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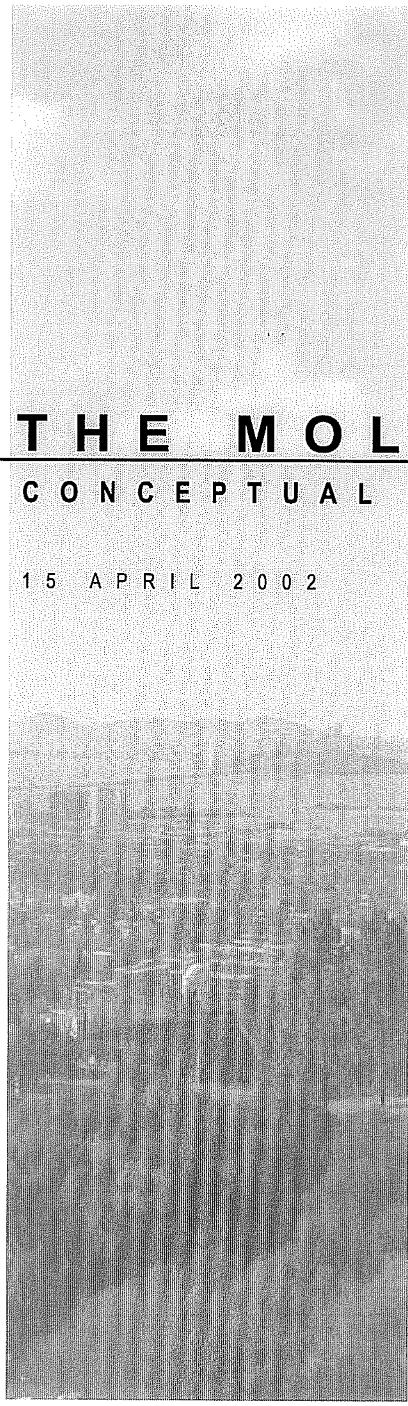

THE MOLECULAR FOUNDRY

CONCEPTUAL DESIGN REPORT

15 APRIL 2002

LAWRENCE BERKELEY NATIONAL LABORATORY
University of California

prepared by:

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1.0 EXECUTIVE SUMMARY

Introduction

This Conceptual Design Report describes the planning and design requirements for the Molecular Foundry at the Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California. The proposed project includes a new research facility with a separate central utility plant, and site development including parking, a landscaped plaza, and a new access road at the west end of the site.

Space Requirements

The requirements for the project were developed through a series of interviews with the Foundry Scientific Leadership and future users of the facility. The interviews were begun with a discussion of the work mission, organization, staffing and functional operation of each department. Once each function was identified, a detailed discussion followed to determine the specific requirements for each department, including what types and sizes of rooms are required including special equipment needs for the spaces. The final program requirements are identified in *Section 2.4* of this document, *Space Program*.

Concept Proposal

The proposed building is planned as a six-story structure, 94,500 gross square foot in size, located between Buildings 66 and 72 on the LBNL campus. The building will contain laboratories and office space for research in the Nanosciences. Six basic research departments will be located within the facility: Inorganic Nanostructures, Organic, Polymer / Biopolymer Synthesis, Biological Nanostructures, Theory, Nanofabrication, and Imaging & Manipulation. The majority of the facility will be structured to house visiting scientists from university, industry, and government laboratories in the United States and worldwide that will come to the facility to use the state-of-the-art technology and equipment for their research. In addition, full-time scientists and technicians who will run and maintain the equipment will permanently staff the building.

The building will have several levels of specific criteria for acoustics, vibration and clean room space. The Imaging & Manipulation department needs 125 micro inches per second vibration criteria as well as high acoustical control. The Nanofabrication department requires some Class 100 clean room space as well as some 125 micro inches per second vibration controlled space for the nanowriter. Due to the restrictive vibration and acoustical criteria required for the building, a separate utility plant is planned to house the various mechanical and electrical systems that generate noise and vibration. This structure will be located just north of the building and will have system lines running underground directly into the main structure.

A link between the existing Materials Sciences Division Building 66 and the National Center for Electron Microscopy (NCEM) Building 72 is desired to encourage interaction and ease of communication between investigators working in the various buildings on the site.

Budget

A construction cost estimate was developed for the proposed building and is based on both the space program and the building concept. This estimate uses a detailed format that outlines the cost plan for each building system. This methodology assures a thorough accounting of the proper costs to accomplish the project and provides a model for tracking the future building design and maintaining the project on budget. The format is also very clear to building contractors and serves as a good tool for translating the design into construction and evaluating contractor bids. The overall construction cost estimate for the proposed building and site work is $43,295,871 and is tied to a November 2003 bid date and a February 2004 construction commencement. For a complete breakdown of the budget, refer to *Section 7 – Construction Cost Estimate.*

2.1 MISSION NEED

The goals and operation of the Molecular Foundry are consistent with DOE guidance and address the research challenges described in the reports "Nanoscale Science, Engineering and Technology Research Directions" and "Complex Systems: Science for the 21st Century." The Foundry's laboratories will be designed and constructed to facilitate collocation of research activities in a wide variety of fields, as required for progress in this new area of science. The Foundry will support a broad research effort focusing on both "hard" nanomaterials (nanocrystals, tubes, and lithographically patterned structures) and "soft" nanometer-sized materials (polymers, dendrimers, DNA, proteins, and whole cells), as well as design, fabrication, and study of multicomponent, complex, functional assemblies of such materials.

The Foundry will house six facilities devoted to Inorganic Nanostructures, Organic, Polymer / Biopolymer Synthesis, Biological Nanostructures, Theory, Nanofabrication, and Imaging & Manipulation. These laboratories, equipped with state-of-the-art instruments and staffed by full-time, dedicated staff scientists and technicians, will be user facilities, available to scientists from universities, industry, and government laboratories whose research proposals have been peer reviewed by a Proposal Study Panel. This combination of advanced equipment, collaborative staff, and breadth across disciplines will allow users to explore the frontiers of nanoscience.

By functioning as a "portal" to Berkeley Lab's established major user facilities, the Foundry will also leverage existing nanoscience research capabilities at the Advanced Light Source (ALS), the National Center for Electron Microscopy (NCEM), and the National Energy Research Scientific Computing Center (NERSC). The research program will, as an additional benefit, provide significant educational and training opportunities for students and postdoctoral fellows as the "first true generation" of nanoscientists.

2.2 BUILDING OCCUPANCY AND USE

The Molecular Foundry will house facilities for the interdisciplinary work of scientists investigating nanosecond phenomena in materials sciences, physics, chemistry, biochemistry, molecular biology, and engineering. The building will be constructed to the H-8 Occupancy requirements as defined in the California Building Code. A staff of approximately 140, including as many as 36 students and postdoctoral fellows, will occupy the Molecular Foundry. Parking availability is planned for a maximum of 1.7 FTEs per parking space at LBNL, as established in LBNL's Long Range Site Development Plan and approved by DOE and the University (backed by a CEQA document). This project will provide 35 new parking spaces to mitigate the net increase of 94 full time employees (FTEs). The new facility will generate a net increase in utility demand but will be accommodated by the current capacity of existing electricity, gas, water, and sanitary sewer utility systems serving the LBNL site.

2.3 RESEARCH LABORATORIES

All laboratories in the Foundry will be provided with the requirements for modern nanoscience research. Clean rooms, cold and warm rooms, and ultra-low vibration areas will also be provided as required for all research components. Facility laboratories will house state-of-the-art instrumentation and will be made available for outside users as well as the internal research programs. A brief description of each of the facilities is presented below.

Inorganic Nanostructures

The inorganic nanostructure preparation laboratory will be dedicated to a comprehensive study of the science of how to optimally prepare nanostructures. The program will encompass design and synthesis of precursors, the study of microscopic elementary processes in nanostructure nucleation and growth, and modeling of "long" time scale events such as mixing and flow. The facility will include equipment for preparing nanocrystals and nanorods by gas phase deposition of organometallics onto hot substrates (Chemical Vapor Deposition) and colloidal methods.

A key attribute of the facility will be the ability to design, synthesize, and handle a very wide range of organometallic precursors. In collaboration with quantum chemists, the design of molecules that decompose at desirable temperatures and the microscopic pathways by which the decomposition products evolve towards the desired solid will be explored. These will include extremely air-sensitive precursor molecules. Thus the facility will be outfitted with a full complement of hoods, dry boxes, etc. We also will pay close attention to developing an effort towards creating scalable, simple, and environmentally benign pathways towards nanostructured materials.

A second feature of the facility will be a strong effort dedicated towards the development of complete automation, control, and monitoring of the processes of nanostructure growth. It will of course be possible for a chemist to come and make nanocrystals or nanorods much as they do today, for example by mixing two solutions, recovering and purifying the product and analyzing it afterwards,. However, our goal will also be to set up test beds where every step in the growth of colloidal nanocrystals can be controlled and monitored. Thus we would electronically and remotely adjust and record the injection rate of the precursors and the rate of mixing, while simultaneously monitoring the temperature, and the concentration of all species present (molecules and nanostructures). In the first generation of experiments, these automated instruments would closely resemble the apparatus that is used today to make nanostructures, only with many more sensors and actuators incorporated. For a few well validated cases, we would set the growth stations up at the Advanced Light Source in order to monitor the growth of the nanocrystals by small angle x-ray scattering and the disappearance of the molecular precursors by time-dependent X-ray absorption. In the next generation, we envision performing nanostructure growth in a lab-on-a-chip environment, to allow for even more comprehensive analysis and monitoring. In the tiny on-chip volumes it is possible to change temperature and concentration orders of magnitude faster than in macroscopic samples, and with a much higher degree of reproducibility, so that the critical timescales of nucleation, mixing, and growth can be more finely controlled and monitored.

Inorganic Nanostructure Equipment
Molecular Beam Epitaxy System
Nanoscale synthesis station
Laser ablation/deposition system
Small ancillary equipment
Dry boxes
Fluorimeter
UV-Vis spectrophotometer

Organic, Polymer/Biopolymer Synthesis

The Organic, Polymer/Biopolymer Synthesis Laboratory will include facilities for both synthesis and characterization with a large number of chemical fume hoods, extensive benchtops, cabinets, manual and robotic instrumentation and reactors, as well as all necessary glassware required for organic synthesis. Its purpose is to provide the resources and instrumentation for the production and characterization of "soft" materials, i.e., organic molecules, synthetic and biological polymers for integration into complex functional nanostructures. The laboratory will comprise two integrated facilities equipped for the following uses: (1) organic synthesis of small molecules, polymers, supramolecular molecular assemblies, and other organic materials; and (2) chemical characterization and analysis of molecular and macromolecular moieties.

The organic synthesis laboratory will provide equipment and space for the multi-step syntheses of organic building blocks and assemblies. Basic research will be conducted by Ph.D. scientists assisted by technical staff focusing on the development of soft materials (ligands, self-assembling components, organic polymers, dendrimers, and other molecular building blocks) for incorporation into functional assemblies and for interfacing with inorganic or biological materials.

Work will be carried out in close collaboration with other facilities enabling the rapid integration of organic building blocks into integrated hybrid structures with a variety of organic, inorganic as well as biological components. Surface active molecules, liquid crystalline materials, designer lipids and other monolayer components, as well as a variety of functional ligands, linear or branched species, will be developed in collaboration with surface scientists, physicists and biologists.

Multipurpose and robotic equipment will be used for multistep syntheses as well as the preparation of combinatorial libraries enabling the rapid development of concepts as well as the verification and optimization of leads. Automatic synthesizers, polymerization reactors, and computer controlled autoclaves will be used in the preparation of macromolecules with various linear, block, branched, or dendritic architectures, as well as latexes, functional beads, and porous polymers in a variety of size regimes, formats, and physical characteristics. Sensitive organic and hybrid organic-inorganic building blocks and assemblies will be prepared using a variety of vacuum line, Schlenck, or glove box techniques. Analytical and characterization tools will involve a variety of microscale and macroscale separation equipment including chromatographic and electrophoretic instruments with an array of specialized detectors, nuclear magnetic, mass, and other specialized spectrometers for the analysis of molecular and macromolecular assemblies, analyzers for porous materials, surface characterization equipment, as well as specialized functional equipment for the determination of optical and electrical properties.

Full-time technical staff will collaborate on synthetic as well as characterization issues providing the facility with a unique combination of staff and equipment capable of addressing a broad array of materials issues. The unique combination of chemical, biochemical, and materials capabilities in one integrated research environment will promote the cross-fertilization of ideas required to realize the Molecular Foundry as a platform for the construction of novel and cross-platform nanostructures.

Organic and Polymeric Nanostructures Equipment
General purpose NMR
MALDI – TOF-MS
Size exclusion chromatograph
Combinational synthesis station
HPLC chromatograph
Refrigerators, glassware, ovens, evaporators etc.
Gas chromatograph – MS detector
Capillary electrophoresis
Solvent purification systems (2)
ASAP 2010 surface area and analyzer
IR spectrometer

Biological Nanostructures

The Biological Nanostructures Laboratory will be equipped with state-of-the-art equipment, including tissue culture hoods and inclubators, for the culturing of microbial, plant and animal cells. Its purpose is to provide the instrumentation and resources for production and characterization of these cells, and for production of proteins and other biopolymers using these cells as hosts for heterologous expression. Either these biopolymers or the cells themselves can be used for integration into complex functional nanostructures. The cell culture laboratory will also provide facilities for protein engineering using chemical and genetic methods in order to design novel molecules and structures for nanoscale devices. It will provide the equipment and resources for recombinant overexpression of proteins and nucleic acids and for their purification. It will require welded, seamless floors, clean ceilings and filtered air. The laboratory will be outfitted for maximal cross-fertilization of synthetic techniques.

Biological Nanostructures Equipment
LC-MC-MC mass spectrometer
Fluorescent imaging microscope
Small ancillary equipment
Peptide synthesizer
Fluorescence spectrophotometer
HPLC
DNA synthesizer
CO2 incubators (4)
UV/VIS spectrophotometer
Cell counter
Inverted stage microscopes (2)

Nanofabrication

The nanofabrication laboratory will be a facility for performing state-of-the-art lithographic and thin-film processing. It will have clean work areas, areas for resist processing, deposition tools such as electron beam, thermal evaporation, and sputtering, and etching tools. This equipment suite will be housed in a class 100 clean room environment. The facility will focus on processes and techniques that are most directly relevant for integration with chemical and biological nanosystems. It will not attempt to duplicate all the functions a standard microlab; for example, many standard CMOS processes and equipment will not be included. These needs can be met, for example, through the use of the microfabrication facility on University of California at Berkeley campus in Cory Hall which will be available to all Foundry collaborators, although there will be a very reasonable charge that the facility assesses all users.

In contrast, nanolithography capabilities will be critical. The growth of research programs in nanoscience will generate a huge demand for patterned nanostructures that is considerably beyond what existing facilities, even those at LBNL can provide. Electron beam lithography is currently the best and most versatile method to pattern nanostructures. The Foundry will therefore install a new, next generation e-beam nanolithography system that will be state-of-the-art for the 2006 time frame, with ultra-high resolution and placement accuracy. This system will have a high degree of flexibility in terms of substrates and materials that can be patterned. This will be crucial to support the broad range and large number of activities within the Foundry program that require e-beam lithography. The nanofabrication laboratory will also include a system capable of the fairly new technique of micro-imprint lithography.

Nanofabrication Equipment
Electron beam lithography apparatus
Surface preparation — etching
Microcontact/soft lithography
Small ancillary equipment

Theory

The Foundry will have a theory, modeling, computational group available for collaboration. At the nanometer scale, quantum and dimensionality effects often dramatically alter the properties of nanoscopic systems compared to macroscopic analogs. In particular, the structural, electronic, bonding, magnetic, transport and optical properties of such systems can be significantly different, leading to novel phenomena and applications. Linkage of a strong theoretical and computational component to an experimental investigation is thus often required for progress. Thus, in addition to developing new concepts and theoretical/computational tools, the function of this group will be to provide such theoretical support, with the goals of explaining specific experiments, guiding the development of new principles that unify different observations, and predicting possible new behavior and applications.

We envision for this group a core of several strong staff theorists together with a number of postdoctoral fellows and Ph.D. students working toward the goals of: 1) developing theoretical and computational tools for nanoscience research, and 2) playing a significant role in collaborating with experimentalists on specific projects in the Molecular Foundry. A strong visitors program, with distinguished theorists in nanoscience worldwide coming for short- and long-term visits, will also be an important element of this program.

Theory Equipment
500 Node Computing System

Imaging & Manipulation

One of the greatest challenges in nanometer scale science research is the difficulty in imaging and probing matter on the nanometer scale. A key component of the center will be an on-site imaging/manipulation facility to investigate systems at the molecular level. This will include an analytical scanning transmission electron microscope that complements other microscopes at the nearby National Center for Electron Microscopy, for imaging as well as for electron lithography. It will include SEMs equipped with in-situ STM/AFM-like levers that will be used as nano-manipulators for contacting nano-objects and perform mechanical and electrical measurement, so that the function as well as the structure of nanosystems can be observed. A UHV STM/AFM lab will also allow users to obtain high quality scanned probe images and spectroscopy on single molecules, functional subunits and assemblies. A suite of advance optical systems will also be employed for imaging and fluorescence studies at the single-molecule level in controlled environments. Optical tweezers, although not a strictly imaging instrument will be available in the future also for studies of mechanical properties of single molecules. In all cases, the goal is to make the most advanced imaging and measurement techniques available within a given field widely available to a broad cross-section of researchers in all disciplines. The imaging laboratory will be placed on the slab-on-grade first floor with special attention paid to air handling systems to ensure exceptionally low vibration levels.

In addition to providing state-of-the-art instrumentation, a critical component of each of the Foundry laboratories will be the development of new, more advanced techniques. For example, we will develop several new non-contact AFM techniques for atomic resolution imaging of insulating materials (hard matter) and for nanoscale resolution imaging of soft matter. The first involves the use of resonant oscillation of the probe cantilever and phase and/or frequency shift detection. In this mode the tip approaches within angstroms of the surface and is therefore most suitable for hard solid surfaces. The second new technique is aimed at soft materials such as liquid films, and soft, mobile organic surfaces that would not withstand the close approach of the tip without substantial perturbation. The development of non-contact techniques is based on extending our Scanning Polarization Force Microscopy (SPFM) mode to high frequency (MHz and GHz) electrical excitation of the tip and its combination with other modes such as cantilever resonance frequency shifts.

Also available at the ALS for Foundry users will be a photoelectron spectroscopy instrument that has been recently developed to provide XPS and electron yield NEXAFS of surfaces under high pressure, up to 10 torr. Further developments will allow use at even higher pressures. This instrumentation does not exist anywhere else and can provide spectroscopic information of delicate surfaces that would not survive exposure to vacuum, but necessitate an appropriate gas background, for example a humid atmosphere for biological material. The instrument offers also unique opportunities for catalysis studies of nanoparticles in high pressure environments of reactant gases.

Imaging & Manipulation Equipment
Analytical Scanning Transmission Electron Microscope
AFM with expanded capabilities: non-contact, dielectric.
Single molecule fluorescence microscopy (confocal, NSOM)
Combined SEM and STM/AFM manipulators
Low temperature non-contact AFM for single molecule imaging/manipulation

User Laboratories

Users will spend the vast majority of their time at the Foundry using the research facilities housed in the six Foundry scientific departments. However, it is important that some separate laboratory space be provided for those users who feel they require it. The Foundry User Laboratories will be outfitted with fixed and moveable benches and chemical storage cabinets. Two of the User Laboratories will have 8 ft. chemical fume hoods and two will have 8 ft laminar flow hoods.

User Laboratory Equipment
Chemical Fume Hoods
Laminar Flow Hoods

2.4 SPACE PROGRAM

This information identifies the space requirements of the Research Laboratories mentioned in the previous section.

The following *Space Program* consists of a Program Summary, a Space List, and a Building Support Functions list. The Program Summary outlines the Space Program by individual department categories. It identifies the overall Assignable Square Footage (ASF) by department and the total building Gross Square Footage (GSF). A total of 94,500 gross square feet of new construction has been identified for the project.

The Space List identifies the Assignable Square Feet (ASF) for each room within each department. Assignable Square Feet represents usable areas that are programmatically required such as laboratories, offices, conference rooms, etc. The Space List also identifies the room count, room size and number of modules. The list is further subdivided into laboratory and office type spaces. Room diagrams for most of these spaces are included in *Appendix A*. The room diagram page number corresponding to each space can be found in the last column of the Space List.

The Building Support Functions list identifies types of rooms that will be required for the functioning of the facility but that are not considered user required assignable square footage. These include mechanical spaces, circulation, toilet rooms, and other related areas.

Program Summary

Department Name	Lab ASF	Office ASF	% Area	Total ASF
Inorganic Nanostructures	4,392	1,429	11%	5,821
Organic, Polymer/Biopolymer Synthesis	4,950	1,390	12%	6,340
Biological Nanostructures	4,878	1,429	12%	6,307
Nanofabrication	5,916	1,569	14%	7,485
Theory	552	3,829	8%	4,381
Imaging & Manipulation	5,178	1,620	13%	6,798
User Laboratories	2,208	4,998	14%	7,206
Common Spaces	492	7,839	16%	8,331
Total Assignable Square Feet (ASF)	**28,566**	**24,104**	**100%**	**52,670**

Assignable Area to Gross Area Factor	**56%**
Total Gross Square Feet (GSF)	**94,500**

Module Organization

12' - 0" x 24' - 0" planning module / 24' - 0" x 24 - 0" structural module

ASF per Module Group

1/2 Module	132	ASF
1 Module	270	ASF
2 Modules	552	ASF
3 Modules	822	ASF
4 Modules	1,093	ASF
9 Modules	2,526	ASF

People Count	**137**
Visitors	42
Scientific Staff	31
Students / PostDocs	36
Technicians	18
Administration	10

Department:

Inorganic Nanostructures

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No *(Appendix A)*
Laboratory					
Pulsed Laser Deposition Lab	3.0	1	822	822	Page 1
Chemical Vapor Deposition Lab	3.0	1	822	822	2
Dry Furnace Lab	2.0	1	552	552	3
Characterization Lab					
Optical Microscope Room	0.5	1	132	132	4
UV-VIS	0.5	1	132	132	5
X- Ray Diffraction	0.5	2	132	264	6
Wet Lab / Characterization Lab Control	5.0	1	1,398	1,398	7
Available	1.0	1	270	270	
Subtotal Laboratory				4,392	
Office					
Office - Scientific Director		1	160	160	55
Office - Lead Scientist		1	135	135	55
Office - Staff Scientist		2	100	200	55
Cubicle - Technicians		4	64	256	55
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	408	408	
Subtotal Office				1,429	
Subtotal Assignable Square Feet				**5,821**	

Department:

Organic, Polymer / Biopolymer Synthesis

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No
					(Appendix A)
Laboratory					
Synthesis Type 1	2.0	3	552	1,656	*Pages 8,9,10*
Synthesis Type 1a	2.0	2	552	1,104	*11*
Synthesis Type 2	2.0	1	552	552	*12,13,14*
Instrument 1 - Spectroscopy	2.0	1	552	552	*15*
Instrument 2 - Chromatography	2.0	1	552	552	*16*
Chemical Storage Room	0.5	1	132	132	*17*
Cold Room	1.0	1	270	270	*18*
Available	0.5	1	132	132	
Subtotal Laboratory				4,950	
Office					
Office - Scientific Director		1	160	160	*55*
Office - Lead Scientist		1	135	135	*55*
Office - Staff Scientist		3	100	300	*55*
Cubicle - Technicians		2	64	128	*55*
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	397	397	
Subtotal Office				1,390	
Subtotal Assignable Square Feet				**6,340**	

Department:

Biological Nanostructures

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No *(Appendix A)*
Laboratory					
Characterization / Application	3.5	1	954	954	Page 19
Synthesis	1.5	2	402	804	20
Instrument Type 1	1.5	1	402	402	21
Glasswash	1.0	1	270	270	22
Cold Room	1.0	1	270	270	23
Cell Culture Room	1.0	2	270	540	24
Cell Handling	3.0	1	834	834	25
Warm Room	0.5	1	132	132	26
Freezer Room / Storage	1.0	1	270	270	27
Optical Characterization Lab	1.0	1	270	270	28
Flex Lab	0.5	1	132	132	29
Subtotal Laboratory				4,878	
Office					
Office - Scientific Director		1	160	160	55
Office - Lead Scientist		1	135	135	55
Office - Staff Scientist		2	100	200	55
Cubicle - Technicians		4	64	256	55
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	408	408	
Subtotal Office				1,429	
Subtotal Assignable Square Feet				**6,307**	

Department:

Nanofabrication

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No
					(Appendix A)
Laboratory					
Nanowriter Clean Room	0.5	1	132	132	*Page 30*
Nanowriter Control Room	0.5	1	132	132	*31*
Nanowriter Pump Galley	0.5	1	132	132	*32*
Nanowriter CADD Room	0.5	1	132	132	*33*
Focused Ion Beam	1.0	1	270	270	*34*
Clean Room (open style)	7.0	1	1,960	1,960	*35*
Clean Room (corridor / chase style)	7.0	1	1,960	1,960	*35*
Clean Room Control Room	0.5	1	132	132	*36*
Gowning / Clean Receiving	0.5	1	132	132	*37*
Chemical Storage	0.5	1	132	132	*38*
Spare Parts Storage / Workbench	1.0	1	270	270	*39*
Nanotechnology Cylinder Holding	0.5	1	132	132	*40*
Clean Room Equipment		1	400	400	
Subtotal Laboratory				5,916	
Office					
Office - Scientific Director		1	160	160	*55*
Office - Lead Scientist		1	135	135	*55*
Office - Staff Scientist		3	100	300	*55*
Cubicle - Technicians		4	64	256	*55*
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	448	448	
Subtotal Office				1,569	
Subtotal Assignable Square Feet				**7,485**	

Department:

Theory

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No (Appendix A)
Laboratory					
Computer Hardware Room	2.0	1	552	552	Page 41
Subtotal Laboratory				552	
Office					
Office - Scientific Director		1	160	160	55
Office - Lead Scientist		1	160	160	55
Office - Staff Scientist		3	135	405	55
Shared Office - Students / Post-Docs (12)		6	135	810	55
Shared Office - Technicians/Short-term Visitor (2)		1	135	135	
Shared Office - Visitor (short-term) (2)		1	135	135	
Office - Visitor (long-term)		3	120	360	
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Conference Room		1	300	300	
Office Suite Circulation		1	1,094	1,094	
Subtotal Office				3,829	
Subtotal Assignable Square Feet				**4,381**	

Department:

Imaging & Manipulation

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No (Appendix A)
Laboratory					
Main Analysis Laboratory	4.0	1	1,116	1,116	Page 42
Atomic Manipulation UHV STM	1.0	1	270	270	43
Atomic Resolution UHV NC-AFM	1.0	1	270	270	44
SPM/EM for Transport Measurements	1.5	1	402	402	45
Prototype / Instrument Test Lab	2.0	1	552	552	46
Microwave AFM / Molecular AFM Studies	1.5	1	402	402	47
Single Molecule Confocal Microscopy	1.5	1	402	402	48
Analytical FE-SEM	1.0	1	270	270	49
X-ray Photoemission System (XPS)	1.0	1	270	270	50
Environmental SEM	1.0	1	270	270	51
NMR - 500 MHZ Self-shielded	1.5	1	402	402	52
Available	2.0	1	552	552	
Subtotal Laboratory				5,178	
Office					
Office - Scientific Director		1	160	160	55
Office - Lead Scientist		1	135	135	55
Office - Staff Scientist		4	100	400	55
Cubicle - Technicians		3	64	192	55
Cubicle - Administrative Assistant		1	120	120	
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	463	463	
Subtotal Office				1,620	
Subtotal Assignable Square Feet				**6,798**	

Department:

User Laboratories

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No *(Appendix A)*
<u>Laboratory</u>					
Flexible Lab	2.0	4	552	2,208	*Pages 53,54*
Subtotal Laboratory				2,208	
<u>Office</u>					
Cubicle - Students / Post-Docs		24	64	1,536	*55*
Visitor Cubicle		33	48	1,584	
Visitor Office		3	100	300	*55*
Copy / File Room		1	100	100	
Mailroom		1	50	50	
Office Suite Circulation		1	1,428	1,428	
Subtotal Office				4,998	
Subtotal Assignable Square Feet				**7,206**	

Common Areas

Room Description	Mods / Room	Room Count	Room ASF	Total ASF	Diagram Page No (Appendix A)
Shared Laboratory Support					
Flammable Storage	0.5	1	132	132	
Cylinder Holding	1.0	1	270	270	
Spill Closets (one per lab floor)	-	6	15	90	
Subtotal Shared Laboratory Support				492	
Shared Non-Laboratory Support					
Seminar Room (60 people)		1	1,500	1,500	56
Conference Rooms (15 people)		5	340	1,700	57
Interaction / Break Room		5	340	1,700	
Shower / Locker Room		2	200	400	58
Program Director's Suite					
Reception		1	120	120	
Director		1	300	300	
Deputy Director		1	200	200	
Administration Support		3	64	192	
File / Copy		1	150	150	
Office Suite Circulation		1	385	385	
Shipping / Receiving / Staging		1	400	400	
Janitorial Bulk Supply Storage		1	132	132	
Lobby / Interaction		1	400	400	
Kitchenette		1	80	80	
Vending Machine Alcove		1	80	80	
Fireman's Control Room		1	100	100	
Subtotal Shared Laboratory Support				7,839	
Subtotal Assignable Square Feet				**8,331**	

Building Support Functions

The following list of rooms are probable required spaces for the building to function as needed. These are not considered as building assignable square feet but account for the gross square footage of the facility and have been planned for in the building design.

Room
Description

Primary Building Corridors
Public Toilet Rooms
Janitor Closets
Telecom Building Distribution Frame Room
Telecom Intermediate Distribution Frame Room
Main Electrical Room
Intermediate Electrical Room
Main Mechanical Room
Elevator Shafts
Elevator Machine Room
HVAC Vertical Duct Shafts
Pipe Vertical Shafts
Stairs
Loading Dock
Service Yard

2.5 PROJECT GOALS & OBJECTIVES

The following Goals have been outlined to guide the development of the project and to evaluate decisions during the phases of planning and designing the project:

- Provide space to stimulate and foster the Laboratory's collaborative, world-class scientific work environment that attracts and retains exceptional scientists and highly qualified professionals.
- Provide flexible, state-of-the art facilities and infrastructures that incorporate sustainability principles. Specific vibration and acoustical criteria will be applied to support particularly sensitive scientific instruments in this and adjacent buildings.
- Develop quality outdoor space to maximize interaction among users and researchers as well as with the surrounding natural environment and vistas.
- Link to adjacent research buildings, nearby research centers, the LBNL Civic Center and destination locations through thoughtful consideration of transportation alternatives and enhanced pedestrian access.
- Create a user-friendly series of spaces and infrastructure that are welcoming, attractive, and safe.
- Incorporate design elements and landscaping consistent with the Laboratory's Fire-based Integrated Landscape Management Program.
- Design a high-reliability structure, incorporating design elements that allow efficient maintenance, repair and modification of operating systems.
- Be efficient and direct in planning and design while providing a cost-effective solution for LBNL.

2.6 ALTERNATIVES

The current proposal—Construct a new 94,500 GSF building

The proposed alternative of constructing a new building is the most cost-effective solution to the need for advanced nanoscience facilities at Berkeley Lab. The Molecular Foundry will provide adequate space for collocated research groups, state-of-the-art research equipment for nanoscale research, and close proximity to interrelated research support facilities. Teams will include researchers in the fields of materials science, physics, chemistry, biology, biochemistry, molecular biology, and engineering. The facility will provide modern, appropriately equipped, and flexible space for the study of matter of nanometer dimensions and will provide space for its users, as well as access to other existing major user facilities important for research at the nanoscale, including the ALS, NCEM, and NERSC.

Lease on-site space

This alternative would involve consolidation of the Molecular Foundry facilities and research program in leased on-site space. A developer would design/construct a building and lease it to LBNL. A preliminary Life Cycle Cost Analysis (LCCA) has been prepared to evaluate the financial impact of this alternative, compared with the first alternative. The analysis shows that the present value of the first alternative is $68M cheaper than the present value of this alternative.

Maintain the status quo—No action

This alternative is unacceptable, because no existing facility at Berkeley Lab provides adequate space for collocating research groups from the variety of disciplines necessary to make the required scientific breakthroughs in the field of nanoscience. No space is available for the sophisticated state-of-the-art research equipment for nanoscale research, which requires clean, utility-intensive modern laboratories. And finally, no existing space is available in close proximity to interrelated research support facilities such as NCEM.

2.7 METHOD OF ACCOMPLISHMENT

General: An integrated team will accomplish this project consisting of the Department of Energy (DOE), Lawrence Berkeley National Laboratory (LBNL), an executive Architect-Engineer firm (AE) and a Construction Manager/General Contractor (CM/GC).

Berkeley Site Office: The Berkeley Site Office (BSO) Federal Project Manager will provide overall project management oversight.

Lawrence Berkeley National Laboratory (LBNL):

Foundry Project Director: The Foundry Project Director will be responsible for control of scope, budget, and schedule throughout the life of the project, from conceptual design through start-up. A Construction Advisory Committee of senior LBNL engineers and scientists, with substantial experience in the management of large construction projects, will provide advice and counsel to the Project Director on a wide variety of project-related issues.

Berkeley Lab Integrated Project Team: The Foundry Project Director will be supported by an integrated project team that includes the Foundry Project Manager, representatives from Contracts, Facilities, and the EH&S Division. Construction contract administration and inspection will be accomplished by the Berkeley Lab Facilities and Purchasing Departments, with the assistance of the A/E firm and appropriate testing laboratories under contract to the University. Special equipment will be procured directly by Berkeley Lab after competitive bidding.

Scientific Director: A senior scientist will be responsible for both the collaborative program and the internal research efforts of the Molecular Foundry laboratories. The Scientific Director will serve as a single point of contact to the Foundry Project Director for scientific programmatic input into the design, procurement, and construction of Molecular Foundry conventional facilities and technical equipment.

Architect and Engineering Firm: An architect and engineering (A/E) firm, with appropriate multidisciplinary and geotechnical support and design experience, will be selected for Titles I and II design and for technical oversight during Title III construction. The firm will be required to demonstrate knowledge of laboratory building design and construction, as well as the EPA Comprehensive Procurement Guidelines for recycled-content building materials, and experience in environmentally sustainable design and the use of building materials that minimize environmental impact throughout their life cycle.

Construction Manager/General Contractor: A Construction Manager/General Contractor (CM/GC) will provide preconstruction services (consultation for costs, schedule and constructability and coordination support) during the design phase. Upon completion of Title I and Title II design, construction will be accomplished under a firm, fixed price agreement with the CM/GC. The CM/GC will be selected during Title 1, based on competitive bidding of the General Conditions, Overhead, and Profit of the construction subcontract costs. A best-value source selection procedure to balance cost and such other factors as safety management, key personnel, and past performance will also be employed in the selection of the CM/GC. The successful CM/GC will be awarded a fixed-price subcontract for services during design, with an option (to be exercised unilaterally by Berkeley Lab) for performance/management during construction.

At the completion of design, the CM/GC will prepare bid packages and competitively bid construction work to sub-subcontractors. The CM/GC will be required to certify that it has followed all legal requirements for competitive bidding of the bid packages. Once the bid packages are accepted by Berkeley Lab, they will be incorporated in the CM/GC contract via a "Contract Amendment," thus increasing the CM/GC's compensation and responsibilities by the amount and the work scope of the bid package. Berkeley Lab has the option to proceed with the CM/GC and its subcontractors or to terminate the CM/GC contract and provide open bidding to general contractors.

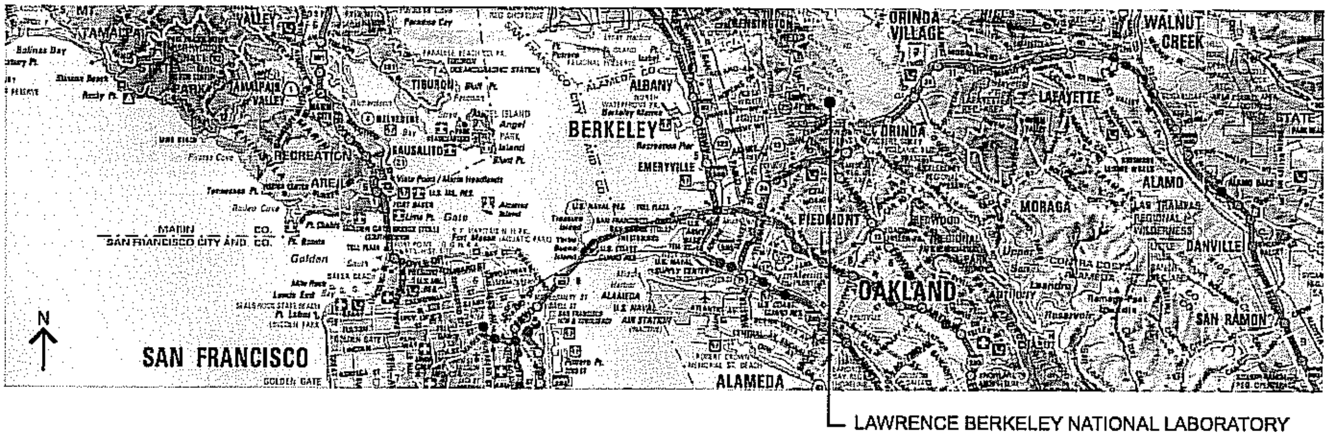
3.0 SITE ANALYSIS

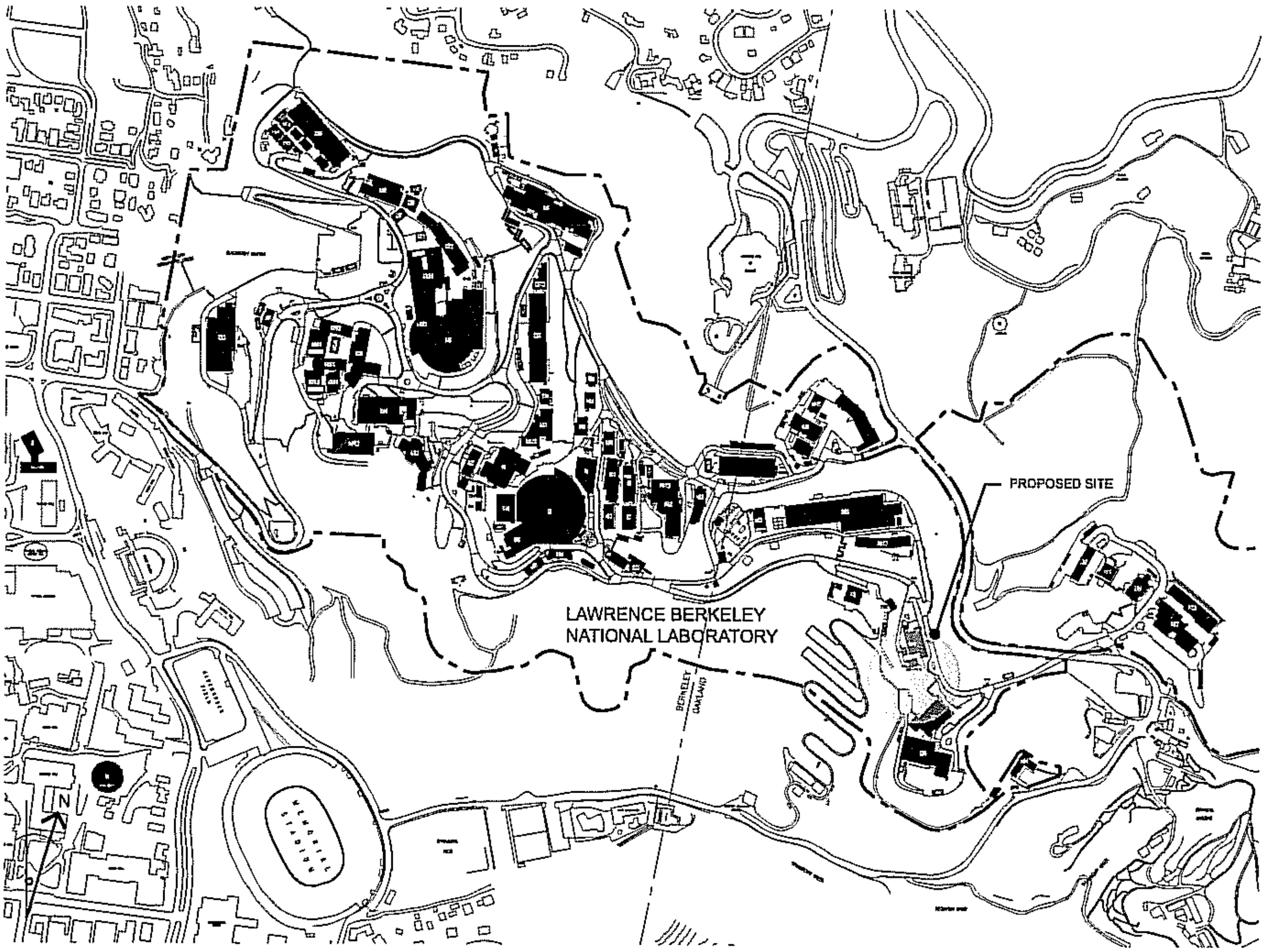
Introduction

The following site analysis presents the different existing conditions, natural and manmade, that will impact the location, scale and size of the Lawrence Berkeley National Laboratory (LBNL) Molecular Foundry. It also describes the design team's response to these elements.

Site Area

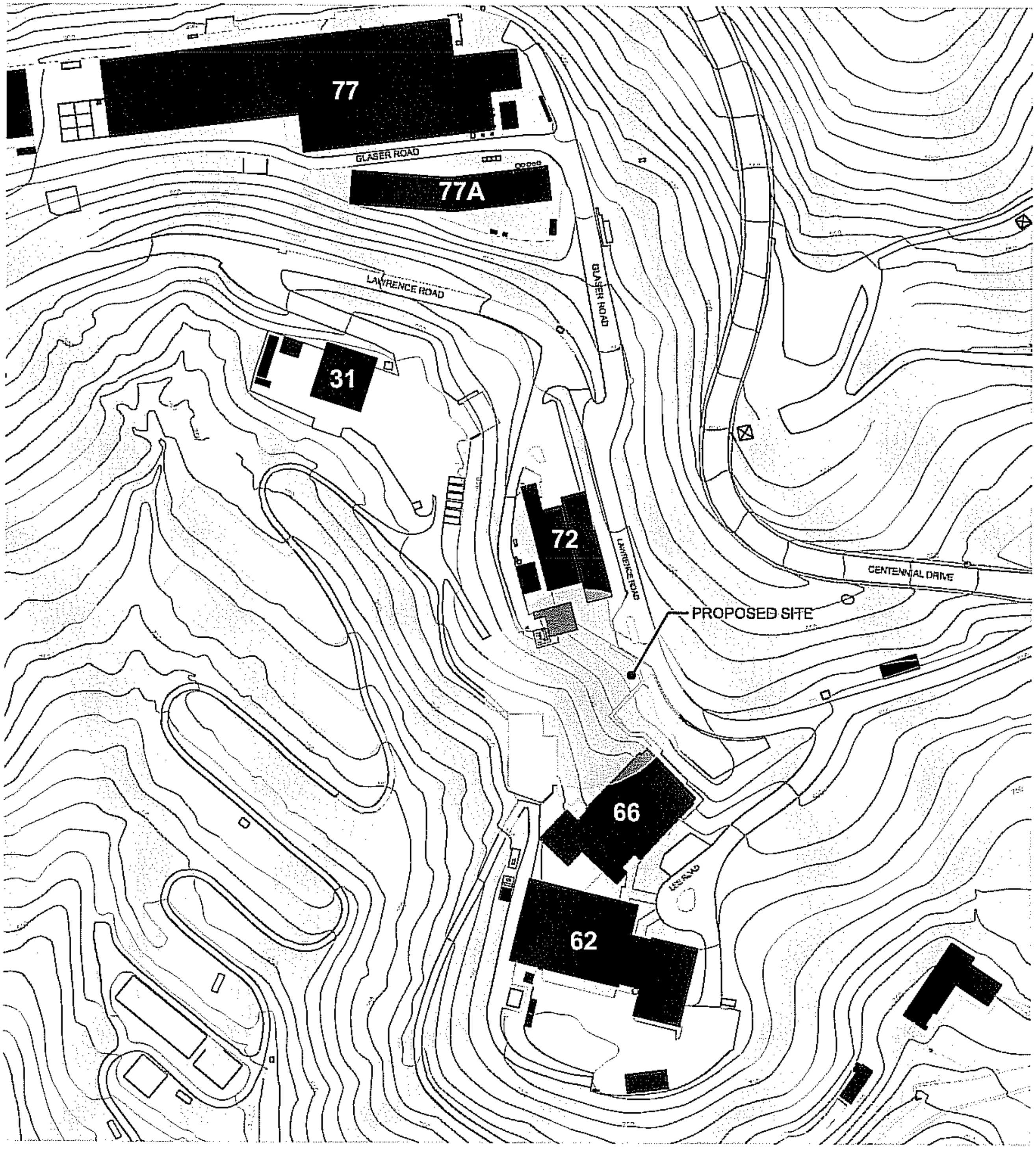
The proposed site for the Molecular Foundry is located at the Lawrence Berkeley National Laboratory in Berkeley, California. The 200-acre campus is neighbored by the University of California at Berkeley to the southwest and the residential hills of Berkeley and Oakland to the north, east and west.



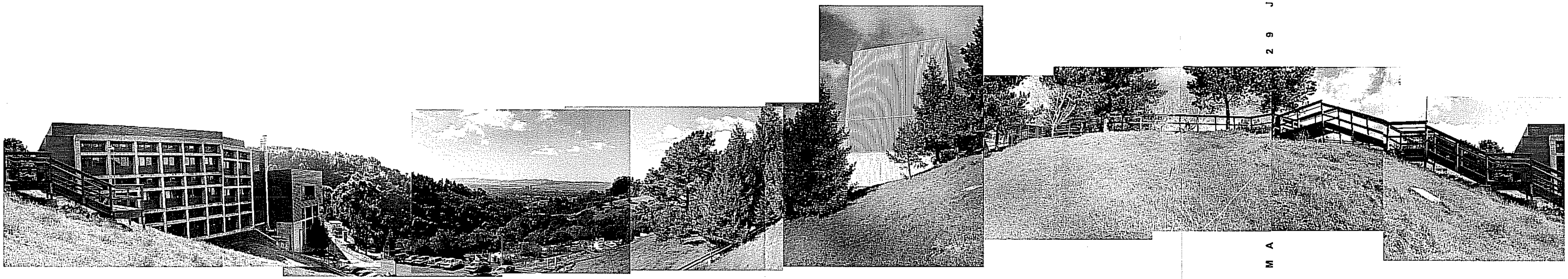


Area of Study

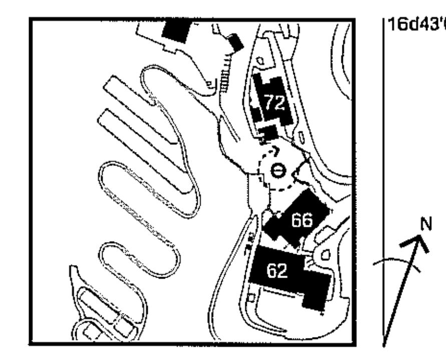
The proposed site is prominently located along Lawrence Road at the southeastern end of the campus. Sloping dramatically to the southwest, the site provides stunning views over the Berkeley Hills to the San Francisco skyline. (See Site Panorama on page 3.0-4 and Site Photos on page 3.0-5)



Site Panorama



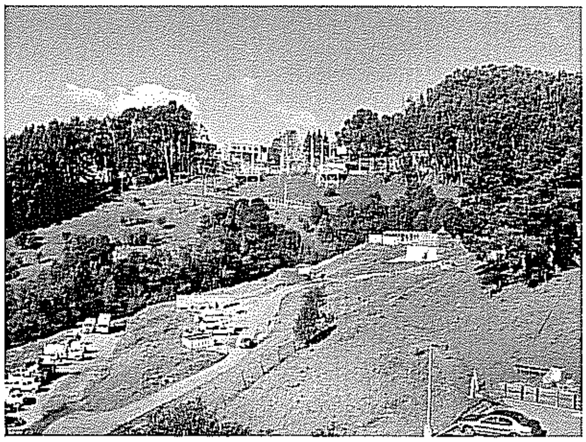
SITE PANORAMA 29 JANUARY 2002



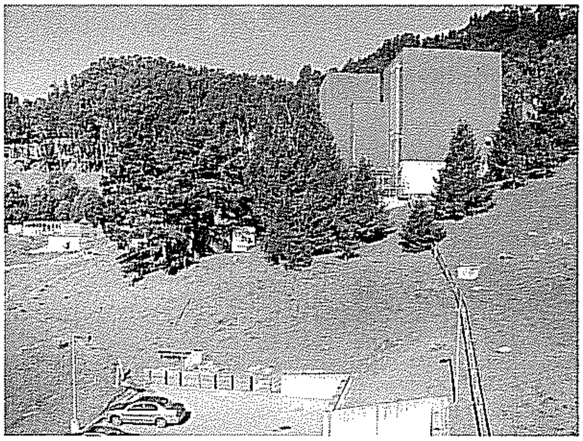
Site Photos

SITE PHOTOS FROM BLDG 66

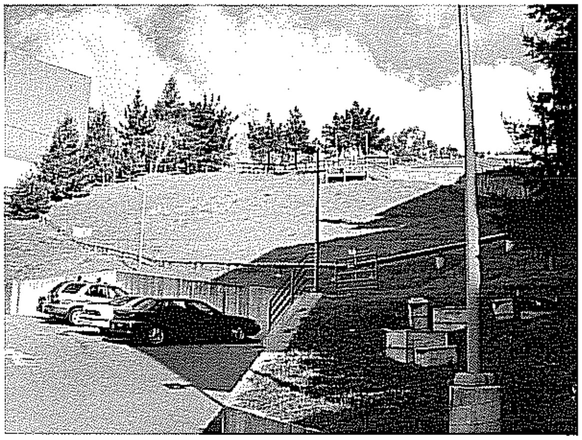
looking NORTHWEST



NORTH

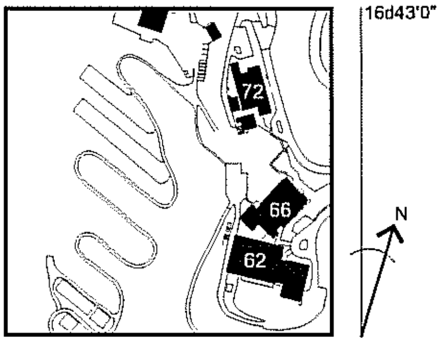


WEST



NORTHEAST

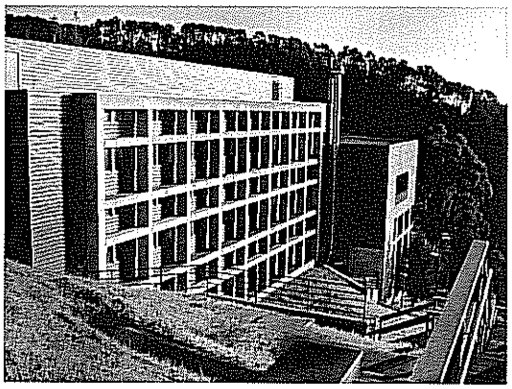
LAWRENCE ROAD



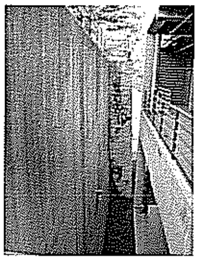
Surrounding Buildings

The LBNL campus contains numerous hillside projects. The proposed site is nestled amongst three of these buildings: Buildings 62, 66, and 72. These surrounding projects are low-rise to mid-rise buildings, constructed in a variety of modern expressions. They house the following scientific programs: Building 72 - the National Center for Electron Microscopy (NCEM), Buildings 66 - the Surface Science and Catalysis Laboratory (SSCL) and Building 62 - the Inorganic Materials Laboratory.

bldg **66**



stair to bldg **66**

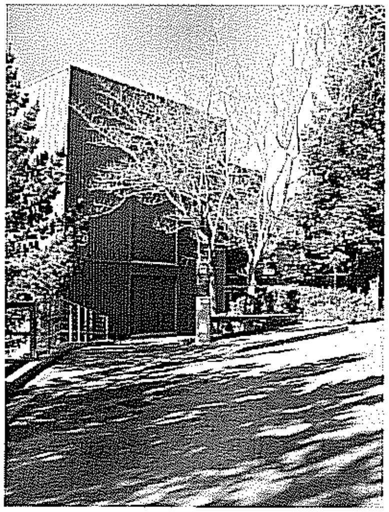


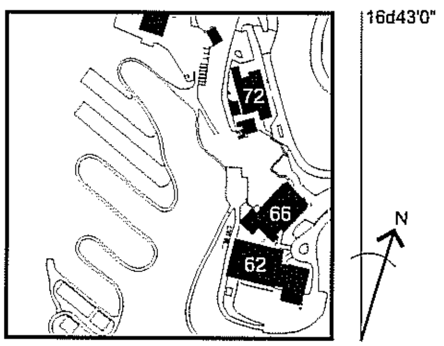
retaining wall at bldg **66**

bldg **62**

SURROUNDING BUILDINGS

bldg **72**

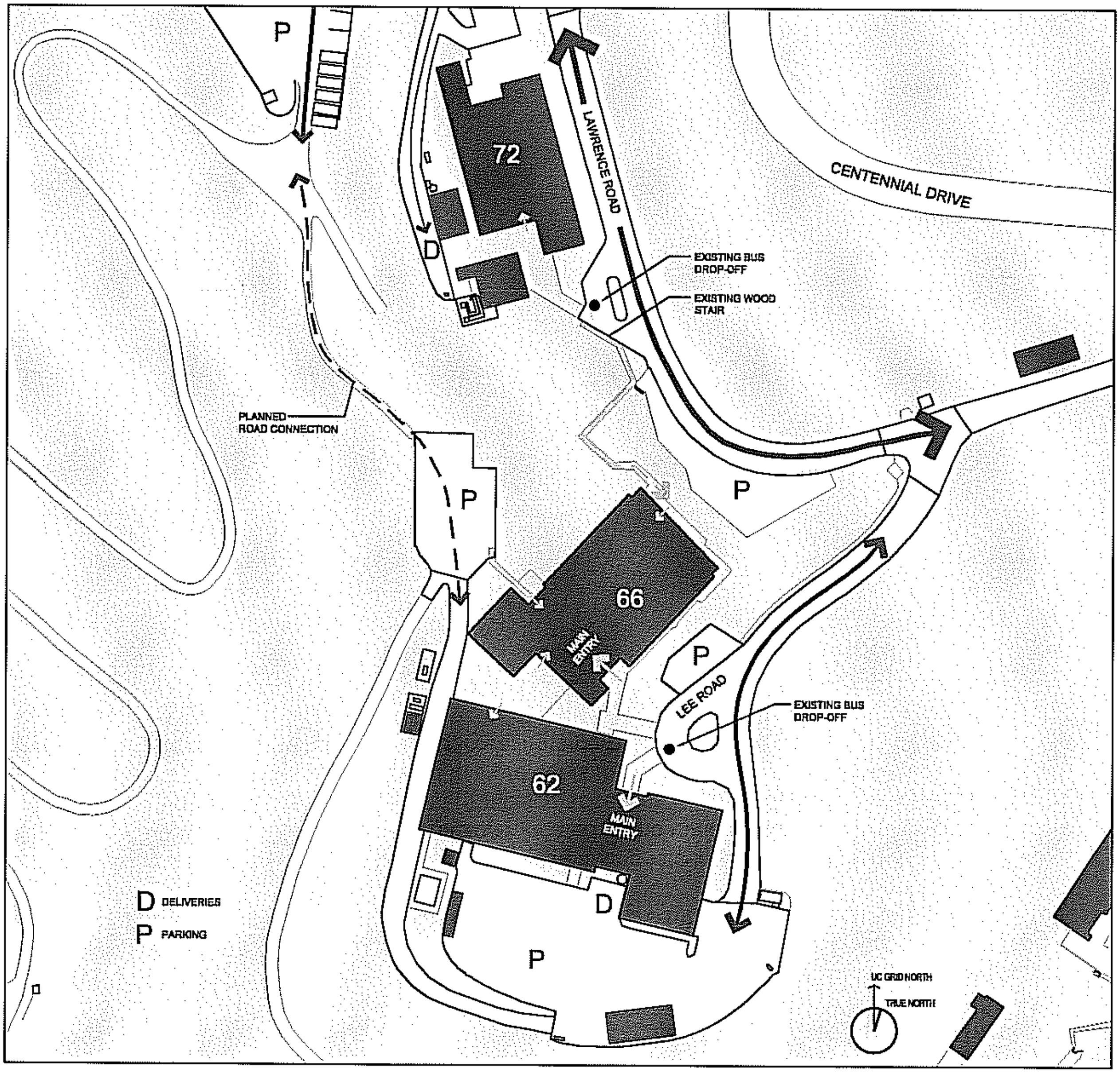




Pedestrian and Vehicular Circulation

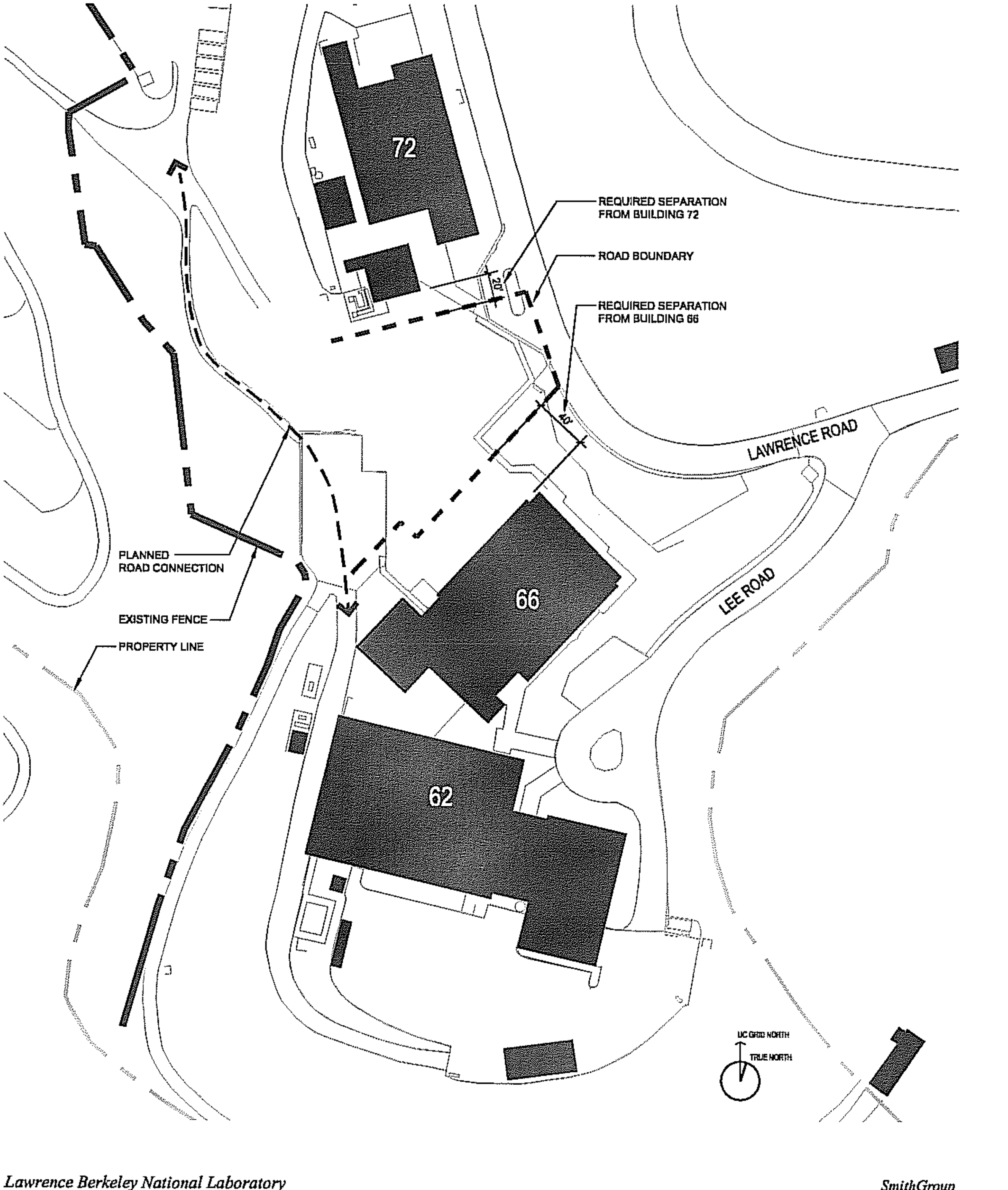
Currently, vehicular access to Buildings 66 and 62 are along Lee Road, a cul-de-sac that branches off Lawrence Road, one of the campus' primary thoroughfares. The loading dock for Building 62 is along its south facade. Building 66 deliveries also utilize this loading dock and are then transported through Building 62. Building 72 has a separate cul-de-sac road and loading area along its southwest facade. A partially paved cul-de-sac road and parking lot also exists southwest of the Building 72 access road.

Pedestrian circulation is primarily from the building's parking lots to various building entries. Sidewalks exist along Lee Road and the bus drop-off zone located at the main entries to Buildings 62 and 66. A wood stair with dramatic views out to San Francisco accesses Building 66 from the bus drop-off along Lawrence Road. One of the intentions of this project is to create a pedestrian link between the proposed project and Buildings 62 and 66, creating a complex of related scientific programs.



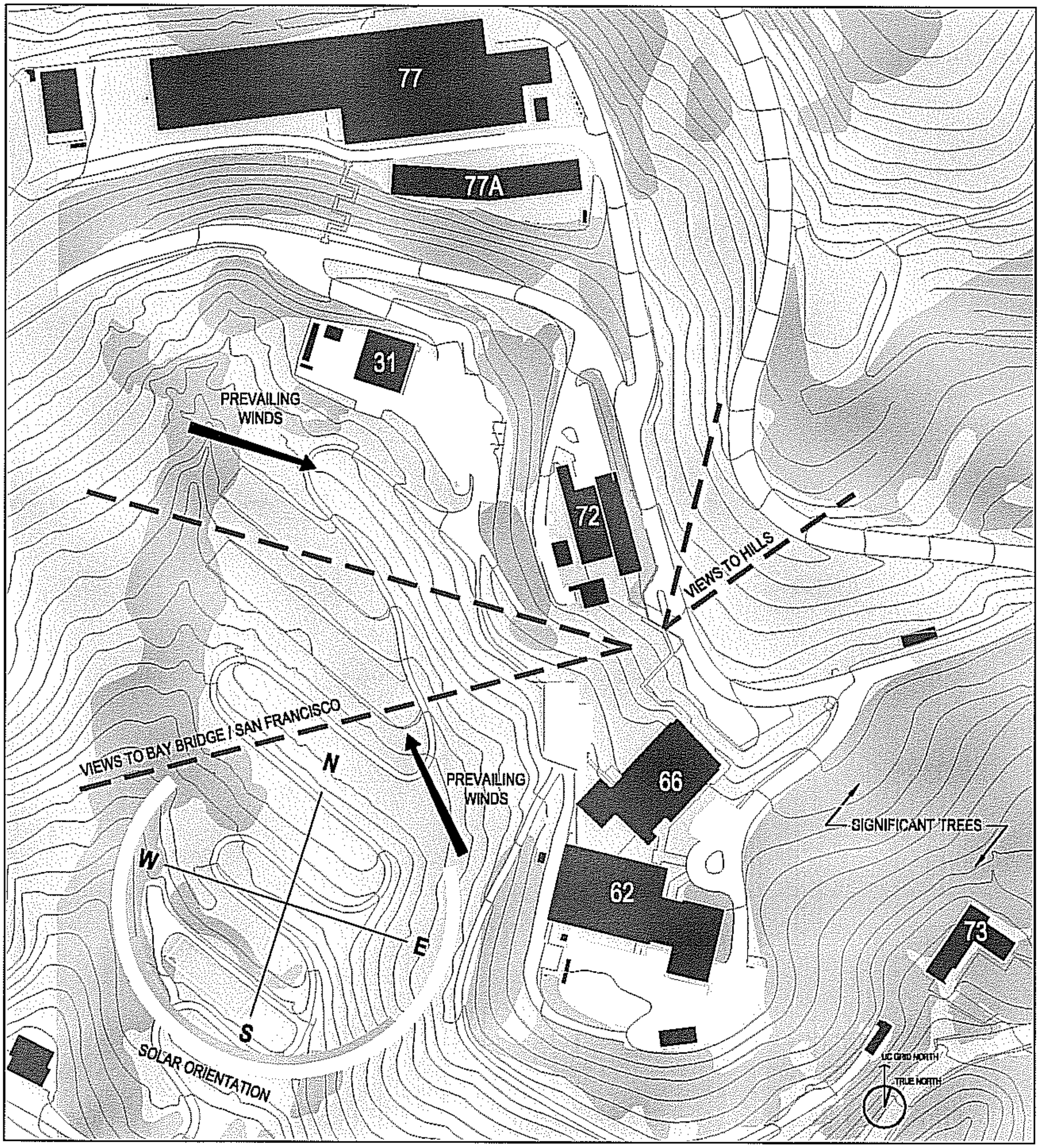
Site Boundaries

The site boundaries are defined by the adjacencies to Buildings 66 and 72, Lawrence Road, the existing fence and the location of the planned road connection.



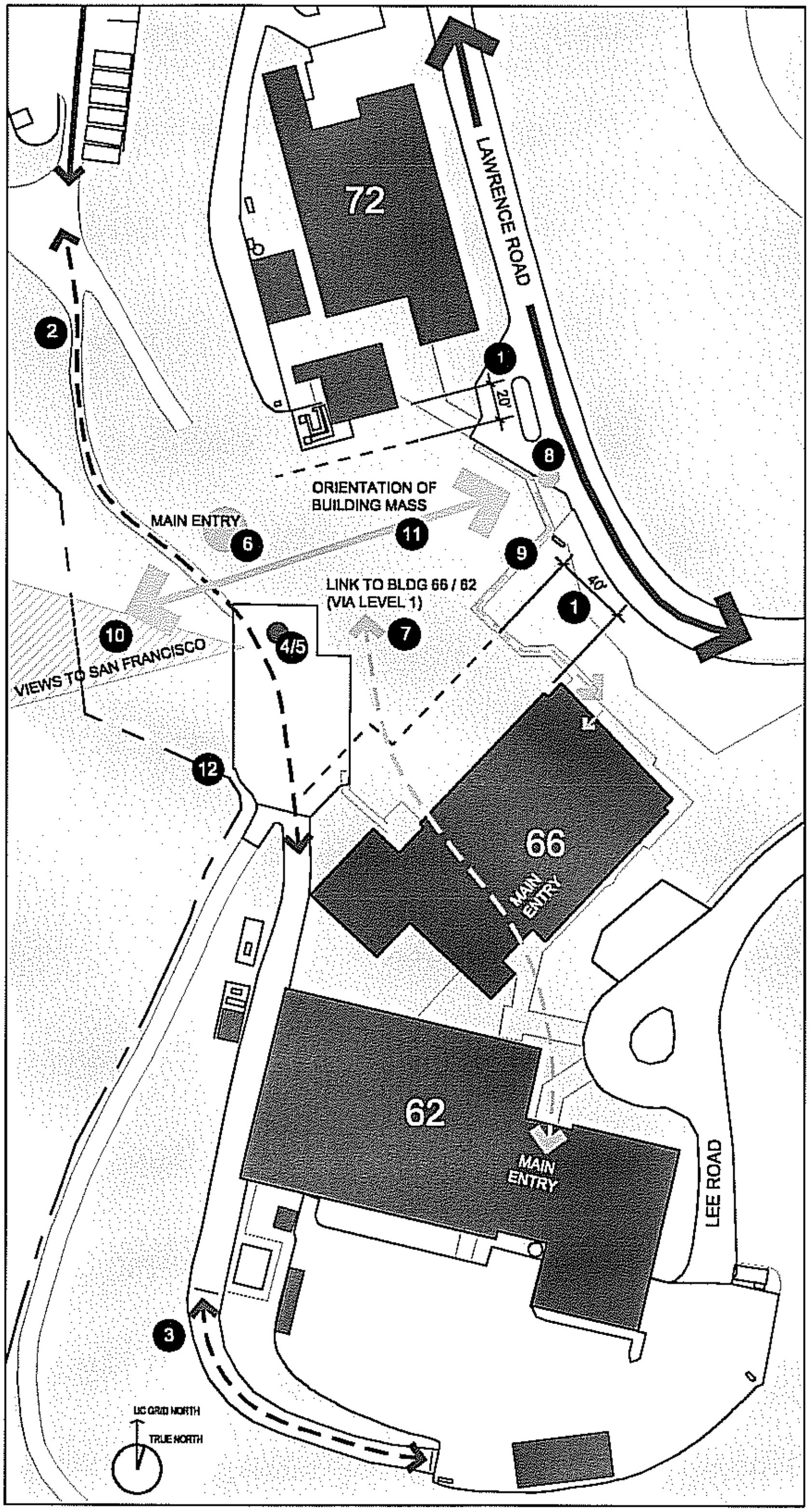
Natural Elements

The site's natural environment is a strong asset. The dramatic hillside and previously mentioned views towards the southwest are inspirational. Attractive views of the Berkeley hills also exist to the north. The site is very verdant, surrounded part of the year by green hillsides and redwood, monterey pine and oak trees. Because of the site's powerful elements, solar and visual orientation will play an important role in the the arrangement of the proposed building program.



Site Guidelines

The general guidelines to establish the footprint for the Molecular Foundry are listed below.

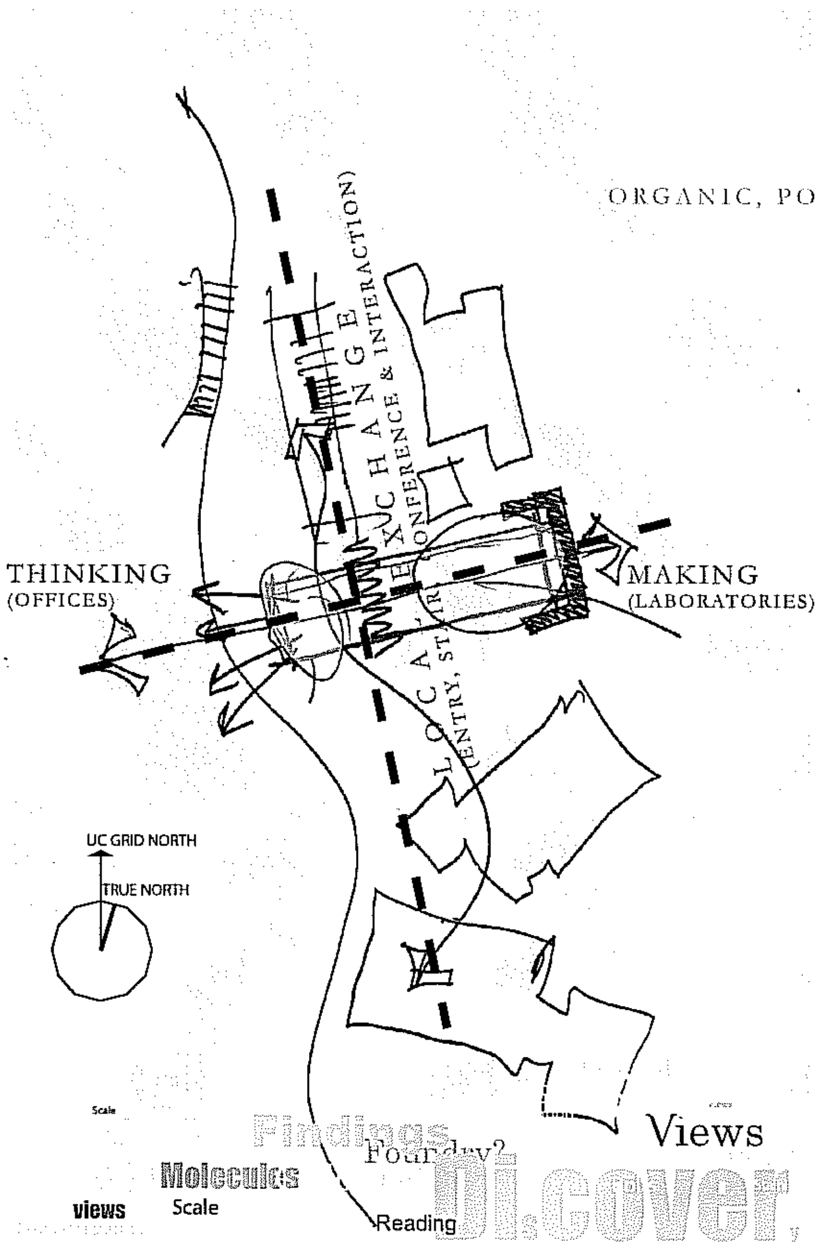


1. By code, the building is required to have a 40' setback from Building 66 and a 20' setback from Building 72. Visually, a distance of 70'-80' is recommended from Building 66.
2. Extend Lee Road 350', connecting it to the existing road southwest of Building 72. This loop road would provide needed vehicular access across the lower end of the site for deliveries, fire trucks, parking and passenger drop-off.
3. Widen a 160' portion of Lee Road south of Building 62, allowing fire and delivery truck passage.
4. Locate delivery access along the planned loop road.
5. Locate fire access to the building along the loop road. Access should be no more than 75' below the highest occupied level to avoid classification of the building as a high-rise.
6. Locate the front door, lobby, and seminar room on a central floor, facilitating vertical access through the building.
7. Create a pedestrian link between the proposed building and Buildings 66 / 62.
8. Locate a secondary entry along Lawrence Road.
9. Re-establish a stair at Lawrence Road for direct access to Building 66 and the proposed building's primary entry level.
10. The building should take advantage of the site's natural views and southern solar orientation.
11. The building should be oriented parallel to the direction of the slope, minimizing obstruction of water flow down the hillside and maintaining a reasonable separation from Building 66.
12. The proposed building will fall within the site boundaries. The proposed loop road and utility requirements may extend beyond the boundary of the existing fence.

4.1 DESIGN PHILOSOPHY

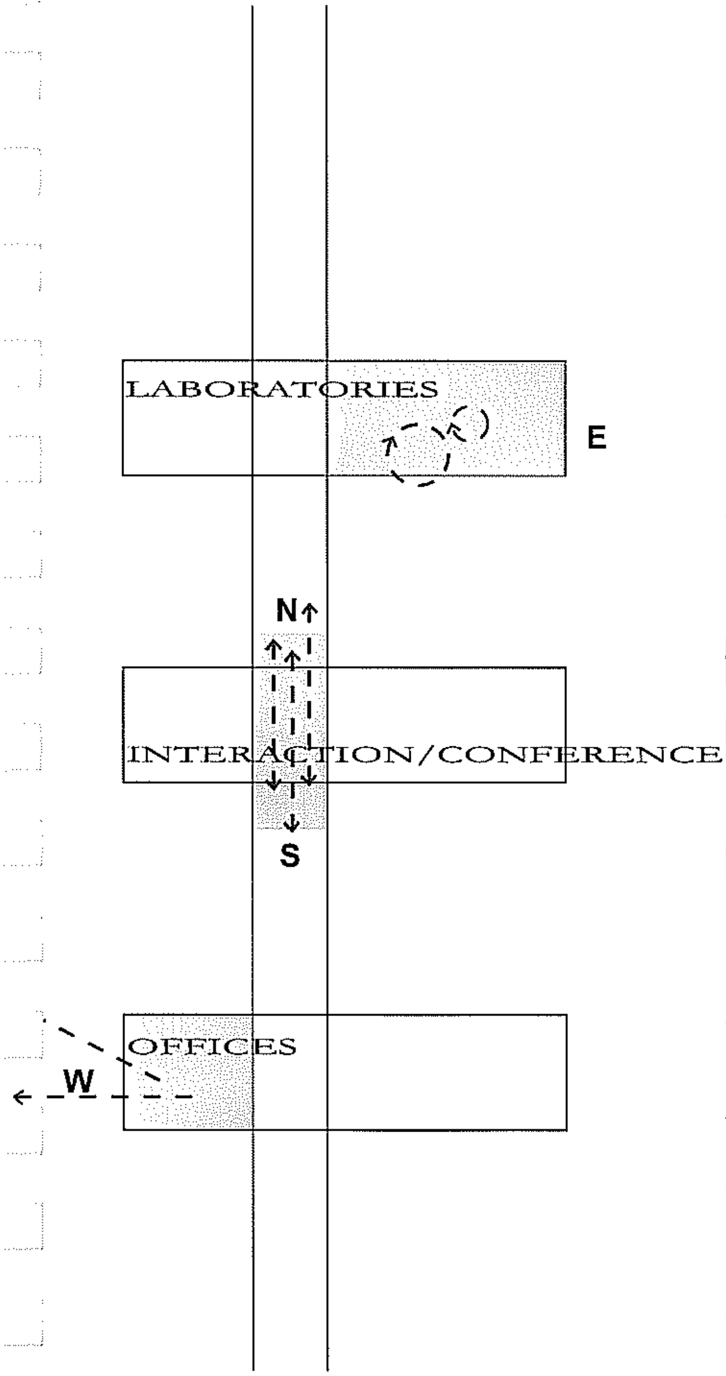
The design of the Molecular Foundry is based on the **philosophical goal** of creating a research workplace that integrates the functional requirements of science with a compositional response to the physical and architectural features found on the LBNL campus.

While the primary goal of the Molecular Foundry is to support scientific research, the architectural design of the planned facility can be an asset that enhances both the "thinking" and "making" effort of research teams that will occupy the facility. The building is organized to link labs and offices together to create opportunities for interaction outside the lab, accommodate visitors, provide linkages to adjacent buildings and have a thoughtful working environment for the intellectual advancement of the nanosciences. The building integrates the surrounding facilities together on the hillside both functionally and visually, creating the larger context of a research center.

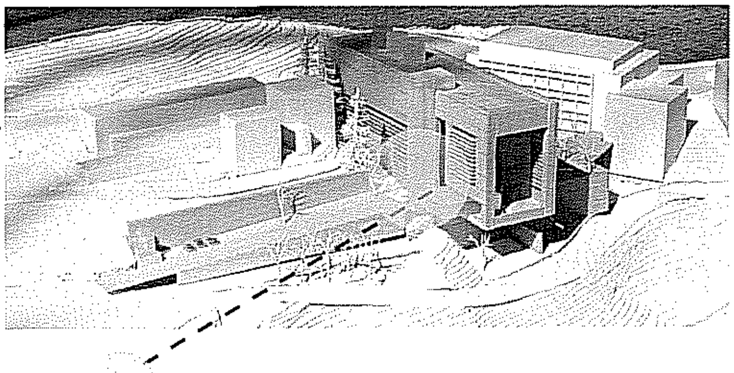


The inspiration for the architectural character of the planned building is drawn from the clear functional nature of the surrounding buildings and the unique features of the steep hillside site. The building is organized into a simple rectangular form with the long axis oriented from east to west. The primary mass of the building emerges from the hillside between the two adjacent buildings to create an integrated composition of structures. Useable outdoor spaces are created on terraces located to the north and south of the new building that are framed and shaped by the existing buildings. The orientation also takes advantage of spectacular views from the site over Strawberry Canyon, the UC Berkeley Campus and San Francisco Bay.

The **program** for the building includes three primary functional components: laboratories, offices, and interaction/collaboration spaces. The laboratories represent the "making" of science in terms of physical development and the offices represent the "thinking" in terms of conceptual development. The interaction and collaboration spaces are located between the labs and the offices and serve to connect people working in the building and foster the exchange of information. This organization allows each research group to have their own dedicated space for their specific work and a physical connection to other related research groups, creating a wider-reaching community for research.



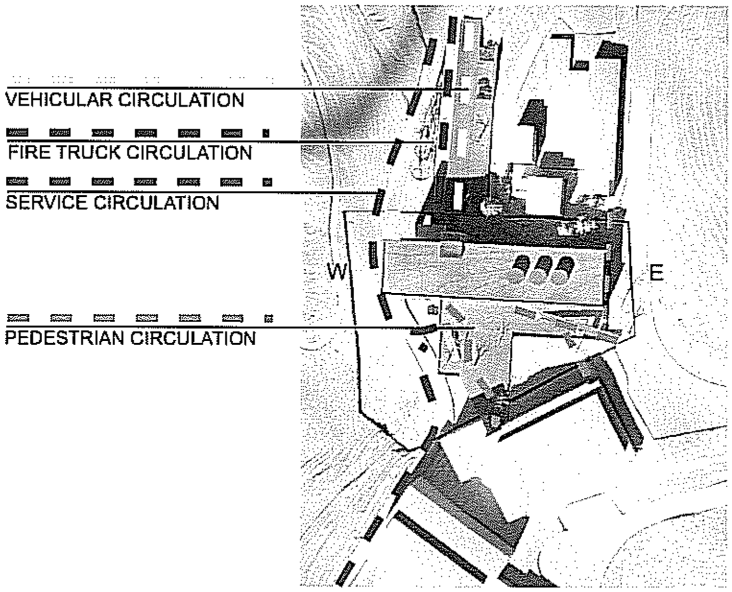
The **building organization** is based on the functional organization of the program components. The laboratories are located at the east end of the building and cover seventy percent of each floor plate along the north and south elevations. The north and south elevations along the lab bays are characterized by window openings in response to the specific needs for daylight in each lab. The research group offices are located at the west end of the building. The west elevation of the building is composed of a full-height window system with an emphasis on natural daylight and views to the San Francisco Bay. The interaction functions are placed between the labs and offices and oriented along a north to south axis to promote visual links to the adjacent buildings, Building 72 (National Center for Electron Microscopy) to the north and Building 66 (Materials Sciences Division) to the south. This link at level 1 allows staff easy access between the three buildings on the site and strengthens collaborative efforts. The east end of the building includes a secondary entry located directly off Lawrence Road.

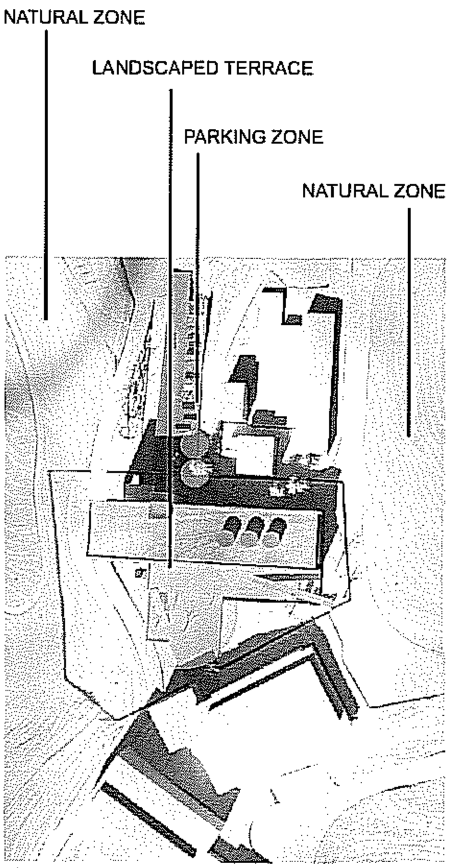


The **main entry** is located on the third floor above ground level and is characterized by a large glass opening at both the north and south elevations between the lab and office functions. The entry lobby penetrates through the entire width of the building to serve as an inviting link to Buildings 72 and 66 with the interaction spaces. A bridge, located to the north of the main entry, connects the parking to the lobby. A large terrace, located on the south side is developed for use as an outdoor interaction area and serves to unify the hillside space between the Molecular Foundry and Building 66.

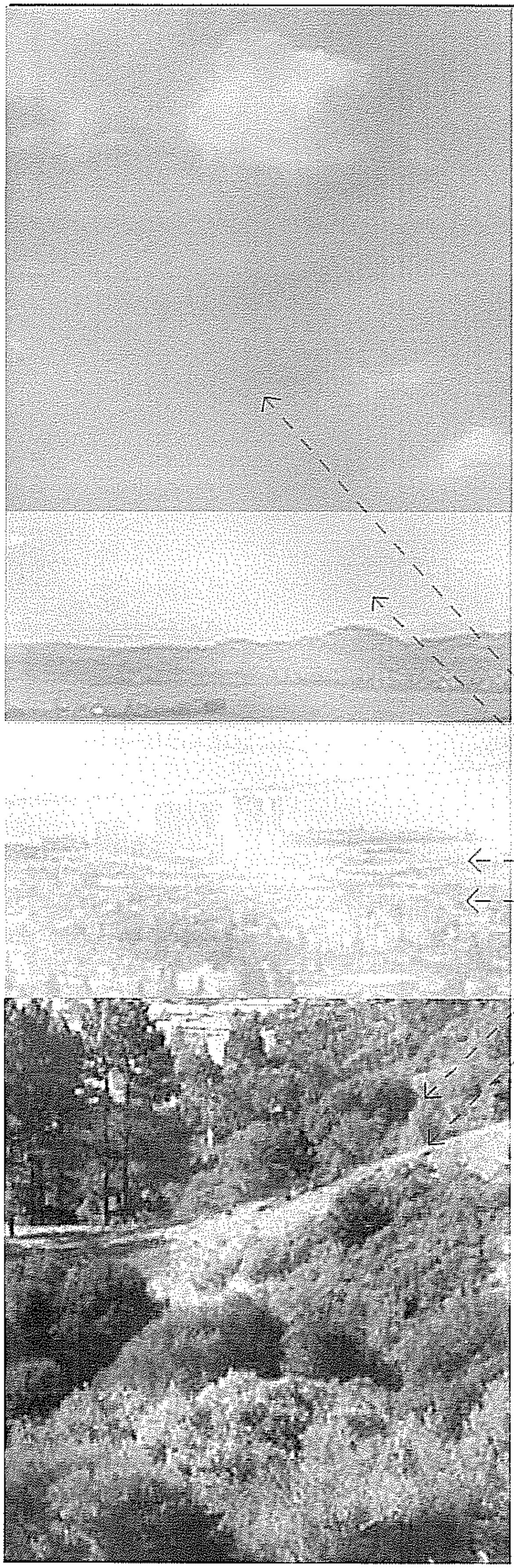
Circulation is divided into three types; building occupant circulation, service access and fire truck access. Each floor of the Molecular Foundry is organized with a main corridor that leads to the labs, offices, interaction spaces, stairs and elevators. All foot traffic through the building and between floors occurs through the corridors, stairs and elevators. The service entry is used to handle all deliveries and is located at the lowest building floor adjacent to the access road. The service yard is screened from view by a retaining wall to the east and by a landscape wall to the north, to minimize the impact on the existing and new facilities. Fire truck access is accommodated from the access road with an entry to the second level above grade.

The **central utility** plant is a separate structure placed into the hillside north of the Molecular Foundry. It is located under the new entry parking lot minimizing its visibility upon entry to the new facility. Access to the central plant is available from the road along its west side.

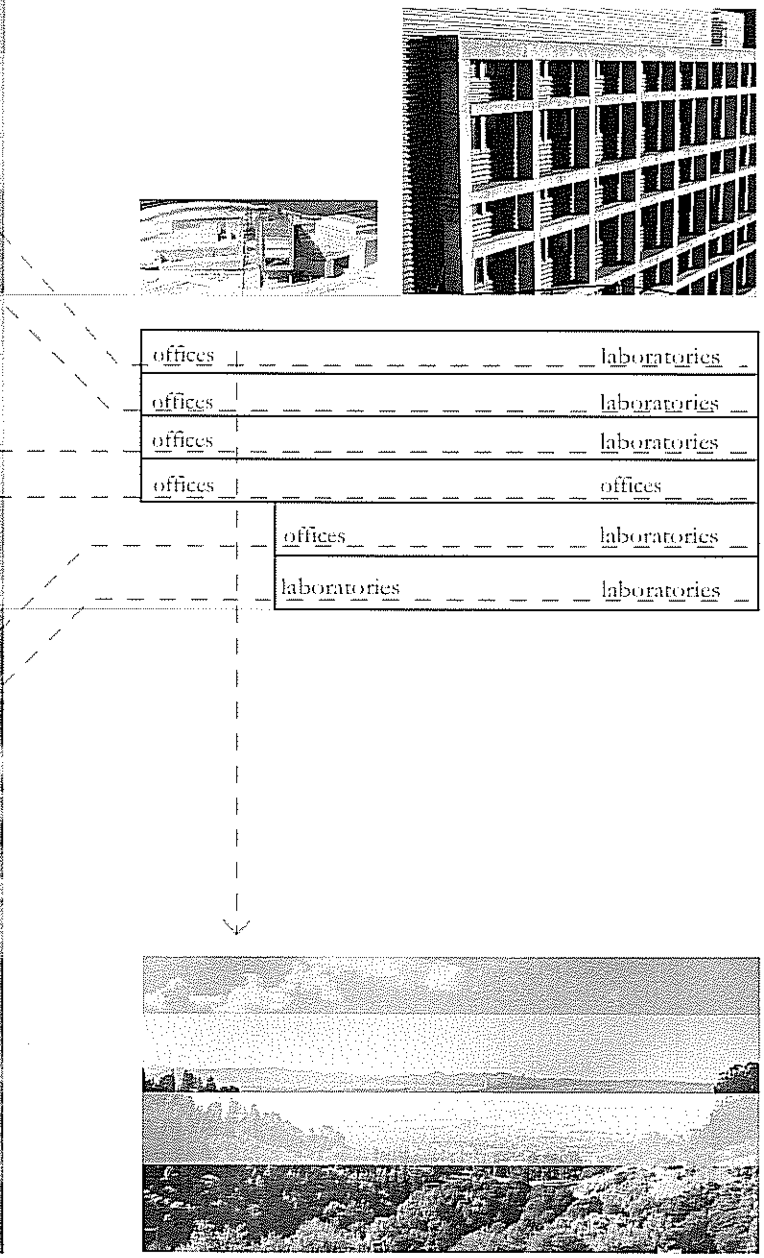




The **landscape** is divided into three zones; a terrace to the south between the Molecular Foundry and Building 66, natural zones to the west and east and a parking zone to the north at the main entry. The location of the terrace has been carefully chosen to minimize the impact on the natural landscape and fulfill the desire for a significant connection between the Molecular Foundry and Building 66. The terrace is intended as a usable space for the occupants of all buildings on the hillside. The terrace is planned with a mixture of paved and planted areas. The entry parking lot is paved with special materials and will have some planted areas. The remaining hillsides are left natural with grass and tree growth.



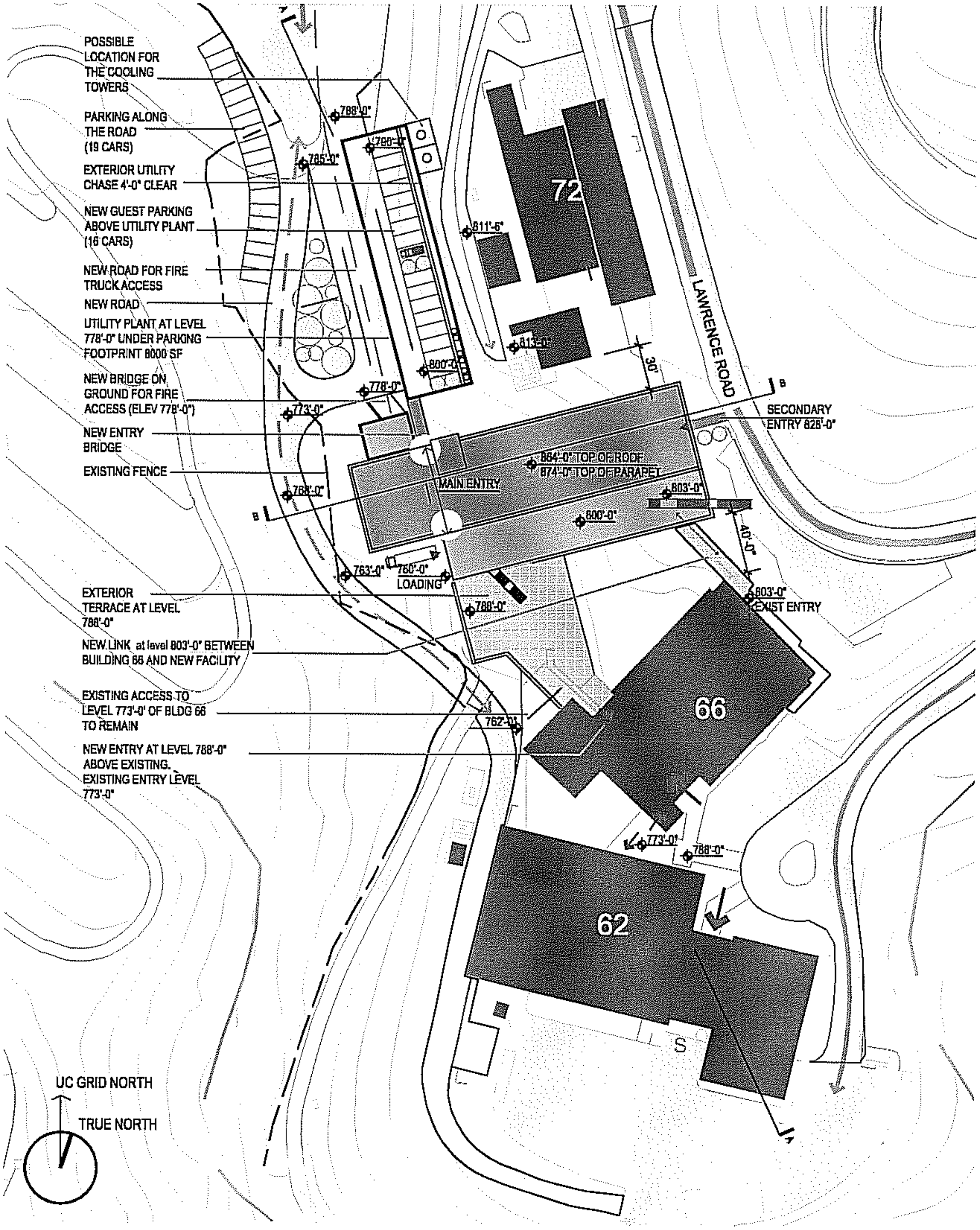
The **views** from the site and the planned building are spectacular and offer a wide range of changing impressions. The building is organized to maximize the experience of the views with the expansive glass facade at the office suite, the careful placement of windows in each lab and the orientation of the south outdoor terrace.



4.2 SITE & BUILDING DIAGRAMS

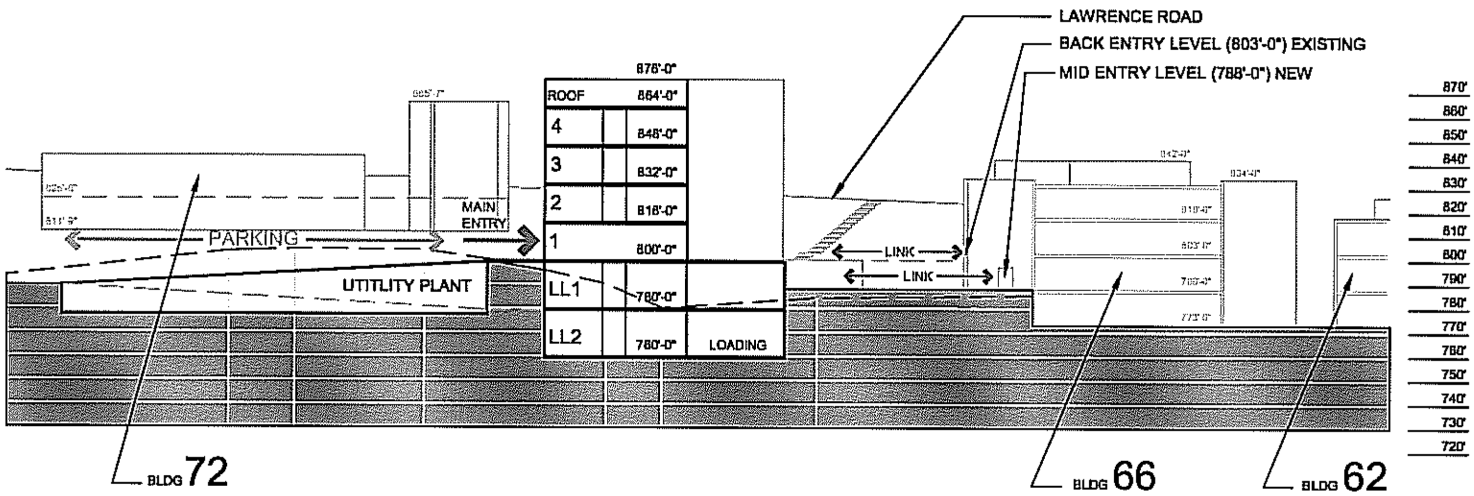
Scale: 1"=100'-0"

SITE DIAGRAM

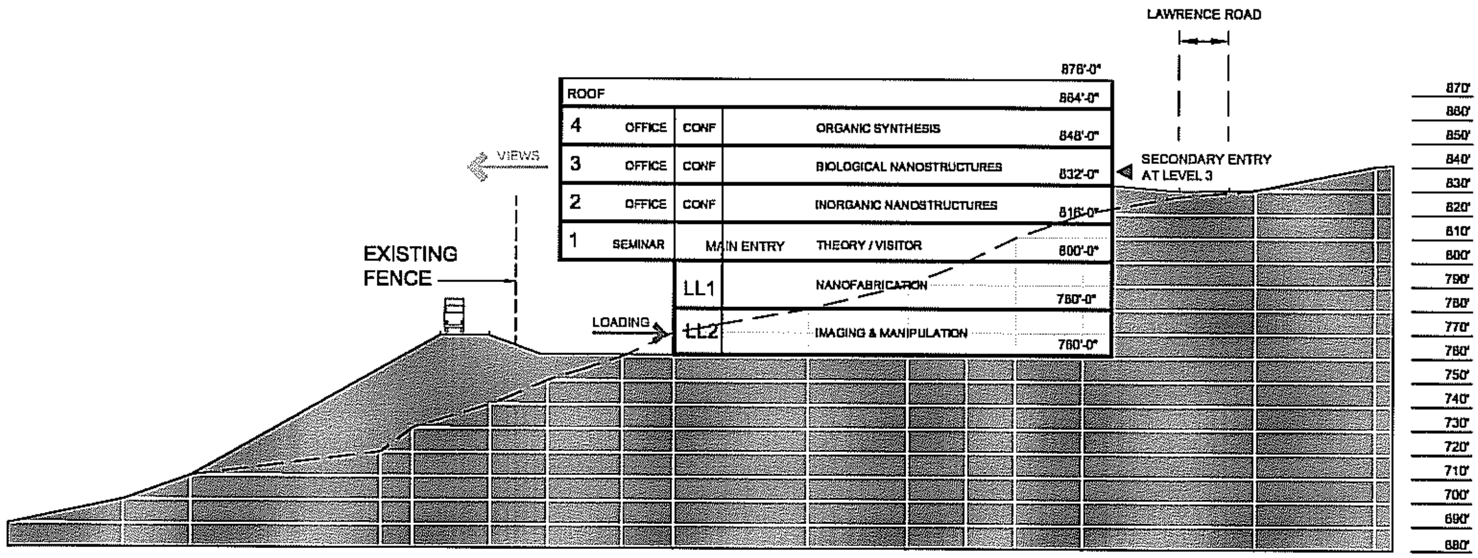


Scale: 1" = 80'-0"

SITE SECTIONS



(A) **LONGITUDINAL SECTION LOOKING EAST**

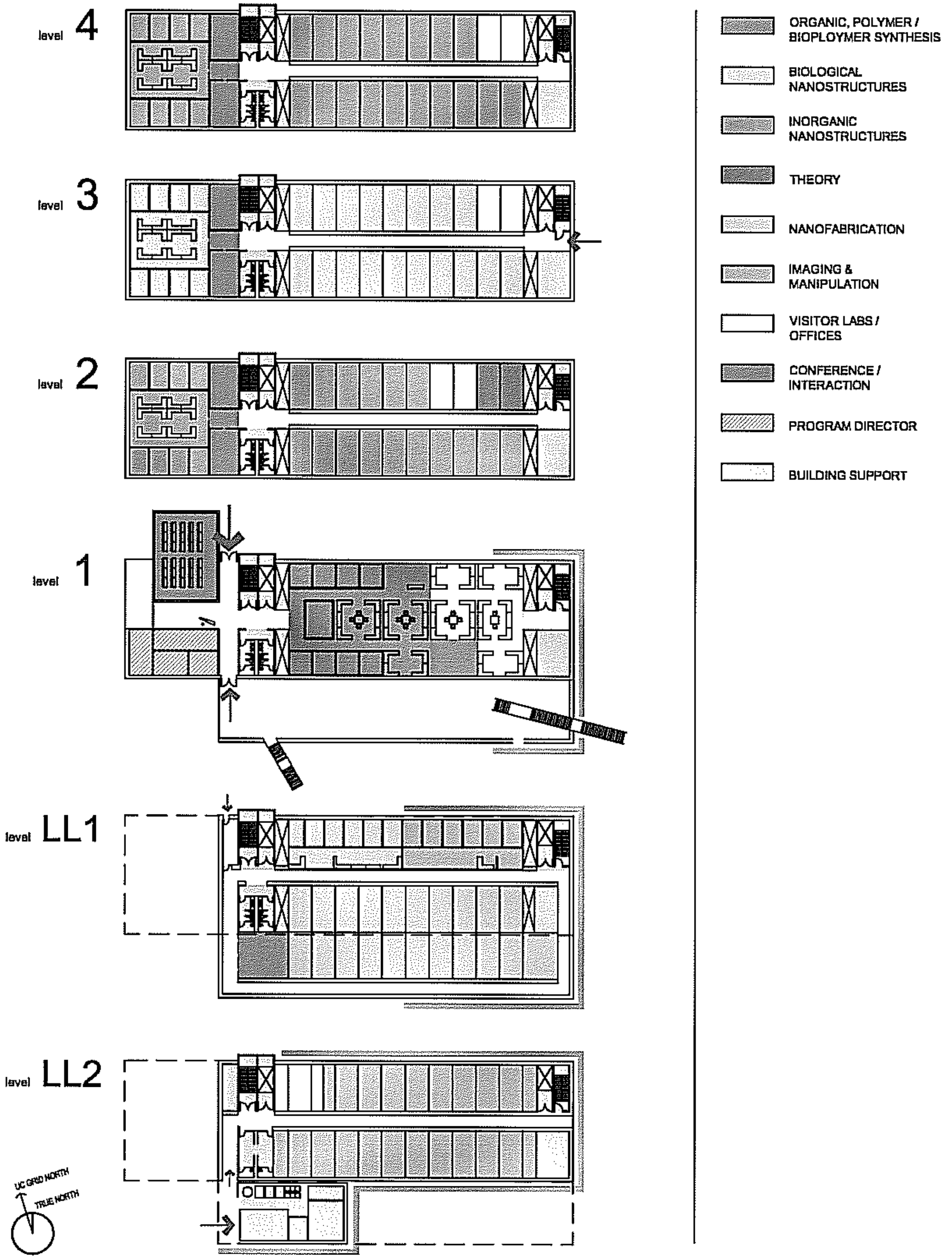


(B) **TRANSVERSE SECTION LOOKING NORTH**

SEE SITE PLAN ON PAGE 4.2-1 FOR SECTION REFERENCES

Scale: 1" = 80'-0"

ORGANIZATIONAL DIAGRAM



Scale: 1" = 40'-0"

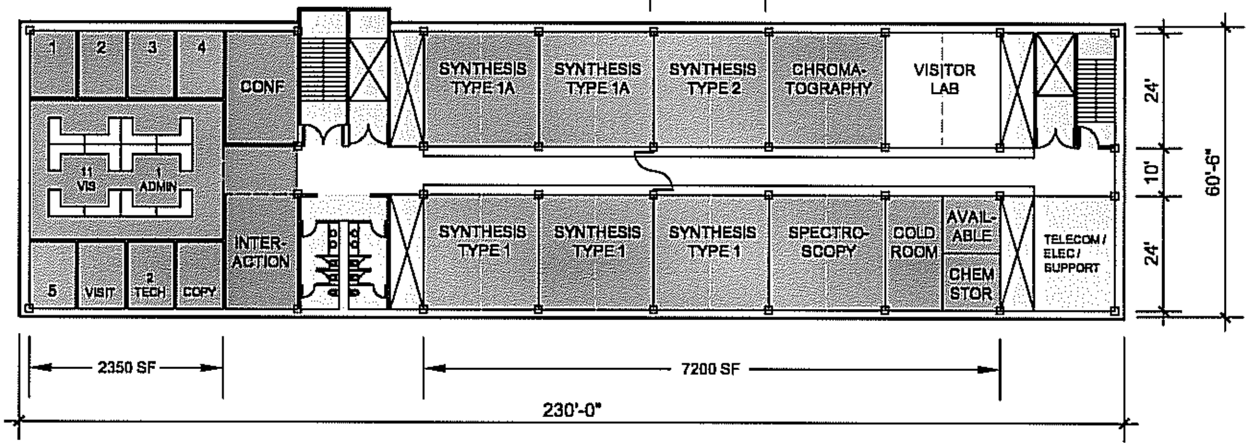
PLAN DIAGRAMS

4

18 LAB MODULES (LM) ORGANIC, POLYMER / BIOPOLYMER SYNTHESIS & OFFICES +
2 LM VISITOR LABS +
880 SF VISITOR OFFICES

ELEVATION 848'-0"

FOOTPRINT 13,920 sf

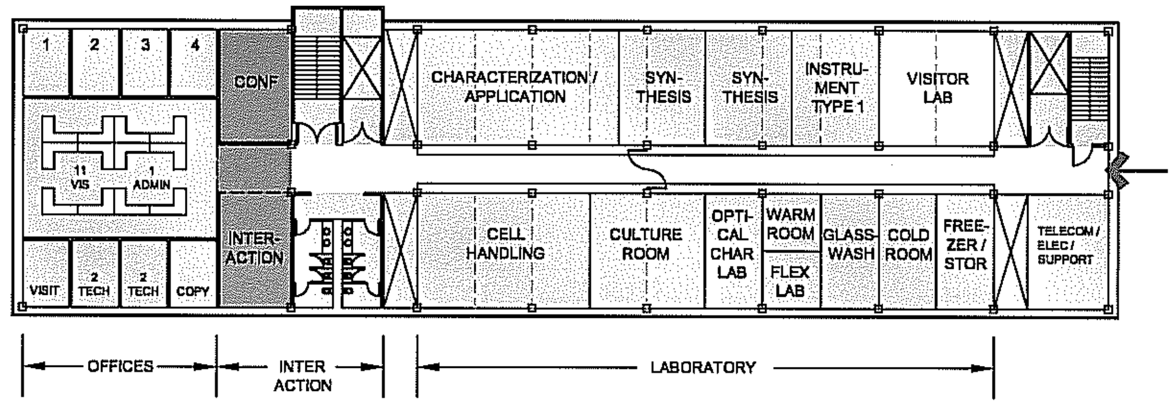


3

18 LM BIOLOGICAL NANOSTRUCTURES & OFFICES +
2 LM VISITOR LABS +
880 SF VISITOR OFFICES

ELEVATION 832'-0"

FOOTPRINT 13,920 sf



ORGANIC, POLYMER / BIOPOLYMER SYNTHESIS

BIOLOGICAL NANOSTRUCTURES

INORGANIC NANOSTRUCTURES

THEORY

NANOFABRICATION

IMAGING & MANIPULATION

VISITOR LABS / OFFICES

CONFERENCE / INTERACTION

BUILDING SUPPORT

Scale: 1" = 40'-0"

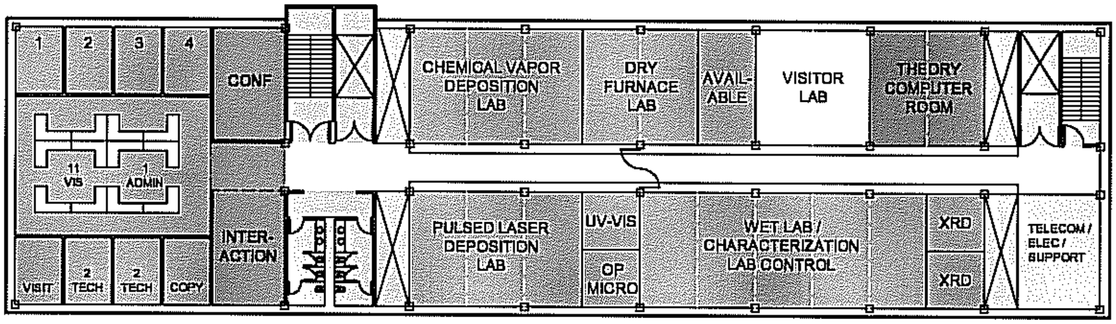
PLAN DIAGRAMS

2

16 LM INORGANIC NANOSTRUCTURES & OFFICES +
2 LM VISITOR +
2 LM THEORY (COMPUTER ROOM) +
880 SF VISITOR OFFICES

ELEVATION 816'-0"

FOOTPRINT 13,920 sf

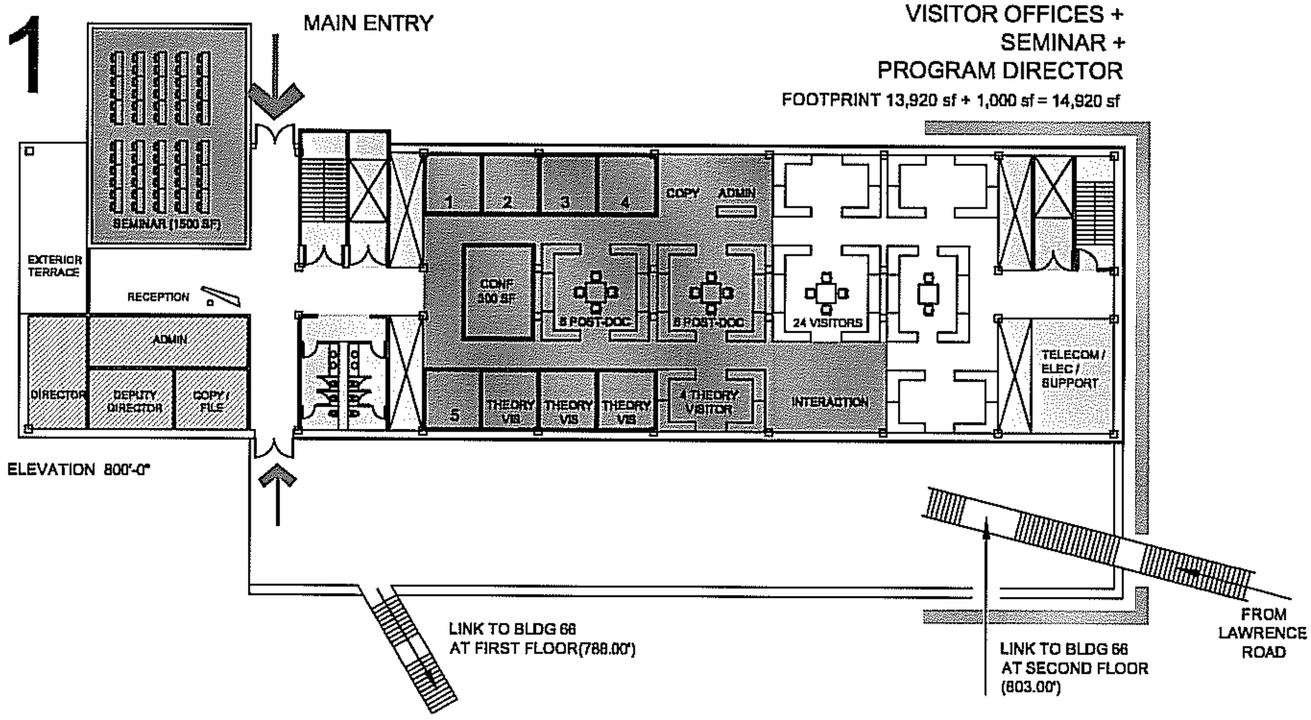


1

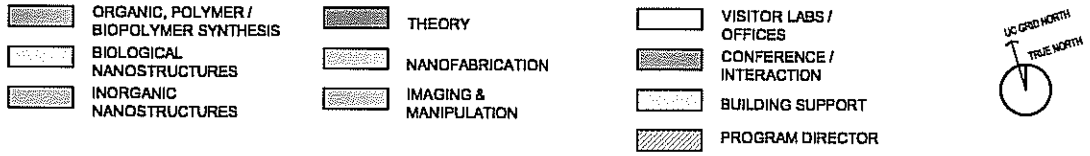
MAIN ENTRY

THEORY +
VISITOR OFFICES +
SEMINAR +
PROGRAM DIRECTOR

FOOTPRINT 13,920 sf + 1,000 sf = 14,920 sf



ELEVATION 800'-0"



Scale: 1" = 40'-0"

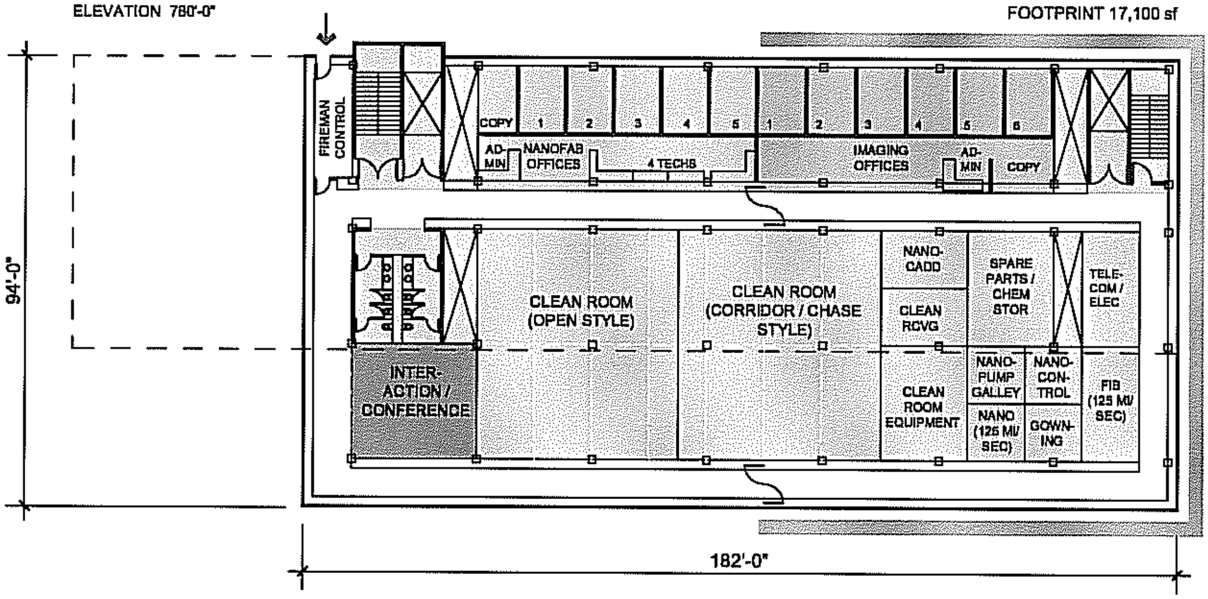
PLAN DIAGRAMS

LL1

ELEVATION 780'-0"

21.5 LM NANOFABRICATION LABS & OFFICES +
IMAGING & MANIPULATION OFFICES

FOOTPRINT 17,100 sf

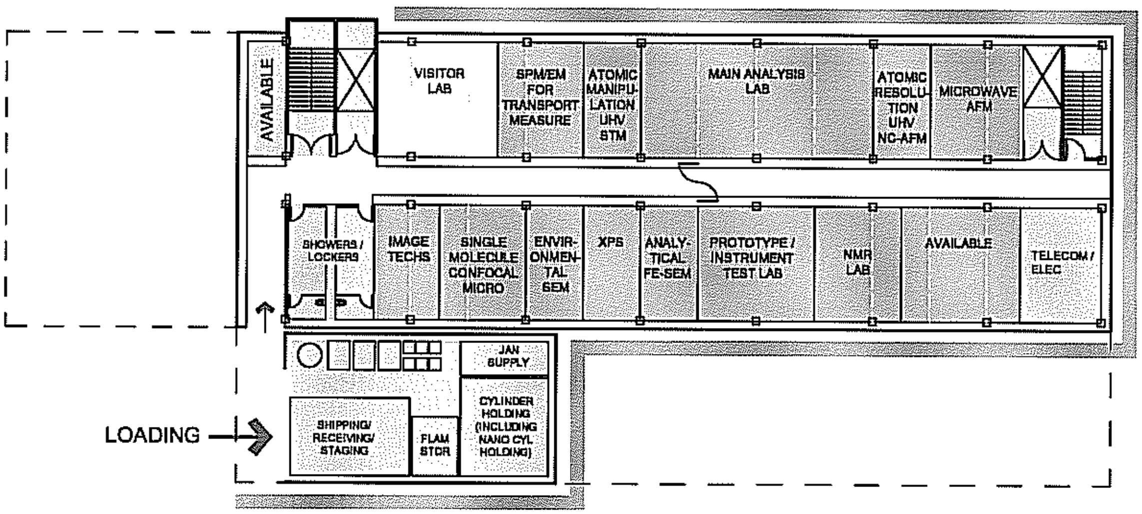


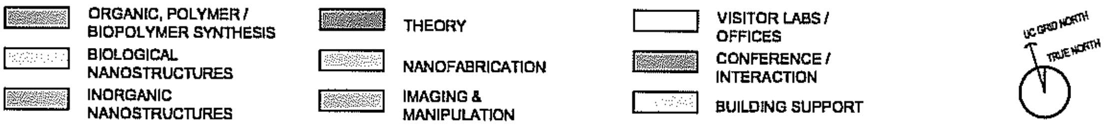
LL2

ELEVATION 760'-0"

19 LM IMAGING & MANIPULATION LABS + IMAGING TECHS +
2 LM VISITOR LABS +
LOADING

FOOTPRINT 11,000 sf + 1720 sf = 12,720 sf





5.1 INTRODUCTION

The purpose of this section is to establish basic guidelines and criteria for the architectural design of the facility during future design phases. This section has been organized by Building Systems namely, architectural, laboratory, structural, mechanical & plumbing, electrical, telecommunications, civil, landscape, and sustainable design.

Because it is a preliminary guideline, some of these systems may be eliminated or replaced with the current, more readily available systems during Title I and Title II design and documentation phases. This selection is an ongoing process, developing over time. The design team will coordinate to select the most appropriate systems for the Foundry.

The goal in designing the **building's systems** is to simplify, integrate and make them part of the overall design concept of the building. The systems will be set in a simple and organized manner to enable future necessary remodeling as requirements change over time. The mechanical, plumbing and electrical systems will provide quality ventilation and individual environment control to give the building's users a high level of comfort.

5.2 ARCHITECTURE

ARCHITECTURAL EXTERIOR

Exterior Cladding

The exterior skin system for the planned building will be durable, water-resistant, compatible with the surrounding context, cost effective and generally appropriate to the intended use.

The primary exterior skin system will likely include the use of metal, concrete, and glass. Several types of metal and window systems are available within the cost allowance for the exterior skin and the final choice of systems will be made during the Title I phase of work. Contrast and texture in the use of exterior materials will be studied carefully for visual interest and for the relationship to the interior function of the building. Careful attention will be given to avoid water and moisture intrusion at areas where different materials or building systems are joined, such as at exterior windows and door conditions. There will be a number of concrete retaining walls at subgrade locations and careful attention to drainage and moisture control is required. The minimum R-value for exterior walls will be R-19 to comply with LBNL requirements.

A glass curtain wall is proposed at some locations to allow large amounts of natural light into public spaces. Sun shading, screening and glazing types will be studied to limit the effects of undesirable afternoon heat gains. The window system may be painted aluminum, structural curtain wall or other appropriate quality system and will be investigated during design.

At exterior door entries, canopies or recessed entries will provide the necessary protection for inclement weather. The features at the entries, canopy or other, should also be used to give the foundry presence and as a way-finding tool.

Where possible and applicable to the interior use, exterior windows shall be used to provide access to natural light and visual relief from the interior environment. Careful consideration will be given to the location of exterior windows with respect to interior furniture and specialty equipment placement. Operable windows will be considered at the office suites if they do not have a significant negative impact upon the mechanical ventilation systems.

Roofing & Waterproofing

The selection of roofing systems will consider the impact of the environment and the long-term effects of sun, wind and rain. The roofing system will provide thermal insulation having a minimum value of R-30 per LBNL requirements. Acceptable roofing membranes include built-up membranes with cap sheet, single ply PVC and EPDM systems.

The functional use of the building requires that the air-handling units and exhaust fans be located on the roof and be vibration isolated. Exposed, roof-mounted equipment will be located behind a parapet wall, screened from view and kept to a minimum. Roof-mounted equipment will be grouped together and rest upon common curbs to the extent possible. This equipment shall be well organized visually and functionally. Roof penetrations for piping and ductwork will be minimized; services requiring penetrations will be grouped together into single penetrations to the extent possible.

ARCHITECTURAL INTERIORS

Interior Partitions and Doors

Metal stud and gypsum board partitions shall be used as the primary interior partition system. Metal stud partitions shall be designed to withstand a minimum lateral force of 5 psf. Where appropriate, partitions shall penetrate through the ceiling and extend full height to the underside of the structure. Partitions that do not extend to the structure shall be braced to the structure above. Connections to the structure above shall be designed to accommodate a slight range of movement in the structure.

Gypsum board shall be 5/8" thick, Type X where required for fire-resistive construction, and comply with the requirements of ASTM C36. Partitions in wet areas shall be designed according to the degree of exposure to moisture. Water-resistant gypsum board shall be used in restrooms and toilets. Water-resistant gypsum board shall be 5/8" thick Type X where required for fire-resistive construction and comply with the requirements of ASTM C630. In areas subject to high exposure to moisture, such as showers, fiberglass mesh mortar panels (cement board) shall be used. Cement board shall be 1/2" thick.

Where heavy equipment or casework is to be mounted on partitions, structural backing appropriate to the loading shall be installed on the loaded side of the partition. The backing shall consist of metal backing plates welded to the metal studs. The anticipated maximum load shall be calculated to determine the backing type, size, gauge, and spacing of the metal studs.

Doors and Frames

Doors may be solid core wood, hollow metal or structural glass construction. Preference should be given to utilizing wood doors in public areas, offices, general storage spaces with low volume of traffic. Typical locations for use of glass doors include exterior doors that serve as primary entrances and doors within curtain wall systems and special locations where vision is desired. Hollow metal doors should be used in doors that require panic exit hardware, service related and back of house doors, and doors that need more than 90 minute ratings.

Interior Finishes

Overall finishes will be considered for aesthetics, acoustics, durability, ease of cleaning, and sustainable qualities appropriate to the areas in which they will be installed.

Floors

Finish flooring materials shall be slip-resistance and comply with the requirements of the American with Disabilities Act Accessibility Guidelines (ADAAG). Various floor material will be considered during the Title I design phase. The selection of materials will be based on the acoustical, visual and vibration needs of each space. Amongst the material studied will be exposed concrete, sheet vinyl, VCT, ceramic tiles and others. The laboratories where chemicals are stored, transported or handled, will require heat-sealed sheet vinyl over concrete sealer for spill containment.

Walls

All partitions shall be finished with gypsum board to a smooth finish, ready for paint. Storage rooms and building support spaces shall be finished in a light texture and ready for paint. Above finish ceilings and at concealed spaces a fire-taped level of finish is acceptable. All gypsum board wall surfaces exposed to view shall be painted. Where ceramic tile, concrete, concrete unit masonry or metal surfaces occur, those surfaces may be left unpainted and their natural finish exposed. Latex enamel interior paint with a satin finish will be the typical paint used at partition.

Ceilings

Finish ceilings may not be appropriate for all spaces and will be omitted where a ceiling system is neither necessary nor desirable. Finish ceilings may be omitted for aesthetic effect in public areas such as the building lobby, office areas, or possibly some laboratories. Consideration will be given to the nature of adjacent spaces when determining whether the finish ceiling may be omitted. Finish ceilings will be provided in utility spaces that adjoin and may be visible on a regular basis from high profile public areas. Acoustics in the areas where open ceilings occur will be studied to achieve appropriate sound levels. Finish ceilings will be omitted in mechanical rooms, electrical rooms, telephone/data room, and other similar spaces.

Where the control of noise or vibration is necessary, the ceiling design may be required to include additional layers of gypsum board, 3-1/2" acoustical batt insulation laid above the ceiling, and/or vibration isolated hanger devices. The Imagining & Manipulation Laboratories will require this type of treatment.

Gypsum board ceilings shall be installed primarily in toilets, locker rooms and showers, and other areas where there will be exposure to water vapor. Gypsum board ceilings shall also be installed as required to control noise and vibration in spaces with high levels of equipment or fixture-generated noise or where aesthetic effects are warranted. All gypsum board ceilings shall be constructed with ceiling framing independent of walls and columns and be attached with resilient channels or resilient hangers to the structure above. All joints between walls and ceilings shall have an acoustic seal.

Gypsum board ceilings in spaces with little to no exposure to water vapor, such as public areas, offices, or other similar spaces where gypsum board is used solely for noise control or aesthetic effect, shall be constructed with standard gypsum board. Standard gypsum board shall be 5/8" thick and comply with the requirements of ASTM C36.

Gypsum board used on ceilings shall be finished smooth, ready for paint. Satin finish, latex enamel interior paint shall be applied to ceilings in general use spaces where there is little or no exposure to vapor. Semi-gloss finish, latex enamel interior paint shall be applied to ceilings in areas with low to moderate exposure to vapor. Semi-gloss finish, alkyd enamel paint shall be applied to ceiling above showers and other spaces with high exposure to water vapor.

Exposed structure with concrete elements, structural steel elements, and metal deck exposed to view may be painted or left unfinished as appropriate for aesthetic effect.

Stairs & Elevators

The stairs and elevators have been located to maximize flexibility for future internal space changes and reconfigurations and to work with the exiting requirements of the building. Stairs and elevators shall be designed to comply with all applicable standards and codes, especially the American with Disabilities Act.

Stairs

Two widely separated interior stairs are proposed to serve all occupied floor levels. It is the design intent to have stairs as visually open as possible to the surrounding space, as allowed by code. This is especially important when located adjacent to lounge or common areas to help aid in visual connection and interaction. Roll-down fire shutters and other means of fire separation will be studied further in design phases as the stairs require two-hour enclosure. As this building is not classified as a highrise, vestibules at stairs are not required.

Elevators

Two elevators are proposed for service and passenger use and both will serve all occupied levels. The service elevator will serve the roof level for maintenance personnel. Elevator hoistways shall be enclosed with two-hour fire-rated partitions. The elevators will be traction type units and shall conform to accessibility requirements.

5.3 LABORATORY SYSTEMS CRITERIA

Modular Design

A. Overview

In order to maximize the adaptability of the laboratory spaces, modular design will be utilized in the planning of all building systems including architectural, mechanical, plumbing, electrical and furnishings.

B. Adaptability

Adaptability is the reserve capacity that is required to be designed into the structural, mechanical, and other building components to accommodate future growth and change. Dedicated zones for mechanical, plumbing, electrical, communication systems, etc., is another form of reserve capacity.

C. Accessibility

The ability to respond to future changes is dependent on easy access to the building's utility systems and the adequate design of those systems. Ease of maintenance, repair, and change drives the need for accessible spaces and systems to minimize costly and time consuming disruptions to ongoing research activities.

A design which effectively integrates accessibility with ease of change can also simplify, and perhaps expedite, the construction process.

D. Laboratory Planning Considerations

1. The laboratories for this building shall be developed from multiples of, or fractions of, a standard module of 12'-0" wide and 12'-0" or 24'-0" deep. The planning module is to the middle of partitions yielding a 11'-6" clear inside dimension for single module labs.

Planning Module	12'-0" x 24'-0" = 288 NSF (270 ASF)
Support Module	12'-0" x 12'-0" = 144 NSF (132 ASF)
½ Support	12'-0" x 6'-0" = 72 NSF (66 ASF)

2. Daylighting: Daylighting should be maximized for labs except in a few cases where it conflicts with the function of the space.

E. Lab Spaces with Additional Design Considerations

1. Environmental Rooms
2. Instrument Labs
3. Glasswashing
4. Clean Room Suite

Laboratory Furnishings

A. Laboratory Casework to be selected for specific use:

1. Material:
   Option: Steel
   Option: Wood
   Option: Lab Grade Plastic Laminate

2. System to be selected for specific use:
   Option: Conventional (floor-mounted)
   Option: C-frame (suspended)

Laboratory Hoods

A. Location: Locate fume hoods in area of minimum turbulence away from personnel traffic and supply air diffusers.

B. Types: Typical fume hood is 8'-0" bench top chemical fume hood. Also to be confirmed during Title I. (LBNL hood design is to be considered)

1. Walk-in hoods
2. Special Depth Hoods
3. Special Chemical hoods

C. Sash Configuration: Main configuration will be horizontal/vertical sash type with operating mode at one-half open.

D. Hood System: Variable volume hood systems to be used where applicable.

E. Sill Configuration: Flush sill

F. Face Velocities: 110 fpm per LBLN standards.

G. Monitors/Alarms: Visible and audible alarm when face velocity is < 80 fpm or > 120 fpm

H. Hours of Operation: 24/7 operation

I. Provide ventilated base cabinets for acids and corrosives

J. Provide flammable storage cabinets

Biological Safety Cabinets:

A. Exhaust: Only selected BSC's to be exhausted

B. Types: (To be determined)
1. Class II Type A
2. Class II Type B3
3. Class II Type B1
4. Class II Type B2

Structural and Vibration Control Systems

A. The following are recommended:

1. Vibration Criteria Laboratories:
   a. 125 micro inches per second maximum velocity (Nanowriter, FIB, Imaging & Manipulation Laboratories)
   b. 2000 micro inches per second maximum velocity (Typical Laboratories)
2. The placement of columns will not fall within the modular lab spaces.
3. Vibration, Noise and Acoustics
   a. General: The surface finishes of laboratories are required to be hardwearing, chemically resistant, easily cleaned and, in some cases, sterile. This usually results in surfaces which are hard and non-porous. These in turn are highly sound reflecting and result in rooms which are excessively reverberant. Reverberant rooms have the following characteristics:
      (1) High ambient noise level.
      (2) Limited decrease in the noise level with distance from the noise source.
      (3) Hard to understand speech
   b. Surface Finishes: Sound absorbing surfaces are usually porous, soft or fibrous, making them unsuitable for laboratory walls and floors. It is recommended that some absorption be introduced on the ceiling (covering a minimum of 50% of the ceiling area) in the form of panels suspended in a grid between the mechanical services or a continuous suspended acoustic tile surface.
   c. Floor Covering: Footfalls on hard floors in the laboratories produce noise and excite the floor, creating vibration. It is recommended that these effects be reduced by providing a resilient floor covering. Laboratory floor surfaces are commonly vinyl tiles or sheets.
   d. Noise Criteria: Refer to Section 5.5 Mechanical Systems.
   e. Vibration Control: Particular attention must be given to the isolation of air handling units, fume hood exhaust fans, associated ductwork and piping and their interaction with the building structure.
   f. Ductwork Noise Control: In general, ductwork must be designed to result in the laminar flow of air through the whole system, with minimum pressure drops. Where possible, fan noise is to be controlled at the source by attenuators and acoustic duct lagging at the fan and/or where the ductwork crosses the mechanical room wall.

Mechanical - HVAC

A. Design Conditions

Laboratories shall be furnished with year-round air conditioning. All chemical laboratories and lab ancillary spaces shall use 100 percent fresh air supply, filtered with prefilter and final filter. Other spaces may be treated in a similar manner if the return of the air to a central system is not economically feasible. Systems shall conform to the State Energy Code. Actual load calculations, fume hood demands, solvent concentrations and equipment heat gain shall govern the ventilation rate of laboratories. Refer to Section 5.5 Mechanical Systems.

B. Environmental Rooms:
Will be designed to provide constant temperature or constant temperature and humidity on a 24-hour per day basis with a dedicated system for each room. Packaged environmental rooms shall be provided with remotely located, modulating refrigeration compressors.

Mechanical - Plumbing/Piped Systems

A. Mechanical- Plumbing/Piped Systems – Refer to Section 5.5 Mechanical Systems

1. Central Systems: The Foundry shall have the following central services available on a modular basis for extension into the laboratories as required:

LW	Laboratory Waste
LWV	Laboratory Waste Vent
HW	Hot Water – 2 fixtures unit per sink, 35 to 50 psi
CW	Cold Water – 2 fixtures unit per sink, 35 psig to 50 psi
PW (DIW)	Purified Water (RO/DEW) – 1 gmp, minimum 35 psi
G	Natural Gas – 4 cfh, 7 inches water column pressure
LV	Vacuum - 0.5 scfm, 26 inches water column of vacuum
A	Compressed Air (100 psig) – 5 scfm, 100 psi
LA	Compressed Air (15 psig) – 1 scfm, 15 psi
N2	Gaseous Nitrogen from Central Liquid Nitrogen Tanks – 1 scfm, 20 psi
TRW	Treated water for equipment and instrument cooling

2. Local Systems: The following services will be used in some laboratories, but not provided as central systems.

HPWCR	High Purity Water for Clean Room
HPW	High Purity Water (Local Polisher)
SG	Special Gases from ventilated gas cabinets
LN2	Liquid Nitrogen to selected labs and Clean Room
Steam	Locally generated for selected labs and autoclaves (Clean Steam)

Electrical Systems - Power

A. Electrical Power - Laboratories

1. Laboratory Power Load: Recommended demand load capability is 20 volt-amperes per square foot of total laboratory area served.
2. Laboratory Service
   a. Panels:
      (1) Location: Provide in a modular fashion anticipated at one panel per two modules.
      (2) Power extension via conduit and wire-to-metal raceways.
   b. Receptacles:
      (1) Generally 125V, 20A duplex receptacles spaced 24 inches apart.
      (2) Receptacles shall not rely on raceways or conduits for grounding; a green wire grounding system will be required.
      (3) 120/208V, 1 phase, and 3 phase receptacles at equipment locations as required.
      (4) Fused disconnects at specific instruments.
   c. Circuiting and Wiring:
      (1) General laboratory bench areas: Connect (2) to (4) receptacles per circuit with adjacent receptacles connected to alternate circuits.
      (2) Equipment locations: connect each receptacle to separate circuit, including refrigerators.
      (3) Use separate neutral for each 20 amps, 120 volt circuit to eliminate negative effects of harmonics.

d. Connected Loads: The programmed-assigned connected load is anticipated to average approximately 32 volt-amps/square foot. Recommended demand calculations shall be based on Table 220-13 of the 1999 National Electrical Code.

3. Standby Power or Alternate Power:
   a. Refer to Section 5.6 Electrical, Lighting and Fire Alarm

4. Cable Tray Systems: A cable tray system shall be extended to access each laboratory module, lab support, office and technical spaces.

B. Electrical Systems – Lighting – Refer to Section 5.6 Electrical, Lighting and Fire Alarm

1. Electrical Lighting - Laboratories
   a. Ambient Lighting
      (1) 80 to 100 footcandles at 3'-0" above floor
      (2) All fluorescent lighting in instrument laboratory spaces should be furnished with RF suppression.
   b. Task Lighting: Provide task lighting at selected locations requiring higher illumination or incandescent lamps with dimming controls used for special purposes.
   c. Energy Management: Use energy saving solid-state ballasts and double switching. Occupancy sensors should not be used for laboratory areas.

Magnetic Interference Issues Related to Imaging Instrumentation

A. Many of the instruments in the Imaging Labs are extremely sensitive to magnetic fields. For this reason, the facility design must carefully consider all sources of magnetic interference. Installation manuals for the specific instruments will describe both the allowable magnetic interference and the best methods for measuring the fields. The following points should be investigated during the Title I design phase of the project:

1. The microscopes should not be located near large electric motors or transformers.

2. The microscopes should be located as far from other laboratory instrumentation producing magnetic fields as possible. This includes NMR's and other electron microscopes.

3. The transformers and power supplies associated with the instrumentation should be located as far away from the units as possible.

4. Installation manuals for the instruments should provide minimum acceptable distances.

5. Location of power supply lines to the instrument suites should be designed to minimize any interfering magnetic fields.

6. For some extremely sensitive instruments, magnetic fields from the reinforcing steel in the floor and surrounding structure (columns and shear walls) have been found to be an issue. Some magnetic fields can be induced in the reinforcing steel by stray currents or ground connections at other parts of the building. This can be reduced by individually isolating the reinforcing steel, if necessary.

7. For some extremely sensitive instruments, magnetic fields from steel chairs and computer equipment (specifically CRT's) may be an issue.

Vibration Interference Issues Related to Imaging Instrumentation

A. Imaging instruments to be installed in the Imaging Labs will have varying levels of vibration sensitivity. This vibration can be either acoustical or mechanical. Specific requirements can be found in the instrument's installation manuals and should be thoroughly investigated during the Title I design phase. In general, it is good practice to understand the following issues:

1. In some cases, near silent airflow is required.
2. It may be necessary to provide sound absorbing wall and floor materials in the microscope room.
3. Microscope rooms should be sound insulated, and preferably away from main corridors.
4. Instruments should be installed on grade level. Isolated slabs should be investigated.
5. Instruments should be located away from street traffic, loading docks, elevator shafts and mechanical rooms.
6. Instruments should be located away from other noisy lab functions such as shops, testing equipment, etc.

Life Safety Systems

A. Fire Suppression System – Refer to Section 5.5 Mechanical Systems

B. Fire Alarm System – Refer to Section 5.6 Electrical, Lighting and Fire Alarm

C. Emergency Shower/Eyewash: Provide per ANSI Z358.1-1998

D. Drench Hose Units

1. Locate combination drench-hose/eye wash at each major sink in each laboratory
2. Double spray-headed, hands-free operation.

5.4 STRUCTURAL SYSTEMS

Design Criteria

1. Live Loads:

a. Laboratory Floors:	100 psf	
b. Office Floors:	80 psf	
c. Stairs and Exit Corridors:	100 psf	
d. Roof (areas w/o mechanical equip):	20 psf	
e. Mechanical Areas:	100 psf	or weight of equip. + 50 psf
f. Parking Deck at Central Utilities:	50 psf	

2. Vibration:

a. Laboratory Floors (U.O.N.):	2000 μ-inches/sec
b. On-grade area at LL1 and LL2:	125 μinches/sec
c. Balance of LL1:	2000 μ-inches/sec
d. Offices:	0.005 G (acceleration)

3. Seismic:

a. Seismic Zone: 4	$Z = 0.4$	
b. Importance Factor:	$I = 1.0$	
c. Soil Profile Type:	S_D	(May be S_C after excavation to foundation level)
d. Near Source Factors:	$N_a = 1.5$;	
	$N_v = 2.0$	
e. Seismic Coefficients:	$C_a = 0.66$	(0.6 for S_C);
	$C_v = 1.28$	(1.12 for S_C)
f. R Factor (MFB):	$R = 7.0$	(Eccentrically Braced Frame)
g. R Factor (CUB):	$R = 4.5$	(Bearing Wall/ Concrete Shear Wall)

h. Dynamic Analysis is expected to be required.

i. LBNL Special Conditions:
   1) h_n shall be measured from top of lowest floor exposed to weather on at least one side.
   2) Dead Load used to resist overturning shall not exceed 0.75W.

4. Wind:

a. Wind Speed:	75 mph (RD3.22)
b. Wind Stagnation Pressure:	qs = 14.5 psf
c. Exposure:	C

5. Foundation:

Preliminary foundation design criteria are given in the report entitled "Geotechnical Investigation/ Proposed Molecular Foundry Building/ Lawrence Berkeley National Laboratory/ Berkeley, California" prepared by Kleinfelder, dated January 29, 2002 and included in *Appendix C.*

Design Criteria:

a. Drilled Piers 8 feet minimum into rock (Neglect upper 3 ft. of pier length):

Allowable Skin Friction:	Dead + Live Load:	1000 psf
	Total Loads:	1500 psf

b. Spread Footings bearing on rock:

Allowable Bearing Pressure:	Dead Load:	2500 psf
	Dead + Live Load:	3000 psf
	Total Loads:	4000 psf

c. Slabs-on-grade:

Soils are potentially expansive. Further evaluation will be performed after site excavation. If soils are found to be expansive, removal and replacement of surface soils will be required.

6. Non-structural Systems Anchorage and Bracing:

RD3.22rev3 requires that most equipment anchorage and bracing be done according to CBC requirements. A special requirement that I_p=1.5 is imposed for "the design of seismic bracing for fume hoods, laminar flow hoods, bio-safety cabinets, and clean rooms containing biological or chemical hazards, including ductwork, filters and blowers associated with these elements".

Structural Systems

Molecular Foundry (MF):

1. Soil Retention: The Molecular Foundry is constructed into a hillside in such a way that earth retention of about 75 feet height will be required at the east side. The retention will have to return to the west along the north and south sides of the building, along the declining slope. It is intended to construct this retention using "soil-nailing" techniques, or other tied-back system, independent from the building itself. A gap will be maintained between the building and the retention sufficient to maintain clearances for lateral displacements (drift) due to seismic forces. The wall will have drainage panels and waterproofing, and will have an inner shotcrete wall to protect the waterproofing. A trench drain will be installed at the lowest level.

2. Foundations: 36 inch diameter drilled cast-in-place piers, approximately 40 to 45 ft. long. The drilled piers will have pier caps and a grid of interconnecting grade beams. Typical columns will require only a single pier, additional piers and larger caps will be required at the ends of braced frame bays.

3. Slabs-on-grade: 6 inch concrete, reinforced with #5 @ 12 inches on center each way. Isolation of the slab from adjacent construction will be required at some locations to minimize structure-borne vibration.

4. Floor Framing at Level LL1: Concrete flat plate, or waffle slab, as required to meet vibration requirements. Columns below this level will be reinforced concrete.

5. Floor Framing (Levels 1 through 4): 3-1/4 in light-weight concrete on 3 inch composite-type metal deck, supported on structural steel beams, girders and columns.

6. Roof Framing: 3-1/4 in light-weight concrete on 3 inch composite-type metal deck, supported on structural steel beams, girders and columns.

7. Cantilever Office Area Framing: The floor decking and framing will be the same as for the typical floors. A heavy steel truss 12 feet deep will be required along the north and south sides of the roof to support tension columns at the extreme western corners of the cantilever office area. The truss will also extend down to the fourth floor in areas adjacent to the cantilever support columns. Lateral bracing for the truss will be required at intervals of about 12 feet from its top down to the roof level. The floor framing for Levels 1 through 4 will be connected to the tension columns and to the cantilever support columns located at the eastern (inboard) end of the cantilever.

8. Lateral Force Resisting System: The lateral force resisting system will consist of steel eccentrically braced frames in both orthogonal directions. Level LL1 will be laterally supported by concrete shear walls.

<u>Central Utility Plant (CUP):</u>

1. Soil Retention: A tied-back system, similar to that to be used for the MF could be used along the length of the east side of the Central Utility Plant. Alternately, this could be a conventional retaining wall, if sufficient lateral resistance can be developed in the building itself to resist the soil pressures.

2. Foundations: The Central Utility Plant will be founded on spread footings, provided that future borings in that area indicate that the foundations will be in the rock strata.

3. Slabs-on-grade: Same as for the MF.

4. Roof / Parking Deck Framing: Reinforced concrete flat plate spanning from exterior supports to a row of columns spaced at about 24 feet on center along the center of the short direction of the building. The slab will be sloped to match the required grades.

5. Lateral Force Resisting System: The lateral force resisting system will consist of reinforced concrete shear walls located at the ends and long sides of the building and transversely at several interior locations.

5.5 MECHANICAL SYSTEMS

Outside Design Conditions

Winter Design: 33 deg. F db (ASHRAE median of extremes)

Summer Design Labs: 90 deg. F db/64 deg. F wb (ASHRAE 0.1%)

Offices: 83 deg. F db/63 deg. F wb (ASHRAE 0.5%)

Cooling Towers and Fluid Coolers: 66 deg. F wb (ASHRAE 0.1%)

Inside Winter Design Conditions

	Temperature (deg. F)	Relative Humidity %RH
Clean Room	68 +/- 1.5	35% minimum
Laboratories	72 +/- 1.5	N/A
Support	72 +/- 1.5	N/A
Offices	72 +/- 2	N/A
Mechanical/non-heated	60 +/- 5	N/A
Electrical	85 +/- 5	N/A

Inside Summer Design Conditions

	Temperature (deg. F)	Relative Humidity %RH
Clean Room	68 +/- 1.5	No dehumidification
Laboratories	72 +/- 1.5	N/A
Support	72 +/- 1.5	N/A
Offices	72 +/- 2	N/A
Mech/non-heated	85 +/- 5	N/A
Electrical	85 +/- 5	N/A

Equipment Load Allowances:

Labs: 8 watts per square foot nominal and up to 16 watts per square foot at maximum air change rate.

Equipment Support: 25 watts per square foot

Offices: 1.5 to 3 watts per square foot

Telephone and Data Closets: Air conditioning to match actual load.

Elevator machine room: Air conditioning to match actual load.

Lighting Load: 1.5 watts per square foot.

Air Change Rates:

	Maximum	Occupied Minimum	Unoccupied Minimum
Labs	10-18[(1)]	10[(2)]	6[(3)]
Equipment	4-35[(1)]	4[(2)]	4
H-3 (if applicable)	15	15	15
Toilets	15	15	4
Offices	3-6[(1)]	3	3

(1) Actual air change rate depends on heat load present

(2) Air change rate will not be below this value regardless of load

(3) Air change rate will not be below this value regardless of load. This value is governed by the fume hood exhaust.

Clean Room: Class 100 - 90 FPM over 70% of the ceiling area.

Ventilation rate: Minimum 20 CFM per person.

Area Pressure Control

Labs: Negative with respect to the hallway

Support areas: Positive, neutral, or negative with respect to the hallway (depending on room function).

Office areas: Positive with respect to the hallway.

Clean Room: Positive with respect to the vestibule. Vestibule positive with respect to the hallway.

Overall Building: Positive with respect to the outdoors.

Fume Hoods:

Chemical fume hoods: Variable volume 110 feet per minute (+/- 10 fpm) face velocity at all sash positions.

Perchloric acid and acid digestion fume hoods: Constant volume 110 feet per minute (+/- 10 fpm) face velocity at 18" open sash position.

Biosafety cabinets:

a. Class II Type A: Fully recirculating. No exhaust duct connection.

b. Class II Type A/B3: 30% exhausted via indirect connection. 70% recirculated.

c. Class II Type B1: 70% exhausted via direct connection. 30% recirculated.

d. Class II Type B2: Fully exhausted via direct connection.

Room Noise Criteria

Typical Laboratories:	RC 35-40 without fume hood
	RC 45-50 with fume hood
Imaging Laboratory:	RC 20-25
Offices:	RC 30-35
Conference:	RC 30-35
Other:	RC 35-40

Seismic Bracing

Mechanical components are installed and braced to conform with LBNL Specification Section 1900.

Vibration Isolation and Acoustic Control

Vibration isolation designs for rotating equipment and acoustic control designs will be as recommended by the specialty vibration / acoustic consultant.

HVAC System

The building is heated and cooled via two 100% outside air single duct variable air volume air handling systems with zone hot water reheat coils. The air handling units are each equipped with 30-35% efficient air pre-filters, space for future odor adsorption filters, electronic filters, hot water pre-heat coil, chilled water cooling coil, variable frequency drive, 2 supply fans each, and 90-95% final air filters.. The estimated supply air handling unit capacities are 75,000 CFM and 85,000 CFM each. Each unit is capable of handling about 63% of the load should one fan within a unit fail.

The office areas are heated and cooled via a single duct variable air volume air handling system with zone hot water reheat coils served by one of the building air handling systems. An economizer system is used to return air to the air handler or exhaust it to atmosphere.

Laboratory quality supply and exhaust variable air volume (VAV) terminal units are provided for the laboratory air handling systems. The supply and exhaust VAV terminals are programmed to satisfy the space temperature and pressure requirements. Reheat coils are omitted in equipment rooms with anticipated heat release.

Commercial quality supply VAV terminal units are provided for the office area air handling systems. The supply VAV terminals are programmed to satisfy the space temperature requirements. There are no exhaust VAV terminals provided. Air is returned to the air handler via ceiling plenums. Space pressure control is provided via return/exhaust fan modulation and is either returned or exhausted by the economizer system.

The clean room area is provided with high volume recirculation air from two 100,000 CFM fans. The fans have 90% pre-filters and cooling coils for motor heat and space heat control. Ventilation air is provided by building air distribution system. Air distribution is by individual ceiling fan-powered HEPA filter modules over 70% of the ceiling. HEPA filtration is 99.99% at Class 100 areas. Air is returned via low returns, wall chases, and a ceiling plenum.

The Utility Center equipment spaces are provided with ventilation only.

Exhaust System

The laboratory exhaust system is a common system for both fume hoods and general exhaust. There are four groups of 2 exhaust fans, one fan operating and one fan standby in each group. The fans operate at constant volume, with atmospheric bypass damper, to maintain exhaust velocity and plume height, but the exhaust system operates as variable volume in response to variable volume supply air to the space. Variable frequency drives are also provided for further volume and dilution control capabilities. The exhaust capacity is estimated to be 25,000 CFM for 2 fan systems and 38,000 CFM for the remaining 2 fan systems.

The chemical fume hoods are variable air volume type hoods. Laboratory quality variable air volume exhaust air terminals are provided for each fume hood to maintain a constant face velocity of 110 fpm at all sash positions. Each fume hood is also equipped with a presence sensor that will turn down the fume hood face velocity to 60 fpm when nobody is working in front of the hood. The proposed basis of design for the fume hood exhaust air terminals is Phoenix Controls. In areas with fume hoods, the supply and general exhaust variable air volume terminals will be the same type as the fume exhaust air terminals.

Any fume hoods used for perchloric acid, acid digestion, or radioisotopes will be constant volume type. Each fume hood is exhausted by its own dedicated fume exhaust fan. The fume exhaust ductwork and exhaust fans will be constructed of all welded type 316 stainless steel, except for the fume exhaust system from the acid digestion hoods, where the ductwork will be constructed of polypropylene and the exhaust fan will be constructed of fiber reinforced plastic. Exhaust air scrubbers will be provided for the acid digestion and perchloric acid fume hood's exhaust. A wash-down system will be provided for the perchloric acid fume hood exhaust duct upstream of the scrubber, and the fume hood. Any flammables or corrosives storage cabinets under the fume hoods or Satellite Accumulation Area cabinets next to the fume hoods will be vented directly to either the fume hood exhaust duct or the fume hood working surface behind the fume hood baffle.

Biosafety cabinets (BSC) Type IIA/B3 fully recirculate air within the room. No exhaust air is provided. Any BSC Type II B2 are provided with dedicated exhaust systems consisting of separate ducts and fans.

The fume/general exhaust fans are of the high velocity discharge type with effective stack heights of up to 40 feet with discharge velocities over 4,000 feet per minute.

We highly recommend conducting a wind tunnel test and analysis to determine the effects of this and surrounding buildings on the exhaust plume and establish any mitigation measures needed.

Special exhausts are provided for:

Flammable chemical storage room. The fan will be of explosion-proof construction. Room will be provided with high and low exhaust inlets.

Glass wash exhaust: All welded stainless steel water-tight duct system with stainless steel exhaust fan.

Direct lab equipment exhaust connections.

Overhead snorkel exhaust.

Work enclosures.

Canopy hoods.

Chilled Water System

The estimated cooling load is about 500 tons. Chilled water is produced by two 350-ton centrifugal, water-cooled, variable speed drive chillers. Chilled water pumping is by a primary /secondary pumping system with one primary pump per chiller and one operating and one standby secondary pump. Secondary pumping is variable volume. There is a cooling tower at grade consisting of 2 cells. One cell operating alone will have the capacity to operate the chiller at higher condensing temperatures, should one tower fail or need service. There is one constant volume condenser pump per chiller. There is a centrifugal separation filtration system for the cooling towers. The chillers, cooling towers and centrifugal separation filter are located at the Utility Center.

Treated Water System

The treated water system consists of two closed circuit fluid coolers and one operating and one standby pump with variable volume operation. The capacity of the system is estimated to be 350 GPM of approximately 88 deg. F to 78 deg. F range. Each fluid cooler operating alone will have the capacity to provide full flow at higher condensing temperature should one fluid cooler fail. The treated water is distributed throughout the building and provides condenser water for fixed building loads such as elevator machine room and telecom room air conditioning units as well as capacity for cooling laboratory equipment and supplementary process chillers and air conditioners.

The existing 4 inch treated water piping serving building 72 from building 62 cooling towers will be removed from the site and served from the new treated water system at the Utility Center.

Heating Hot Water System

The estimated building space heating load is about 8,500,000 BTUH (250 horsepower). Heating hot water source is obtained from two 150 horsepower gas-fired forced draft hot water boilers located in the Utility Center. A variable volume heating hot water pump for each boiler provides circulation heating hot water to the air handling unit pre-heat coils and zone reheat coils.

Steam System

Where required for the autoclaves and glass washers, steam is generated via the equipment integral electric steam generator (they will be specified by the architect/lab equipment specifier as part of the autoclave and glass equipment).

Humidifier System (Clean Room)

If humidification is required, gas-fired humidifiers in the clean room fan/mechanical room serve humidification grids in the clean room air handling units to maintain a minimum average space relative humidity of 35 percent.

Supplement Cooling System

Water-cooled air conditioning units are provided for year-round supplemental cooling for telephone/data and elevator machine rooms. Nominal 1.5 to 3 tons each.

Temperature Control System

The temperature control system is a direct digital control system by Johnson Controls – an extension of the existing campus-wide system. Control valves to the coils and damper actuators are electric/electronic type. Room sensors are DDC type. VAV terminals controllers are DDC Type.

Cold Rooms

Cold room condensing units (see page 5.3-3) are air-cooled or water-cooled type. Supply and exhaust air is provided at 50 CFM per working cold room.

Fire Protection System

The entire facility is protected with a wet pipe sprinkler system. A fire sprinkler riser serves each floor. Each floor is individually annunciated through floor zone control assembly. Hazard classifications and sprinkler flow densities will be based on Ordinary Hazard, Group 2 occupancy, over a 3,000 square feet area. Pre-action sprinkler systems are provided for the Clean Room.

Fire sprinkler water source is from an existing main in the street which has adequate pressure to serve the building without a fire pump. There is an outdoor backflow preventer.

There is a wet standpipe system with risers in the stairwells. The risers are interconnected at the lowest level. Fire department connections are at two street access points to the building.

Where mission-critical equipment requires additional protection, high temperature sprinkler heads or clean-agent primary fire suppression systems with a pre-action sprinkler secondary fire suppression system will be considered.

Cold Water

Cold water source is from an existing main in the street. There is a backflow preventer near the street connection .The pressure reducing station is in the Utility Center. Water supply is separated into industrial and domestic cold water systems. Domestic cold water serves the kitchen, restrooms, drinking fountains, and interaction room sinks. Industrial cold water serves lab sinks and equipment. Water pressure range is 35 to 50 psig.

Separate water meters are provided for the water supply to the main building, the utility center, and cooling tower makeup.

Hot Water

Laboratory hot water is generated by two gas-fired storage type water heaters and domestic hot water is generated by one gas-fired storage type water heater. The water heaters are located in the Utility Center.

Hot water piping is distributed throughout the building and temperature in the hot water mains are maintained with looped systems with circulating pumps. Domestic water temperature is maintained at 110 deg F. Industrial hot water is maintained at 120 deg F. Domestic hot water is piped to the kitchen, restrooms and interaction room sinks.

Higher temperature water required at equipment such as glass washers is generated by local water temperature boosters provided with the equipment.

Emergency Shower and Eyewash

Cold water is piped to emergency shower and eyewash systems. The water is tempered. There are no floor drains provided at emergency showers and eyewashes.

Compressed Utility Gases

Compressed air will be supplied from duplex tank mount air compressors. High purity nitrogen boil-off gas will be supplied to each laboratory from a new on-site liquid nitrogen system. (Note: Liquid nitrogen is transferred to laboratory dewars at the site of the liquid nitrogen storage tank.) Both systems are distributed to the conventional labs and the Clean Room in copper pipe for smaller sizes and stainless steel pipe for larger sizes.

The compressed air system is located in the Utility Center.

Purified Water

CAP II purified water (2 megohm) is provided to the conventional labs and the Clean Room at a rate of approximately 1 gpm per outlet. Where higher purity water is required, it can be locally polished to CAP I.

The front end of the purified water system includes carbon filtration, water softeners (if required by local water quality), reverse osmosis system, booster pumps, ultraviolet sterilization, ion exchange system and a storage tank holding high-resistivity water for use by the laboratories. The same water in storage is further purified for wafer processing use by organic destruction ultraviolet lights, ion exchange, 1.0 micron filtration, bacteria destruction ultraviolet lights, and finally 0.2 micron filtration.

All components are electro-polished (25 Ra) stainless steel where possible. Piping and fittings are PP (polypropylene). Feed water capacity to reverse osmosis will the 5 gpm. Laboratory water (60 gpm) is fed using a supply and return piping system operations at 70 psi and 60 gpm (2" PP piping).

The deionized water system is located in the Utility Center.

Process Vacuum

A central process vacuum system consisting of duplex tank mounted vacuum pumps will be provided to the conventional labs and the Clean Room. Vacuum level is approximately 26 inches. Outlets are be provided throughout the Clean Room and conventional laboratories with a vacuum rate of approximately 0.5 scfm per outlet. Equipment requiring greater vacuum is provided with local special vacuum pumps provided by the users.

Process Waste Systems

A small pH neutralization system is provided to neutralize waste water from the Clean Room and conventional laboratories. Once acid waste has been neutralized, it is discharged to the on-site sanitary sewer system.

Solvent wastes generated by the building are collected within containers at the point of generation and removed for off-site disposal.

Spill Storage

Spill storage is not required.

Natural Gas

Natural gas is distributed to laboratories at 7" water column pressure at about 4 cfh per working outlet. Natural gas is supplied from on-site gas main through gas meter, pressure regulator, and automatic seismic gas shut-off valve. Natural gas will also be supplied to water heating and space heating equipment.

Fuel Oil System

A fuel oil system is provided for generator operation consisting of 3000-gal above-ground, double-containment diesel fuel tank (48-hour operation), a day tank near the generator, and fuel pumping and control equipment.

Utility Distribution

Utility distribution from the Utility Center to the building is via an accessible underground trench.

Emergency Power Connection

The fume hood exhaust systems, lab supply and general exhaust fans (for minimum 1 CFM/SF building air circulation), special exhaust systems, minimum Utility Center ventilation, and supplement cooling AC systems are connected to the emergency power generator (partial equipment cooling water system operation may be required).

Testing and Balancing

Testing and balancing is performed by a specialty testing and balancing firm (TAB).

Testing and balancing are limited to air and water systems.

Commissioning

The HVAC systems are commissioned by the contractor using Functional Performance Test Procedures produced by a Contract-independent commissioning agent who works directly for the Owner.

Energy Conservation Features

Equipment efficiencies to conform to California Energy Efficiency Standards, or better.

High efficiency variable speed drive chillers.

Primary/secondary chilled water pumping with variable volume secondary.

Oversize cooling towers with variable speed drives.

Oversize equipment cooling water fluid coolers with variable speed drives.

Variable volume equipment cooling water pumping.

Lowered face velocity cooling coils for lower pressure drop.

Oversize filter banks for lower pressure drops.

1500 feet per minute maximum air duct velocity.

Variable volume, single duct, terminal reheat supply air handling, systems.

Variable volume fume hoods with presence sensors for face velocity reduction when not in use.

Return air with economizer for office areas.

Ventilation only for the Utility Center.

High efficiency motors with variable frequency drives throughout.

Chilled water temperature reset.

Heating hot water temperature reset.

Non-use hours temperature and air change rate setbacks as well lab and domestic hot water circulation shut-down and lighting shut-down.

Elevator hoistway normally closed automatic vents.

Direct digital building automation controls throughout.

Automatic lighting control scheduling integrated into the building automation system.

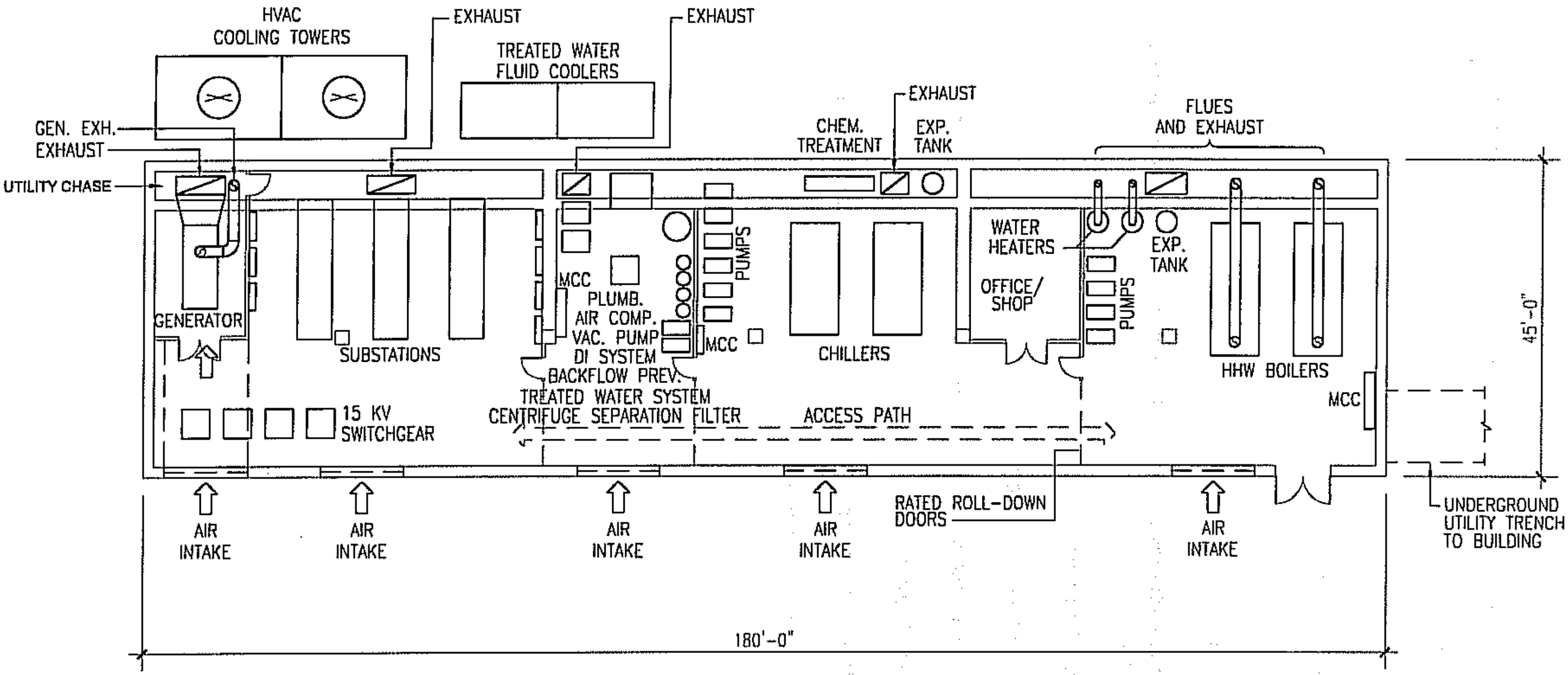
Listed water conserving plumbing fixtures.

Listed water conserving faucets – metering or sensor operated faucets in public lavatories.

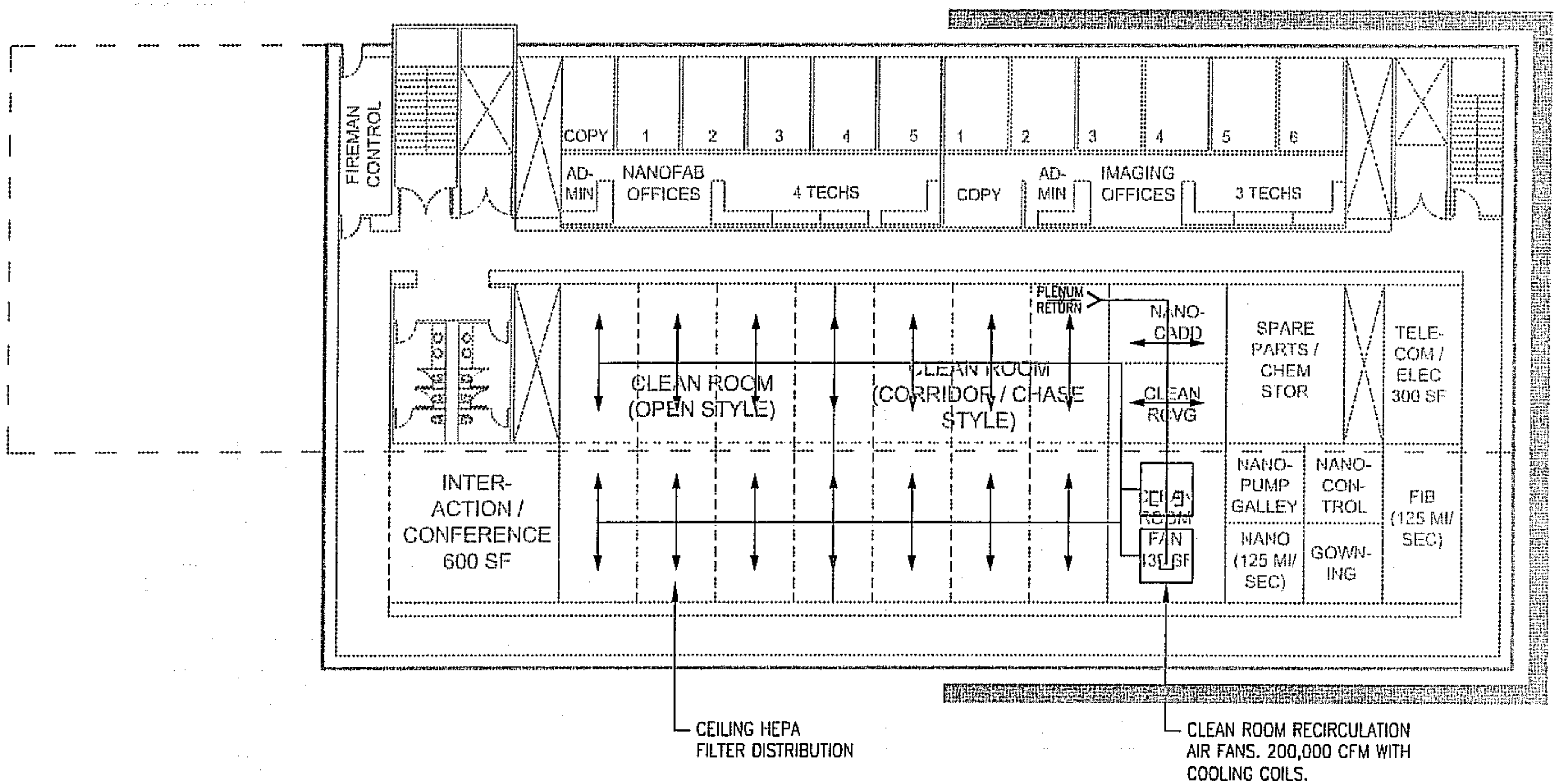
Gas-fired water heaters with 80% efficiency or better.

Insulated hot water piping.

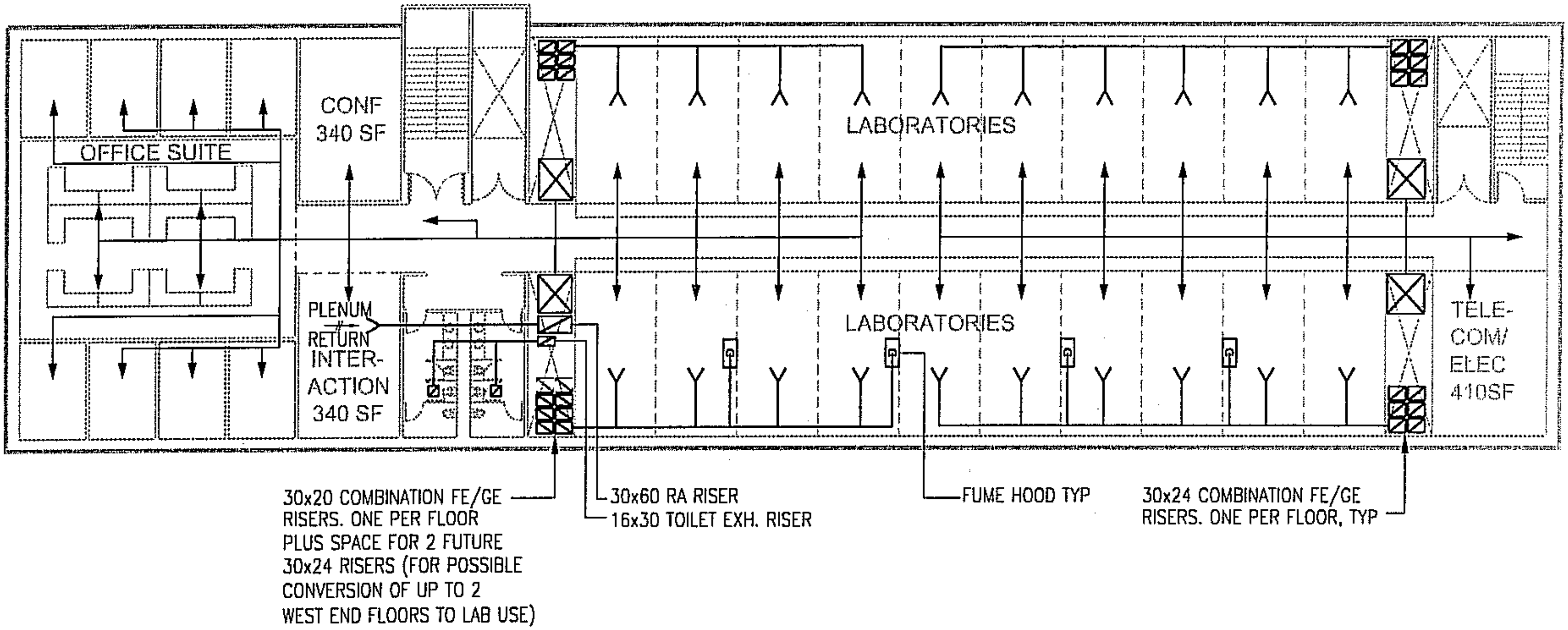
Full commissioning.



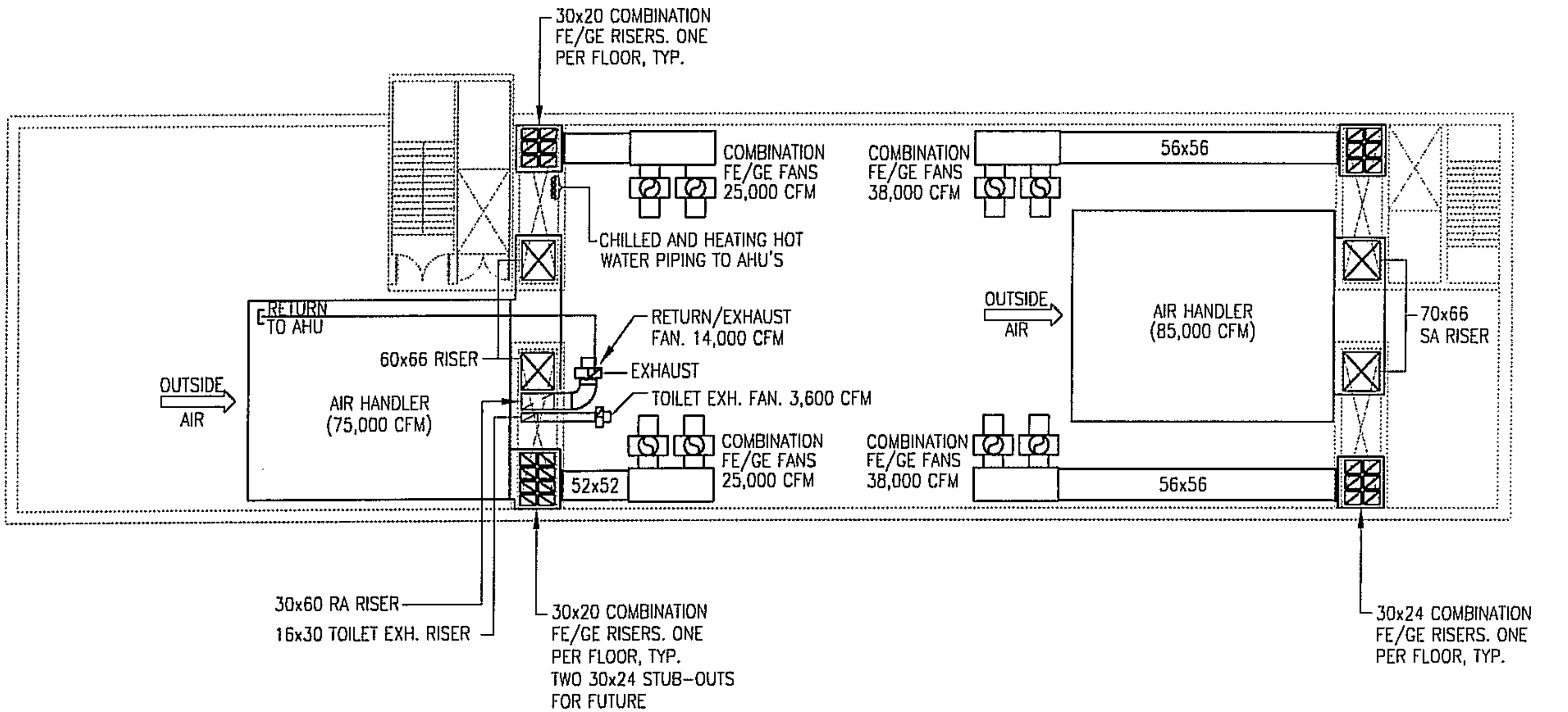
UTILITY PLANT
Not to Scale



LOWER LEVEL 1 - MECHANICAL PLAN
Not to Scale



TYPICAL LAB LEVEL - MECHANICAL PLAN
Not to Scale



ROOF LEVEL - MECHANICAL PLAN
Not to Scale

5.6 ELECTRICAL, LIGHTING, & FIRE ALARM

Electric Service

Electric service is provided by the existing 12,470 volts, 3-phase, 3-wire, medium voltage switching substation SW-A5 located along Lawrence Road near the Strawberry Canyon entrance gate. Two existing circuit breakers along with its existing medium voltage underground feeders are reused. The existing feeders are intercepted at the existing manhole EMH-99 and extended to the new medium voltage sectionalizing switchgears MV-SWA1 and MV-SWA2 at the Utility Center of the Molecular Foundry Building.

Primary Power Distribution

Primary power is distributed by the medium voltage switchgears MV-SWA1 and MV-SWA2 to the 2 substations SS-A1 and SS-A2 in the Utility Center of the Molecular Foundry Building. The existing medium voltage services to existing Building 62 and 66 substations are reconnected to the new switchgears MV-SWA1 and MV-SWA2.

Secondary Substations

The estimated load for the Molecular Foundry Building and its Utility Center is 3,800 KVA. This estimated load includes a 30 percent spare capacity. There are two secondary substations each rated 2,000 KVA, 3-phase, 12,470-volt dual circuit primary, cast-coil dry type transformers, and electrically operated low-voltage power circuit breakers at 277/480 volts, 3-phase, 4-wire. The transformers have provisions to add future fans to increase capacity by 40 percent.

Secondary Power Distribution

Secondary power distribution in the building is 277/480-volt, 3-phase, 4-wire, and 120/208-volt, 3-phase, 4-wire derived from step-down dry type transformers.

Emergency Power System

The emergency power source for the Molecular Foundry Building is a Level 1 classification. A diesel-engine generator set located within the Utility Center. The generator is 750 KW/937.50 KVA, 80% power factor, 277/480-volt, 3-phase, 4-wire. The generator system includes a permanent load test bank as well as circuit breakers, controls, and interlocks to allow for occasional testing. There is fuel storage for 48 hours of operation.

Two automatic transfer switches are provided. One automatic transfer switch serves life safety loads such as exit signs, egress lighting, and the fire alarm system and transfers within 10 seconds of a power outage. The second automatic transfer switch serves non-life safety loads such as certain mechanical systems, fume hoods, freezers, cold rooms, incubators, and other select laboratory equipment systems and transfers after 30 seconds of a power outage.

Uninterruptible Power Supply (UPS)

A central or local UPS system is not provided. If an equipment or laboratory instrument requires a UPS power supply, it will be provided by the lab users.

Lighting

The interior lighting system, throughout the Molecular Foundry Building, will generally consists of energy efficient fluorescent fixtures. The fixtures will consist of T-8 fluorescent lamps and electronic ballasts. Lighting controls and overall lighting efficiency will be in conformance with California Energy Efficiency Standards, or better.

The exterior lighting system for this facility will include parking lot lighting, landscape lighting, and the building exterior. The building exterior lighting will be limited to the exit doors at/or near outdoor equipment.

Electrical System Metering and Controls

The Molecular Foundry Building facility electrical power distribution system is equipped with an integrated microprocessor-based power metering, protection, and central control system. The primary point of metering will be at the building's unit substation low-voltage switchgear main circuit breakers. Sub-metering will be provided at each level to determine the energy usage of various users. This system has its own computer station and also integrated with the building control systems' computer station.

Grounding

Ground bus bars and risers are located in electrical closets for use by lab equipment that needs supplemental grounding. A perimeter grid with bonding to structural columns is provided.

Fire Alarm System

The building interior fire detection and alarm system is an addressable system as manufactured by Siemens-Cerberus, compatible with the campus existing systems, and transmits an alarm to the LBNL Fire Dispatch Office. Annunciator panels are provided at Level 3 and Level 1 entries to the building. The fire alarm system consists of manual pull stations, strobes, horns/strobes, monitoring of fire sprinkler flow and tamper switches, elevator recalls, and duct smoke detectors for air handling equipment. Building-wide smoke detection is not provided. Where mission-critical equipment or areas require additional protection, special smoke detectors commensurate with the protection needs are provided.

Each floor is on a separate water flow zone and critical equipment is shut down automatically upon actuation of its zone.

Seismic Bracing

Electrical components are installed and braced to conform with LBNL Specification Section 1900.

Energy Conservation Features

Equipment efficiencies to conform to California Energy Efficiency Standards or better.

277- volt lighting circuits.

Motion sensors for lighting control in offices, conference rooms, and toilets.

Automatic lighting control for select areas.

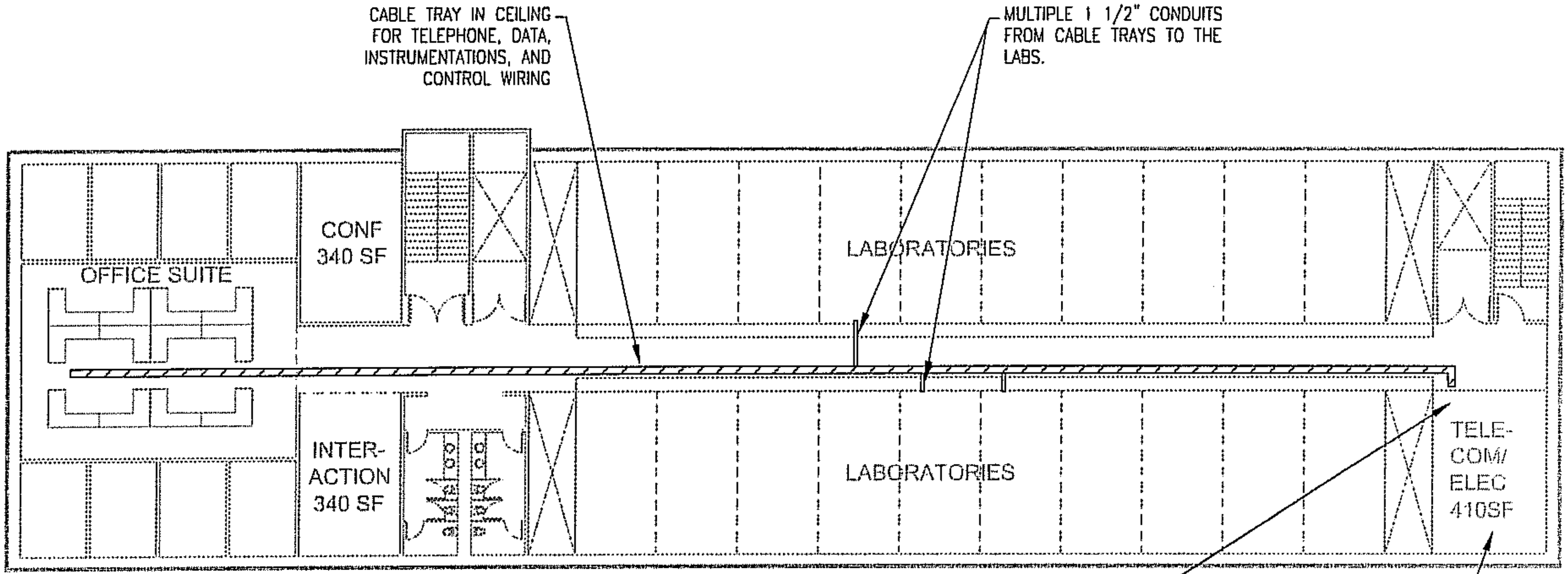
Separate lighting control for day-lighted areas.

Multiple level lighting control zones in lab areas.

Task-oriented lighting designs.

High efficiency transformers.

Over-sized feeder conductors for reduced energy losses.



TELEPHONE-DATA CLOSET TO HOUSE:

1. 3/4" THICK PLYWOOD BACKBOARDS ON ALL WALLS.
2. TERMINATION BLOCKS FOR TELEPHONE WIRING.
3. OPEN-STYLE ALUMINUM EQUIPMENT RACKS, FLOOR MOUNTED FOR DATA COMMUNICATIONS WIRING.
4. 12x12x4 TERMINAL CABINETS FOR PAGING AND SECURITY SYSTEMS.
5. LADDER TRAYS.
6. EMERG. POWER SUBPANEL 120/208V FOR TEL-DATA EQUIPMENT; ONE SUBPANEL FOR EVERY 3 FLOORS.

ELECTRICAL CLOSET TO HOUSE:

1. ONE 120/208V SUBPANEL FOR OFFICE/ADMIN. AREAS.
2. SUBPANELS FOR LAB AREAS; ONE 42-CKT., 120/208V FOR EVERY 1,100 SF. OF LAB SPACE.
3. TWO EMERGENCY SUBPANELS 120/208V, ONE SUBPANEL IS FOR NORTH AREAS OF THE BUILDING AND THE OTHER FOR THE SOUTH AREAS.
4. NORMAL POWER LIGHTING SUBPANEL, 277/480V.
5. EMERGENCY POWER LIGHTING SUBPANEL, 277/480V, ONE SUBPANEL TO SERVE 3 FLOORS.
6. FIRE ALARM TERMINAL CABINETS.
7. LAB INSTRUMENT GROUND BAR AND GROUND RISER CABLE.
8. SPACE FOR CONDUIT RISERS.

TYPICAL LEVEL - ELECTRICAL AND TELECOMMUNICATIONS PLAN
Not to Scale

5.7 TELECOMMUNICATION SYSTEMS

Telephone (Voice)

A structured cabling system is provided for voice telephone system consisting of Category 6 compliant unshielded twisted pair (UTP) copper cables including wall jacks, cable trays, wiring, raceway, terminal blocks, cabinets, back boards, and riser and backbone cabling. The backbone cable is a 600-pair, copper cable that is run from the main voice/data room (BDF Room) to existing Telephone Node Building 62B located south of Building 62. The riser cables from the BDF room to each local intermediate distribution facility (IDF) closet is 200 pair copper cable.

Data Communications-Local Area Network

A structured cabling system is provided for data communications system consisting of wall jacks, Category 6 compliant unshielded twisted pair wiring to outlets, raceways, terminal backboards, cable trays, equipment racks, grounding, patch panels, power strips, fiber patch panels, cabinets, backboards, riser and backbone wiring. Selected lab areas are provided with fiber optic cable drops.

A typical telephone and data outlet has four-plex jack: 2 data, one voice and one spare. A ¾-inch conduit is run from each outlet box to the nearest cable tray. This common conduit system is used for telephone and data wiring.

LBNL provides all electronic equipment (switches, routers, and file servers).

The backbone wiring is two 48-strand fiber optic cables from the lab's BDF room to existing Data Node Building 62B located southeast of the Molecular Foundry Building. The riser cables are 12-strand fiber optic cables from BDF room to each satellite IDF closets.

Integrated Communications System (ICS)/Paging/Security

Each floor of the building will have an IDF communications closet from which telephone, communications, building entry security system, and fiber-optic data circuits will be distributed. Within the building, the cable trays and raceways will be run to the office and laboratory areas from local IDF communications closets. Raceways and wiring for the paging system equipment, intercom cables, and speakers will provide the Laboratory public address system to all required areas in the building and Utility Center building.

Security System

A raceway only system is provided to facilitate the installation of an electronic security system.

5.8 CIVIL ENGINEERING AND SITE DEVELOPMENT

Refer to page 5.8-2 for the existing site utilities diagram and page 5.8-3 for the proposed site utilities diagram.

Site Earthwork

The site excavation for the building totals approximately 26,000 to 30,000 cu. yds. The fill for the proposed lower access road and site, without the use of retaining walls down hill of the access road, totals approximately 25,000 cu. yds. With some adjusts during design the site earthwork quantities are expected to balance. The down hill side of the proposed access road downhill with a 2:1 slope will be designed with a geo-tech type reinforcement. The 2:1 slope will extend onto the dirt road below. Retaining walls will be required at various locations on the site.

Site Utilities

Utilities corridor

New water supply, electrical power and natural gas service will be routed along the north side of the proposed Molecular Foundry. The services will be routed from points of connection on Lawrence road along the north of the proposed Molecular Foundry into the south side of the proposed central plant.

Water Supply

An existing 12" high pressure cold water (HPCW) main is routed in Lawrence road with fire and domestic water service to building 72. Fire protection and domestic water service for the new building will be supplied off the existing 12" HPCW on Lawrence road. New fire hydrants will be placed along the lower site with a connection to the existing 6" HPCW at the southwest corner of building 66.

Storm Water

Existing storm water drainage piping crosses the proposed building footprint. An existing 12" main storm drain line requires re-routing to the proposed lower access road. The re-routed line will extend approx. 450' from the lower side of building 72 to the lower side of building 66. New site storm drainage will collect and discharge into this re-routed line.

Sanitary Sewer

An existing 6" sanitary sewer crosses the proposed building footprint. This line will require re-routing to the proposed lower access running parallel to the re-routed 12" storm drain. The re-routed line will extend approx. 450' from the lower side of building 72 to the lower side of building 66. New sanitary sewage form the proposed facilities will discharge into this re-routed line.

Natural Gas

An existing 3" high pressure natural gas main crosses the proposed building footprint. The 3" main will be re-routed between the proposed building and the existing building 72, from the lower site running up to Lawrence road approx. 210 feet.

Compressed Air

An existing 3" compressed air line crosses the proposed building footprint. The line needs to be re-routed into the proposed lower access road. The re-routed line will extend approx. 360' from the lower side of building 72 to the lower side of building 66.

Treated Water

Existing supply and return treated water piping which serves building 66 crosses the new building footprint. It is assumed that this piping will be abandoned and removed. It is assumed that new treated water will be supplied from the proposed Utility Plant. Phasing may be required.

Power

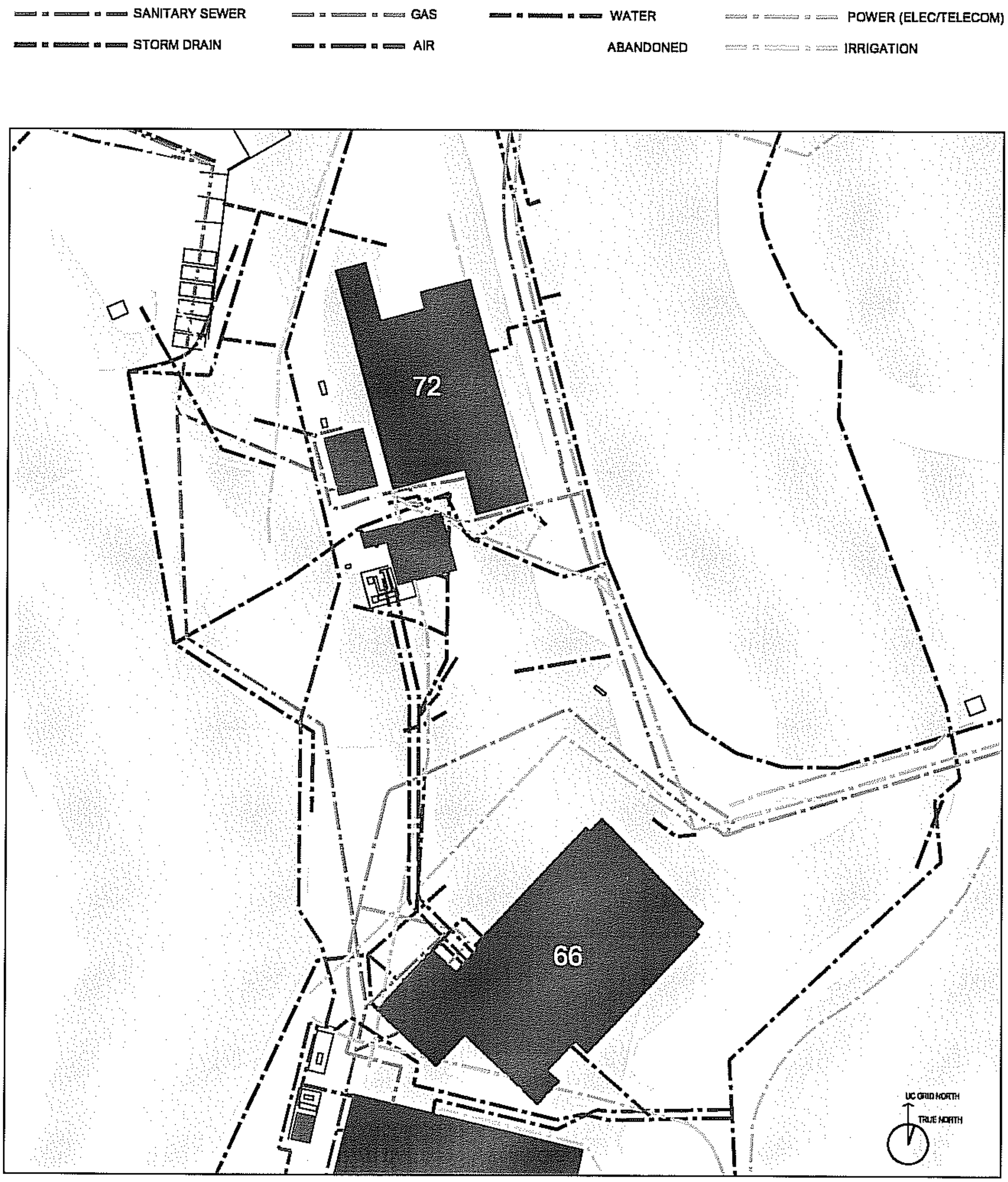
Electric service at 12,470-volt will come from the existing campus substation SW-A5 located along Lawrence Road near the Strawberry Canyon entrance gate. Refer to Electrical Section for additional details.

Telecommunications-Telephone and Data

Services will come from the existing telephone and data communications node located south of Building 62. Refer to Electrical and Telecommunications for additional details.

Existing Site Utilities

The existing site utility locations shown on the following diagram have been extrapolated from documentation provided by LBNL. Exact locations to be confirmed by future site survey.



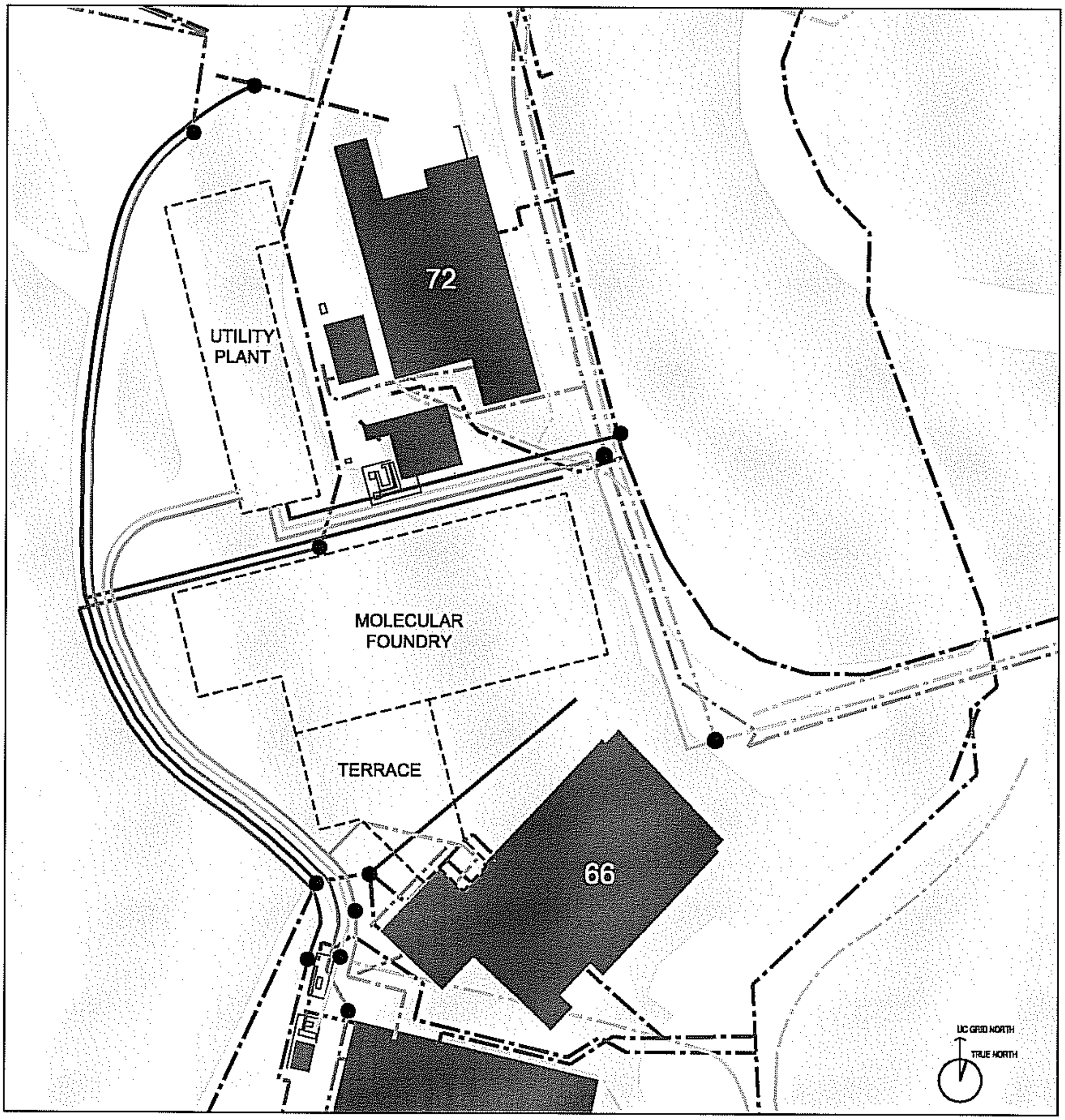
Proposed Site Utilities

The following diagram describes the locations of the proposed utilities for the Molecular Foundry. All connections to existing utility locations to be confirmed by future site survey.

SANITARY SEWER — GAS — WATER — POWER (ELEC/TELECOM)

STORM DRAIN — AIR — IRRIGATION

● CONNECTION POINT TO EXISTING UTILITY



5.9 LANDSCAPE ARCHITECTURE

The landscape is divided into three zones; a terrace to the south between the Molecular Foundry and Building 66, natural zones to the west and east and a parking zone to the north at the main entry. The location of the terrace has been carefully chosen to minimize the impact on the natural landscape and fulfill the desire for a significant connection between the Molecular Foundry and Building 66. The terrace is intended as a useable space for the occupants of all buildings on the hillside and is planned with a mixture of paved and planted areas. The entry parking lot will be paved with special materials and have some planted areas. The remaining hillside will be left natural with grass and tree growth.

The design intends to use indigenous plants to relate to the existing context. The planting will consider the LBNL vegetation guidelines. Special attention will also be paid to the type of vegetation to minimize the impact of fire storms caused by the severe Mount Diablo winds. A system to gather gray water will be investigated and integrated with the landscape design if appropriate and desirable.

5.10 SUSTAINABLE DESIGN PRINCIPLES

The Molecular Foundry will exemplify sustainable, healthy, and environmentally responsible design and construction. Its environmental impact will be minimized through attention to sensitive site development, water and energy conservation, indoor air quality, environmentally responsible building materials, and waste reduction. Green building design features for architectural, structural, mechanical and electrical systems will be employed to the maximum extent possible.

Environmentally Sensitive Siting and Orientation

Southern exposures will be minimized. Sunshades, recessed windows, and landscaping screens will control southern solar loads.

Office Environment

Maximum flexibility will be obtained by use of open office areas where possible. Highly reflective ceiling light shelves and indirect lighting will be used to reduce glare.

Indoor Air Quality

The building will have operable windows and adequate ventilation, and will use no- or low-emitting building materials and finishes (paint, sealants, carpet, cabinetry). Interior landscaping can serve as a low-tech means of removing pollutants from the air.

Energy Conservation

Insulation

To reduce heating and cooling loads, high R-value insulation will be installed external to the building's thermal mass. The building's double-glazed windows will have a spectrally selective low-emissivity coating, with U-value and solar heat gain factor optimized for each exposure direction.

Lighting

Light shelves, tall windows, and skylights will provide daylighting to reduce electrical demand. The building's integrated lighting controls will use photo cells, dimmers, and motion sensors to control power use in response to daylighting, occupancy, user preference, and load shedding conditions. Plug loads will have workstation occupancy sensor controls.
Indirect/direct lighting fixtures will have dimming electronic ballasts. Exterior lighting will consist of T5 fluorescent lamps with motion sensors. Exit signs will be electroluminescent (ELD). Energy-efficient office equipment will include Energy Star® computers, monitors, printers, fax machines, and copiers. An automated energy management system will be tied into the Labwide Facility Monitoring and Control System.

Building Systems

The design of building systems will promote energy efficiency. Ventilation and temperature control will be based on individual preference and occupancy. Indirect/direct evaporative cooling will cool supply air. Ventilation ducts and pipes will be tightly joined and sized to minimize pressure drops.

Boilers

Heat recovery on the exhaust air stream will be used to preheat boiler water for space heating. The boilers will be modulating gas-fired with condensing heat exchangers. A condensing gas-fired water heater will provide domestic hot water; heat will be recovered from the waste water stream.

Electrical System

The electrical system will include loss-optimized circuit conductors and amorphous-core transformers.

Plumbing

Low-flow plumbing fixtures and water-saving appliances will conserve water. The building design will minimize construction waste through standard dimensioning of materials, use of full-size panels, etc. Construction, demolition, and operational waste will be recycled.

Building Materials

Environmentally responsible building materials and finishes will be selected for their low environmental impact throughout their life cycles (raw materials, manufacturing, shipping, installation and use, and next use). Exterior siding will be maintenance-free, factory-finished metal. Interior finishes, including gypsum board, acoustical tiles, ceramic tiles, and carpet, will use recycled materials. Wood products will be certified, and will not include any wood products from old-growth forests. Paints and coatings will contain low-volatility or non-volatile organic compounds (VOCs). Structural and reinforcing steel will have 100-percent recycled content, with a minimum of 75-percent post consumer steel. Fly ash will replace up to 20-percent of portland cement. Concrete formwork will be reusable—constructed of steel, fiberglass-reinforced plastic, or wood.

6.1 APPLICABLE CODES & GUIDELINES

Applicable Codes and Guidelines

The design and construction of the facility shall conform to the current edition of all applicable building codes, laws, and regulations under the jurisdiction of the local building officials. In the event of conflict or inconsistency between standards or codes, those that are more restrictive shall govern.

A detailed code search must be performed at the beginning of the Title I Design phase after the scope of the project has been fully developed. The information in this section is not the result of a comprehensive code search, but merely a listing of code and standard requirements that have been determined to date.

Adopted Building Codes (Latest edition as adopted by LBNL fire marshal)

- California Building Code (CBC)
- California Plumbing Code (CPC)
- California Mechanical Code (CMC)
- California Electrical Code (CEC)
- California Fire Code (CFC)
- California Energy Code (Title 24)
- California Code of Regulations; Title 8, Title 19
- National Fire Protection Association (NFPA) National Fire Codes
- National Electrical Safety Code, ANSI C2
- NFPA 10, Fire Extinguishers.
- NFPA 13, Installation of Sprinkler Systems
- NFPA 14, Standpipe and Hose Systems
- NFPA 24, Private Fire Mains
- NFPA 45, Fire Protection for Laboratories Using Chemicals.
- NFPA 45-3-4.1, Egress.
- NFPA 45-13, Automatic Sprinklers.
- NFPA 54, National Fuel Gas Code
- NFPA 70, National Electrical Code
- NFPA 72, Fire Alarm Code
- NFPA 90A, Air Conditioning and Ventilating Systems
- NFPA 101, Life Safety Code
- NFPA 110, Emergency and Standby Power Systems
- NFPA 220 – "Standard on Types of Building Construction", current edition

Design Guidelines and Standards

- National Institute of Occupational Safety and Health Act (OSHA)
- Occupational Safety and Health Standards, 29 CFR Part 1910, Dept. of Labor
- Americans with Disabilities Act (ADA)
- The American Society for Testing and Materials (ASTM) Standards
- Underwriters' Laboratories, Inc. (UL) Standards and "Building Materials, Fire Protection Equipment, and Fire Resistive Directories"
- American Institute of Steel Construction (AISC) Manual of Steel Construction
- Sheet Metal and Air Conditioning Contractors' National Association Standards
- The American Society of Heating and Air Conditioning Engineers Handbooks
- The American Society of Mechanical Engineers (ASME) Standards and Codes
- General Services Administration 41 CFR Part 101-19
- American National Standards Institute (ANSI) Standards
- Energy Conservation Performance Standards, 10 CFR Part 435
- Safety and Health Regulations for Construction, 29 CFR Part 1926, Dept. of Labor
- Environmental Protection Agency, 40 CFR Parts 264 and 265
- Life Cycle Costing Manual for the Federal Energy Management Program,
- National Institute of Standards and Technology, Handbook 135.
- American Concrete Institute (ACI) Manual of Concrete Practice; Parts 1 through 5
- Air Moving & Conditioning Association (AMCA) Fan Test Code
- Factory Mutual Engineering Corp. Approval Guide & Loss Prevention Data Sheets
- ASHRAE 110-1995 (Methods of Testing Performance of Laboratory Fume Hoods).
- ASHRAE HANDBOOK, 1993: Heating, Ventilating and Air Conditioning Systems and Applications. Chap. 30: Laboratories.
- ANSI Z358.1 (Emergency Eyewash and Shower Equipment).
- ACGIH Industrial Ventilation Manual.
- NIH Guidelines for the Laboratory Use of Chemical Carcinogens, (US DHHS).
- Prudent Practices for Handling Hazardous Chemicals in Laboratories. National Research Council. National Academy Press, 1981.
- Safety in Academic Chemistry Laboratories, American Chemical Society, 1990 (suggestions for design and use).
- CDC-NIH Biosafety in Microbiological and Biomedical Laboratories, (US DHHS, 1993).
- Standard Number 49, Class (II) (Laminar Flow) Biohazard Cabinetry. National Sanitation Foundation, (1992). (Being revised)

- Guidelines for Research Involving Recombinant DNA Molecules, (NIH Guidelines) United States Department of Health and Human Services

LBNL Guidelines and Standards

- LBNL Long Range Site Development Plan
- "Lateral Force Design Criteria", RD3.22rev3 of LBNL Project and Design Management Procedures Manual
- Lawrence Berkeley Laboratory Health and Safety Manual, Publication 3000

6.2 PRELIMINARY TITLE 24 CODE ANALYSIS

Building Code: 1997 Uniform Building Code with 1998 California Modifications

Building Area: 94,500 GSF

Occupancy: H-8

Construction Type: Type I – F.R.

Basic Allowable Area: Unlimited

Maximum Number of Stories: (Table 5-B) 10 stories

Seismic Zone: Zone 4

Maximum Building Height: Assume six-story building with a combination of 20' and 16' floor-to-floor heights. (20' + 20' + 16' + 16' + 16' + 16' + 12' = 116'). Per Table 5-B, maximum building height is unlimited.

Highrise Classification: The fire truck access for the building will be located at the lower level 1. From this access point to the highest level of occupancy (level 4) the dimension is 68'-0". This dimension is less that the 75' rule for highrise classification so the building will not be classified as a highrise. The local fire official has requested some components to be incorporated into the design such as a fire control room and dual stair access to the roof. Stair pressurization, vestibules at stairs and elevators, and life safety upgrades will not be required.

H-8 Horizontal Exiting Separation: The required H-8 horizontal exiting separation will be located down the middle of the lab wing at approximately the mid-point of the lab. It will run in the north-south direction. This will have 2-hour wall construction. The mechanical systems will not cross this separation.

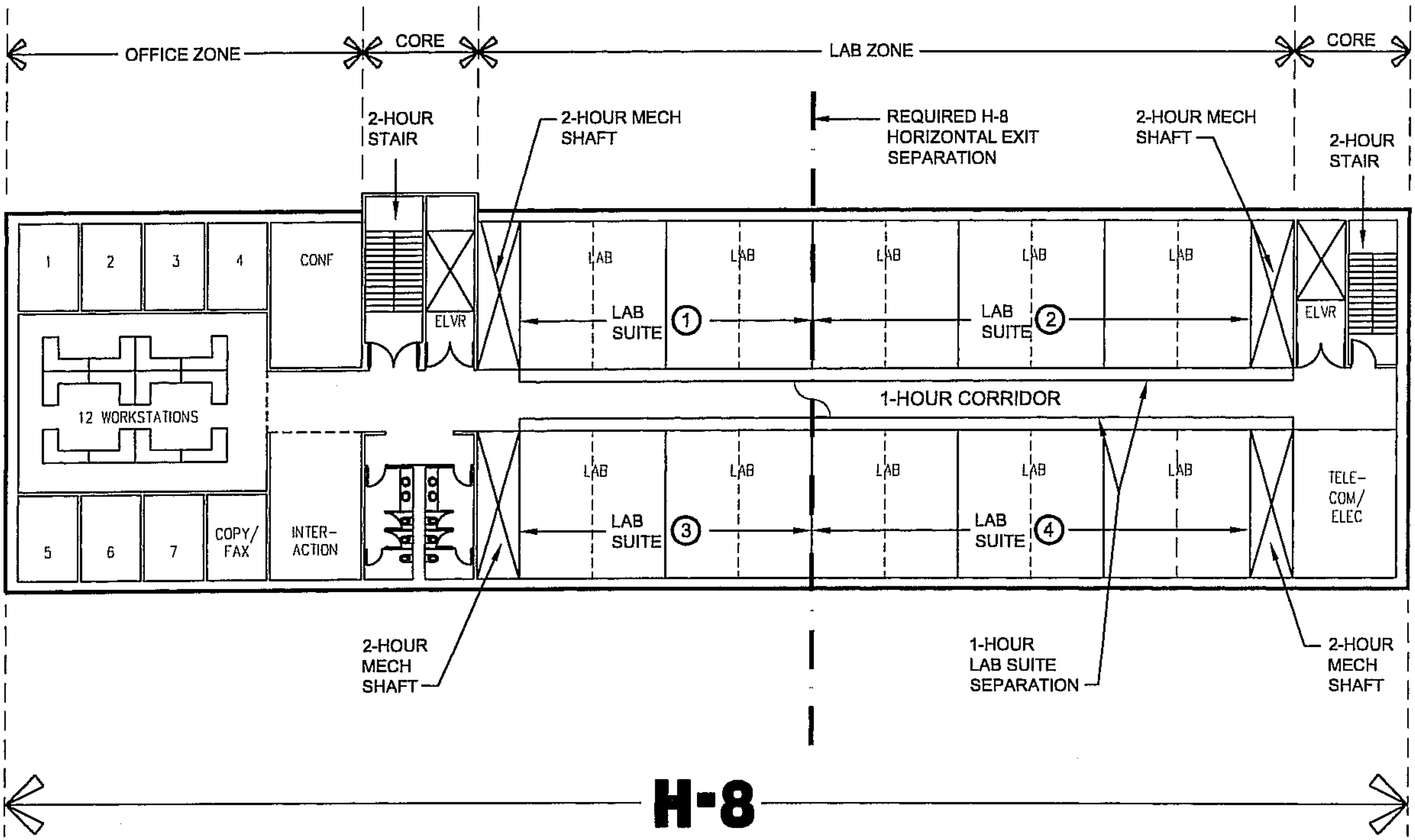
Lab Suites: It is proposed that there be four lab suites per floor that are separated by the horizontal exit separation wall and the 1-hour rated corridor.

Basement Classification: Per definition of a story section 220-S, the structure has no basements based on the 6' and 12' rule.

Summary: The laboratory building will be built as a Type I – F.R. building. The proposed 94,500 GSF on six-stories is within the area allowed (unlimited) for this type of construction. The assumed 88' building height complies with the maximum allowable height as shown in Table 5-B (unlimited). This structure will not be considered highrise.

6.3 CODE ANALYSIS DIAGRAM

TYPICAL LAB LEVEL
Not to Scale



7.1 BASIS FOR THE ESTIMATE

Construction Cost Estimate

The construction cost estimate is based on an evaluation of the program requirements, site conditions, the utility infrastructure, the conceptual design documents, the written building systems descriptions and input from the consultant team.

The cost estimate is organized with a detailed listing of building components as potentially priced by each specialty subcontractor and includes both labor and material pricing. Unit pricing is based on experience, a database of past projects, vendor quotes, current labor rates, R.S. Means, Richardson, and other recognized cost estimating sources. This methodology assures a thorough accounting of the proper costs to accomplish the project and provides a thorough model for tracking the future building design to maintain the project budget. The format is also very clear to building contractors and serves as a good tool for translating the design into construction and evaluating contractor bids.

The estimate is based on a 24-month construction period, a construction mid-point of February 2005, a single construction phase, prevailing labor rates, competitive bidding between five to seven general contractors, competitive bidding between a minimum of three subcontractors for each building system and LBNL site access conditions.

The quoted unit prices for each item include all subcontractor markups. The general contractor's general conditions, overhead and profit are calculated on top of the total subcontractor costs for the entire building cost. The general contractor's general conditions and overhead include all costs to mobilize and manage the project including such items as temporary utilities, site fencing, security, temporary office trailers, signage, clean up, insurance, bonds and safety programs. The general contractor's profit is calculated on the total amount of the subcontractor costs and the general conditions.

DOE Escalation Rates

The following table lists the published U. S. Department of Energy annual escalation rates.

Annual DOE Escalation Rates

FY 2002 at 2.6%
FY 2003 at 2.8%
FY 2004 at 2.8%
FY 2005 at 2.9%
FY 2006 at 2.9%
FY 2007 at 3.0%

Construction Cost Estimate Escalation

The construction cost estimate is based on a start date of February 2004 with escalation factored to a construction mid-point of February 2005. The escalation is derived using the DOE rates listed above.

Annual DOE Esc. Rate	Fiscal Year Period	Duration	Project Escalation
FY 2002 at 2.6%	April 2002 to October 2002	7 months	1.52%
FY 2003 at 2.8%	October 2002 to October 2003	12 Months	2.80%
FY 2004 at 2.8%	October 2003 to October 2004	12 Months	2.80%
FY 2005 at 2.9%	October 2004 to February 2005	4 Months	0.97%
Total Escalation			8.32%

Technical Equipment Cost Escalation

The construction cost estimate is based on a start date of February 2004 with escalation factored to a procurement mid-point of February 2005. The escalation is derived using the DOE rates listed above.

Annual DOE Esc. Rate	Fiscal Year Period	Duration	Project Escalation
FY 2002 at 2.6%	April 2002 to October 2002	7 months	1.52%
FY 2003 at 2.8%	October 2002 to October 2003	12 Months	2.80%
FY 2004 at 2.8%	October 2003 to October 2004	12 Months	2.80%
FY 2005 at 2.9%	October 2004 to June 2005	8 Months	1.93%
Total Escalation			9.36%

7.2 VALUE ENGINEERING

A Value Engineering (VE) Study will be performed during the Title I design process. The study will follow the traditional approach to VE, according to the procedures established by Society of American Value Engineering (SAVE). An independent review team, with Berkeley Lab IPT and A/E representatives, will evaluate alternative design approaches, evaluate the flexibility of the design for present and future research, review sustainability design features, and evaluate specific energy savings. The VE approach will determine the impacts on the capital cost and life-cycle cost of any suggested changes to the design. Additionally, the project team and the A/E design team will perform informal VE evaluations throughout the design of the project.

7.3 CONSTRUCTION COST SUMMARY

Direct Costs						$ 35,061,671
(Excluding General Conditions, Overhead, Profit and Escalation)						
Foundry Facility and Utility Plant	94,500 SF	$	344.34	$	32,540,585	
Sitework	65,340 SF	$	38.58	$	2,521,086	

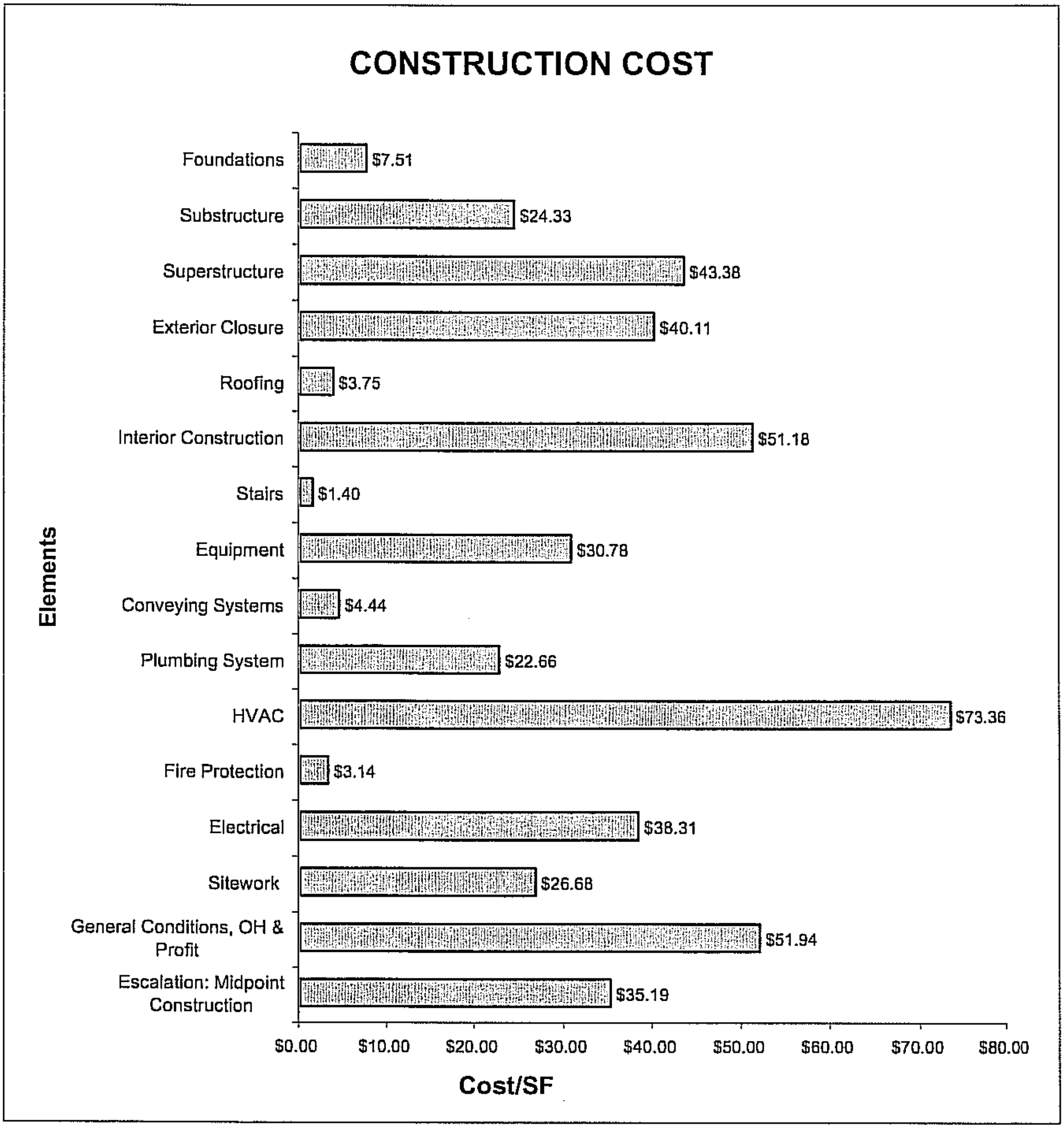
Total Estimated Construction Budgets						$ 43,295,871
(Including General Conditions, Overhead, Profit and Escalation)						
Foundry Facility and Utility Plant	94,500 SF	$	425.21	$	40,182,685	
Sitework	65,340 SF	$	47.65	$	3,113,186	

LEVEL 2 CONSTRUCTION COST SUMMARY

April 15, 2002

SYSTEM	Foundry Building		Utility Plant		Sitework	TOTAL	
	86,500 GFA		8,000 GFA			94,500 GFA	
	$/GFA	AMOUNT	$/GFA	AMOUNT	AMOUNT	$/GFA	AMOUNT
01 Foundations							
011 Standard Foundations	$ 1.26	$ 109,000	$ 7.72	$ 61,750		$ 1.81	$ 170,750
012 Special Foundations	$ 5.41	$ 468,000	$ 8.84	$ 70,700		$ 5.70	$ 538,700
02 Substructure							
021 Slab on Grade	$ 1.84	$ 159,019	$ 6.00	$ 48,000		$ 2.19	$ 207,019
022 Basement Excavation	$ 2.34	$ 202,059	$ 6.65	$ 53,185		$ 2.70	$ 255,244
023 Basement Walls	$ 17.90	$ 1,548,425	$ 36.01	$ 288,080		$ 19.43	$ 1,836,505
03 Superstructure							
031 Floors Construction	$ 34.66	$ 2,997,702	$ 14.98	$ 119,821		$ 32.99	$ 3,117,523
032 Roof Construction	$ 9.32	$ 806,017	$ 22.00	$ 176,000		$ 10.39	$ 982,017
04 Exterior Closure							
041 Exterior Walls	$ 33.73	$ 2,917,690	$ 12.65	$ 101,160		$ 31.95	$ 3,018,850
042 Exterior Windows	$ 7.91	$ 684,500	$ 0.53	$ 4,200		$ 7.29	$ 688,700
043 Exterior Doors	$ 0.67	$ 58,050	$ 3.13	$ 25,000		$ 0.88	$ 83,050
05 Roofing							
051 Roofing	$ 3.96	$ 342,126	$ 1.50	$ 12,000		$ 3.75	$ 354,126
06 Interior Construction							
061 Partitions	$ 28.19	$ 2,438,715	$ 3.13	$ 25,050		$ 26.07	$ 2,463,765
062 Interior Finishes	$ 18.05	$ 1,561,054	$ 3.29	$ 26,302		$ 16.80	$ 1,587,356
063 Specialties	$ 8.84	$ 765,040	$ 2.50	$ 20,000		$ 8.31	$ 785,040
07 Stairs							
071 Stairs Construction	$ 1.53	$ 132,000	$ -	$ -		$ 1.40	$ 132,000
08 Equipment							
081 Fixed Equipment	$ 22.41	$ 1,938,890	$ 2.50	$ 20,000		$ 20.73	$ 1,958,890
082 Furnishings	$ 10.98	$ 949,700	$ -	$ -		$ 10.05	$ 949,700
09 Conveying Systems							
091 Elevators	$ 4.86	$ 420,000	$ -	$ -		$ 4.44	$ 420,000
092 Other Conveyances	$ -		$ -	$ -		$ -	$ -
10 Plumbing							
101 Plumbing System	$ 17.40	$ 1,504,710	$ 79.60	$ 636,780		$ 22.66	$ 2,141,490
11 HVAC							
111 HVAC	$ 59.92	$ 5,183,380	$ 218.70	$ 1,749,560		$ 73.36	$ 6,932,940
12 Fire Protection							
121 Fire Protection System	$ 3.18	$ 274,950	$ 2.66	$ 21,310		$ 3.14	$ 296,260
13 Electrical							
131 Service & Distribution	$ 1.40	$ 121,010	$ 126.38	$ 1,011,000		$ 11.98	$ 1,132,010
132 Lighting & Power	$ 16.21	$ 1,402,330	$ 9.06	$ 72,460		$ 15.61	$ 1,474,790
133 Special Elec Systems	$ 11.65	$ 1,008,000	$ 0.73	$ 5,860		$ 10.73	$ 1,013,860
14 Sitework							
141 Site Preparation/Demolition					$ 688,550	$ 7.29	$ 688,550
142 Site Improvements					$ 1,314,736	$ 13.91	$ 1,314,736
143 Site Civil/Mechanical Utilities					$ 245,550	$ 2.60	$ 245,550
144 Site Electrical Utilities					$ 272,250	$ 2.88	$ 272,250
PLANNED CONSTRUCTION COST	$ 323.61	$ 27,992,366	$ 568.53	$ 4,548,218	$ 2,521,086	$ 371.02	$ 35,061,671
General Conditions, OH & Profit 14%	$ 45.31	$ 3,918,900	$ 79.60	$ 636,800	$ 353,000	$ 51.94	$ 4,908,700
Escalation: Midpoint Construction 8.32%	$ 30.69	$ 2,655,000	$ 53.93	$ 431,400	$ 239,100	$ 35.19	$ 3,325,500
TOTAL BUILDING & SITEWORK	$399.61	$34,566,266	$ 702.05	$5,616,418	$3,113,186	$458.16	$ 43,295,871

April 15, 2002



7.4 TECHNICAL EQUIPMENT COST ESTIMATE

Nanofabrication	**5,750,000**
Electron Beam Lithography	4,500,000
Surface Preparation/Etching	750,000
Microcontact soft lithography-facility	250,000
Misc. small equipment	250,000
Inorganic Nanostructures	**1,786,000**
Chemical Vapor Deposition System	1,012,000
Nanoscale Synthesis Station	250,000
Laser Ablation/Deposition	212,000
Small Ancillary Equipment	140,000
Dry boxes (2)	95,000
Fluorimeter	58,000
UV VIS Spectrometer	19,000
Biological Nanostructures	**863,000**
LC-MC-MC Mass spectrometer	227,000
Small Ancillary Equipment	120,000
DNA Synthesizer	115,000
Inverted stage microscopes (4)	100,000
Fluorecent imaging microscope	80,000
HPLC (2)	70,000
Peptide Synthesizer	63,000
Fluoresence spectrophotometer	32,000
CO2 Incubators (8)	23,000
Cell counter	20,000
UV-VIS Spectrophotometer	13,000
Organic, Polymer/ Biopolymer Synthesis	**1,531,000**
General purpose NMR	620,000
MALDI-TOF-MS	297,000
Size exclusion chromatograph	133,000
Combinational Synthesis Station	106,000
HPLC chromatograph	96,000
Refrigerators, glassware, ovens, evaporators, etc.	88,000
Gas chromatograph-MS detector	55,000
Capillary electrophoresis	50,000
Solvent Purification Systems (2)	40,000
ASAP 2010 surface area and analyzer	28,000
IR spectrometer	18,000
Imaging and Manipulation	**2,500,000**
Analytical scanning transmission electron microscope	750,000
Combined SEM and STM/AFM manipulators	700,000
Low temperature non-contact AFM for single molecule imaging/manipulation	500,000
Single molecule fluorescence microscope	300,000
AFM with expanded capabilities: non-contact, dielectric	250,000

Theory	**500,000**
500 node computing system	500,000
General Use Equipment	**2,090,000**
Laboratory Fume Hoods/Glove Boxes/Laminar Flow Hoods, etc.	1,355,000
Laboratory fixed benches, countertops, & cabinets	735,000
Sub-Total	**15,020,000**
LBNL Procurement Burden @ 5.9% *	**601,092**
Technical Equipment	**15,621,092**
Miscellaneous	**600,000**
Specs Preparation	100,000
Installation	250,000
Test and Acceptance	250,000
Escalation @ 9.36%	**1,518,294**
Total Technical Equipment Cost Estimate	**17,739,386**

* Cap of $25.9K on any single procurement

8.1 SCHEDULE SUMMARY

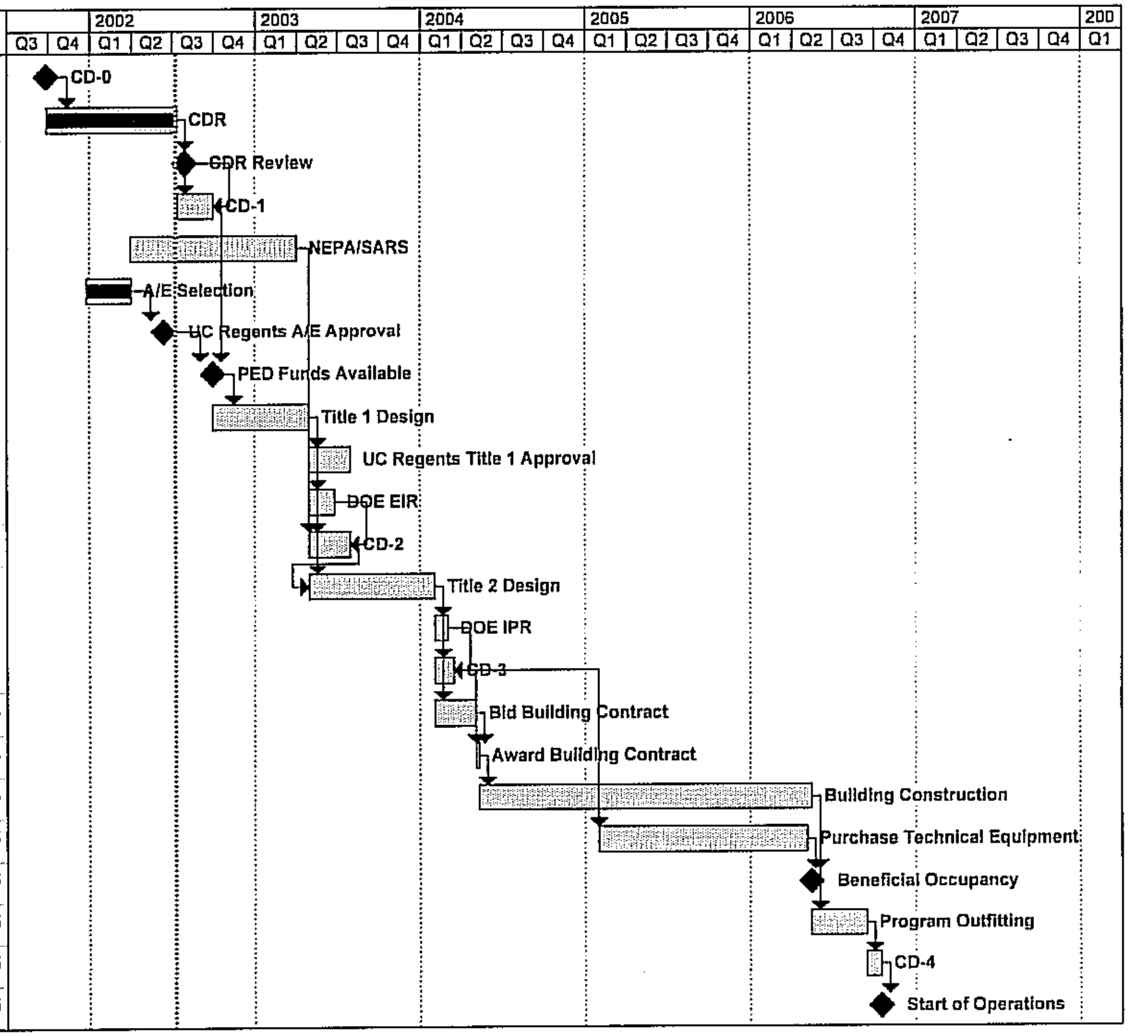
The summary project schedule is shown in Section 8.2. It assumes PED funding availability by July 2002.

The first year (FY 02) obligations provide for funding of AE design, AE support, and project management functions. FY 03 funding obligations would continue design and initiate Phase 1 activities by the CM/GC and project management. FY 04 funding obligations will complete design and initiate the general building construction, AE support, project management, construction management and construction support activities. FY 05 funding obligations continue building construction activities, construction support activities and beginning procurement of technical equipment. FY 06 funding obligations will be to complete construction and the procurement and installation of technical equipment.

The award will be made in FY 2002 to the AE for the Title I and II design. Award to the CM/GC for Pre-Construction Services will occur in FY 03 and General Building Subcontracts will be awarded in FY 04. Construction is scheduled for 24 months, to be completed in February, 2006. The technical equipment procurement will start in FY 04. Installation of technical equipment will be completed by June, 2006.

8.2 SCHEDULE

ID	Task Name	Duration	Start	Finish
1	CD-0	1 day	Thu 6/28/01	Thu 6/28/01
2	CDR	206 days	Fri 6/29/01	Fri 4/12/02
3	CDR Review	0 days	Tue 4/30/02	Tue 4/30/02
4	CD-1	56 days	Mon 4/15/02	Mon 7/1/02
5	NEPA/SARS	262 days	Tue 1/1/02	Wed 1/1/03
6	A/E Selection	70 days	Wed 9/26/01	Tue 1/1/02
7	UC Regents A/E Approval	0 days	Fri 3/15/02	Fri 3/15/02
8	PED Funds Available	0 days	Mon 7/1/02	Mon 7/1/02
9	Title 1 Design	152 days	Tue 7/2/02	Wed 1/29/03
10	UC Regents Title 1 Approval	65 days	Thu 1/30/03	Wed 4/30/03
11	DOE EIR	40 days	Thu 1/30/03	Wed 3/26/03
12	CD-2	65 days	Thu 1/30/03	Wed 4/30/03
13	Title 2 Design	198 days	Thu 1/30/03	Mon 11/3/03
14	DOE IPR	20 days	Tue 11/4/03	Mon 12/1/03
15	CD-3	30 days	Tue 11/4/03	Mon 12/15/03
16	Bid Building Contract	65 days	Tue 11/4/03	Mon 2/2/04
17	Award Building Contract	5 days	Tue 2/3/04	Mon 2/9/04
18	Building Construction	525 days	Tue 2/10/04	Mon 2/13/06
19	Purchase Technical Equipment	330 days	Mon 11/1/04	Fri 2/3/06
20	Beneficial Occupancy	0 days	Mon 2/13/06	Mon 2/13/06
21	Program Outfitting	87 days	Tue 2/14/06	Wed 6/14/06
22	CD-4	23 days	Thu 6/15/06	Mon 7/17/06
23	Start of Operations	0 days	Mon 7/17/06	Mon 7/17/06



9.1 INTEGRATED SAFETY MANAGEMENT

Integrated Safety Management Plan

The LBNL Integrated Safety Management Plan is the governing institutional doctrine. Molecular Foundry design, construction and operation are covered under the institutional domain from the onset. As the Foundry advances to completion, details will support a Foundry specific ISM plan.

Berkeley Lab Integrated Safety Management (ISM) holds the Foundry Project Director accountable to design and execute this project in a manner that will not compromise the safety or health of workers, the public, or the environment. As one means of ensuring that these goals are achieved, the guiding principles and core functions of ISM will be understood and applied by all project personnel in their management of ES&H functions and activities. Management of all aspects of the project to a "Zero Accident" goal will be an integral part of the overall Foundry project mission.

Each stage of Molecular Foundry development, from conceptual design through operational turnover, has and will continue to reiterate the ISM functions: (1) define the work and identify the potential hazards; (2) analyze potential hazards and design the facility or activities to appropriately mitigate those hazards; (3) develop operational controls for hazards that cannot be eliminated through design features; (4) perform the construction and operate the facility in accordance with prescribed limits and procedures; and (5) review the effectiveness of the analyses performed previously and the controls and practices implemented, then provide feedback for improvement.

Safety through design will be our primary driver throughout the design phases of this project. Through management commitment and leadership, safety in the conduct of activities will continue as a fundamental driver through construction and turnover of the completed facility.

Following the transition to operations, the Foundry Scientific Director will fold the operation and maintenance of the completed facility and installed equipment into the existing Berkeley Lab ES&H management infrastructure.

Safety Analysis

A preliminary hazard screening was conducted for the Foundry itself. For CD-1 purposes, the Molecular Foundry is classified as a "general or other industrial" facility following DOE OAK Supplemental Directive 5481.1B, Safety Analysis and Documentation, protocol. The hazard level classification will be refined as the Preliminary Hazard Analysis (PHA) undergoes iteration in early Title I design.

The PHA developed during Conceptual Design will serve as the initial baseline and safety basis for design safety criteria, remedial action needs, unique and routine construction ES&H requirements, and facility startup ES&H requirements. Based on the PHA, a Preliminary Safety Analysis Report (PSAR) will be drafted during Title I design and completed by CD-3 (Title II). The Final Safety Analysis Report (FSAR) will be complete as construction commences (CD-4) and will be reviewed for change during start-up and as routine operations at the facility commence.

Because not every ES&H hazard can be addressed through design alone, hazards must be identified, evaluated, and controlled at every operation and operational sub-task level. Job Hazard Analyses by responsible supervision and crafts are required of construction personnel and then by operational personnel once start up and normal facility operation commence. For construction contractors, these task- and job-specific hazard analyses are contractual requirements. For facility operational personnel, LBNL Divisional ISM and other institutional safety requirements mandate graded levels of task and job hazard analysis.

Design

Design and engineering will be conducted by an A/E firm with support from a collaborative multidisciplinary Berkeley Lab team that includes engineers and project managers, as well as industrial hygiene, environmental protection, design and construction safety, ergonomics, fire protection, and radiation protection professionals from the Berkeley Lab EH&S Division. Key planners, management, engineering staff, and user representatives will provide critical input into the design process. Our initial systems safety objectives will be preliminary identification, evaluation, and analysis of hazards with the goal of maximizing mitigation of potential ES&H issues during the design of all new building components, systems, and equipment, from both constructability and operations perspectives.

Construction safety

The Foundry Project Office, with support from the Berkeley Lab Construction Safety Engineer, will monitor the construction site for compliance with Berkeley Lab, DOE, CAL/OSHA, federal OSHA, and other applicable safety requirements identified in our Work Smart Standards. Monitoring activities will include validation of the contractor's ISM program, apprising the contractor of safety criteria pertaining to the construction project, conducting and documenting frequent periodic inspections to verify contractor safety compliance, and ensuring that the construction contractor meets ongoing ES&H submittal requirements. Contractors performing specified work become mission partners and will be compelled to embrace Berkeley Lab safety philosophy through binding contract language. Contract and procurement specifications lay the foundation for contractor and lower tier subcontractor ISM participation. LBNL safety requirements may be found to exceed construction and industry standards. Where this is the case, specific contract language binds the contractor to these performance criteria.

Start-up and operational safety

Hazard identification and mitigation will play an integral role during the development of the operational procedures for all systems and equipment installed during this project. This process will be started during the design phase as part of the systems safety analysis, with the goal of eliminating hazardous installations. The process continues through construction as specific conditions materialize, and conclude with a final round of evaluations after installation and after any start-up modifications have been made. A hazard management plan, including required emergency training and response plans, commensurate with the hazards and materials identified, will be developed as determined necessary in the FSAR.

9.2 ENVIRONMENTAL CONSIDERATIONS

Environmental considerations

The Foundry will be designed, constructed, and operated in a manner to protect the safety of workers, the public, and the environment. This will be accomplished by preparation of appropriate NEPA documentation and by designing, procuring, constructing, commissioning, and operating the facility in accordance with the principles of ISM. The Foundry's environmental impact will be minimized through sensitive site development, the use of appropriate building materials, waste minimization, minimization of energy use and atmospheric impact, and water use efficiency. Project waste disposal and recycling requirements are incorporated into the project procurement documents.

NEPA and CEQA reviews will be conducted during the conceptual design phase and completed during the Title I phase. Based on preliminary analysis information presented by the Berkeley Lab, DOE-OAK's NEPA compliance officer is recommending an EA as the appropriate level of NEPA review. DOE-OAK's Manager is expected to concur with this recommendation and request the Director of the Berkeley Site Office to proceed with an EA. The Federal Project Manager, Barry Savnik, has been selected as the NEPA Document Manager for this project. In addition, an Initial Study will be prepared to satisfy the requirements of CEQA (California Environmental Quality Act), of which the University of California will be the lead agency.

10.0 QUALITY ASSURANCE

Reliability, maintainability, and operability

The Title I and II designs will be reviewed for reliability, maintainability, and operability by the Foundry Project Manager and the Construction Manager (CM/GC) and by the Berkeley Lab Facilities Department. The primary objective of these reviews will be to ensure the development of systems that will be reliable, safe, easy to operate, and maintainable with minimum resources.

Quality assurance:

Quality assurance procedures during project development, design, and construction will ensure that all safety, operational, and subcontract requirements are met. The established system to review, inventory, and document facility construction, acceptance, and project closeout includes the following elements:

Engineering

The Berkeley Lab Facilities Department, assisted by selected consultants, provides quality control and assurance measures during design and construction.
Design and cost estimates are prepared by the A/E and reviewed by the Foundry Project Manager at completion of schematics and by the Foundry Project Manager and CM/GC during and after the Title I and Title II designs are completed. Cost estimates are also prepared by the CM/GC to compare with the A/E's cost estimate. An independent third-party plan check is made of the seismic design. Plans and specifications are also reviewed by the Berkeley Lab Fire Marshal, the Berkeley Lab Environment, Health and Safety (EH&S) Division, the Berkeley Lab Energy Conservation Engineer, and the Berkeley Lab Facilities Department at each stage of design development. A consulting geotechnical firm will provide appropriate geotechnical data and review the design at each stage of design and during construction.

Construction

Subcontract documents are reviewed by Berkeley Lab technical staff for compliance with Berkeley Lab design criteria.
The Foundry Project Manager and the Construction Inspector review, and the A/E and Facilities' staff of engineers, in consultation with the Foundry Project Management, accept or reject all materials and workmanship in accordance with subcontract documents.
A submittal control system for materials, shop drawings, test reports, and certifications assures that all necessary reviews for compliance with specifications, codes, environmental mitigation measures, and other requirements—including provisions for the handicapped and energy conservation—have been conducted.
A Construction Inspector observes construction activities and reports discrepancies to the Foundry Project Manager. Daily inspection reports are maintained in a file or a project logbook.
A Contract Administrator (from the Berkeley Lab Procurement Department) reviews documentation for compliance with subcontract provisions.
A Safety Inspector (from the Berkeley Lab EH&S Division) and the Fire Marshal make frequent periodic inspections of construction to ensure compliance with safety and fire codes and regulations.
Specialty inspections are made of rebar, structural steel, welding, concrete, and geotechnical conditions to assure compliance with codes and specifications. Appropriate testing laboratories are utilized for support as necessary. The A/E is required to inspect the construction at appropriate times and provide interpretation of the subcontract documents whenever necessary.

Subcontract Change Orders

The Foundry Project Manager, the Berkeley Lab A/E team, and the A/E review any proposed change and provide justification and an independent cost estimate. The subcontractor's proposed cost is evaluated relative to Berkeley Lab's cost estimate, and a subcontract price is negotiated. If all project and subcontract requirements are met, and the Foundry Project Director concurs, a Change Order is executed.

Final Inspection and Acceptance

The following items are accomplished by the Inspector and the A/E, working together:
Preliminary inspection and list of incomplete work.
Equipment testing and operational instruction of Berkeley Lab personnel.
Final inspection walk-through and punch list.
Inspection of correctional and completion work (punch list work).
Inventory of all operational manuals, instructions, and guarantees.
Internal sign-off sheet: Acknowledgment of completion and acceptance of all work under construction subcontract by the Foundry Project Manager, Inspector, Foundry Project Director, and Facilities Management.

Project Closeout

After final acceptance of the facility, Berkeley Lab audits all charges to ensure that all costs are in proper accounts.
Berkeley Lab sends the cost closing statement to DOE/BSO.
Project authorization closed by DOE/BSO.

11.0 ACKNOWLEDGEMENTS

The following participants were involved in the decision-making process and in preparing this Conceptual Design Report for the Molecular Foundry.

Department of Energy:

- Barry Savnik, Federal Project Manager

Lawrence Berkeley National Laboratory:

- Jim Krupnick, Foundry Project Director
- David Tudor, Foundry Project Manager
- Paul Alivisatos, Foundry Scientific Director, Facility Director, Inorganic Nanostructures
- Daniel Chemla, Materials Sciences Division Director
- Mark Alper, Foundry Deputy Director (Acting)
- Carolyn Bertozzi, Facility Director, Biological Nanostructures
- Jeff Bokor, Facility Director, Nanofabrication
- Jean Frechet, Facility Director, Organic, Polymer/Biopolymer Synthesis
- Steve Louie, Facility Director, Theory
- Miquel Salmeron, Facility Director, Imaging & Manipulation
- Facilities Architect/Engineer Support Team

Consultant Design Team:

- Bill Diefenbach, SmithGroup, Inc. - Architecture
- David Moore, SmithGroup, Inc. - Architecture
- Lise Barriere, SmithGroup, Inc. - Architecture
- Roxanne Malek, SmithGroup, Inc. - Architecture
- Suzanne Napier, SmithGroup, Inc. - Architecture
- Ken Pang, Smith Group, Inc. - Estimating
- Jenny Young, Smith Group, Inc. - Estimating
- Michael Somin, Earl Walls Associates - Laboratory Planning
- Scott Lindner, Earl Walls Associates - Laboratory Planning
- Heather Porto, Earl Walls Associates - Laboratory Planning
- Mark Saunders, Rutherford and Chekene - Structural
- Don Miller, Rutherford and Chekene - Civil
- Nick Mironov, Gayner Engineers - Mechanical
- Lito Magbitang, Gayner Engineers - Electrical
- John Yee, Gayner Engineers - Plumbing and Fire Protection
- Anthony Bernheim, SMWM - Sustainability
- Marian Keeler, SMWM - Sustainability

APPENDIX A: ROOM DIAGRAMS

A *Room Diagram* has been completed for most of the spaces identified in the *Space Program*, which can be found in Section 2 – *Project Description*. These diagrams are shown at either 1/8"=1'-0" or 1/16"=1'-0" scale as noted on each sheet. The Room Diagrams are intended to be graphic representations of potential room layouts, including equipment, laboratory benches, office furniture, etc. Also indicated on each sheet are preferred overall room dimensions, shown to the inside face of each wall. Detailed room services, such as electrical and data outlets, are intentionally not shown at this time and will be developed during future design phases. These room diagrams are the basis for testing the program on the proposed site and the development of the preferred planning diagram. They are also the basis for the preferred *Building Concept* shown in Section 4 and the *Construction Cost Estimate* described in Section 7.

ROOM NAME: Pulse Laser Deposition Lab
DEPARTMENT: Inorganic Nanostructures

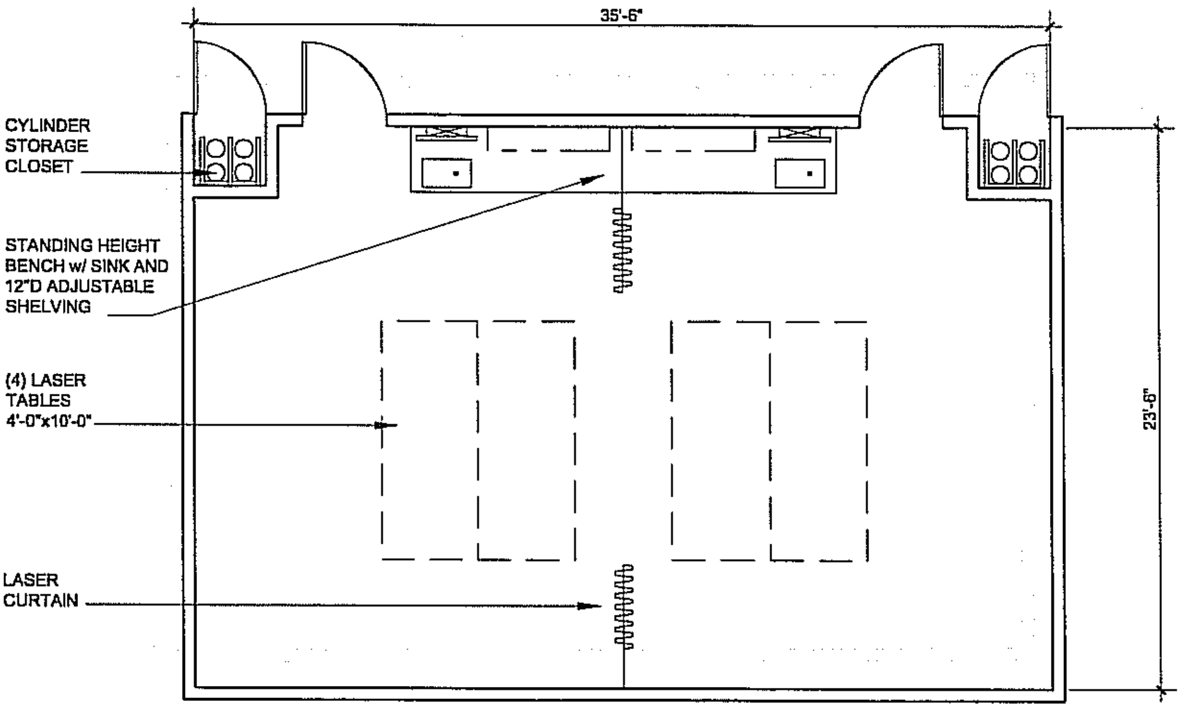
SIZE: 822 ASF

OCCUPANCY: 4 - 6

FUNCTION: Dividable darkenable space for setting up and performing laser based experimentation.

SPECIAL REQUIREMENTS: This room will have 2 laser systems sitting on laser tables (4'x10') in parallel with curtain separation. The laser tables must have vibration control built in. Consider vestibule entry. Room will include ventilated gas closets w/ corridor access and overhead shelving framing systems. Power: 208V. No daylight required. Lab will have bake-out capabilities.

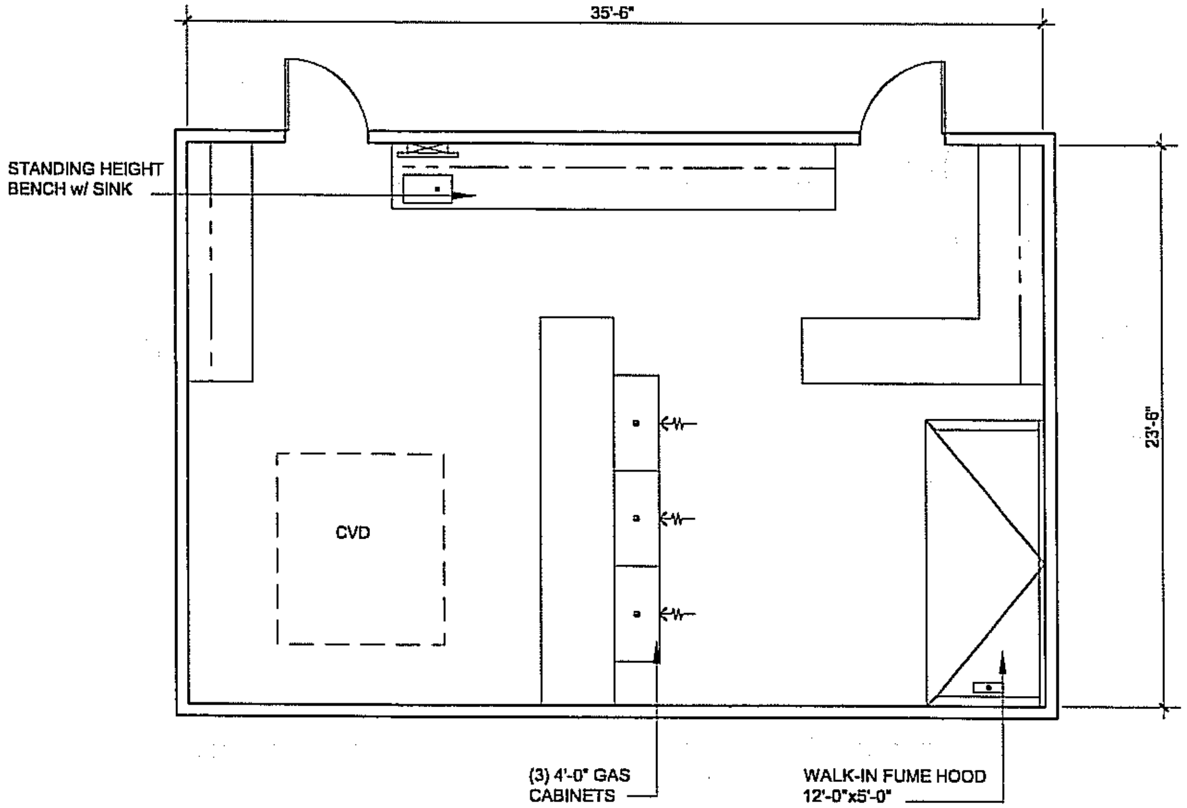
Scale: 1/8"=1'-0":



ROOM NAME: Chemical Vapor Deposition Lab
DEPARTMENT: Inorganic Nanostructures

SIZE: 822 ASF **OCCUPANCY:** 6 - 8
FUNCTION: This lab will be used to develop microelectronic samples using chemical vapor deposition techniques.
SPECIAL REQUIREMENTS: The Lab will contain a commercial CVD system, a custom fabricated system w/ walk-in hood, gas cabinets and benchwork.

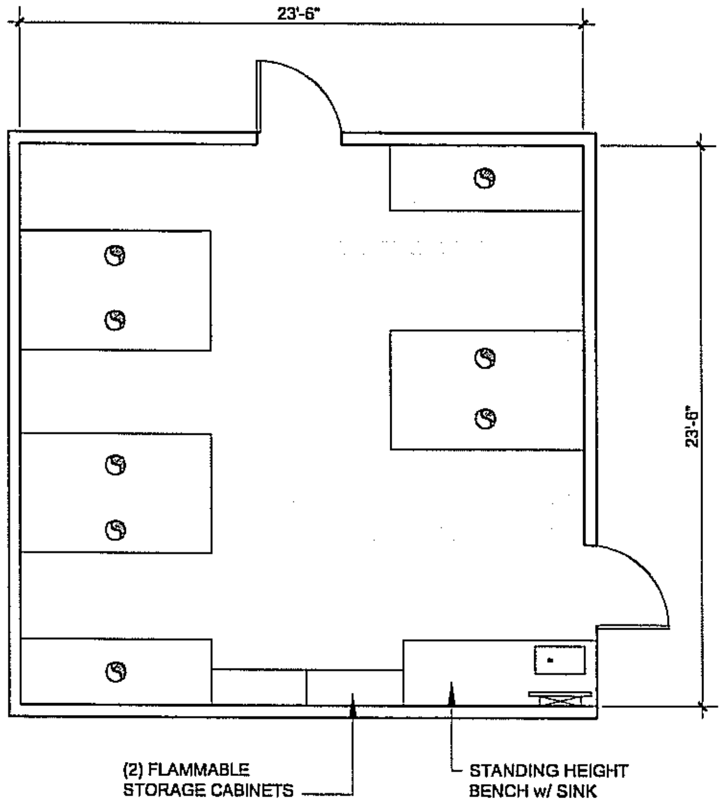
Scale: 1/8"=1'-0":



ROOM NAME: Dry Furnace Lab
DEPARTMENT: Inorganic Nanostructures

SIZE: 552 ASF **OCCUPANCY:** 2 - 4
FUNCTION: This room will house the furnaces used in preparation of microelectronics.
SPECIAL REQUIREMENTS: The room will include a commercial system, eight benchtop furnaces with canopy exhausts, ovens, standing height bench with sink, flammable storage cabinets and chemical waste collection.

Scale: 1/8"=1'-0":



ROOM NAME: Optical Microscope Room
DEPARTMENT: Inorganic Nanostructures

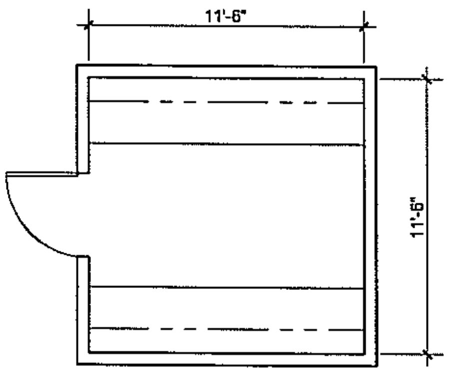
SIZE: 132 ASF

OCCUPANCY: 1 - 2

FUNCTION: This room is an instrument room used to support research done in the Inorganic Laboratories.

SPECIAL REQUIREMENTS: This room is set up as an alcove off of the Wet Lab.

Scale: 1/8"=1'-0":



ROOM NAME: UV-Vis
DEPARTMENT: Inorganic Nanostructures

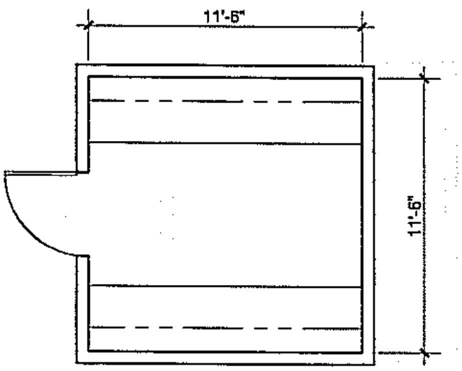
SIZE: 132 ASF

OCCUPANCY: 1 - 2

FUNCTION: This room is an instrument room used to support research done in the Inorganic Laboratories.

SPECIAL REQUIREMENTS: This room is set up as an alcove off of the Wet Lab.

Scale: 1/8"=1'-0":



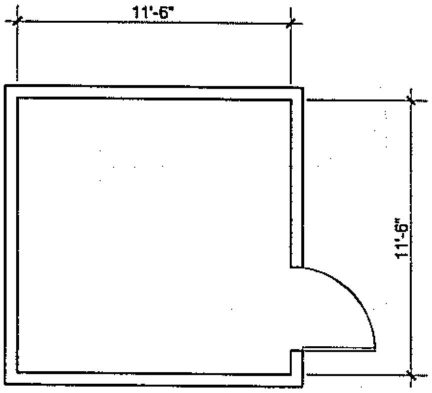
ROOM NAME: X-Ray Diffraction
DEPARTMENT: Inorganic Nanostructures

SIZE: 132 ASF

OCCUPANCY: 1 - 2

FUNCTION: These rooms will house XRD instruments to be used in characterizing compounds created in the Inorganic laboratories.
SPECIAL REQUIREMENTS: This room is set up as an alcove off of the Wet Lab.

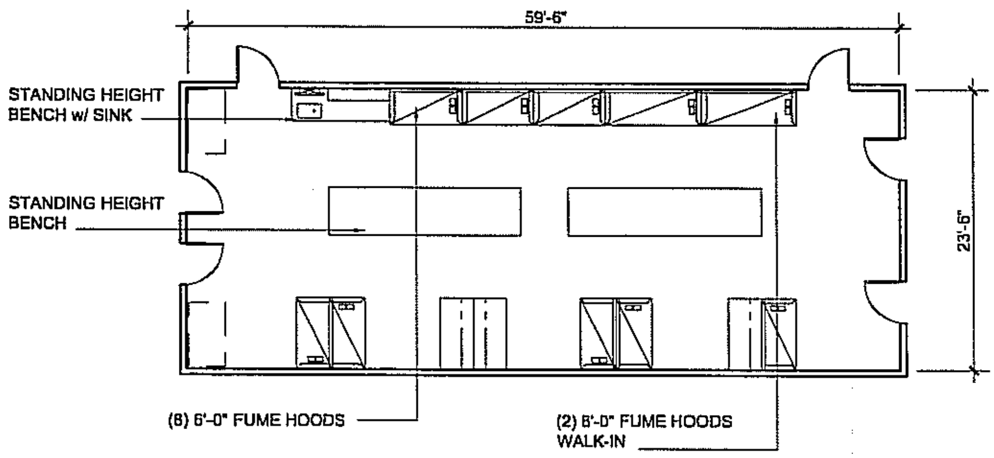
Scale: 1/8"=1'-0":



ROOM NAME: Wet Lab / Characterization Lab Control
DEPARTMENT: Inorganic Nanostructures

SIZE: 1398 ASF **OCCUPANCY:** 10 - 14
FUNCTION: This space will be used for preparation of samples to be used in the characterization labs and to support the XRD labs.
SPECIAL REQUIREMENTS: This lab will house chemical fume hoods, sinks, and fixed working benches equal to work space inside the hood. Consider accommodating instruments in & adjacent to fume hoods. Locate racks adjacent to fume hoods for computers and instruments.

Scale: 1/16"=1'-0":



ROOM NAME: Synthesis Type 1 (Option 1)
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

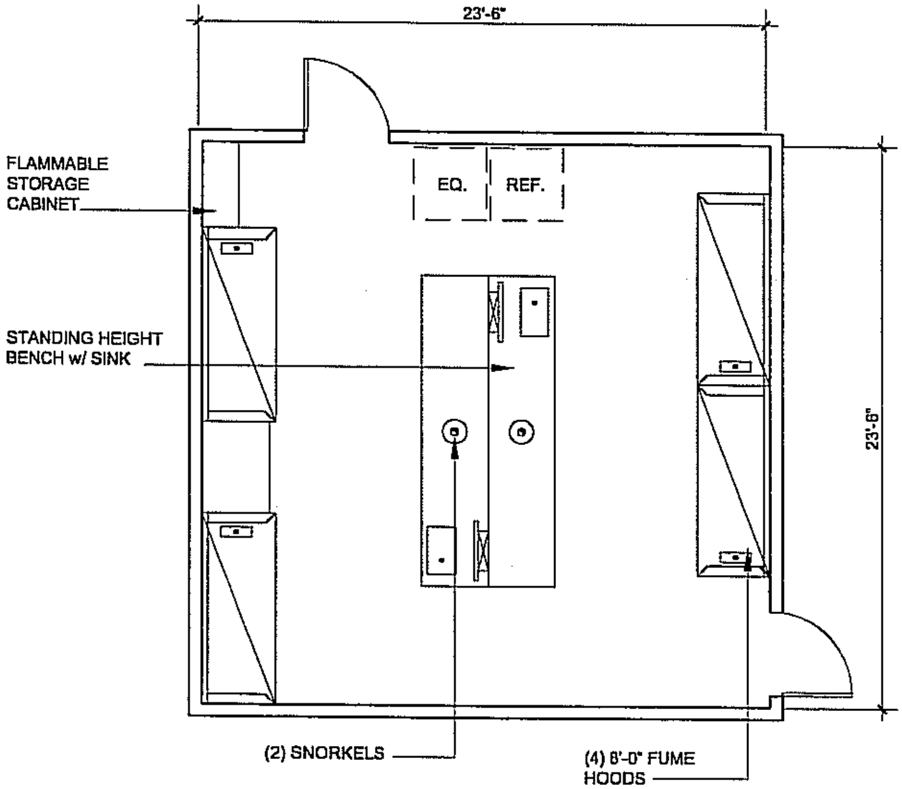
SIZE: 552 ASF

OCCUPANCY: 4 - 6

FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.

SPECIAL REQUIREMENTS: Daylight into this lab is preferred. Refrigerator will be on emergency power. The space will contain chemical fume hoods, fixed bench space with snorkel exhausts, sinks and a flammable storage cabinet.

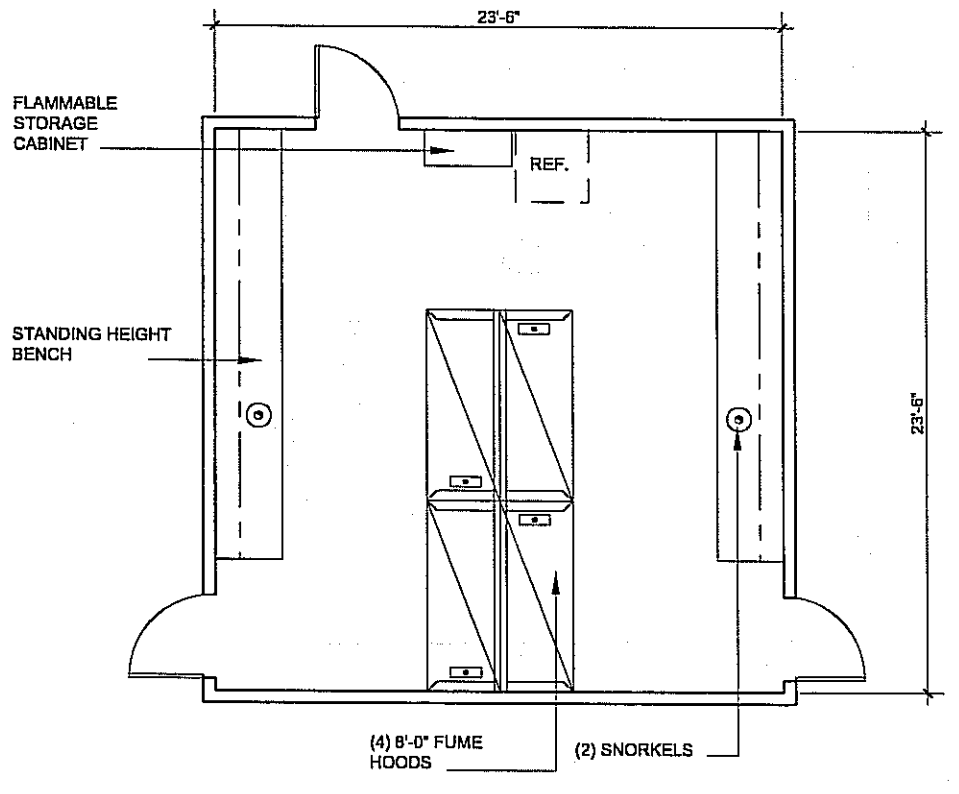
Scale: 1/8"=1'-0":



ROOM NAME: Synthesis Type 1 (Option 2)
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.
SPECIAL REQUIREMENTS: Daylight into this lab is preferred. Refrigerator will be on emergency power. This space will contain chemical fume hoods, fixed bench space with snorkel exhausts and a flammable storage cabinet.

Scale: 1/8"=1'-0":



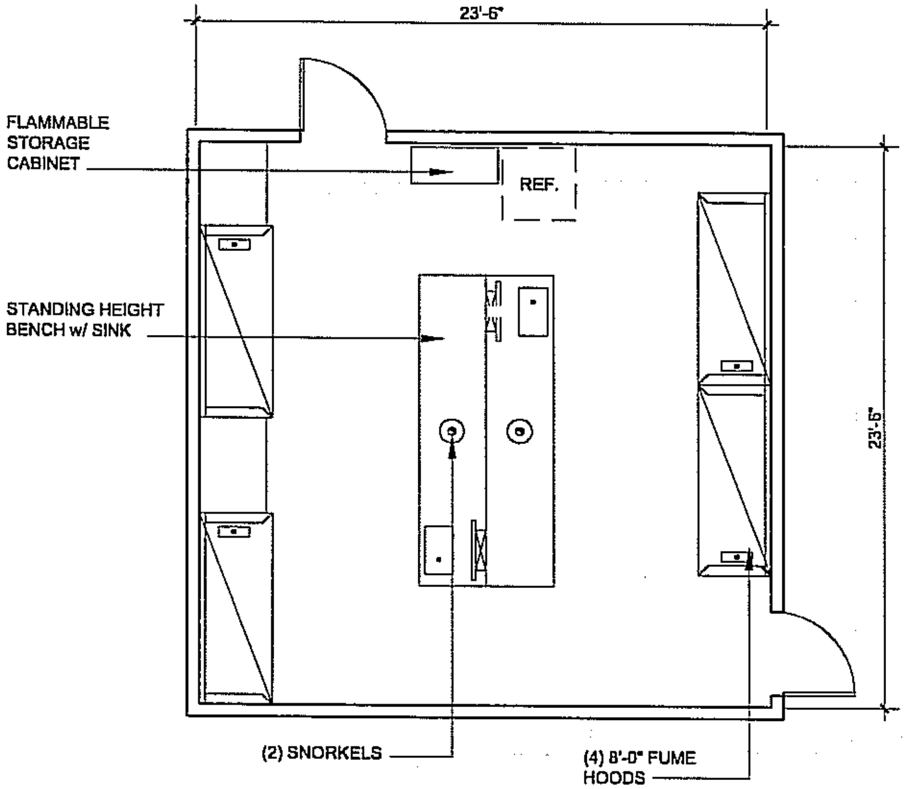
ROOM NAME: Synthesis Type 1 (Option 3)
DEPARTMENT: Organic, Polymer / Bioplymer Synthesis

SIZE: 552 ASF

OCCUPANCY: 4 - 6

FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.
SPECIAL REQUIREMENTS: Daylight into this lab is preferred. Refrigerator will be on emergency power. The space will contain chemical fume hoods, fixed bench space with snorkel exhausts, sinks and a flammable storage cabinet.

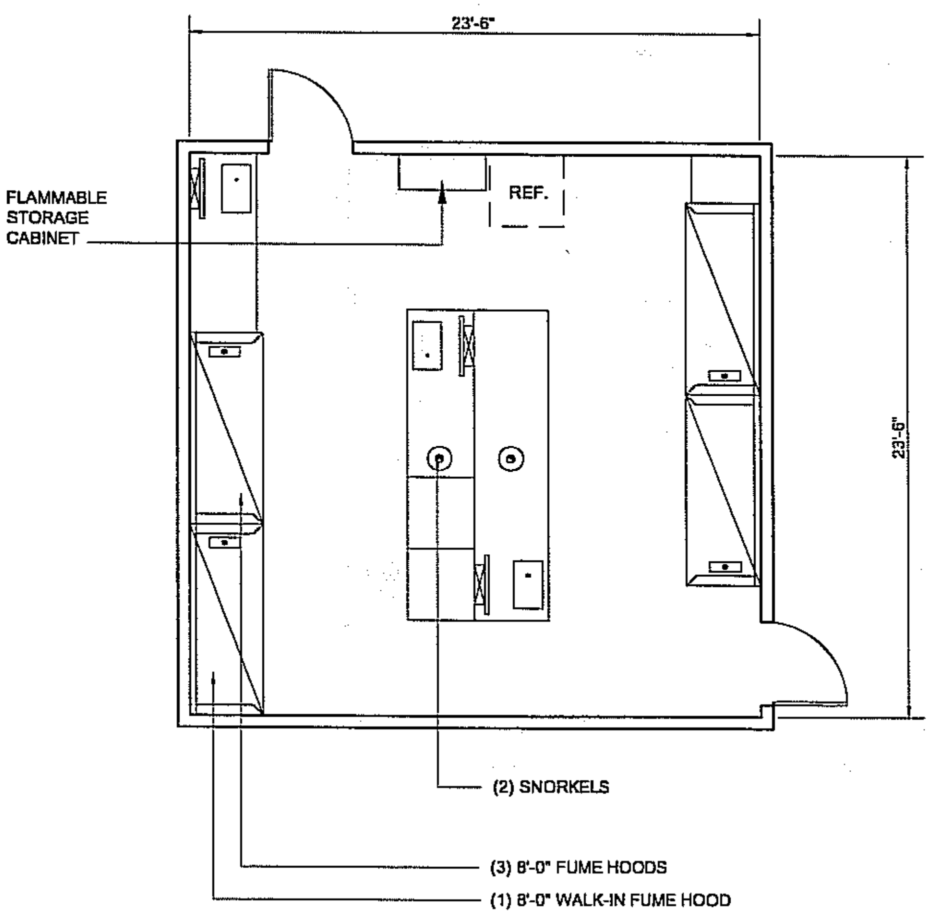
Scale: 1/8"=1'-0":



ROOM NAME: Synthesis Type 1a
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.
SPECIAL REQUIREMENTS: This space will house chemical fume hoods, fixed bench space with snorkel exhausts, refrigerator, sinks and a flammable storage cabinet

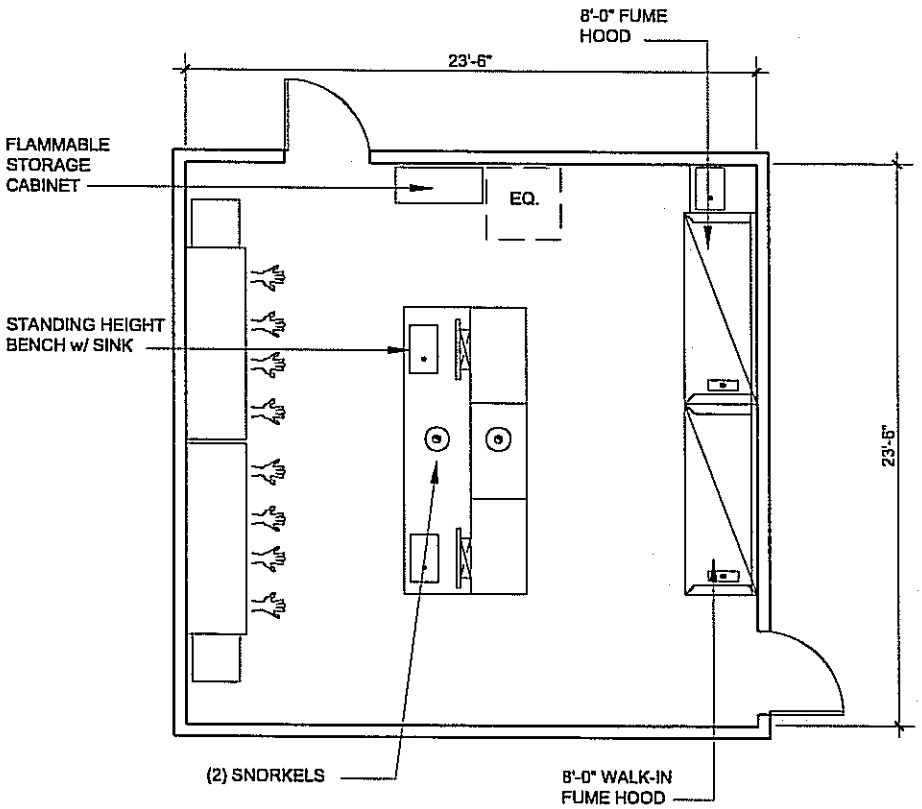
Scale: 1/8"=1'-0":



ROOM NAME: Synthesis Type 2 (Option 1)
DEPARTMENT: Organic, Polymer/ Bioploymer Synthesis

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.
SPECIAL REQUIREMENTS: This lab will contain two double glove boxes (8' each) with two transfer ports, chemical fume hoods, mobile benches with snorkel exhausts, flammable storage cabinets and solvent purification.

Scale: 1/8"=1'-0":



ROOM NAME: Synthesis Type 2 (Option 2)
DEPARTMENT: Organic, Polymer / Bioploymer Synthesis

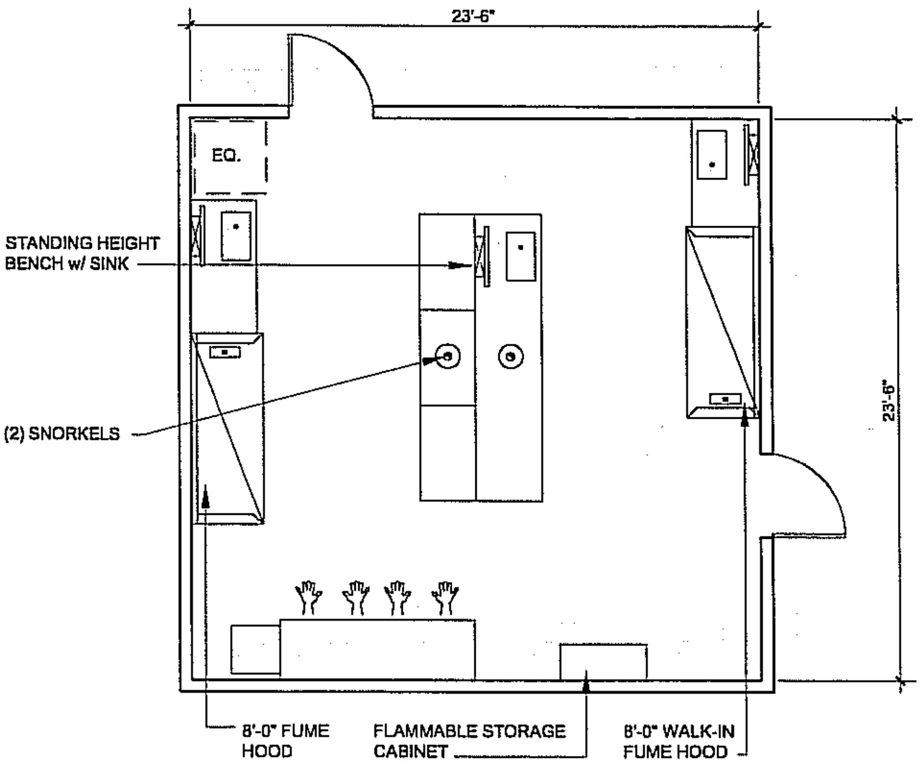
SIZE: 552 ASF

OCCUPANCY: 4 - 6

FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.

SPECIAL REQUIREMENTS: This lab will contain a double glove box (8') with two transfer ports, chemical fume hoods, mobile benches with snorkel exhausts, a flammable storage cabinet and solvent purification.

Scale: 1/8"=1'-0":



ROOM NAME: Synthesis Type 2 (Option 3)
DEPARTMENT: Organic, Polymer / Bioploymer Synthesis

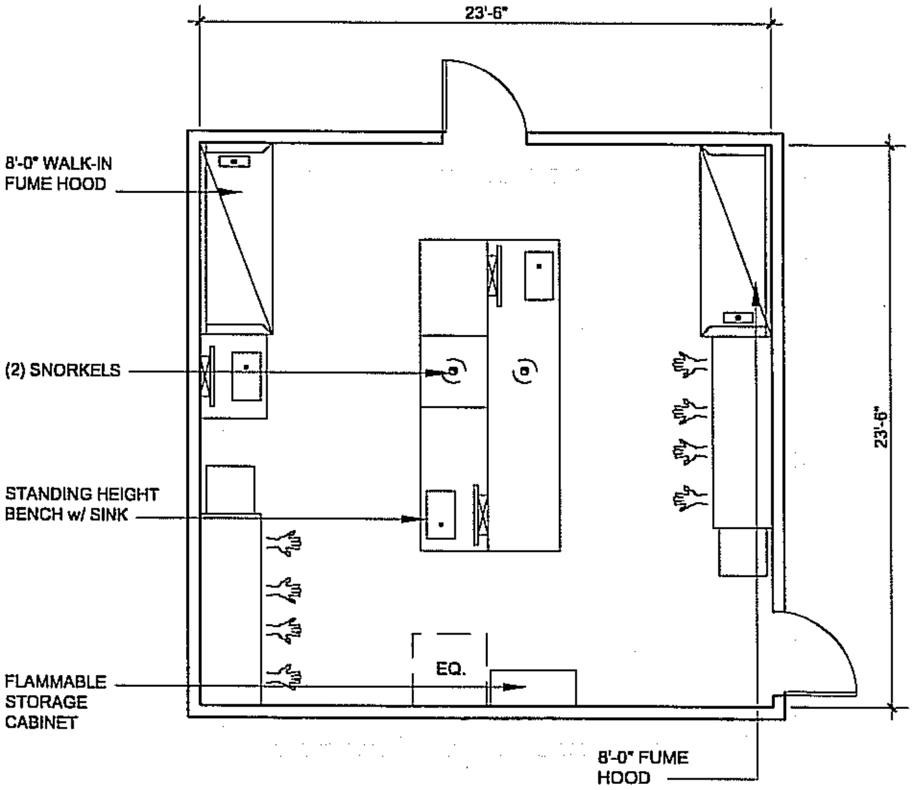
SIZE: 552 ASF

OCCUPANCY: 4 - 6

FUNCTION: The Synthesis Labs will be used to prepare novel chemical compounds for use in nanostructure research.

SPECIAL REQUIREMENTS: This lab will contain two double glove boxes (8' each) with two transfer ports, chemical fume hoods, mobile benches with snorkel exhausts, a flammable storage cabinet and solvent purification.

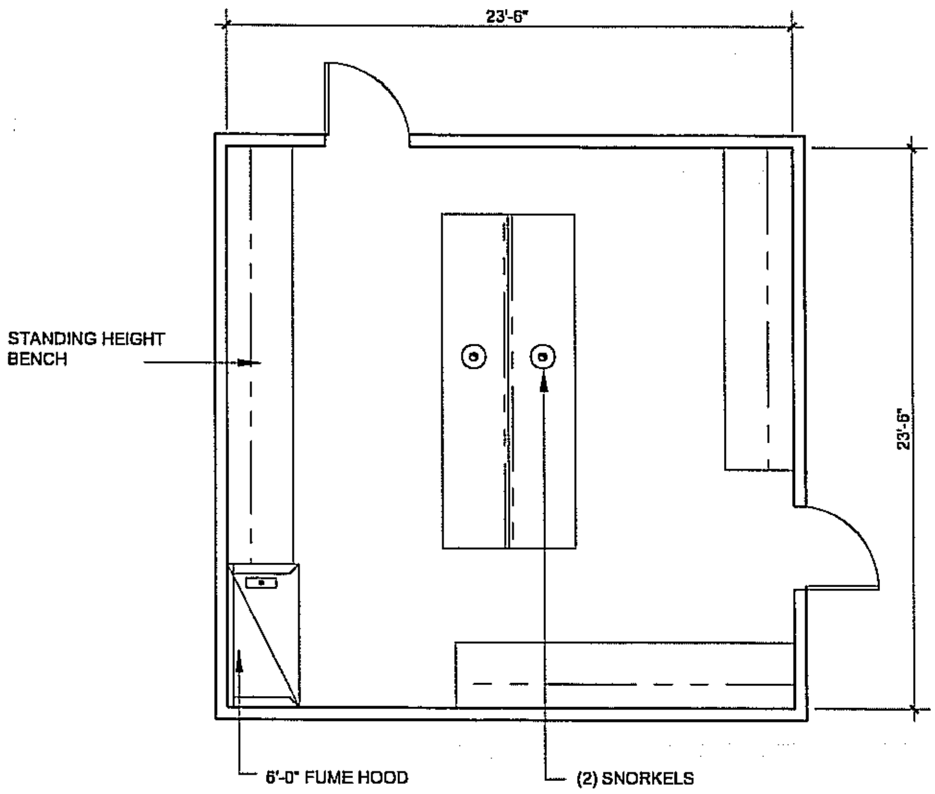
Scale: 1/8"=1'-0":



ROOM NAME: Instrument 1 - Spectroscopy
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: The Spectroscopy Lab will house various spectrometers, which will be used in characterization of compounds created in the Synthesis Labs.
SPECIAL REQUIREMENTS: This lab contains standing height benches, snorkel exhausts and a chemical fume hood. The lab needs to be centrally linked to the Synthesis Lab.

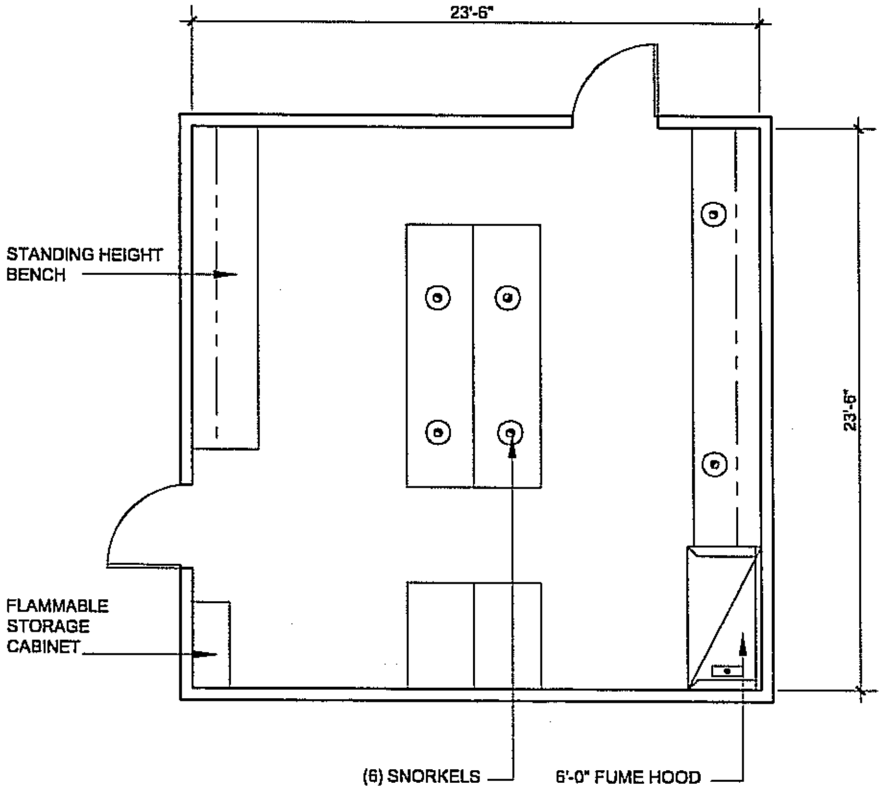
Scale: 1/8"=1'-0":



ROOM NAME: Instrument 2 - Chromatography
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: The chromatography lab will house various chromatography set-ups used to help characterize compounds created in the Synthesis Labs.
SPECIAL REQUIREMENTS: The lab contains standing height benches with snorkel exhausts, a chemical fume hood, a solvent purification system and a flammable storage cabinet. This lab needs to be centrally linked to the Synthesis Labs.

Scale: 1/8"=1'-0":



ROOM NAME: Chemical Storage Room
DEPARTMENT: Organic, Polymer / Biopolymer Nanostructures

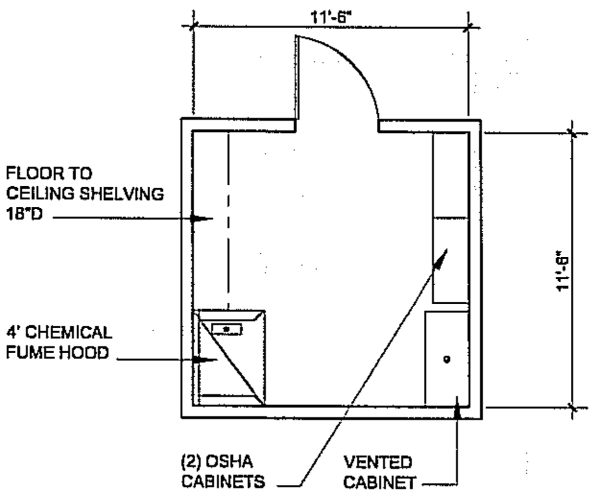
SIZE: 132 ASF

OCCUPANCY: 0

FUNCTION: This space will be used to store chemicals used by the Organic, Polymer / Biopolymer Synthesis group. Chemical quanitities will be limited by code.

SPECIAL REQUIREMENTS: This room will have an H-3 Occupancy and contain a chemical fume hood for dispensing.

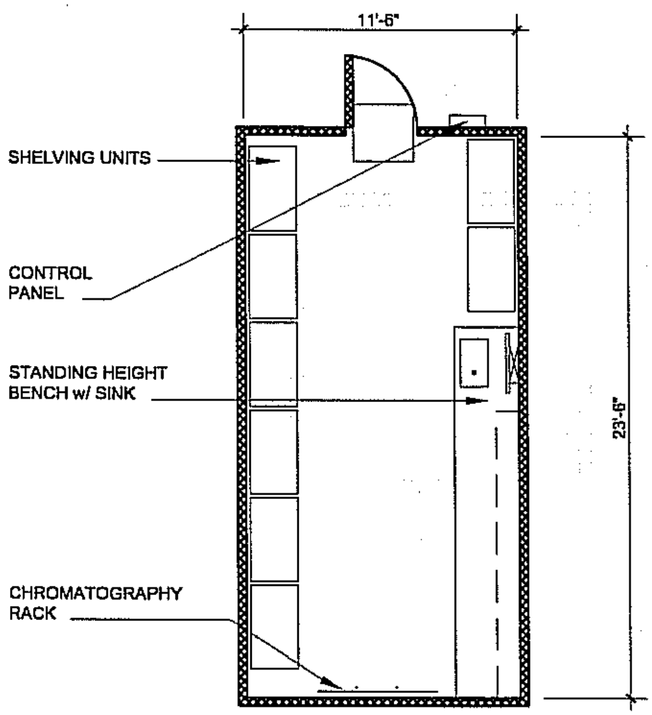
Scale: 1/8"=1'-0":



ROOM NAME: Cold Room
DEPARTMENT: Organic, Polymer / Biopolymer Synthesis

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: The Cold Room will be used for storing supplies and to provide a controlled environment for specialized analysis techniques.
SPECIAL REQUIREMENTS: This room is to be flexible. It contains one wall of bench and one wall of storage and is ventilated for chemical use. The room will be kept as +4 degrees Celsius, +/-1 degree. Consider this room at 132 ASF with an ante room and a small instrument room in front.

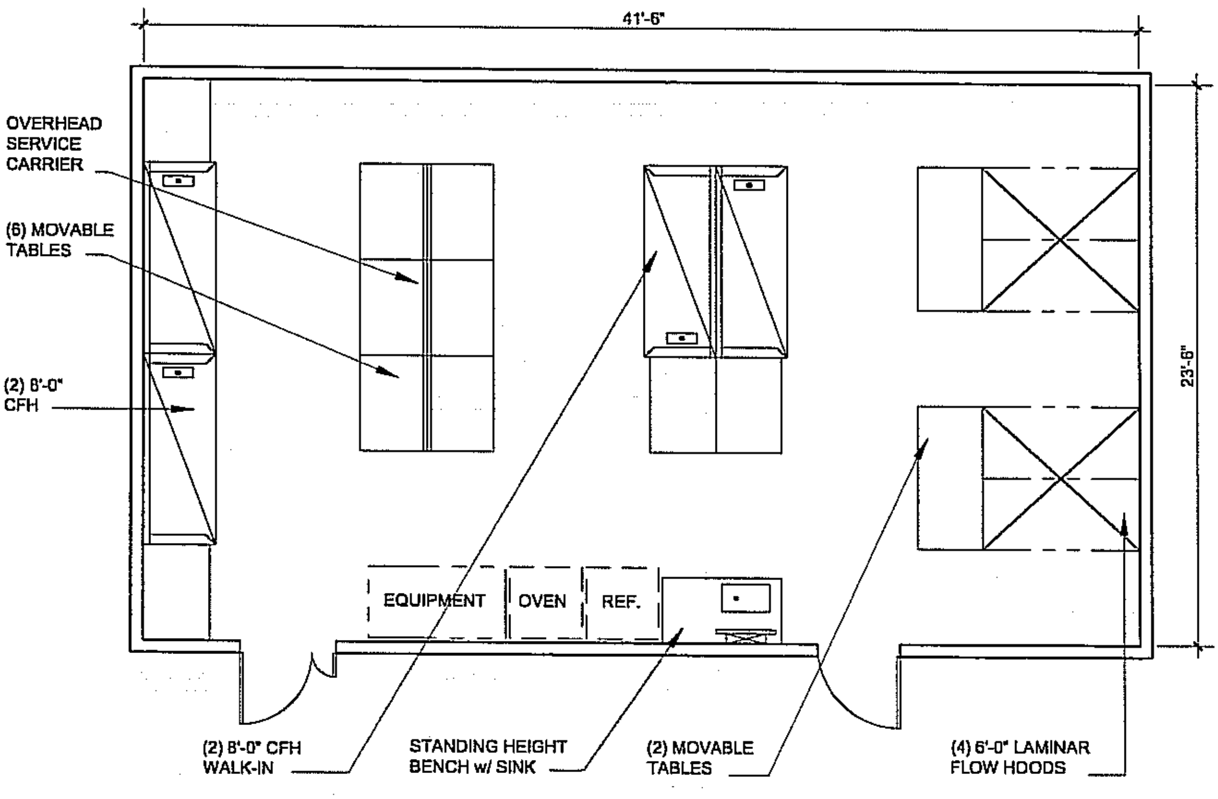
Scale: 1/8"=1'-0":



ROOM NAME: Characterization / Application
DEPARTMENT: Biological Nanostructures

SIZE: 954 ASF **OCCUPANCY:** 8 - 10
FUNCTION: This space will be used for general characterization of the biological products prepared by the Biological group. Application of the Biological nanostructure technology will also occur in this lab.
SPECIAL REQUIREMENTS: This lab includes chemical fume hoods, laminar flow hoods, refrigerator, oven and mobile benches.

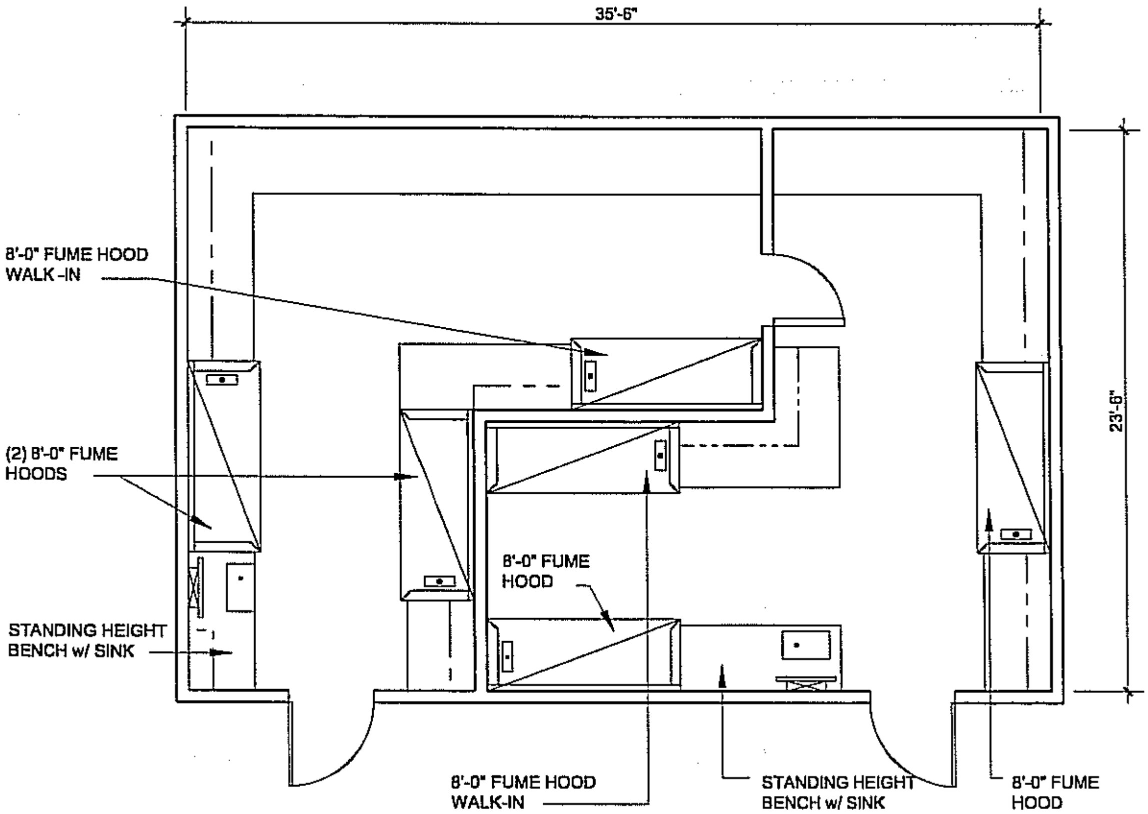
Scale: 1/8"=1'-0":



ROOM NAME: Synthesis
DEPARTMENT: Biological Nanostructures

SIZE: 804 ASF (2 rooms at 402 ASF each) **OCCUPANCY:** 3 - 5
FUNCTION: The Synthesis Labs will be used to create new organic molecules for use in nanotechnology studies.
SPECIAL REQUIREMENTS: These labs will house fume hoods.

Scale: 1/8"=1'-0":



ROOM NAME: Instrument Type 1
DEPARTMENT: Biological Nanostructures

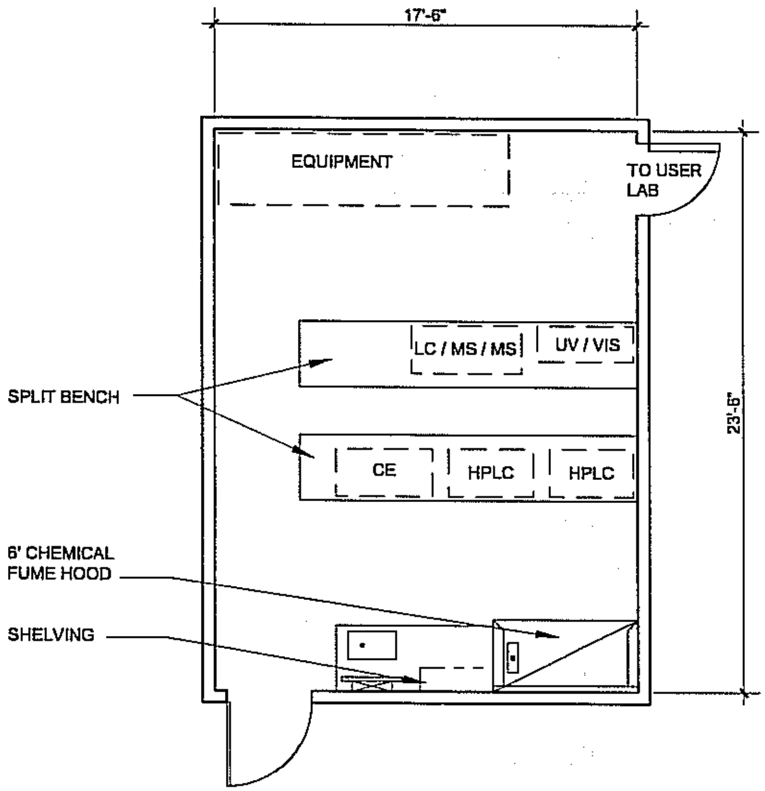
SIZE: 402 ASF

OCCUPANCY: 2 - 4

FUNCTION: The Instrument Type 1 Lab will be used as a support room for the Biological group. The room will contain sensitive instruments and prep benches.

SPECIAL REQUIREMENTS: This room will house benches, UV-Vis Spectrometer, 2-HPLC, LC-MS-MS, CE and a chemical fume hood.

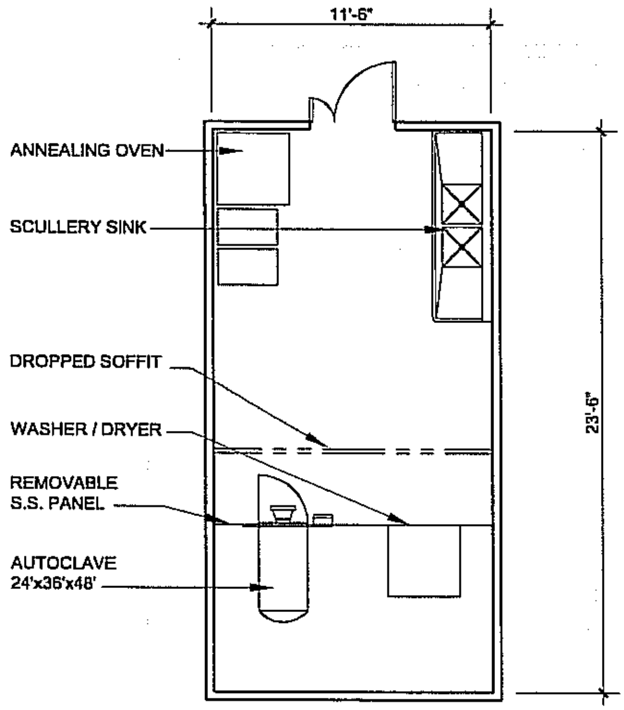
Scale: 1/8"=1'-0":



ROOM NAME: Glasswash
DEPARTMENT: Biological Nanostructures

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: The Glasswash Room will be used for cleaning and sterilizing the Biological group's glassware and laboratory supplies.
SPECIAL REQUIREMENTS: The room will contain an autoclave, glasswasher, dryer, annealing oven and scullery sink.

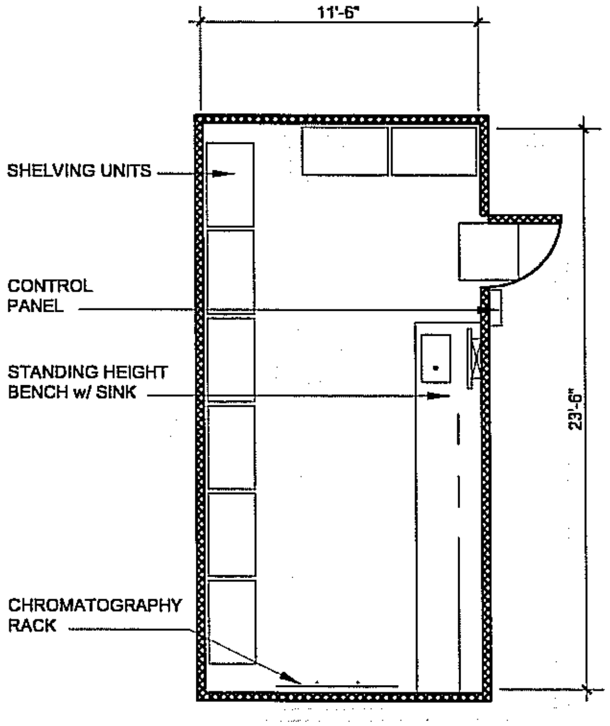
Scale: 1/8"=1'-0":



ROOM NAME: Cold Room
DEPARTMENT: Biological Nanostructures

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: The Cold Room will be used for storing supplies and to provide a controlled environment for specalized analysis techniques.
SPECIAL REQUIREMENTS: This room will contain protein purification instruments.

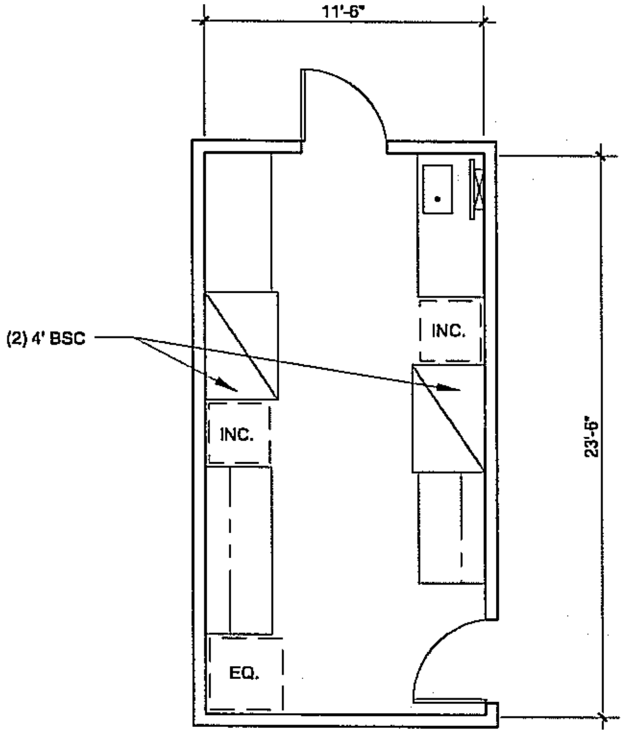
Scale: 1/8"=1'-0":



ROOM NAME: Cell Culture Room
DEPARTMENT: Biological Nanostructures

SIZE: 270 ASF **OCCUPANCY:** 2
FUNCTION: Both mammalian and bacterial cultures will be grown in the cell culture rooms. Researchers will use sterile techniques, including working in BSC's.
SPECIAL REQUIREMENTS: These rooms contain biosafety cabinets and incubators. Bacterial and mammalian cultures should be separated and the room is to be isolated from cell handling.

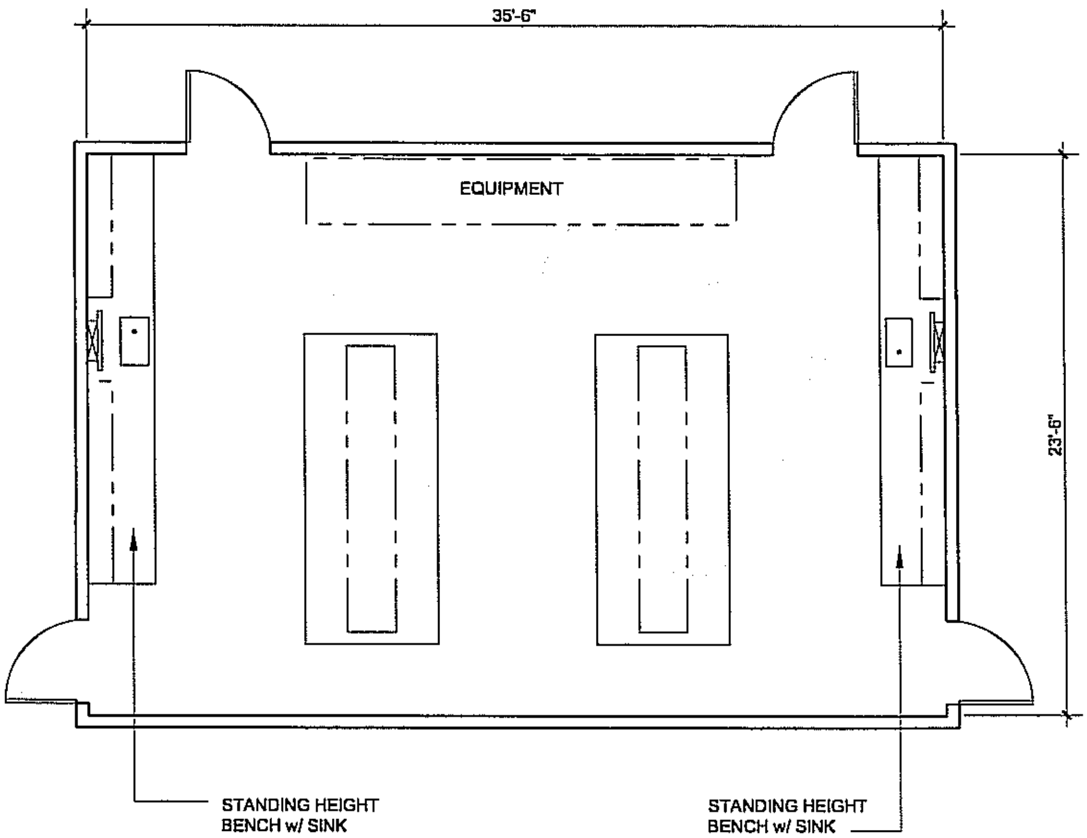
Scale: 1/8"=1'-0":



ROOM NAME: Cell Handling
DEPARTMENT: Biological Nanostructures

SIZE: 834 ASF **OCCUPANCY:** 9 - 12
FUNCTION: Cell cultures and their subsequent by-products will be manipulated in the Cell Handling Room. This may include protein purification, electrophoresis, and DNA / RNA purification.
SPECIAL REQUIREMENTS: None

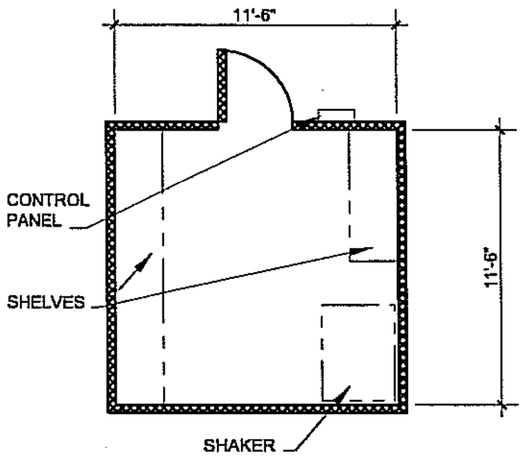
Scale: 1/8"=1'-0":



ROOM NAME: Warm Room
DEPARTMENT: Biological Nanostructures

SIZE: 132 ASF **OCCUPANCY:** 1
FUNCTION: The Warm Room will be used to grow biological samples for use in the researcher's experiments.
SPECIAL REQUIREMENTS: This room will be kept between +37-42 degrees Celsius.

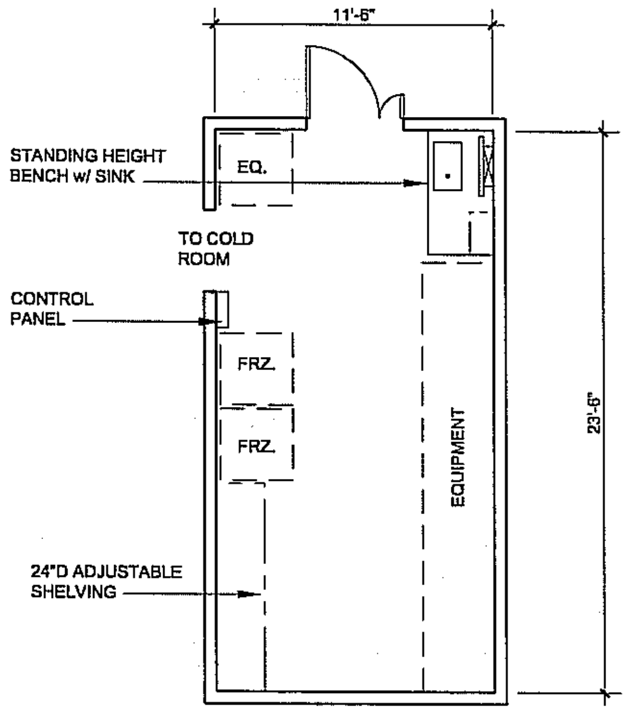
Scale: 1/8"=1'-0":



ROOM NAME: Freezer Room / Storage
DEPARTMENT: Biological Nanostructures

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: The Freezer / Storage Room will be used to store the researcher's equipment, such as ultra low temp. freezers, centrifuges. Supplies will also be stored in this space.
SPECIAL REQUIREMENTS: This room will house two (-80 degree) freezers.

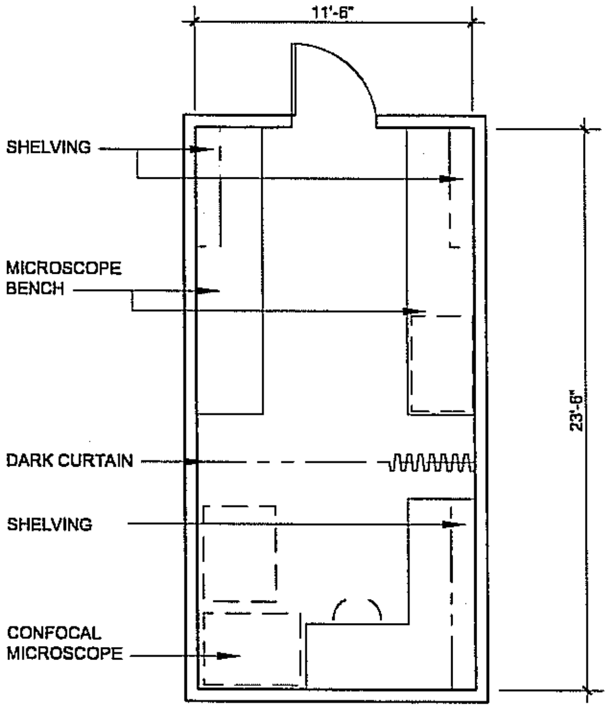
Scale: 1/8"=1'-0":



ROOM NAME: Optical Characterization Lab
DEPARTMENT: Biological Nanostructures

SIZE: 270 ASF **OCCUPANCY:** 2 - 3
FUNCTION: This room will be used to house various types of microscopes. Light control is required in this space.
SPECIAL REQUIREMENTS: The lab will contain a confocal microscope and two photon microscopes.

Scale: 1/8"=1'-0":



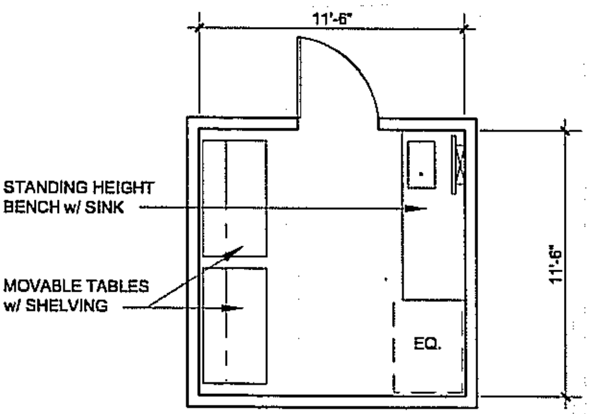
ROOM NAME: Flex Lab
DEPARTMENT: Biological Nanostructures

SIZE: 132 ASF

OCCUPANCY: 1 - 2

FUNCTION: Support room for Biological group. Uses will include fluorescence Microscopy and experiment support.
SPECIAL REQUIREMENTS: Fluorescence Microscopy will be performed in this room.

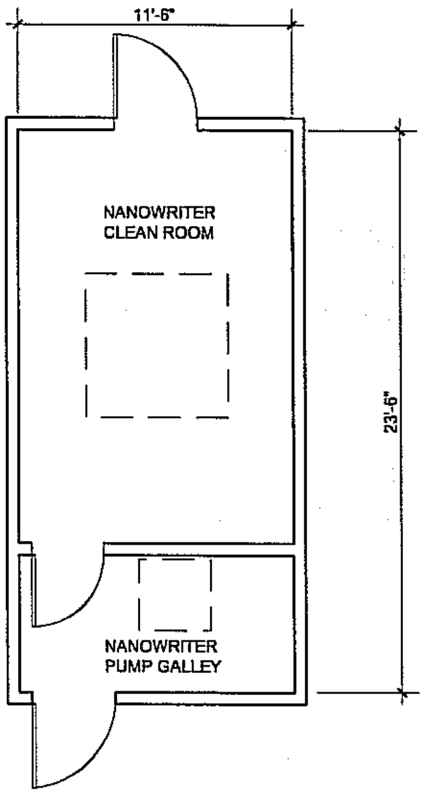
Scale: 1/8"=1'-0":



ROOM NAME: Nanowriter Clean Room
DEPARTMENT: Nanofabrication

SIZE: 132 ASF **OCCUPANCY:** 2
FUNCTION: This room will house the facility's Nanowriter. Vibration, temperature, and sound control are critical.
SPECIAL REQUIREMENTS: The room will be Class 100 and will include liquid nitrogen and chilled water. Vibration control to be at 125 mi/sec. This room may require high ceilings.

Scale: 1/8"=1'-0":



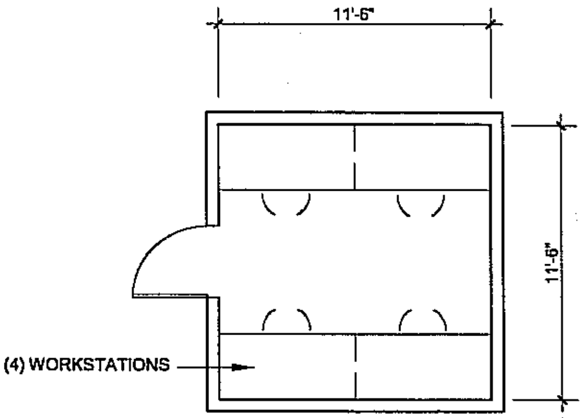
ROOM NAME: Nanowriter Control Room
DEPARTMENT: Nanofabrication

SIZE: 132 ASF

OCCUPANCY: 4

FUNCTION: This room allows the users to control the Nanowriter and FIB without entering the rooms housing the instruments.
SPECIAL REQUIREMENTS: This prototype Nanowriter room is Class 100 with a temperature control of .1C (performs at .1F). The room requires variable volume air control to quiet the room when the Nanowriter is in use. The humidity is at a set point of +/- 40 %.

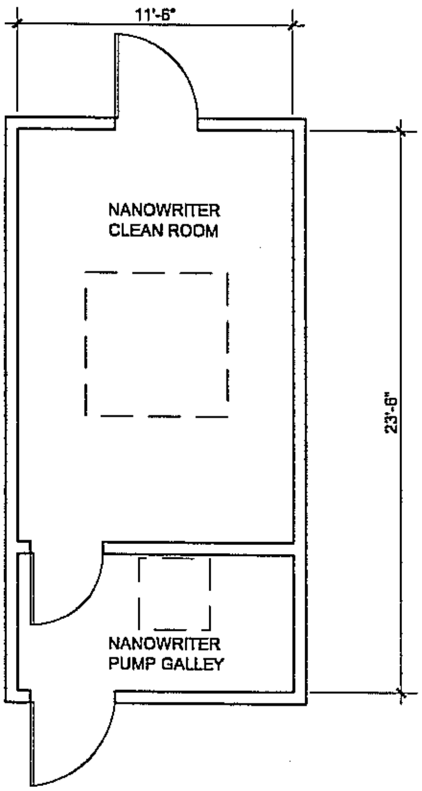
Scale: 1/8"=1'-0":



ROOM NAME: Nanowriter Pump Galley
DEPARTMENT: Nanofabrication

SIZE: 132 ASF **OCCUPANCY:** 0
FUNCTION: Mechanical equipment room for pumps, chillers and electronics associated with Nanowriter.
SPECIAL REQUIREMENTS: The Pump Galley is adjacent to the Clean Room and includes a pump chase.

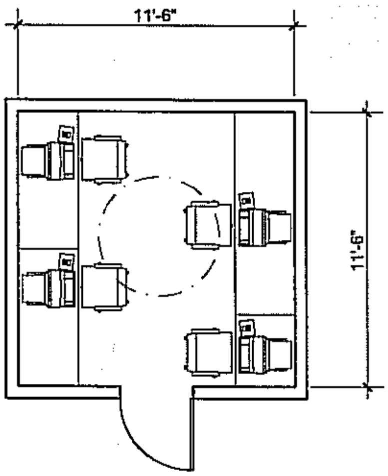
Scale: 1/8"=1'-0":



ROOM NAME: Nanowriter CADD Room
DEPARTMENT: Nanofabrication

SIZE: 132 ASF **OCCUPANCY: 4**
FUNCTION: To house four computers for individuals temporary use in performing computer drafting using Autocad software program.
SPECIAL REQUIREMENTS: Power and data connections for four stations.

Scale: 1/8"=1'-0":



ROOM NAME: Focused Ion Beam
DEPARTMENT: Nanofabrication

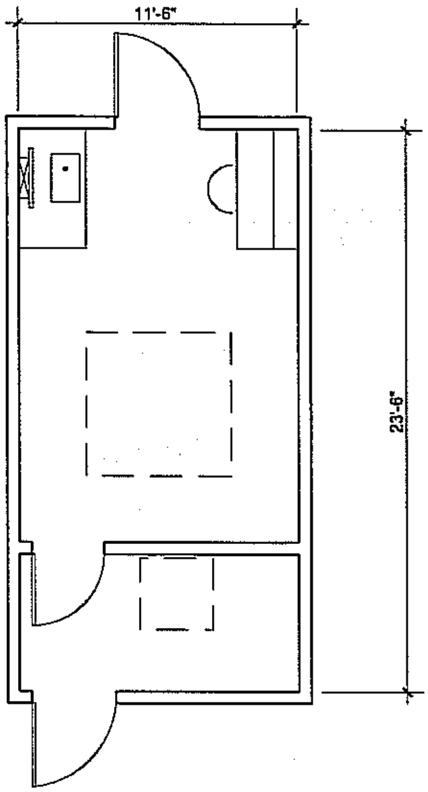
SIZE: 270 ASF

OCCUPANCY: 1 - 2

FUNCTION: This space will be used to huse the facility's focused ion beam instrument. This will be used for techniques such as mask repair, milling, deposition, etc. Vibration control and sound are crucial.

SPECIAL REQUIREMENTS: The FIB space is part of the Class 100 clean room suite. It will contain instrument floor space, bench with sink, and a computer. The space shares the Nanowriter Control and Pump rooms for Nanofabrication. Vibration control is at 125 mi/sec.

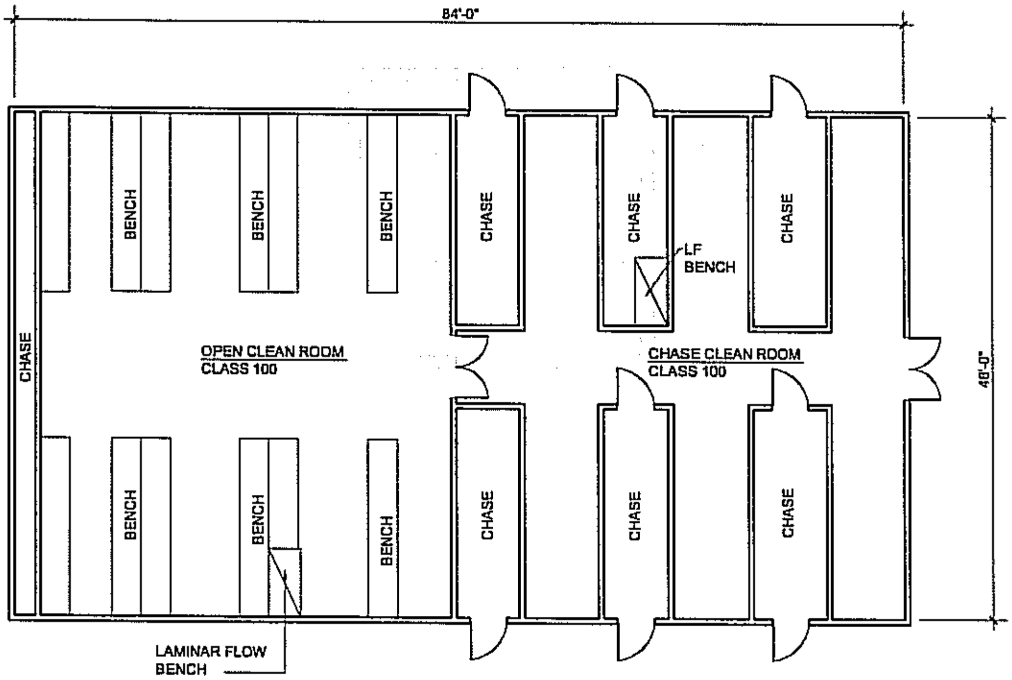
Scale: 1/8"=1'-0":



ROOM NAME: Clean Room (Open & Corridor / Chase Style)
DEPARTMENT: Nanofabrication

SIZE: 3920 ASF (2 at 1960 ASF each) **OCCUPANCY:** 6 - 12
FUNCTION: This space will be used for typical clean room functions with an emphasis on nanofabrication. It will house typical clean room equipment, etchers, mask aligners, wet benches, polishers, evaporators, etc.
SPECIAL REQUIREMENTS: Molecular beam epitaxy will be performed in this space Class 100 cleanroom. The room will contain laminar flow benches and some wet baths. Some areas may require yellow lighting.

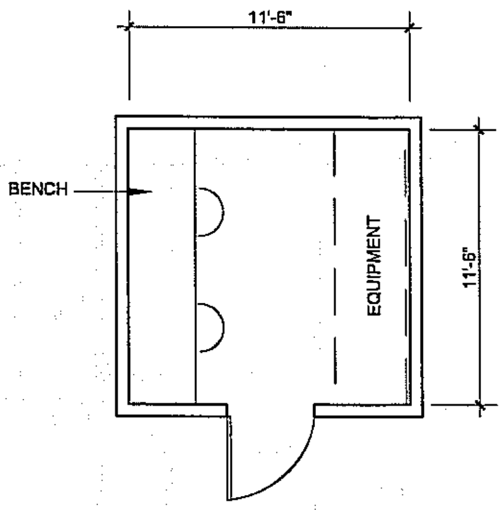
Scale: 1/16"=1'-0":



ROOM NAME: Clean Room Control Room
DEPARTMENT: Nanofabrication

SIZE: 132 ASF **OCCUPANCY:** 2
FUNCTION: Room used for housing alarm controls, computer monitoring systems and fire control systems.
SPECIAL REQUIREMENTS: None

Scale: 1/8"=1'-0":



ROOM NAME: Gowning / Clean Receiving
DEPARTMENT: Nanofabrication

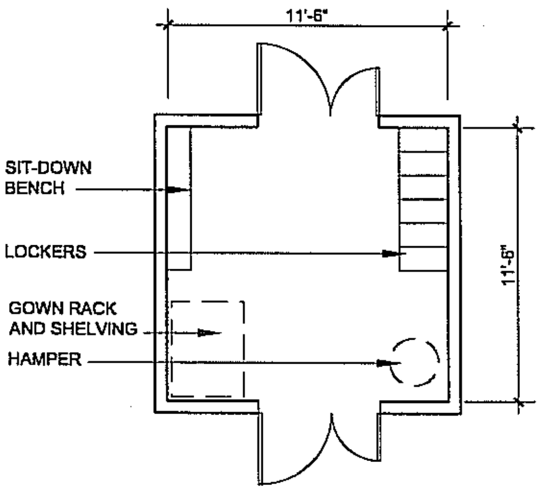
SIZE: 132 ASF

OCCUPANCY: 2 - 4

FUNCTION: Change room / airlock for entering the Clean Room Suite. Also used for bringing new equipment into the clean room. Wipe down of the equipment will occur in this space.

SPECIAL REQUIREMENTS: This space will have a combined use (clean receiving is rare). The room will include a gown hanger rack & shelving for clean gowns and disposables, hampers for used gowns and gloves. Shoe covers are to be worn outside the clean room (provide bench seating).

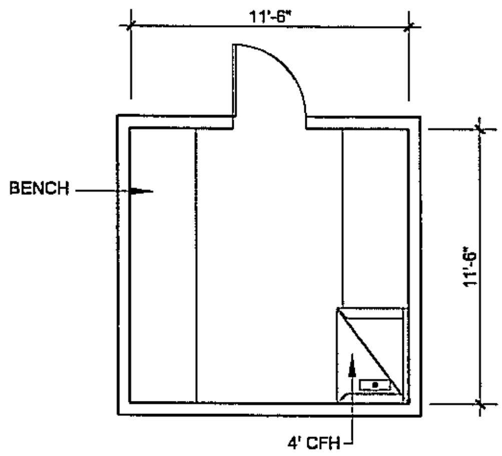
Scale: 1/8"=1'-0";



ROOM NAME: Chemical Storage
DEPARTMENT: Nanofabrication

SIZE: 132 ASF **OCCUPANCY:** 1
FUNCTION: This room will be used for chemical storage and dispensing for the Nanofabrication Department.
SPECIAL REQUIREMENTS: The room will have an H-3 Occupancy and contain a chemical fume hood for dispensing.

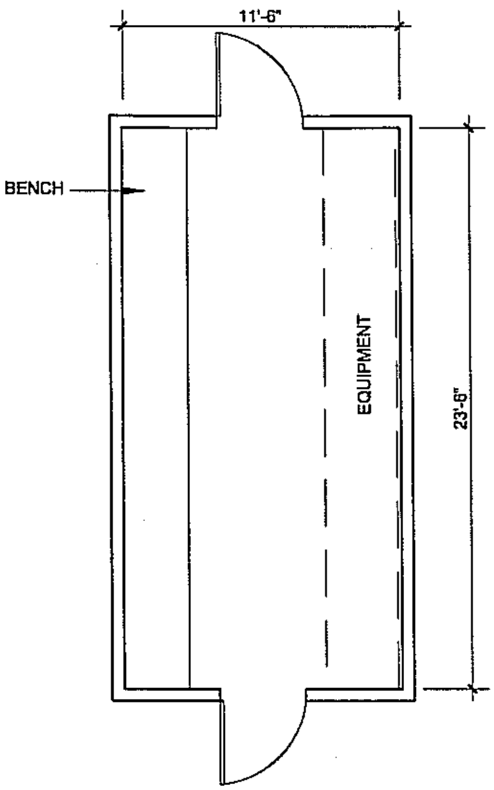
Scale: 1/8"=1'-0":



ROOM NAME: Spare Parts Storage / Workbench
DEPARTMENT: Nanofabrication

SIZE: 270 ASF **OCCUPANCY:** 2
FUNCTION: Supply storage and clean room instrument repair space.
SPECIAL REQUIREMENTS: This space is not in the clean rooms suite, but should be located near the clean room. Consider security for high value materials.

Scale: 1/8"=1'-0":



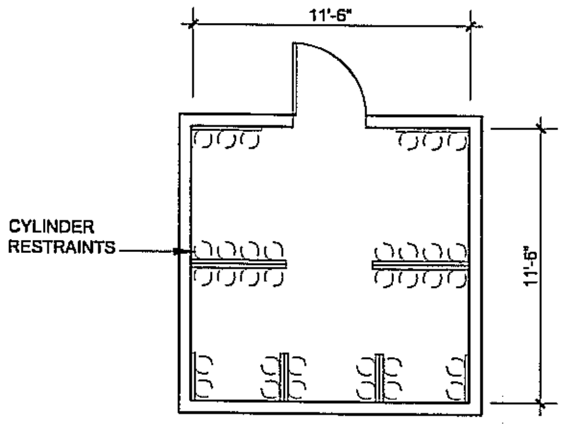
ROOM NAME: Nanotechnology Cylinder Holding
DEPARTMENT: Nanofabrication

SIZE: 132 ASF

OCCUPANCY: 1

FUNCTION: This room will be used for storing full and empty gas cylinders.
SPECIAL REQUIREMENTS: Consider perimeter or exterior location. Potential for high hazardous occupancy classification depending on specific types of gases stored.

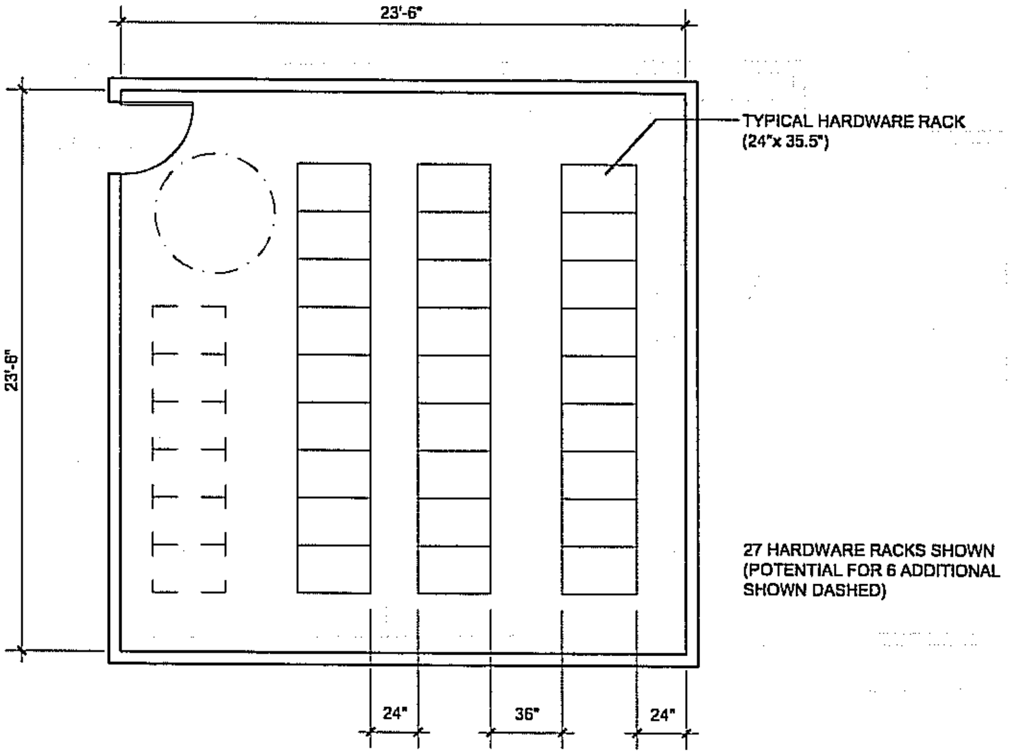
Scale: 1/8"=1'-0":



ROOM NAME: Computer Hardware Room
DEPARTMENT: Theory

SIZE: 552 ASF **OCCUPANCY:** 0
FUNCTION: To house 25 to 30 racks for servers for the department's computers.
SPECIAL REQUIREMENTS: Special cooling needs, flexible power and data infrastructure for server connections and possibly space for UPS.

Scale: 1/8"=1'-0":



ROOM NAME: Main Analysis Laboratory
DEPARTMENT: Imaging & Manipulation

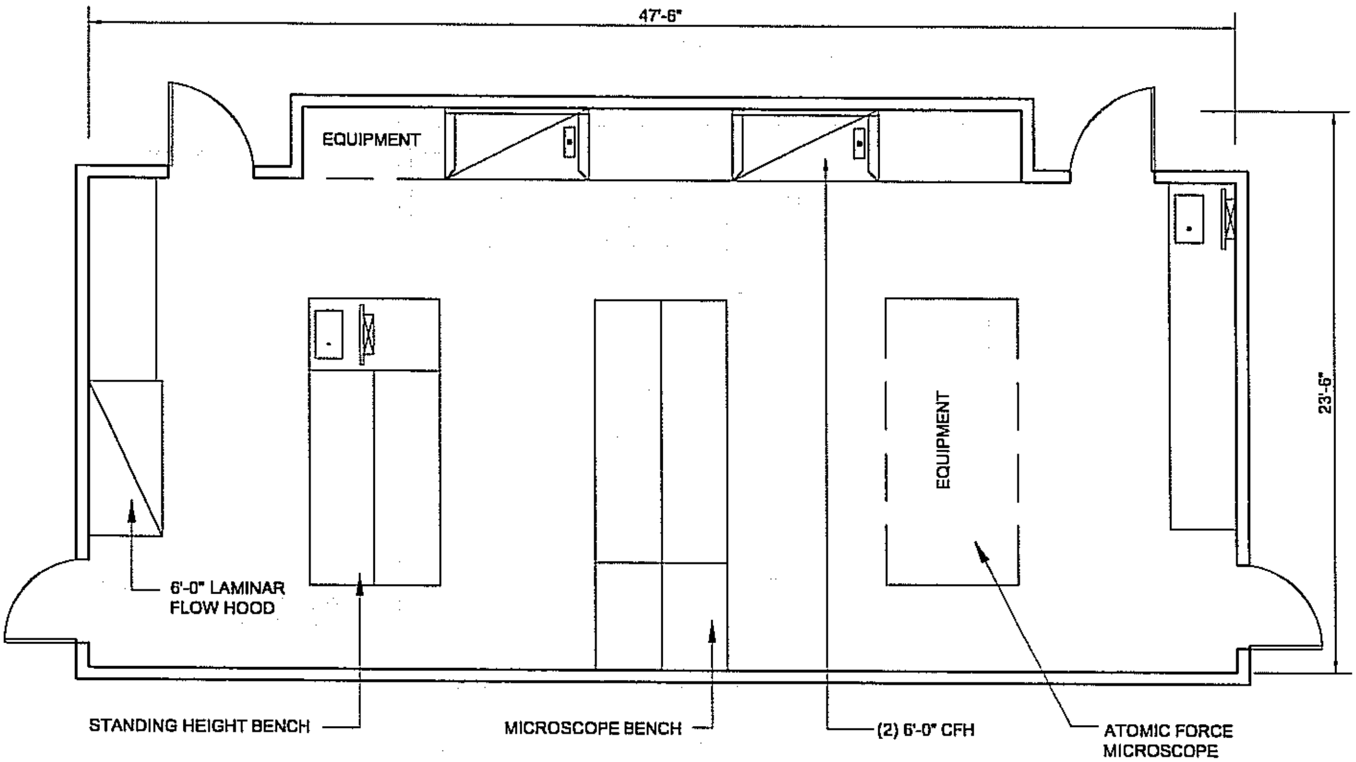
SIZE: 1116 ASF

OCCUPANCY: 8 - 14

FUNCTION: The Main Analysis Room will be used to prepare samples for use in the Image Analysis rooms, as well as for housing non-light sensitive analysis equipment.

SPECIAL REQUIREMENTS: This room includes an Optical Microscope, commercial instruments, chemical fume hoods, an atomic force microscope, prep area, sample prep, sink, laminar flow hood, bench space, sonicators, and a refrigerator. No darkenable areas, UPS, or SEM are required.

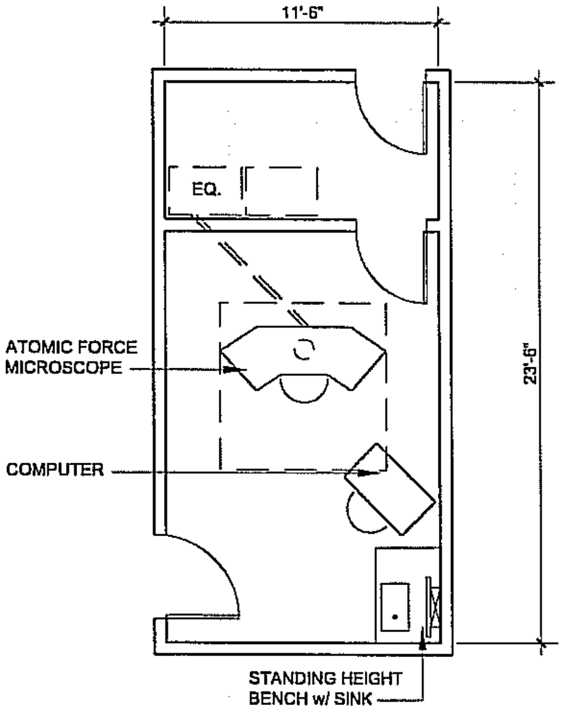
Scale: 1/18"=1'-0":



ROOM NAME: Atomic Manipulation UHV-STM
DEPARTMENT: Imaging & Manipulation

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: This room will house the facility's scanning-tunneling microscope. The space needs to be extremely quiet and vibration free.
SPECIAL REQUIREMENTS: This room contains instrument floor space, bench space, computer, and a sink. The room must have high-level sound insulation, with a potential isolation box. Floor vibration: 125 mi/Sec.

Scale: 1/8"=1'-0":



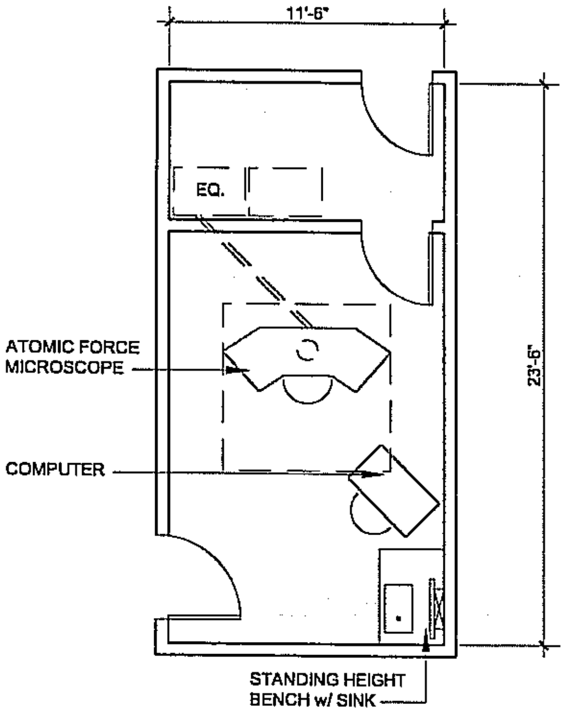
ROOM NAME: Atomic Resolution UHV NC-AFM
DEPARTMENT: Imaging & Manipulation

SIZE: 270 ASF

OCCUPANCY: 1 - 2

FUNCTION: This room will house the facility's scanning-tunneling microscope. The space needs to be extremely quiet and vibration free.
SPECIAL REQUIREMENTS: This room contains instrument floor space, bench space, computer, and a sink. The room must have high-level sound insulation, with a potential isolation box. Floor vibration: 125 mi/Sec.

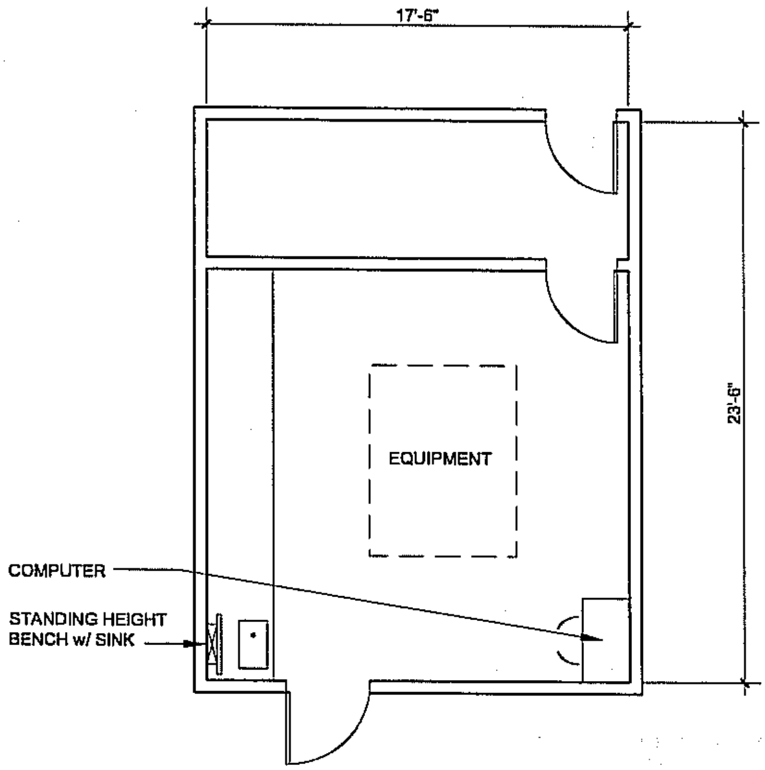
Scale: 1/8"=1'-0":



ROOM NAME: SPM / EM for Tranport Measurements
DEPARTMENT: Imaging & Manipulation

SIZE: 402 ASF **OCCUPANCY:** 1 - 2
FUNCTION: This space will house the facilities scanning probe microscope. Vibration control and ound isolation are critical.
SPECIAL REQUIREMENTS: This room contains instrument floor space, bench, computer, and a sink. The room may have a potential isolation box for sound isolation. Floor vibration: 125 mi/Sec

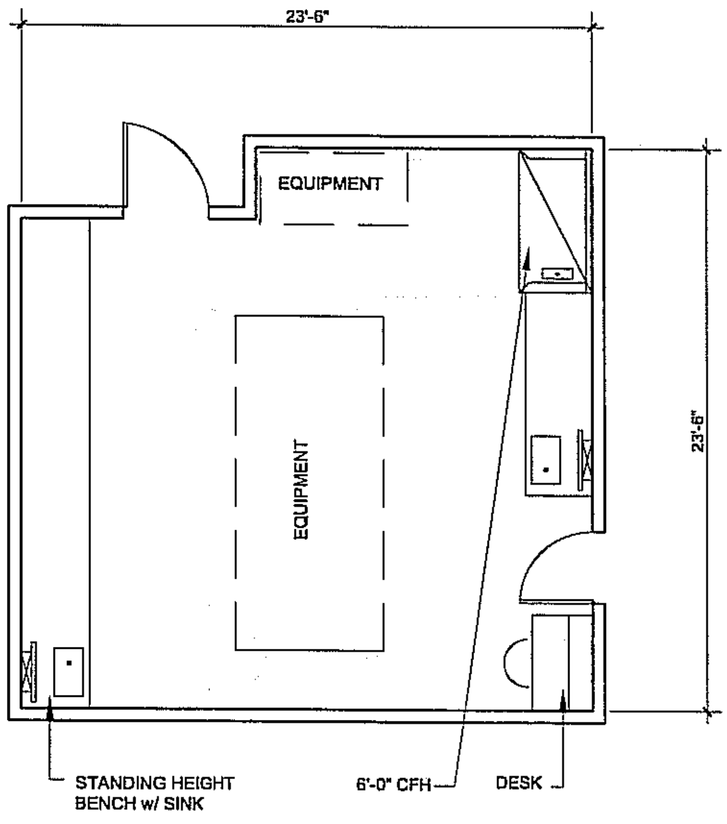
Scale: 1/8"=1'-0":



ROOM NAME: Prototype / Instrument Test Lab
DEPARTMENT: Imaging & Manipulation

SIZE: 552 ASF **OCCUPANCY:** 4 - 6
FUNCTION: This will be available for researching new technology imaging instrumentation, as well as for testing new equipment.
SPECIAL REQUIREMENTS: This lab contains instrument floor space, bench, computer, sink and a chemical fume hood.

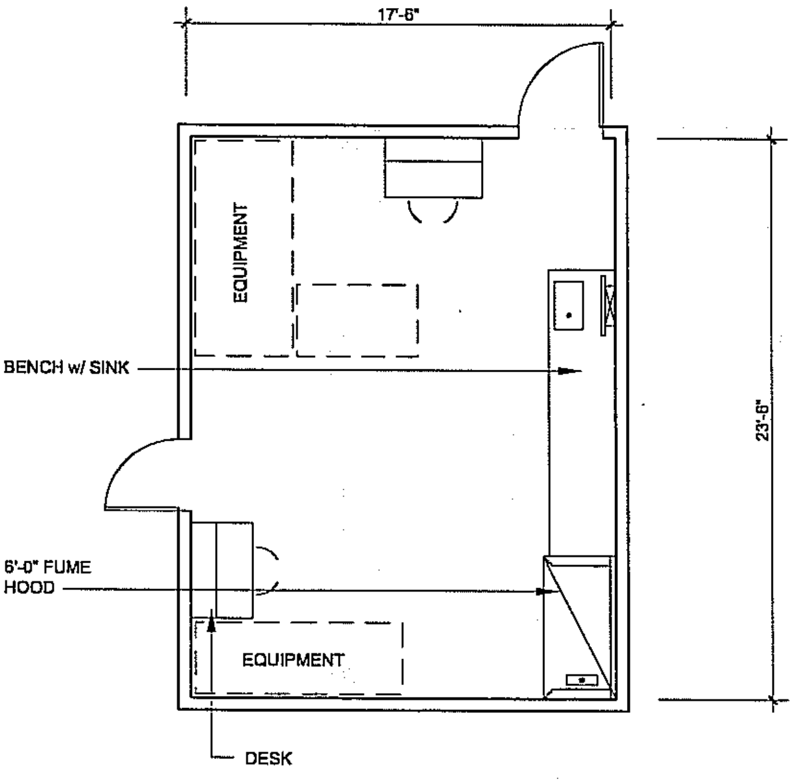
Scale: 1/8"=1'-0":



ROOM NAME: Microwave AFM / Molecular AFM Studies
DEPARTMENT: Imaging & Manipulation

SIZE: 402 ASF **OCCUPANCY:** 2 - 4
FUNCTION: A future specialty atomic force microscope will be built and installed in this space.
SPECIAL REQUIREMENTS: LBNL will build a custom model with instrument floor space, bench, computer, sink and fume hood.

Scale: 1/8"=1'-0":



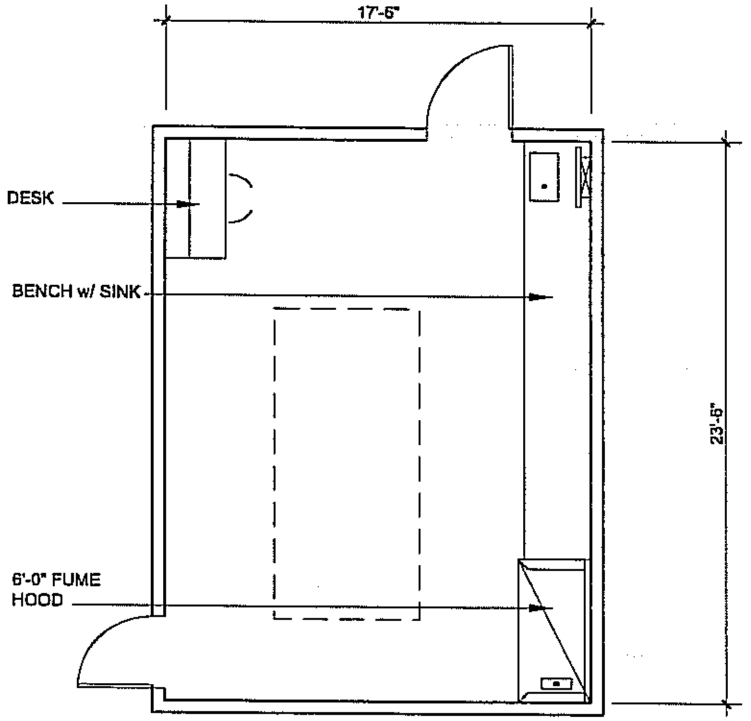
ROOM NAME: Single Molecule Confocal Microscopy
DEPARTMENT: Imaging & Manipulation

SIZE: 402 ASF

OCCUPANCY: 2 - 4

FUNCTION: This space will house a next generation confocal microscope.
SPECIAL REQUIREMENTS: This space contains instrument floor space, bench, computer, sink, and a fume hood.

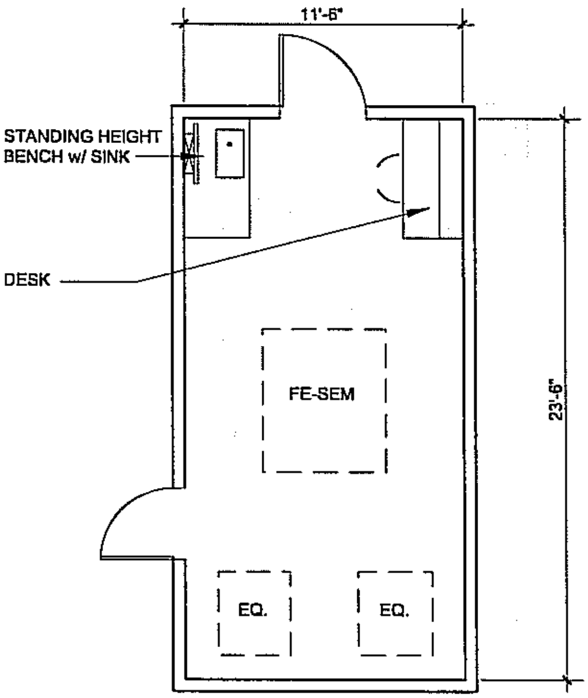
Scale: 1/8"=1'-0":



ROOM NAME: Analytical FE-SEM
DEPARTMENT: Imaging & Manipulation

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: This space will house the facility's FE-SEM. Vibration and sound control, although important, are not as critical as the atomic level instruments.
SPECIAL REQUIREMENTS: This room contains instrument floor space, bench space, computer, and a sink.

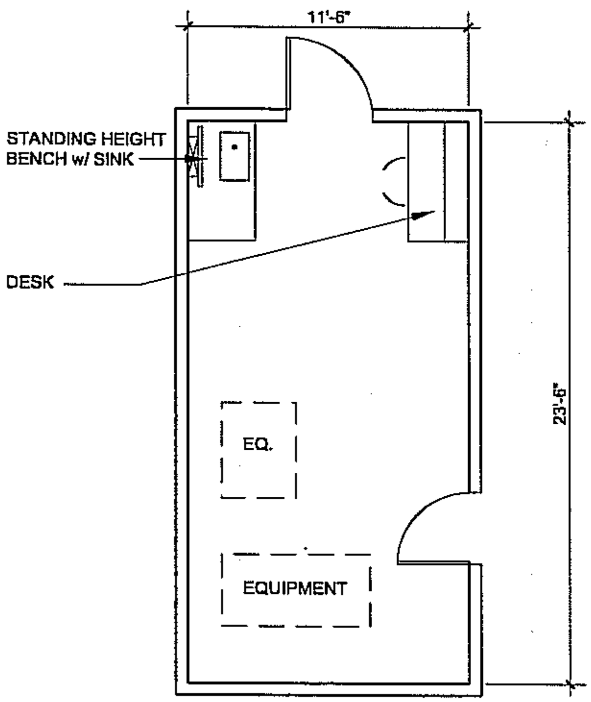
Scale: 1/8"=1'-0":



ROOM NAME: X-Ray Photoemission System (XPS)
DEPARTMENT: Imaging & Manipulation

SIZE: 270 ASF **OCCUPANCY:** 1 - 2
FUNCTION: This space will house an XPS, which will be used for surface analysis of materials.
SPECIAL REQUIREMENTS: This room can be combined with Environmental SEM.

Scale: 1/8"=1'-0":



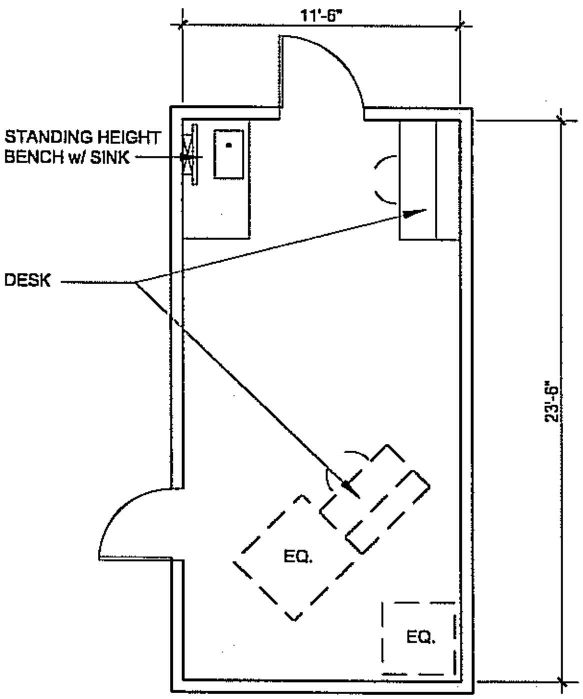
ROOM NAME: Environmental SEM
DEPARTMENT: Imaging & Manipulation

SIZE: 270 ASF

OCCUPANCY: 1 - 2

FUNCTION: This space will house the ESEM, which is used to image wet or oily materials, such as biological organisms, with minimal sample preparation.
SPECIAL REQUIREMENTS: This room can be combined with XPS, 200 Kva.

Scale: 1/8"=1'-0":



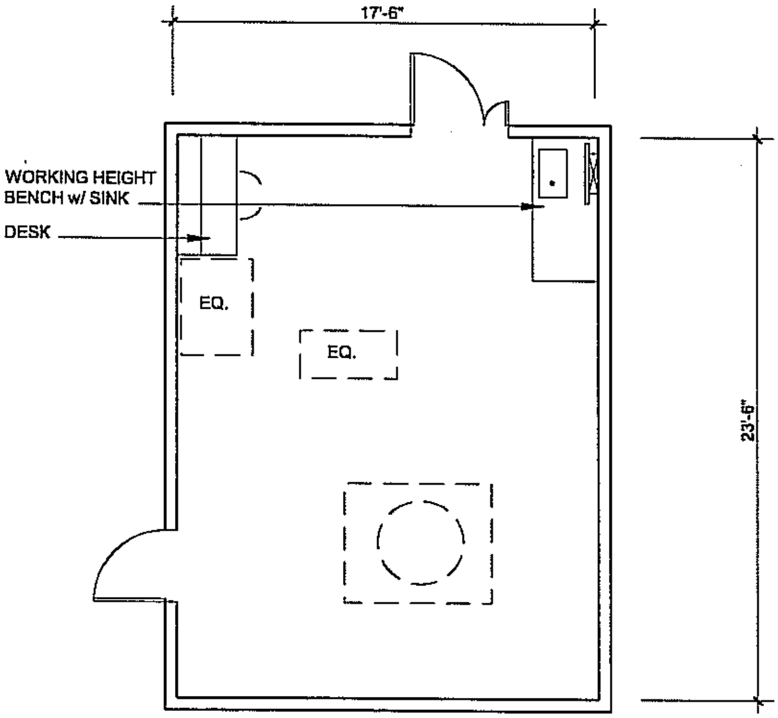
ROOM NAME: NMR - 500 MHz Self Shielded
DEPARTMENT: Imaging & Manipulation

SIZE: 402 ASF

OCCUPANCY: 2 - 4

FUNCTION: The facility's NMR will be housed in this space. The NMR is helpful in determining the three dimensional structure of molecules.
SPECIAL REQUIREMENTS: Keep metal objects away from this space.

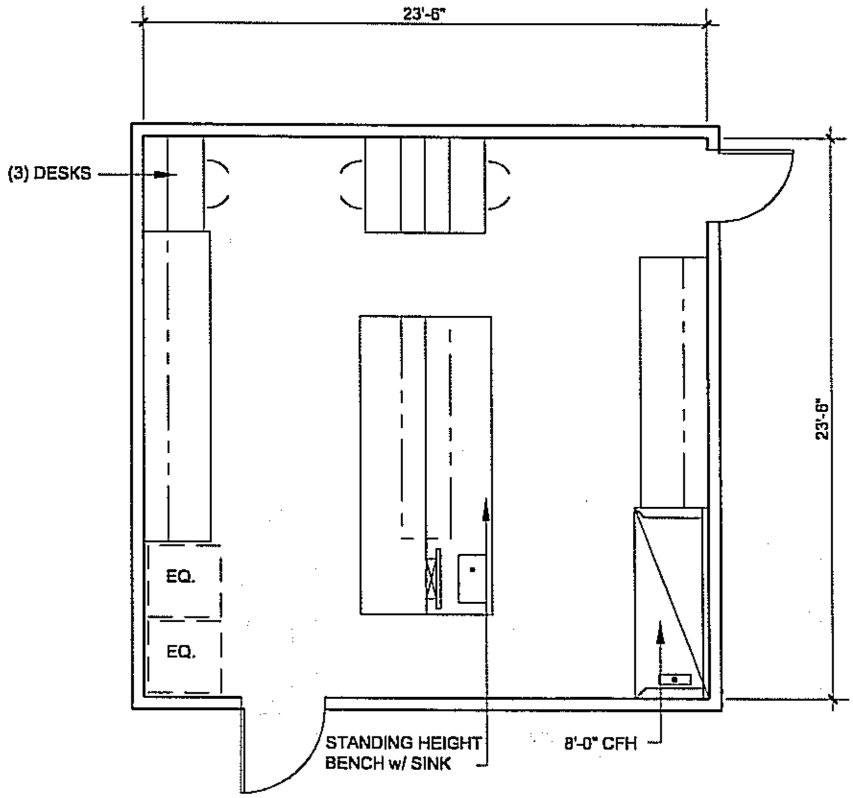
Scale: 1/8"=1'-0":



ROOM NAME: Flexible Lab (Type 1)
DEPARTMENT: User Laboratories

SIZE: 552 ASF **OCCUPANCY:** 6 - 8
FUNCTION: The User Laboratories are general research laboratories to be used by guest researchers. The labs must be flexible enough to accommodate a wide range of research techniques.
SPECIAL REQUIREMENTS: These labs contain a chemical fume hood, benches and floor space.

Scale: 1/8"=1'-0":



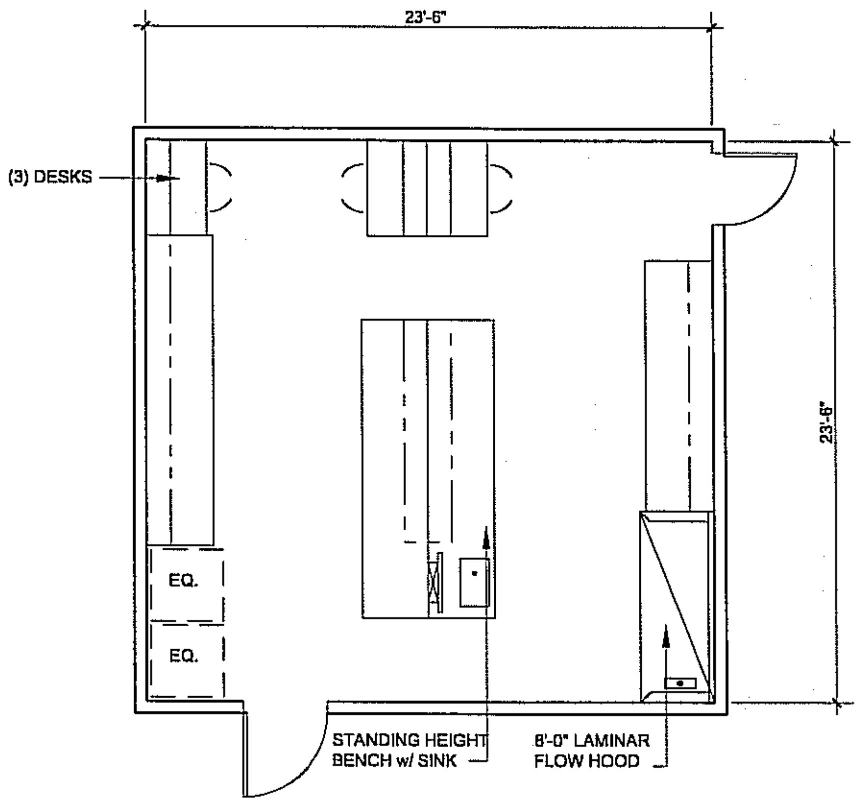
ROOM NAME: Flexible Lab (Type 2)
DEPARTMENT: User Laboratories

SIZE: 552 ASF **OCCUPANCY:** 6 - 8

FUNCTION: The User Laboratories are general research laboratories to be used by guest researchers. The labs must be flexible enough to accommodate a wide range of research techniques.

SPECIAL REQUIREMENTS: These labs contain a laminar flow hood, benches and floor space.

Scale: 1/8"=1'-0":

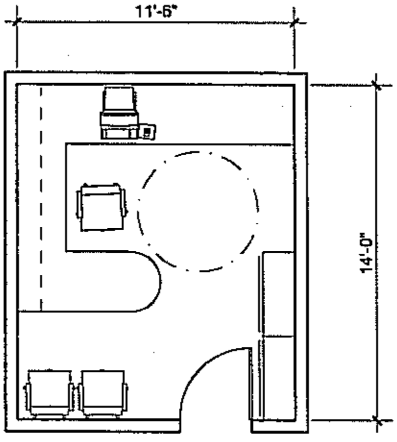


ROOM NAME: As Noted
DEPARTMENT: Various

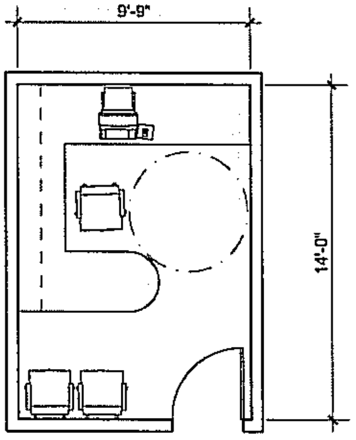
SIZE: As Noted
FUNCTION: Various offices / workstations
SPECIAL REQUIREMENTS: None

OCCUPANCY: As Noted

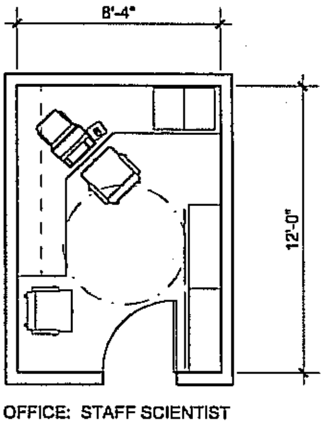
Scale: 1/8"=1'-0":



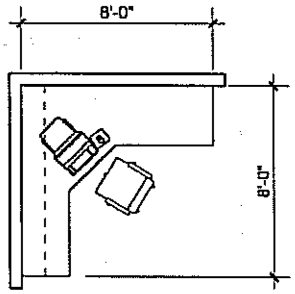
OFFICE: SCIENTIFIC DIRECTOR
160 SQUARE FEET



OFFICE: LEAD SCIENTIST
135 SQUARE FEET



OFFICE: STAFF SCIENTIST
100 SQUARE FEET

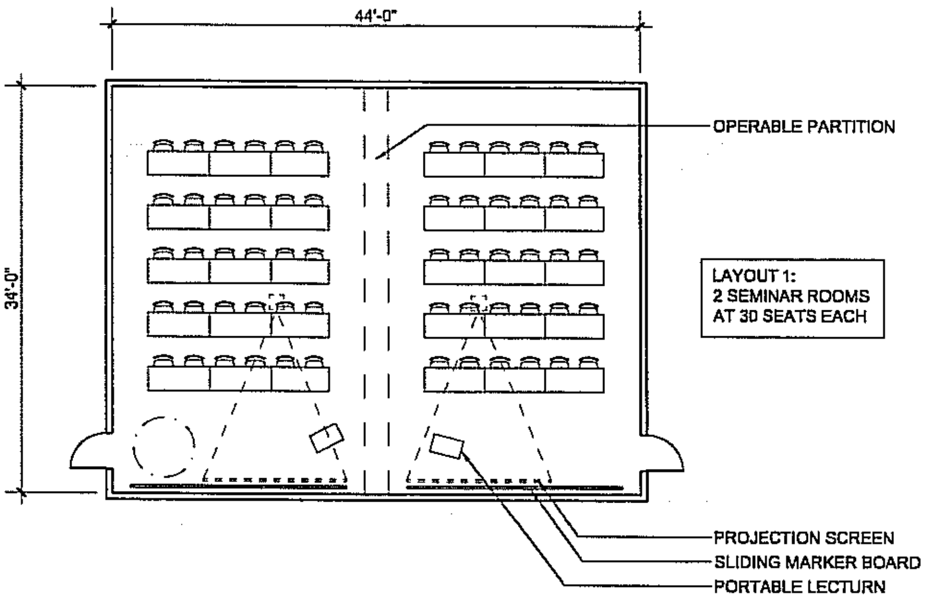


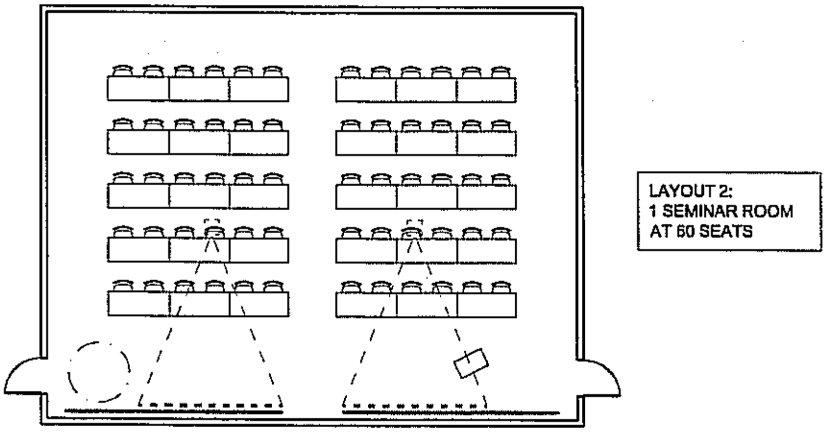
CUBICLE: TECHNICIAN / STUDENT / POST-DOC
64 SQUARE FEET

ROOM NAME: Seminar Room
DEPARTMENT: Common Spaces

SIZE: 1500 ASF **OCCUPANCY: 60**
FUNCTION: Teaching, conference and seminar type space for various meetings, lectures and discussions.
SPECIAL REQUIREMENTS: Audio-visual equipment, darkenable window treatments, adjustable lighting, acoustical separation, operable partition.

Scale: 1/16"=1'-0":

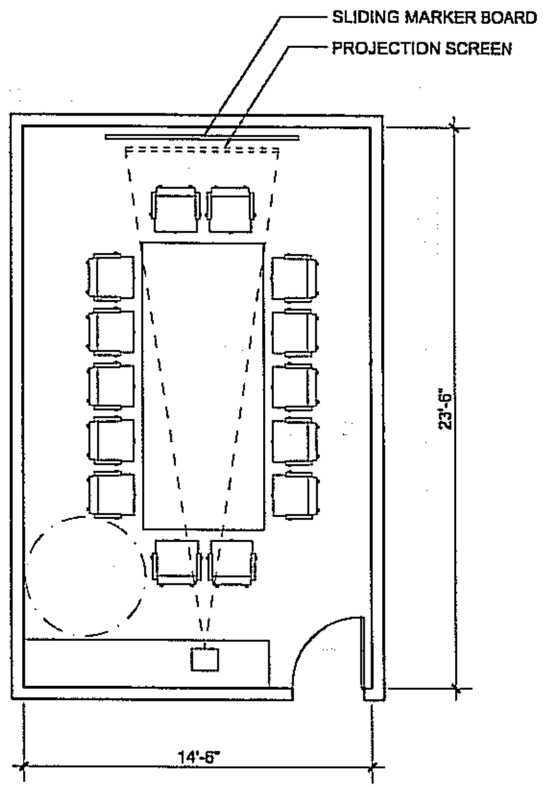




ROOM NAME: Conference Room
DEPARTMENT: Common Spaces

SIZE: 340 ASF **OCCUPANCY: 15**
FUNCTION: Conference space for meetings and discussions
SPECIAL REQUIREMENTS: Audio-visual equipment, darkenable window treatments, adjustable lighting

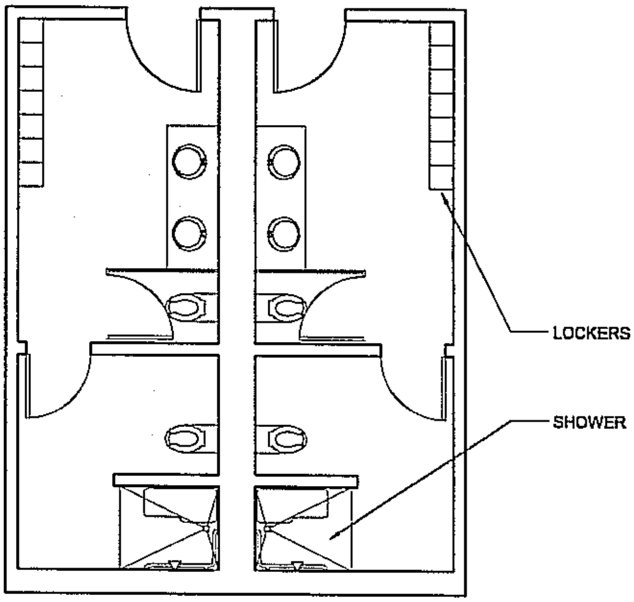
Scale: 1/8"=1'-0":



ROOM NAME: Shower / Locker Room
DEPARTMENT: Common Space

SIZE: 200 ASF Each **OCCUPANCY: 0**
FUNCTION: For employee and researcher use
SPECIAL REQUIREMENTS: Water-resistant gypsum board ceilings

Scale: 1/8"=1'-0":



APPENDIX B: CONSTRUCTION COST ESTIMATE

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
01 FOUNDATIONS					
011 STANDARD FOUNDATIONS	**20,000**	**FPA**	**$ 5.45**		
Wall foundations					
Reinforced concrete continuous wall footing	552	LF	125.00	69,000	
Column foundations					
Pile caps	100	CY	400.00	40,000	
Standard Foundations					**$109,000**
012 SPECIAL FOUNDATIONS	**20,000**	**FPA**	**$ 23.40**		
Drilled concrete piers, 36" dia (avg. depth 40'-0")	2,120	LF	125.00	265,000	
Rock excavation - not included					
Reinforced concrete grade beams	1,680	LF	100.00	168,000	
Dewatering, allow	1	LS	35,000.00	35,000	
Special Foundations					**$468,000**
FOUNDATIONS TOTAL					**$577,000**
02 SUBSTRUCTURE					
021 SLAB ON GRADE	**20,000**	**SF**	**$ 7.95**		
Slab on grade incl. sand base and vapor barrier	20,000	SF	5.50	110,000	
Reinforced concrete slab at Loading dock	1,750	SF	6.50	11,375	
Concrete trenches including cover	70	LF	150.00	10,500	
Elevator pit & slab - complete	2	EA	7,500.00	15,000	
Subdrainage systems	607	LF	20.00	12,144	
Slab on Grade					**$159,019**

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
022 BASEMENT EXCAVATION	**593,000**	**BCF**	**$ 0.34**		
Mass excavation	26,356	CY	7.00	184,489	
Imported structural backfill - Allow 20%	879	CY	20.00	17,570	
Basement Excavation					**$202,059**
023 BASEMENT WALLS	**25,525**	**BWA**	**$ 60.66**		
Basement waterproofing	25,525	SF	3.00	76,575	
Retaining walls 16" thick	6,700	SF	23.00	154,100	
Tie-back wall system including 8" shotcrete wall	18,825	SF	70.00	1,317,750	
Basement Wall					**$1,548,425**
SUBSTRUCTURE					**$1,909,503**
03 SUPERSTRUCTURE					
031 FLOOR CONSTRUCTION	**66,696**	**UFA**	**$ 44.95**		
Columns supporting floors					
Reinforced concrete shear walls, 12" thick	5,190	SF	16.00	83,040	
Concrete pilasters	400	LF	150.00	60,000	
Concrete columns, 24" x 24"	500	LF	100.00	50,000	
Structural steel columns & braced framing	117	TN	2,300.00	269,100	
Miscellaneous connections, plates & angles	12	TN	3,500.00	40,950	
Floor girder and beams					
Structural steel girders & beams	597	TN	2,300.00	1,372,928	
Miscellaneous connections, plates & angles	60	TN	3,500.00	208,924	
Expansion control	1	LS	50,000.00	50,000	

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
Floor decks, slabs and toppings					
Waffle slab, 40"	2,880	SF	37.50	108,000	
Suspended concrete floor slab, 14"	9,846	SF	23.00	226,458	
Lightweight concrete topping, 3 1/4"	56,850	SF	3.80	216,030	
Composite metal floor deck	56,850	SF	2.50	142,125	
Allow for drop	300	LF	15.00	4,500	
Embedded plates at supported slab	1,546	LF	50.00	77,300	
Fireproofing and firestopping					
Fireproofing steel frame, allow 50%	393	TN	225.00	88,348	
Floor Construction					**$2,997,702**
032 ROOF CONSTRUCTION	**20,886**	**RA**	**$ 38.59**		
Roof framing					
Structural steel roof framing	84	TN	2,300.00	193,200	
Cantilever roof trusses	124	TN	3,000.00	372,600	
Miscellaneous connections, plates & angles	21	TN	3,500.00	72,870	
Roof decks and toppings					
Metal roof deck, 3"	20,886	SF	2.50	52,215	
Lightweight concrete topping, 3 1/4"	20,886	SF	3.80	79,367	
Fireproofing and firestopping					
Fireproofing steel frame, allow 50%	115	TN	225.00	25,765	
Equipment pads	500	SF	20.00	10,000	
Roof Construction					**$806,017**
SUPERSTRUCTURE					**$3,803,719**

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
04 EXTERIOR CLOSURE					
041 EXTERIOR WALLS	**68,380**	**XWA**	**$ 42.67**		
Wall framing, furring and insulation					
Steel framing	55,990	SF	5.00	279,950	
Insulation	55,990	SF	1.25	69,988	
Expansion joints, allow	1	LS	20,000.00	20,000	
Exterior wall finishes					
Exterior wall cladding system	37,680	SF	45.00	1,695,582	
Column covers	1,500	SF	50.00	75,000	
Parapet wall finish, one side	7,200	SF	14.00	100,800	
Interior finish to exterior walls					
Gypsum board with furring channel to interior of exterior wall	46,080	SF	5.00	230,400	
Fascias, bands and trim, etc	2,378	LF	45.00	107,010	
Exterior soffit					
Suspended cement plaster system	3,050	SF	17.00	51,850	
Balustrades, parapets and roof screens					
Exterior sunscreen	800	LF	135.00	108,000	
Exterior canopy including steel framing	3	EA	30,000.00	90,000	
Parapet wall construction, wall caps	1,800	SF	20.00	36,000	
Stainless steel joint cover	554	LF	80.00	44,320	
Perimeter firesafing	2,930	LF	3.00	8,790	
Exterior Wall					**$2,917,690**
042 EXTERIOR WINDOWS	**15,100**	**XDA**	**$ 45.33**		
Windows, glazing and louvers					
Curtain walls/Aluminum glazed windows	14,100	SF	45.00	634,500	
Metal louvers, allow	1,000	SF	50.00	50,000	
Exterior Window & Door					**$684,500**

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
043 EXTERIOR DOORS	**565**	**XDA**	**$ 102.74**		
Exterior doors					
Main entrance storefront system	350	SF	45.00	15,750	
Aluminum storefront doors					
Single	2	EA	1,800.00	3,600	
Double	4	PR	2,800.00	11,200	
Hollow metal door					
Single	5	EA	1,200.00	6,000	
Rolling steel door	200	SF	40.00	8,000	
Automatic door hardware	1	LS	6,000.00	6,000	
Special door hardware	1	LS	7,500.00	7,500	
Exterior Door					**$58,050**
EXTERIOR CLOSURE					**$3,660,240**
05 ROOFING					
051 ROOFING & SHEETMETAL	**20,886**	**RA**	**$ 16.38**		
Thermaplastic roofing	20,886	SF	4.50	93,987	
Rigid insulation	20,886	SF	2.50	52,215	
Roof deck walking pads, allow	2,089	SF	15.00	31,329	
Sheetmetal cover flashings & trims	2,910	LF	18.00	52,380	
Skylight, allow	500	SF	100.00	50,000	
Caulking and sealants	20,886	SF	2.50	52,215	
Expansion joints - allow	1	LS	10,000.00	10,000	
ROOFING					**$342,126**

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
06 INTERIOR CONSTRUCTION					
061 PARTITIONS	**112,500**	**PSF**	**$ 21.68**		
Furring to interior shearwalls	5,190	SF	5.50	28,545	
Standard gypboard partition including insulation	78,900	SF	8.50	670,650	
Rated partitions, 2 hour	33,600	SF	10.50	352,800	
Shaft liner, 1"	29,120	SF	1.00	29,120	
Gypsum board column furring	22,400	SF	6.50	145,600	
Metal railing, allow	200	LF	150.00	30,000	
Brace frame gypsum board enclosures	6,000	SF	10.00	60,000	
Interior glazing, allow	7,500	SF	40.00	300,000	
Interior doors including framing and hardware					
Laboratory					
Single	50	EA	1,800.00	90,000	
Double	20	PR	2,500.00	50,000	
Premium for half glass	90	EA	125.00	11,250	
Offices, seminar, conference & interaction rooms	145	EA	1,500.00	217,500	
Service doors and others	30	EA	1,200.00	36,000	
Corridor doors	12	PR	2,000.00	24,000	
Panic hardware	1	LS	20,000.00	20,000	
Clean room: Interior partitions, door and glazing					
Panelized wall systems	6,500	SF	35.00	227,500	
Column furring and gypboard	1,500	SF	6.50	9,750	
Viewing windows	900	SF	60.00	54,000	
Interior doors including framing and hardware					
Corridor doors	4	EA	2,500.00	10,000	
Cleanroom doors	20	EA	2,500.00	50,000	
Material pass-thru	1	EA	2,000.00	2,000	
Panic hardware	1	LS	20,000.00	20,000	
Interior Partitions					**$2,438,715**

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
062 INTERIOR FINISHES	**86,500**	**SF**	**$ 18.05**		
Floor finishes					
Laboratory suites	23,252	SF	6.50	151,138	
Offices, seminar, interaction & conference rooms	23,581	SF	7.00	165,067	
Corridors and circulation	8,800	SF	2.75	24,200	
Lobby area	2,500	SF	25.00	62,500	
Support areas	16,058	SF	4.00	64,232	
Toilets	2,760	SF	12.00	33,120	
Mechanical/Utility rooms	9,549	SF	1.00	9,549	
Base					
Rubber base	17,930	SF	2.00	35,860	
Wood base	850	LF	15.00	12,750	
Ceramic tiles	552	LF	12.00	6,624	
Wall finishes					
Paint	304,670	SF	1.00	304,670	
High performance coating to selected labs, allow	18,000	SF	3.50	63,000	
Acoustical wall panels, allow	3,000	SF	10.00	30,000	
Ceramic wall tiles	5,760	SF	14.00	80,640	
Architectural detailing/treatments	1	LS	50,000.00	50,000	
Ceiling finishes					
Laboratory suites	23,252	SF	3.00	69,756	
Offices, seminar, interaction & conference rooms	22,081	SF	3.20	70,659	
Seminar	1,500	SF	16.00	24,000	
Corridors and circulation	8,800	SF	2.75	24,200	
Lobby area	3,500	SF	12.00	42,000	
Support areas	16,058	SF	2.75	44,160	
Toilet rooms	2,760	SF	6.50	17,940	
Mechanical/Utility rooms	8,549	SF	1.00	8,549	
Clean room: Floor, wall and ceiling finishes					
Electro-statically dissipative flooring/base	4,320	SF	12.00	51,840	
Epoxy paint to non-cleanroom side walls	3,300	SF	2.00	6,600	
Ceiling panels/gasketed ceiling grid & support	4,320	SF	22.00	95,040	
Epoxy paint ceiling structure, deck above, etc	4,320	SF	3.00	12,960	
Interior Finishes					**$1,561,054**

CONSTRUCTION COST DETAIL

MAIN BUILDING April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
063 SPECIALTIES	**86,500**	**SF**	**$ 8.84**		
Protective guards, barriers and bumpers					
Wall and corner guards	1	LS	35,000.00	35,000	
Loading dock bumpers	1	LS	4,000.00	4,000	
Prefabricated compartments and accessories					
Toilet partitions	40	EA	1,550.00	62,000	
Shower enclosure and accessories	1	LS	15,000.00	15,000	
Toilet accessories	1	LS	36,000.00	36,000	
Grab bars, sets	12	EA	280.00	3,360	
Shelving and millwork					
Janitors' shelf and mop rack, etc	6	EA	400.00	2,400	
Display case	24	EA	1,000.00	24,000	
Miscellaneous wood trims	1	LS	15,000.00	15,000	
Cabinets and counter tops					
Reception counter: Lobby	15	LF	1,000.00	15,000	
Interaction/Breakroom counter	1	LS	36,000.00	36,000	
Plastic laminated base cabinet with counter top	100	LF	180.00	18,000	
Plastic laminated wall cabinet	100	LF	150.00	15,000	
Plastic laminated counter top with open shelves	100	LF	150.00	15,000	
Plastic laminated counter top	100	LF	100.00	10,000	
Vanity counter top	72	LF	200.00	14,400	
Markerboards, tackboards, insignia & graphics					
Markerboards and tackboards	1	LS	18,000.00	18,000	
Directories, signage & graphics - Allow	86,500	SF	0.60	52,000	
Mail boxes	1	LS	10,000.00	10,000	
Window blinds and vision equipment					
Window shades and blinds	14,071	SF	5.50	77,000	
Projection screens	1	LS	25,000.00	25,000	
Equipment support brackets	1	LS	5,000.00	5,000	
Conveying and powered mechanical equipment					
Trash compactor at Service Yard	1	LS	15,000.00	15,000	
Loading dock levelers	1	LS	30,000.00	30,000	

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
Amenities and convenience items					
Recessed entrance mats & frames	3	EA	3,500.00	10,500	
Metal lockers, 2- tier	1	LS	4,500.00	4,500	
Fire extinguisher cabinets, recessed - Allow	1	LS	10,000.00	10,000	
Operable partitions	400	SF	90.00	36,000	
Coiling fire doors	6	EA	5,500.00	33,000	
Interior planting and planters	1	LS	5,000.00	5,000	
Unistrut system	5,000	SF	10.00	50,000	
Miscellaneous specialties	1	LS	25,000.00	25,000	
Cleanroom specialties					
Signage, fire extinguishers, etc	4,320	SF	4.00	17,280	
Unistrut, seismic bracing, etc	4,320	SF	5.00	21,600	
Specialties					**$765,040**
INTERIOR CONSTRUCTION					**$4,764,809**

07 STAIR CONSTRUCTION

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
071 STAIR CONSTRUCTION & FINISHES	**12**	**FLTS**	**$ 11,000**		
Staircase structure including handrailings and finishes					
Stairs: Floor-to-floor, flight	6	EA	8,500.00	51,000	
Feature stairs: Flight	6	EA	12,500.00	75,000	
Concrete short steps	2	EA	3,000.00	6,000	
STAIR CONSTRUCTION					**$132,000**

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
08 EQUIPMENT					
081 FIXED EQUIPMENT	**86,500**	**SF**	**$ 22.41**		
Nanofabrication (5,516 ASF)					
Wall cabinets	50	LF	250.00	12,500	
Standing height benches	200	LF	300.00	60,000	
Epoxy counter tops	200	LF	85.00	17,000	
Laminar flow hoods and benches, 6' wide	1	EA	8,000.00	8,000	
Bath enclosures & accessories	2	EA	4,500.00	9,000	
Curtain & track	7	EA	500.00	3,500	
Gown hanger rack	1	LS	2,450.00	2,450	
Seating benches	6	LF	150.00	900	
Fume hood, 4' wide	1	EA	6,000.00	6,000	
Cylinder rack	10	EA	900.00	9,000	
Lockers	6	EA	225.00	1,350	
Imaging and Manipulation (4,224 ASF)					
Laminar flow hood, 6' wide	1	EA	9,000.00	9,000	
Fume hood, 6' wide	4	EA	8,000.00	32,000	
Wall cabinets	50	LF	250.00	12,500	
Standing height benches	180	LF	300.00	54,000	
Epoxy counter tops	180	LF	85.00	15,300	
Prefabricated NMR shielding	1	LS	52,500.00	52,500	
OSHA/Flammable storage cabinet	2	EA	900.00	1,800	
Inorganic Nanostructures (4,122 ASF)					
Wall cabinets	125	LF	250.00	31,250	
Standing height benches	160	LF	300.00	48,000	
Epoxy counter tops	160	LF	85.00	13,600	
Gas cabinet	3	EA	6,675.00	20,025	
Curtain & track	2	EA	500.00	1,000	
OSHA/Flammable storage cabinet	8	EA	900.00	7,200	
Flammable storage cabinet: Fullheight	2	EA	1,100.00	2,200	
Fume hoods, 6' wide	8	EA	8,000.00	64,000	
Fume hoods, 8' wide, walk-in	2	EA	10,000.00	20,000	
Fume hoods, 12' wide, walk-in	1	EA	15,000.00	15,000	
User Laboratories (2,208 ASF)					
Fume hood, 8' wide	2	EA	9,500.00	19,000	
Wall cabinets	100	LF	250.00	25,000	
Standing height benches	100	LF	300.00	30,000	
Epoxy counter tops	100	LF	85.00	8,500	
Laminar flow hoods, 8' wide	2	EA	13,600.00	27,200	
OSHA/Flammable storage cabinet	4	EA	900.00	3,600	

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
Organic, Polymer/Biopolymer Synthesis (4,818 ASF)					
Fume hoods, 6' wide	2	EA	8,000.00	16,000	
Fume hoods, 8' wide	20	EA	9,500.00	190,000	
Fume hoods, 8' wide, walk-in	2	EA	10,000.00	20,000	
Wall cabinets	100	LF	250.00	25,000	
Standing height benches	300	LF	300.00	90,000	
Epoxy counter tops	300	LF	85.00	25,500	
Snorkel exhaust	20	EA	1,000.00	20,000	
OSHA/Flammable storage cabinet	13	EA	900.00	11,700	
Flammable storage cabinet: Fullheight	5	EA	1,100.00	5,500	
Mobile benches	2	EA	1,200.00	2,400	
Ventilated chemical storage cabinet	2	EA	1,500.00	3,000	
Cold room	1	EA	46,000.00	46,000	
Miscellaneous storage shelving & equipment	1	LS	5,000.00	5,000	
Double glove box, 8', with transfer ports	2	EA	50,000.00	100,000	
Full height storage shelving	28	LF	350.00	9,800	
Biological Nanostructures (5,772 ASF)					
Fume hoods, 8' wide	6	EA	9,500.00	57,000	
Fume hoods, 8' wide, walk-in	6	EA	10,000.00	60,000	
Wall cabinets	170	LF	285.00	48,450	
Standing height benches	400	LF	300.00	120,000	
Epoxy counter tops	400	LF	85.00	34,000	
Autoclaves	1	EA	110,000.00	110,000	
Glasswasher & dryer	1	EA	35,000.00	35,000	
Scullery sink	1	EA	1,000.00	1,000	
Environmental rooms					
Warm room	1	EA	40,000.00	40,000	
Cold room	2	EA	46,000.00	92,000	
OSHA/Flammable storage cabinet	6	EA	900.00	5,400	
Miscellaneous shelving and equipment	1	LS	10,000.00	10,000	
Laminar flow cabinet, 6' wide	4	EA	8,000.00	32,000	
Bio-safety cabinets, 4' wide	4	EA	9,000.00	36,000	
Removable stainless steel panels	120	SF	30.00	3,600	
Full height storage shelving	38	LF	350.00	13,300	
Shared Laboratories Support (360 ASF)					
Flammable storage cabinet: Fullheight	4	EA	1,100.00	4,400	
Dry chemical storage cabinets 36" x 84"h	4	EA	1,200.00	4,800	
Cylinder rack	1	LS	3,000.00	3,000	
Theory					
Base cabinet	36	LF	250.00	9,000	
Plastic laminated counter top	41	LF	65.00	2,665	
Miscellaneous storage shelvings	1	LS	5,000.00	5,000	
Fixed Equipment					**$1,938,890**

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
082 FURNISHINGS	**86,500**	**SF**	**$ 10.98**		
Kitchen appliances - Allow	1	LS	35,000.00	35,000	
Workstations with overhead storage	135	EA	2,200.00	297,000	
Task chair with arms	150	EA	500.00	75,000	
Straight leg stackable chair at Seminar	60	EA	300.00	18,000	
Seminar tables	200	LF	200.00	40,000	
Conference tables	6	EA	7,500.00	45,000	
Chair at Conference	80	EA	450.00	36,000	
Bookcases, 36w x 12"d x29"h	60	EA	500.00	30,000	
File drawer, vertical	135	EA	800.00	108,000	
File drawer, lateral	135	EA	500.00	67,500	
Laboratory stools with backs	234	EA	300.00	70,200	
Lobby furniture	1	LS	10,000.00	10,000	
Executive desks	6	EA	3,000.00	18,000	
Miscellaneous unidentified furniture - Allow	1	LS	100,000.00	100,000	
Furnishings					**$949,700**
EQUIPMENT					**$2,888,590**
09 CONVEYING SYSTEM					
091 ELEVATORS	**13**	**LO**	**$ 32,308**		
Elevators, traction					
7-Stops, 5,000#, non-ferrous counterweight	1	EA	225,000.00	225,000	
6-Stops, 3,500#	1	EA	195,000.00	195,000	
Elevators					**$420,000**
092 OTHER CONVEYING SYSTEMS					
NONE					
Other Conveying Systems					**$0**
CONVEYING SYSTEM					**$420,000**

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
10 PLUMBING					
101 Plumbing	**86,500**	**SF**	**$ 17.40**		
WATER DISTRIBUTION SYSTEM					
2" COPPER TYPE "L" / HANGERS/ HARD	10,560	LF	22.00	232,320	
FITTINGS & VALVES	1	LS		69,696	
PIPE IDENTIFICATION	10,560	LF	0.21	2,218	
VALVE TAGS	211	EA	17.56	3,705	
INLINE HW CIRCULATING PUMPS, 1/2 HP	1	EA	1,691.92	1,692	
HOSE BIBB	4	EA	204.16	817	
WALL HYDRANT	6	EA	576.17	3,457	
2" BFP, INCL OS&Y VALVES, DBL CHECK, FLANGED	6	EA	1,126.06	6,756	
PLUMBING FIXTURES & SETTING					
WC, WALL HUNG, AUTO FLUSH, WC-1	40	EA	843.98	33,759	
COUNTER TOP LAV, AUTO FAUCET, LAV-1	24	EA	696.61	16,719	
URINAL, WALL HUNG, AUTO FLUSH, UR-1	12	EA	905.04	10,860	
SHOWER TRIM, WITH MIXING VALVE, SH-1	3	EA	648.26	1,945	
WATER COOLER, WALL HUNG, EWC-1	12	EA	2,484.06	29,809	
MOP SINK, PRECAST TERRAZZO, SS-1	12	EA	681.53	8,178	
COMBINATION DRENCH SHOWER/EYE WASH UNIT, ESEW-1	20	EA	2,339.78	46,796	
EYE & FACE WASH	20	EA	651.17	13,023	
SK BY OTHERS	120	EA	433.39	52,007	
PLUMBING FIXTURES CARRIERS					
WATER CLOSET	40	EA	294.08	11,763	
URINAL	12	EA	231.28	2,775	
DRINKING FOUNTAIN BI-LEVEL	12	EA	370.04	4,440	
PLUMBING FIXTURES RIFC					
WATER CLOSET	40	EA	593.13	23,725	
LAVATORY	24	EA	650.00	15,600	
SINK	120	EA	568.40	68,208	
URINAL	12	EA	573.50	6,882	
ELECTRIC WATER COOLER BI-LEVEL	12	EA	674.82	8,098	
MOP SINK	12	EA	624.46	7,494	
EYE & FACE WASH	20	EA	594.37	11,887	
EMERGENCY SHOWER	20	EA	569.82	11,396	
SHOWER	3	EA	756.71	2,270	

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
SANITARY WASTE SYSTEM					
UNDERGROUND					
4" S.W.C.I. SINGLE HUB PUSH ON GASKET	600	LF	24.75	14,850	
FITTINGS & VALVES	1	LS		2,970	
EXCAVATION & BACKFILL	150	CY	36.43	5,465	
ABOVEGROUND					
3" CAST IRON NO HUB / HANGERS	3,580	LF	25.76	92,221	
FITTINGS & VALVES	1	LS		18,444	
PIPE IDENTIFICATION	3,580	LF	0.21	752	
4" FLOOR DRAIN & P-TRAP	30	EA	295.56	8,867	
STORM DRAINAGE SYSTEM					
STORM DRAINAGE SYSTEM	17,100	SF	2.25	38,475	
NATURAL GAS SYSTEM					
NATURAL GAS SYSTEM	52,570	SF	1.58	83,061	
LABORATORY COMPRESSED AIR SYSTEM					
LABORATORY COMPRESSED AIR SYSTEM	52,750	SF	2.00	105,500	
LABORATORY VACUUM SYSTEM					
LABORATORY VACUUM SYSTEM	52,750	SF	1.50	79,125	
DEIONIZED / RO WATER SYSTEM					
DEIONIZED / RO WATER SYSTEM	52,750	SF	2.00	105,500	
LABORATORY WASTE PIPING					
3" POLYPROPYLENE SCH. 40 ACID RESISTANT / HANGERS	3,000	LF	39.00	117,000	
FITTINGS & VALVES	1	LS		35,100	
PIPE IDENTIFICATION	3,000	LF	0.21	630	
VALVE TAGS	60	EA	17.55	1,053	
DOMESTIC HOT & COLD WATER INSULATION					
1" THICK INSULATION ON 2" PIPE	10,560	LF	6.56	69,274	
FITTINGS & VALVES	1	LS		13,855	
STORM DRAINAGE SYSTEM INSULATION					
STORM DRAINAGE SYSTEM INSULATION	17,100	SF	0.25	4,275	
PLUMBING					**$1,504,710**

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
11 H V A C					
111 HVAC	86,500	SF	$ 59.92		
HEATING GENERATION					
CONNECT TO UTILITY CENTER					
COOLING GENERATION					
CONNECT TO UTILITY CENTER					
HEATING HOT WATER PIPING					
2" COPPER TYPE "L" / HANGERS/ HARD	10,350	LF	22.02	227,907	
FITTINGS & VALVES	1	LS		45,581	
PIPE IDENTIFICATION	10,350	LF	0.21	2,174	
VALVE TAGS	207	EA	17.56	3,635	
3/4" REHEAT COIL PIPING	230	EA	809.06	186,084	
CHILLED WATER PIPING					
3" COPPER TYPE "L" / HANGERS/ HARD	600	LF	56.49	33,894	
FITTINGS & VALVES	1	LS		10,168	
PROCESS CHILLED WATER PIPING					
3" COPPER TYPE "L" / HANGERS/ HARD	4,500	LF	37.46	168,570	
FITTINGS & VALVES				33,714	
CONDENSATE DRAIN WASTE PIPING					
3/4" COPPER TYPE "L" / HANGERS/ HARD	300	LF	9.95	2,985	
1" COPPER TYPE "L" / HANGERS/ HARD	200	LF	11.09	2,218	
FITTINGS & VALVES	1	LS		1,041	
PIPE IDENTIFICATION	500	LF	0.21	105	
VALVE TAGS	10	EA	17.52	175	
LIQUID DISTRIBUTION TERMINAL DEVICES					
UNIT HEATERS	12	EA	647.00	7,764	
CABINET UNIT HEATERS	6	EA	801.19	4,807	
SHEET METAL DUCTWORK					
GALVANIZED DUCT	134,600	LB	6.00	807,600	
STAINLESS STEEL DUCT	68,000	LB	11.00	748,000	
MIXING BOXES					
MIXING BOXES	250	EA	729.33	182,333	

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
DUCT ACCESSORIES					
FLEXIBLE DUCT	640	EA	32.00	20,480	
SPIN IN COLLAR	640	EA	42.02	26,893	
VOLUME DAMPERS SMALL / ACCESS DOOR	653	EA	90.32	58,979	
VOLUME DAMPERS MEDIUM / ACCESS DOOR	52	EA	135.47	7,044	
VOLUME DAMPERS LARGE / ACCESS DOOR	36	EA	188.86	6,799	
COMBINATION FIRE & SMOKE DAMPERS LARGE	290	EA	714.83	207,301	
LOUVERS	592	SF	53.13	31,453	
HOOD CONNECTION ONLY	50	EA	337.56	16,878	
SUPPLY, RETURN, EXHAUST REGISTERS					
SUPPLY DIFFUSER					
STANDARD	256	EA	126.55	32,397	
LINEAR 4' LONG	384	EA	170.26	65,380	
HEPA FILTER 2x4 WITH FAN (CLASS 100)	250	EA	1,161.62	290,405	
RETURN GRILLE	40	EA	102.40	4,096	
EXHAUST REGISTER	389	EA	114.47	44,529	
AIR HANDLING UNITS					
AHU-1, 85,000 CFM VSD	1	EA	311,173.00	311,173	
AHU-2, 75,000 CFM VSD	1	EA	274,803.00	274,803	
EXHAUST FANS					
TOILET EXHAUST, 3,600 CFM	1	EA	2,200.30	2,200	
EF-2, 2 FANS, 38,000 CFM	2	EA	61,413.50	122,827	
EF-3, 2 FANS, 30,000 CFM	2	EA	48,662.50	97,325	
RETURN FANS					
REF-1, 14,000 CFM	1	EA	9,701.10	9,701	
SUPPLY FANS					
SF-1, 100,000 CFM	2	EA	40,584.00	81,168	
INSULATION					
1" THICK INSULATION ON 3/4" PIPE	300	EA	5.56	1,668	
1" THICK INSULATION ON 1" PIPE	200	EA	5.72	1,144	
1" THICK INSULATION ON 3" PIPE	4,500	EA	7.53	33,885	
1" THICK INSULATION ON 4" PIPE	600	EA	9.19	5,514	
1 1/2" THICK INSULATION ON 2" PIPE	10,350	EA	7.99	82,697	
FITTINGS & VALVES	1	LS		24,982	
1 1/2" TH. DUCTWORK INSULATION, .75# DENSITY.	120,000	EA	2.08	249,600	
1" THICK BOARD FIBERGLASS, 3# DENSITY.	18,000	EA	4.35	78,300	

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
BUILDING MANAGEMENT SYSTEM					
CONTROL & INSTRUMENTATION	1	LS		450,000	
TESTING, ADJUSTING & BALANCING					
TESTING, ADJUSTING & BALANCING	1	LS		75,000	
H V A C					**$5,183,380**
12 FIRE PROTECTION					
121 Fire Protection	**86,500**	**SF**	**$ 3.18**		
Sprinkler heads and piping	1,006	EA	242.19	243,643	
Center of tiles	704	EA	31.48	22,162	
Concealed sprinkler heads	493	EA	18.54	9,140	
FIRE PROTECTION					**$274,950**
13 ELECTRICAL					
131 Service & distribution	**86,500**	**SF**	**$ 1.40**		
Main service and distribution					
Connect to substations and switchgear at Utility Center	1	LS	25,000.00	25,000	
Transformers - 480/208V	570	KVA	73.00	41,610	
Feeder conduit and wire	800	LF	68.00	54,400	
Service & Distribution					**$121,010**

CONSTRUCTION COST DETAIL

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
132 Lighting and Power	**86,500**	**SF**	**$ 16.21**		
Machine and equipment power					
Connections and switches including feeder, conduit and wire					
> 50HP<=100HP	2	EA	3,200.00	6,400	
> 25<=50HP	8	EA	2,500.00	20,000	
> 10<=25HP	16	EA	1,200.00	19,200	
<=10HP	80	EA	700.00	56,000	
Miscellaneous equipment connections	1	LS	35,000.00	35,000	
User convenience power					
Panelboards, 120V - circuits	252	EA	36.00	9,072	
Feeder conduit and wire	1,200	LF	12.00	14,400	
Lab Panelboards, 120V - circuits	1,092	EA	36.00	39,312	
Lab Feeder conduit and wire	3,600	LF	12.00	43,200	
Receptacles including conduit and wire	300	EA	150.00	45,000	
Wiremold including devices	3,500	LF	35.00	122,500	
Lighting					
Panelboards, 277V - circuits	252	EA	75.00	18,900	
Feeder conduit and wire	1,300	LF	24.00	31,200	
Fixtures including conduit and wire					
Incandescent	40	EA	350.00	14,000	
Fluorescent	1,000	EA	250.00	250,000	
Fluorescent - water tight	250	EA	550.00	137,500	
Compact fluorescent	650	EA	420.00	273,000	
High intensity discharge	60	EA	600.00	36,000	
Exit and emergency	20	EA	460.00	9,200	
Wall mounted exterior	15	EA	900.00	13,500	
Switches including conduit and wire	170	EA	185.00	31,450	
Lighting and power specialties					
Cable tray	1,350	LF	30.00	40,500	
Grounding	1	LS	45,000.00	45,000	
Lighting control panel	1	LS	10,000.00	10,000	
Low voltage relay panel	4	EA	3,000.00	12,000	
Dimming systems	1	LS	5,000.00	5,000	
Audio/visual systems rough-in only	1	LS	30,000.00	30,000	
Specialty systems connection	1	LS	20,000.00	20,000	
Transient voltage surge protection	1	LS	15,000.00	15,000	
Lighting & Power					**$1,402,330**

MAIN BUILDING

April 15, 2002

SYSTEM	QUANTITY	UNIT	$/UNIT	ITEM COST	SYS.COST
133 Special Electrical Systems	**86,500**	**SF**	**$ 11.65**		
Telephone and Communication Systems					
Telephone/data main distribution frame rough-in only	1	LS	10,000.00	10,000	
Telephone/data intermediate distribution frame rough-in only	5	EA	1,800.00	9,000	
Telephone/data outlets including conduit only	300	EA	200.00	60,000	
Communication infrastructure raceway	1	LS	20,000.00	20,000	
Network data wiring	1	LS	200,000.00	200,000	
Telephone equipment and wiring	1	LS	220,000.00	220,000	
Card access equipment and wiring	1	LS	75,000.00	75,000	
Internal paging system including speakers, conduit and wiring	1	LS	70,000.00	70,000	
Alarm and signal systems					
Fire alarm main panel	1	EA	30,000.00	30,000	
Fire alarm annunciator	1	EA	4,000.00	4,000	
Fire alarm fan control panel	1	EA	40,000.00	40,000	
Fire alarm device including conduit and wire	250	EA	600.00	150,000	
Security systems					
Security system rough-in raceway	1	LS	45,000.00	45,000	
CCTV rough-in raceway	1	LS	30,000.00	30,000	
Testing	1	LS	45,000.00	45,000	
Special Electrical Systems					**$1,008,000**
ELECTRICAL					**$2,531,340**

UTILITY CENTER

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SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
01 FOUNDATIONS					
011 STANDARD FOUNDATIONS	**8,000**	**FPA**	**$ 7.72**		
Wall Foundations					
Reinforced concrete continuous wall footings	450	LF	115.00	51,750	
Pile caps	22	CY	450.00	10,000	
Standard Foundations					**$61,750**
012 SPECIAL FOUNDATIONS	**8,000**	**FPA**	**$ 8.84**		
Reinforced grade beams	657	LF	100.00	65,700	
Dewatering, allow	1	LS	5,000.00	5,000	
Special Foundations					**$70,700**
FOUNDATIONS TOTAL					**$132,450**
02 SUBSTRUCTURE					
021 SLAB ON GRADE	**8,000**	**SF**	**$ 6.00**		
Slab on grade incl. sand base and vapor barrier	8,000	SF	6.00	48,000	
Slab on Grade					**$48,000**
022 BASEMENT EXCAVATION	**128,000**	**BCF**	**$ 0.42**		
Mass excavation removal	5,481	CY	7.00	38,370	
Imported structural backfill - allow	741	CY	20.00	14,815	
Basement Excavation					**$53,185**

CONSTRUCTION COST DETAIL

UTILITY CENTER

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
023 BASEMENT WALLS	**4,320**	**BWA**	**$ 66.69**		
Basement waterproofing	4,320	SF	3.00	12,960	
Tie-back wall system including 8" shotcrete wall	3,700	SF	70.00	259,000	
Basement walls, 18" thick	620	SF	26.00	16,120	
Basement Wall					**$288,080**
SUBSTRUCTURE					**$389,265**
03 SUPERSTRUCTURE					
031 FLOOR CONSTRUCTION	**8,000**	**UFA**	**$ 14.98**		
Columns supporting floors					
Interior shear walls, 12" thick	4,125	SF	16.00	66,000	
Concrete pilasters	200	LF	150.00	30,000	
Reinforced concrete columns	63	LF	100.00	6,321	
Equipment pads	500	SF	20.00	10,000	
Trench drain incl. slab thickening	50	LF	150.00	7,500	
Floor Construction					**$119,821**
032 ROOF CONSTRUCTION	**8,000**	**RA**	**$ 22.00**		
Floor decks, slabs and toppings					
Reinforced concrete slabs	8,000	SF	22.00	176,000	
Roof Construction					**$176,000**
SUPERSTRUCTURE					**$295,821**

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
04 EXTERIOR CLOSURE					
041 EXTERIOR WALLS	**7,920**	**XWA**	**$ 12.77**		
Wall framing, furring and insulation					
Steel studs framing	2,960	SF	4.50	13,320	
Exterior wall finishes					
Exterior cladding system	2,960	SF	27.00	79,920	
Interior finish to exterior walls					
Concrete sealer	7,920	SF	1.00	7,920	
Exterior Wall					**$101,160**
042 EXTERIOR WINDOWS	**584**	**XDA**	**$ 7.19**		
Exterior doors					
Hollow metal door					
Single	2	EA	1,200.00	2,400	
Double	1	PR	1,800.00	1,800	
Exterior Window					**$4,200**
042 EXTERIOR WINDOWS					
Windows, glazing and louvers	**500**	**XDA**	**$ 50.00**		
Metal louvers	500	SF	50.00	25,000	
Exterior Door					**$25,000**
EXTERIOR CLOSURE					**$130,360**
05 ROOFING					
050 ROOFING & SHEETMETAL	**8,000**	**RA**	**$ 1.50**		
Waterproofing	8,000	SF	1.50	12,000	
ROOFING					**$12,000**

UTILITY CENTER

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SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
06 INTERIOR CONSTRUCTION					
061 PARTITIONS	**2,100**	**PSF**	**$ 11.93**		
Gypsum board partitions	2,100	SF	8.50	17,850	
Hollow metal door, double	4	PR	1,800.00	7,200	
Interior Partitions					$25,050
062 INTERIOR FINISHES	**8,000**	**SF**	**$ 3.29**		
Floor finishes					
Concrete sealer	8,000	SF	1.00	8,000	
Wall finishes					
Paint finish	12,120	SF	0.85	10,302	
Ceiling finishes					
Paint exposed ceilings	8,000	SF	1.00	8,000	
Interior Finishes					$26,302
063 SPECIALTIES	**8,000**	**SF**	**$ 2.50**		
Allow	8,000	SF	2.50	20,000	
Specialties					$20,000
INTERIOR CONSTRUCTION					$71,352
07 STAIR CONSTRUCTION					
071 STAIR CONSTRUCTION & FINISHES					
NONE					
STAIR CONSTRUCTION					$0

CONSTRUCTION COST DETAIL

UTILITY CENTER

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SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
08 EQUIPMENT					
081 FIXED EQUIPMENT	**8,000**	**SF**	**$ 2.50**		
Allow	8,000	SF	2.50	20,000	
Fixed Equipment					**$20,000**
082 FURNISHINGS					
NONE					
Furnishings					**$0**
EQUIPMENT					**$20,000**
09 CONVEYING SYSTEM					
091 ELEVATORS					
NONE					
Elevators					**$0**
092 OTHER CONVEYING SYSTEMS					
NONE					
Other Conveying Systems					**$0**
CONVEYING SYSTEM					**$0**

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
10 PLUMBING					
101 Plumbing					
WATER DISTRIBUTION SYSTEM					
1/2" COPPER TYPE "L" / HANGERS/ HARD	120	LF	8.85	1,062	
3/4" COPPER TYPE "L" / HANGERS/ HARD	140	LF	9.95	1,393	
1 1/2" COPPER TYPE "L" / HANGERS/ HARD	150	LF	16.51	2,477	
2" COPPER TYPE "L" / HANGERS/ HARD	180	LF	22.02	3,964	
4" COPPER TYPE "L" / HANGERS/ HARD	140	LF	56.49	7,909	
6" COPPER TYPE "L" / HANGERS/ HARD	140	LF	113.13	15,838	
FITTINGS & VALVES	1	LS		6,529	
PIPE IDENTIFICATION	870	LF	0.21	183	
VALVE TAGS	17	EA	17.54	298	
WATER METERS					
6" WATER METER FLANGED / METER BY CITY	1	EA	1,362.89	1,363	
WATER HEATER	2	EA	29,412.20	58,824	
INLINE HOT WATER CIRCULATING PUMPS	1	EA	1,691.92	1,692	
DOMESTIC BOOSTER PUMPS	1	EA	87,572.60	87,573	
WATER SOFTENER	1	EA	19,325.52	19,326	
HOSE BIBB	4	EA	204.16	817	
WALL HYDRANTS					
WALL HYDRANT	2	EA	576.17	1,152	
4" BFP, IRON OS&Y VALVES, PRESS. REDUCING, FLANGED	1	EA	3,263.00	3,263	
6" BFP, IRON OS&Y VALVES, PRESS. REDUCING, FLANGED	1	EA	5,078.06	5,078	
PLUMBING FIXTURES & SETTING					
MOP SINK	1	EA	1,775.31	1,775	
PLUMBING FIXTURES RIFC	1	EA	624.79	625	
MOP SINK					
SANITARY WASTE SYSTEM					
UNDERGROUND					
4" S.W.C.I. SINGLE HUB PUSH ON GASKET	220	LF	24.75	5,445	
FITTINGS & VALVES	1	LS		1,089	
EXCAVATION & BACKFILL	55	CY	36.43	2,004	
ABOVEGROUND					
1 1/2" CAST IRON NO HUB / HANGERS	80	LF	22.06	1,765	
2" CAST IRON NO HUB / HANGERS	60	LF	23.05	1,383	
3" CAST IRON NO HUB / HANGERS	120	LF	25.76	3,091	
4" CAST IRON NO HUB / HANGERS	80	LF	29.64	2,371	
FITTINGS & VALVES	1	LS		1,722	
PIPE IDENTIFICATION	340	LF	0.21	71	
3" FLOOR DRAIN & P-TRAP	2	EA	348.84	698	
4" FLOOR DRAIN & P-TRAP	8	EA	380.06	3,040	

CONSTRUCTION COST DETAIL

UTILITY CENTER

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
STORM DRAINAGE SYSTEM					
STORM DRAINAGE SYSTEM	7,000	SF	2.25	15,750	
DRAIN TILE					
4" PVC SCH 40 PERFORATED SUBDRAINAGE PIPE	620	LF	13.30	8,246	
FITTINGS & VALVES	1	LS		1,649	
EXCAVATION & BACKFILL	124	CY	36.43	4,517	
NATURAL GAS SYSTEM					
NATURAL GAS SYSTEM	1	LS	42,000.00	42,000	
LABORATORY COMPRESSED AIR SYSTEM					
2" COPPER TYPE "L" / HANGERS/ HARD	250	LF	22.02	5,505	
FITTINGS & VALVES	1	LS		1,101	
PIPE IDENTIFICATION	250	LF	0.21	53	
VALVE TAGS	5	EA	17.52	88	
AIR COMPRESSOR	1	EA	58,084.95	58,085	
LABORATORY VACUUM SYSTEM					
3" COPPER TYPE "L" / HANGERS/ HARD	250	LF	37.46	9,365	
FITTINGS & VALVES	1	LS		1,873	
PIPE IDENTIFICATION	250	LF	0.21	53	
VALVE TAGS	5	EA	17.52	88	
VACUUM PUMP	1	EA	44,760.85	44,761	
DEIONIZED / RO WATER SYSTEM					
DEIONIZED / RO WATER SYSTEM	1	LS	150,000.00	150,000	
ACID WASTE SYSTEM					
4" POLYPROPYLENE SCH. 40 ACID RESISTANT / HANG	250	LF	46.74	11,685	
FITTINGS & VALVES	1	LS		2,337	
PIPE IDENTIFICATION	250	LF	0.21	53	
VALVE TAGS	5	EA	17.52	88	
ACID WASTE SYSTEM TANK & MONITORING	1	LS	26,250.00	26,250	
DOMESTIC HOT & COLD WATER INSULATION					
1" THICK INSULATION ON 1/2" PIPE	120	LF	5.23	628	
1" THICK INSULATION ON 3/4" PIPE	140	LF	5.56	778	
1" THICK INSULATION ON 1 1/2" PIPE	150	LF	6.17	926	
1" THICK INSULATION ON 2" PIPE	180	LF	6.56	1,181	
1" THICK INSULATION ON 4" PIPE	140	LF	9.19	1,287	
1" THICK INSULATION ON 6" PIPE	140	LF	11.33	1,586	
FITTINGS & VALVES	1	LS		1,277	
STORM DRAINAGE SYSTEM INSULATION					
STORM DRAINAGE SYSTEM INSULATION	7,000	SF	0.25	1,750	
PLUMBING					**$636,780**

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
11 H V A C					
111 HVAC	**8,000**	**SF**	**$ 218.70**		
HEATING GENERATION					
BOILER, 200 HP	1	EA	86,365.60	86,366	
BOILER, 200 HP	1	EA	86,365.60	86,366	
HHWP-1, 50 HP	2	EA	7,359.52	14,719	
HHWP-2, 10 HP	2	EA	4,265.26	8,531	
VARIABLE SPEED DRIVE, 10 HP	2	EA	7,478.64	14,957	
VARIABLE SPEED DRIVE, 50 HP	2	EA	14,421.18	28,842	
EXPANSION TANK & AIR SEPARATOR	1	EA	7,519.51	7,520	
CHEMICAL TREATMENT	1	LS	5,000.00	5,000	
COOLING GENERATION					
CHILLER, 400 TON, VSD	1	EA	131,349.70	131,350	
CHILLER, 400 TON, VSD	1	EA	131,349.70	131,350	
COOLING TOWER CERAMIC, 400 TON	1	EA	72,776.50	72,777	
COOLING TOWER CERAMIC, 400 TON	1	EA	72,776.50	72,777	
FLUID COOLER, 200 TON	2	EA	33,445.45	66,891	
CHILLED WATER PUMPS	2	EA	10,088.52	20,177	
VARIABLE SPEED DRIVE	2	EA	12,865.52	25,731	
CONDENSER WATER PUMPS	2	EA	12,262.02	24,524	
VARIABLE SPEED DRIVE	2	EA	14,073.02	28,146	
EXPANSION TANK & AIR SEPARATOR	1	EA	8,366.35	8,366	
CHEMICAL TREATMENT	1	LS	7,500.00	7,500	
HEATING HOT WATER PIPING					
6" B.S. SCH. 40 P.E. / HANGERS / A53	200	LF	69.24	13,848	
8" B.S. SCH. 40 P.E. / HANGERS / A53	600	LF	90.43	54,258	
FITTINGS & VALVES	1	LS		20,432	
PIPE IDENTIFICATION	800	LF	0.21	168	
VALVE TAGS	16	EA	17.53	280	
8" BOILER PIPING	2	EA	10,669.98	21,340	
6" PUMPS PIPING	2	EA	6,001.07	12,002	
8" PUMPS PIPING	2	EA	7,752.98	15,506	
1 1/4" CABINET / UNIT HEATERS PIPING	4	EA	1,105.50	4,422	
2" HEATING HOT WATER COIL PIPING	1	EA	4,529.31	4,529	
CHILLED WATER PIPING					
6" B.S. SCH. 40 P.E. / HANGERS / A53	200	EA	69.24	13,848	
8" B.S. SCH. 40 P.E. / HANGERS / A53	400	EA	90.43	36,172	
12" B.S. SCH. 40 P.E. / HANGERS / A53	600	EA	154.07	92,442	
FITTINGS & VALVES				42,739	
8" CHILLER PIPING CHW SIDE	2	EA	7,684.78	15,370	
6" PUMP PIPING	2	EA	6,001.07	12,002	

CONSTRUCTION COST DETAIL

UTILITY CENTER

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
PROCESS CHILLED WATER PIPING					
6" COPPER TYPE "L" / HANGERS/ HARD	600	LF	113.13	67,878	
FITTINGS & VALVES	1	LS		27,151	
CONDENSER WATER PIPING					
8" GROOVED JOINT SCH. 40 STL PIPE / HANGERS	60	EA	76.54	4,592	
10" GROOVED JOINT SCH. 40 STL PIPE / HANGERS	80	EA	100.97	8,078	
12" GROOVED JOINT SCH. 40 STL PIPE / HANGERS	200	EA	121.33	24,266	
FITTINGS & VALVES	1	LS		11,081	
10" CHILLER PIPING CONDENSER SIDE	2	EA	9,945.68	19,891	
10" PUMPS PIPING	2	EA	11,639.58	23,279	
10" COOLING TOWER	2	EA	13,519.86	27,040	
FUEL OIL SYSTEM					
FUEL OIL SYSTEM	3,000	GAL	13.00	39,000	
LIQUID DISTRIBUTION TERMINAL DEVICES					
UNIT HEATERS, 1/6 HP	4	EA	1,812.17	7,249	
SHEET METAL DUCTWORK					
RECTANGULAR GALVANIZED DUCT	12,000	LB	6.63	79,560	
DUCT ACCESSORIES					
FLEXIBLE DUCT	12	EA	31.98	384	
SPIN IN COLLAR	12	EA	42.02	504	
VOLUME DAMPERS LARGE / ACCESS DOOR	14	EA	188.86	2,644	
COMBINATION FIRE & SMOKE DAMPERS LARGE	6	EA	714.80	4,289	
MOTORIZED DAMPERS LARGE	6	EA	888.73	5,332	
LOUVERS	96	SF	53.13	5,100	
BREECHING					
BREECHING	1	LS	50,000.00	50,000	
SUPPLY, RETURN, EXHAUST REGISTERS					
SUPPLY DIFFUSER LARGE	10	EA	189.78	1,898	
EXHAUST REGISTER LARGE	10	EA	158.94	1,589	
AIR HANDLING UNITS					
H& V, 12,000 CFM	1	EA	13,214.60	13,215	
FANS					
FANS, 20,000 CFM	1	EA	7,420.90	7,421	

UTILITY CENTER

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
INSULATION					
1" THICK INSULATION ON 6" PIPE8	800	EA	11.33	9,064	
1" THICK INSULATION ON 8" PIPE8	460	EA	14.34	6,596	
1" THICK INSULATION ON 10" PIPE	80	EA	16.17	1,294	
1" THICK INSULATION ON 12" PIPE	800	EA	18.25	14,600	
1 1/2" THICK INSULATION ON 6" PIPE	200	EA	13.15	2,630	
1 1/2" THICK INSULATION ON 8" PIPE	600	EA	16.22	9,732	
FITTINGS & VALVES				13,175	
1 1/2" TK.DUCT WORK INSULATION, .75# DEN.	2,500	EA	2.08	5,200	
1" THICK BOARD FIBERGLASS, 3# DENSITY	4,500	EA	4.35	19,575	
BUILDING MANAGEMENT SYSTEM					
CONTROL & INSTRUMENTATION				Not Required	
TESTING, ADJUSTING, & BALANCING					
TESTING, ADJUSTING, & BALANCING	1	LS	35,000.00	35,000	
HVAC					**$1,749,560**
12 FIRE PROTECTION					
121 Fire Protection	**8,000**	**SF**	**$ 2.66**		
Sprinkler heads & piping	88	EA	242.19	21,313	
FIRE PROTECTION					**$21,310**
13 ELECTRICAL	**8,000**	**SF**	**$ 136.17**		
131 Service & Distribution					
Medium voltage switchgears, connect to existing substations, primary	1	LS	245,000.00	245,000	
Secondary substations	4,000	KVA	106.00	424,000	
Feeder conduit and cabling	1	LS	120,000.00	120,000	
Emergency gen set, stand alone diesel (750 kW)	1	LS	200,000.00	200,000	
Above ground fuel tank, 3000 gal	1	LS	22,000.00	22,000	
Service & Distribution					**$1,011,000**

UTILITY CENTER

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
132 Lighting & Power					
Power distribution					
Motor control center	3	EA	4,800.00	14,400	
<= 25Hp motor connection incl. disc sw	14	EA	950.00	13,300	
> 25Hp motor connection incl. disc sw	6	EA	1,800.00	10,800	
Chiller controller connection	1	EA	200.00	200	
Miscellaneous motor connections <=2 Hp	1	LS	10,000.00	10,000	
Lighting					
Wiring devices circuit	10	EA	260.00	2,600	
Lighting and lighting control circuit	50	EA	100.00	5,000	
Fixture Type					
Fluorescent surface mounted vandal resistant	20	EA	380.00	7,600	
Fluorescent industrial suspended fixture	10	EA	700.00	7,000	
Exit sign fixture	4	EA	200.00	800	
Switch	8	EA	95.00	760	
Lighting & Power					**$72,460**
133 Special Electrical Systems					
Fire alarm pull station	3	EA	390.00	1,170	
Fire alarm speaker with visual device	4	EA	310.00	1,240	
Fire alarm connection to existing system	1	LS	3,000.00	3,000	
Equipment grounding	1	LS	450.00	450	
Special Elec. Systems					**$5,860**
ELECTRICAL					**$1,089,320**

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
12 SITE WORK					
121 SITE PREPARATION & DEMOLITION	**1.50**	**ACR**			
Site preparation, earthwork, etc					
Site clearing and grubbing	65,000	SF	1.15	74,750	
Finished grade	45,000	SF	0.85	38,250	
Site cut & fill "on-site"	28,900	CY	7.00	202,300	
Erosion control measure	1	LS	45,000.00	45,000	
"Geogrids" slope reinforcement	67,500	SF	3.50	236,250	
Selective demolition					
Selective demo Building 66: New doorways	1	LS	35,000.00	35,000	
Concrete/bituminous paving, curbs, etc	18,000	SF	1.50	27,000	
Miscellaneous site structure & fixtures - allow	1	LS	15,000.00	15,000	
Patch/repair existing site paving damaged during construction including new curb cuts	1	LS	15,000.00	15,000	
Site Preparation & Demolition					**$ 688,550**
122 SITE IMPROVEMENT	**1.50**	**ACR**			
Vehicular paving					
Roadway	29,600	SF	2.50	74,000	
Loading dock paving	3,750	SF	5.50	20,625	
Parking	12,100	SF	2.50	30,250	
Curbs & gutters	1,100	LF	25.00	27,500	
Patch/repair existing paving - allow	1	LS	5,000.00	5,000	
Pedestrian paving					
Sand base	144	CY	25.00	3,611	
Concrete, 4"	2,800	SF	5.00	14,000	
Concrete, 8"	5,000	SF	7.50	37,500	
Site structure & miscellaneous					
Site retaining walls including footings	520	LF	445.00	231,400	
Low walls/planters including footings	140	LF	260.00	36,400	
Bollards	10	EA	600.00	6,000	
Trash receptacles	5	EA	500.00	2,500	
Striping, stall	1	LS	5,000.00	5,000	
Exterior signage - allow	1	LS	12,000.00	12,000	
Miscellaneous site structures	1	LS	20,000.00	20,000	

CONSTRUCTION COST DETAIL

SITEWORK

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
Linkages					
Plaza/terrace including foundation footings	8,000	SF	21.00	168,000	
Pedestrian linkway/bridge including footings	350	SF	120.00	42,000	
Guardrails, stainless steel	80	LF	350.00	28,000	
Pedestrian access ramp	5,400	SF	38.00	205,200	
Exterior stairs including handrailings (to Bldg 66)	2	EA	60,000.00	120,000	
Landscape planting & maintenance					
Topsoil spreading	1,700	CY	10.00	17,000	
Fine Grading	45,000	SF	0.25	11,250	
Shrubs planting	4,000	SF	7.50	30,000	
Lawn seeding	45,000	SF	0.80	36,000	
Groundcover planting	4,000	SF	2.50	10,000	
Trees: Shade	50	EA	750.00	37,500	
Trees: Ornamental	25	EA	1,100.00	27,500	
Metal edge	2,000	LF	3.50	7,000	
Irrigation system					
Landscape irrigation system	45,000	SF	1.10	49,500	
Site Improvement					**$1,314,736**

123 SITE CIVIL/MECHANICAL UTILITIES	**1.50**	**ACR**			
Storm sewer					
Manhole	5	EA	1,800.00	9,000	
Tap into existing manhole	1	LS	3,500.00	3,500	
Trench drain	50	LF	100.00	5,000	
Catch basin, outlets, etc	8	EA	1,100.00	8,800	
Storm sewer line 10"	200	LF	60.00	12,000	
Remove & reroute existing 12" mains on site	500	LF	90.00	45,000	
Sanitary sewer					
Manhole	3	EA	1,500.00	4,500	
Tap into existing manhole	1	LS	3,500.00	3,500	
Remove & reroute existing 6" sanitary sewer	500	LF	90.00	45,000	
Water main and fire hydrant					
Tap into existing HPCW off Lawrence Road	1	LS	5,000.00	5,000	
Fire hydrant	2	EA	1,500.00	3,000	
Gate valves	20	EA	650.00	13,000	
Water main line 6"	150	LF	50.00	7,500	
Water connections	1	LS	15,000.00	15,000	

CONSTRUCTION COST DETAIL

SITEWORK

April 15, 2002

SYSTEM	QUANTITY	UNIT	UNIT COST	ITEM COST	SYS.COST
Natural gas service					
Remove & reroute existing 3" HP gas main	210	LF	75.00	15,750	
Compressed air service					
Remove & reroute existing 3" air line	400	LF	75.00	30,000	
Miscellaneous demolition and temporary protection to existing utilities - allow	1	LS	20,000.00	20,000	
Site Civil/Mechanical Utilities					**$245,550**
124 SITE ELECTRICAL UTILITIES					
Site lighting					
Site/parking lighting fixture	20	EA	1,900.00	38,000	
Walkway pole lighting	20	EA	1,300.00	26,000	
Site Electrical Utilities					
Primary feeder	500	LF	120.00	60,000	
Splicing at new manhole - allow	5	EA	850.00	4,250	
New electrical manhole	2	EA	6,000.00	12,000	
New communication manhole	2	EA	6,000.00	12,000	
Communication duct bank	500	LF	220.00	110,000	
Remove & reroute existing cable - allow	1	LS	10,000.00	10,000	
Site Electrical Utilities					**$272,250**

APPENDIX C: GEOTECHNICAL INVESTIGATION

KLEINFELDER
An employee owned company

January 29, 2002
Project No. 41-7702-01

Lawrence Berkeley National Laboratory
1 Cyclotron Road, Bldg. 90G
Berkeley, California 94720

Attention: Mr. Robert Schilling

Subject: Geotechnical Investigation
Proposed Molecular Foundry Building
Lawrence Berkeley National Laboratory
Berkeley, California

Gentlemen:

This report presents the results of our geotechnical investigation for the conceptual design of the proposed Molecular Foundry Building, Lawrence Berkeley National Laboratory, Berkeley, California. The planned new building will be located on Cyclotron Road between Buildings 66 and 72. The site location is shown on the Site Plan, Plate 1. Work performed during this investigation was conducted in accordance with the tasks described in our subcontract agreement dated January 2, 2002.

Purpose and Scope of Services

The purpose of this investigation is to provide preliminary geotechnical conclusions and recommendations to be used for conceptual design of the planned building. Our scope of services includes the following tasks:

- Reviewing selected geologic and seismic literature and maps pertaining to the site and vicinity.
- Exploring subsurface conditions at the site by drilling and sampling two test borings.
- Laboratory testing of selected soil samples obtained from the borings.
- Compiling and analyzing of the obtained data.
- Preparing this letter report containing our conclusions and recommendations.

KLEINFELDER 35 Mitchell Boulevard, Suite 5A, San Rafael, CA 94903 (415) 472-6770 (415)-472-6773 fax

Site Description

The building site, as shown on Plate 1, is located on a hillside west of Cyclotron Road. The existing ground surface slopes down from Cyclotron Road to an existing paved parking lot. The slope of the ground is about two horizontal to one vertical (2:1). The upper part of the site is a landslide that was repaired in 1978.

Planned Building

The planned building will be a six-story structure that is roughly 140 feet square in plan view. The building foundation will notched into the existing hillside at the first and fourth floor levels. The fifth floor will be at the level of Cyclotron Road and the first floor at the level of the existing paved parking lot.

Geology

The project area is located within a geologically complex and seismically active region characterized by subparallel northwest trending faults, mountain ranges, and valleys. Tectonically induced folding and faulting, occurring since Cretaceous and Pleistocene age, along with erosion of rock and soil, have generated the current topography. In general, the project site has been documented as consisting of surficial colluvium and artificial fill underlain by Miocene-Pliocene age bedrock of the Orinda formation. The Orinda formation has been shown to be shallow marine deposits of poorly consolidated claystone, siltstone, sandstone and conglomerate. The southeastern portion of the site has been mapped as a landslide.

Faulting and Seismicity

The entire North Bay region is seismically active, and earthquakes of various magnitudes occur frequently. The nearest faults considered seismically active (experiencing surface rupture within the last 11,000 years) are listed in the following table.

Fault	Distance (km)	Direction from Site
Hayward	0.5	West
San Andreas	30.4	Southwest
Seal Cove-San Gregorio	35.2	Southwest
Green Valley	21.7	Northwest
Calaveras	22.2	Southwest

Based upon empirical data and the length of the San Andreas fault, the maximum credible earthquake is approximately 8.3 Magnitude (Richter Scale), or 7.9 Moment Magnitude. Similarly, the maximum credible earthquake for the Hayward fault is approximately 7.5 Magnitude (Richter Scale), or 7.1 Moment Magnitude. The Intensity of future ground shaking will depend on the distance from the site to the earthquake focus, magnitude of the earthquake, and the response the underlying soil and bedrock.

We evaluated anticipated peak soil and bedrock accelerations at the site from sources including Seed and Idriss (1982) and Boore, Joiner and Fumal (1993 and 1977). Based on the results of our evaluation, anticipated peak bedrock accelerations at the site of about 0.70g and 0.40g can be expected during the maximum credible earthquake produced by earthquakes on the Hayward and San Andreas faults, respectively.

The site is not located within a California Special Earthquake Fault Studies Zone (formerly referred to as Alquist-Priolo Special Studies Zone), by the California Division of Mines and Geology (1992).

Field Exploration Program

We explored subsurface conditions by drilling two borings designated as KB-1 and KB-2 on January 8, 2002. The borings were drilled with a truck-mounted drill rig utilizing six-inch diameter augers. The approximate boring locations are shown on Plate 1. Also shown on Plate 1 are the locations of borings drilled for previous nearby projects. The logs from these borings were used to help evaluate subsurface conditions as shown on the geologic profile, Plate 2.

Our field engineer observed the drilling, logged the conditions encountered, and obtained soil samples for visual examination, classification, and laboratory testing. Soil samples were retrieved using a 2.4-inch sampler driver with a 140-pound hammer falling 30 inches. Our field engineer recorded the blow counts required to drive the sampler.

The soils encountered were described in accordance with the Unified Soil Classification System (USCS), as presented on Plate 3. Bedrock classification is shown on Plate 4. The stratification lines presented on the boring logs represent approximate boundaries between soil types: the transitions are generally gradational. The boring logs are presented on Plates 5 through 6.

Laboratory Testing

Selected soil samples collected from the borings were laboratory tested to determine their moisture content, dry density, plasticity, and triaxial shear strength. The results of these tests are presented on the boring logs in a manner described on the Boring Log Legend, Plate 1, and on laboratory test Plates 7 through 8.

Subsurface Conditions

As encountered in our borings, the site consists of surface soils underlain by bedrock. The surface soils are colluvium, slide debris, and fill. The colluvial soils consist mostly of stiff clays and silts that are moderately too highly expansive. Landslide debris was encountered in boring KB-2. This is consistent with a previously map landslide at this location. The fill on the site was placed during development of the area and for repair of the landslide adjacent to Cyclotron Road.

The quality of compaction of the previously placed fill for development appears to be variable. The fill placed for the landslide repair is reported to be well compacted. The side repair contains a subdrain system consisting of drainrock and perforated pipe. The colluvium, slide debris, and fill are underlain by siltstone and sandstone bedrock. Ground water was not encountered in the two borings drilled for this investigation.

RECOMMENDATIONS

Seismic Design Considerations

The site is located in Seismic Zone 4 as designated by the 1997 edition of the Uniform Building Code (UBC) and will be subject to moderate to strong earthquake-induced ground shaking. The Soil Profile Type is S_D. The Hayward fault is the closest significant fault to the site (0.5 km) and is classified as a seismic source Type A. According, Near Source Factors N_a and N_v of 1.5 and 2.0, respectively, should be used.

Site Preparation

As previously described, the building site is underlain by a combination of compacted fill placed for landslide repair, landslide debris, and colluvial soil. The excavation for the building will remove much, but not all of these materials. In the existing landslide repair area subdrains should be reconfigured so as to be functional. The landslide debris down slope from the existing repaired section should be removed to bedrock and replaced with compacted fill containing a subdrain system. This repair should extend downslope of any improvements associated with the building.

On-site soil or imported soil should be used in fills. Drying of on-site soil may be necessary to obtain proper compaction. Because some of the on-site soil has a high expansion potential, the geotechnical engineer should approve soil prior to its use as fill material. Fill material should be moisture conditioned and compacted to at least 90 percent relative compaction using ASTM D-1557 test procedure.

Foundations

The bottom of the excavation for the building will be in soil and in bedrock. The soil would not provide a suitable foundation for the building because potential differential settlement between the soil and bedrock. Were the building overlies soil, a drilled pier foundation extending into bedrock should be used. Where the building overlies bedrock, a spread footing or drilled pier foundation can be used.

A drilled pier foundation should consist of piers drilled at least eight feet into bedrock. The piers should be at least 15 inches in diameter and should be connected with grade beams. The pier capacity should be obtained from skin friction in the bedrock. Allowable skin friction values of 1000 pounds per square foot (psf) should be used for dead plus live loads, 1500 psf for total loads. These values should be reduced by 30 percent for uplift loads. The upper three feet of the pier should be neglected in computing the capacity. The actual pier penetration into bedrock should be determined by the Structural Engineer.

Lateral loads can be resisted by pile caps, grade beams, and the piers. The lateral capacity of piers should be determined when the pier sizes, vertical and lateral loads, and allowable deflections are known.

For spread footing foundations on bedrock individual rectangular footings should be at least 18 inches wide and continuous footings should be at least 12 inches wide. All footings should be at least 24 inches below the lowest adjacent grade. The bottom of footing excavations should be firm, and free of loose soil and standing water. The allowable bearing values, in pounds per square foot (psf), shown in the following table should be used.

Load Conditions	Allowable Bearing Pressures
Dead Load	2500 psi
Dead plus Live Load	3000 psi
Total Loads	4000 psi

Lateral loads on the foundation should be resisted by friction on the bottoms of footings and passive pressure on footing sides. A factor of 0.3 times the dead load should be used to determine allowable friction and a value of 350 pounds per cubic foot (pcf) equivalent fluid weight should be used to determine allowable passive pressure. The upper foot should be neglected in computing passive pressure unless covered with pavement.

Slab-on-Grade Floors

The following recommendations would apply to slab-on-grade floors. Because of the presence of potentially expansive soil on the site, the soil at subgrade level should be evaluated during site excavation to determine its expansion characteristics. If found to be expansive, it should be excavated and replaced with material of low expansion potential.

Slab-on-grade floor subgrades should be moisture conditioned to slightly above optimum moisture content and rolled to provide a smooth surface compacted to at least 90 percent relative compaction. Concrete slabs should be underlain by at least four inches of clean, free-draining crushed rock or gravel to act as a capillary moisture barrier. The rock or gravel should grade between ½-inch and ¾-inch size. The rock should be drained by pipes or weep holes through the foundation so that it cannot collect and retain water.

Where mitigation of moisture vapor through the slab would be detrimental an impermeable moisture membrane should be provided between the drainrock and the slab. The membrane should be covered with two inches of sand for its protection. If the floor covering is a type that is sensitive to moisture, waterproofing the floor should be used.

Retaining Walls

The lateral pressure on retaining walls free to rotate should be determined using an equivalent fluid weight of 45 pounds per cubic foot (pcf) where the backfill slope is 3:1 or less. Retaining walls that are not free to rotate should be designed for an equivalent fluid weight of 60 pcf. A surcharge load should be applied to walls where appropriate. If a seismic load is applied to the wall, the pressure should be determined by using 12H psf, where H is the wall height. The seismic force should be applied at one-half the wall height.

Lateral wall forces can be resisted by friction on the bottom of the foundation and passive pressure against the face of the foundation. The allowable friction factor should be 0.3 and the allowable passive pressure should be determined using an equivalent fluid weight of 350 pcf. The upper foot of soil should be neglected unless it is covered with pavement. If piers are used for wall foundations the lateral resistance can be provided by the piers.

Retaining wall foundations should be as previously described for the building.

Where the excavation for a wall is a relatively high and steep, a tieback wall may be appropriate. Tieback walls also will be appropriate where the wall heights are greater than about 15 feet.

All walls should be backdrained with a drain rock and pipe system or with geotextile drain material.

Temporary Excavations

Excavations for the proposed building will be near existing buildings and they should be protected from damage by shoring, bracing, and underpinning. A Professional Engineer retained by the contractor should design the system.

All excavations must comply with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations.

Additional Services

The conclusions and recommendations presented in this Conceptual Design Report need to be verified and expanded by a design level geotechnical investigation report.

Limitations

The services provided under this contract as described in this report include professional opinions and judgements based on the data reviewed. These services have been performed according to generally accepted geotechnical engineering practices that exist in the area at the time the report was written. No other warranty is expressed or implied. This report is issued with the understanding that the owner chooses the risk he wishes to bear by the expenditures involved with the construction alternatives and scheduling that is chosen.

The conclusions and recommendations of this report are for the proposed Molecular Foundry Building as described in this report. The conclusions and recommendations in this report are invalid if:

Changes are implemented which materially alter the project form that was proposed at the time this report was written.

The conclusions and recommendations contained in this report are based upon our review of the reports and drawings previously described, our knowledge of the planned project, and our experience in the area.

The test borings do not provide a warranty as to the conditions that may exist throughout the site. The extent and nature of subsurface soil and groundwater variations may not become evident until construction begins. It is possible that variations in soil conditions between test borings could exist between or beyond the points of exploration or that groundwater elevations may change, both of which may require additional studies, consultation and possible design revisions. If conditions are encountered in the field during construction which differ from those described in this report, we should be contacted immediately to provide any necessary revisions to these recommendations

It is the client's responsibility to see that all parties to the project including the designer, contractor, subcontractors, etc. are made aware of this report in its entirety including the Additional Services and Limitations section.

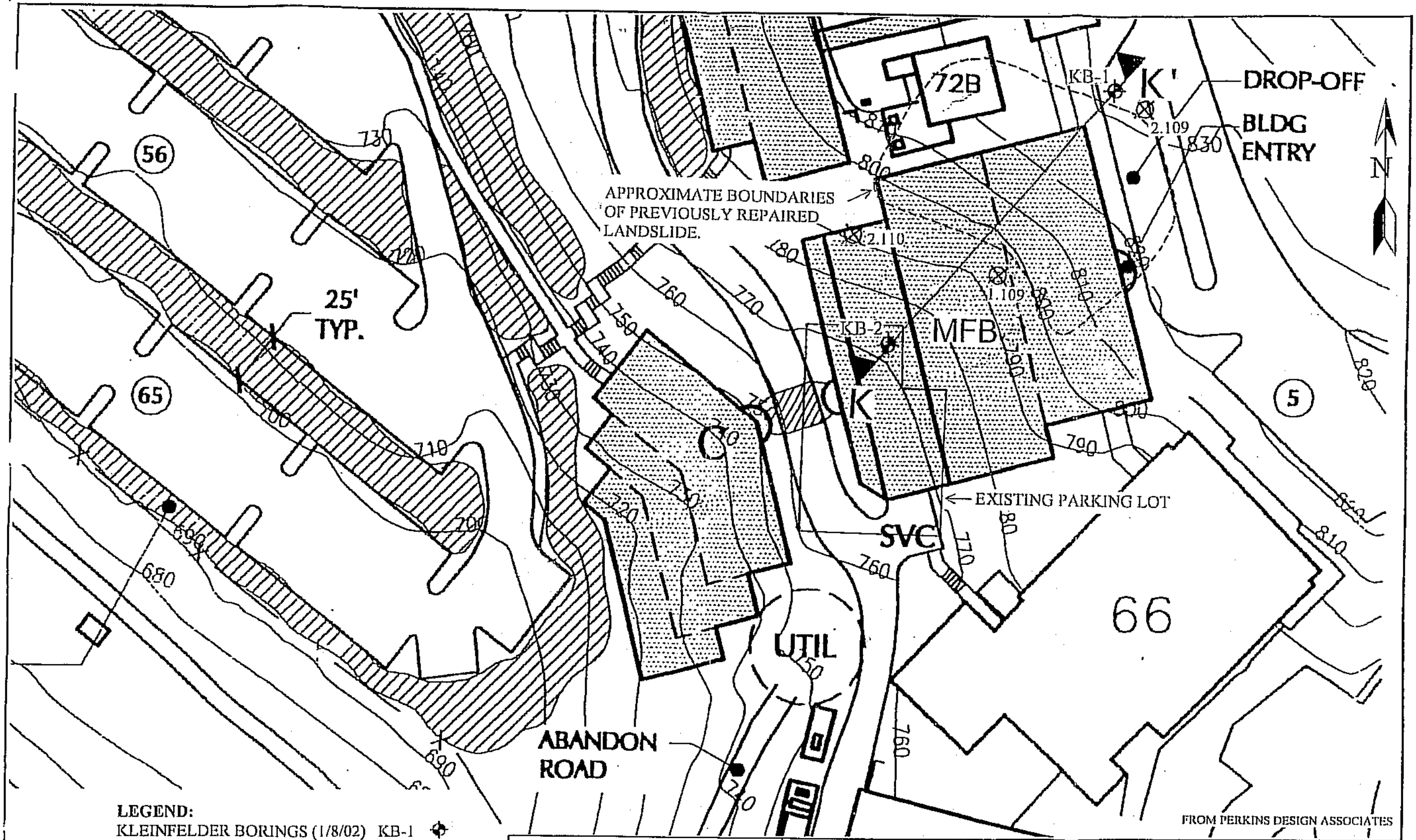
Kleinfelder has prepare this report for exclusive use of Lawrence Berkeley National Laboratory and their design consultants of this project in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. The recommendations provided in this report are based on the assumption that our firm will conduct an adequate program of tests and observations during the construction phase in order to evaluate compliance with our recommendations. If we are not retained for these services, the client agrees to assume Kleinfelder's responsibility for any potential claim that may arise during or after construction.

Respectfully,

KLEINFELDER, INC.

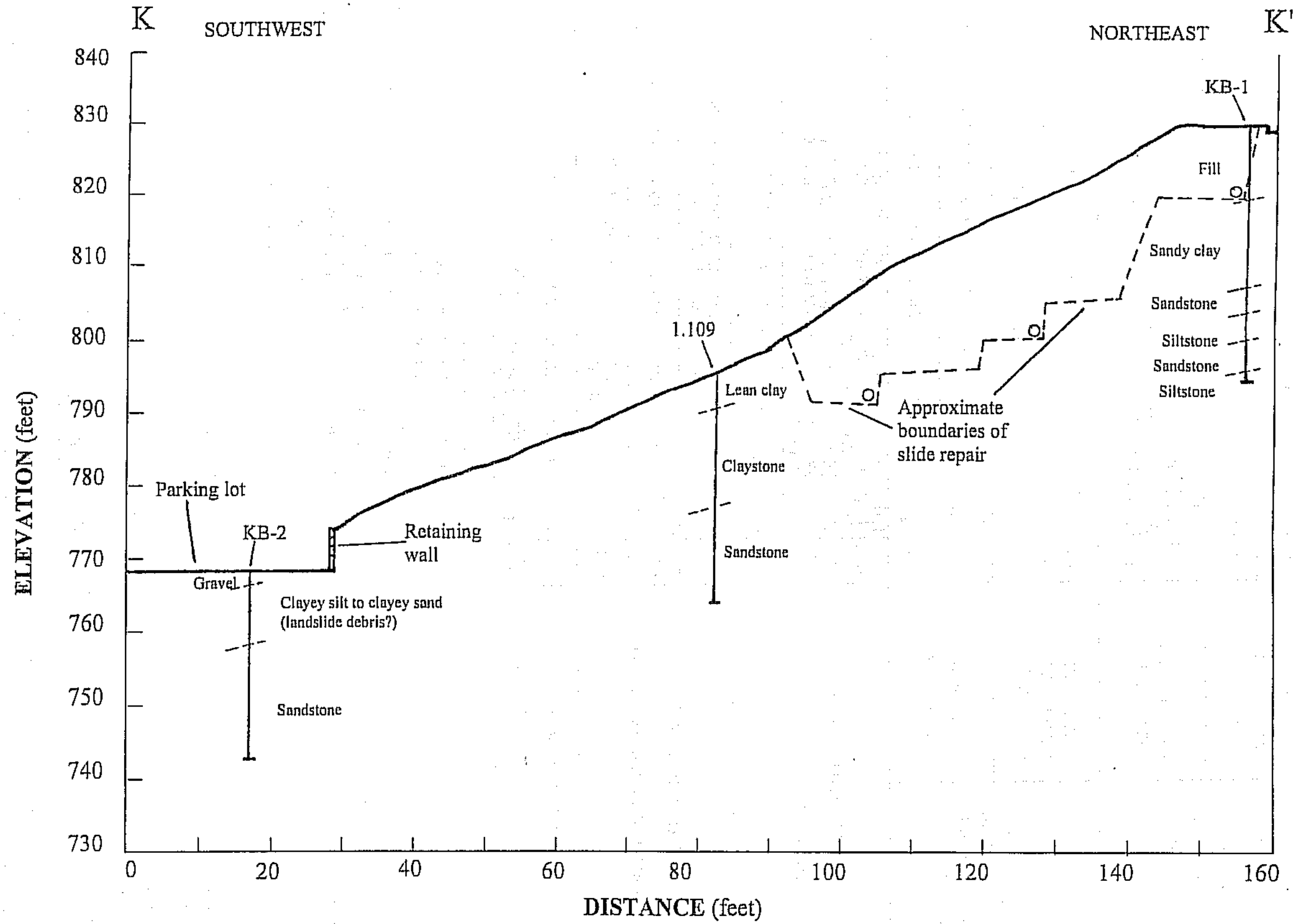
Hugo Hanson
Senior Engineer

Lyle E. Lewis
Principal Engineer



LEGEND:
KLEINFELDER BORINGS (1/8/02) KB-1
HARDING-LAWSON BORINGS (5/23/77) 2.109
GEOLOGIC CROSS-SECTION K —— K'
SCALE: 1'=40'

KLEINFELDER Geotechnical, Materials and Environmental Engineering	Project No. 41-7702-01-001 Date: January 2002	SITE AND BORING LOCATION PLAN LAWRENCE BERKELEY NATIONAL LABORATORY MOLECULAR FOUNDRY BUILDING BERKELEY, CALIFORNIA	PLATE 1



SCALE:1" = 20'
HORTIZONTAL & VERTICAL

KLEINFELDER
Geotechnical, Materials and
Environmental Engineering

PROJECT NO. 41-7702-01

LBNL MOLECULAR FOUNDARY BUILDING GEOLOGIC CROSS-SECTION K to K'

PLATE
2

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POOORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAYMIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION SYSTEM

PS	Percent Saturation		Shear Strength, psf (Confining Pressure, psf)	
SG	Specific Gravity			
Consol	Consolidation	Tx	2630 (240)	Unconsolidated Undrained Triaxial
LL	Liquid Limit (in %)	Tx sat	2100 (575)	Unconsolidated Undrained Triaxial, saturated prior to test
PL	Plastic Limit (in %)	DS	3740 (960)	Consolidated Drained Direct Shear
PI	Plasticity Index	FVS	1320	Field Vane Shear
TS	Total Saturation Moisture Content	UC	4200	Unconfined Compression
SA	Sieve Analysis	LVS	500	Laboratory Vane Shear
■	Undisturbed Sample	C	Concrete Compressive Strength	
☒	Bulk Sample	PE	Petrographic Examination	
◥	Standard Penetration Test	Perm	Permeability	
□	Sample Attempt with No Recovery	SE	Sand Equivalent	

KEY TO TEST DATA

KLEINFELDER
Geotechnical, Materials and Environmental Engineering

PROJECT NUMBER 41-7702-01-001 DATE JAN 2002

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
MOLECULAR FOUNDRY BUILDING
Berkeley, California

PLATE 3

ROCK SYMBOLS

SHALE OR CLAYSTONE	CHERT	SERPENTINITE
SILTSTONE	PYROCLASTIC	METAMORPHIC ROCKS
SANDSTONE	VOLCANIC	ALTERED ROCKS
CONGLOMERATE	PLUTONIC	SHEARED ROCKS

LAYERING

MASSIVE	Greater than 6 feet
THICKLY BEDDED	2 to 6 feet
MEDIUM BEDDED	8 to 24 inches
THINLY BEDDED	2-1/2 to 8 inches
VERY THINLY BEDDED	3/4 to 2-1/2 inches
CLOSELY LAMINATED	1/4 to 3/4 inches
VERY CLOSELY LAMINATED	Less than 1/4 inch

JOINT, FRACTURE, OR SHEAR SPACING

VERY WIDELY SPACED	Greater than 6 feet
WIDELY SPACED	2 to 6 feet
MODERATELY SPACED	8 to 24 inches
CLOSELY SPACED	2-1/2 to 8 inches
VERY CLOSELY SPACED	3/4 to 2-1/2 inches
EXTREMELY CLOSELY SPACED	Less than 3/4 inch

HARDNESS

SOFT - Pliable; can be dug by hand

FIRM - Can be gouged deeply or carved with a pocket knife

MODERATELY HARD - Can be readily scrached by a knife blade; scratch leaves heavy trace of dust and is readily visable after the powder has been blown away

HARD - Can be scratched with difficulty; scratch produces little powder and is often faintly visable

VERY HARD - Cannot be scratched with pocket knife; leaves a metallic streak

STRENGTH

PLASTIC - Capable of being molded by hand

FRIABLE - Crumbles by rubbing with fingers

WEAK - An unfractured specimen of such material will crumble under light hammer blows

MODERATELY STRONG - Specimen will withstand a few heavy hammer blows before breaking

STRONG - Specimem will withstand a few heavy ringing hammer blows and usually yields large fragments

VERY STRONG - Rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

DEGREE OF WEATHERING

HIGHLY WEATHERED - Abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thourough discoloration, rock disintegration, mineral decomposition

MODERATELY WEATHERED - Some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition

SLIGHTLY WEATHERED - A few stained fractures, slight discoloration, little or no effect on cementation, no mineral decomposition

FRESH - Unaffected by weathering agents, no appreciable change with depth

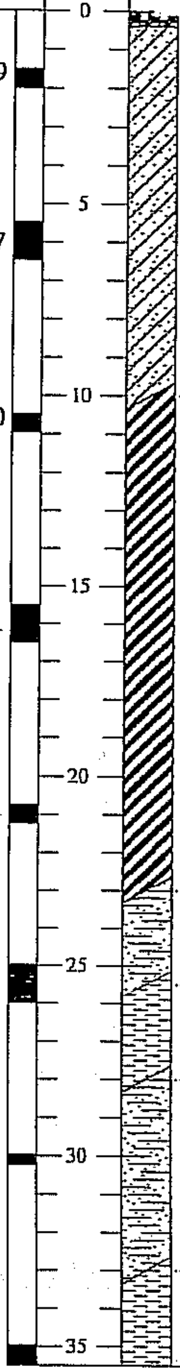
KLEINFELDER
Geotechnical, Materials and Environmental Engineering

PROJECT NUMBER 41-7702-01-001 DATE JAN 2002

ENGINEERING GEOLOGY ROCK TERMS
MOLECULAR FOUNDRY BUILDING
Berkeley, California

PLATE 4

Other Laboratory Tests	Dry Density (pcf)	Moisture Content (%)	Sample Interval (feet)	Blows/ Foot *	Description
					Sidewalk 1" AC
				19	BROWN CLAYEY SAND WITH GRAVEL (SC), moist, stiff (Fill)
TxUU 1917(600)	103	20.1		27	OLIVE BROWN CLAYEY SAND (SC), moist, very stiff, scattered rock fragments (Fill)
LL51PL25PI26				20	REDDISH BROWN SANDY CLAY WITH GRAVEL (CH), moist, very stiff, subangular gravels, scattered rootlets (Colluvium)
LL66PL31PI35 TxUU 1041(1800)	94	26.8		14	
	99	21.9		21	OLIVE BROWN WITH GRAY SILTY CLAY (CH), moist, stiff to very stiff
					YELLOWISH BROWN SANDSTONE, highly weathered with clay seams, friable
				43	MEDIUM BROWN WITH GREY MOTTLING SILTSTONE, moderately weathered, weak to moderately strong
					GREEN SANDSTONE, slightly weathered, friable
				31/5"	
					OLIVE GREY SILTSTONE, slightly weathered, moderately weathered, weak
				29/6"	



EQUIPMENT: **Mobile B-61**
LOGGED BY: **Steve Carroll**
ELEVATION: **830' ****
START DATE: **1-8-02**
FINISH DATE: **1-8-02**

BOTTOM OF BORING 35.5 FEET
No Groundwater Encountered

* Converted to equivalent standard penetration blow counts.
** Existing ground surface at time of drilling.

KLEINFELDER
Geotechnical, Materials and Environmental Engineering

PROJECT NUMBER **41-7702-01-001** DATE **JAN 2002**

LOG OF BORING KB-1

MOLECULAR FOUNDRY BUILDING

Berkeley, California

PLATE **5**

EQUIPMENT: **Mobile B-61**

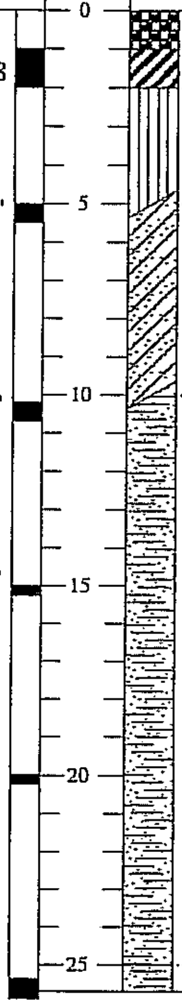
LOGGED BY: **Steve Carroll**

ELEVATION: **768' ****

START DATE: **1-8-02**

FINISH DATE: **1-8-02**

Other Laboratory Tests	Dry Density (pcf)	Moisture Content (%)	Sample Interval (feet)	Blows/ Foot *	DEPTH (FEET)
				18	
				30/6"	5
LL38PL24PI14 TxUU 2166(1200)	104	16.7		30/6"	10
				30/6"	15
				30/4"	20
TxUU 2780(2800)	123	11.2		30/4.5"	25



3" AC

9" Baserock/gravel

OLIVE BROWN SILTY CLAY WITH GRAVEL (CH)

REDDISH BROWN CLAYEY SILT (ML), moist, stiff (Landslide Debris?)

OLIVE BROWN CLAYEY SAND WITH SCATTERED GRAVEL (SC), moist, dense (Landslide Debris?)

GREEN SANDSTONE, slightly weathered, weak to friable

YELLOWISH BROWN SANDSTONE, slightly weathered, weak to friable

BOTTOM OF BORING 25.9 FEET
No Groundwater Encountered

* Converted to equivalent standard penetration blow counts.

** Existing ground surface at time of drilling.

KLEINFELDER
Geotechnical, Materials and Environmental Engineering

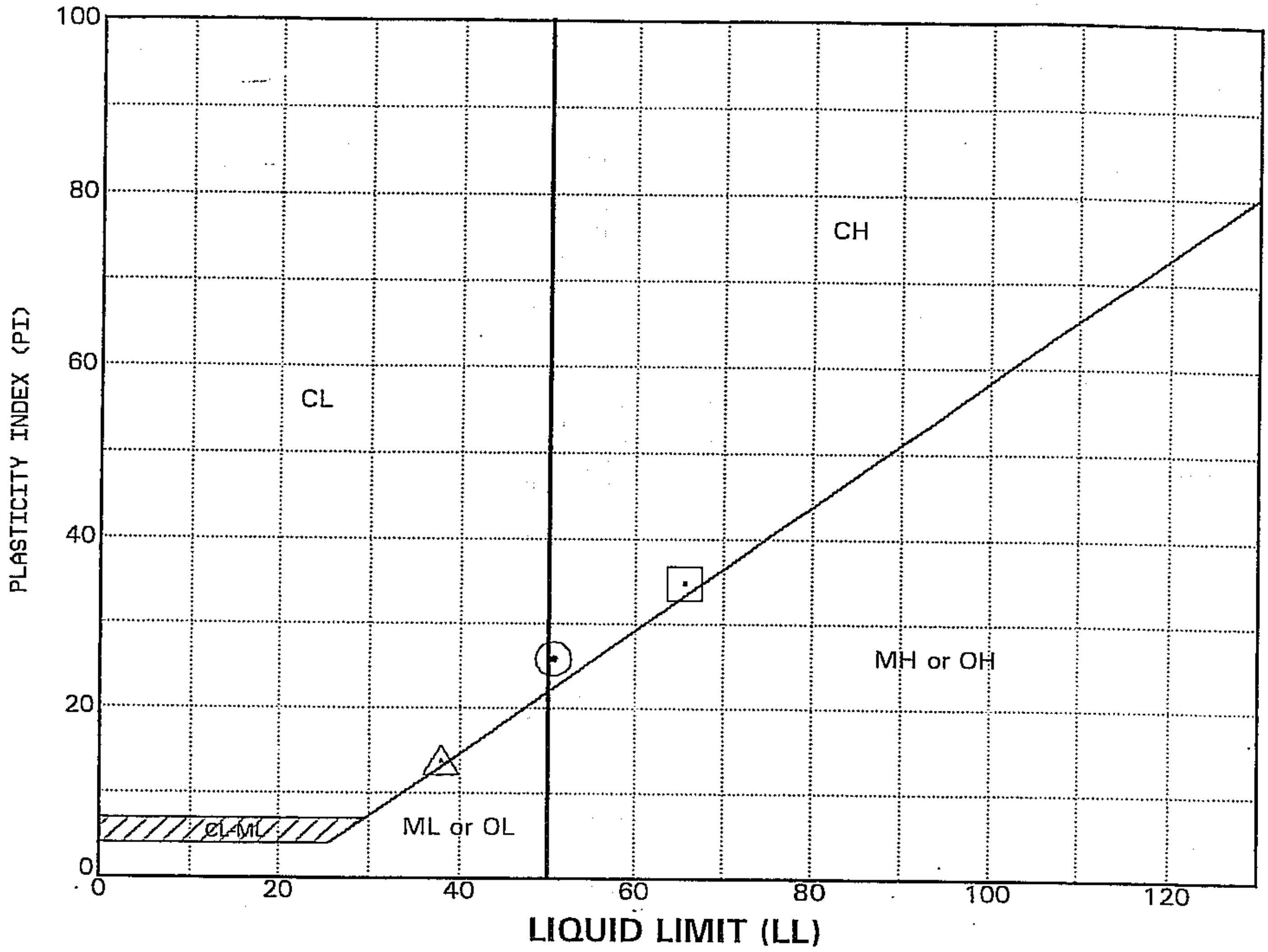
PROJECT NUMBER **41-7702-01-001** DATE **JAN 2002**

LOG OF BORING KB-2

MOLECULAR FOUNDRY BUILDING

Berkeley, California

PLATE **6**



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ KB-1 @ 10.3'	Brown Sandy Clay (CH)	51	25	26	
⊡ KB-1 @ 16.0'	Brown Sandy Clay (CH)	66	31	35	
△ KB-2 @ 10.2'	Olive Clayey Sand (SC)	38	24	14	

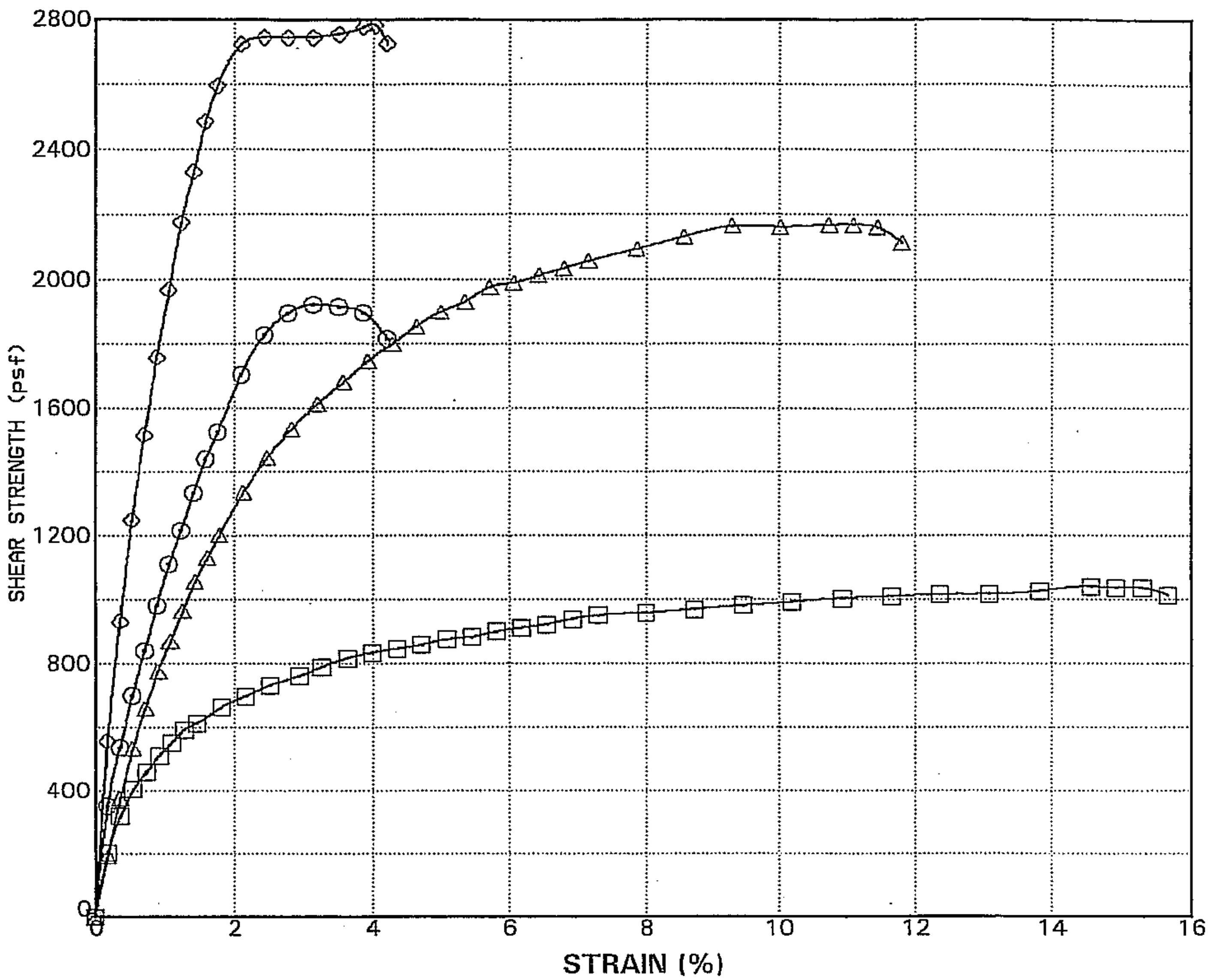
KLEINFELDER
Geotechnical, Materials and Environmental

Job No. 41-7702-01-001

Date: JANUARY, 2002

PLASTICITY DATA
MOLECULAR FOUNDRY BUILDING
BERKELEY, CALIFORNIA

PLATE **7**



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Ultimate Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ KB-1 @ 5.8'	Brown Clayey Sand (SC)	TX/UU	600	1917	3	103	20.1
⊡ KB-1 @ 16.0'	Brown Sandy Clay (CH)	TX/UU	1800	1041	15	94	26.8
△ KB-2 @ 10.2'	Olive Clayey Sand (SC)	TX/UU	1200	2166	11	104	16.7
◇ KB-2 @ 25.3'	Olive Clayey Sand (SC)	TX/UU	2800	2780	4	123	11.2

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
Geotechnical, Materials and Environmental

Job No. 41-7702-01-001

Date: JANUARY, 2002

STRENGTH TEST DATA
MOLECULAR FOUNDRY BUILDING
BERKELEY, CALIFORNIA

PLATE

8

APPENDIX D: ENVIRONMENTAL SAMPLING REPORT

LAWRENCE BERKELEY NATIONAL LABORATORY

Earth Sciences Division
Mail: 90-1116, Phone: 6106

February 1, 2002

MEMORANDUM

TO: James Krupnick

From: Iraj Javandel Iraj

Re: Environmental Sampling at the Proposed Molecular Foundry Site.

Based on long-term environmental investigation at the Lawrence Berkeley National Laboratory (LBNL), there is no evidence of the presence of any contamination at the proposed site (between Buildings 72 and 66) for the molecular foundry. However, in response to a request from you and Dr. Sally Benson, the following investigation was carried out. On January 7, 2002, soil samples were collected from two depths at six points selected on a grid pattern as shown in Figure 1.

Shallow samples were collected from the depth of 6 to 12 inches and were tested for gross alpha, gross beta and gamma spectroscopy. Analyses were conducted by a California-certified laboratory. Results of these analyses are presented in attachment 1. All gamma-emitter chemicals are naturally occurring. The gross alpha and gross beta activities are also consistent with those identified as gamma emitters.

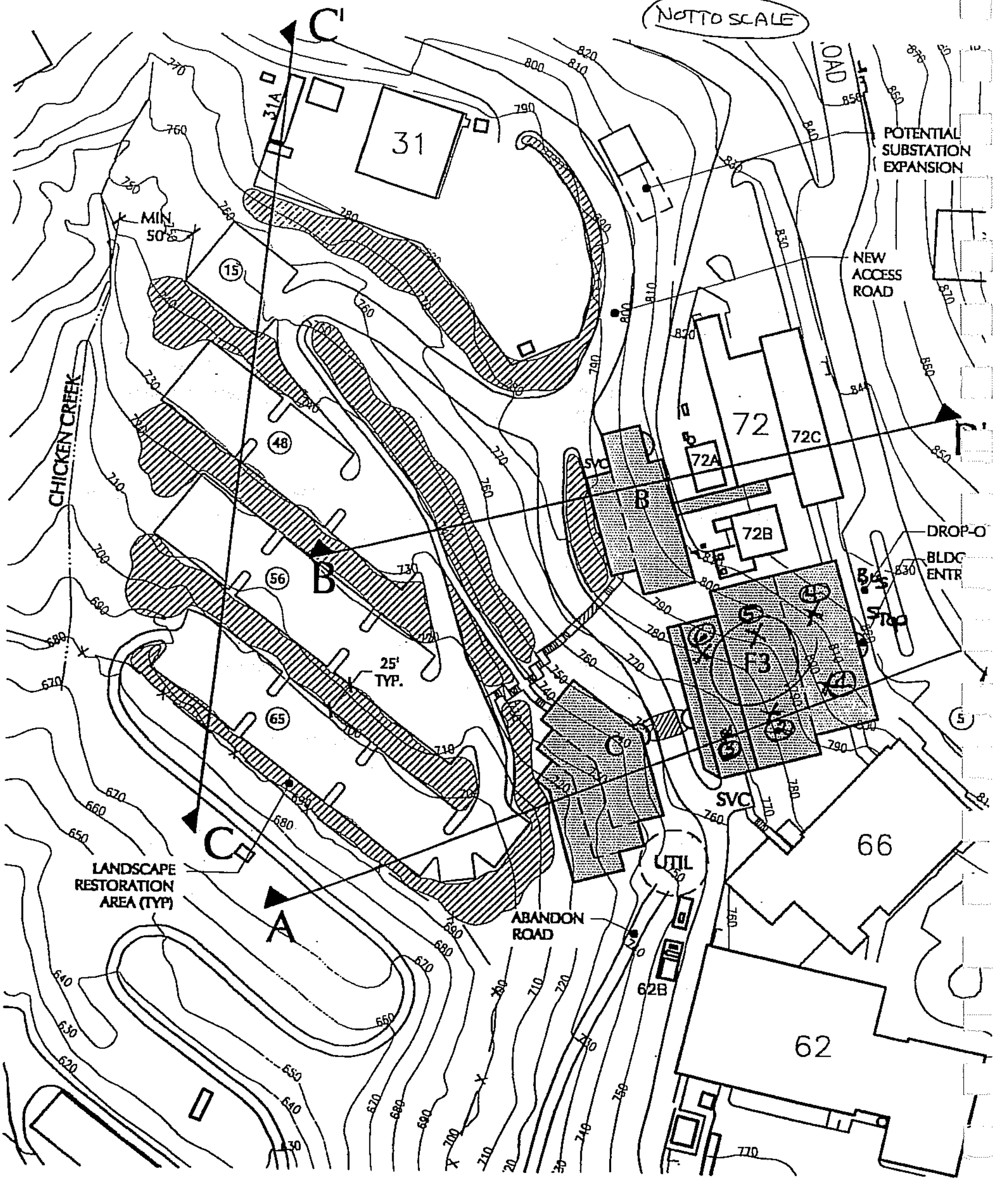
Soil samples were also collected from depth of 3 to 3.5 ft. at all six locations. These samples were tested for volatile organic compounds (VOCs) in accordance with EPA Method 8260 and California Code of Regulation 17 metals. All analyses were carried out by a California-certified laboratory. Results of these analyses are presented in Attachment 2. No VOCs were reported in any of these samples and all reported metals are within their corresponding LBNL background concentrations.

In conclusion, based on the 10-year site-wide investigation and the recent soil sampling information, it appears that the proposed site is free of chemicals of potential concern.

CC: (No Attachment)
Sally Benson
Bob Camper
David Tudor

Figure 1

New Building F3
Location Map



Molecular Foundry Site Environmental Investigation

ATTACHMENT 1

Radiological Analysis Results

LAWRENCE BERKELEY LABORATORY
ANALYTICAL SERVICES GROUP
Bldg.: 26 Room: 034 Ext.: 7712

RADIOCHEMICAL ANALYSIS REPORT
ENVIRONMENTAL RESTORATION GROUP

COC #: 02-1-6
Date Received: 1/8/2002
Lab Control # 14107
Sampled by: EG
Sample Matrix: SOIL

Date Reported: 1/25/2002
Generated by: ANGELA DAVI
Title: TSG TECHNICAL LEAD
DHS CERTIFICATE: 1941

ANALYSES

(units are pCi/g)

SAMPLE ID	SERIAL	GROSS ALPHA			GROSS BETA			GAMMA			
		RESULT	ERROR	MDA	RESULT	ERROR	MDA	ISOTOPE	RESULT	ERROR	MDA
SS-F3Site-02-1-0.5	1	6	3	5	15	2	6	K-40	7	1	0.2
								Th-232	ND		0.09
								U-nat	2.4	0.3	0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04
SS-F3Site-02-2-0.5	2	9	3	5	15	2	6	K-40	7	1	0.2
								Th-232	ND		0.09
								U-nat	1.1	0.1	0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04
SS-F3Site-02-3-0.5	3	ND		5	14	1	6	K-40	5	1	0.2
								Th-232	ND		0.09
								U-nat	0.4	0.2	0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04
SS-F3Site-02-4-0.5	4	ND		5	12	1	6	K-40	4	1	0.2
								Th-232	ND		0.09
								U-nat	ND		0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04
SS-F3Site-02-5-0.5	5	ND		5	8	1	6	K-40	5	1	0.2
								Th-232	ND		0.09
								U-nat	0.9	0.1	0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04

LAWRENCE BERKELEY LABORATORY
ANALYTICAL SERVICES GROUP
Bldg.: 26 Room: 034 Ext.: 7712

RADIOCHEMICAL ANALYSIS REPORT
ENVIRONMENTAL RESTORATION GROUP

COC #: 02-1-6
Date Received: 1/8/2002
Lab Control # 14107
Sampled by: EG
Sample Matrix: SOIL

Date Reported: 1/25/2002
Generated by: ANGELA DAVI
Title: TSG TECHNICAL LEAD

DHS CERTIFICATE: 1941

ANALYSES
(units are pCi/g)

SAMPLE ID	SERIAL	GROSS ALPHA			GROSS BETA			GAMMA			
		RESULT	ERROR	MDA	RESULT	ERROR	MDA	ISOTOPE	RESULT	ERROR	MDA
SS-F3Site-02-6-0.5	6	ND		5	15	2	6	K-40	8	2	0.2
								Th-232	0.6	0.5	0.09
								U-nat	0.3	0.1	0.2
								Cs-137	ND		0.02
								Am-241	ND		0.04

ND = Not detected.

Reviewed by: [signature]
Angela Davi

C:\My Documents\winword\IJREPORTS 1999.doc

LAWRENCE BERKELEY LABORATORY
ANALYTICAL SERVICES GROUP
Bldg.: 26 Room: 034 Ext.: 7712

RADIOCHEMICAL ANALYSIS REPORT
ENVIRONMENTAL RESTORATION GROUP

COC #: 02-1-6
Date Received: 1/8/2002
Lab Control # 14107
Sampled by: EG
Sample Matrix: SOIL

ADDENDUM

ANALYSES

Date Reported: 2/01/2002
Generated by: ANGELA DAVI
Title: TSG TECHNICAL LEAD

DHS CERTIFICATE: 1941

(units are pCi/g)

SAMPLE ID	SERIAL	GROSS ALPHA			GROSS BETA			ALPHA SPECTROSCOPY			
		RESULT	ERROR	MDA	RESULT	ERROR	MDA	ISOTOPE	RESULT	ERROR	MDA
SS-F3Site-02-1-0.5	1	6	3	5	15	2	6	*Pu-238*	*ND*		*0.2*
								Pu-239	*ND*		*0.2*
								Cm-244	*ND*		*0.2*
SS-F3Site-02-2-0.5	2	9	3	5	15	2	6	*Pu-238*	*ND*		*0.2*
								Pu-239	*ND*		*0.2*
								Cm-244	*ND*		*0.2*

ND = Not detected.

Reviewed by: *[signature]*
Angela Davi

ATTACHMENT 2

Organic and Metals Analyses Results

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-1-3.0
Sample Depth: 3.0
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 13:30

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050 '04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3185
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-1-3.0, 01/07/2002 @ 13:30, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-1-3.0, 01/07/2002 @ 13:30, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	101.	70-121
Toluene-d8	96.	81-117
4-Bromofluorobenzene	93.	74-121

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-1-3.0, 01/07/2002 @ 13:30, 3.0, EMILIO GONZALEZ

Flag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
California D.O.H.S. Cert. #1186

Stuart G. Buttram
Department Supervisor

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-2

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-2-3.0
Sample Depth: 3.0
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 13:38

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050 *04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3185
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-2

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-2-3.0, 01/07/2002 @ 13:38, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-2

Sample Description: COC #BRP-02-1-7, SITE RESTORATION, SS-F3SITE-02-2-3.0, 01/07/2002 @ 13:38, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	106.	70-121
Toluene-d8	106.	81-117
4-Bromofluorobenzene	96.	74-121

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

AWRENCE BERKELEY NATIONAL LABORATORY	Date Reported: 01/16/2002
NVIRONMENTAL RESTORATION DEPARTMENT	Date Received: 01/09/2002
CYCLOTRON ROAD, MAIL STOP 90-1116	Laboratory No.: 02-00369-2
ERKELEY, CA 94720	
ttn: DR. IRAJ JAVANDEL 510-486-6106	

ample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-2-3.0, 01/07/2002 @ 13:38, 3.0, EMILIO GONZALEZ

lag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
alifornia D.O.H.S. Cert. #1186

tuart G. Buttram
epartment Supervisor

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-3-3.0
Sample Depth: 3.0
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 13:50

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500	
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425	
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430	
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450	
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500	
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550	
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830	
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575	
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180	
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800	
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000	
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050	*04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150	
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200	
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427	
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429	
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200	
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3185	
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720	
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230	

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-3-3.0, 01/07/2002 @ 13:50, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

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Volatile Organic Analysis
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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-3-3.0, 01/07/2002 @ 13:50, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	97.	70-121
Toluene-d8	101.	81-117
4-Bromofluorobenzene	94.	74-121

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-3-3.0, 01/07/2002 @ 13:50, 3.0, EMILIO GONZALEZ

Flag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
California D.O.H.S. Cert. #1186

Stuart G. Buttram
Department Supervisor

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Volatile Organic Analysis
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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00169-4

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-4-3.0
Sample Depth: 3.0
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 14:03

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500	
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425	
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430	
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450	
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500	
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550	
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830	
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575	
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180	
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800	
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000	
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050	*04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150	
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200	
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427	
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429	
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200	
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3185	
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720	
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230	

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-4

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-FJSITE-02-4-3.0, 01/07/2002 @ 14:03, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-4

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-4-3.0, 01/07/2002 @ 14:03, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	103.	70-121
Toluene-d8	98.	81-117
4-Bromofluorobenzene	90.	74-121

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-4

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-4-3.0, 01/07/2002 @ 14:03, 3.0, EMILIO GONZALEZ

Flag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
California D.O.H.S. Cert. #1186

Stuart G. Buttram
Department Supervisor

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-5-1.0
Sample Depth: 1.0
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 14:22

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050 *04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3185
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-5-3.0, 01/07/2002 @ 14:22, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-5-3.0, 01/07/2002 @ 14:22, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	103.	70-121
Toluene-d8	104.	81-117
4-Bromofluorobenzene	95.	74-121

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-5-3.0, 01/07/2002 @ 14:22, 3.0, EMILIO GONZALEZ

Sample specific matrix spike recovery(s) not within QC limits.

Flag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
California D.O.H.S. Cert. #1186

Stuart G. Buttram
Department Supervisor

BC Laboratories, Inc

Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-6-2.8
Sample Depth: 2.8
Sample Matrix: SO - Soil or sediment
Sample Collected By: EMILIO GONZALEZ

Date Collected: 01/07/2002 @ 14:45

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	
Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	0500	
Bromobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1425	
Bromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1430	
Bromodichloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1450	
Bromoform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1500	
Bromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1550	
n-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5830	
sec-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7575	
tert-Butylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8180	
Carbon tetrachloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	1800	
Chlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2000	
Chloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2050	*04
Chloroform	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2150	
Chloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2200	
2-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2427	
4-Chlorotoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	2429	
Dibromochloromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3200	
1,2-Dibromo-3-Chloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3165	
1,2-Dibromoethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4720	
Dibromomethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3230	

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-6-2.8, 01/07/2002 @ 14:45, 2.8, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3300
1,3-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3350
1,4-Dichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3400
Dichlorodifluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3500
1,1-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3550
1,2-Dichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3600
1,1-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3650
cis-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3695
trans-1,2-Dichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3700
1,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3850
1,3-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3855
2,2-Dichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3880
1,1-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3870
cis-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3900
trans-1,3-Dichloropropene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	3950
Ethyl Benzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4700
Hexachlorobutadiene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5100
Isopropylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5435
p-Isopropyltoluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	6355
Methylene Chloride	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5750
Naphthalene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5800
n-Propylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5835
Styrene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	7968
1,1,1,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8185
1,1,2,2-Tetrachloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8200
Tetrachloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8250
Toluene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8350

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-6-2.8, 01/07/2002 @ 14:45, 2.8, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code
1,2,3-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8499
1,2,4-Trichlorobenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8500
1,1,1-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8550
1,1,2-Trichloroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8600
Trichloroethene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8650
Trichlorofluoromethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8700
1,2,3-Trichloropropane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8753
1,1,2-Trichloro-1,2,2-trifluoroethane	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	4850
1,2,4-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8765
1,3,5-Trimethylbenzene	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8767
Vinyl Chloride	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8900
Total Xylenes	None Detected	mg/kg	0.01	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	8975
Methyl-t-butylether	None Detected	mg/kg	0.005	8260	01/10/02	DJP	1.	MS-V8	5030	01/10/02	E8260	5728

Quality Control Data

Surrogates	% Recovery	Control Limits
1,2-Dichloroethane-d4	105.	70-121
Toluene-d8	100.	81-117
4-Bromofluorobenzene	94.	74-121

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Volatile Organic Analysis
(EPA Method 8260)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/16/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-6-2.8, 01/07/2002 @ 14:45, 2.8, EMILIO GONZALEZ

Flag Explanations:
*04 = Sample specific matrix spike recovery(s) are not within QC limits. Accuracy verified through LCS.
California D.O.H.S. Cert. #1186

Stuart G. Buttram
Department Supervisor

BC Laboratories, Inc

TOTAL CONCENTRATIONS
(California Code of Regulations, Title 22, Section 66261)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-P3SITE-02-1-3.0
Sample Depth: 3.0
Sampling Date/Time: 01/07/2002 @ 13:30
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type III: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	8.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA36E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	210.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	63.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	13.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	29.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	None Detected	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.947	FSP1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	77.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	39.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	67.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

(See Last Page for Comments, Definitions, and References)

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TOTAL CONCENTRATIONS
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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-1

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-1-3.0, 01/07/2002 @ 13:30, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg

Comment: All above constituents are reported on an as received (wet) sample basis. Results reported represent totals (TTLC) as sample subjected to appropriate techniques to determine total levels.

P.Q.L. = Practical Quantitation Limit (refers to the least amount of analyte quantifiable based on sample size used and analytical technique employed).
STLC = Soluble Threshold Limit Concentration
TTLC = Total Threshold Limit Concentration

REFERENCES:
EPA = "Methods for Chemical Analysis of Water and Wastes", EPA-600, /4-79-020.

California D.O.H.S. Cert. #1186

Dan Schultz
Laboratory Director

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/24/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-2

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-2-3.0
Sample Depth: 3.0
Sampling Date/Time: 01/07/2002 @ 13:38
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type III: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	10.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	5.	mg/kg	1.	EPA-6010	01/17/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	230.	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	57.	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	12.	mg/kg	5.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	30.	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	6.1	mg/kg	5.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	None Detected	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.95	DCA-1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	72.	mg/kg	5.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	2.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	10.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	32.	mg/kg	1.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	58.	mg/kg	5.	EPA-6010	01/15/02	JCC	1.94	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/24/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-2

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-2-3.0, 01/07/2002 @ 13:38, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg

Comment: All above constituents are reported on an as received (wet) sample basis. Results reported represent totals (TTLC) as sample subjected to appropriate techniques to determine total levels.

P.Q.L. = Practical Quantitation Limit (refers to the least amount of analyte quantifiable based on sample size used and analytical technique employed).
STLC = Soluble Threshold Limit Concentration
TTLC = Total Threshold Limit Concentration

REFERENCES:
EPA = "Methods for Chemical Analysis of Water and Wastes", EPA-600, /4-79-020.

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Dan Schultz
Laboratory Director

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-P3SITE-02-3-3.0
Sample Depth: 3.0
Sampling Date/Time: 01/07/2002 @ 13:50
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type III: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	5.	mg/kg	2.5	EPA-6010	01/17/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	210.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	56.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	26.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	None Detected	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.95	DCA-1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	73.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	32.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	55.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.9	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-3

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-3-3.0, 01/07/2002 @ 13:50, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg

Comment: All above constituents are reported on an as received (wet) sample basis. Results reported represent totals (TTLC) as sample subjected to appropriate techniques to determine total levels.

P.Q.L. = Practical Quantitation Limit (refers to the least amount of analyte quantifiable based on sample size used and analytical technique employed).
STLC = Soluble Threshold Limit Concentration
TTLC = Total Threshold Limit Concentration

REFERENCES:
EPA = "Methods for Chemical Analysis of Water and Wastes", EPA-600, /4-79-020.

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Dan Schultz
Laboratory Director

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-4

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-4-3.0
Sample Depth: 3.0
Sampling Date/Time: 01/07/2002 @ 14:03
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type iii: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	4.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	150.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	78.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	16.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	28.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	None Detected	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.947	LDC1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	74.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	74.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	50.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.85	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

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LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-4

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-4-3.0, 01/07/2002 @ 14:03, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg

Comment: All above constituents are reported on an as received (wet) sample basis. Results reported represent totals (TTLC) as sample subjected to appropriate techniques to determine total levels.

P.Q.L. = Practical Quantitation Limit (refers to the least amount of analyte quantifiable based on sample size used and analytical technique employed).
STLC = Soluble Threshold Limit Concentration
TTLC = Total Threshold Limit Concentration

REFERENCES:
EPA = "Methods for Chemical Analysis of Water and Wastes", EPA-600, /4-79-020.

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Dan Schultz
Laboratory Director

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ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-5-3.0
Sample Depth: 3.0
Sampling Date/Time: 01/07/2002 @ 14:22
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type iii: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	4.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	140.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	67.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	20.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	29.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	None Detected	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.868	LDC1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	55.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	73.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	66.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.76	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

(See Last Page for Comments, Definitions, and References)

BC Laboratories, Inc

TOTAL CONCENTRATIONS
(California Code of Regulations, Title 22, Section 66261)

LAWRENCE BERKELEY NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-5

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-5-3.0, 01/07/2002 @ 14:22, 3.0, EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg

Comment: All above constituents are reported on an as received (wet) sample basis. Results reported represent totals (TTLC) as sample subjected to appropriate techniques to determine total levels.

P.Q.L. = Practical Quantitation Limit (refers to the least amount of analyte quantifiable based on sample size used and analytical technique employed).
STLC = Soluble Threshold Limit Concentration
TTLC = Total Threshold Limit Concentration

REFERENCES:
EPA = "Methods for Chemical Analysis of Water and Wastes", EPA-600, /4-79-020.

California D.O.H.S. Cert. #1186

Dan Schultz
Laboratory Director

4100 Atlas Court * Bakersfield, CA 93308 * (661) 327-4911 * Fax (661) 327-1918 * www.bclabs.com

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ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Project Number: COC #ERP-02-1-7
COC Number: 02-1-7
Sampling Location: SITE RESTORATION
Sample ID: SS-F3SITE-02-6-2.8
Sample Depth: 2.8
Sampling Date/Time: 01/07/2002 @ 14:45
Sample Matrix: SO - Soil or sediment

Title 22 Waste Type: Type iii: Non-filterable, non-millable sludge.
Sample Collected By: EMILIO GONZALEZ

Constituents	Results	Units	P.Q.L.	Method	Run Date	Analyst	Dilution	Instrument	Prep Method	Prep Date	LLNL Method	LLNL Code	Regulatory Criteria STLC mg/L	Regulatory Criteria TTLC mg/kg
Antimony	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0400	15.	500.
Arsenic	4.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0450	5.0	500.
Barium	180.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0475	100.	10000.
Beryllium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	0900	0.75	75.
Cadmium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	1650	1.0	100.
Chromium	70.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2450	560.	2500.
Cobalt	16.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2625	80.	8000.
Copper	38.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	2800	25.	2500.
Lead	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5450	5.0	1000.
Mercury	0.47	mg/kg	0.2	EPA-7471	01/15/02	PAP	0.893	LDC1	SW-7471	01/14/02	TTLCLBNL	5600	0.2	20.
Molybdenum	None Detected	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5775	350.	3500.
Nickel	77.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	5850	20.	2000.
Selenium	None Detected	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	7600	1.0	100.
Silver	None Detected	mg/kg	5.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	7800	5.0	500.
Thallium	None Detected	mg/kg	25.	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	8300	7.0	700.
Vanadium	61.	mg/kg	2.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	8875	24.	2400.
Zinc	57.	mg/kg	12.5	EPA-6010	01/15/02	JCC	4.81	TJA61E	SW-3050	01/11/02	TTLCLBNL	9050	250.	5000.

(See Last Page for Comments, Definitions, and References)

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ENVIRONMENTAL RESTORATION DEPARTMENT
1 CYCLOTRON ROAD, MAIL STOP 90-1116
BERKELEY, CA 94720
Attn: DR. IRAJ JAVANDEL 510-486-6106

Date Reported: 01/23/2002
Date Received: 01/09/2002
Laboratory No.: 02-00369-6

Sample Description: COC #ERP-02-1-7, SITE RESTORATION, SS-F3SITE-02-6-2.8, 01/07/2002 @ 14:45, 2.8, EMILIO GONZALEZ

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