9 PROCESS SYSTEMS

9.1 Design Criteria

9.1.1 Codes and Standards

The latest edition of the codes, standards, orders, and guides referred to in this section will be followed, with a reference point of August 2008 being the anticipated design completion date. All work will be in accordance with BNL's Implementation Plan for DOE 413.3, "Program and Project Management for the Acquisition of Capital Assets."

9.1.2 DOE Orders

DOE O5480.4 – Environmental Protection, Safety and Health Protection Standards
DOE O413.3A – Program and Project Management for the Acquisition of Capital Assets
DOE O414.1C – Quality Assurance
DOE O420.1B – Facility Safety
DOE O420.2B – Safety of Accelerator Facilities

9.1.3 Codes, Standards, and Guides

Building Code of New York State (NYSBC) – 2002 Edition
American National Standards Institute
ANSI 117.1 Accessible and Useable Buildings and Facilities
American Society of Mechanical Engineers
American Society for Testing Materials Standards
American Water Works Association
ANSI/AIHA Z9.5-2003 Standards for Laboratory Ventilation
Factory Mutual
Mechanical Code of New York State
National Institute of Standards and Technology
National Fire Protection Association (NFPA) Standards
Occupational Safety and Health Administration (OSHA)
Underwriters Laboratory
New York State Plumbing Code - 2002 Edition

9.2 Preliminary Design

Process systems will be provided to NSLS-II to meet the needs of the accelerator, beamlines, and laboratories. The following process systems are included:

- Nitrogen
- Liquid nitrogen
- Compressed air
- Deionized water
- Process Cooling Water (provided by Accelerator Systems)

9.2.1 Nitrogen

Scope/Major elements	Site nitrogen skid, evaporator
	Piping and accessories
Redundancy	None*
Supply pressure	100 psig
Coverage	Experimental Hall
	Lab Office Buildings
Materials of construction	
Piping	Type L hard-drawn copper, oxygen cleaned
Valves	Ball, full port, brass, 3-piece, oxygen cleaned

*System redundancy is initially not provided, however the system will be configured to add an additional nitrogen tank and vaporizer in the future as beamlines are added and demand increases.

The source for gaseous nitrogen will be vaporizers installed at the liquid nitrogen tank. Primary distribution will occur in the Ring Building. Secondary mains serving the lab/office buildings will be valved to permit isolation for maintenance and modifications. Branches serving individual laboratory modules will be valved.

Piping material will be type L copper tubing with wrought copper fittings and solder joints utilizing 95-5 tin-antimony solder.

The gaseous nitrogen distribution system will be designed to maintain a maximum pressure drop of 10-percent from the point of discharge to the farthest outlet.

9.2.2 Liquid Nitrogen

Scope/Major elements	Site nitrogen skid
	Piping and accessories
Redundancy	None*
Coverage	Experimental Hall
	RF Building
Materials of construction	
Piping	Vacuum jacketed

*System redundancy is initially not provided, however the system will be configured to add an additional nitrogen tank and vaporizer in the future as beamlines are added and demand increases.

Liquid nitrogen will be stored in a centrally located tank between LOBs 4 and 5. Primary distribution will occur in the Ring Building with connection points available for beamline use and the RF cryo systems area. Filling stations will be provided at each lab/office building to permit dewars to be filled.

The piping distribution system will be through vacuum jacketed piping with either a dynamic or static vacuum. The piping shall contain an inner carrier tube and an exterior jacket. The annular space shall be under vacuum and have appropriate spacers. The system components (piping, fittings, valves, etc.) shall be products manufactured by, or provided by, a single manufacturer and not built up assemblies.

9.2.3 Clean Dry Compressed Air

Scope/Major elements	Filter / dryer skids
	Piping and Accessories
Redundancy	Oil free back-up compressor / dryer skid
Capacity	TBD
Supply pressure	100 psig from site system
	95 psig after regulator
Quality	Clean (Oil free), dry air
Moisture	-20°F dew point
Particulate	1 micron
Coverage	Experimental Hall
	Central Lab Office Building
	Lab Office Buildings
	Service buildings
Materials of construction	
Piping	Hard-drawn copper, brazed
Valves	Ball, full port, brass

The source for the laboratory compressed air will be the site wide 100 psig system. The site system is oil free, filtered, clean, and dried to minus 20°F dew point.

To assure clean, dry compressed air delivery to the laboratories, the incoming service will be provided with a 1 micron coalescing filter to collect moisture and/or particulates originating in the site distribution piping. The filter will be designed to remove all particulates 1 micron and larger, and 100% of liquid water. A pressure regulator will be installed downstream of the filter and set for a discharge pressure of 95 psig. Individual connection points for personnel use will be provided with a regulator set limiting the pressure to 30 psig.

Piping for the system will be Type L copper tubing (ASTM B819) with wrought copper fittings and brazed joints. All components including valves will be cleaned for oxygen service and capped and/or bagged by the manufacturer for delivery to the site for installation. Assembly will be with brazing filler alloy without the use of flux.

Note: During the detailed design phase the need for both a GN2 system and compressed air system will be evaluated. It may be feasible to just utilize GN2 in lieu of compressed air service. The compressed air main will be run to the NSLS II site as part of the connection to the central chilled water system and will be available if deemed necessary.

9.2.4 Deionized Water

Scope/Major elements	DI water
	Point-of-use systems
Redundancy	
Capacity	
Supply temperature	78 F
Supply pressure	
Make-up water source	Potable water make-up system
Coverage	Lab Office Buildings Laboratories
Water quality	
Resistivity	1 mega-ohm/cm (min)
Materials of construction	
Piping	Sch. 80 polypropylene
Tanks	GRP, stainless steel
Valves	Diaphragm or ball, polypropylene
Pumps	Stainless steel

Each Lab Office Building that requires DI water as a consumable will be provided with a separate point-of-use water system. The system will include polishing, storage, and distribution components. Point-of-use polishing units will be installed in the laboratory designated for “wet use” in each LOB.

9.2.5 Process Cooling Water

The deionized process cooling water systems for the Booster, Linac, Storage Ring and beamlines are included in the Technical Construction portion of the NSLS-II project. These systems will be located in designated space in the Service Building and the equipment areas of the Injection and RF Buildings. Conventional Facilities will provide process cooling tower water and chilled water to these systems.

The process cooling tower water system will reject the majority of the process loads captured by the process water systems. Chilled water will be used to finely control the cooling water temperature. Plate and frame heat exchangers located in the mechanical equipment room spaces will reject heat to both the process cooling tower water system and the chilled water system. Process cooling water piping will be distributed around the perimeter of the Ring Building. Chilled water piping will be insulated to prevent condensation at low supply water temperatures. Cooling tower water and process cooling water systems will not require insulation.