Work scope details:

Title: Water Chiller Maintenance

Work Scope Summary: - The work involves draining and flushing treated water from neutron chopper water chillers, refilling them with new treated water, switching to a spare chiller, and performing maintenance on minor components.

Key Work Scope Components: - Draining treated water from neutron chopper water chillers - Flushing chillers with new treated water - Refilling chillers with new treated water - Switching operations to a spare chiller - Maintenance of minor components

Relevant previous events and lessons learned:

Event Title	Event Summary	Lessons Learned	Reference link
Water Release During Maintenance of 858N Chiller Number 3	On May 19, 2011, during maintenance of chiller number 3 condenser tubes, 360 to 700 gallons of water were released into the mechanical room and storm water system. The release was due to a manual chain-operated condenser isolation valve being locked in the open position instead of closed.	Ensure proper lockout/tagout procedures and verify valve positions before maintenance.	Link
Chiller Catches Fire at LSL2	In January 2020, a PNNL researcher noticed an acrid smell and sparks from a water chiller used to cool a TGA manifold. The researcher unplugged the chiller and pulled the fire alarm.	Be vigilant for unusual smells or sounds during maintenance and respond quickly to potential fire hazards.	Link
Explosion at T2 Laboratories	On December 19, 2007, a reactor cooling system failure led to a runaway chemical reaction, causing an explosion and fire.	Ensure regular maintenance and checks of cooling systems to prevent blockages or failures.	Link
Vapor Cloud Explosion at Synthron Inc.	On January 31, 2007, inadequate safeguards and emergency cooling measures led to a vapor cloud explosion and fire.	Implement robust emergency cooling measures and safeguards to prevent similar incidents.	Link
Chiller Line Rupture at Los Alamos National Laboratory	On November 17, 1997, a chiller line rupture caused a major accident with significant property loss.	Regular inspection and maintenance of chiller lines to prevent ruptures.	Link

Missing Hazards:

Hazard	Missing or Inadequate Mitigation in Current Work Control Document	Recommended Mitigation for Revision	Reference link	SBMS Link
Corrosive chemicals used in maintenance	Inadequate specification of PPE for corrosive chemicals	Specify PPE requirements for corrosive chemicals, including safety glasses with side shields and appropriate gloves	N/A	Link
Water release due to improper valve operation	Lack of controls for valve operation	Implement safety valve systems and regular maintenance checks	Safety Valve, Valve Role in HAZOP	Link
Fire hazard from electrical faults in chillers	No mention of electrical fault risks in chillers	Regular inspection and maintenance of electrical systems in chillers	Potential	Link
Explosion due to cooling system failure	No controls for cooling system failures	Implement explosion-proof cooling systems and regular maintenance	Hazardous Location Cooling	Link
Vapor cloud explosion from inadequate safeguards	Lack of safeguards for vapor cloud explosions	Install vapor cloud detection systems and emergency response plans	Vapor Cloud Explosion Guidelines	Link
Chiller line rupture	No mention of chiller line rupture risks	Regular inspection and maintenance of chiller lines, and installation of safety switches	Chiller Safety	Link
Environmental hazards from chemical spills	Insufficient spill containment measures	Implement spill containment systems and regular training on spill response	Spill Containment	Link

Failure mode analysis:

Current control	Failure mode of the control	Effect of Failure	Cause of Failure	Recommended action
Written permits for the work activity	Permit not obtained or expired	Unauthorized work leading to safety hazards	Oversight or miscommunication	Implement a checklist to verify permit status before work begins

Precautions, step warnings, Hold Points	Steps not followed or missed	Increased risk of accidents or equipment damage	Lack of attention or understanding	Conduct a pre-job briefing to emphasize critical steps and hold points
Personal Protective Equipment (PPE)	PPE not used or inadequate	Increased risk of injury from chemical exposure or physical hazards	Lack of awareness or availability	Ensure PPE availability and conduct training on its importance and use
Work instructions for information	Instructions not followed or misunderstood	Inefficient work process or safety incidents	Poor communication or unclear instructions	Simplify and clarify instructions; use visual aids if necessary
ORNL subject area requirements	Non-compliance with specific safety standards	Regulatory non-compliance and potential fines	Lack of awareness or training	Regular audits and training sessions on compliance requirements
Discuss group/individual responsibilities	Roles not clearly defined	Confusion and potential safety lapses	Poor communication or lack of leadership	Clearly define roles and responsibilities in pre-job meetings
Follow work instructions & safety procedures	Deviations from procedures	Safety incidents or equipment damage	Complacency or time pressure	Reinforce the importance of adherence to procedures through regular training
Availability/location of materials, tools	Tools/materials not available or misplaced	Delays in work or unsafe improvisation	Poor inventory management	Implement a tool/materials checklist and storage system
Response if work cannot be performed as planned	Inadequate response to unexpected issues	Escalation of safety risks or project delays	Lack of contingency planning	Develop and communicate contingency plans for common issues
Eyewash/safety shower availability	Eyewash/safety shower not accessible	Inability to respond to chemical exposure	Poor equipment placement or maintenance	Regularly inspect and maintain safety stations; ensure clear access
Ventilation in work area	Insufficient ventilation	Accumulation of hazardous fumes	Poor design or maintenance of ventilation systems	Conduct regular ventilation assessments and maintenance
Suitable shoes and safety glasses	Inappropriate or lack of PPE	Increased risk of slips, trips, falls, or eye injuries	Lack of enforcement or awareness	Enforce PPE policies and conduct regular checks

Emergency Response Plan	Plan not followed or outdated	Ineffective response to emergencies	Lack of training or updates	Regularly review and drill emergency response plans