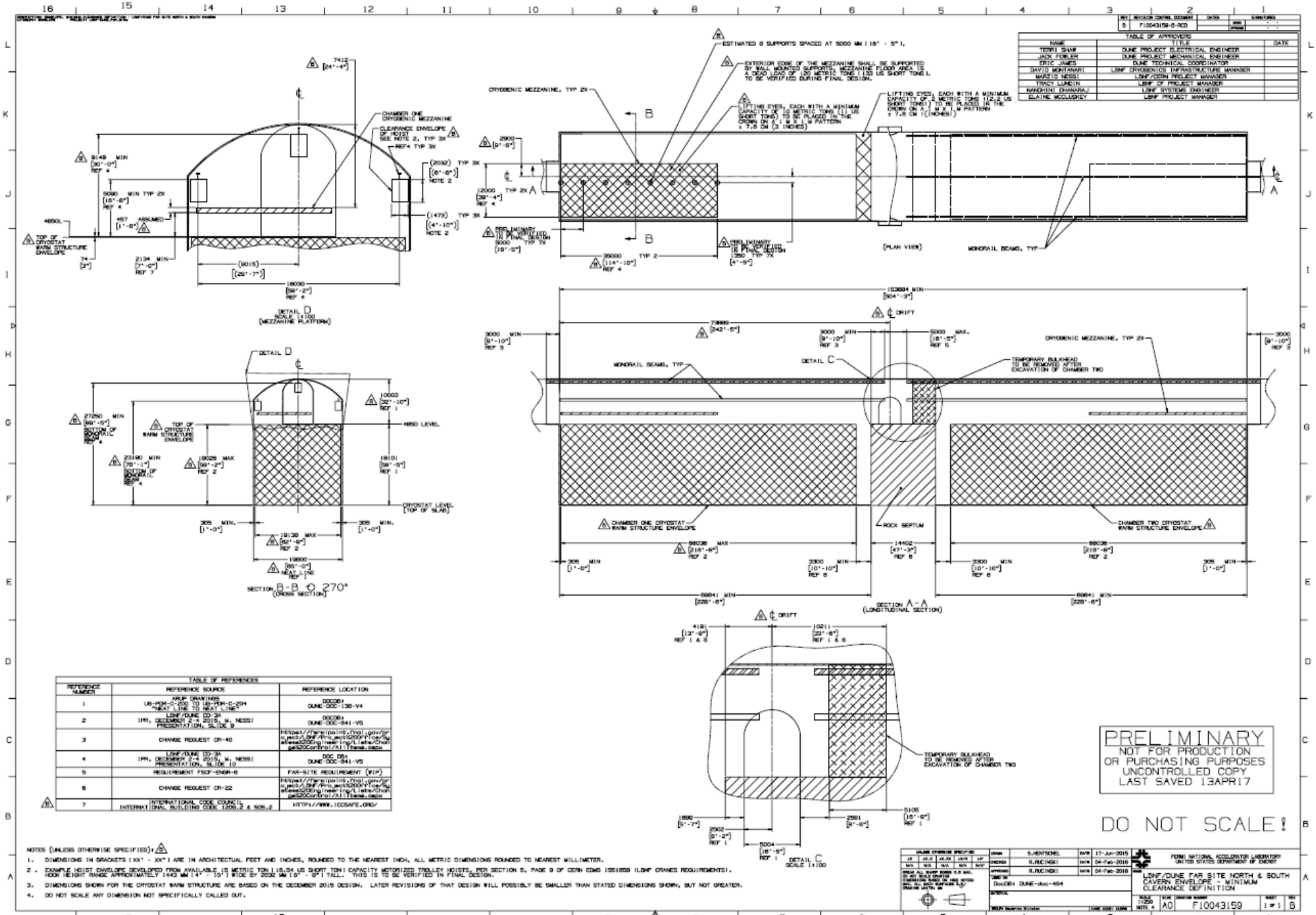
Changes to EXC scope – Cavern Design – Monorails & Hoists

- **The Final EXC Design shall include 15 – metric ton minimum capacity monorails and hoists.**
- **The Final EXC Design shall include two sets of three 15 – metric ton capacity monorail hoists (chamber 1 & 2).**
- **The Final EXC Design shall verify hook height/width clearance envelope and monorail beam locations shown on Control Drawing F10043159.**
- **The Final EXC Design shall verify all other clearance envelope dimensions shown on Control Drawing F10043159.**

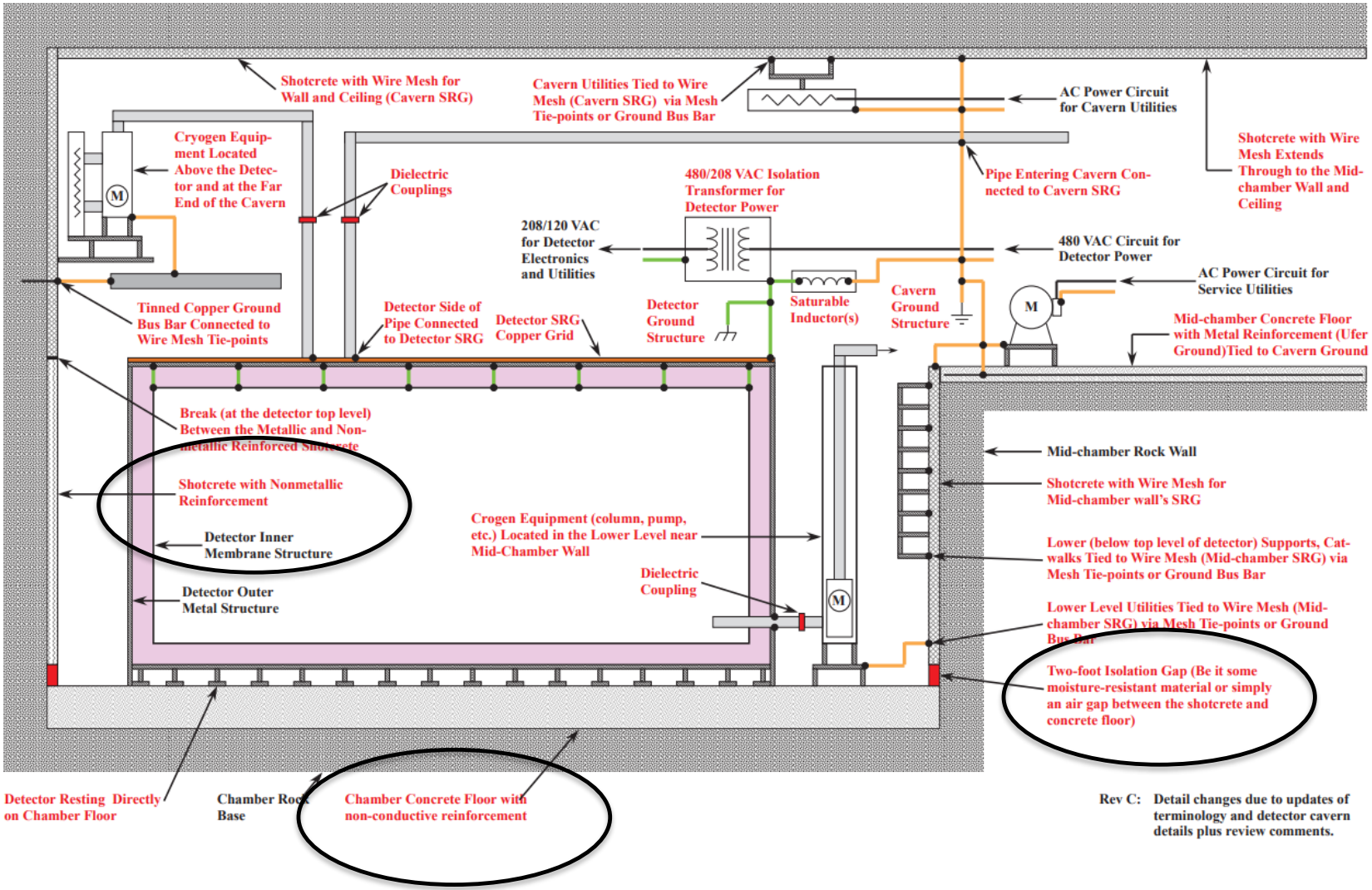
Changes to EXC scope – Cavern Design

- **The Final EXC Design shall include a reduction in septum pillar width to 14.4m, increasing each chamber's overall length by 0.3m. The overall Cavern length does not change.**
- **The Final EXC Design shall include addition of full-width 3m deep "antechambers" to both ends of the detector caverns, extend monorails into that space, and move the AHU's accordingly.**
- **See DUNE DocDB 464 - Control Drawing F10043159 (next slide)**

DUNE DocDB 464 - Control Drawing F10043159



EXC Changes - Grounding



BSI Scope Design Changes

Questions?