Labs21 Environmental Performance Criteria

Version 2.0

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1 Overview

Laboratory facilities present a unique challenge for energy efficient and sustainable design, with their inherent complexity of systems, health and safety requirements, long-term flexibility and adaptability needs, energy use intensity, and environmental impacts. The typical laboratory is about five times as energy intensive as a typical office building and costs about three times as much per unit area.

The Labs21 Environmental Performance Criteria (EPC) is a rating system for use by laboratory building project stakeholders to assess the environmental performance of laboratory facilities. Currently, the U.S. Green Building Council's LEED™ Rating System is the primary tool used. However, LEED™ was designed for U.S. commercial office buildings and as such, lacks some attributes essential to the sustainable design of this unique and complex building type. To facilitate widespread use and to avoid "re-inventing the wheel" this effort builds on the existing LEED™ Rating System 2.0.

2 Background

The Labs21 EPC is the result of two complementary efforts:

First is the LEED™ Green Building Rating System. The U.S. Green Building Council (USGBC) developed LEED™ under a grant from the U.S. Department of Energy, Energy Efficiency and Renewable Energy, Office of Building Technology. The Rating System is available through a free download at: http://www.usgbc.org/programs/leed.htm. LEED™ is a standard that improves environmental performance of commercial buildings using established or advanced industry principles, practices, materials and standards. LEED™ is a tremendous tool being used for all building types. However, because of the significantly higher impact of laboratories on the environment, the Labs21 EPC leverages LEED™, extending it to set appropriate and specific requirements for laboratories.

The second effort is the Laboratories for the 21st Century (Labs21) Program. See http://www.epa.gov/labs21century. This is a program aimed at improving environmental performance of public and private laboratory buildings. The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) have been the lead sponsors of this effort. Labs21 needs a method to evaluate laboratory environmental performance and a tool to provide guidance regarding what is a "green" laboratory.

3 Labs21 EPC Version 2.0 Development Process

Eight working groups have been established to develop version 2.0, primarily via a series of conference calls, using Version 1.1 (12/21/01) as a starting point. Running notes with call summaries and revision histories are maintained for each working group:

WG1 Sustainable Sites

WG2 Water Efficiency

WG3a Energy & Atmosphere (Energy Supply)

WG3b Energy & Atmosphere (Energy Efficiency)

WG3c Energy & Atmosphere (Laboratory Equipment)

WG4 Materials and Resources

WG5 Indoor Environmental Quality

WG6 Innovation & Design Process

Participation is open to all interested stakeholders. Over 40 people (architects, engineers, consulting experts, health & safety personnel, facilities personnel) participated in the working group conference calls, many of who also developed draft revisions for the credits in each working group, as indicated in the participant list.

This version includes the intent, requirements and technologies and strategies for each credit. A reference manual for the Labs21 EPC will be developed in the future, analogous to the LEED™ reference manual.

Based on the feedback, a second series of conference calls may be held for each working group, and a revised version will be issued if necessary.

4 EPC and LEED™

As noted earlier, the EPC leverages the existing LEED™ Rating System 2.0. The EPC is a public domain document that is available for anyone to use as they see fit. Labs21 does not provide a project certification process. The USGBC is considering developing and publishing a LEED™ Application Guide for Laboratories and/or a Laboratory Supplement to LEED™, and has expressed a strong interest in using the EPC as a basis for this effort.

5 EPC Structure

The Labs21 EPC follows the format of LEED™ Version 2.0. When not mentioned, LEED™ credits and requirements are assumed to remain the same. This document only contains additional credits (over and above LEED™ credits) as well as modifications to LEED™ credits. For example, in the Sustainable Sites (SS) category the LEED™ prerequisite and credits SS-1 through SS-8 remain unchanged. Labs21 EPC proposes an additional credit (SS-9), Safety and Risk Management with a potential two-point credit. Therefore, the Labs21EPC must be considered in conjunction with the LEED™ Version 2.0.

This version of the Labs21 EPC increases the number of possible points from 69 to 85. This will dictate a commensurate increase in the threshold values for certification and the ratings of silver, gold and platinum. Threshold values have not yet been proposed, and will be determined based on pilot-testing on selected laboratory facilities.

Note that the credit numbering system in this draft (version 2.0) is different from the numbering system in version 1.1, due to additions and deletions of credits.

6 Credit Summary (LEED + EPC)

Notes:

1. The credit numbering in this draft is different from version 1.1
2. EPC additions and modifications are highlighted.

Sustainable Sites		**16**
Prereq 1	**Erosion & Sedimentation Control**	Required
Credit 1	**Site Selection**	1
Credit 2	**Urban Redevelopment**	1
Credit 3	**Brownfield Redevelopment**	1
Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
Credit 4.3	**Alternative Transportation**, Alternative Fuel Refueling Stations	1
Credit 4.4	**Alternative Transportation**, Parking Capacity	1
Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1
Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1
Credit 6.1	**Stormwater Management**, Rate or Quantity	1
Credit 6.2	**Stormwater Management**, Treatment	1
Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1
Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1
Credit 8	**Light Pollution Reduction**	1
Credit 9.1	**Safety and Risk Management**, Air Effluent	1
Credit 9.2	**Safety and Risk Management**, Water Effluent	1
Water Efficiency		**7**
Prereq 1	**Laboratory Equipment Water Use**	Required
Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
Credit 2	**Innovative Wastewater Technologies**	1
Credit 3.1	**Water Use Reduction**, 20% Reduction	1
Credit 3.2	**Water Use Reduction**, 30% Reduction	1
Credit 4.1	**Process Water Efficiency**, Document Baseline	1
Credit 4.2	**Process Water Efficiency**, 20% Reduction	1
Energy & Atmosphere		**25**
Prereq 1	**Fundamental Building Systems Commissioning**	Required
Prereq 2	**Minimum Energy Performance**	Required
Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required
Prereq 4	**Assess Minimum Ventilation Requirements**	Required
Credit 1.1	**Optimize Energy Performance**, 5%	1
Credit 1.2	**Optimize Energy Performance**, 10%	1
Credit 1.3	**Optimize Energy Performance**, 15%	1
Credit 1.4	**Optimize Energy Performance**, 20%	1

Credit 1.5	**Optimize Energy Performance**, 25%	1
Credit 1.6	**Optimize Energy Performance**, 30%	1
Credit 1.7	**Optimize Energy Performance**, 35%	1
Credit 1.8	**Optimize Energy Performance**, 40%	1
Credit 1.9	**Optimize Energy Performance**, 45%	1
Credit 1.10	**Optimize Energy Performance**, 50%	1
Credit 2.1	**Renewable Energy**, 2% Contribution	1
Credit 2.2	**Renewable Energy**, 5% Contribution	1
Credit 2.3	**Renewable Energy**, 10% Contribution	1
Credit 3	**Additional Commissioning**	1
Credit 4	**Ozone Depletion**	1
Credit 5	**Measurement & Verification**	1
Credit 6	**Green Power**	1
Credit 7.1	**Energy Supply Efficiency**, 10%	1
Credit 7.2	**Energy Supply Efficiency**, 20%	1
Credit 7.3	**Energy Supply Efficiency**, 30%	1
Credit 7.4	**Energy Supply Efficiency**, 40%	1
Credit 7.5	**Energy Supply Efficiency**, 50%	1
Credit 8	**Improve Laboratory Equipment Efficiency**	1
Credit 9.1	**Right-size Laboratory Equipment Load:** Measure Comparable Lab	1
Credit 9.2	**Right-size Laboratory Equipment Load:** Metering Provision	1

Materials & Resources		**14**
Prereq 1	**Storage & Collection of Recyclables**	Required
Prereq 2	**Hazardous Material Handling**	Required
Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell	1
Credit 1.2	**Building Reuse**, Maintain 100% of Shell	1
Credit 1.3	**Building Reuse**, Maintain 100% Shell & 50% Non-Shell	1
Credit 2.1	**Construction Waste Management**, Divert 50%	1
Credit 2.2	**Construction Waste Management**, Divert 75%	1
Credit 3.1	**Resource Reuse**, Specify 5%	1
Credit 3.2	**Resource Reuse**, Specify 10%	1
Credit 4.1	**Recycled Content**, Specify 25%	1
Credit 4.2	**Recycled Content**, Specify 50%	1
Credit 5.1	**Local/Regional Materials**, 20% Manufactured Locally	1
Credit 5.2	**Local/Regional Materials**, of 20% Above, 50% Harvested Locally	1
Credit 6	**Rapidly Renewable Materials**	1
Credit 7	**Certified Wood**	1
Credit 8	**Chemical Resource Management**	1

Indoor Environmental Quality		18
Prereq 1	**Minimum IAQ Performance**	Required
Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
Prereq 3	**Laboratory Ventilation**	Required
Prereq 4	**Exterior Door Notification System**	Required
Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**	1
Credit 2	**Increase Ventilation Effectiveness**	1
Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
Credit 4.2	**Low-Emitting Materials**, Paints	1
Credit 4.3	**Low-Emitting Materials**, Carpet	1
Credit 4.4	**Low-Emitting Materials**, Composite Wood	1
Credit 5	**Indoor Chemical & Pollutant Source Control**	1
Credit 6.1	**Controllability of Systems**, Perimeter	1
Credit 6.2	**Controllability of Systems**, Non-Perimeter	1
Credit 7.1	**Thermal Comfort**, Comply with ASHRAE 55-1992	1
Credit 7.2	**Thermal Comfort**, Permanent Monitoring System	1
Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1
Credit 9.1	**Indoor Environmental Safety**, Airflow Modeling	1
Credit 9.2	**Indoor Environmental Safety**, Fumehood Commissioning	1
Credit 9.3	**Indoor Environmental Safety**, Alarm Systems	1

Innovation & Design Process		5
Credit 1.1	**Innovation in Design**: Specific Title	1
Credit 1.2	**Innovation in Design**: Specific Title	1
Credit 1.3	**Innovation in Design**: Specific Title	1
Credit 1.4	**Innovation in Design**: Specific Title	1
Credit 2	**LEED™ Accredited Professional**	1

Project Totals	85
Certified TBD points **Silver** TBD points **Gold** TBD points **Platinum** TBD points	

Sustainable Sites

Credit 9 **Safety and Risk Management**

Intent

Minimize building effluents and environmental, safety and health impacts to site and neighbors.

Requirement

Credit 9.1 (1 point)	Meet all standards and generally accepted guidelines for outdoor protection of workers and general public from airborne chemical, radioactive and biological hazards. Use mathematical modeling, physical modeling and/or post-construction testing and certification to prove compliance. Use effluent controls that minimize generation of waste subject to special regulations.
Credit 9.2 (1 Point)	Prevent releases of hazardous chemicals and other pollutants to sanitary sewer, using containment and engineering controls.

Technologies and Strategies

For Credit 9.1:

Workers: Meet or exceed all exposure limits established by ACGIH, OSHA, NRC, ANSI, local standards or generally accepted best practice, whichever are most stringent. The requirement applies on rooftops, catwalks and all other areas which workers may reasonably occupy with systems in operation.

Visitors and the Public: Meet or exceed all exposure limits established by EPA, other organizations, local standards or generally accepted best practice, whichever are most stringent. In the absence of guidance or defensible rationale, use 10 percent of the applicable workplace limit as a standard for visitor and public exposure.

If the occupant's radiation safety staff requires air effluent precautions, verify that methods used to limit chemical exposures are adequate to protect against radioactive material releases or include additional precautions.

Meet or exceed NIH-CDC guidelines for airborne effluent from laboratories that handle biohazards (CDC-NIH. Biosafety in Microbiological and Biomedical Laboratories, Latest edition, currently May, 1999). Test and certify all filters as installed prior to occupancy and placard them for at least annual re-certification.

Make credible worst-case assumptions of airborne releases. Then use mathematical (e.g. CFD) and/or physical (e.g. wind tunnel) modeling to show that any target location (rooftop worker, operable window, air intake, pedestrian walk, etc. will not be exposed to levels exceeding one-tenth of the appropriate standard with a probability greater than 0.0001 in any 7 day period [i.e. one minute per week] AND/OR Verify safe building performance by post-construction tracer gas studies under a variety of weather conditions and correct design problems immediately.

Use filters only where justified, no fiberglass or other duct liner exposed to exhaust stream, air cleaning systems selected for low waste generation as well as effectiveness.

For Credit 9.2:

Protect municipal sewage treatment works from pollutant discharge from building operations. Apply a drain discharge restriction policy that ensures routine discharges for laboratory and maintenance operations meet the most rigorous sewer use or local limits ordinances (Clean Water Act and Resource Recovery and Conservation Act pollutants). Seek out and gain a waiver from the municipal sewage treatment authority of the code requirement for an interceptor. If no such waiver is granted, ensure that the interceptor is never charged with limestone. Use removable plugs in all drains (floor, sink, cup sink, fume hood) in the building, unless the drains are in regular use. Do not use liquid plugs for drains with infrequent use. Take steps to prevent accidental discharges to drain, such as raised lips around cup sinks, working over trays or using other methods of secondary containment.

Water Efficiency

Prerequisite 1 — Laboratory Equipment Water Use

Intent

Reduce water use for laboratory equipment.

Requirements

Prerequisite 1.0 — No domestic water shall be used "once-through" for any laboratory equipment, unless it is needed as direct contact process water.

Definitions

Direct contact process water is defined as any water which, during use, comes into direct contact with any raw material, product, or waste.

Technologies and Strategies

Use closed-loop cooling water for equipment cooling instead of open-loop (once through).

Use non-potable water sources.

Use vacuum pumps instead of aspirator fittings at cold-water faucets. One way to discourage this is to specify the use of non-threaded faucets, unless threaded faucets are required for other laboratory functions

Credit 4 **Process Water Efficiency**

Intent

Reduce process water use and process wastewater generation.

Requirements

Credit 4.1 (1 point):	Calculate and document baseline of annual process water use and process wastewater generation. Install water meters to measure process water use.
Credit 4.2 (1 point):	Adopt technologies and strategies to reduce process water use and process wastewater generation by 20%. Document the reductions from baseline.

Definitions

Process water is defined as any water which, during use, comes into direct contact with any raw material, product, or waste.

Technologies and Strategies

Credit 4.2:

Employ technologies/methodologies based on Pollution Prevention hierarchy – reduce, reuse, recycle.

Treat process wastewater so that is can be downcycled for use in cooling towers, etc.

Apply segregation – especially in baths – so that materials are separated from process water. This also recovers materials and thereby reduces overall material use (applicable to credit 8 of Materials & Resources).

Reduce water use for wash-up by using efficient floor wash machines instead of hosing.

Work with scientists and researchers to modify process to reduce water use (if feasible and does not interfere with science).

Energy & Atmosphere

Prerequisite 2 **Minimum Energy Performance** *(Replaces LEED Prereq. 2)*

Intent

Establish the minimum level of energy efficiency for the base building and systems.

Requirements

Design to meet building energy efficiency and performance as required by the local energy code or the ASHRAE/IESNA 90.1-2001, which ever is more stringent. When using the Energy Cost Budget method of ASHRAE 90.1 as described in section 11, assume the following modifications to the specifications for the budget building design and proposed design:

	Budget Building Design	*Proposed Design*
Fumehood/exhaust device density	Same as proposed design	Based on prerequisite 4
Plug loads	Same as proposed design	Based on laboratory requirements and operation
Lighting power density in laboratory spaces	1.8 W/ sf (net)	As designed
Fumehood configuration	100 fpm face velocity w/ vertical rising sash 18" open	As designed
Ventilation system control	100% outside air, constant volume, without heat recovery	As designed, using same occupied hours schedule as budget design

All other characteristics of the budget building design and proposed design (e.g. envelope, etc.) shall remain the same as in the ASHRAE 90.1 standard.

Prerequisite 4 **Assess Minimum Ventilation Requirements**

Intent

To determine minimum ventilation requirements in laboratories based on user needs, health/safety protection and energy consumption

Requirements

The ventilation requirements shall be determined and documented by a team including each of the following professionals: A/E Team, Laboratory Consultants*, User Representative, Owner Facilities Group, Facilities Maintenance, Owner Environmental Health & Safety, Commissioning Agent*, Construction Manager* (*If these have not been appointed, an individual who independently and conscientiously represents these interests.)

The team shall, at a minimum, do the following:

- Determine the necessary fresh air ventilation rate and number of fume hoods and other exhaust devices based on applicable codes and the planned use of the laboratory over the next 5 years.
- Consider exhaust alternatives such as instrument exhausts and ventilated storage cabinets with very low flow ventilation and good ergonomic accessibility.
- Develop a workable fume hood sash management plan including: a) Informational placards for hoods; b) Awareness and Use Training. The Sash Management Plan should be incorporated in the Chemical Hygiene Plan for the laboratory.

The process and findings should be documented.

Credit 1 **Optimize Energy Performance** *(Replaces LEED Credit 1)*

Intent

To achieve increasing levels of energy performance to reduce environmental impacts associated with excessive energy use.

Requirement

Reduce design energy cost compared to the energy cost budget for regulated energy components described in the requirements of ASHRAE/IESNA Standard 90.1-2001, as demonstrated by a whole building simulation using the Energy Cost budget Method described in section 11, with the following modifications to the specifications for the budget building design and proposed design:

	Budget Building Design	*Proposed Design*
Fumehood/exhaust device density	Same as proposed design	Based on prerequisite 4
Plug loads	Same as proposed design	Based on laboratory requirements and operation
Lighting power density in laboratory spaces	1.8 W/ sf (net)	As designed
Fumehood configuration	100 fpm face velocity w/ vertical rising sash 18" open	As designed
Ventilation system control	100% outside air, constant volume, without heat recovery	As designed, using same occupied hours schedule as budget design

All other characteristics of the budget building design and proposed design (e.g. envelope, etc.) shall remain the same as in the ASHRAE 90.1 standard. Plug loads should be included in the simulation, but should be excluded in calculating the percentage difference between budget building and proposed design.

Credit 1.1 (1 point) Reduce design energy cost by 5%

Credit 1.2 (2 points) Reduce design energy cost by 10%

Credit 1.3 (3 points) Reduce design energy cost by 15%

Credit 1.4 (4 points) Reduce design energy cost by 20%

Credit 1.5 (5 points) Reduce design energy cost by 25%

Credit 1.6 (6 points) Reduce design energy cost by 30%

Credit 1.7 (7 points) Reduce design energy cost by 35%

Credit 1.8 (8 points) Reduce design energy cost by 40%

Credit 1.9 (9 points) Reduce design energy cost by 45%

Credit 1.10 (10 points) Reduce design energy cost by 50%

Technologies and Strategies

Design building systems to maximize energy performance while maintaining or improving health and safety requirements. Consider the following strategies in particular:

- Use high performance low-flow fume hoods.
- Use variable air volume fume hoods (combined with VAV supply and exhaust) assuming maximum 50 percent flow turndown between design maximum and minimum volume.
- Use energy (latent and sensible) recovery.
- Eliminate simultaneous heating and cooling.
- Use evaporative cooling when ambient conditions allow.
- Minimize outside air to 1 cubic foot per minute per square foot (cfm/sf) or less.
- Reduce unoccupied outside airflow during unoccupied periods.
- Expand unoccupied temperature dead band by automatically resetting zone temperature set points based on occupancy.
- Encourage small HVAC zones with no 100 percent outside air control zones greater than 1000 square feet.
- Provide a cooling system with at least two cooling loops operated at different temperatures. This can be accomplished with separate chillers (or direct tower cooling).
- Design for high part-load heating and cooling efficiency.

Use a computer simulation model to assess the energy performance and identify the most cost effective energy efficiency measures. Quantify energy performance as compared to a baseline building.

Credit 2 **Renewable Energy** *(Replaces LEED Credit 2)*

Intent

Encourage use of renewable energy technologies to reduce fossil fuel energy use

Requirements

Supply a net fraction of the building's total energy use (as expressed as a fraction of annual energy cost) with on-site renewable energy systems.

Credit 2.1 (1 point)	Renewable energy, 2% contribution
Credit 2.2 (2 point)	Renewable energy, 5% contribution
Credit 2.3 (3 point)	Renewable energy, 10% contribution

Technologies and Strategies

Assess the project for renewable energy potential including: solar (PV and active thermal), wind, geothermal, biomass, hydro, and biogas strategies. Note that ground source heat pumps do not count as geothermal.

When applying these strategies, take advantage of "net metering" with the local utility.

Credit 7 **Energy Supply Efficiency**

Intent

Reduce the total non-renewable source energy required for the facility through increased energy supply efficiency

Requirements

Calculate the total annual non-renewable source energy requirements for the facility as designed, using the calculated site energy requirements and the source conversion values provided in the table below. Calculate the percentage reduction in the total annual non-renewable source energy, achieved through the use of combined heat and power systems, or other methods of cascading energy recovery of primary fuel supplies.

Fuel Type	Site (kBTU)	Source (kBTU)
Electricity	1	3.013
Natural gas	1	1.024
Fuel oil	1	1
Steam	1	1.38
Hot Water	1	1

Local air emissions regulations must be met. This credit cannot be applied for fuel switching without the use of energy generation equipment.

Credit 7.1 (1 point) Reduce source energy use by at least 10%

Credit 7.2 (2 points) Reduce source energy use by at least 20%

Credit 7.3 (3 points) Reduce source energy use by at least 30%

Credit 7.4 (4 points) Reduce source energy use by at least 40%

Credit 7.5 (5 points) Reduce source energy use by at least 50%

Technologies and Strategies

Increased supply efficiency, such as through cascading heat use/recovery leads to higher overall supply efficiency, as in the case of heat recovered from electricity generation to generate hot or cold thermal distribution fluids.

Credit 8 **Improve Laboratory Equipment Efficiency**

Intent

Save energy with efficient laboratory equipment.

Requirement

Credit 8.0 (1 Point)	Use Energy Star™ compliant equipment or equipment in the top 25th percentile for at least 75 percent of new Class 1 and Class 2 equipment and at least 30 percent of all Class 1 and Class 2 equipment. Acceptance of equipment in the 25th percentile requires a minimum of 4 different models that meet the functional needs of the research. If only 2 or 3 functionally equivalent models are available, acceptance requires selection of the most energy efficient model.

Definitions

Class 1 equipment is defined as equipment that due to is size, utility requirements or function requires that the utilities be hard piped or hard wired. Fumehoods are excluded. Examples: autoclaves, depyrogenation ovens, cold room, mass spectrometers, NMR's, etc.

Class 2 equipment is defined as equipment that occupies floor space rather than on the bench, but does not require hard piping or hard wiring. Examples: refrigerators, freezers, incubators, biological safety cabinets, laminar flow benches, centrifuges, etc.

If energy use data is not available for comparison, use peak power rating for the equipment, taking into account all fuels that the equipment uses (not just electricity).

Technologies and Strategies

Consider all domestic and foreign models available through US suppliers

Look for EnergyStar labeled products.

Work with lab users to identify equipment alternatives that are functionally equivalent from a user standpoint

Credit 9 **Right-size Laboratory Equipment Load**

Intent

"Right-size" mechanical equipment by improving estimates of heat-gain from laboratory and process equipment.

Requirements

Credit 9.1 (1 point)	Measure base usage of equipment electrical loads in a comparable laboratory space for each functional type of laboratory space and design electrical and cooling systems based on these measurements.
Credit 9.2 (1 point)	Design electrical distribution system to provide for portable or permanent check metering of laboratory equipment electric consumption. Design for safe access to electrical feeder enclosures and provide sufficient space to attach clamp-on or split core current transformers.

Definitions

A comparable laboratory space is one in which the equipment type, quantity and use profile is similar to the proposed laboratory space. For each comparable laboratory space, obtain one week (7 days) of continuous power metering at a distribution panel level of all laboratory equipment, including plug loads and hard-wired equipment, from a similar laboratory facility. The laboratory spaces for which the measured data is applicable should collectively constitute at least 75% of the net laboratory space. Metering data should be obtained while the spaces are fully occupied. Continuous metering data should be time averaged over one hour (60 minute) time periods. Design heat load criteria for each typical laboratory space in the facility should then be based on the maximum load indicated over the metering period, with no more than 50% added for a safety factor or for future changes in load.

Technologies & Strategies

Heat loads from laboratory equipment are often significantly overestimated leading to grossly oversized mechanical and electrical equipment. This results in wasted first cost, and inefficient operation. Measured data should be used for estimating loads. Allowances for future growth should be taken judiciously. Designing the system so that additional capacity can be added in the future is recommended, and can be achieved through modular design of HVAC and electrical systems.

Materials & Resources

Prerequisite 2 **Hazardous Material Handling**

Intent

Develop information system to manage hazardous materials stream.

Requirement

Prerequisite 2.0	Develop a system to maintain current information about hazardous material types, quantity, location, and disposal/use histories, and deliver information to a central location.

Technologies and Strategies

Use BOCA, IBC, or other generally accepted hazardous material classification tables to classify materials. Monitor all known hazardous materials quantities and locations on a continuous basis.

Include an area for associated inventory tracking equipment.

Credit 8 **Chemical Resource Management**

Intent

Reduce potential harm to the environment and people through improved management of chemicals.

Requirements

Credit 8.0 (1 point)	Develop an action plan to eliminate, minimize, substitute, recycle, and dispose of harmful chemicals safely. Plan should improve distribution, and limit quantities, storage and waste.

Technologies & Strategies

Develop material handling and processing guidelines as a part of initial building design, and monitor implementation of guidelines as a part of final building commissioning. Guidelines should reduce consumption of hazardous materials, and to prevent potential contamination of the surrounding environment.

Consider providing dedicated centralized areas for receiving of, return of, or safe disposal of, hazardous materials. Also consider providing dedicated space in each lab for receiving of, return of, or safe disposal of, hazardous materials. Include an area for reporting of all hazardous material "transactions" to central inventory system.

Develop decanting procedures that eliminate waste or allow for recycling of waste streams.

Minimize proliferation of hazardous materials in laboratories by developing "just in time" inventory system.

Provide coordinated materials transport strategy that allows efficient "just in time" delivery of hazardous materials.

Use alternative equipment or laboratory methods designed to reduce consumption of hazardous materials.

Minimize use of hazardous materials in relationship to testing/experimental volume.

Use automated laboratory equipment that maximizes sample throughput while minimizing sample size, reagent quantity, and waste streams.

Work with EHS personnel and local code officials in developing action plan.

Indoor Environmental Quality

Prerequisite 3 **Laboratory Ventilation**

Intent

Ensure that minimum requirements for IAQ and safety are met

Requirements

Prerequisite 3.0	Meet the minimum requirements of ANSI Z9.5 (latest version).

Technologies & Strategies

Provide monitoring and control of fume hoods and room pressure. Technologies include fume hood monitors and alarms, volume metering, and automated laboratory room pressure control.

Prerequisite 4 **Exterior Door Notification System**

Intent

Ensure that use of exterior doors does not compromise laboratory safety.

Requirement

Prerequisite 3.0	Provide an explicit notification system for all doors leading directly from pressure-controlled laboratory spaces to the outside.

Technologies and Strategies

Install alarms or warning lights for all doors leading directly from lab spaces to outside. Alarm system should notify affected persons with minimal annoyance to other building occupants.

Credit 6 **Controllability of Systems** *(Replaces LEED Credit 6)*

Intent

Provide a high level of individual occupant control of thermal ventilation and lighting systems to support optimum health, productivity and comfort conditions.

Requirement

Credit 6.1 Provide a minimum of one operable window and one lighting control zone per 200 SF for all occupied areas within 15 feet of the perimeter wall. Pressure-controlled laboratory spaces are exempted from the operable window requirement.

Credit 6.2 Provide controls for each individual for airflow, temperature, and lighting for 50% of the non-perimeter, regularly occupied areas.

Technologies and Strategies

Design the building with occupant controls for airflow, temperature and lighting. Strategies to consider include task lighting, operable windows, and under floor HVAC systems with individual diffusers.

Credit 9 **Indoor Environmental Safety**

Intent

Ensure health and safety of employees

Requirements

Design laboratories to ensure contaminants are contained and workers are protected.

Credit 9.1 (1 point)	Optimize indoor airflow based on results of computational fluid dynamics (CFD) or physical modeling.
Credit 9.2 (1 point)	Conduct fume hood commissioning that includes ASHRAE-110 Method of Testing Performance of Laboratory Fume Hoods (latest version) *As Installed.* Scope of testing to include 6.1 Flow Visualization, 6.2 Face Velocity Measurements and 7.0 Tracer Gas Test Procedures. The hood performance rating for the Tracer Gas Test procedure shall be at least 4.0 AI 0.1 as specified in ASHRAE-110.
Credit 9.3 (1 point)	Design all alarm systems in the laboratory to be inherently self-identifying and failsafe.

Technologies & Strategies

Credit 9.1:

Optimize indoor lab airflow with proper fume hood location. Use small control zones. Use specialty laboratory supply air diffusers. Separate lab from non-lab spaces.

Credit 9.3:

Incorporate verbal warning systems, placards, and/or warning lights into alarm systems.

Conduct failure mode analysis on alarm systems.

Innovation and Design Process

The following is a list of suggested areas for innovation credits. It is not meant to be an exhaustive or restrictive list, and innovations not on the list may also be candidates for the innovation credits.

- Mini Environments: Minimize the space that has rigorous environmental requirements. Use specially enclosed spaces to keep areas requiring tight environmental controls as small as possible. One example is the provision of a clean bench for a process instead of the use of an entire cleanroom.
- Displacement Ventilation: A low-pressure air distribution system in which incoming air originates at floor level and rises to exhaust outlets at the ceiling. Incoming air is delivered to interior rooms by way of floor-level vents. This incoming air displaces upper air, which is exhausted through ceiling-level vents. Air pollutants generated within the building are removed at source and are not recirculated. In addition, heat generated by ceiling level lights is removed, and thus heat is not included when estimating building cooling loads.
- Optimized Utility Services: Use equipment without excessive utility service requirements (e.g. high pressure), or provide stand-alone utility services. For example, equipment that requires high-pressure compressed air, water, or steam, or excessively chilled water should be avoided when equipment requiring less intensive service are available to the owner/occupant. Often excessive requirements are driven by low equipment first-cost, but put a significant burden on the laboratory's utility infrastructure. One piece of equipment can dictate the utility service delivery set-point with significant energy impacts. Where lab equipment may dictate utility service set-points, consider stand-a-lone utility systems (e.g. a dedicated chiller).
- Design for Flexibility and Modularity: For example, the use of interstitial floors.
- Design for Catastrophic Events: Innovative design that minimizes the release of hazardous chemicals into sanitary sewer and storm water during a catastrophic event such as a fire, flood or earthquake.

Comment Form

Name:______________________________ Organization: ________________________________

Email:_____________________________________ Phone: ________________________________

When providing comments for specific credits, please indicate credit number, and suggested changes if any.

Please return comments to:

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