Advanced Photon Source Upgrade

Advanced Photon Source Upgrade Project

Final Design Report

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Chapter 7: Environment, Safety, Health, and Quality Assurance

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Acronyms and Abbreviations

ALARA	As Low As Reasonably Achievable
APS	Advanced Photon Source
APS-U	Advanced Photon Source Upgrade
Argonne	Argonne National Laboratory
ASE	Accelerator Safety Envelope
ASO	Argonne Site Office
ASQ	American Society for Quality
CAS	Contractor Assurance System
CDB	Component Database
CORAL	Chemical Ordering Reporting and Attributes Library
DOE	U.S. Department of Energy
EMS	Environmental Management System
ESH&Q	Environment, Safety, Health, and Quality
HA	Hazard Analysis
HAR	Hazards Analysis Report
ISM	Integrated Safety Management
ISO	International Organization for Standardization
LBB	Long Beamline Building
LMS	Laboratory Management System
MCI	Maximum Credible Incident
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
ODH	Oxygen-deficiency Hazard
OHSAS	Occupational Health and Safety Assessment Series
PDRC	PSC Design Review Committee
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Program Plan

SAD	Safety Assessment Document
SC	Office of Science
UBC	Universal Building Code
UChicago	UChicago Argonne LLC
WPC	Work Planning and Control

7 Environment, Safety, Health, and Quality Assurance

7-1 Introduction and Overview

Argonne is committed to the protection of workers, visitors, the public and the environment. Consistent with its prime contract, the UChicago Argonne, LLC, as operator of Argonne National Laboratory, maintains an Environmental Management System (EMS) Description, a Quality Assurance Program Plan, and an Integrated Safety Management System / Worker Safety and Health Program Description. These programs implement the applicable requirements of DOE O 436.1, *Departmental Sustainability*, 10 CFR 830 Subpart A, *Quality Assurance Requirements*, DOE 414.1D, *Quality Assurance*, and 10 CFR 851, *Worker Safety and Health Program*, respectively.

To support a robust Contractor Assurance System (CAS) and provide reasonable assurance that objectives are accomplished and systems and controls are effective and efficient, the Laboratory maintains certifications to three internationally recognized standards:

- International Organization for Standardization (ISO) 14001:2015 *Environmental Management Systems*;
- ISO 9001:2015 *Quality Management Systems*; and
- Occupational Health and Safety Assessment Series (OHSAS) 18001:2007 *Occupational Health and Safety Systems*.

Argonne's environment, safety, health, and quality (ESH&Q) policies, either directly or via contractual flowdown documents, are applicable to all employees, subcontractors, users, research visitors, students, and suppliers. Fundamental drivers are delineated in Argonne's Laboratory Management System (LMS). Key ESH&Q policies include:

- LMS-POL-1, *Safety and Health* [1]
- LMS-POL-2, *Environmental Policy* [2]
- LMS-POL-9, *Quality Policy* [3]

Commitment to ESH&Q is further described in policies for specific topical areas, including:

- LMS-POL-4, *Emergency Management Planning* [4]
- LMS-POL-6, *Traffic Safety* [5]
- LMS-POL-8, *Aviation Management and Safety* [6]
- LMS-POL-10, *Working Alone* [7]
- LMS-POL-16, *Work Planning and Control* [8]
- LMS-POL-35, *Radiological, Nuclear, and Accelerator Safety* [9]
- LMS-POL-60, *Transportation Management,* [10]
- LMS-POL-69, *Electrical Safety* [11]
- LMS-POL-76, *Management and Control of Construction Projects*

These Argonne policies are further delineated through Laboratory and local implementing procedures, to ensure protection across all levels of management and work practices.

An Integrated Safety Management Plan [12] was prepared for the APS Upgrade project that further delineates the roles, responsibilities, authorities and accountabilities related to safe execution of the overall APS Upgrade project. The APS U ISM plan is a supplement to the Laboratory and APS policies and procedures to ensure the appropriate granularity of expectations related to a diverse project utilizing resources from across the Laboratory and DOE.

In this Final Design Report (FDR), the Laboratory-wide implementing policies and procedures are collectively referred to as the "ESH and QA program". The policies and procedures are placed in prescribed formats and associated with essential functions, by core process, within Argonne through the Laboratory Management System (LMS). Policies and procedures related to ESH are contained within the ESH core process, whereas QA and work planning and control are contained within the Governance core process.

The potential Hazards associated with the operation of the current Advanced Photon Source (APS) facility and generic x-ray beamlines have been addressed in the *Advanced Photon Source Safety Assessment Document (SAD)* [13]. The APS SAD will be revised during the project execution phase, prior to commissioning, to reflect implementation of the APS Upgrade Project by incorporating information from this FDR and the APS Upgrade project Hazards Analysis Report (HAR).

An important result of the current APS SAD was the establishment of the safety envelope for the components of the APS. In the operating range of the APS, the maximum radiation dose rate increases as particle beam power increases in each of the injector components. For this reason, the safety envelope for injector components has been defined in terms of maximum beam power. The safety envelope for the storage ring in injection mode is also defined in terms of maximum beam power. In stored-beam mode, the storage ring safety envelope is related to loss of the entire beam, and is therefore defined in terms of the maximum stored energy in the beam, measured in joules. Storage ring radiation and shielding assessment is covered in detail in section 4-3.12.4. The consequences of the Maximum Credible Incident (MCI) for each part of the APS was calculated for the conditions within the current ASE as defined maximum operating conditions. The MCIs and their consequences are discussed in Chapter 4 of the current APS SAD. The Accelerator Safety Envelope (ASE) is provided in Chapter 5 of the APS SAD. Consistent with this approach the APS Upgrade project has been performing calculations based on the stored energy and operating parameters of the final design to ensure that the APS-U machine will safely operate within the shielded enclosures that are presently in place, and to identify those areas that will need supplemental shielding.

The safety envelope for the beamlines is defined differently as it requires a set of controls to be in effect to ensure that radiation exposures inside Building 400, and outside beamline enclosures, are maintained As Low As Reasonably Achievable (ALARA). Beamline safety envelopes consists of in-place shielding and hutch construction, interlocks, and administrative controls that are applied. Modeling to ensure the worst-case scenario loss-of-vacuum accident is being conducted to ensure that the *in situ* controls are adequate and appropriate in conjunction with the administrative controls.

The HAR documents the study of potential hazards associated with the intended modifications to the APS machine, considering both its associated systems and the physical facility. These hazards include, but are not limited to: radiation, energy sources, hazardous materials, and natural phenomena. Hazard categories from the APS Upgrade are the same as those addressed in the APS SAD. Hazard analyses are based on a potential bounding-event approach in which the most severe case of each Hazard category is analyzed to identify worst-case outcome. Outcomes that are not bounded in the existing SAD HA will require that a new event analysis be developed, including a determination of the initiating occurrence, possible detection or mitigation methods, potential added safety features to prevent or mitigate the event, probability of occurrence, and possible consequences. A review of the HAR results thus far has not identified any new analyses that are likely to result in consequences beyond those evaluated in the currently approved SAD. A new or revised SAD will be developed regardless of this outcome, as it will need to be updated to properly describe the new APS Upgrade machine and the impacted beamlines.

Table 7.1 summarizes the expected hazards that will result from the APS Upgrade Project, and lists the corresponding controls to mitigate each hazard to an acceptable risk level to ensure safe operation. The HAR provides a more detailed discussion of each hazard and the resulting mitigation strategy.

Table 7.2 provides a summary of the Hazards analyzed in the HAR; their probability level, as described in Table 7.3; and their consequence level, as described in 7.4. Table 7.5 provides an overall risk matrix, with resultant risk levels given in Table 7.6. The last column in Table 7.2 corresponds to the risk levels shown in Table 7.6.

7-2 Environmental Protection

The National Environmental Policy Act of 1969 (NEPA) requires that the environmental impacts of proposed actions with potentially significant effects be considered in an environmental assessment or environmental impact statement. 10 CFR Part 1021, *Department Of Energy: National Environmental Policy Act Implementing Procedures* [14] lists classes of actions that require those levels of documentation or are categorically excluded from further NEPA review. An assessment of environmental impact considering the original construction and operation of the APS facility resulted in a Finding of No Significant Impact [15]. To address the APS Upgrade project, two separate NEPA determination documents were prepared and the DOE Argonne Site Office issued categorical exclusions covering the APS upgrade activities within the physical structures: ASO-CX-313, approved in 2015, and ASO-CX-337, approved in 2017, for the construction of the Long Beamline Building.

The removal of the existing storage ring will involve nearly 1900 tons of material, which will be processed through the Argonne waste management program. Planning for the disposition of the materials, and the associated disposition pathways, has begun with a waste management plan being developed along with an updated cost estimate which will be finalized as the Project nears the point of shutdown of the current APS machine. All disposition paths will adhere to the current DOE environmental policy at the time of generation. The Argonne Radiological Protection Program Technical Basis Document, RS-TBD-003 *Clearance Protocol for Potentially Activated Material* [16] provides a methodology to allow recycling of materials and reduce the land disposal burdens of cost and impact for a large volume of material. A project specific survey and release protocol technical basis document is under development, RS-TBD-003, to detail the implementation methodology specific to the APS Upgrade activities. The Argonne Nuclear and Waste Management division is developing a waste management plan to identify the methodology for handling the waste that will require further separation and segregation to reduce volume and maximize recycling.

Table 7.1. APS-U Project Hazards and Associated Controls

Hazards	Associated Controls
Ionizing Radiation	
Accelerator Systems	Shielding, Access Control and Interlock System, procedures, training, Argonne Radiation Protection Program (radiological surveys, dosimetry, posting, & labeling)
X-ray Beamlines	Shielding, Personnel Safety System, procedures, training, Argonne Radiation Protection Program (radiological surveys, dosimetry, posting, & labeling)
Nonionizing Radiation	
Radio-frequency	Shielding, interlock system, field surveys, posting & labeling, personal protective equipment (PPE), procedures, training, standards
Laser	Shielding, interlock system, field surveys, posting & labeling, PPE, procedures, training, standards
Visible/UV Light	Shielding, optics, PPE, procedures, training, standards
Chemical	Designated storage areas, ventilation hoods, APS Chemical Hygiene Plan, Safety Data Sheets, Chemical Ordering Reporting and Attributes Library (CORAL) System, satellite waste-accumulation areas, posting & labeling, PPE, procedures, training, standards
Cryogenic	Containment design, stand along systems, oxygen-deficiency hazard (ODH) monitors where needed, ventilation, PPE, procedures, training, standards
Electrical	Barrier design, interlocks, equipment inspection, energized electrical work permit, posting & labeling, PPE requirements and testing, procedures, training and qualification program, standards, equipment
Equipment Removal and Assembly Installation	Work planning & control processes, dedicated staff for planning, posting & labeling, pre-job briefings, practice on mockups, PPE, procedures, training, standards
Fire	Barriers, detectors (smoke & heat), alarms, sprinkler system, ventilation, emergency egress routes, Fire Department, limitations on combustibles, flammable liquid storage cabinets, open-flame permits, procedures, training, evacuation drills, standards
Magnetic Fields	Field surveys, posting & labeling, procedures, training, standards
Oxygen Deficiency	Evaluation of new installations, ventilation, ODH monitors, alarms, confined-space entry permit, posting & labeling, procedures, training, standards
Noxious Gases	Ventilation, procedures, training, standards
Mechanical	Design, barriers (machine guards), inclusion of handling provisions, equipment inspection, posting & labeling, PPE, training, standards and lift planning
Vacuum and Pressure	Design, pressure relief devices, monitors/gauges, flow & pressure control devices, posting & labeling, PPE, training, standards

Table 7.2. APS-U Risk Determination Summary

Hazard (Off-Normal)	Probability Level	Consequence Level	Risk Level
Ionizing Radiation			
Accelerator Systems	Low	Low	Extremely low
X-ray Beamlines	Low	Medium	Low
Nonionizing Radiation	Extremely low	Low	Extremely low
Chemical	Medium	Low	Low
Cryogenic	Low	Low	Extremely low
Electrical	Low	Medium	Low
Equipment Removal	Medium	Low	Low
Equipment Assembly and Installation	Low	Medium	Low
Fire	Medium	Low	Low
Magnetic Fields	Low	Low	Extremely low
Oxygen Deficiency	Extremely low	Medium	Extremely low
Noxious Gases			
Accelerator Systems	Medium	Low	Low
X-ray Beamlines	Low	Medium	Low
Mechanical	Medium	Low	Low
Vacuum and Pressure	Medium	Low	Low

Table 7.3. Hazard Probability Rating Levels

Category	Estimated Occurrence (per year)	Description
High	$>10^1$	Event is likely to occur several times during the life of the facility or operation
Medium	10^{-2} to 10^{-1}	Event may occur during the life of the facility or operation.
Low	10^4 to 10^2	Occurrence is unlikely or the event is not expected to occur, but may occur during the life of the facility or operation.
Extremely Low	10^6 to 10^4	Occurrence is extremely unlikely or the event is not expected to occur during the life of the facility or operation. Events are limiting faults considered in design.
Incredible	$<10^6$	Probability of occurrence is so small that a reasonable scenario is inconceivable. These events are not considered in the design or SAD accident analysis.

Table 7.4. Hazard Consequence Rating Levels

Consequence Level	Maximum Consequence
High	Serious impact on-site or off-site. May cause deaths or loss of the facility/operation. Major impact on the environment.
Medium	Major impact on-site or off-site. May cause deaths, severe injuries, or severe occupational illness to personnel or major damage to a facility/operation or minor impact on the environment. Facility is capable of returning to operation.
Low	Minor on-site impact with negligible off-site impact. May cause minor injury or minor occupational illness or minor impact on the environment.
Extremely Low	Will not result in a significant injury or occupational illness or cause a significant impact on the environment.

Table 7.5. Overall Risk Matrix

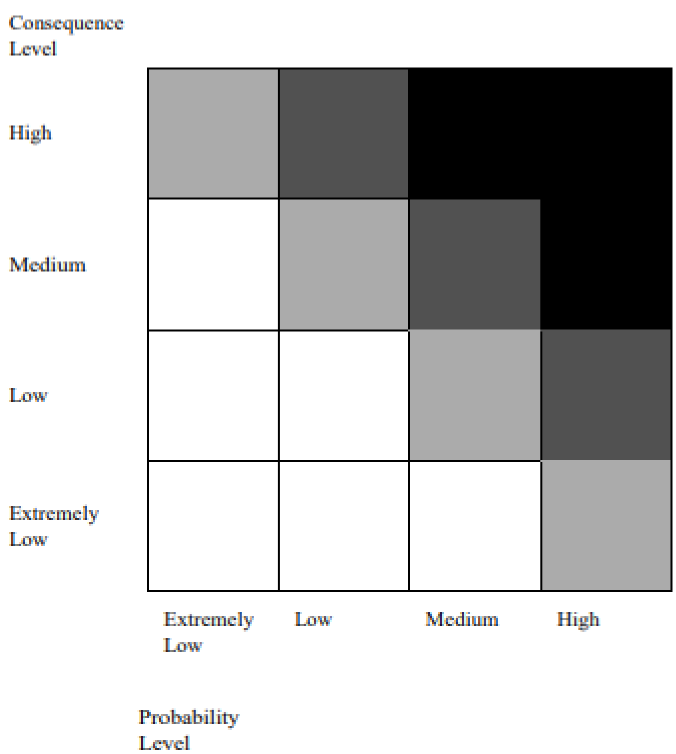
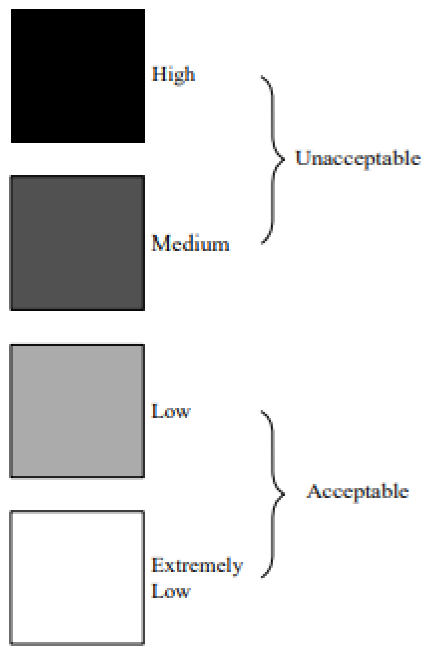


Table 7.6. Hazards Risk Determination Based on Hazards Risk Matrix



7-2.1 ESH and Quality Management

The APS Upgrade Project is committed to planning and execution in a manner that preserves the safety of the workers, the public and the environment. The project has a dedicated ESH Lead, fully matrixed and field-deployed from the Argonne ESH&Q Worker Safety and Health organization, who is also integrated into the Photon Sciences Directorate/APS safety support group. The project also has a dedicated senior Work Planning and QA Lead, and a dedicated Quality Assurance Coordinator. Each participates in design reviews, design meetings, and routinely consult with design staff to ensure the integration of safety and quality throughout design, planning, and implementation. Both senior positions also integrate closely with the Photon Sciences Directorate/APS safety support group to assure consistency and coordination in approach. This will simplify the transition to operation phases, as safety staff across the Photon Sciences Directorate have been integrally involved throughout project design and implementation.

7-2.2 Integration of Safety and Quality into Design Features

Design and development of technical components for the APS Upgrade Project has been reviewed consistently with the APS Upgrade design review process. Design reviews are performed to confirm and substantiate that the proposed design will achieve its desired outcome. Review ensures that appropriate safeguards have been incorporated, appropriate codes and standards have been utilized, and materials, processes and qualified parts have been addressed appropriately. Final design reviews confirm that all analyses have been properly documented and reviewed, in accordance with the APS-U Quality Assurance Plan. Procurement and quality assurance requirements are also verified at this stage. Both the ESH Lead and Quality Assurance Coordinator are standing members of all design reviews held. Other subject matter expertise is added as appropriate. Design elements that integrate safety and quality into the assembly, installation, maintenance and operation of the machine, beamlines and related components are defined early and incorporated, considering input from the ESH Lead, WPC and QA Lead, QA Coordinator, and additional ESH SME's as appropriate.

7-2.2.1 Codes and Standards

Consistent with DOE regulation 10 CFR 851, *Worker Safety and Health Program* [17], the requirement for adherence with specified codes and standards is verified through a defined APS-U design review process, which includes a check to verify that appropriate codes and standards have been utilized. At the time of final design approval, the applicable version of codes and standards will be identified. Because the APS Upgrade spans several years using the code or standard that is either required or is most current at the time of final design for the individual components or work activity ensures compliance of an overall system while avoiding rework of items.

The Long Beamline Building (LBB) will be designed and constructed using the code of record identified at the time of final design approval, consistent with the Argonne Facilities Design Guide [18] revision in place at the time of design approval.

7-2.2.2 Design Reviews

The *APS Design Review Procedure* (APS_000031) [19], defines the APS-U process to evaluate systems and component designs to determine their adequacy in meeting its performance, safety and operational objectives. The process, which implements Laboratory-level LMS-PROC-305, *Design Review*, defines a graded approach to determine the appropriate scope and level of formality and approval for a Design Review. Grading is based on the potential consequence of a failure in the implementation of the design. The grading considers the potential financial, operational, and ES&H consequences of a design failure. The procedure applies to designs for new systems and components, and modifications to existing systems or components to be installed at the APS. This includes mechanical, pressure, cryogenic, electrical, safety, software, conventional construction, APS facility modifications, and shielding systems and components. The procedure is used for designs created by internal or external parties. Depending on the complexity and potential impact on the APS, internal and external panels and SMEs may be included in the review.

The process is facilitated with the support of the PSC Design Review Committee (PDRC). The PDRC assures that the level of the review is commensurate with the complexity of the technical design and intended function, and that all safety aspects of the design are considered. The PDRC also advises on whether follow-on committee review(s) should occur, and whether additional subject matter experts are needed to review specific safety or performance aspects of the design.

From the outset, the safety of the beamline components has been evaluated as the components are designed. When assembled, the beamline components are inspected by the Beamline Commissioning Readiness Review Team and the PDRC. Comments and guidance from each of these reviews provide input to the iterative process of safety design and procedures improvement.

Design reviews of the LBB are conducted in accordance with LMS-PROC-305, and incorporate key APS stakeholders and subject matter experts.

7-2.2.3 Natural Phenomena Hazards Mitigation

The current design of the APS office building and experiment hall has been identified in the *Code of Record Report for Argonne National Laboratory* [20] as having been designed and constructed in accordance with *Uniform Building Code 1991 edition* [21] which considered and addressed mitigation of Hazards posed by natural phenomena. The bulk of the APS Upgrade Project will utilize the current structures without major modifications, thus the original design and construction assumptions are valid:

- Seismic risk of the existing APS structure design and construction was defined by the *Universal Building Code, 1991 edition* (UBC) [21], the code of record, and was considered low, with Argonne residing in Zone 0. Construction met the minimum seismic requirements of the UBC-1991 Chapter 23.
- Wind-loading requirements for the buildings (per the UBC) are specified in the structural design, calculations, and specifications, and are similarly specified for building exterior enclosure systems consistent with the requirements of UBC-1991 Chapter 23. Tornado shelters are designated per Argonne guidelines at interior protected locations within the APS buildings.
- Flooding is not considered to be a likely Hazard because the APS is not in a flood zone, is on high ground, and has few subsurface areas, which all have dedicated sump pumps coupled with 25 years in operation in which record rain events have occurred without issue.

The LBB design and construction is in accordance with the Argonne Facilities Design Guide, [18] current edition at the time of design and approval, with interfaces to grandfathered portions of the building in accordance with the applicable code, standard or procedure in place at the time of the design approval.

Lightning protection and grounding have been included in the design for the entire APS facility, per IBC, NFPA, and National Electrical Code requirements.

7-2.3 Work Planning and Control

Before any work is performed, hazards are identified and analyzed so that appropriate controls can be developed through a formal work planning and control (WPC) process, established through Argonne policy LMS-POL-16, *Work Planning and Control*, and implemented through a site-wide *Work Planning and Control Manual* [22] and APS_1432773, *Work Planning and Control at the APS* [23]

Per LMS-POL-16, Work Planning and Control, when planning and executing work on site, APS must reduce risk to an acceptable level that protects workers, the public, the environment, and the Laboratory.

The Work Planning and Control Manual supports WPC at Argonne through detailing the complete process of planning work, approving the plan, authorizing workers, performing work, and obtaining feedback.

A web-based application, AWARE, is used to conduct the hazard assessment, identify controls, and act as a repository for work control documents. The APS-U WPC and QA Lead, together with the

ESH Lead, subject matter experts, and APS ESH safety staff, support the creation of the work plan, review work packages, evaluate potential worker exposure to chemical, radiological, and physical agents, and determine the need for worker exposure assessments.

Work involving suppliers and subcontractors is conducted in accordance with LMS-PROC-123, *Contractor Safety* [24], and LMS-PROC-221, *Technical Representative and Contractor ESH Representative* [25]. Contractual mechanisms flow down the ESH and QA program requirements, and verification of compliance is accomplished by a combination of the assigned technical representative and the APS-U ESH and QA staff.

7-2.4 Equipment Removal and Assembly/Installation

APS Upgrade Project management recognizes that equipment removal and assembly/installation activities can pose significant Hazards, directly and indirectly. Thus, management will ensure that APS Upgrade Project activities and associated Hazards are evaluated prior to commencement for each phase of work. Typically, for the installation or modification of equipment, a procedure and associated Hazard analysis will be developed. The procedures incorporate Hazard controls, including relevant PPE, and address QA procedures and processes that must be followed to allow for maximum repeatability and consistency. Coordination of removal and installation will be accomplished in conjunction with safety staff to allow review of the overlapping tasks to ensure that any precautions needed due to concurrent activities are addressed and adequately flowed down to the workers and subcontractors involved in the work. Storage ring removal and other infrastructure modifications will be performed over an extended period forecast to last about one year utilizing multiple work shifts. It is possible for beamline installations or modifications to be carried out during operating periods if the work is being performed outboard of the storage ring ratchet wall, with the beamline safety and photon shutters fully closed and utilizing the properly developed work control documents and procedures.

7-2.5 Conduct of Operations

Accelerator facility operation is conducted in a safe and environmentally sound manner, as defined in the *Advanced Photon Source Conduct of Operations Manual* [26], which was prepared in accordance with DOE O 5480.19 Change 2, *Conduct of Operations Requirements for DOE Facilities* [27]. The APS manual implements the 18 chapters of DOE O 5480.19 Change 2 in sequence and supplements the requirements of the Order with Argonne site procedures where applicable. A graded approach is applied when determining which chapters, or which elements of chapters, are applicable to any activity. This means that the elements of the chapters are applied to each activity at a level of detail that is commensurate with the operational importance of the activity and its potential environmental, safety, and/or health impact.

For example, initial operation of the storage ring following Upgrade modifications will be conducted in the same way as the machine studies that precede the start of each operations run. Machine studies are covered in the *APS Conduct of Operations Manual* [26], *Chapter 2, Shift Routines and Operating Practices.*

Following the approval of the *APS Conduct of Operations Manual* [26], the DOE O 5480.19 [27] was replaced by DOE O 422.1 Change 2, *Conduct of Operations* [28]. DOE O 422.1 Change 2 is directly applicable to nuclear facilities, and states that it is only applicable to accelerators when designated by DOE Line Management. At this time, the DOE Argonne Site Office Manager has not designated the directive to apply to the APS, and thus, APS management continued to use the existing *APS Conduct of Operations Manual* [26]. When DOE O 422.1 Change 2 [28] is made applicable to the APS, a revision to the Conduct of Operations Manual will be prepared and submitted to DOE to comply with the directive. It is anticipated that applicability would occur prior to the completion of the APS Upgrade.

7-2.6 Emergency Planning

The APS participates in the Argonne Comprehensive Emergency Management Plan and has developed local area emergency plans for all APS buildings. The emergency management program incorporates documentation, including maps with designated tornado shelters and fire rally points; assignment of area emergency response responsibilities; and periodic drill requirements. The APS Upgrade Project modifications will be incorporated into the emergency management program as the modifications are implemented. It is not anticipated that there will need to be significant changes to the plans or the risk evaluations as a result of the project.

7-3 Quality Assurance

The Quality Assurance (QA) requirements for the APS Upgrade Project are implemented in accordance with DOE Order 413.3B, P*rogram and Project Management for the Acquisition of Capital Assets* and Guide DOE G413-3.2, *Quality Assurance Guide for Project Management*.

Implementation is accomplished using a project quality assurance program based upon the Argonne Quality Assurance Program Plan (QAPP), which defines the Laboratory's approach to meeting the quality assurance requirements listed under its Prime Contract with DOE, and addresses the ten quality assurance criteria contained within Attachment 2 of DOE O 414.1D, *Quality Assurance* [29]. The QAPP is a component of the Laboratory Management System, which has been certified to the ISO 9001:2015 quality standard since 2010. The implementation of the Laboratory quality assurance program is verified by the Laboratory assessment program, internal management reviews, and annual surveillance and recertification audits performed by an independent quality registrar at 3-year intervals.

The APS Upgrade Quality Assurance Program has been designed to implement and manage the following:

- Evaluation and monitoring of commercial suppliers and DOE Partner Laboratories
- Inspection and testing of purchased products
- Prevention of counterfeit items
- Control of nonconforming items and services
- Correction and prevention of quality issues
- Assessments of the project QA Program

The implementation of the quality program includes flowcharts based on information contained in ISO/TC 176/SC 2/N 544R3, *Guidance on the Concept and Use of the Process Approach for*

Management Systems [30]. The use of process flowcharts helps to ensure that the project's quality program is focused on quality assurance requirements that are value-added, make effective use of resources, and provide consistent and measurable results.

The implementation of the project quality program is supported by experienced quality professionals that have the requisite experience, training, and certifications such as those provided by the American Society for Quality (ASQ). Project QA personnel assist project personnel in performing visits to vendor facilities, and reporting and resolving vendor nonconformances. Project QA personnel also evaluate the quality assurance programs of other DOE Laboratories providing items and services to the APS Upgrade Project (i.e., Partner Laboratories), and assist in correcting potential weaknesses.

7-3.1 Component Handling and Acceptance

The APS Upgrade Project will utilize software applications, such as the Component Database and eTraveler System, to facilitate the handling and acceptance of incoming components. The Component Database (CDB) is a software application developed by the APS as a repository for documentation associated with a particular component for the APS-Upgrade Project and its related assemblies throughout its lifetime. The CDB provides links to other information systems, such as the APS drawing repositories, the APS document management systems, and the Argonne procurement system, so that information stored in other information systems can be easily be retrieved.

An eTraveler software application is used to identify and record quality assurance activities performed after a component has been delivered to the APS, including critical component tests and measurements. The eTraveler System replaces a past practice using paper-based travelers. When discrepancies are identified, the discrepancies are managed via electronic Discrepancy Travelers. APS-U has a formal exception from the Laboratory's acceptance criteria and non-conformance reporting processes, which has been documented and approved by the Office of the Director via an ANL-893, *Request for Exception to Internal or External Requirement* [31].

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