Met-Ed / GPU

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Writer's Direct Dial Number

June 17, 1981
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U.S. NUCLEAR REGULATORY COMMISSION

TMI Program Office
Attn: Mr. Lake Barrett, Deputy Director
U. S. Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, Pennsylvania 17057

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Hot Chemistry Laboratory Design Criteria

Enclosed for your review is the Design Criteria for the Hot Chemistry Laboratory (HCL). In addition to the criteria described in the document, we intend to add the following criteria:

- Drains will be added for equipment maintenance.
- The effect of the HCL on connecting seismic structures will be evaluated.

Based on our current work plans, we request your comments by July 6, 1981. We anticipate resolution to your comments consistent with a desired approval date of July 31, 1981.

Sincerely,

G. K. Hovey
Vice-President and
Director, TMI-2

GKH:RBS:vjf

Enclosure

cc: Dr. B. J. Snyder, Program Director, TMI Program Office

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HOT CHEMISTRY LABORATORY

DESIGN CRITERIA DOCUMENTS

COVER SHEET

GENERAL PUBLIC UTILITIES SERVICE CORPORATION

THREE MILE ISLAND - UNIT 2

JOB NO: 13587

DISCIPLINE: GENERAL

REV NO.	DATE	REVISION DESCRIPTION	ORIGINATOR	GROUP SUPV	PROJECT ENG	GPUSC
				APPROVAL		
TR. 0	9/11/80	Issued for Use Upon GPUSC Approval	RLM			

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SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.
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BECHTEL

REVISION STATUS SHEET
HOT CHEMISTRY LABORATORY
DESIGN CRITERIA

JOB NO. 13587

REV.

DISCIPLINE
General

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DESIGN CRITERIA
FOR
HOT CHEMISTRY LABORATORY
FOR
GPU SERVICE CORPORATION
THREE MILE ISLAND - UNIT 2

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DESIGN CRITERIA
FOR
HOT CHEMISTRY LABORATORY
FOR
GPU SERVICE CORPORATION
THREE MILE ISLAND - UNIT 2

1.0 PURPOSE

The TMI Unit 2 Hot Chemistry Laboratory (HCL) is intended to provide capabilities for the chemical and radiological analyses of radioactive samples to:

1.1 Support the recovery efforts of TMI-2, and secondarily, the future restart and normal plant operation,

1.2 Reduce the dependency upon outside radiochemical support, and

1.3 Satisfy the required separation of Unit 1/Unit 2 analysis functions.

2.0 FUNCTION

2.1 The HCL shall provide capabilities for chemical analyses of:

2.1.1 All samples drawn from Unit 2 Nuclear Sampling System, and

2.1.2 Those present and future samples taken in support of the TMI-2 Recovery Program.

2.2 The HCL shall provide capabilities for radioisotopic analysis for all high level radioactive samples taken above.

3.0 SCOPE

The Hot Chemistry Laboratory will be constructed in accordance with criteria established herein. These include constraints in the form of codes, regulations, and standards. The criteria delineates requirements for the following portions of the facility:

3.1 Civil/Structural as defined in Section 6.10.

3.2 Instrumentation and Controls as defined in Section 6.4.

3.3 Materials as defined in Section 6.6.

3.4 Layout as defined in Section 6.7.

3.5 Building HVAC as defined in Section 6.9.

3.6 Building Fire Protection as defined in Section 6.15.

3.7 Utility Services as defined in Section 6.11.

3.8 Liquid Waste Disposal and Drains as defined in Section 6.12.

3.9 Electrical and Communications as defined in Section 6.14.

3.10 Laboratory Chemistry as defined in Section 6.13.

3.11 Radiation Monitoring and Protection as defined in Section 6.16.

3.12 Building Mechanical as defined in Section 6.17.

3.13 Radiochemistry Laboratory Equipment and Furniture as defined in Section 6.18.

3.14 Painting and Coating as defined in Section 6.19.

Samples for testing in the HCL will be brought in containers. However, space will be reserved inside the HCL for samples to be piped in at some future time.

The scope of supply for the HCL is divided between Bechtel Power Corporation and General Public Utilities Service Corporation and is defined herein.

This criteria document addresses essential design requirements. Additional criteria are delineated in the General Project Design Criteria. It is recognized that specific design features and equipment may be required, in addition to those features explicitly described, to implement the overall criteria.

4.0 INTERFACES

The laboratory will interface with the following existing systems:

4.1 DOMESTIC WATER SYSTEM

Interface with existing domestic water lines will be required to provide hot and cold water services in the laboratory.

4.2 DEMINERALIZED WATER SYSTEM

Demineralized water will be obtained from existing demineralized water system to provide flushing services for decontamination in the laboratory, and for diluting samples.

4.3 STORM DRAINAGE

The laboratory will interface with existing storm drainage system to provide roof drainage for the building.

4.4 FIRE PROTECTION

For the laboratory fire protection system, fire water will be obtained from existing fire water yard loop. Alarms from the laboratory fire detection system may interface with the existing detection system in the main control room.

4.5 RADIOACTIVE DRAINAGE

Liquid waste from the HCL sample disposal sinks will be routed to existing waste facilities, i.e., Unit 2 miscellaneous waste holdup tank.

4.6 ELECTRICAL SERVICE

The laboratory will be provided with non-vital 480-volt electrical service from a new 4160 to 480-volt unit substation. Redundant power for certain essential services shall also be provided from a 480-volt power source.

4.7 COMMUNICATION SYSTEM

The laboratory will interface with existing plant communication systems to provide intra- and extra-facility, telephone and paging services.

4.8 RADIATION MONITORING SYSTEM

The HCL radiation monitoring system will interface with the existing plant monitoring systems in the main control room to provide remote radiation monitoring of the laboratory.

4.9 COMPRESSED AIR AND INSTRUMENT AIR SERVICES

Compressed air and instrument air services for the HCL will be provided from existing air lines.

5.0 FUNCTIONAL REQUIREMENTS

5.1 FUNCTIONS

5.1.1 The laboratory will be designed for continuous occupancy and to limit radiation dose to personnel to as low as reasonably achievable.

5.1.2 The laboratory shall be designed to maximize work space, minimize contaminant spread, and provide an environment suitable for analyses. Layout shall allow control of personnel traffic occurring between clean and potentially contaminated areas. Movement of radioactive samples into sample rooms shall be as direct as possible and away from normal personnel traffic.

5.1.3 The laboratory shall have provisions for minimizing, suppressing, and containing hazards originating from within, and protecting life and property from such hazards, i.e., fire, explosion, corrosion, toxic chemicals, radioactive contaminants.

5.2 AVAILABILITY AND RELIABILITY

The facility will be available on a continuous basis (contingent on off-site power availability). HVAC system and drainage transfer pumps shall be redundant or be capable of partial shutdown. A regulated power source shall be provided to the high level counting area. Equipment selection shall consider commonality with current Unit 1 equipment to minimize personnel training and spare parts inventories.

5.3 ACCESSIBILITY

5.3.1 The HCL will be located within the protected area and outside of the vital area. The building will be located on the roof of the existing Emergency SG Feedwater Pump Area adjacent to the Turbine Building and the Reactor Building. No through or cross traffic normally occurs in this area.

5.3.2 Access into the HCL will be controlled through the access control area of the existing service building. Outside egress from the building will be provided through two or more doors.

5.3.3 Within the building access space will be allowed for maintenance and decontamination.

5.3.4 Equipment will be provided with access doors or removable panels to reach internal parts.

5.4 MAINTAINABILITY

Mechanical and electrical equipment shall be isolated from laboratory work areas to the greatest extent practical. In contaminated areas, equipment requiring regular maintenance will be located in low radiation areas or removed from contamination paths, i.e., motors shall be mounted outside of contamination path. In addition, capabilities for isolating and/or flushing such equipment shall be provided as required for equipment shutdown and/or subsequent cleanup, i.e., isolation dampers and water service at hoods. Materials, surface coating and painting of structures equipment and components exposed to contaminants will resist corrosion and will be easy to decontaminate. Stainless steel and coated furniture will also contribute to ease of decontamination.

5.5 PERSONNEL

5.5.1 Laboratory Staff

The HCL will be designed to provide working space and facilities to accommodate up to six technicians at any time.

5.5.2 Maintenance

One person may be required to make rounds at least once per shift to ensure that equipment is functioning as required and to check on monitors and recorders.

5.6 SAFETY

The design of the facility shall ensure that all of its operations shall minimize risk to public health and safety by addressing the prevention and mitigation of accidents. Hazards to personnel and property associated with the handling and storage of radioactive, combustible, explosive, corrosive and/or noxious materials shall be reduced by the use of radiation shielding, noncombustible construction, confinement systems, isolating devices, chemically compatible materials, explosion-proof equipment, spark-proof floors, and filtration. Personnel protection shall include safety facilities such as safety showers, eyewash fountains, first aid stations, and air breathing manifolds in each work area (at least three locations). Areas shall be zoned according to hazard. Signs and markings shall be posted to flag exits, fire, and safety equipment. Liquid waste from sinks, emergency showers, and eyewash fountains shall be collected for transfer to existing waste storage facilities.

The design of the HCL shall implement occupational exposure limits as required by 10 CFR Part 20 for normal and anticipated plant operations and shall meet the requirements of 10 CFR Part 20, Appendix B, Table II, for off-site releases.

6.0 DESIGN REQUIREMENTS

6.1 SAFETY DESIGN BASIS

The facility serves no safety-related function as defined in the General Project Design Criteria (See Reference 7.1).

6.2 GENERAL DESIGN BASES

6.2.1 The building shall be designed for low air leakage and negative pressure.

6.2.2 The facility shall be designed in accordance with the following environmental conditions:

6.2.2.1 Laboratory Rooms

	Summer	Winter
Temperature	77 F	65 F
Relative Humidity	55% max	25% min.
Background Radiation Level	0.5 mr/hr	

6.2.2.2 High Level Counting Area (Inside)

	Summer	Winter
Temperature	77 F	65 F
Relative Humidity	55% max	25% min
Background Radiation Level	0.5 mr/hr	

6.2.2.3 Sample Rooms (Inside)

	Summer	Winter
Temperature	77 F	65 F
Relative Humidity	55% max	25% min
Background Radiation Level	0.5 mr/hr	

6.2.2.4 Equipment Rooms (Inside)

	Summer	Winter
Temperature	104 F max	50 F min.

6.2.3 For contamination control, the facility shall be designed to establish a confinement system to prevent the uncontrolled spread of radioactive material in the facility or to the environment in case of an incident. The heating, ventilating, and air conditioning (HVAC) system shall be designed to control airborne activity in the building by directing airflow from clean to higher contamination areas. Also, all radioactive materials being handled or stored shall be contained in three systems of confinement, namely:

6.2.3.1 Primary confinement barrier--to provide first and immediate confinement under normal conditions, i.e., sample bottles.

6.2.3.2 Secondary confinement barrier--All equipment/furnishings for enclosing or storing primary confinement, i.e., hoods, glove boxes, shielded storage cabinets.

6.2.3.3 Tertiary confinement barrier--The building structure that houses the primary and secondary confinement shall be designed for the final physical protection against spread of contaminants to the environment. The building or portions of it shall be capable of being isolated in case of accidental breach of primary and secondary barriers.

6.2.4 The facility shall be designed for easy decontamination, taking into consideration the following:

6.2.4.1 Suitable surface finish for floors, walls, structures, and equipment such as the use of sealed and nonporous surfaces, epoxy-coated steel, stainless steel, and/or strippable linings.

6.2.4.2 Ease of replacement or repair such as use of quick disconnect fittings, quick opening doors.

6.2.4.3 Access openings for equipment for decontamination and verification, and adequate work space.

6.2.4.4 Provision for decontamination services.

6.2.5 For additional design requirements, see General Project Design Criteria (Reference 7.1).

6.3 CODES, STANDARDS, AND REGULATORY REQUIREMENTS

Unless otherwise specified, the design of the hot chemistry laboratory shall conform to all applicable portions of the latest issue of the following codes, specifications, industry standards, and regulations, including case rulings, interpretations, and addenda where applicable. Where conflict in criteria occurs, the more restrictive shall apply.

6.3.1 Code of Federal Regulations(CFR)

6.3.1.1 10 CFR Part 20, "Standards for Protection Against Radiation."

6.3.1.2 10 CFR Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Plant Reactor Effluents."

6.3.1.3 29 CFR Part 1910 Occupational Safety and Health Act (OSHA)

6.3.2 United States Nuclear Regulatory Commission (USNRC)

6.3.2.1 Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light Water-Cooled Nuclear Power Plants," Rev. 1, June 1974.

6.3.2.2 Regulatory Guide 1.140, "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," Rev. 1, October 1979.

6.3.2.3 Regulatory Guide 8.8, "Information Relevant to Ensuring the Occupation Radiation Exposures at Nuclear Power Stations will be as low as is reasonably achievable," Rev. 3, June 1978.

6.3.3 American Refrigeration Institute (ARI)

6.3.4 Air Moving and Conditioning Association, Inc. (AMCA)

6.3.5 Department of Energy (formerly ERDA)

ERDA 76-21, "Nuclear Air Cleaning Handbook," Oak Ridge National Laboratory

6.3.6 American National Standards Institute (ANSI)

6.3.7 National Fire Protection Association (NFPA)

6.3.8 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

6.3.9 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

6.3.10 American Society of Mechanical Engineers (ASME)

6.3.11 American Society for Testing and Materials (ASTM)

6.3.12 American Water Works Association (AWWA)

6.3.13 Illuminating Engineering Society (IES)

6.3.14 Institute of Electrical and Electronics Engineers (IEEE)

6.3.15 Insulated Cable Engineers Association (ICEA)

6.3.16 Manufacturers Standardization Society of the Valves and Fittings Industry (MSS)

6.3.17 National Electrical Manufacturers Association (NEMA)

6.3.18 Underwriters' Laboratories (UL)

6.3.19 Pennsylvania State Building Code for Fire and Panic Regulations by the Department of Labor and Industry

6.3.20 Building Officials and Code Administrators International (BOCA) Basic Building Code, Basic Mechanical Code and Basic Plumbing Code

6.3.21 Compressed Gas Association, Inc. (CGA)

6.4 INSTRUMENTATION AND CONTROLS

6.4.1 Controls for the heating, ventilating, and air conditioning system shall include automatic temperature and humidity controls; alarms for low temperature, high temperature, low flow, and fire; and automatic shutdown for protection against low flow and fire. Manual overrides to restart components after automatic shutdown will be provided in the mechanical-electrical equipment room, except for those of the perchloric hood exhaust fans which will be located in the same room as that of the hoods.

6.4.2 Controls for the liquid waste drainage tank will include level switches with local indication and alarm.

6.4.3 Room temperature and humidity indication will be provided in the laboratory area. Differential pressure indication will be locally provided across all component filters and limit switches signal runout conditions to local alarm. Area or process radioactivity will be alarmed, indicated, and recorded locally in the HCL and remotely in the main control room. A fire detection system will activate a local alarm in the laboratory and remote alarm in the main control room.

6.5 INTERLOCKS AND ADMINISTRATIVE CONTROL

6.5.1 The HVAC system, including hoods and glove boxes, shall be so designed that the negative building pressure and relative pressurization between functional areas is not upset by independent component shutdown. Supply fans and subsystem exhaust shall be interlocked with the operation of the main exhaust fan.

6.5.2 The HVAC system shall shut down whenever a fire or smoke detector is activated. A remote alarm shall be provided at the main control room to indicate a fire occurrence in HCL.

6.5.3 Radiation monitors shall remotely alarm in the main control room an unsafe condition in the HCL.

6.6 MATERIALS OF CONSTRUCTION

Building structure and system components will be constructed of materials consistent with the fire protection requirements. In addition, materials and surfaces will be suitable for easy decontamination and for handling corrosive chemicals. For painting and coating of surfaces see Section 6.19.

6.6.1 Roof

The roof will be gravel-surfaced built-up roofing with insulation and vapor barrier on metal decking. Roof material will conform to UL Class A rating. Roof construction will be qualified for Factory Mutual System Class I roof.

6.6.2 Walls

Interior walls will be fire-rated, full-height walls constructed of concrete masonry units.

6.6.3 Floors

Floors will be concrete slab. The first floor working areas, including corridors, will be provided with a seamless covering which is easy to decontaminate.

6.6.4 Ceiling

Equipment room ceiling will be exposed structural steel or concrete. Finished areas will be provided with lay-in type suspended ceiling so that ceiling panels may be easily removable for access to overhead ductwork, piping, and valves.

6.6.5 Stairs

Stairs will be steel with galvanized steel treads, platforms, railings, and landings.

6.6.6 Doors and Frames

All personnel doors will be hollow metal doors with pressed steel frames and will be provided with wired glass windows. Doors and frames will be painted.

6.6.7 Equipment and Furniture

6.6.7.1 The laboratory bench tops will be of the following materials:

Chemically Inert	Stainless Steel
Standards Lab	Radiochemistry Lab
	Sample Preparation Lab
	Plant Chemistry Lab
	Sample Rooms

6.6.7.2 The sinks and drains will be compatible with the following materials which will be used in the Radiochemistry Laboratory:

Acids	Caustics
Sulfuric	Sodium hydroxide
Nitric	Potassium hydroxide
Hydrochloric	
Phosphoric	
Hydrofluoric	
Perchloric	

6.6.7.3 Internal surfaces of all hoods will be stainless steel.

6.6.7.4 Laboratory furniture will be fabricated of painted steel.

6.6.7.5 The unit vent hood for the atomic absorption spectrophotometer (AAS) will be designed for an acetylene combustion exhaust temperature of approximately 300 F at 12 inches above the flame.

6.6.7.6 Compressed gas cylinders will be enclosed in explosion-proof enclosures.

6.7 LAYOUT REQUIREMENTS

6.7.1 Area Definition

The hot chemistry laboratory will include the following areas:

6.7.1.1 First Floor

a. High level counting area

b. Sample preparation laboratory*

c. Sample room(s)*

d. Standards laboratory

e. Plant chemistry laboratory*

f. Radiochemistry laboratory

g. Storage room

h. Counting preparation room

* With safety shower and eyewash fountain

6.7.1.2 Second Floor - mechanical and electrical equipment room

6.7.2 Access Definition

6.7.2.1 Normal controlled access for the HCL will be provided from the existing Service Building through the Ante Room of Personnel Air Lock No. 2.

6.7.2.2 During recovery operations, as Personnel Air Lock No. 2 is dedicated for the containment entry, provision for controlled access from the Control Building will be made.

6.7.2.3 For samples being brought from areas other than the Auxiliary and Fuel Handling Building, access will be provided through the Personnel Access Facility/Containment Recovery Service Building or through the existing Control Building via the Turbine Building.

6.7.2.4 Access to the HCL second floor and roof will be provided from the south side via the Turbine Building. In addition, a ladder will be provided to access the second floor from the laboratory area.

6.7.2.5 Emergency exits will be provided as required.

6.7.3 All areas in the facility shall be classified into control zones denoting the potential for occupational exposure or contamination spread. Control zone categories shall be designated by control zone numbers representing radiation zone categories and a letter identifying contamination control category. The designation shall delineate shielding and contamination control requirements for the operations involving a given sample. Classifications will follow those in Reference 7.1.

6.7.3.1 Radiation Zone Designation

Radiation zones shall identify potential sources or areas of radiation that contribute to the maximum dose limit to the whole body. These dose rates limits for a given zone determine shield thickness and separation distance for the planned duration of personnel exposure.

6.7.3.2 Contamination Zone Designation

The HCL will normally be operated as a "clean" facility exhibiting no detectable surface or airborne contamination. Contamination zones shall identify potentially contaminated areas that may cause radiation exposure to skin, bones, and other organs, i.e., through ingestion or inhalation. These zones will serve as criteria for defining ventilation airflow paths from clean to higher contamination areas.

6.8 RADIATION SHIELDING REQUIREMENTS

Radiation shielding (portable and/or permanent) shall be provided as required to limit personnel dosage from radioactive sources within limits prescribed by 10 CFR Part 20 and "as low as is reasonably achievable" per Reg. Guide 8.8.

6.9 HVAC REQUIREMENTS

6.9.1 A heating, ventilating, and air conditioning (HVAC) system will provide an environment suitable for personnel comfort and equipment. The system will maintain inside temperature and humidity throughout the year within required ranges of Section 6.2.2.

6.9.2 The system shall maintain negative building pressure using a once-through forced supply and forced exhaust. The system will be designed for contamination control in the building by supplying one hundred percent outside air so that airflow is directed from clean to higher contamination areas. Outside air shall be filtered with prefilters and high efficiency filters. Building exhaust shall be filtered, if necessary, by high efficiency particulate air (HEPA) filters and charcoal filters. The ventilation system will allow for all hoods to be in operation. Building exhaust fan capacity shall be redundant. HVAC supply capacity shall be sized for partial shutdown capability. Exhaust filtration units shall meet the requirements of Reg. Guide 1.140, with exceptions as described in Reference 7.1.

6.9.3 Collection hoods and glove boxes shall be provided as secondary confinement for airborne contaminants and noxious fumes. Hoods shall be capable of shutdown without upsetting airflow from clean to higher contamination zones. Exhaust ducts under positive pressure shall be avoided or minimized by locating subsystem fans near the building main exhaust duct.

6.9.4 The perchloric acid hoods will be provided with individual exhaust fans and ducts, constructed of materials compatible with the chemicals listed in Section 6.6.7.2. Due to the presence of highly corrosive fumes, these hoods should be directly exhausted to the outdoors. If this is unacceptable because of potential radioactive releases, means will be provided to protect exhaust filters and/or radiation monitors from the corrosive fumes.

6.9.5 Cooling, heating, and humidification will be provided as required to maintain the environmental conditions given in Section 6.2.2.

6.9.6 Isolating devices shall be provided as required to maintain area separation or for maintenance.

6.9.7 Sheet metal ductwork for supply and exhaust will be constructed per SMACNA recommendations, and will be insulated as required. Conditioned-air supply ductwork will be internally lined to attenuate noise transmission through the ductwork.

6.9.8 HVAC equipment and components shall be coated or constructed of material suitable for decontamination and/or conducting corrosive fumes as required.

6.10 CIVIL/STRUCTURAL REQUIREMENTS

6.10.1 Structural Description

The HCL will consist of the following structural systems:

6.10.1.1 The superstructure will consist of structural steel framing supported by steel columns.

6.10.1.2 The roof structure will be metal decking.

6.10.1.3 The second floor will be reinforced concrete slab with metal decking.

6.10.1.4 Exterior walls will be grout filled masonry.

6.10.1.5 The HCL superstructure will be located on the roof of the existing Emergency SG Feedwater Pump Area inset between the Control Building main superstructure, Turbine Building, and Reactor Building.

6.10.2 Design Basis

The design of the HCL will be based on the following:

6.10.2.1 The design wind velocity shall be 80 mph at 30 feet above grade.

6.10.2.2 The HCL is a Non-Seismic Category I structure located adjacent to safety-related systems, structures, and equipment. The HCL shall be designed for seismic loads determined in accordance with the BOCA Basic Building Code. In addition, the structure shall be checked to assure that it will not collapse or experience excessive deformation when subjected to the safe shutdown earthquake (SSE).

6.10.3 Design Loads

The following loads will be used in the design of the HCL:

6.10.3.1 The HCL shall be designed for the following minimum live loads:

Uniform floor load (all floors)	100 psf
Stairs	100 psf or 1000 lbs

6.10.3.2 The roof shall be designed for a ground snow load of 30 psf using appropriate distribution coefficients to account for roof geometry and drifting.

6.10.3.3 To allow for small miscellaneous equipment to be located in the facility a uniform dead load of 50 psf shall be used.

6.10.4 Additional Requirements

Structural provisions will be made for the following items:

6.10.4.1 Cutouts and coredrills in the existing roof slab of the control building area shall be provided for the addition of drains in the HCL.

6.10.4.2 Interior walls required for nuclear shielding requirements shall be grout filled masonry.

6.10.4.3 The structural adequacy of the existing Emergency SG Feedwater Pump Area structure shall be evaluated for the new loads imposed by the HCL to assure conformance with the Unit 2 FSAR (Reference 7.2).

6.11 SUPPORT SERVICE REQUIREMENTS

6.11.1 Vacuum

Vacuum capabilities shall be provided within all hoods by portable vacuum pumps.

6.11.2 Laboratory Gas

6.11.2.1 Laboratory gas requirements are defined as follows:

Acetylene

Propane

Argon

Nitrogen

P-10

Instrument air

Service air

6.11.2.2 All hoods shall be provided with a minimum of instrument air and propane.

6.11.2.3 The atomic absorption spectrophotometer hood shall be provided with instrument air and acetylene in accordance with Compressed Gas Association recommendations.

6.11.2.4 The gas chromatograph shall be provided with instrument air and argon connections in accordance with Compressed Gas Association recommendations.

6.11.2.5 The high level counting room shall be provided with P-10 gas and instrument air. Three P-10 gas connections will be located on each working wall.

6.11.2.6 All laboratory gas lines shall be clearly and distinctly marked indicating type of gas. All associated valves will be similarly marked.

6.11.3 Water

6.11.3.1 Demineralized water shall be provided in all hoods and sinks. Demineralized water shall also be provided at the refrigerator location.

6.11.3.2 For protection against chemical upsets and maintenance outages of the existing demineralized water system, a 300- to 500-gallon demineralized water day tank shall be provided for the HCL.

6.11.3.3 Domestic water outlets (both hot and cold) shall be provided at all sinks. Cold domestic water shall be available in all hoods. Centrally located hose connections shall be available throughout the laboratory to facilitate floor washing.

6.11.3.4 A domestic hot water heater will provide hot water service in the HCL.

6.11.4 Air Breathing Apparatus

Air breathing manifolds with three hose connections shall be provided in the sample room, sample preparation lab, plant chemistry lab, and radiochemistry lab.

6.12 LIQUID WASTE DISPOSAL REQUIREMENTS

Drains designed to dispose of both chemical and radiological liquid wastes shall be located throughout the laboratory. Drainage shall be provided from all sample disposal sinks, work benches, and hoods. All drainage systems shall be designed to remove all free standing liquids. The drainage system will be trapped to prevent backflow of radioactive and toxic gases into the lab. The location of the trap(s) will be determined based upon the relative risk of potential radioactive crud buildup versus releasing toxic acid gases. Flushing capabilities shall be provided with all sinks, work benches, and associated drains. Drainage shall be pumped to the Unit 2 miscellaneous waste holdup tank.

6.13 CHEMISTRY REQUIREMENTS

In addition to samples from Unit 2 Nuclear Sampling System, samples from the following support systems for the TMI-2 Recovery Program will be analyzed.

6.13.1 Processed Water System

6.13.2 Submerged Demineralizer System (Reactor Building Sump Water)

6.13.3 Low Level Waste Processing System

6.13.4 Liquid Radwaste Processing System (Evaporator)

6.13.5 Emergency Liquid Cleanup System (Epicor II)

6.14 ELECTRICAL REQUIREMENTS

6.14.1 General

6.14.1.1 The HCL will be a permanent structure and, therefore, normal building service loads will be added to the plant electrical distribution system for the life of the plant. Due to the magnitude of the load for the HCL it will be necessary to obtain service from one of the 4kV buses in the turbine building. In addition, a second source of 480 volt power will be used to provide redundant service to selected essential building loads.

6.14.2 Power System

6.14.2.1 A new 4-kV feeder will be added to one of the existing 4kV busses in the turbine building which will supply the facility unit substation.

6.14.2.2 A unit substation, 4160 to 480 volt, single ended, 3 phase, will be provided to supply 480 volt power and lighting loads. This unit substation will normally power the majority of the facility loads. Those loads requiring a backup source of power (the drainage transfer pumps, building exhaust fans, perchloric acid hood fans, glove box booster fan, normal lighting, and bench and hood power receptacles) shall normally be connected to a separate 480 volt source. Provision will be made within the facility to manually transfer these loads to the HCL unit substation, which will be rated to carry all facility loads simultaneously.

6.14.2.3 A motor control center will be energized directly from a 480 volt substation. The 480/277 volt lighting and distribution panels shall be energized via 480 to 480/277 volt transformers from this substation and the motor control center. The 120/240 volt lighting and distribution panels shall be fed from the motor control center or distribution panelboards via stepdown transformers. Branch circuits shall be supplied through individual circuit breakers within the panel boards.

6.14.2.4 Voltage sensitive loads requiring a regulated and isolated power source will be supplied from voltage regulating/isolating transformers. In addition, these loads will be connected such that, upon loss of voltage, a manual reset will be required to re-energize the equipment following a restoration of power.

6.14.2.5 125-volt dc power from the existing plant dc panels will be provided for substation breaker control power.

6.14.3 Normal Lighting System

6.14.3.1 This system will provide adequate illumination levels and convenience power for operating and service conditions. In addition, it serves as a distribution system of 120/240 VAC power to serve miscellaneous small load requirements. This system consists of a complete distribution network of cables, raceways, transformers, lighting panels, lighting fixtures, receptacles, and switches.

6.14.3.2 Lighting levels in general mechanical equipment room areas will be 20 fc, and from 50 to 100 fc in laboratory areas, depending upon the specific work area involved.

6.14.4 Emergency Lighting System

This system will provide emergency lighting for egress routes in all areas and shall consist of individual, self-contained, sealed-beam battery units (8-hour rated) connected to the normal lighting ac source to maintain battery charge and which automatically transfer to their internal batteries upon loss of ac. Illumination levels shall be as required per Pennsylvania Department of Labor and Industry Fire and Panic Regulations.

6.14.5 Exterior Lighting System

Exterior lighting will be limited to fixtures mounted on the perimeter building structure for entrance areas and where required for security illumination of areas adjacent to the structure. Exterior lighting levels will be in accordance with existing site surveillance requirements.

6.14.6 Raceway

A complete system of raceways will be provided to furnish protection and support for all wire and cable systems.

6.14.7 Cable

Power and control and instrument cable will meet IEEE 383 flame resistance tests. Capacity rating and group derating factors of cables will be in accordance with ICEA P-46-426 for cables in conduit, ducts, and trays with maintained spacing. ICEA P-54-440 will be used for cables in random filled tray.

Single phase branch circuit wiring for receptacle and lighting runs will be copper with insulation rated for 90 C, 12 AWG minimum gauge. Insulation will be 600 volt, type THW moisture and heat resistant thermoplastic. Lighting fixture wire shall be Class B stranded, tinned copper with insulation rated for 200 C, 14 AWG minimum gauge. Insulation will be 600 volt, type SF-2 silicone rubber.

Polyvinylchloride (PVC) insulation will not be used in any cable construction with the exception of lighting and receptacle wiring, which will be totally enclosed in conduit. All wiring shall carry Underwriters' Laboratories approval.

6.14.8 Grounding

All new structures, electrical equipment, and metal components likely to become energized under abnormal conditions will be grounded by direct or indirect connection to the existing site grounding system.

6.14.9 Hazardous Areas

Where hazardous materials are used electrical equipment installation will conform to appropriate sections of chapter 5 of the National Electrical Code (NFPA Standard).

6.14.10 Communications

6.14.10.1 Equipment ties into the plant public address system will be provided in the sample room, plant chemistry lab, radiochemistry lab, sample preparation lab, and the counting preparation room.

6.14.10.2 Telephone service will be provided in every room except the mechanical-electrical equipment room and storage room.

6.15 FIRE PROTECTION

6.15.1 A fire protection system as described in NFPA-801 section 5.3 shall be provided for all areas of the radiochemical hot laboratory.

6.15.2 Construction and location of hoods and associated air filtration systems, glove boxes, and work benches shall be in accordance with NFPA-801 sections 4.2, 4.3, and 4.4.

6.15.3 Walls, floors, and partitions shall be constructed of noncombustible material.

6.15.4 NFPA-45 states those fire codes applicable to a cold chemistry laboratory. Various sections shall be applied to the HCL as follows:

Chapter 3 - Laboratory Construction and Design

Chapter 4 - Fire Protection

Chapter 5 - Explosion Hazard Protection

Chapter 6 - Ventilating Systems

Chapter 7 - Chemical Storage, Handling, and Waste Disposal

Chapter 8 - Compressed or Liquefied Gases

Chapter 9 - Laboratory Operations and Apparatus

6.16 RADIATION MONITORING AND PROTECTION REQUIREMENTS

6.16.1 Function

The radiation monitoring system shall provide the following functions:

6.16.1.1 Detect and indicate continuously airborne activity in the form of gases, particulates and halogens in the high level counting area.

6.16.1.2 Provide continuous indication of background beta-gamma radiation at each functional area

6.16.1.3 Monitor environmental releases at the exhaust point

6.16.1.4 Provide local alarm (both visual and audible), and remote alarm in the main control room for all monitored points or areas when limits are exceeded.

6.16.2 Radiation Monitoring Requirements

6.16.2.1 Sample Room

The sample room facility is to be used for drawing and collecting radioactive samples. Therefore, for personnel protection, one area radiation monitor will be provided for the one sample room. Additional area radiation monitor(s) may be required for future sample room(s).

6.16.2.2 Sample Preparation Lab

The sample preparation room is to provide provisions for storage of radioactive samples, opening the sealed samples, and preparing the samples for analysis. To monitor the background radiation levels, one area radiation monitor will be provided for the sample preparation room.

6.16.2.3 Solids Lab

One area radiation monitor will be provided for the solid laboratory facility as the activities of analyzing the radioactive samples will be carried on in this area.

6.16.2.4 Chemistry Labs

The chemistry laboratories are to be used for the analysis of liquid radioactive samples. Two area radiation monitors (one each for the radiochemistry laboratory and plant chemistry laboratory) will be provided for the purpose of monitoring the background radiation levels.

6.16.2.5 Counting Room

The counting room is to provide capabilities of checking and measuring the activity of the radioactive samples. One area radiation monitor for the counting room will be provided to detect the background radiation levels.

6.16.2.6 To collect airborne activities and subsequently measure the activities in the HCL, air samplers with appropriate filters will be provided in the sample room, sample preparation lab, and HCL interior corridor.

6.16.2.7 A three-channel monitor will be provided at the ventilation exhaust point to monitor environmental releases.

6.16.3 Radiation Monitoring Devices

6.16.3.1 The radiation monitoring system (RMS) shall be divided into the following subsystems:

a. Area radiation monitors (ARM)

These monitors shall use halogen-quenched GM detectors to detect and measure ambient beta and gamma radiation. ARM readout shall be in mr/hr.

b. Continuous airborne contamination monitors (CAM)

These monitors shall consist of a thin-walled beta scintillator for detecting noble gases, a thin-walled beta scintillator with the fixed filter for detecting particulates, and a charcoal filter cartridge with sodium iodine (NaI) scintillation detector with two single-channel analyzers for detecting Iodine-131. Air samples shall be passed through a fixed filter in close proximity to a detector.

c. Portable alpha, beta, and gamma radiation survey meters (to be supplied by GPUSC)

The HCL shall be provided with the following portable meters to check and measure personnel and surface contamination:

- o Alpha survey meters with proportional or scintillation detectors.
- o Beta/gamma survey meters with GM halogen-quenched detectors.
- o Alpha friskers using air proportional detectors.
- o Beta survey meters with telescoping probes with GM halogen-quenched detectors.

d. Personnel Dosimeters (to be supplied by GPUSC)

Thermoluminescent dosimeters (TLD) and pocket dosimeters shall be provided to all personnel in the HCL. TLDs to be read at prescribed intervals require a separate readout device to track accumulated dosage for an individual. Pocket dosimeters offering more limited range than TLDs allow direct reading by personnel.

6.16.4 Checking/Testing Requirements

Testing and/or checking of all radiation monitors shall be performed frequently for reliability and accuracy.

6.17 GENERAL MECHANICAL REQUIREMENTS

All plumbing will be concealed within working aisles, behind wall furniture, and/or shielded as necessary. Shielded pipes will include only those associated with radwaste (i.e., sink, hood, and work bench drains).

6.18 RADIOCHEMISTRY LAB AND COUNTING EQUIPMENT

Equipment marked "To be supplied by GPUSC" will be specified and procured by General Public Utilities Service Corporation. All other equipment and activities associated with achieving a complete facility are to be provided by Bechtel.

6.18.1 Analytical Chemistry Equipment (To be supplied by GPUSC)

6.18.1.1 (1) Spectrophotometer, UV and visible

6.18.1.2 (1) Atomic Absorption Spectrophotometer

6.18.1.3 (2) pH meters, with extended millivolt range and pH electrodes for specific ion measurements

6.18.1.4 (2) Conductivity meters

6.18.1.5 (1) Automatic titrator

6.18.1.6 (1) Set of fluoride electrodes

6.18.1.7 (2) Balances, analytical

6.18.1.8 (2) Balances, top loaders

6.18.1.9 (1) Gas chromotograph

6.18.1.10 (2) Centrifuges

6.18.1.11 (1) Oven, drying

6.18.1.12 (1) Furnace, muffler

6.18.1.13 (6) Hotplates with magnetic stirrers

6.18.1.14 (1) Turbidimeter

6.18.2 Nuclear Counting Equipment (To be supplied by GPUSC)

6.18.2.1 (1) Gas flow proportional counter with changer

6.18.2.2 (1) Liquid scintillation counting system

6.18.2.3 (1) Gamma ray spectrophotometer using a Ge(Li) detector

6.18.2.4 (1) Local computer

6.18.3 Miscellaneous Equipment and Supplies (To be supplied by GPUSC)

6.18.3.1 (6) Vacuum pumps

6.18.3.2 Glassware: pipets, burets, beakers, etc.

6.18.3.3 Consumables: rubber gloves, lab coats, shoe covers, compressed air, argon, gas, and chemicals.

6.18.3.4 Lead glass shielding, lead bricks, and lead specialty shields for syringes, beakers, etc.

6.18.3.5 (1) Double glove box

6.18.3.6 (1) File cabinet, 5 drawers

6.18.3.7 (1) Explosion-proof refrigerator with ice maker

6.18.4 Furniture

6.18.4.1 (5) hoods (std. chemical lab.) with base cabinets, 4 feet wide

6.18.4.2 (2) hoods (perchloric acid type) with base cabinets, 6 feet wide

6.18.4.3 (3) hoods (std. chemical lab.) with base cabinets, 6 feet wide

6.18.4.4 (1) hood (std. chemical lab.) with base cabinets, 5 feet wide

6.18.4.5 (3) sinks with base cabinets, 4 feet wide

6.18.4.6 (2) sinks with base cabinets, 3 feet wide

6.18.4.7 (2) sinks with base cabinets, 2 feet wide

6.18.4.8 (1 lot) benches, 71 feet 6 inches total length, and 6 corner units

6.18.4.9 (1 lot) wall unit cabinets, 95 feet, 6 inches total length, and 6 corner units

6.18.4.10 (1) desk

6.18.4.11 (4) acid storage cabinets, 3 feet wide

6.18.4.12 (1) acid storage cabinet, 4 feet wide

6.18.4.13 (1) chemical storage cabinet, 4 feet wide by 22 inches deep by 6 feet high

6.18.4.14 (1) Standard balance table (36")

6.18.4.15 Benches are standard laboratory benches with base units containing drawers and/or cabinets.

6.18.4.16 (1) Large vertical fireproof cabinet for solvents

6.18.4.17 Wall cabinets will be standard laboratory wall cabinets with movable shelves and sliding glass doors. They will be supplied in standard lengths. A combination of several standard length cabinets will be required to make up some of the longer cabinets described above.

6.18.4.18 (2) First aid cabinets

6.19 PAINTING AND COATING

Painting and coating of structures, equipment and furniture will be provided in accordance with the General Project Design Criteria (See Reference 7.1).

7.0 REFERENCES

7.1 General Project Design Criteria, Document No. 13587-2-G01-100.

7.2 Three Mile Island Unit 2 Final Safety Analysis Report.