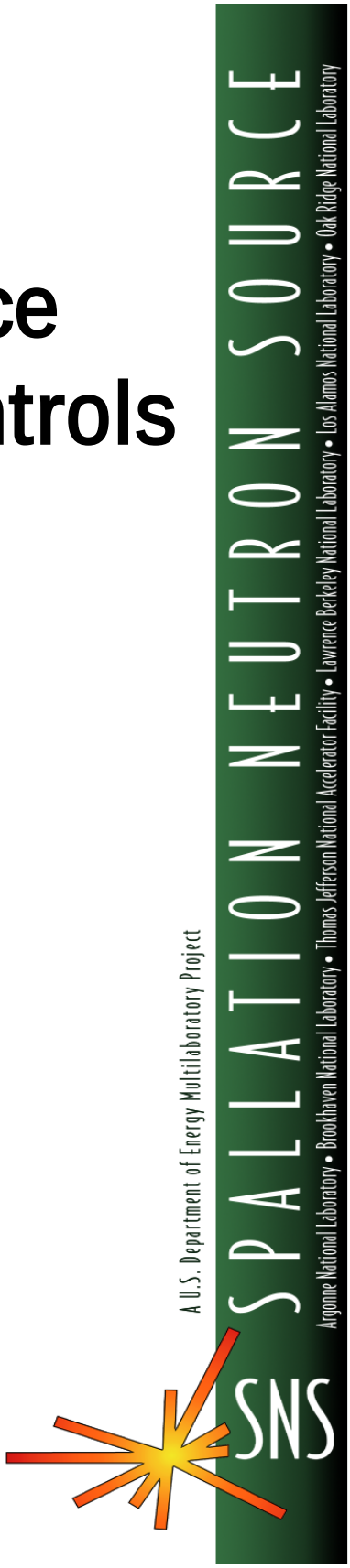
102030100-ES0007-R01

Spallation Neutron Source Credited Engineered Controls List

October 2012



Approvers for SNS Credited Engineered Controls List:

	Date
David Freeman, SNS Safety Specialist	Oct 2, 2012
Mike Baumgartner, Mechanical Systems and Operations Group Leader	10/5/12
Glen Johns, Accelerator Operations Group Leader	10-5-12
George Dodson, Accelerator and Target Operations Manager	4/oct/2012
Kevin Jones, RAD Division Director, SNS Directorate Operations Manager	10.05.2012

SNS CREDITED ENGINEERED CONTROLS LIST

October 2012

Prepared for the
U.S. Department of Energy
Office of Science

UT-BATTELLE, LLC
managing
Spallation Neutron Source activities at
Argonne National Laboratory
Brookhaven National Laboratory
Thomas Jefferson National Accelerator Facility
Lawrence Berkeley National Laboratory
Los Alamos National Laboratory
Oak Ridge National Laboratory
under contract DE-AC05-00OR22725
for the
U.S. DEPARTMENT OF ENERGY

Table 1 Neutron Facilities Credited Engineered Controls (CECs)		
	CEC o **Safety Function**	**FSAD Reference Section**
1	Cryogenic Moderator System (CMS) Hydrogen Boundary (includes overpressure protection rupture discs and seismically qualified, restrained/externally protected relief path). o Prevent H_2 release into core vessel.	FSAD-NF[1] 3.3.3, 5.2.1
2	CMS Vacuum Boundary (includes rupture discs and relief path) o Provide an additional layer of safety against release of H_2 into core vessel.	FSAD-NF 3.3.3, 5.2.2
3	Service Bay/Core Vessel Fire Barrier o Isolation Function: maintain physical separation between target mercury and combustibles (e.g., combustible shielding). o Two Hour Equivalent Fire Barrier Function: Prevent transmission of two-hour equivalent fire into core vessel or target service bay.	FSAD-NF 3.3.2, 3.3.5.1, 3.3.10.3.1, 5.2.3, 5.2.4
4	Target Protection System (TPS) o Cuts off the proton beam when necessary to prevent overheating of mercury due to inadequate mercury loop flow or cooling. o Prevents beam on target when target carriage withdrawn	FSAD-NF 3.3.8.2, 5.2.5
5	Fire Suppression System (FSS) inside the Target Service Bay o Detect and suppress a fire inside the target service bay.	FSAD-NF 3.3.10.3, 5.2.6
6	FSS outside the Service Bay o Automatically initiate sprinkler flow to control a fire that develops in areas directly adjacent to service bay, the high bay, instrument hall, or target building basement area.	FSAD-NF 3.3.10.3, 5.2.7
7	Core Vessel with Rupture Disk and Neutron Beam Windows – Confinement Function o In event of mercury spill inside the core vessel, retains liquid mercury in a confined location and mitigates mercury vapor release inside the building.	FSAD-NF 3.3.2, 5.2.8

[1] Spallation Neutron Source Final Safety Assessment Document for Neutron Facilities, SNS 102030102-ES0016-R03, September 2011.

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	CEC o **Safety Function**	**FSAD Reference Section**
8	Target Service Bay and Monolith - Confinement of Mercury [includes mercury loop steel shielding (PC-2) for seismic event] o Provides confinement of liquid mercury and mitigates airborne mercury following a mercury spill event by retaining liquid mercury in a confined location in the target service bay or monolith. o Loop steel shielding acts as fire barrier	FSAD-NF 3.3.1, 3.3.1.2, 3.3.4, 3.3.5.1, 5.2.9
9	Primary Confinement Exhaust System (includes associated ductwork, backdraft dampers and sulfur impregnated charcoal adsorbers) o Minimizes escape of mercury-vapor-contaminated air from the target service bay to other parts of the target building.	FSAD-NF 3.3.9.1, 5.2.10
10	High Bay Crane Design per ASME NOG-1 o Reduce the probability of breaching the high bay floor above the process bay or core vessel due to a failure of the crane that could result in the load being dropped.	FSAD-NF 5.2.11
11	High Bay Floor Design o Maintain structural integrity to prevent a dropped load (consisting of the maximum load and height above floor allowed by administrative controls) from contacting the interior of the target service bay process bay or core vessel.	FSAD-NF 3.2.3, 3.3.5.1, 5.2.12
12	Mercury Heat Exchanger o Prevent failure of single wall from allowing radioactive mercury to escape from the target service bay via the mercury loop cooling water system.	FSAD-NF 3.3.1, 5.2.13
13	Service Bay Differential Pressure Monitoring System o Provide an alarm when target service bay primary confinement ventilation system is not maintaining adequate negative pressure (can be switched to the flow alarm mode when transfer bay personnel access door is open).	FSAD-NF 3.3.8.2, 5.2.14
14	Mercury Pump Tank Exhaust Line Loop Seal o Prevent mercury pump tank overfill during system startup from leaking mercury outside the target service bay via the offgas system.	FSAD-NF 3.3.7, 5.2.15

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15	Transfer Bay Access Control System o Protects worker from excessive radiation and/or airborne Hg by preventing access to transfer bay when either the upper or lower segment of the intra-bay shielding door is not closed. Sounds an alarm if intra-bay door segment becomes not closed during access.	FSAD-NF 3.3.8.4, 5.2.16
16	Target and Instrument PPS o Target PPS - Prevent potentially injurious exposure to prompt radiation [by the target cart position interlock and by executing protective response to Instrument PPS fault signal(s).] o Instrument PPS - In general, all instrument enclosures: Prevents potentially injurious radiation exposure to prompt radiation in instrument enclosures o Instrument PPS - Specific instrument enclosures: Monitor O_2 concentration and provide alarm in the event of inert gas release inside an enclosure.	FSAD-NF 3.3.8.3, 3.3.8.3.1.10, 5.2.17 FSAD-NF 3.3.8.3, 5.2.18, 7.7, 7.8

Table 2 Proton Facilities Credited Engineered Controls (CECs)		
	CEC o **Safety Function**	**FSAD Reference Section**
1	Personnel Protection System (PPS) o Prevents potentially injurious radiation exposure to prompt accelerator radiation.	FSAD-PF[2] 3.2.3, 4.2.3, 5.2.1
2	Oxygen Deficiency Hazard Safety Instrumented System o Monitors oxygen levels in the superconducting LINAC (SCL) and the CHL and provides visible and audible alarms inside the areas and at entrances when the decreased oxygen level indicates a significant release of inert gas may have occurred from the cryogenic system.	FSAD-PF 3.2.3, 4.3.1.5, 4.4.2.2.2, 5.2.2
3	Emergency Ventilation System (EVS) o Provides a forced-flow exhaust path to the outdoor environment to help ensure that released helium would not spread to occupied spaces within the front end building or tunnel regions outside of the LINAC/HEBT tunnel in the event of a significant long term accidental release from the helium system of the superconducting LINAC.	FSAD-PF 3.2.3.1, 3.2.3.11, 3.2.4.1.3, 4.3.1.5, 5.2.3
4	CHL Compressor Room Passive Ventilation Features o Provides an abundant source of outdoor air and roof-level exhaust outlets for natural circulation flow of helium and air for a potential inadvertent leak in the helium compressor or associated piping.	FSAD-PF 3.2.1.4, 3.2.3.11, 5.2.4

[2] Spallation Neutron Source Final Safety Assessment Document for Proton Facilities, SNS 102030103-ES0018-R02.