

Interface Requirements between I&I and NSCF

Gordon Cline

LBNF/DUNE Near Site Integration Workshop

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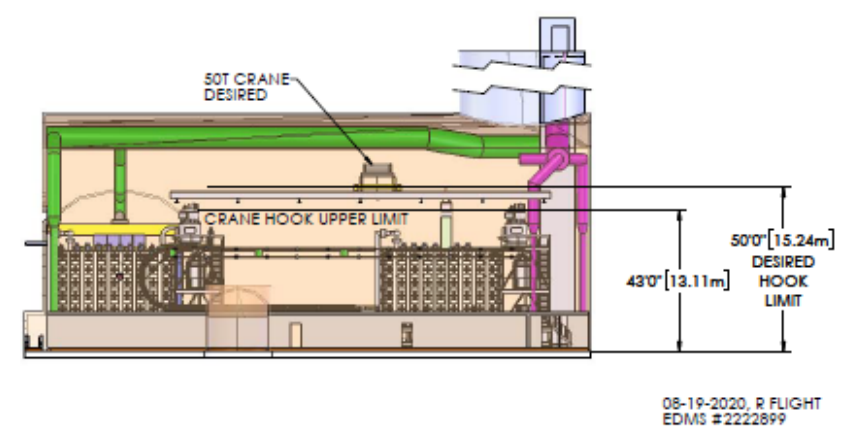
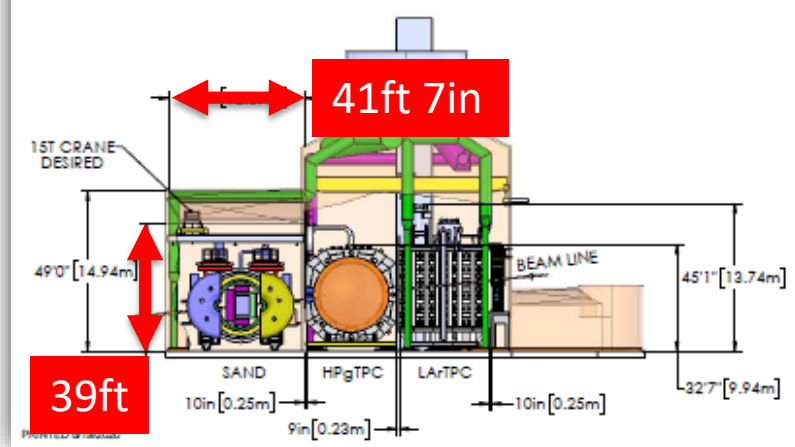
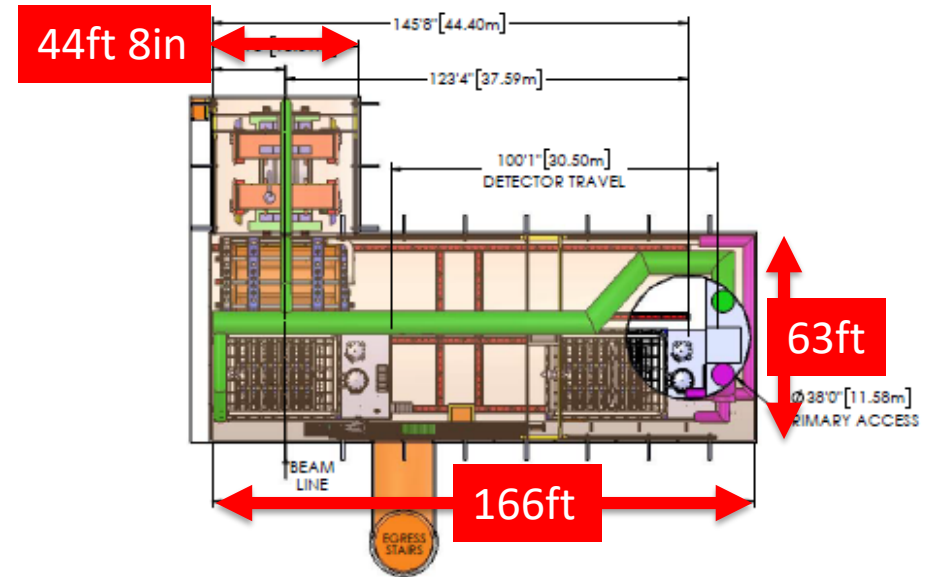
Outline

- Deep dive into NSCF requirements documented by I&I.
 - Brief summary of each requirement
 - Tying requirement to additional interface documentation
 - Format:

REQ #	Item	Requirement (Paraphrased)
I&I # (DOORS #)	Short Item Description	Summary of requirement as stated in DU-1001-7116B (EDMS 2443705).

Geometric Requirements

REQ #	Item	Requirement (Paraphrased)
001 (2355)	Cavern Dimensions	<ul style="list-style-type: none"> Cavern 166ft x 63ft Alcove 44ft 8in x 41ft 7in <ul style="list-style-type: none"> 39ft height EDMS 2222899 Transition details to DU-1001-6831
002 (+)	Beamline Location	Beamline position with respect to cavern. <ul style="list-style-type: none"> EDMS 2222899

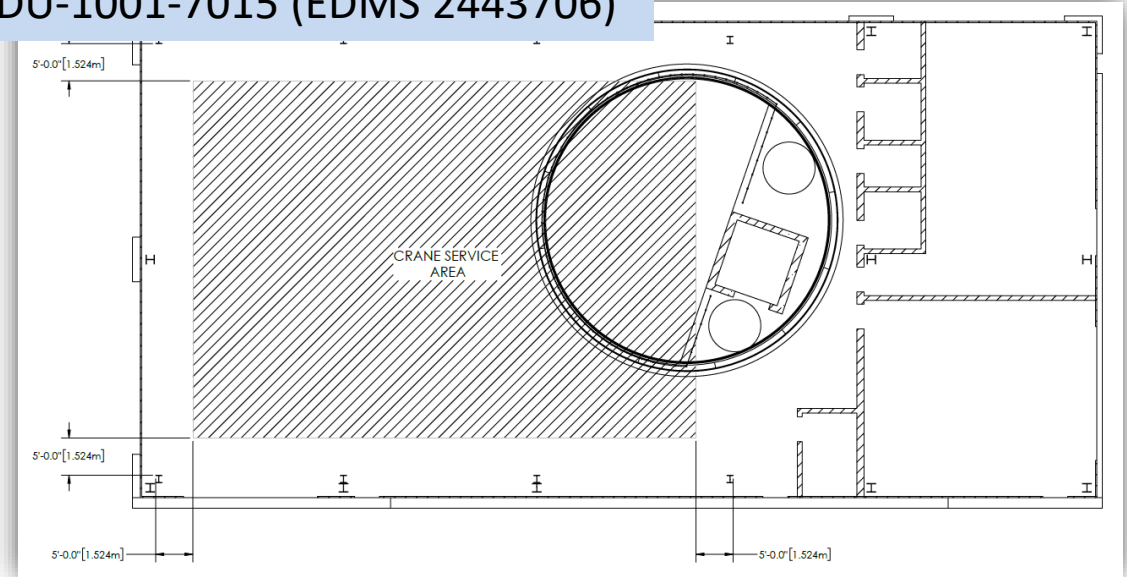


08-19-2020, R FLIGHT
EDMS #2222899

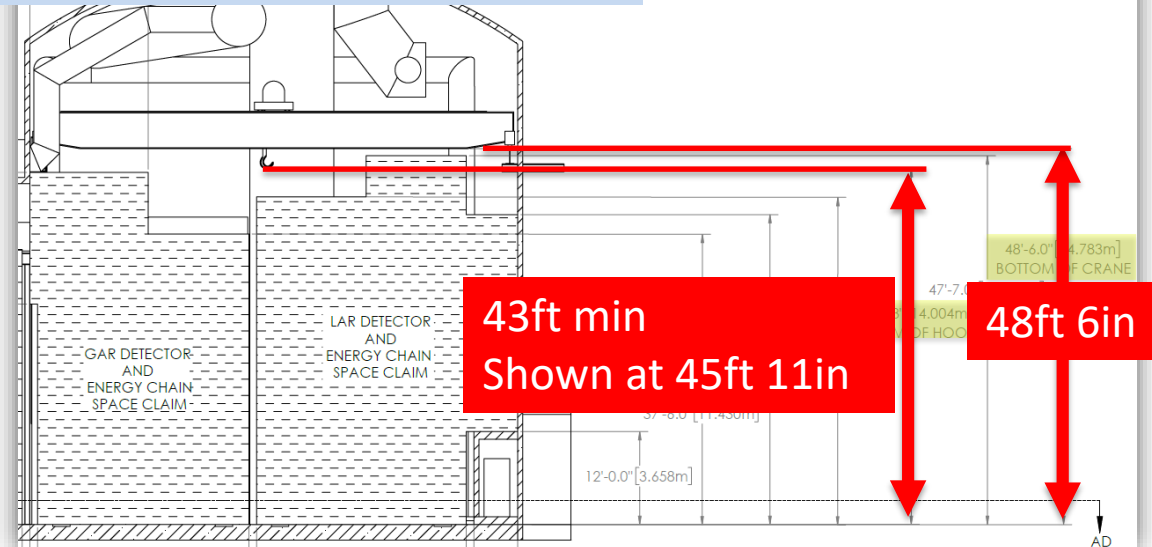
Crane Requirements

REQ #	Item	Requirement (Paraphrased)
003 (2351)	Surface Crane	<ul style="list-style-type: none"> • 15 US Ton capacity • Coverage and height per DU-1001-7015
004 (2348)	Underground Crane	<ul style="list-style-type: none"> • 15 US ton > 60 US ton approved • Coverage: shaft CL to as close to alcove as possible • Height: <ul style="list-style-type: none"> • Hook – 43ft • B.o.C. – 48ft 6in • Ref: DU-1001-6831

DU-1001-7015 (EDMS 2443706)



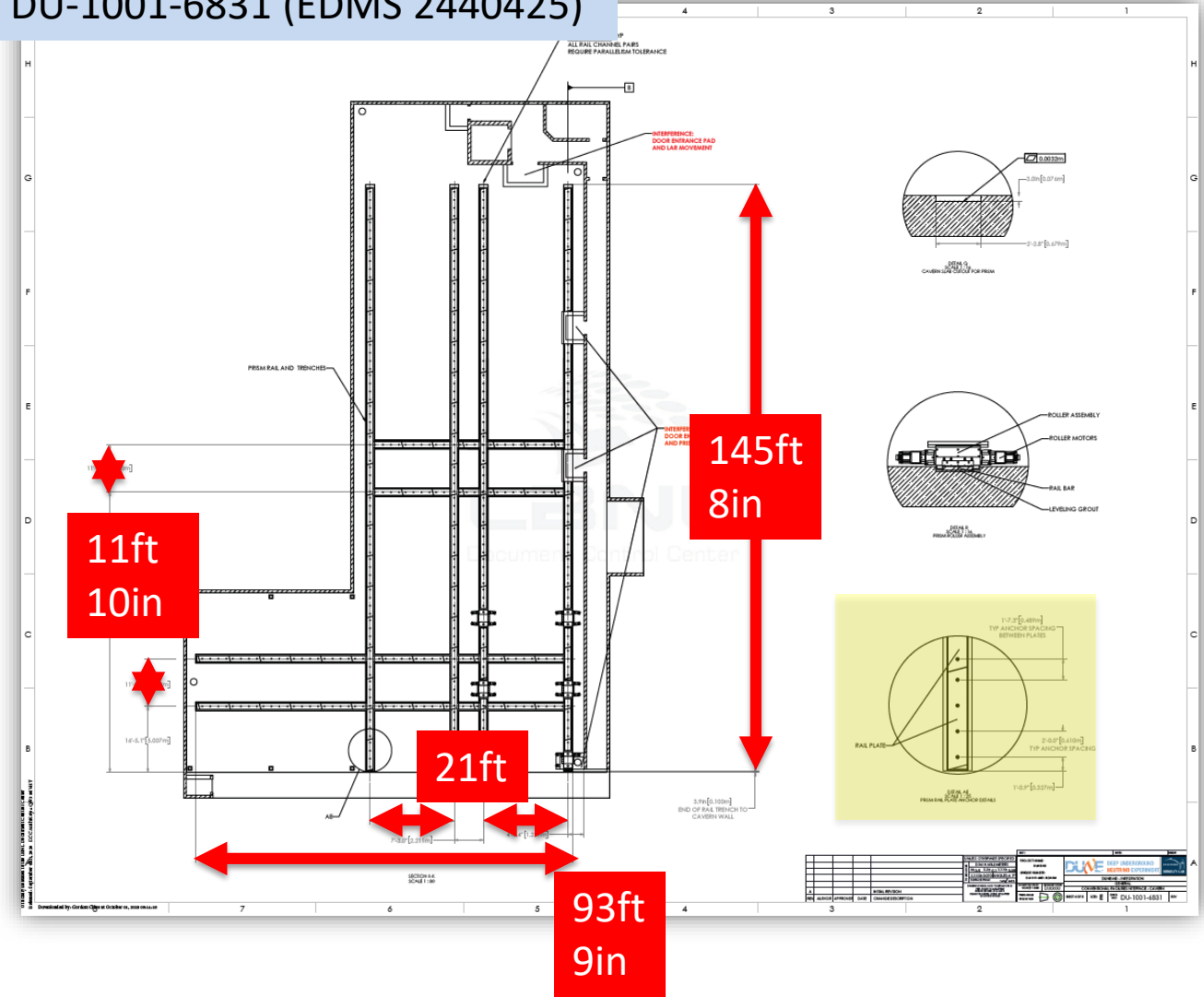
DU-1001-6831 (EDMS 2440425)



Floor Requirements

REQ #	Item	Requirement (Paraphrased)
005 (2349)	Floor Surface	Flatness <ul style="list-style-type: none"> Overall FF=25, 20 Localized FF=17, 15
006 (2350)	Floor Surface	PRISM Trench details <ul style="list-style-type: none"> Dimensions
007 (2350)	Floor Surface	PRISM Trench Details <ul style="list-style-type: none"> Anticipated Weight: 1300 US Ton per detector.
008 (+)	Floor Surface	NSCF to provide PRISM Rail Anchor holes <ul style="list-style-type: none"> Location/dimensions

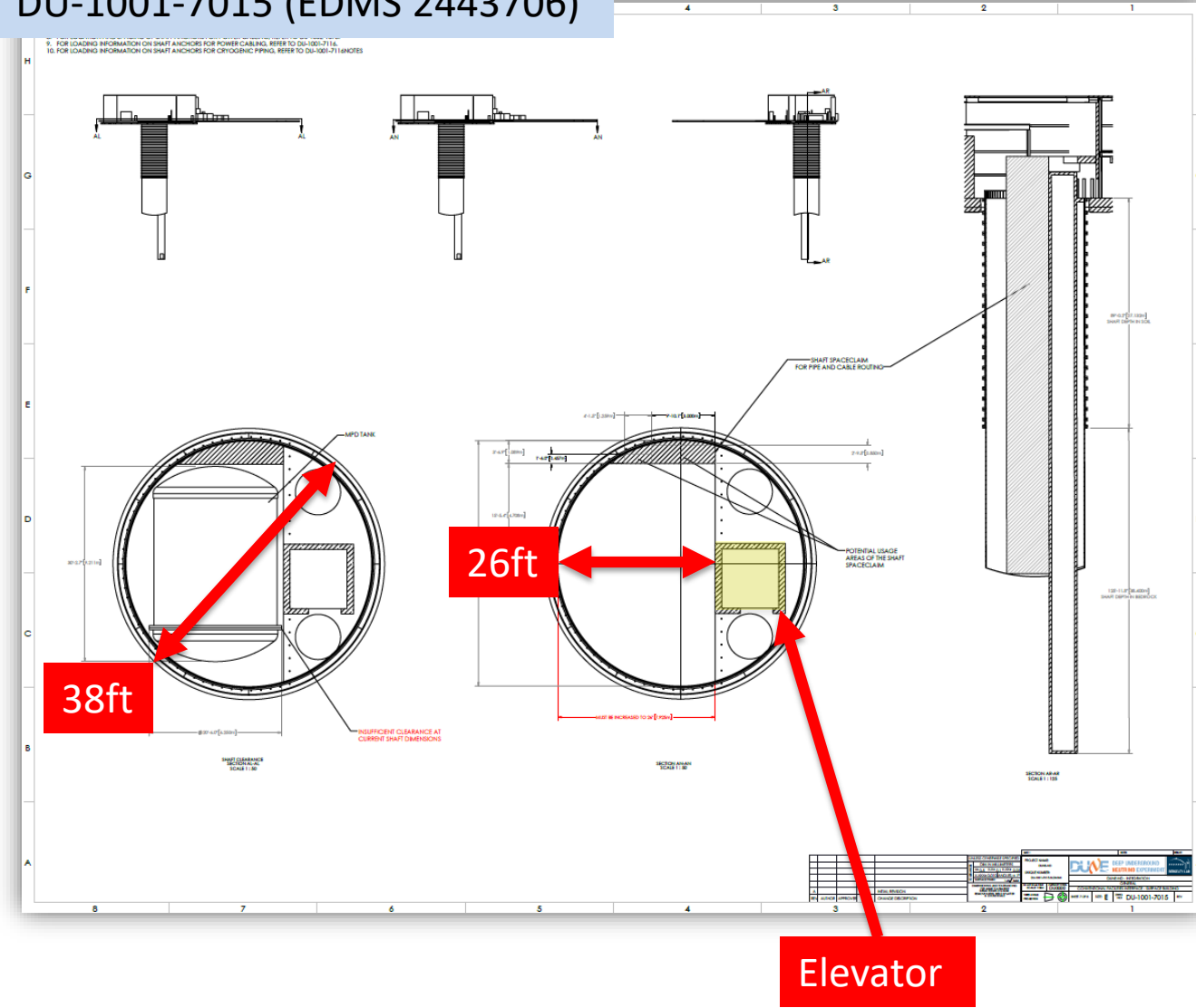
DU-1001-6831 (EDMS 2440425)



Shaft Requirements

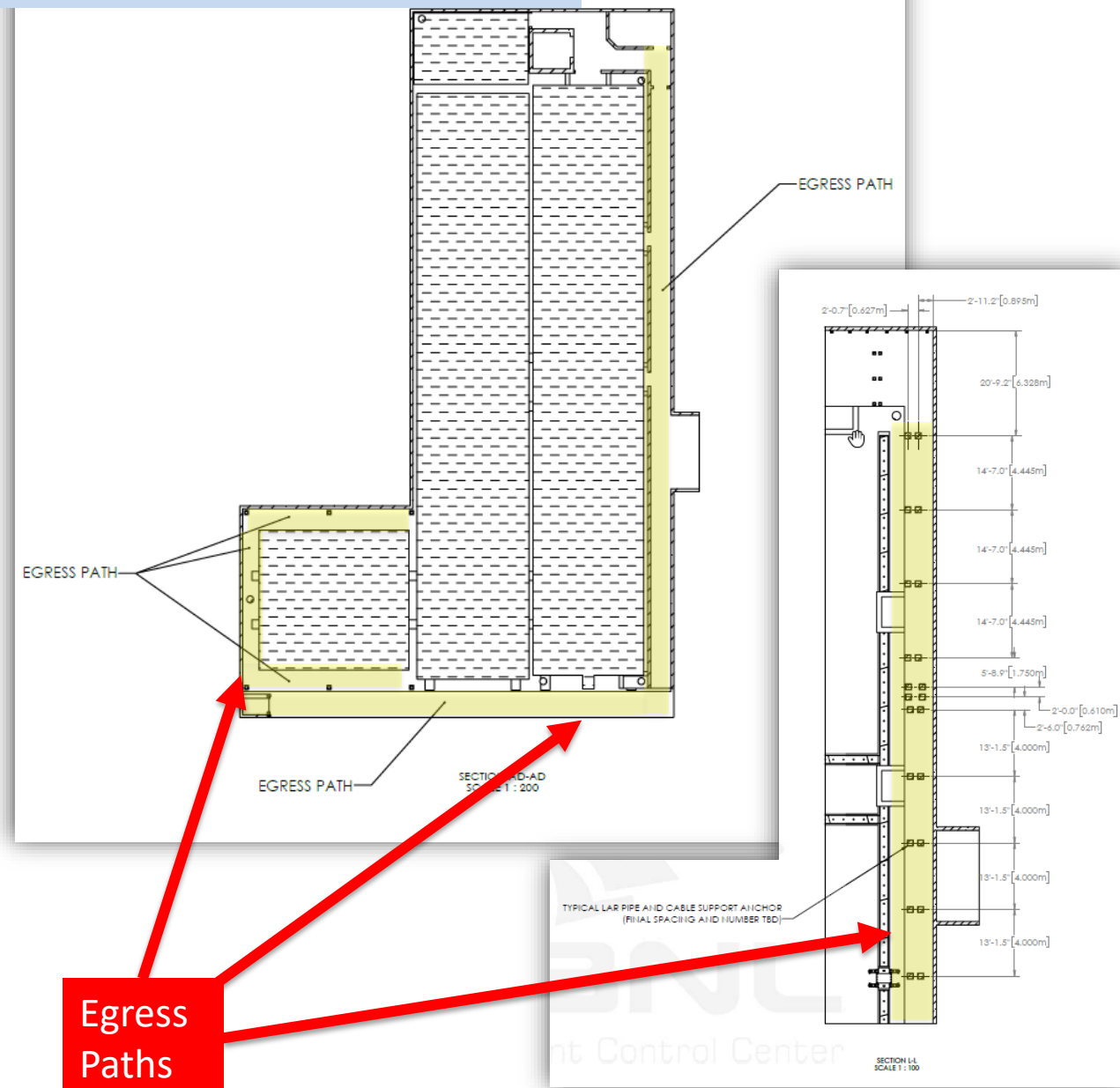
REQ #	Item	Requirement (Paraphrased)
009 (2356)	Cavern Shaft	<ul style="list-style-type: none"> 38 ft diameter, 26 ft to septum wall. Shaft routing space claim
010 (+)	Cavern Shaft	Shaft wall provision for anchors/mounting fixtures for utility routing
011 (2357)	Size and Capacity of Elevator	Elevator sizing to support 49 person cavern occupancy. <ul style="list-style-type: none"> 4ft x 7ft min size 3,500 lb min capacity

DU-1001-7015 (EDMS 2443706)



Egress Requirements

REQ #	Item	Requirement (Paraphrased)
012 (+)	Egress	Egress path raised by 1 foot
013 (+)	Egress	Positive air pressure in egress path and stairwells.
014 (+)	Egress	Assisted Opening on doors to Egress path (due to positive pressure)
015 (+)	Egress	Planned egress paths noted on interface drawing
016 (+)	Egress	Energy chain mounting on top of egress path for LAr Energy chain.



Environmental Requirements

REQ #	Item	Requirement (Paraphrased)
017 (2342)	Environmental	<ul style="list-style-type: none">• 60-80 deg F• 15-85% humidity• Min 48 deg F dewpoint
018 (2362)	Cavern Moisture	<ul style="list-style-type: none">• NSCF drainage and sumps to prevent standing water.• Drip ceiling structures to prevent dripping on detectors.



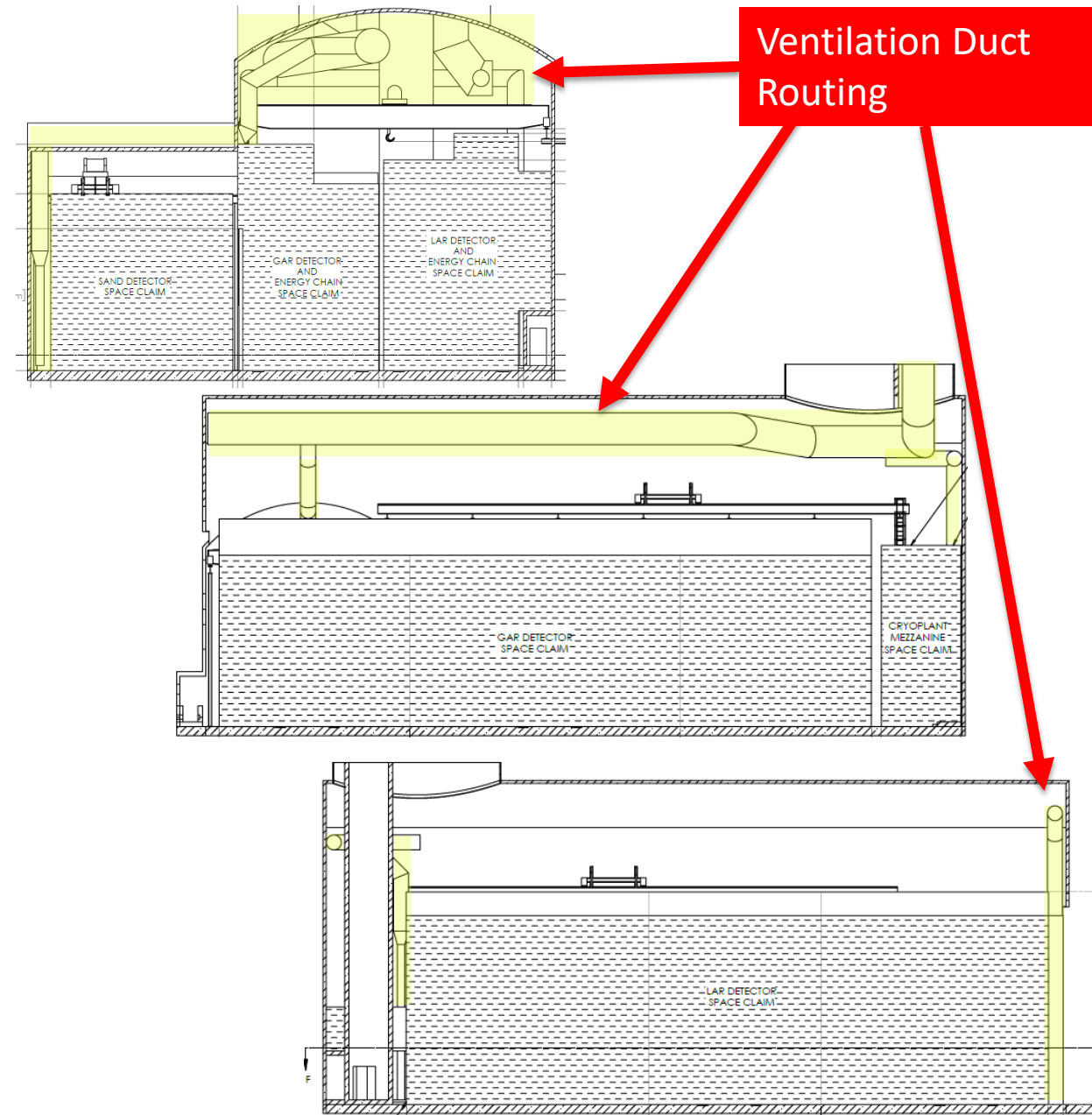
Shotcrete Wall Requirements

REQ #	Item	Requirement (Paraphrased)
019 (+)	Shotcrete Wall	NSCF Shall provide shotcrete walls
020 (+)	Shotcrete Wall	NSCF shall not use electrically conducting mesh for coverings/reinforcement
021 (+)	Shotcrete Wall	NSCF shall provide mounting pads on walls anchored into the rock structure
022 (+)	Shotcrete Wall	NSCF to provide generic Unistrut anchor locations for utility routing



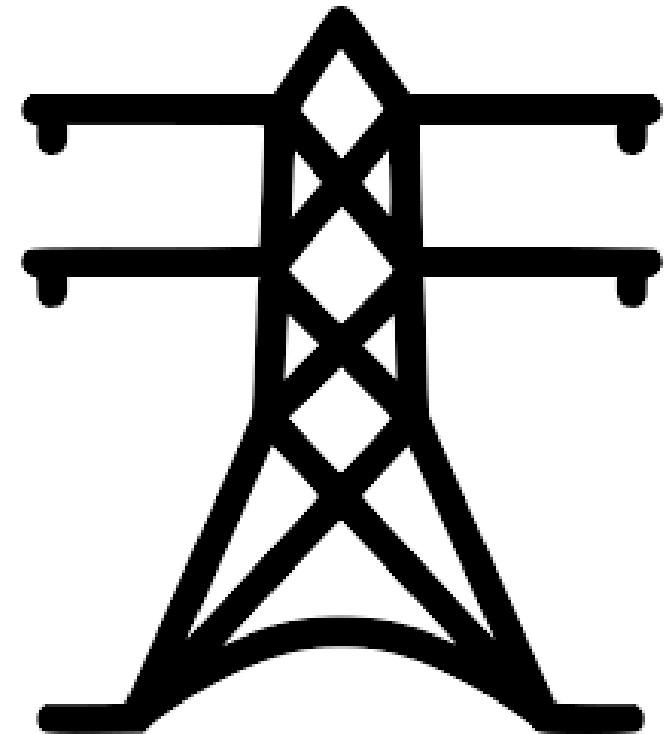
Ventilation Requirements

REQ #	Item	Requirement (Paraphrased)
023 (2343)	Ventilation	<ul style="list-style-type: none"> • Min 7,500 CFM fresh air • Cryo input to control logic for emergency situations
024 (+)	Ventilation	Min ventilation flow of 40,000 cfm in cavern
025 (+)	Ventilation	Ventilation ducts details per DU-1001-6831
026 (+)	Ventilation	Ventilation inlet/outlet/register details
027 (+)	Ventilation	Min 75% airflow in HVAC equipment failure scenario
028 (+)	Ventilation	HVAC equipment signage
029 (+)	Ventilation	Cryo air velocity sensor placement.
030 (+)	Air Quality	Air quality per building code



Electrical Requirements

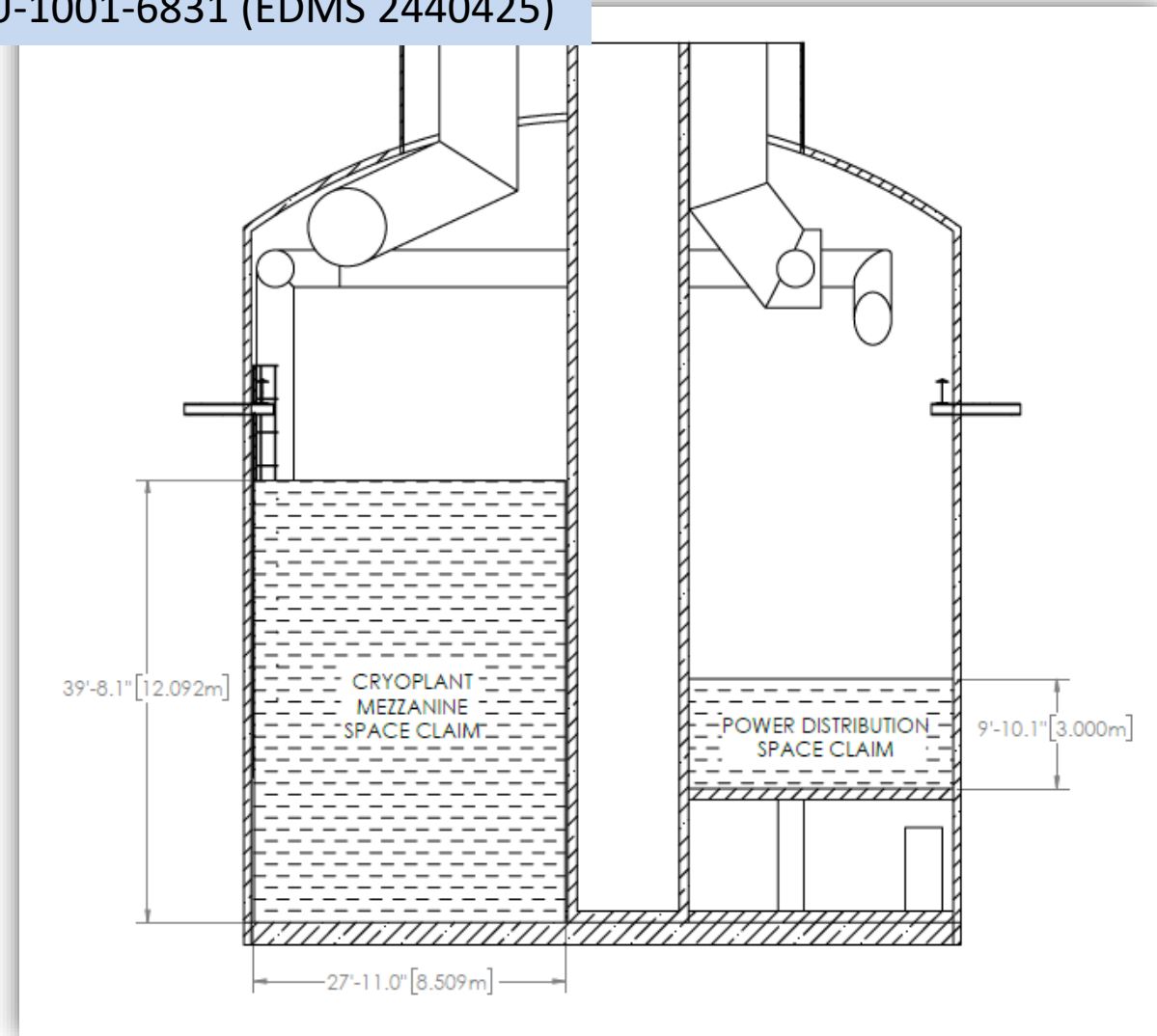
REQ #	Item	Requirement (Paraphrased)
031 (2345)	Electrical Power Distribution	NSCF provides main building power <ul style="list-style-type: none"> 60% SLED is in work. It will be based on values from the Consortia captured in EDMS 2494090
032 (+)	Electrical Power Distribution	NSCF to allocate power distribution equipment per DU-1002-1073
033 (+)	UPS and Standby Power	NSCF to provide standby power for: <ul style="list-style-type: none"> Cryo Controls Cryo Air Compressor Networking
034 (+)	Electrical Grounding	NSCF provides building ground per DUNE specification
035 (+)	Lighting	Lighting per FESS standards
036 (2347)	VFD Issues	NSCF to notify DUNE of VFDs in the ND complex



Cavern Cryogenic Space Requirements

DU-1001-6831 (EDMS 2440425)

REQ #	Item	Requirement (Paraphrased)
037 (+)	Underground Cryogenic Space	North-west corner reserved for cryogenic equipment mezzanine.
038 (+)	Underground Cryogenic Space	NSCF preparation of anchors and pads for mezzanine <ul style="list-style-type: none"> • NSCF to take on mezzanine scope – BCR #613
039 (+)	Underground Cryogenic Space	<ul style="list-style-type: none"> • Cavern wall not to protrude in mezz. • Space, drip cover to prevent water dripping over mezz.

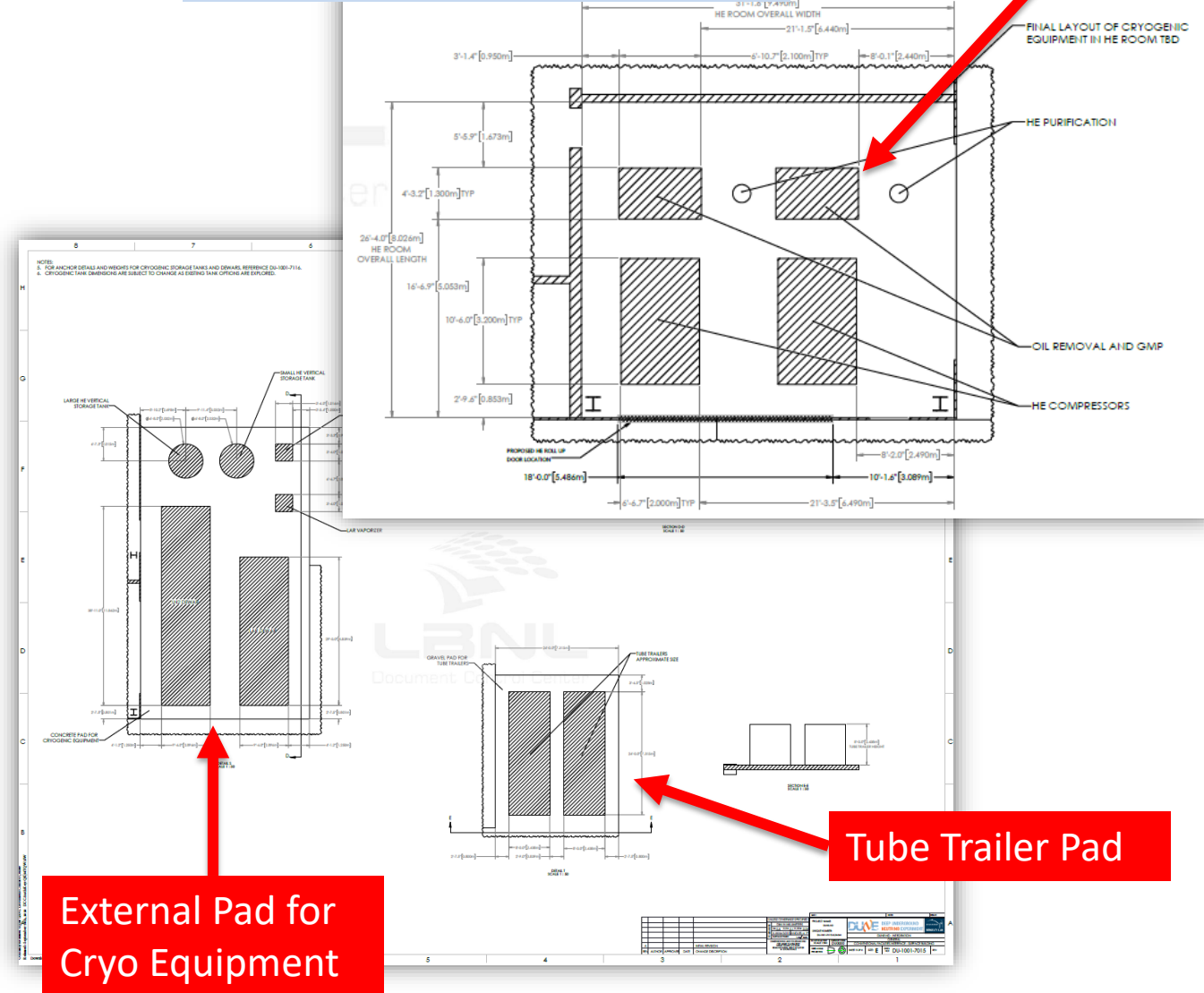


Surface Cryogenic Space Requirements

REQ #	Item	Requirement (Paraphrased)
040 (+)	Surface Cryogenic Equipment Space	LHe Compressor Room <ul style="list-style-type: none"> Roll up door Dimensions - DU-1001-7015
041 (+)	Surface Cryogenic Equipment Space	External Pad for Cryogenic Equipment <ul style="list-style-type: none"> 57 ft x 33 ft
042 (+)	Surface Cryogenic Equipment Space	Louvers in Compressor Room <ul style="list-style-type: none"> Size and position - DU-1001-7015
043 (+)	Surface Cryogenic Equipment Space	Gravel Pad for Tube Trailers <ul style="list-style-type: none"> 24 ft x 30 ft

DU-1001-7015 (EDMS 2443706)

LHe Compressor Room



External Pad for Cryo Equipment

Tube Trailer Pad

Cooling Water Requirements

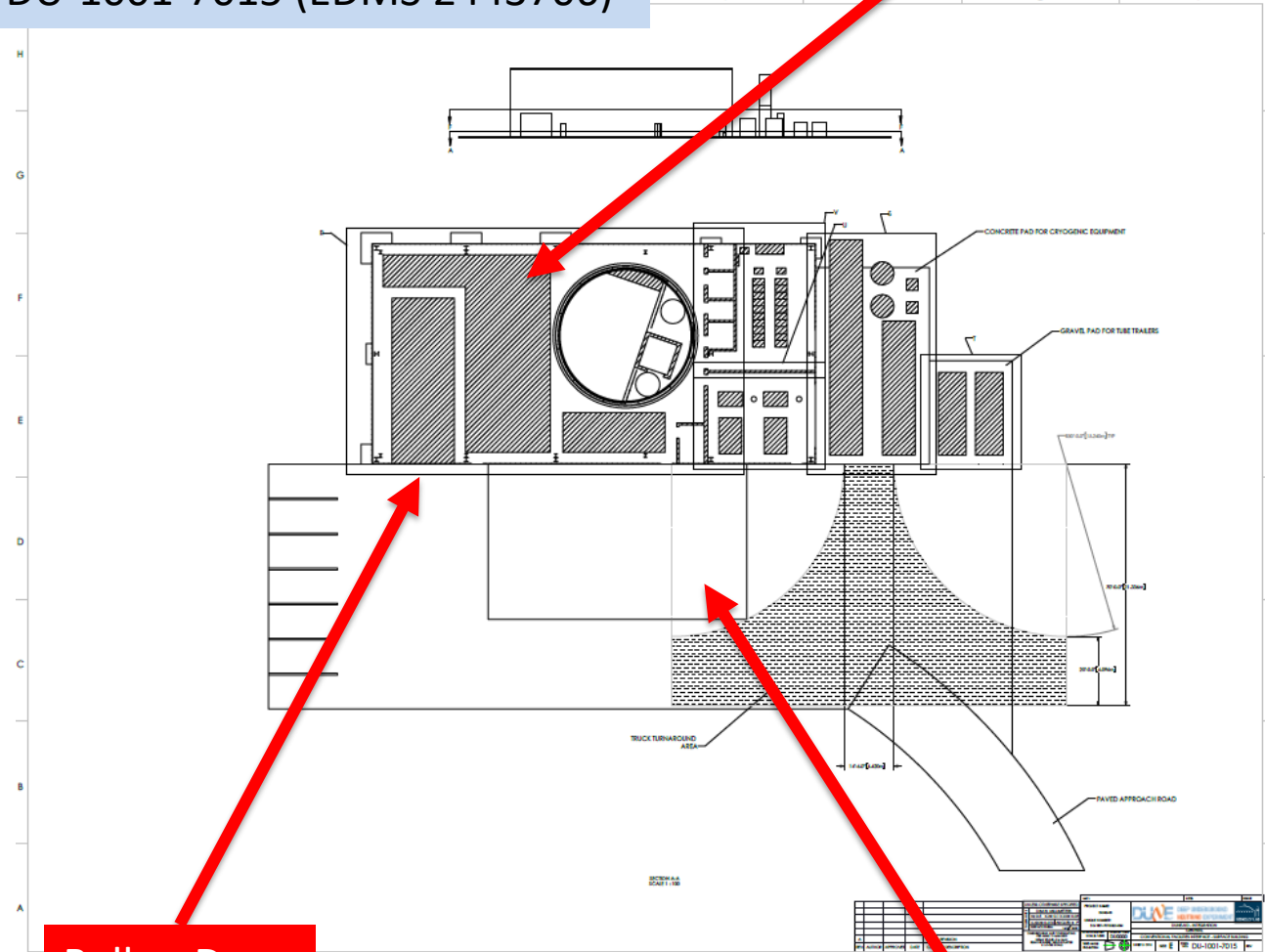
REQ #	Item	Requirement (Paraphrased)
044 (2354)	Cooling Water	<ul style="list-style-type: none">• Supply/Return near the Cryo Mezzanine under the shaft.• 200 to 250 gal/min• 90 psi• 70-90 F max inlet temp
045 (+)	Cooling Water	<ul style="list-style-type: none">• Supply/Return in cryoplant compressor room.• 160 gal/min• 90 psi• 77-90 F max inlet temp



Surface Building Requirements

REQ #	Item	Requirement (Paraphrased)
046 (+)	Roof Hatch	Dimensions per DU-1001-7015 <ul style="list-style-type: none"> To be open/closed in 1 hour
047 (+)	Surface Building Crane Pad	63ft x 72ft pad for rental crane. <ul style="list-style-type: none"> DU-1001-7015 DU-1002-1138
048 (+)	Surface Building Main Rollup Door	Height to be maximized within building framing (17-18ft)
049 (+)	Surface Building Staging Space	Staging space per DU-1001-7015

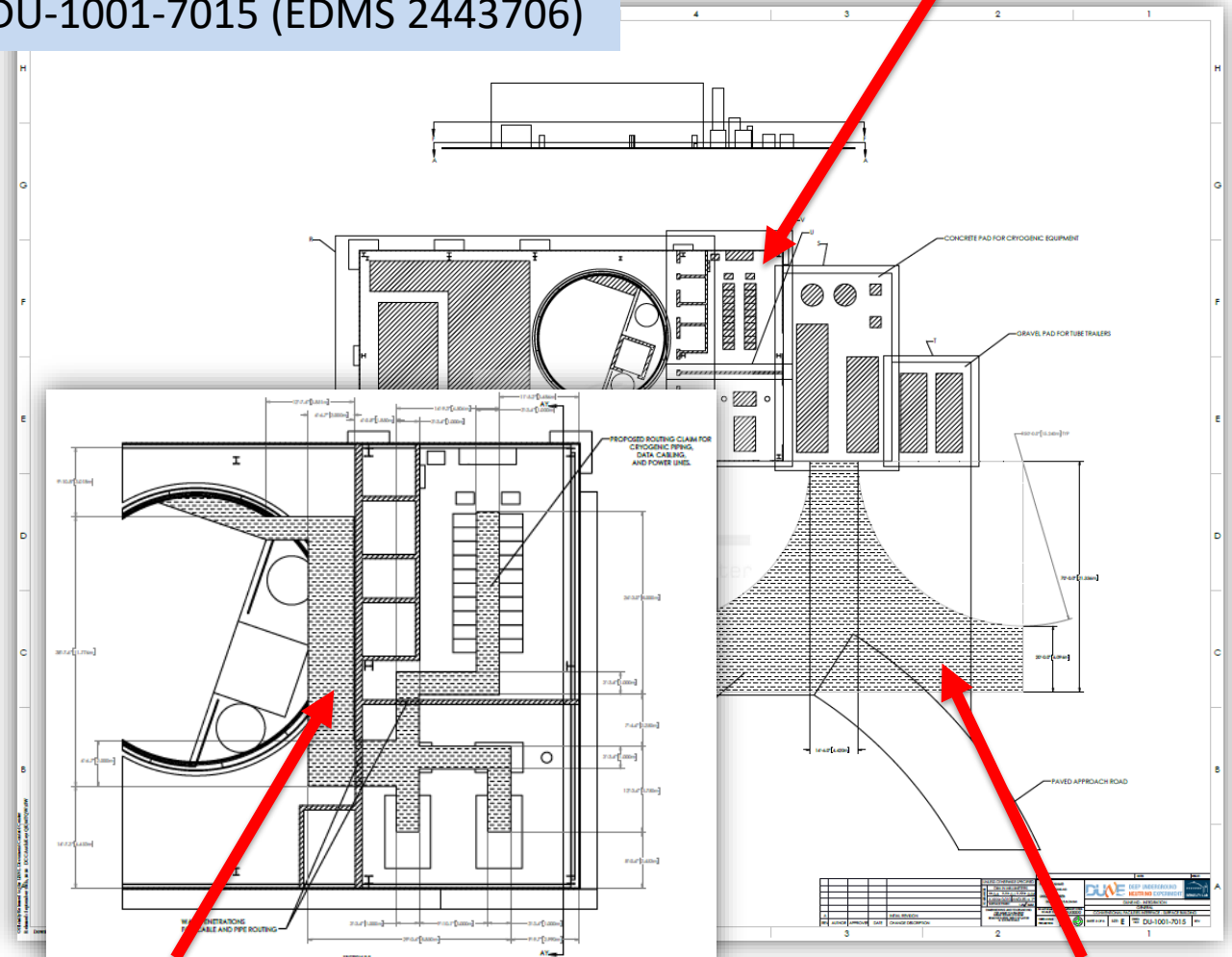
DU-1001-7015 (EDMS 2443706)



Misc Requirements

REQ #	Item	Requirement (Paraphrased)
050 (+)	Surface Building Truck Access	Gravel surface for truck access to buildings/cryo tanks. Grade not to exceed 2%
051 (+)	Surface Building Utility Routing	Clearance to be maintained for routing of scientific utility routing.
052 (2344)	DAQ Space	Space for 20 data racks. Cooling unit optimized for server room usage. <ul style="list-style-type: none"> • Power: DU-1002-1016 • Space: DU-1001-7015
053 (2359)	Data Networking	Space for 3-48U racks to accommodate data networking equipment.

DU-1001-7015 (EDMS 2443706)



Utility Routing

Truck Access

Fire Suppression Requirements

REQ #	Item	Requirement (Paraphrased)
054 (2360)	Fire Suppression Underground	NSCF to provide pre-action sprinklers for protection of electronics.
055 (+)	Fire Suppression Underground	Fire Suppression connection points for cryogenic equipment mezzanine
056 (+)	Fire Suppression Surface	Fire suppression per DOE Standard 1066
057 (2361)	Cable Fire Rating	NSCF to provide all cable to meet code and be low smoke/zero halogen. ...



Summary

- NSCF design period is quickly drawing to a close:
 - Shortly, the parameters discussed in these requirements will become fixed, and the detector consortia will need to continue their design within the bounds that are defined at this stage.
- Thus, it is very important that these requirements:
 - Accurately capture the scope of detector needs from the facility
 - Are conservative enough to allow consortia design progression without requiring NSCF rework.
 - Changes will only become more costly as time goes on!