



## Department of Energy

Argonne Site Office  
9800 South Cass Avenue  
Argonne, Illinois 60439

SEP 29 2014

Dr. Peter B. Littlewood  
Director, Argonne National Laboratory  
President, UChicago Argonne, LLC  
9700 South Cass Avenue  
Argonne, IL 60439

Dear Dr. Littlewood:

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION FOR ARGONNE NATIONAL LABORATORY (ARGONNE)

The Argonne Site Office (ASO) has approved the following as a categorical exclusion (CX) under Appendix B (to 10 CFR Part 1021, Subpart D, Integrated DOE NEPA Implementing Procedures, December 1996), Category B 3.15 "Small-scale indoor research and development projects using nanoscale materials" applicable to:

- Building 440 Center for Nanoscale Materials Clean Room Expansion (ASO-CX-306)

Therefore, no further NEPA review is required. However, if any modification or an expansion of the scope is made to the above project, additional NEPA review will be necessary.

Enclosed please find a copy of the approved Environmental Review Form (ERF) for the project. If you have any questions, please contact Kaushik Joshi of my staff at (630) 252-4226.

Sincerely,

Joanna M. Livengood  
Manager

Enclosure:  
As Stated

cc: J. Stauber, ANL, w/encl.  
M. Finder, ANL, w/encl.  
D. Tinnin, ANL, w/encl.  
M. McKown, SC-CH, w/encl.  
P. Siebach, SC-CH, w/encl.  
K. Joshi, ASO, w/encl.

## Environmental Review Form for Argonne National Laboratory

**Project/Activity Title:** Building 440 CNM Clean Room Expansion

**ASO NEPA Tracking No.** 1914 ASO-CX-306 **Type of Funding:** IGPP

B&R Code \_\_\_\_\_

**Identifying number:** 01422 WFO proposal # \_\_\_\_\_ CRADA proposal # \_\_\_\_\_

Work Project # : 08165 ANL accounting # (item 3a in Field Work Proposal) \_\_\_\_\_

Other (explain) Cost Code: 0816500 Center: 208

**Project Manager:** Douglas J. Tinnin Signature: *Douglas J. Tinnin* Date: 9/23/2014

**NEPA Owner:** Michael P. Finder Signature: *M.P.F.* Date: 9/23/2014

**ANL NEPA Reviewer:** Joel V. Stauber Signature: *Joel V. Stauber* Date: 9/23/14

**I. Description of Proposed Action:** The proposed action includes an expansion of the existing CNM cleanroom building. The new addition will include 10,000 ft<sup>2</sup> (net) of floor space in two stories and will consist of three major components: (1) conventional facilities, (2) fabrication facilities, and (3) instruments for characterization.

**II. Description of Affected Environment:** Previously disturbed area west of existing CNM structure, adjacent to existing clean rooms.

**III. Potential Environmental Effects:** (Attach explanation for each "yes" response.)

**A. Complete Section A for all projects.**

1. Project evaluated for Pollution Prevention and Waste Minimization opportunities and details provided under items 2, 4, 6, 7, 8, 16, and 20 below, as applicable Yes X No \_\_\_\_\_

Project will implement waste minimization opportunities and pollution prevention practices.

2. Air Pollutant Emissions Yes X No \_\_\_\_\_

Vehicle and construction equipment exhaust will be expected.

3. Noise Yes X No
- Typical construction equipment noise will occur. Measures will be taken to address worker hearing in accordance with OSHA.
4. Chemical/Oil Storage/Use Yes X No
- Chemical use and storage will be conducted in accordance with ANL procedures. Secondary containers will be used when necessary.
5. Pesticide Use Yes      No X
6. Polychlorinated Biphenyls (PCBs) Yes      No X
7. Biohazards Yes      No X
8. Effluent/Wastewater (If yes, see question #12 and contact Gregg Kulma (FMS-SEP) at 2-9147 or gkulma@anl.gov) Yes      No X
9. Waste Management
- a) Construction or Demolition Waste Yes X No
- Construction waste will be produced. Efforts will be made to recycle construction debris.
- b) Hazardous Waste Yes      No X
- c) Radioactive Mixed Waste Yes      No X
- d) Radioactive Waste Yes      No X
- e) PCB or Asbestos Waste Yes      No X
- f) Biological Waste Yes      No X
- g) No Path to Disposal Waste Yes      No X
- h) Nano-material Waste Yes      No X
10. Radiation Yes      No X
11. Threatened Violation of ES&H Regulations or Permit Requirements Yes      No X
12. New or Modified Federal or State Permits Yes      No X
13. Siting, Construction, or Major Modification of Facility to Recover, Treat, Store, or Dispose of Waste Yes      No X

14. Public Controversy Yes  No
15. Historic Structures and Objects Yes  No
16. Disturbance of Pre-existing Contamination Yes  No
17. Energy Efficiency, Resource Conserving,  
and Sustainable Design Features Yes  No

Design documents incorporate best practices sustainable design features. These practices will be documented during construction.

**B. For projects that will occur outdoors, complete Section B as well as Section A.**

18. Threatened or Endangered Species, Critical Habitats, and/or  
other Protected Species Yes  No
19. Wetlands Yes  No
20. Floodplain Yes  No
21. Landscaping Yes  No

Landscaping best practices will be used in accordance with Argonne Draft Landscape Management Guidelines.

22. Navigable Air Space Yes  No
23. Clearing or Excavation Yes  No

Excavation will be performed during construction. Erosion controls will be implemented in accordance with the Storm Water Pollution Prevention Plan.

24. Archaeological Resources Yes  No
25. Underground Injection Yes  No
26. Underground Storage Tanks Yes  No
27. Public Utilities or Services Yes  No
28. Depletion of a Non-Renewable Resource Yes  No

**C. For projects occurring outside of ANL complete Section C as well as Sections A and B.**

29. Prime, Unique, or Locally Important Farmland Yes  No

30. Special Sources of Groundwater (such as sole source aquifer) Yes \_\_\_ No \_\_\_
31. Coastal Zones Yes \_\_\_ No \_\_\_
32. Areas with Special National Designations (such as National Forests, Parks, or Trails) Yes \_\_\_ No \_\_\_
33. Action of a State Agency in a State with NEPA-type Law Yes \_\_\_ No \_\_\_
34. Class I Air Quality Control Region Yes \_\_\_ No \_\_\_

**IV. Subpart D Determination: (to be completed by DOE/ASO)**

Are there any extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal? Yes \_\_\_ No X

Is the project connected to other actions with potentially significant impacts or related to other proposed action with cumulatively significant impacts? Yes \_\_\_ No X

If yes, is a categorical exclusion determination precluded by 40 CFR 1506.1 or 10 CFR 1021.211? Yes \_\_\_ No \_\_\_

Can the project or activity be categorically excluded from preparation of an Environment Assessment or Environmental Impact Statement under Subpart D of the DOE NEPA Regulations? Yes X No \_\_\_

If yes, indicate the class or classes of action from Appendix A or B of Subpart D under which the project may be excluded. Appendix B, B. 3.15 Small-scale indoor research and development projects using nanoscale materials.

If no, indicate the NEPA recommendation and class(es) of action from Appendix C or D to Subpart D to Part 1021 of 10 CFR.

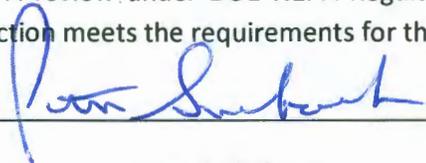
**ASO NEPA Coordinator Review:** Kaushik Joshi

Signature: 

Date: 9-24-2014

**ASO NCO Approval of CX Determination:**

The preceding pages are a record of documentation that an action may be categorically excluded from further NEPA review under DOE NEPA Regulation 10 CFR Part 1021.400. I have determined that the proposed action meets the requirements for the Categorical Exclusion identified above.

Signature: 

Date: 9/24/2014

Peter R. Siebach  
Acting Argonne Site Office NCO

**SO NCO EA or EIS Recommendation:** *Not Applicable*

Class of Action: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Peter R. Siebach  
Acting Argonne Site Office NCO

**Concurrence with EA or EIS Recommendation:** *Not Applicable*

CH GLD: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**ASO Manager Approval of EA or EIS Recommendation:** *Not Applicable*

An  EA  EIS shall be prepared for the proposed \_\_\_\_\_ and  
\_\_\_\_\_ shall serve as the document manager.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Dr. Joanna M. Livengood  
Manager



M+W GROUP



## **Basis of Design—Concept**

*prepared for*

**Argonne National Laboratory**

**June 02, 2014**

submitted by:

**M+W U.S. Inc., A Company of the M+W Group**



## Executive Summary

Argonne National Laboratory plans to construct additional cleanroom space at the Laboratory to benefit various programmatic needs across the Laboratory and support world-class science and the development of new technologies. Argonne conducted a siting feasibility study and determined that an expansion of the Center for Nanoscale Materials (CNM) Building 440 cleanroom facility presented the most advantageous location for this new facility.

The cleanroom expansion based on a preliminary tool list will involve adding approximately 6000 square feet of new footprint directly to the west of the existing CNM cleanroom space. The new cleanroom space, to be located on the ground floor with its supporting mechanical mezzanine on the second floor, will constitute approximately 12,000 square feet of new space. The general basis of design for the expansion is to simply extrude the existing cleanroom box. The design will copy the current CNM design and use it for new expansion, while taking into account any necessary improvements to meet current code or incorporate minor value lessons learned into the design.

Four alternative conceptual layouts were developed for this expansion for a preliminary list of potential tools. The tools required additional wall space which increased the footprint from the original planned 5000 sf to almost 6000 sf. One option was selected by Argonne and is the basis for this conceptual planning report.

Included herein is a list of major equipment elements, concept layouts of the 1<sup>st</sup> and 2<sup>nd</sup> floors of the proposed expansion, and a conceptual cost estimate for use by Argonne in planning and decisions.

The estimated cost of the project is \$6.1M. This exceeds the target originally set by Argonne of \$5.5M. Decisions regarding the building size and capital budget are now required before proceeding with design. Options can include:

- reduction of the building footprint
- partial buildout of interior space with a portion of the expansion shelled for future



## **Cleanroom**

Major elements include:

### **Floor:**

- Trenching will continue from existing to new footprint.
- Floor finishes: Bays - ESD rubber tile (2x2) on concrete, Central Aisle – ESD tile rubber tile (2x2).
- Chases – CRC on floor surfaces and Trenches (vert. & horz. surfaces with galv. Grating on top).
- Trenches in Central Aisle – CRC on Vert. & horz. surfaces with aluminum raised floor panel covers.

### **Walls:**

- Standard 2" Cleanroom wall system (non-progressive) with 25% glazing. Sliding doors and manual doors. Wall design to match existing.

### **Ceiling Grid: (10'-0" high)**

- Aluminum T-grid, Walkable 2x4 & 4x4 with lighting, blank pans, ducted HEPAS, sprinkler penetrations, ect.
- Ceiling support: Unistruts, turn buckles, threaded rods, plenum barriers.

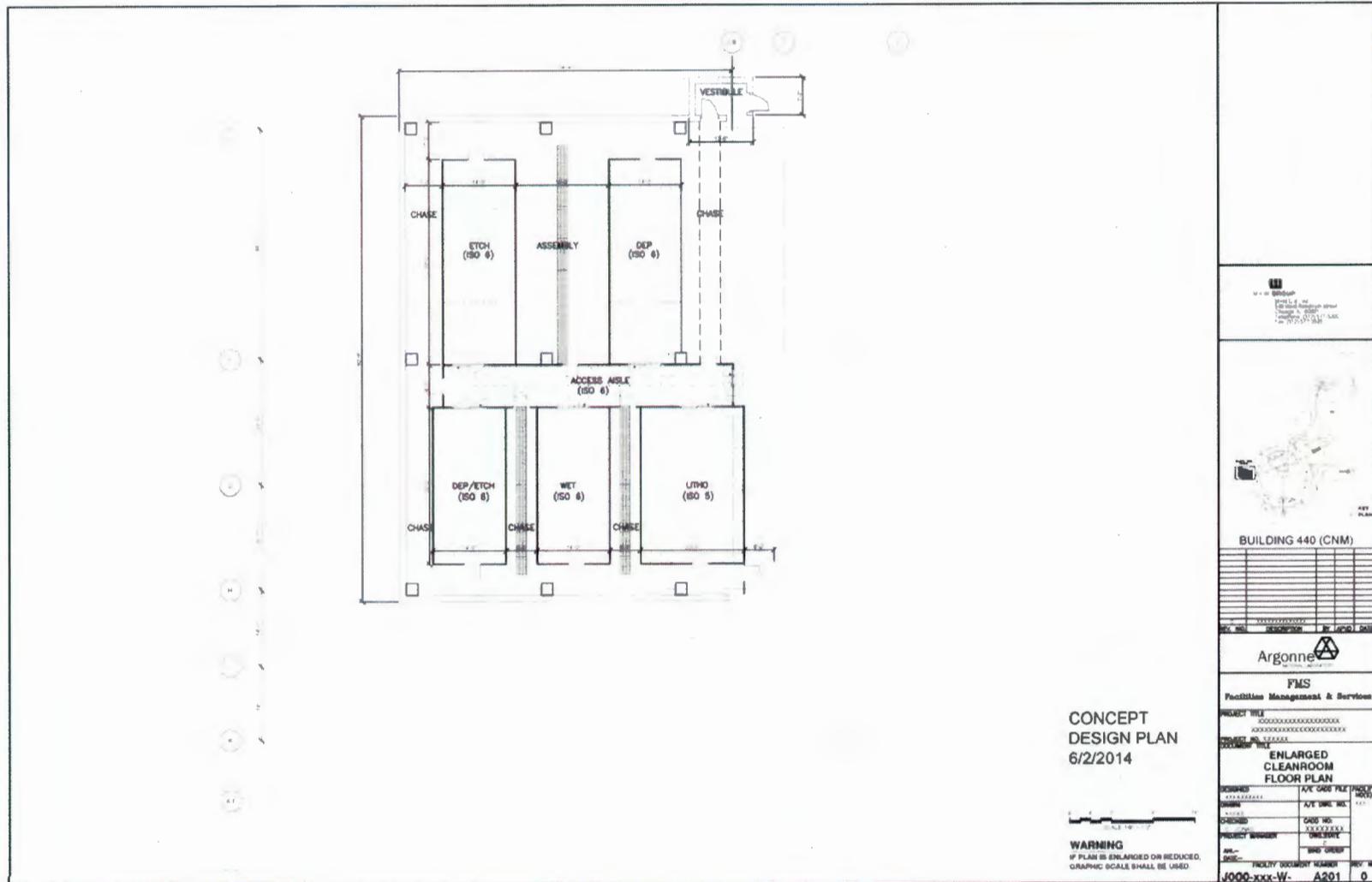
### **Arch. (Demolition) –**

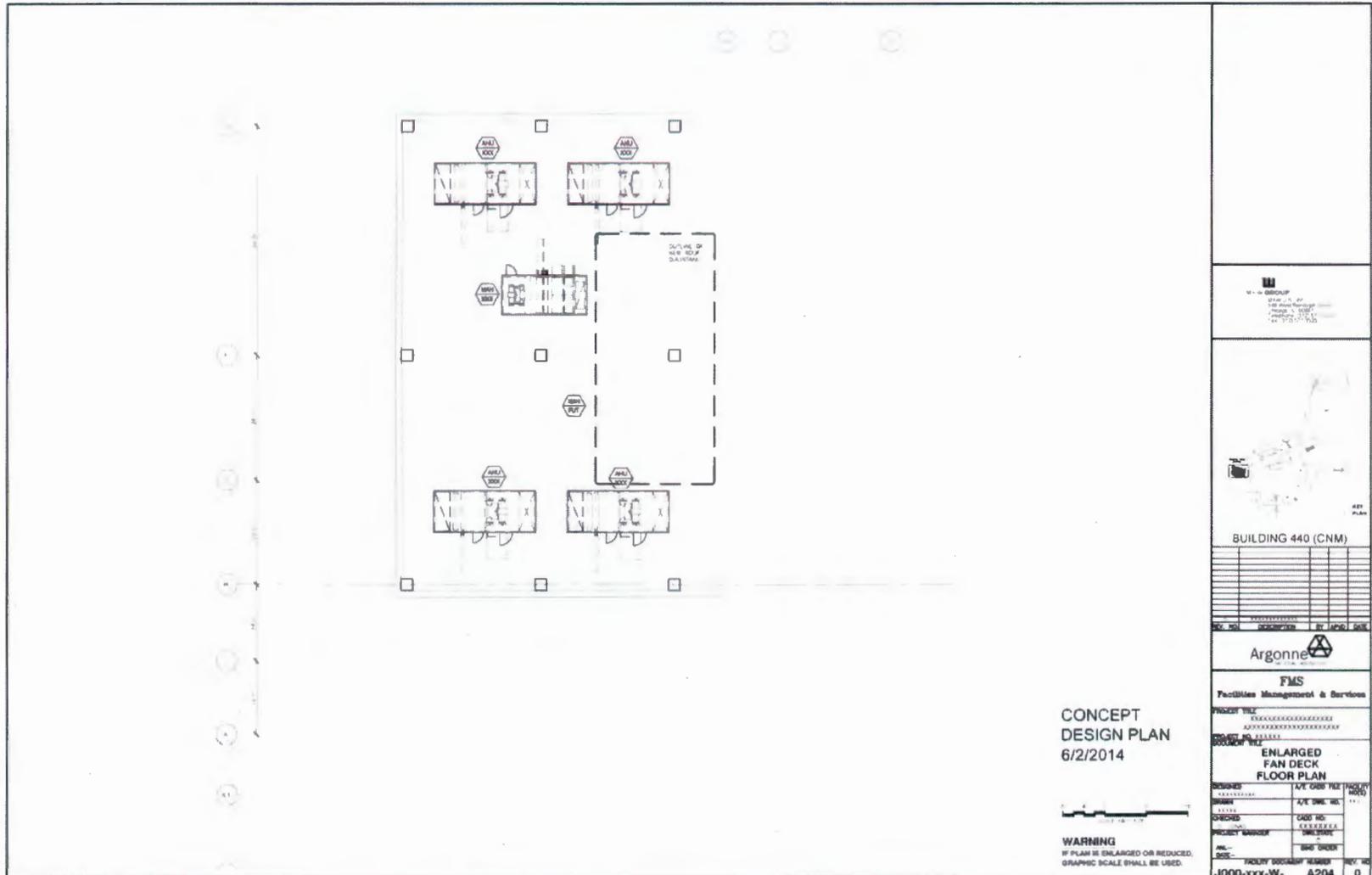
#### **Exterior wall assembly:**

- Remove entire exterior skin assembly (metal ribbed panel). Shear wall at north to remain. South wall remove completely.
- Air intake louver (Doghouse) on roof: Remove west wall to prep. For extension into new roof footprint.

### **Arch. (New) –**

- Exterior wall assembly/Skin (ribbed panel) to match existing (for both levels)
- Roof: Match existing (single-Ply roofing on rigid insulation)
- Fandek Floor: match existing (concrete sealer). Provide 6" high curbing at perimeter.
- HM ext. doors to match existing (including hardware).
- South wall of fandek- provide 10wx12h removable wall for equipment move-in.
- New 10x10 vestibule at L1 Cleanroom North wall







## **Mechanical**

Major equipment units include:

- Four Cleanroom Recirculating Air Handling Units RCUs. (2) – 24,000 cfm and (2) – 14,000 cfm
- Sixty (60) Ducted ULPA filters,
- 12 FFU's with ULPA filters for access corridor.
- 4 sensible cooling coils for access corridor.
- One Air Handling Unit (AHU) sized for the Fan deck (6,000 cfm, 15 hp, cooling coil, heating coil, heat recovery coil [heat pipe or run around coil], filters and distribution ductwork)
- Exhaust fan(s)
  - 1 – 26,000 cfm Strobic (Laboratory, induced draft, roof mounted) exhaust fan – 40 hp motor
  - 1 – Inline exhaust fan for fan deck ventilation – 7-1/2 hp.
- Two Tertiary pumps – assume 3 hp, inline pumps.
- One HW PHC pump for AHU. (assume 1 hp, inline)
- One 10 gallon Hot water heater with a 5 kW heater.

## **Electrical**

Major equipment units include:

- One 800A 480/277V distribution panel for tool power
- Two 225kVA 480V to 208/120V K-13 rated transformers for tool power
- Two 800A 208/120V distribution panels for tool power
- Six 225A 208/120V panelboards for tool power
- One 800A 480/277V distribution panel for mechanical equipment and other facility loads including lighting and general use receptacles
- One 225A 480/277V panelboard for lighting
- One 75kVA 480V to 208/120V transformer for general use receptacles
- One 225A 208/120V panelboard for general use receptacles
- One 100A 208/120V panelboard for general use receptacles
- One 100A 208/120V panel for emergency power
- Cleanroom lighting
- Lighting in the fan deck
- No exterior lighting other than building exit
- Lightning protection
- VFDs for mechanical equipment
- Plug-in busway for power distribution is planned in future when tool set is identified. This is excluded in expansion scope.



## Controls

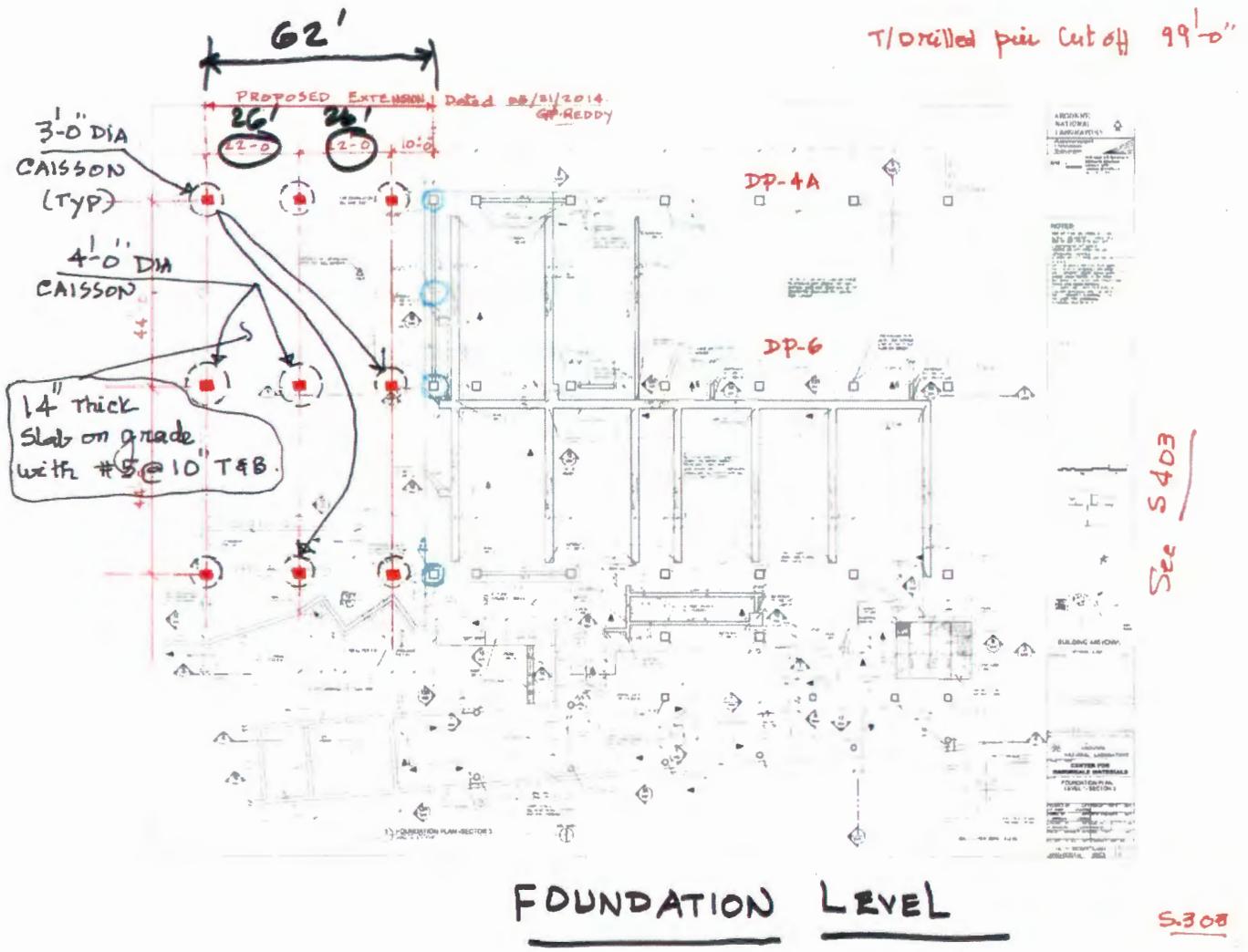
Major equipment units include:

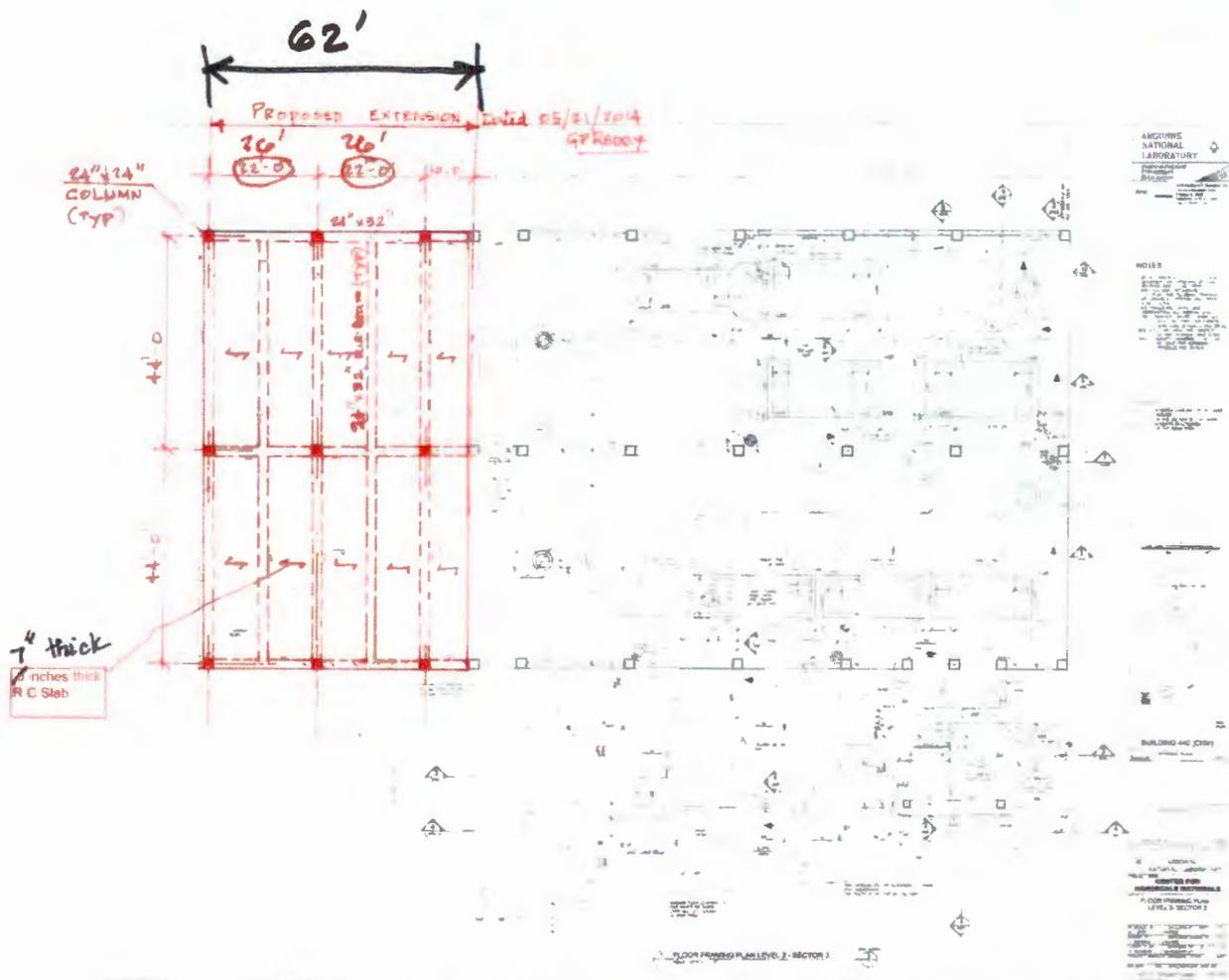
- Furnish and install a complete system of temperature and safety controls. In general, all sensors and controls shall be electronic direct digital control (DDC) with pneumatic damper actuators and electric valve actuators. The system shall be complete with:
  - DDC field controllers with indicating display
  - Electronic sensors and relays
  - Control and indicating panels
  - Electric wiring
  - Dampers and control valves
  - Fire alarm system interface
  - The controls shall be integrated into the existing building automation system (BAS) with direct digital control that is to be microprocessor-based with an enhanced graphics color monitor, keyboard and a read/write printer.
  - System must be Johnson Metasys or Owner approved equal



### Structural

Structural elements are indicated on the following sketches:





LEVEL 2.

S.307



## **Civil**

Major elements include:

The scope of this work includes topsoil stripping and stockpiling (assumed 8") over the area of the building addition up to 15' outside of proposed walls, sidewalk removal around the south and east side of existing lab, proposed PCC sidewalk, 5" around and graded away from the building along the existing and new north wall, new west wall and new south wall; topsoil placement and grass seeding along the new sidewalk areas, perimeter and stockpile erosion control and disposal of excess topsoil.

Excluded are modifications to the saw-tooth dumpster area retaining walls in the loading dock. Excluded are any underground utilities or stormwater management work as all services (electric, gas, communication, sanitary, potable water, roof drainage, etc.) are all served from/to the existing building, the addition location does not impact any buried utilities we are aware of and Argonne staff have stated there is enough capacity in the existing facilities for this addition.



## Process

Preliminary equipment list includes:

System	Quantity	Unit	Comments
<b>UPW</b>			
UPWS main, 1-1/2" PVDF	180	ft	Cut into existing 2" on Level 2 - requires system shutdown and flush to quality
UPWR main, 1-1/2" PP	180	ft	Cut into existing 1-1/2" on Level 2 - requires system shutdown and flush to quality
UPWS laterals, 1" PVDF	144	ft	
UPWR laterals, 1" PP	144	ft	
Diaphragm valves, 1" PVDF	4	each	Lateral isolation valves + future
Diaphragm valves, 1" PP	4	each	Lateral isolation valves + future
Diaphragm valves, 1/2" PVDF	24	each	
Diaphragm valves, 1/2" PP	24	each	
End-of-main loop	1	each	w/ bypass, rotometer, gauges, isolation valves, PT, CV
End-of-lateral loops	3	each	w/ bypasses, rotometers, gauges, isolation valves
Hangers/supports			
<b>PCW</b>			
PCWS main, 4" 304I SS Sch 10	96	ft	Hot tap into existing 6" on Level 2 (no futures found)
PCWR main, 4" 304I SS Sch 10	96	ft	Hot tap into existing 6" on Level 2 (no futures found)
PCWS laterals, 2" PVC Sch 80	240	ft	
PCWR laterals, 2" PVC Sch 80	240	ft	
Ball valves, 2" SS	12	each	Lateral isolation valves + future
Ball valves, 2" PVC	80	each	POC valves
End-of-main loop	1	each	w/ bypass, rotometer, gauges, isolation valves, PT, CV
End-of-lateral loops	5	each	w/ bypasses, rotometers, gauges, isolation valves
Hangers/supports			
<b>CDA</b>			
CDA main, 1-1/2" Type L copper, CFOS	72	ft	EOM reduces to 1/2" - cut off 1/2" valve and install 1-1/2" valve - requires system shutdown
CDA laterals, 3/4" Type L copper, CFOS	240	ft	
Ball valves, 3/4" bronze, CFOS	6	each	Lateral isolation valves + future
Ball valves, 1/2" bronze, CFOS	40	each	
Hangers/supports			
<b>PVAC</b>			
PVAC main, 4" PVC Sch 80	96	ft	Cut into existing 4" on Level 2 - requires system shutdown
PVAC laterals, 2" PVC Sch 80	240	ft	
Ball valves, 2" PVC	6	ft	Lateral isolation valves + future
Ball valves, 1" PVC	40	each	
Hangers/supports			
<b>N2</b>			
Nitrogen main, 1-1/2" 316L EP SS	144	ft	Connect to existing valve on Level 2
Nitrogen main, 1" 316L EP SS	240	ft	
Diaphragm valves, 1" SS EP	6	each	Lateral isolation valves + future
Diaphragm valves, 1/2" SS EP	40	each	
Hangers/supports			
<b>Acid Waste</b>			
AW main, 4" PVC Sch 80	72	ft	
AW laterals, 3" PVC Sch 80	144	ft	
Capped POCs, 2" x 3" wyes	24	each	
Trench supports			
<b>Detergent Waste</b>			
DTGW main, 4" PVC Sch 80	72	ft	
DTGW laterals, 3" PVC Sch 80	144	ft	
Capped POCs, 2" x 3" wyes	24	each	
Trench supports			

**Assumptions:**

- Existing systems have sufficient capacity to serve the expansion; no system upgrades required
- Main line sizes based on 1/2 of existing system capacities
- Lateral sizes match existing CNM cleanroom laterals
- Lateral length = 40 feet
- Three (3) laterals provided for UPW and Waste; all other services have (5) laterals
- Each lateral has 2x the number POCs as existing CNM laterals
- 20% contingency added to all pipe lengths



### **Life Safety/ Telecom/Security**

Major equipment includes:

Code required systems for fire and smoke detection, alarms, and tie-in to existing system.

Leak detection and TGMS devices and connections are to be designed and procured by owner when the tool set is identified and funded. These are excluded from the expansion project.

An allowance has been established for Telecom devices and connection to existing system.

Security systems have been excluded since the building is a secure facility.



### Preliminary Tool List

Tool	Width (ft)
Assembly: BlackStar SW300 Laser Dicer	7
Assembly: Flip chip bonder	4
Assembly: Wafer bonder	4
Assembly: Wire bonder	4
Deposition: ALD	6
Deposition: ALD	6
Deposition: Ebeam evaporator (for liftoff)	8
Deposition: LPCVD (if possible)	10
Deposition: LPCVD tube cleaning	10
Deposition: PECVD (Nitride)	10
Deposition: PECVD (Oxide)	10
Etch: Chemically assisted Ion beam mill	10
Etch: XeF2 Etch System	4
Gas cabinets	0
Gas Manifolds	0
LF Hood: develop, rinse, dry (Plastic)	6
LF Hood: Electroplating (plastic)	6
LF Hood: general (plastic)	6
LF Hood: HF Wet Etch Hood (plastic)	6
LF Hood: metal wet etch (SS)	6
LF Hood: RCA clean hood or track (plastic)	6
LF Hood: resist removal and Liftoff (SS)	6
LF Hood: Spin Coat and Bake (SS)	6
LF Hood: TMAH + KOH wet bench (plastic)	6
Metrology: Automated imager	4
Metrology: HRSEM	8
Metrology: Optical LEXT profilometer (Large area, stitching capable)	4
Metrology: Optical microscope	6
Metrology: Optical microscope	6
Metrology: Optical microscope	6
Metrology: Optical stress tool (FLEXUS)	4
Metrology: Probe station	4
Metrology: SEM for MEMS	8
Metrology: Spectroscopic Variable Angle Ellipsometer	6



Metrology: White light interferometer	4
Optical Litho: Heidelberg pattern generator	8
Optical Litho: MA / BA 6 with backside alignment	4
Optical Litho: Stepper (i-line)	10
Oven: Vapor priming image reversal oven (add ammonia)	4
Oven: Vapor priming oven	3
Process: Mask cleaning tool	4
Process: Ultrasonic sonicator inside hood 3 ft x 3 ft	
Process: Wafer spin rinse dryer	4
RIE: DRIE (fab grade)	10
RIE: Fluorine (Nb etch + SiO <sub>2</sub> + SiN <sub>x</sub> )	10
RIE: Metal etch	10
RIE: resist asher	4
Sputtering: AJA multi-target sputtering system (for all sputtering)	10
Sputtering: AJA multi-target sputtering system (for all sputtering)	10
Sputtering: with oxidation chamber for junctions	10
Sputtering: WSix sputter deposition tool	10
Storage: Corrosive cabinets	6
Storage: Flammable cabinets	6
Storage: Glass ware cabinets	6
Storage: Mask Storage	14
Storage: Wafer storage	14
Tables for samples	4
Wafer track: bake, develop, rinse, dry, resist removal	14
Wafer track: spin coat and bake (2 step LOR process)	14
<b>Linear Wall Space Required (including clearances) in feet</b>	<b>396</b>
Wall space available with 3 30' bays	180
Wall space available with 3 40' bays	240
<b>Total wall space available</b>	<b>420</b>
<b>Required / Available (or utilization)</b>	<b>94%</b>