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Mu2e Project Document No.1088
CF Requirements

the
Mu2e
project

Date: 2014-June 13

Mu2e Conventional Facilities Requirements

Abstract

This note summarizes the requirements for the Conventional Facilities sub-project.

Submitted by :	***Checked by :***	***Approved by :***
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History of Changes

Rev. No.	*Date*	*Pages*	*Description of Changes*
1.0	6-March-2012		Entire document reviewed and documented
2.0	04-May-2012		Changed ODH Ventilation amount. Updated loads from Solenoid Power Supplies
3.0	26-Mar-2013		Major updates
4.0	02-May-2013		Review comments incorporated
5.0	27-Nov.-2013		Basis of Contract Document design
6.0	3-April -2014		Update
7.0	27-May-2014		Incorporated Review Comments
8.0	13-June-2014		Additional Review Comments

Table of Contents

1) Introduction:

The purpose of the Mu2e Conventional Facilities is to provide an adequate space to assemble, house and maintain the experimental equipment in support the Mu2e Experiment. This set of user requirements provides the framework for the Conventional Facilities design. Enterprise and Organizational requirements, referenced in the CDR, Chapter 6, are incorporated into the building's design. The experiment will produce strong magnetic fields that may affect various components in the building. The elevator, sump pumps and fans are positioned as far as possible from the magnetic influence.

Incorporated into this document are selected drawings that define the agreed upon dimensions in plan and elevation and the Basic Design Data prepared by Middough Inc. Doc DB # 3620. The complete set of contract documents including Exhibit A, technical specifications and drawings for construction can be viewed in Doc DB # 3494. The net building areas are listed below.

Room Name	Area	Sq. Ft.	Area	Sq. Meters
Grade Level	**12600**	**Sq. Ft.**	**1171.2**	**Sq. M.**
Entry 101	281	Sq. Ft.	26.1	Sq. M.
Planning Room and Toilets	485	Sq. Ft.	45.1	Sq. M.
Mechanical Room	975	Sq. Ft.	90.6	Sq. M.
Machine Shop	360	Sq. Ft.	33.5	Sq. M.
Data Acquisition Room	630	Sq. Ft.	58.6	Sq. M.
Solenoid & Power Supply Room	2400	Sq. Ft.	223.1	Sq. M.
Truck Bay / High Bay	6390	Sq. Ft.	594.0	Sq. M.
Detector Level	**9640**	**Sq. Ft.**	**896.0**	**Sq. M.**
DS Hall	4485	Sq. Ft.	416.9	Sq. M.
TS Hall	890	Sq. Ft.	82.7	Sq. M.
PS Hall	1010	Sq. Ft.	93.9	Sq. M.
Proton Absorber	225	Sq. Ft.	20.9	Sq. M.
Extinction	540	Sq. Ft.	50.2	Sq. M.
Remote handling	980	Sq. Ft.	91.1	Sq. M.
Beamline	1200	Sq. Ft.	111.5	Sq. M.

2) Truck Bay, High Bay Grade Level Area: Access and space for receiving the scientific equipment including the solenoids. Access is via a thirteen foot ten inch wide by sixteen foot high roll-up overhead door. The high bay area may be used for storage and staging. The beamline power supplies will be housed along the north side of the high bay. The length of the loading dock, crane coverage and overhead door is sized to accommodate the Detector Solenoid which is the largest single element that will be brought into the building. The overhead door and loading dock length is sized for a standard height trailer. If a longer low boy type trailer is used the dock will be extended using shield blocks supported by steel frames in order to accommodate the additional length. The high bay will also

house the gas bottle storage area located near the overhead door. There are no flammable gasses planned for and no special mechanical requirements for this gas bottle storage.
The High Bay is constructed around a 40 feet by 157 feet column grid. Two large hatches dominate the floor plan. The hatches and slabs are designed to carry a minimum of fifteen feet of normal weight concrete shielding with slightly higher shielding over the TS solenoids.

Occupancy: 5 during installation and maintenance; Occasional during operations.

Egress: Maximum 300 feet travel distance, 50 feet maximum single path of travel.

Equipment Access and Rigging: Material handling is via two 30-ton CMAA Class D, top-riding, overhead building cranes with radio and pendant controls. The motions of the cranes will normally be control individually. A selector switch on the radio controller will allow the two cranes to be controlled in tandem. The largest single pick is the Detector Solenoid plus rigging at slightly over 50 US tons. The cranes shall be configured so that both cranes can be used to lower the Heat Shield, Production Solenoid, and Transport Solenoid (TS) through the TS hatch.

Each crane: 30 ton capacity

Bridge speeds up to 80 feet per minute, variable frequency control.

Trolley speeds up to 35 feet per minute, variable frequency control.

Hoist speeds up to 21 feet per minute, variable frequency control.

Crane hook height above receiving finished floor + 20'-0 min. Hook to extend to within 1'-0 of lower level finished floor elevation. Disconnects positioned on upper and lower levels.

Cranes to be positioned so that the hook to hook spacing is no more than 15'-4 and the hook on the west crane can approach to within 9'-0 of column line A. The west crane's footwalk will be approximately 1'-6 wide.

Ventilation and HVAC:

Heat load to air:	Magnet Power Supplies and Racks (See Appendix-A)
Temperature:	68 Degrees F minimum; 78F maximum.
Stability:	none required
Humidity:	No minimum requirement. 60% RH maximum
Pressurization:	Positive with respect to lower space when blocks are in place
HVAC controls:	Site BAS (Building Automation System)
ODH Ventilation:	None

Fire Protection: Ordinary Hazard Fire Sprinklers, Group 1

Process Water:

LCW:	By Accelerator subproject.
Chilled Water:	Building HVAC (see mech room).

Electrical:

480V Distribution:	Fed from Mechanical & Electric Room 1200 amp DHP panelboard
AC Distribution:	120V/208V – 20 Amps. Quad outlet @ +/-25' 480V – 60 Amp Welding outlets
Grounding	Structural Steel Frame
Lighting:	75 foot-candles – Fluorescent High Bay

Penetrations:	42-6 between Power Supplies Loading Dock and enclosure
Emergency:	Battery powered exit lights and emergency lighting
Experimental:	Disconnect Switch, 2-PHP panelboards fed from Solenoid and Power Supply Room 2000 amp switchboard

Stand-by Power loads: Cranes during installation period.

Fire Detection: Addressable fire detection and alarm system are to be provided for the building. The system will consist of manual pull stations located at all exits, duct type smoke detectors on the supply sides of all air handling units having a capacity greater than 2000 cfm, and sprinkler system water flow detectors and valve supervisory switches, and notification devices located throughout the facility

3) DAQ Electronics Rack Room: The electronics space is divided into two locations. A space has been provided at the level of the Detector Solenoid, in the alcove near the solenoid's downstream end, for several racks. The rack heat load to air is minimal. At grade, El 746'-6, there is a 31'-10 by 19'-10 space to house the Data Acquisition Racks (DAQ) and relay racks. The room is positioned in line with the end of the detector and positioned away from the magnetic field. Penetrations between the two locations are provided for cabling.

Occupancy:	none
Egress:	Maximum 300 feet travel distance, 50 feet maximum single path of travel

Equipment Access and rigging: none

Ventilation and HVAC: (for rack area/ control room at grade level)

Heat load:	(7) DAQ Racks and (6) Solenoid Relay racks (see Appendix-A)
Temperature:	68 Degrees F minimum; 85F maximum.
Stability:	none required
Humidity:	≥20% RH minimum. 60%RH maximum
HVAC controls:	Site BAS (Building Automation System)
ODH Ventilation:	None
Fire Protection:	Ordinary Hazard Fire Sprinklers, Group1
Process Water:	
LCW:	None
Chilled Water:	For CRAC (computer room air conditioner)
DWS:	for CRAC humidification
Electrical:	
480V Distribution:	Fed from 1200A DHP panel board in Mechanical & Electric Room
AC Distribution:	2- 225Amp, 208Y/120V Panels for Rack Power. (Distribution of power from the panelboards to the racks is not in this WBS) 208Y/120V – 20 Amps. Quad outlet @ +/-25'
Grounding	Structural Steel Frame, Ground Bus Bar
Lighting	50 foot-candles - Fluorescent
Emergency:	Battery powered exit lights and emergency lighting
Stand-by:	None
Fire Detection:	Heat / Smoke / Air Sampling, manual pull stations and notification

4) Solenoid Support & Power Supply Room: Space provided for four feed cans, 3 feet in diameter by 6 feet high, power supplies, fast switches, resistor banks and control racks. 10 smaller vacuum pumps are also located in this space. The room is roughly 50 feet wide by fifty-three feet deep and 16 feet minimum clear to the underside of the steel framing.

Occupancy: 5 during installation and maintenance; None normally during operations

Egress: Maximum 300 feet travel distance, 50 feet maximum single path of travel

Equipment Access and rigging: Eight foot wide by nine foot high pair of swing doors provided for a fork lift

Ventilation:

Heat load to air:	Solenoid Power Supplies & Vac Pumps (see Appendix-A)
Temperature:	68 Degrees F minimum; 85F maximum
Stability:	No more than 10-20C variance during the course of seasons
Pressurization:	Positive with respect to lower space when blocks are in place
Humidity:	None
HVAC controls:	to be connected to Site BAS (Building Automation System)
ODH Ventilation:	6,300 cfm

Fire Protection: Ordinary Hazard Fire Sprinklers, Group 1

Process Water:

LCW:	Power supplies are cooled by LCW under WBS 2
Chilled Water:	For HVAC

Electrical:

AC Distribution:	Fed from 2000 Amp Switchboard in Solenoid Room and Mechanical & Electric Room 1200 amp DHP panelboard 120V/208V – 20 Amp. Quad outlet @ +/-25' 480V – 60 Amp Welding outlets
Grounding	Structural Steel Frame, Ground Bus Bar
Lighting	50 feet-candles
Emergency:	Battery powered exit lights and emergency lighting
Experimental:	Disconnect Switch
Quench Protection:	Exterior concrete pad and ducts for quench protection resistors.

Fire Detection: Heat / Smoke Detectors

5) Mechanical & Electrical Room: Contains building electrical power distribution equipment and building mechanical equipment. Space provided for air compressor with dryer (25 HP), and Tracker/Calorimeter cooling system.

Occupancy: none

Egress: Maximum 300 feet travel distance, 50 feet maximum single path of travel.

Equipment Access and rigging: none

Ventilation and HVAC:

Heat load to air:	Minor loads from pumps, HVAC equipment, air compressor and dryer.

Temperature:	68°F minimum; 10°F above ambient maximum (ventilated)
Temp Stability:	none required
Humidity:	None
HVAC controls:	Site BAS (Building Automation System)
ODH Ventilation:	None
Fire Protection:	Normal Hazard Fire Sprinklers
Process Water:	
LCW:	None
Chilled Water:	For Air Handler (serving the lower space)
Electrical:	
480V Distribution:	One 1200 Amp panelboard
AC Distribution:	120V/208V – 20 Amps. Quad outlet @ +/-25' 480V – 60 Amp Welding outlets
Grounding	Ground Grid with Ground Rods @ 50', Structural Steel Frame, Ground Bus Bar
Lighting	50 foot-candles - Fluorescent
Emergency:	Battery powered exit lights and emergency lighting
Stand-by:	Elevator & UPS
Cable Tray:	None
Fire Detection:	Heat / Smoke Detectors

6) Creature Comforts: Two unisex toilet rooms and a planning room are provided. An elevator is provided to transport workers and tools between the lower level and grade level. The elevator is sized for a gurney. The elevator is connected to stand by power.

7) Detector Solenoid Area: This portion of the lower level of the building contains the Detector Solenoid. This space also includes alcoves for lower mechanical room to house the vacuum pumps, and the lower electrical alcoves to house the miscellaneous racks. A cross trenches is positioned in the slab to route services in and out of the detector and longitudinal trench extends downstream of the Detector solenoid for a rolling cable tray. Trenches are three feet wide and three feet deep. A shielded depression for the Calorimeter calibration DT source is provided at the west end of Alcove #3, north of the Detector Solenoid end. Electrical outlets at 120V /208V are provided for this equipment.

Occupancy:	5 to 10 during installation and maintenance; none during operations
Egress:	Maximum 300 feet travel distance, 50 feet maximum single path of travel
Shielding:	The hatch over the detector will have a minimum of six (6) feet of normal weigh concrete blocks. More shielding is required at the upstream end for primary proton beam shielding. The haunches that support the concrete shield blocks are design to carry fifteen (15) feet of normal weight concrete.

Equipment Access and rigging: Portions of the space are accessible via the two (2) High Bay 30 ton overhead cranes. Six feet of normal weight concrete shielding over detector.

Equipment Space Criteria: The area downstream of the Detector Solenoid is provided for the installation and removal of the detector elements inside of the solenoid. The overall space is 25 feet wide, 147 feet long including the space to house the Transport Solenoid and detector servicing area, the space has a minimum 18 foot clear height under the loading dock and 19'-6 over the DS and TS under the concrete shield blocks.

Equipment Loading: The gravity loads and magnetic forces developed in each solenoid are resisted by the concrete base slab.

Ventilation:

Heat load to air:	Vacuum/ Cryo pumps, Racks, CRV FEBs (See Appendix-A)
Temperature:	68 Degrees F minimum (winter); 80F maximum (summer)
Stability:	none required
Humidity:	No minimum.
HVAC controls:	BAS- Building Automation System
ODH Ventilation:	See Appendix-A
Others:	Future cleanroom and its associated system will be by others- Conventional facility to consider spaces and utilities for this.
Fire Protection:	Ordinary Hazard Fire Sprinklers – Pre-action system
Process Water:	
LCW:	Not included in this WBS.
Chilled Water:	Available for vacuum pumps/future equipment (See Appendix A)

Electrical:

AC Distribution:	120V/208V – 40 Amps. Quad outlet @ 60'480V – 60 Amp Welding outlets
Lighting:	40 foot-candles
Ground:	Copper ground bus
Emergency Power:	Remote UPS powered exit lights and emergency lighting
Cable Tray:	1'-0 tray along north, east and south perimeter for CRV signal cables. A trench is provided in the concrete base slab at east end of the Detector Solenoid for a cable tray and other utilities that connect to the detectors.
Fire Detection:	Heat/smoke detection

8) Production Solenoid Area / Proton Absorber: This portion of the lower level of the building contains the Production Solenoid, area under a shielded hatch and space for the primary beam absorber. The stray magnetic field is strongest in this area. The forces on the concrete surfaces are less than twenty pounds per square foot. The impact of the magnetic field on items such as HVAC controls or fire alarm pull stations are not fully understood but the items that could be affected have been identified. The Proton Absorber will be constructed under WBS 3.0 with the cooling manifold and steel plates supplied by the WBS 2.0 Accelerator Subproject.

Occupancy:	none during operations

Egress:	Maximum 300 feet travel distance, 50 feet maximum single path of travel.
Shielding:	The primary proton beam requires sixteen (16) feet of earth equivalent shielding to occupied areas. Shielding for the target and proton absorber losses are analyzed for the geometry shown on the drawings.

Equipment Access and rigging: The TS Hatch is the initial choice for rigging in the Production Solenoid and heat shield. In the event that the schedule will not allow this approach, the 15'-10 by 22'-10 clear opening of the PS hatch and a rental mobile crane will need to be employed.

Equipment Loading: The gravity loads and magnetic forces developed in each solenoid are resisted by the concrete base slab.

Ventilation: (No serviceable equipment to be located between the PS and Absorber)

Heat load to air:	Minimal (see Appendix-A)
Temperature:	68 Degrees F minimum; 85F maximum
Stability:	none required
Humidity:	No minimum. Maximum 50% RH @ 70F or 50F dew point (based on proper sealing of hatch by others)
HVAC controls:	BAS- Building Automation System
ODH Ventilation:	See Appendix-A
Other ventilation:	maintain negative pressure in relation to adjacent space, while meeting the decay time requirements
Fire Protection:	None
Process Water:	
LCW:	Included in WBS 2.0.
RAW:	Not required.
Electrical:	
AC Distribution:	120V/208V – 20 Amps. Quad outlet @ +/-25'480V – 60 Amp Welding outlets
Lighting:	40 foot-candles
Emergency Power:	Remote UPS powered exit lights and emergency lighting
Cable Tray:	None
Fire Detection:	Heat/smoke detection

9) M4 Beamline Enclosure Area: This portion of the lower level is upstream of the Production Solenoid and will house the primary beam line. The Beamline Enclosure area will be isolated from the Detector Solenoid Area by an air barrier in order for the enclosure to maintain a negative pressure relative to the Detector Solenoid Area (once the barrier is in place) and to divert air activated during beamline operation away from the Detector Solenoid space toward the Delivery Ring.

Occupancy:	none during operations
Egress:	Maximum 300 feet travel distance, 50 feet maximum single path of travel

Shielding: The primary proton beam requires sixteen (16) feet of earth equivalent shielding to occupied areas.

Equipment Access and rigging: Shielded hatch upstream with cover

Ventilation:

Heat load to air:	No air-cooling is required
Temperature:	68 Degrees F minimum
Stability:	none required
Humidity:	No minimum. 60% RH maximum (based on proper sealing of hatches, penetrations and doors)
HVAC controls:	BAS- Building Automation System
ODH Ventilation:	See Appendix-A

Fire Protection: None

Process Water:

LCW: Included in Accelerator WBS.

Electrical:

AC Distribution:	120V/208V – 20 Amps. Quad outlet @ +/-25'480V – 60 Amp Welding outlets
Grounding:	Copper ground cable along wall
Lighting:	20 foot-candles
Emergency Power:	Remote UPS powered exit lights and emergency lighting
Cable Tray:	4- 18"; 42-6" PVC ducts to power supplies in the Detector Building high bay.

Fire Detection: Heat/smoke detection/line type

10) Remote Handling Area: This portion of the lower level of the building contains the remote handling equipment during target exchange. The equipment will normally not be in the room and will be lowered through the 9'-2 x 11'-2 hatch. This room will contain vacuum pumps for the PS. The wall between the PS and the Remote Handling Room shall be 2'-0 minimum for radiation protection concerns.

Occupancy: 6-10 persons for setup during beam off

Egress: Aisle to Stairs at M4 Beamline Enclosure

Shielding: The primary proton beam requires sixteen (16) feet of earth equivalent shielding to occupied areas. Shielding for the target and proton absorber losses are analyzed for the geometry shown on the drawings.

Equipment Access and rigging: 9'-2 x 11'-2 shielded hatch to be used with mobile crane.

Ventilation:

Heat load to air:	none
Temperature:	68 Degrees F minimum; no maximum
Stability:	none required
Humidity:	no requirement
ODH Ventilation:	no requirement

Fire Protection: Not required

Process Water: Chilled water for Vacuum System

Electrical:

AC Distribution:	20 Amps. 120V Quad outlets, 208V 3 phase outlets; Fused disconnect switches for vacuum pumps
Lighting:	20 foot-candles
Emergency Power:	Remote UPS powered exit lights and emergency lighting
Fire Detection:	Heat/smoke detection

11) Extinction Monitor Area: This area is above and downstream of the Proton Absorber and contains two rooms. The upstream room contains a permanent magnet and the downstream room contains monitor equipment and electronic racks. A carrier pipe for future equipment is routed from the Extinction Monitor magnet, over the Proton Absorber to the area downstream of the PS.

Occupancy:	none
Egress:	via stairs
Equipment Access and rigging:	Shielded Hatch with cover
Ventilation:	
Heat load to air:	none. Require 100 cfm dry Outside Air from the absorber unit
Temperature:	68 Degrees F minimum; no maximum
Stability:	no requirement
Humidity:	no requirement
ODH Ventilation:	no requirement
Fire Protection:	None
Process Water:	no requirement
Electrical:	
AC Distribution:	120V/208V – 20 Amps. Quad outlets.
Ground Grid:	none
Lighting:	20 foot-candles
Emergency Power:	Remote UPS powered exit lights and emergency lighting
Cable Tray:	None
Fire Detection:	Heat/smoke detection

12) Delivery Ring Upgrade:

Upgrade the electrical power at AP-30 Service Building with fans on the 1500KVA substation and a second main breaker. Install new 1200 Amp service into building and route to northwest end of building. Modify HVAC controls to route exhaust air towards AP-0.

13) Site Power Delivery and Distribution

Primary Electrical Source:	40 MVA, 345 – 13.8kV Master Substation
Backup Electrical Source:	175 kw generator 40 MVA, 345 – 13.8kV Kautz Rd. Substation via F3 switch
13.8 kV Feeders:	One Primary Feeder Feeder 24 from MSS Backup feeder 53 from KRS (capacity for house power only)
13.8 kV Distribution:	Looped Feeder, Air Switch Sectionalized from F-3.
Service Transformers:	1-750 kVA, 13.08D kV – 480Y/277 V, Solid Ground

1-1500 kVA, 13.08D kV – 480Y/277 V, Solid Ground

Abbreviations used:
LCW= Low conductivity Water
ICW= Industrial cooling water from Caseys Pond or Pond water
Kva= Kilovolt-Ampere

References
(The following references are incorporated in their entirety into this document.)

[1] The complete set of Mu2e Conventional Facilities contract documents can be viewed in Doc DB # 3494.

[2] Mu2e Building Basic Design Data, dated 11/1/13 prepared by Middough Doc DB# 3620

Appendix A Mu2e Conventional Facility Cooling Load

APPENDIX A

Mu2E Conventional Facility Cooling Load (from technical equipment only) ***APR 03 2014***

[1] *LCW & Tracker Cooling by others*
[2] for *LCW loads, refer to DocDB# 3598*

	Load to LCW[2] (KW)	Load to ICW (gpm)	Load to AIR (KW)	Load to CHW	source
HIGH BAY (Surface)					
RAW skid (for SHIELDING)					J.Popp & B.Wands (email 11/17/10); K.Williams (5/3/11); Updated (mtg 1/28/2013). Removed per integration meeting (12/02/2013)
BEAM (SCR) POWER SUPPLY @**Mu2e** HighBay	note 2		*1.8*		updated per S.Hays (email 1/18/13)- 18gpm LCW to power supp, or total 30 1KW cooling for magnet+PS; Updated JBudlong (email 1/30/13), placeholder for misc relay racks. Phone discussion JBudlong 12/03/2013
BEAM (SM) POWER SUPPLY @**Mu2e** HighBay			*21.5*		
Misc Relay Racks @**Mu2e** HighBay			*11.5*		
ELECTRONICS AREA (Surface)					
DAQ racks			40		M Bowden (email 2/8/12) 5 racks +2 conting @ total ~30KW, <85F@ >20% to 60%RH; Updated loads to 40KW M Bowden (email 1/28/13)
Relay Racks Sol Rm(12 Kva) (6qty)			9.6		M.Lamm (email 6/24/11)
SOLENOID POWER SUPPLY ROOM (Surface)					
Solenoid Power Supplies-High Current (Qty 2)	*note 2*		*50*		M.Lamm (6/24/11); TPage, M Lamm (12/12/2011), guess on %heat load; old Nos. from Reqmnt Doc# 1237; Updated S.Hays (email 1/18/13); Mu2e DocDB 1237 Feb 15 2014
Solenoid Power Supplies-Low Current (Qty2)					
Relay Racks *(B.Norris)*			4.8		B. Norris (email 4/12/11) ; Doc# 1481
VACUUM PUMPS & Assoc Racks				*(11 KW)*	T.Page (phone 12/12/2011) 10qty @1gpm; Updated T.Page (meeting 1/28/13)to aircooled; Updated T.Page (phone 3/05/2014) five- 2.2KW vac pump @ 1/4gpm @ 60F each
MECHANICAL- ELECTRICAL ROOM (Surface)					
Tracker/Calorimeter Cooling Syst[1] Heat Excha				*(15KW)*	E. Voirin (1/27/2012 Phone); Updated B Wagner (email 1/30/2013); updated to include calorimeter, increase the previous 10kw load 15x (3/05/2014); Mar 14 2014 email from A.Mukherjee, increase to 15 KW system
Air Compressor					Unknown size, aircooled or watercooled GGinther (12/03/2013)
LOWER MECH & ELEC RM					
DT Source / Calorimeter Calibration					unknown load, justplaceholder, GGinther (12/03/2013); TomL (3/05/2014) no load
Two vacuum pumping system (Diffusion Pump, Roughing pump)			*5.1*	18 gpm	B Norris (email 4/12/11), 2.75 gpm ea; Qty Update (Doc# 1481). Heat load to air taken from Doc# 1481 Changed from ICW to CHW (DPushka email 11/26/13)
Slow Control Chassis (16)4x4x12			0.8		M.Bowden (email 2/8/12) 16 slow control chassis @ 50w each
REMOTE HANDLING					
One set vac pump system (Diffusion Pump, Roughing pump)				9 gpm	DPushka email 11/26/13
Vacuum Pumps				*(2.2KW)*	T.Page (phone 3/05/2014) One 2.2KW vac pump @ 1/4gpm @ 60F each.
LOWER DETECTOR SOLENOID AREA					
Dehumidifier (Munters dessicant)				2 gpm	B Wagner (email 1/30/2013)- only when tracker in garage
VACUUM PUMPS & assoc Racks				*(17.6 KW)*	TPage (mtng 1/28/13); update Tpage (mtg 1/28/13) 5KW to lower level. TPage (phone 3/05/2014) Eight 2.2KW vac pump @ 1/4gpm @ 60F each. Two of this could be in the PS tunnel
CRV			10		S.Hansen front-end boards (email 12/12/12)
LOWER PRODUCTION SOLENOID AREA					
Target					R.Coleman (email 12/7/12) Target just radiate heat to vacuum of PS. Absorber 6KW to air
Absorber			6		
TUNNEL near Mu2e					
Mu2e BEAMLINE MAGNETS & cables	*note 2*				extrapolated from SHays email 1/18/13
AP30					
Power Supplies & Racks	*note 2*				
BEAMLINE MAGNETS & cables near AP30	*note 2*				
AP50					
RF				*(12 KW)*	JP Morgan (7-8-13) email (assumed 10% to air)- Final Heat Rejection to CHW by AD. JP Morgan (8-19-2013 email) 12 KW RF to chilled water
MC1 Bldg					
Mu2e BEAMLINE Power Supplies @ MC1 bldg	*note 2*		*7*		JP Morgan (8/21/2012) email. (assumed 10% to air). Guess during MC1project
G-2 BEAMLINE Power Supplies @ MC1 bldg	*note 2*		*30*		
BEAMLINE MAGNETS & cables near MC1	*note 2*				

Ventilations			
Production Solenoid Area **(ODH)**	7,000	cfm	*Doc# 2232 ODH assessment*
Production Solenoid Area **(Air Activation)**	~900*	cfm	*Dec 12 2012 email K.Vaziri ~51minute transit time*
Detector Solenoid Area **(ODH)**	7,000	cfm	*Doc# 2232 ODH assessment*
Solenoid Power Supply Room **(ODH)**	6,300	cfm	*Doc# 2232 ODH assessment*
Mu2e High Bay **(ODH)**	none	cfm	*Doc# 2232 ODH assessment*
Delivery Ring / AP30 (placeholder)	minimal	cfm	