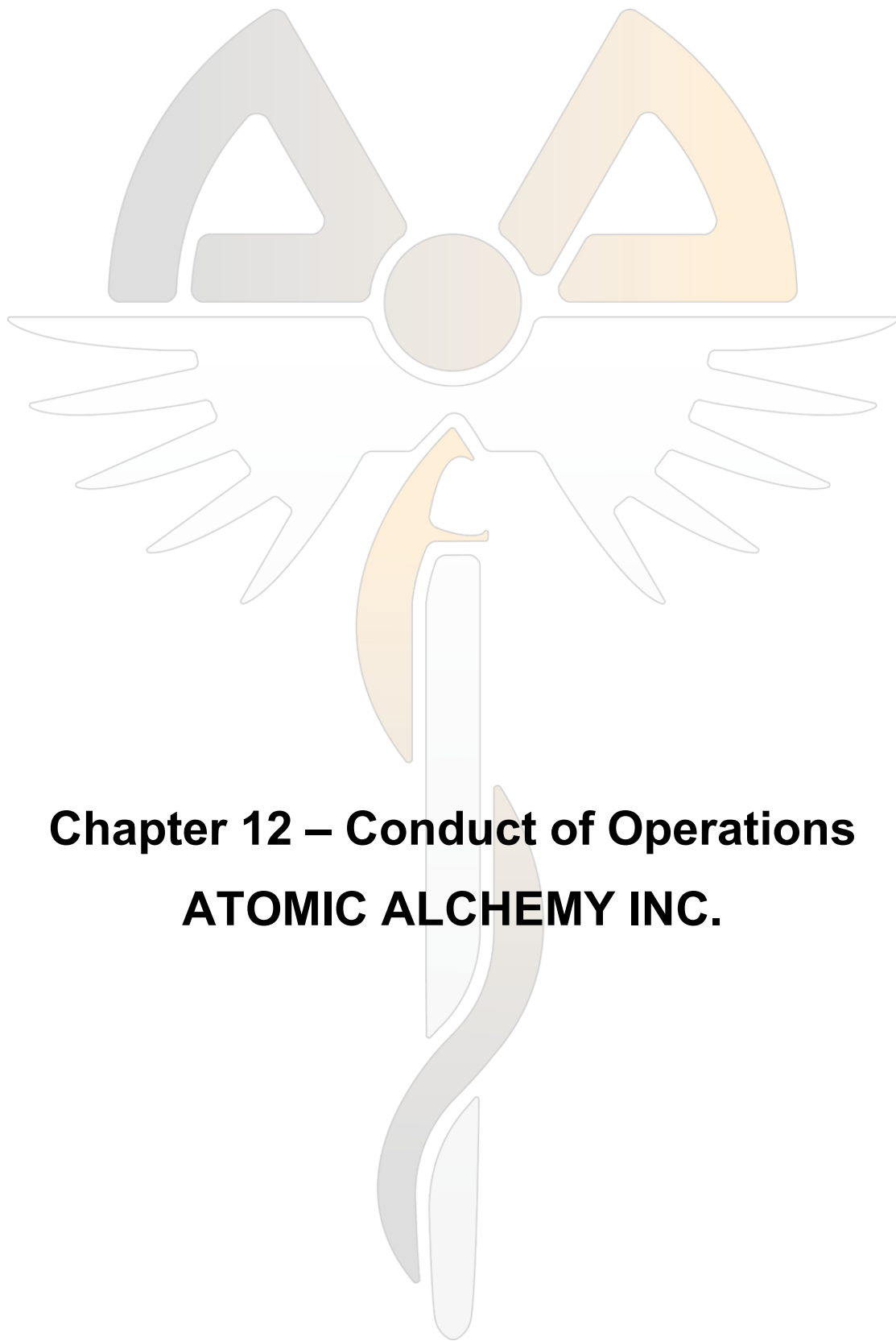




Chapter 12 – Conduct of Operations

ATOMIC ALCHEMY INC.

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CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-1

TABLE OF CONTENTS

Terms	12-3
Acronyms and Abbreviations	12-3
12 Conduct of Operations	12-4
12.0 Introduction	12-4
12.1 Organization	12-4
12.1.1 Structure	12-4
12.1.2 Responsibilities	12-5
12.1.3 Staffing	12-5
12.1.4 Selection and Training of Personnel	12-6
12.1.4.1 Training and Qualification Program (TQP) Administration and General Information ...	12-7
12.1.4.2 Entry-Level Requirements for Key AAI Positions	12-7
12.1.4.3 New Employee Indoctrination	12-9
12.1.4.4 General Employee Training (GET)	12-9
12.1.4.5 Facility-Specific Training (FST)	12-10
12.1.4.6 Hazard-Specific Training (HST)	12-10
12.1.4.7 Program-Specific Training (PST)	12-11
12.1.4.8 Task-Specific Training (TST)	12-11
12.1.4.9 System-Specific Training	12-11
12.1.4.10 Position-Specific Training and Qualification	12-11
12.1.4.11 Review of Compliance with the Requirements of 10 CFR 55, Operators' Licenses	12-12
12.1.5 Radiation Protection Program	12-12
12.2 Review and Audit Activities	12-13
12.2.1 Composition and Qualifications of IRC	12-13
12.2.2 Charter and Rules of IRC	12-14
12.2.3 Review Function	12-14
12.2.4 Audit Function	12-15
12.3 Procedures	12-16
12.4 Required Actions	12-17
12.4.1 Safety Limit Violation	12-17
12.4.2 Release of Radioactivity Above Limits	12-18



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-2

12.4.3	Other Reportable Events.....	12-18
12.4.3.1	Operation with Safety System Settings Less Conservative Than Limiting Safety System Settings (LSSS)	12-18
12.4.3.2	Operation That Violates Limiting Conditions for Operation (LCO)	12-18
12.4.3.3	Safety System Component Malfunction That Renders Safety System Incapable of Performing Its Intended Safety Function.....	12-18
12.4.3.4	Unanticipated or Uncontrolled Reactivity Change Greater Than One Dollar.....	12-19
12.4.3.5	Abnormal and Significant Degradation in Reactor Fuel or Cladding, Coolant Boundary, or Containment Boundary	12-19
12.4.3.6	Observed Inadequacy in Implementation of Administrative or Procedural Controls Important to Safety.....	12-19
12.4.4	Other Actions	12-19
12.5	Reports.....	12-19
12.6	Records	12-22
12.6.1	Lifetime Record	12-22
12.6.2	Five Year Record.....	12-22
12.6.3	Records To Be Retained For At Least One Certification Cycle	12-22
12.7	Emergency Planning	12-23
12.8	Security Planning	12-23
12.8.1	Fitness for Duty	12-24
12.8.2	Access Authorization	12-24
12.9	Quality Assurance	12-24
12.10	Operator Training and Requalification	12-24
12.11	Startup Plan	12-25
12.12	Vacated (Formerly “Environmental Review,” Moved to Chapter 19).....	12-26
12.13	Material Control and Accounting Program	12-26
12.14	References	12-27
12.15	Appendices	12-28

LIST OF FIGURES

N/A



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-3

LIST OF TABLES

Table 12-1. Minimum entry-level education and experience requirements for key AAI positions	12-8
Table 12-2. Report Requirements and Implementation Summary	12-19

TERMS

ACRONYMS AND ABBREVIATIONS

Common acronyms, abbreviations, and units of measurements may not be included here as it is assumed the reader is familiar with their meaning.

AAI	Atomic Alchemy Inc.
ALARA	as low as reasonably achievable
CFR	<i>Code of Federal Regulations</i>
FSAR	final safety analysis report
FST	facility-specific training
HST	hazard-specific training
GET	general employee training
IRC	Independent Review Committee
ISG	Interim Staff Guidance
MC&A	material control and accounting
PDD	Program Description Document
PSAR	preliminary safety analysis report
PST	program-specific training
QAP	Quality Assurance Program
RO	reactor operator
RPP	Radiation Protection Program (used synonymously with Radiation Safety Program)
RSO	Radiation Safety Officer
SNM	special nuclear material
SRO	senior reactor operator
SSC	structures, systems, and components
TQP	Training and Qualification Program
TST	task-specific training



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-4

12 CONDUCT OF OPERATIONS

12.0 INTRODUCTION

Chapter 12 of the Atomic Alchemy Inc. (AAI) SAR discusses the conduct of operations for the facility pursuant to Title 10 of the *Code of Federal Regulations* (CFR) 50.34, "Contents of applications; technical information." This chapter forms the basis of the Technical Specifications, Chapter 14, Appendix A, Section 6, "Administrative Controls." AAI utilizes a graded approach to implement requirements and guidance, as appropriate.

This chapter will be updated in the FSAR, pursuant to 10 CFR 50.34(b), to provide evidence that operating phase plans, programs, and procedures have been or are being implemented. Because this chapter covers topics involved in the operation of the facility, detailed discussions of several topics is deferred to the FSAR, as noted.

12.1 ORGANIZATION

The AAI organizational structure defines responsibilities and staffing, including the selection and training of personnel. AAI management and staff are:

- knowledgeable about the technical requirements for safe facility operation,
- responsible for compliance with regulations and license conditions, and
- accountable for implementing the Radiation Protection Program (RPP) and other safety programs to protect the health and safety of the public, staff, environment, and facility.

12.1.1 Structure

The AAI organizational structure is designed to ensure that quality work is performed safely and effectively, while meeting or exceeding requirements. The AAI organization consists of personnel with responsibility for design, procurement, construction, testing, operation, and maintenance of the facility. Implementing programs and procedures assign specific responsibilities and duties and define organizational interfaces involved in conducting activities and duties within the scope of the AAI Quality Assurance Program (QAP).

The AAI organizational structure is composed of four levels, consistent with the organizational framework outlined in Section 6, Administrative Controls, of ANSI/ANS-15.1-2007, "The Development of Technical Specifications for Research Reactors," and is summarized below:

- Level 1: The most senior AAI individual, the Chief Executive Officer (CEO), is ultimately responsible for the facility license. The second-most senior AAI individual, the Chief Operating Officer (COO), collaborates with the CEO to ensure the safe operation of the facility.
- Level 2: Senior AAI managers and staff are responsible for managing specific functional areas, as assigned by the CEO or COO, and for supervising the personnel who report to them.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-5

Level 3: Line managers, supervisors, and technical leads are responsible for the day-to-day management of activities and operations in their assigned areas, and they have the authority and responsibility to maintain open and direct communication with peers and upper-level managers.

Level 4: Individuals are responsible for conducting operations or activities that directly support facility operations.

The AAI organization structure is depicted and described in the Appendix 12A, “Quality Assurance Program” PDD-001, Section 2.1.

The Chief Executive Officer (CEO) holds ultimate responsibility for the safe operation of the AAI facility, including protecting the public and facility personnel from undue radiation or chemical exposure, ensuring compliance with the operating license and technical specifications, and safeguarding the environment. This responsibility extends through the management chain of command to every employee and contractor, consistent with their assigned duties and contractual obligations.

12.1.2 Responsibilities

Responsibilities for each function shown in the organization structure are described in PDD-001 Rev 2, Section 2.1, included as Appendix 12A of this PSAR.

12.1.3 Staffing

Minimum numbers of staff at the facility during all modes of operation, including exceptions, contingencies, or both, will be established and maintained. Conditions may require initiation of emergency plan actions such as notifications and evacuations. This will include a combination of licensed senior reactor operators (SROs), reactor operators (ROs), radiation safety personnel, laboratory, industrial, and chemical safety personnel, and technical and managerial support personnel as appropriate. For example, an SRO will be required to be in the reactor control room during

- initial startup and approach to power,
- all fuel or control-rod relocations within the reactor core region,
- relocation of any experiment with reactivity worth greater than one dollar, and
- recovery from unplanned or unscheduled shutdown or significant power reduction.

The minimum types, numbers, locations, and contacts for these staff, including those readily available on call, will be formally documented and physically available to operations personnel at key locations at the facility and offsite—summary information will be included in the FSAR. Staffing at the AAI reactor facility will meet the requirements of 10 CFR 50.54, “Conditions of Licenses,” and 10 CFR 55, “Codes and Standards.”

The detailed operating organization along with the minimum types, numbers, and locations of operations and operations support staff will be included in the FSAR.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-6

12.1.4 Selection and Training of Personnel

Applicable requirements from 10 CFR Parts 19, 20, 21, 30, 37, 40, 50, 70, 71, 73, and 74 will be addressed in AAI's QAP-level Training and Qualification Program, along with appropriate procedures to implement the program.

Applicable portions of this program will be implemented prior to the start of construction and will continue to be refined and implemented as activities progress towards nuclear operations. The licensed SRO and RO training and qualification plans (specifically addressed in Section 12.10) will ideally, be implemented within 3 months of NRC's issuance of an operating license to AAI.

The personnel training program will be developed in accordance with ANSI/ANS-15.4-2016, "Selection and Training of Personnel for Research Reactors," and will incorporate the systems approach to training as defined in 10 CFR 55.4, "Definitions." The program will address the selection and training of personnel in all positions associated with the safe operation of the AAI facility. Training requirements will be commensurate with each individual's level of responsibility and will provide reasonable assurance that decisions and actions during all modes of operation support safe facility operations. The program will provide for training and qualification of the following categories of facility personnel:

- Licensed operator (addressed in Section 12.10)
- Non-licensed operator
- Shift supervisor
- Shift technical advisor
- Instrument and control technician
- Electrical maintenance personnel
- Mechanical maintenance personnel
- Radiological protection and safety (used synonymously with health physics) technicians and engineers or health physicists
- Chemistry technician
- Engineering support personnel
- Independent Review Committee (IRC) personnel

The program will address implementation of personnel selection and training requirements for all key technical, managerial, and operational positions, from cradle to grave, i.e., including, but not limited to

- Definition of specific job functions, tasks, responsibilities, skills, and physical and mental attributes necessary, and minimum requirements for academic education, job-related experience, training, qualification, licensing, and requalification
- Identification and selection of potential candidates, interviews, verification of credentials, and hiring
- Types of training, e.g., classroom, on-line or computer-based, hands-on or on-the-job training, practical demonstrations, written and oral examinations, qualification and licensing, and requalification



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-7

- Content of training, e.g., purpose, learning objectives, fundamental knowledge, hazards, lessons learned, etc.
- Frequency of training, e.g., initial or continuing
- Health requirements
- Fitness for duty aspects
- Potential radiological, chemical, and industrial hazards, safety and health programs, monitoring, notifications, reporting, records, associated worker responsibilities and rights
- Violations and penalties

12.1.4.1 Training and Qualification Program (TQP) Administration and General Information

Responsibility for development and administration of the AAI TQP is assigned to the AAI Level 3 QA Manager. The AAI TQP will:

- Incorporate instructional requirements necessary to ensure qualified personnel can operate and maintain the facility safely in all modes of operation.
- Comply with the facility license, including all technical specifications and applicable regulations.
- Provide training curricula with sufficient detail to meet objectives, including scope, applicability, learning objectives, trainee responsibilities, technical and administrative content, and lessons learned.
- Ensure instructors are adequately trained and qualified to deliver instruction.
- Document and control all training and qualification curricula in accordance with the AAI Document Management Program.
- Undergo periodic evaluation and revision to reflect AAI and industry experience as well as changes to the facility, procedures, regulations, and QA requirements.
- Be periodically reviewed by AAI management for effectiveness and program integrity.
- Maintain sufficient records in accordance with the AAI Records Management Program, ensuring availability for NRC inspection to verify program adequacy.
- Safeguard records containing personally protected information in accordance with AAI's Controlled Unclassified Information Program.

12.1.4.2 Entry-Level Requirements for Key AAI Positions

Table 12-1 provides a general summary of minimum entry-level education and experience requirements for key AAI positions. All positions require that individuals are capable of meeting health, fitness for duty, and security requirements when applicable for specific tasks and access to certain facilities or areas. Additional requirements will be prescribed in program descriptions and procedures.

Sections 12.1.4.3 through 12.1.4.10 describe specific training elements that are part of the AAI TQP.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-8

Table 12-1. Minimum entry-level education and experience requirements for key AAI positions

Position	Ideal Entry Level Education	Recommended Entry Level Experience
Level 1: • CEO • COO	Baccalaureate degree in Engineering or Scientific Field	6 years nuclear experience across university, commercial, government, or military entity 3 years education and or experience in business (may be overlapped with other experience requirement)
Level 2: • QA Manager • IRC Chairperson and Alternate	Baccalaureate degree in Engineering or Scientific Field	6 years nuclear experience across university, commercial, government, or military entity 3 years experience in line management / personnel supervision (may be overlapped with other experience requirement)
Level 3: • Managers and Technical Leads • Supervisory SROs • Shift Supervisors • Radiation Safety Officer	Baccalaureate degree in related field; or Associate degree plus Formal Certification or 4 years work in applicable field from professional, education, government, or military entity	3 years relevant experience across university, commercial, government, or military entity (A maximum of 2 years equivalent full-time academic training may be substituted for 2 of the 3 years of nuclear experience required.) 1 year experience in line management / personnel supervision (may be overlapped with other experience requirement; 120 hours maximum (10 hours per month) of formal education or training in line management or supervisory topics may be substituted for this experience requirement)
Level 4: • Engineers • Other Professional Technical Staff	Baccalaureate degree or higher in related field	3 years job-related experience in applicable field Some nuclear experience preferred



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-9

Position	Ideal Entry Level Education	Recommended Entry Level Experience
Level 4: Licensed Operator Positions: • SROs • Ros	HS Diploma or GED (Associate degree or higher preferred)	2 years job-related experience in applicable field 1 year nuclear experience at university, commercial, government, or military entity preferred (may be overlapped with other experience requirements)

12.1.4.3 New Employee Indoctrination

New Employee Indoctrination is an element of AAI's TQP which is provided to new AAI employees early in their employment with AAI. This training element provides new employees with general information pertinent to:

- Organization structure and chain of command
- Regulators and inspectors
- AAI code of conduct
- Work location and support areas
- Access, alarms, responses, and notifications
- Co-workers and mentors
- Job responsibilities
- Training and qualification requirements
- Protection of information and technology
- Employee concerns and communications
- Tools and resources

12.1.4.4 General Employee Training (GET)

All employees (including contracted employees) are required to receive general employee training (classroom or web-based) within the first couple of months after reporting to AAI for work. Once an employee satisfactorily completes the initial GET, a biennial refresher is required thereafter. Aspects of this training may be required for visitors as well, as determined on a case-by-case basis. It provides more information than the New Employee Indoctrination on more specific activities performed by AAI, plus technical background, including:

- General mission
- Governing regulations
- Stakeholders
- Facilities and locations
- Access, alarms, responses, and notifications
- Radiation protection (including requirements of 10 CFR 19.12, "Instructions to Workers")
- Chemical, physical, and industrial hazards
- Waste management, waste minimization, and pollution prevention



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-10

- Alarms, notifications, and associated employee actions
- Basic nuclear, health physics, and reactor technology
- Cyber and operational security
- Key processes and documents
- Safety conscious work environment
- Performance improvement

12.1.4.5 Facility-Specific Training (FST)

Individuals assigned to work in specific facilities are required to complete FST for their assigned facility or facilities prior to being able to work at the facility without being escorted by a qualified employee. Initial FST includes classroom training and a facility walk-through by facility management. Periodic refresher FST are also required to highlight lessons learned and new or changed features pertinent to the facility. The focus of FST is on details pertinent to the subject facility, such as:

- Facility organization and chain of command
- Access and escort requirements
- Activities conducted and associated hazards
- Key facility structures, systems, and components (SSCs)
- Normal and potential abnormal operations
- Response to alarms, notifications, and emergencies
- Personnel and equipment resources

12.1.4.6 Hazard-Specific Training (HST)

Individuals assigned to work with or in areas where hazardous materials or equipment are used or stored, including visitors when appropriate, are required to be trained and qualified to safely perform their work regarding the respective hazard(s). Examples of hazardous materials or equipment include radioactive material, chemicals with hazardous properties such as corrosive, explosive, reactive, etc., equipment that is dangerous and require certain safety precautions, such as ladders, confined spaces, loud noises, etc. Methods for HST vary depending on the hazard, but may include classroom training, demonstrations, hands-on practice in detecting and measuring hazardous properties, and in donning and doffing protective clothing and equipment, on-the-job training, etc. Periodic refresher HST will also be provided which highlights lessons learned and new or changed aspects of the subject hazard. The focus of HST is on details pertinent to the hazard, such as:

- Safety Data Sheets
- Hazardous properties
- Exposure limits
- Exposure pathways and consequences
- Personnel protective equipment and other safety equipment, locations, and procedures
- Safety requirements and practices
- Monitoring
- Notifications and reporting
- Lessons learned, etc.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-11

12.1.4.7 Program-Specific Training (PST)

Program-specific training and qualification requirements for AAI's programs and procedures are specified within each Program Description Document (PDD) or procedure when applicable. Refresher training and requalification may be required as well.

12.1.4.8 Task-Specific Training (TST)

TST addresses specific training for certain tasks. Tasks may be physical, e.g., replace a glove in a glovebox, or administrative in nature, e.g., report a nonconformance. Procedures are typically used by task performers. Tasks may be routine, e.g., review logbooks weekly, or performed only once or seldomly, e.g., replace a pump. It may involve several types of training, e.g., classroom, demonstration, procedure walk-through, on-the-job training, etc. Procedures or other work instructions prescribe required TST for the task(s) to be performed, when applicable.

12.1.4.9 System-Specific Training

System-specific training is focused on one or more specific systems; it covers all aspects of a particular system. It may consist of classroom, self-study, demonstration, on-the-job training, etc. It may include refresher training and requalification, depending on responsibilities related to a certain system and on complexity of the system. Specific system operating or maintenance procedures specify the training and qualification/requalification requirements. Topics include, but are not limited to:

- System identifier and name
- Description
- Purpose and fundamental technical information
- Boundaries and interfaces
- Components
- Design and licensing bases
- Safety, seismic, and quality classifications
- Technical specifications
- Operations (normal, abnormal, and emergency)
- Inspections, testing, and monitoring
- Maintenance
- Replacement
- Final disposition

12.1.4.10 Position-Specific Training and Qualification

Certain positions have specific training and qualification requirements, which may be established by professional standards, government regulations, or industry guidance. Position-specific TQP requirements are prescribed in qualification documents or, when appropriate, in applicable procedures. The Training and Qualification Program for licensed operators is addressed in Section 12.10.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-12

12.1.4.11 Review of Compliance with the Requirements of 10 CFR 55, Operators' Licenses

Per NUREG-1537 Part 2, Section 12.1.4 "Acceptance Criteria," a summary matrix that shows applicable requirements of 10 CFR 55, "Operators' Licenses," and how and where each is addressed in the AAI SAR, programs, and procedures, will be prepared. This matrix will be included along with the TQP Plan for ROs and SROs in the FSAR.

See Section 12.10 for additional information.

12.1.5 Radiation Protection Program¹

The RPP meets applicable requirements of 10 CFR 20, "Standards for Protection Against Radiation." This program is further described in Chapter 11 of this SAR. AAI implements this program commensurate with the risks posed by specific operations. The facility incorporates, to the extent practicable, engineering controls and procedures, based upon sound radiation protection and waste management principles, to achieve occupational doses to facility personnel, doses to members of the public, and allowable releases to the environment that are as low as reasonably achievable (ALARA). This program will be reviewed at least annually, as required by 10 CFR 20.1101(c). Sufficient resources in terms of staffing and equipment will be provided to effectively implement this program.

Overall responsibility for the RPP rests with the AAI CEO who collaborates with the COO for the safe operation of the facility. The CEO delegates direct program implementation to the Radiation Safety Officer (RSO). The RSO works closely with other AAI managers and staff to ensure consistent interpretations of radiation safety requirements, support operations, and perform independent reviews related to radiation safety.

The RSO will be responsible for:

- Providing technical direction to health physics technicians
- Implementing the RPP
- Updating the RPP and associated procedures based upon lessons learned from past AAI and other facilities' operating lessons learned
- Ensuring that ALARA is practiced by personnel
- Monitoring occupational doses to ensure the 10 CFR Part 20 limits are not exceeded under normal operations
- Assigning health physics technicians to support normal operations in the facility
- Selecting appropriate radiation monitoring equipment and overseeing its calibration
- Overseeing and providing (or contracting) RPP training to personnel
- Posting restricted areas, and within these areas, posting radiation, airborne radioactivity, high radiation, and contaminated areas as appropriate

Health physics technicians assigned to support operations in a specific facility will be directly supervised while in the facility by a Level 3 Facility Operations Manager or Shift Supervisor. The RSO will either be in the facility or will be on-call to assist in resolving RPP-related questions and concerns

¹ AAI uses the terms "Radiation Protection Program" and "Radiation Safety Program" synonymously.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-13

from the health physics technicians and the Operations Shift Supervisor. The RSO and health physics technicians, as with all AAI operating staff, have the responsibility and authority to interdict or terminate licensed activities that are believed to be unsafe or non-compliant to quality requirements. In such cases, operations will be halted to a “safe-hold” point and not commence until the concern is satisfactorily resolved, either through an informal “time-out” and discussion among the staff member raising the concern, operators, and the Shift Supervisor, or through a formal “stop-work” declaration and subsequent discussion and resolution among applicable parties.

Escalation of a safety or quality concern by any employee beyond a time-out to a formal stop-work declaration that requires Level 2 senior management participation and resolution (up to the Level 1 CEO if not unanimous among Level 2 management) is expected to be very rare. AAI policies include the expectation that all employees have questioning attitudes and situational awareness and deserve questions or concerns to be satisfactorily addressed in a respectful and timely manner.

12.2 REVIEW AND AUDIT ACTIVITIES

This section focuses on review and audit activities for AAI’s facility. Review and audit activities are fundamental to developing, implementing, and improving processes; and, for unplanned situations and events, in identifying, responding to, categorizing, reporting, determining, and implementing corrective and preventive actions and assessing their effectiveness. AAI fully endorses robust review and audit programs that involve both internal and external processes, as they are important to safe operations and protection of workers, the public, and the environment. They improve overall quality and safety, promote continuous improvement, and facilitate discovery and correction of problems before they become regulatory enforcement issues. These activities crosscut several nuclear safety and QA criteria, as addressed where applicable in the AAI QAP (PDD-001), appended as Appendix 12A.

12.2.1 Composition and Qualifications of IRC

As described previously in Section 12.1.2.5 and 12.1.2.6, the IRC will be appointed by and will directly report to the AAI CEO or COO, to perform independent review and audit activities as described in various AAI QAP-level PDDs and implementing procedures. An IRC Chairperson, members, and alternates will be appointed. Minimum entry-level and training and qualification requirements for these individuals are described in Section 12.1.4.2.

The IRC may include both internal and external organizations, and will represent a broad spectrum of expertise, e.g. nuclear, mechanical, electrical, instrumentation and control, and chemical engineering; radiation, laboratory, chemical, and industrial safety; operations and maintenance; and QA. When specific activities or documents require IRC review or audit, at least two IRC members plus the IRC Chairperson, or their alternates as applicable, that collectively have appropriate expertise associated with the review or audit scope, will be tasked accordingly. The IRC Chairperson may call upon additional members or a subgroup to participate in a review or audit based on the complexity of the topic being reviewed or audited. IRC approval or concurrence, as applicable per the specific audit or review procedure, will be required. In the case that other Level 3 or Level 2 management approval or concurrence is required, and such management disagrees with the IRC Chairperson, final resolution will



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-14

be elevated to be decided by the CEO. The IRC Chairperson and all members for any specific review or audit activity will not be allowed to participate if they perform, supervise, or have concurrence or approval authority relative to the items or activities being reviewed or audited. In such cases, alternates or other members, as applicable, would be required to fulfill the IRC review or audit function.

12.2.2 Charter and Rules of IRC

A formal charter and rules of conduct for the IRC shall be developed and maintained. As a minimum, the following will be required regarding IRC activities.

- The IRC Chairperson, members, and alternates will meet as a whole at least annually to discuss past, planned, and potential other recommended review and audit activities, focusing on lessons learned and potential improvements.
- All IRC activities and results will be documented and distributed to affected personnel in a timely manner (not to exceed 1 month following completion of a review or audit, or sooner as required by task-specific procedure, e.g., the review of a change, test, or experiment per 10 CFR 50.59, or as otherwise stated within this SAR for specific activities).
- Summary-level IRC activity reports will be periodically developed (at least annually) and provided to all Level 1, Level 2, and Level 3 personnel.
- Notifications and reports for activities involving the IRC will also be provided to NRC when required.
- As stated previously, IRC participation in reviews and audits requires at least two members plus the IRC Chairperson, which is considered a quorum. For IRC activities where more than the minimum participants required are assigned to the activity, IRC decisions will be based on the majority votes. In case of a tie vote, the IRC Chairperson vote breaks the tie.
- IRC membership constituting the majority vote for any specific activity shall not include IRC members from the same organization as is responsible for the item or activity being reviewed or audited.

An IRC charter, including rules for conduct and performance, will be developed prior to the start of operations, and will be available during NRC inspections.

12.2.3 Review Function

All documents generated by an AAI staff member are required to be reviewed by a peer or supervisor who is technically competent in the document subject matter, beyond the primary author. For many document types, additional reviews beyond the peer or supervisor are required, as specified by applicable procedures for generating the respective document type.

The following documents are required to be reviewed by the IRC prior to implementation:



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-15

- Determinations that proposed changes in equipment, systems, test, experiments, or procedures are allowed without prior authorization by the responsible authority, for example, 10 CFR 50.59 or 10 CFR 830, as described in AAI's Safety Authorization Bases Review procedure
- All new procedures and major revisions thereto having safety significance, proposed changes in reactor facility equipment, or systems having safety significance
- All new experiments or classes of experiments that could affect reactivity or result in the release of radioactivity
- Proposed changes in technical specifications, license, or charter
- Violations of technical specifications, license, or charter, and violations of internal procedures or instructions having safety significance
- Operating abnormalities having safety significance
- Reportable occurrences as described in Section 12.4
- Audit reports
- Corrective and preventive action plans to address internal and external audit reports
- Others as determined and requested to be reviewed by a Level 2 manager or the Level 1 CEO or COO

12.2.4 Audit Function

The AAI audit function is addressed in its Assessment Program and implementing procedures. Audits will be selective but comprehensive. They will include examination of records, logs, and other associated documents. Discussions with cognizant personnel and observation of operations will be used also as appropriate. Individuals immediately responsible for an activity or item being audited shall not serve as an audit team member in an independent audit for their respective item or activity.

Audits will be planned, and the plans will be documented prior to the start of the audit. Organizations will be notified of audits in advance of the planned start of the audit, and all appropriate audit plans and checklists will be provided by the auditing entity prior to the start of the audit.

Audit results will be documented. The audited organization will be allowed to provide comments on the results in a timely matter to the audit team leader prior to the audit report being approved.

Deficiencies that affect facility safety or quality discovered during the audit will be communicated to the applicable shift supervisor and up through the applicable chain of command as quickly as practicable, no later than the end of the day when the deficiency is discovered. If required, the deficiency will be reported to NRC per Sections 12.4 and 12.5.

Audit reports will be finalized and provided in a timely manner to the AAI CEO, COO, and other managers responsible for items and activities included in the scope of the audit.

AAI will expeditiously determine the extent of conditions for any deficiencies found in the audit and will develop and document corrective and preventive actions.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-16

The following items important to safety will be subject to audits performed by the IRC:

- Reactor operations for conformance to Technical Specifications and applicable license or charter conditions, at least once per calendar year (with interval between audits not to exceed 15 months)
- The retraining and requalification program for the operating staff: at least once every other calendar year (interval between audits not to exceed 30 months)
- The results and effectiveness of action taken to correct those deficiencies that may occur in the reactor facility equipment, systems, structures, or methods of operations that affect reactor safety: at least once per calendar year (interval between audits not to exceed 15 months)
- The reactor facility Emergency Plan and implementing procedures: at least once every other calendar year (interval between audits not to exceed 30 months)

12.3 PROCEDURES

Administrative and operating procedures that will be used by facility personnel to ensure that routine operating, off-normal, and emergency activities are conducted in a safe manner. The PDD-001 describes procedural document control, record retention, adherence, assignment of responsibilities, and changes. These will be further described in AAI's Documents and Records Management Program and implementing procedures. These programs and the implementing procedures have been established per the guidelines in Section 6.4, "Procedures" of ANSI/ANS-15.1-2007.

Activities will be performed in accordance with written, reviewed, and approved procedures, prior to performance. Minimum reviews and approvals for categories of procedures will be specified within the Document Management Program and will be documented within each procedure. Reviews of procedures and other documents that are required to be evaluated/approved by NRC in advance of implementation and major changes thereto will include the IRC and will be approved by the CEO, COO, or designated alternate. Current procedures will be readily available to users. Temporary deviations from the procedures that are verified to fall within the current safety authorization bases may be made by the responsible SRO or higher-supervisory or management individual present, to deal with special or unusual circumstances or conditions. Such deviations shall be documented and reported within 24 hours or the next working day to the Level 1 COO, Level 2 management, or designated alternate.

Procedures that address at least the following operational activities will include, but are not limited to

- startup, operation, and shutdown of the reactor SSCs,
- fuel loading, unloading, and movement,
- target loading, unloading, and movement,
- maintenance of major components of systems that could negatively impact reactor safety,
- surveillance checks, calibrations, and inspections required by the technical specifications or those that may negatively impact reactor safety,



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-17

- personnel radiation protection, consistent with applicable regulations or guidelines, and the management commitment and programs to maintain exposures and releases ALARA,
- administrative controls for operations and maintenance and for the conduct of irradiations for experiments and radioisotope production that could affect reactor safety or reactor core reactivity,
- implementation of required plans such as those listed at the end of Section 12.4.4,
- use, receipt, storage, and transfer of by-product, source, and special nuclear material (SNM), as applicable, and
- implementation of requirements and administrative controls for reviews, approvals, assessments and audits, notifications, reporting, and actions regarding anomalies, nonconformances, non-compliances, violations, and abnormal, accident, emergency, and security events.

12.4 REQUIRED ACTIONS

This section lists events considered as reportable events, and the actions required to be taken for each.

12.4.1 Safety Limit Violation

Safety limits are limits on important process variables that are found to be necessary to reasonably protect the integrity of the principal physical barriers that guard against the uncontrolled release of radioactivity. In accordance with ANSI/ANS-15.1-2007, Section 6.6, "Required Actions," the following actions will be taken in case a safety limit (listed in SAR Chapter 14, Section 2.1) violation occurs:

- The reactor will be shut down and reactor operations will not be resumed until authorized by the NRC, consistent with 10 CFR 50.36(c)(1).
- The safety limit violation will be promptly reported up to the CEO.
- The safety limit violation will be promptly reported by the CEO, COO, or designated alternate, to the NRC verbally as soon as practicable, but no later than the following working day, which will be confirmed in writing via phone or e-mail.
- The facility manager, or alternate, with input from individuals involved in operations when the violation occurred, will assess circumstances around the violation, and prepare a report that describes
 - applicable circumstances leading to the violation including the cause and contributing factors,
 - results of extent of conditions review,
 - effect of the violation upon reactor or applicable radioisotope production SSCs, and the health and safety of workers, the public, and the environment, and



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-18

- the corrective and preventive actions taken or planned to be taken to prevent recurrence.
- The report will be reviewed by the IRC and approved by the CEO, COO, or designated alternate.
- The AAI-approved report will be provided to the NRC by the CEO or COO, no later than 14 days after occurrence of the event.
- The report will be updated with any additional information pertinent to the event, if applicable, and the updated version will be provided by the CEO or COO, to the NRC when formal authorization is sought to resume operations of the reactor or radioisotope production process.

12.4.2 Release of Radioactivity Above Limits

Depending on what is required to correct the occurrence of releasing radioactivity above limits, the required action is to either shut down the reactor, or to return operations to normal. If shutdown is necessary, return to normal operations may not be resumed without the Level 1 COO (or alternate) authorization. Reporting actions are the same as described in section 12.4.1.

12.4.3 Other Reportable Events

The following other reportable events, consistent with ANSI/ANS-15.1, require the same reporting actions as described in section 12.4.1 above.

12.4.3.1 Operation with Safety System Settings Less Conservative Than Limiting Safety System Settings (LSSS)

LSSS are specified in Chapter 14, Section 2.2, and further discussed in applicable other sections of the SAR where the LSSS are derived.

12.4.3.2 Operation That Violates Limiting Conditions for Operation (LCO)

LCOs are specified in Chapter 14, Section 3, and further discussed in applicable other sections of the SAR where the LCOs are derived. LCOs are those administratively established constraints on equipment and operational characteristics that shall be adhered to during operation of the facility. The LCOs are the lowest functional capability or performance level required for safe operation of the facility. Deviations from LCOs may be allowed under specified conditions that do not impact safety, such as action statements as used in NUREGs-1434 through -1440 in which case the event is not reportable.

12.4.3.3 Safety System Component Malfunction That Renders Safety System Incapable of Performing Its Intended Safety Function

If the malfunction or condition is caused by maintenance, then no report is required. Where components or systems are provided in addition to those required by the technical specifications, the failure of the extra components or systems is not considered reportable provided that the minimum numbers of components or systems specified or required perform their intended safety function.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-19

12.4.3.4 Unanticipated or Uncontrolled Reactivity Change Greater Than One Dollar

A smaller allowable reactivity change, as defined in Chapter 14, is allowed, and not considered reportable. Reactor trips resulting from a known cause are excluded from reporting.

12.4.3.5 Abnormal and Significant Degradation in Reactor Fuel or Cladding, Coolant Boundary, or Containment Boundary

The AAI reactor facility does not require a containment. Minor leaks from the confinement boundary are not reportable.

12.4.3.6 Observed Inadequacy in Implementation of Administrative or Procedural Controls Important to Safety

This event is reportable if the inadequacy causes, or could have caused, the existence or development of an unsafe condition regarding reactor operations.

12.4.4 Other Actions

Other applicable actions required by NRC and other regulations, guidance documents for implementation of regulatory requirements, and AAI's programs and procedures, will be taken by AAI as necessary. Examples include, but are not limited to required actions associated with:

12.5 REPORTS

Key information pertaining to reports that are required to be provided to the NRC, including the content, timing, and distribution of such reports are addressed by this section. **Table 12-2** below provides preliminary information. AAI commits to provide all required reports to the NRC within the timeframe required, per 10 CFR 50.4, and other requirements and NRC-endorsed guidance. All required reports will be listed and tracked in AAI's Commitments Program.

Distribution of written reports will include the NRC Document Control Desk, NRC Region IV Administrator, and NRC Resident Inspector (if assigned by NRC). Verbal notifications, when required, will be provided to the NRC Operations Center, NRC Region IV Administrator, and NRC Resident Inspector (if assigned by NRC). Additional distributions and notifications will be made pursuant to specific regulations and guidance, as applicable.

Table 12-2 will be updated, as applicable, in the FSAR.

Table 12-2. Report Requirements and Implementation Summary

Regulation or Guidance Reference	Topic/Content to be Reported	Required Timing of Report
10 CFR 50.36a(a)(2) 10 CFR 50.59(d)(2)	Routine Operating Report Operating summary narrative, Unscheduled shutdowns, including corrective & preventive actions,	1 month after end of calendar year, not to exceed 12 months from prior year's report.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-20

Regulation or Guidance Reference	Topic/Content to be Reported	Required Timing of Report
ANSI/ANS-15.1-2007, Section 6.7.1, Operating Reports	Major preventive and corrective maintenance important to safety, Major changes in facilities and procedures, results of USQEs that did not require NRC authorization prior to implementation, per 10 CFR 50.59* Radioactive effluents released or discharged, Summarized result of environmental surveys performed outside facility if Part 20 limits are exceeded, and Worker and visitor exposures which were greater than 25% of allowed.	(*Note: 10 CFR 50.59(d)(2) requires a report containing a brief description of any changes, tests, and experiments, including a summary of the evaluation of each, be submitted at intervals not to exceed 24 months; AAI will include this information in its annual operating report.)
ANSI/ANS-15.1-2007, Section 6.7.2, Special Reports (1)	Event Occurrence Reports (as described in sections 12.4.1 through 12.4.3.	Event reported verbally to the NRC as soon as practicable, but no later than the following working day, which will also be confirmed in writing via facsimile or e-mail within the same period. AAI-reviewed and approved written occurrence report no later than 14 days after occurrence of the event.
ANSI/ANS-15.1-2007, Section 6.7.2, Special Reports (2)(a)	Level 1 or Level 2 Permanent AAI Personnel Change(s)	Written report to NRC no later than 30 days after change.
ANSI/ANS-15.1-2007, Section 6.7.2, Special Reports (2)(b)	Significant Changes in Accident Analysis as Described in SAR (If changes are outside of NRC authorization bases per 10 CFR 50.59 process, then NRC approval would be required prior to implementation.)	Written report to NRC no later than 30 days after change.
10 CFR 50.4 10 CFR 50.54(p)(2) 10 CFR 73.71	Revisions and change history/description of the Safeguards Contingency Plan (if applicable), Physical Security Plan, Guard Training & Qualification Plan, or Cyber Security Plan that do not decrease their effectiveness, hence can be implemented without prior NRC approval	Written report describing changes within 60 days after change is made.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-21

Regulation or Guidance Reference	Topic/Content to be Reported	Required Timing of Report
10 CFR 50.4 10 CFR 50.54(q)(5)	Revisions and change history/description of the Emergency Plan that do not reduce its effectiveness, hence can be implemented without prior NRC approval	Written report to NRC no later than 30 days after change is effective.
10 CFR 50.55(e)(3)	Evaluation of deviations and failures to comply associated with substantial safety hazards or that could create a substantial safety hazard, were it to remain uncorrected.	Within 60 days of discovery (final evaluation, or if not complete, an interim evaluation and completion date)
ANSI/ANS-15.1, Section 6.7	Initial Startup Report	As required by NRC via license condition or formal request
10 CFR 50.55(f)(3)	Changes to the QAP that do not reduce the commitments in the previously NRC-accepted QAP (or the NRC Safety Evaluation Report of their acceptance)	Within 90 days of the change
10 CFR 50.71	Revision of FSAR to bring up to date with any changes made since last submittal that did not require NRC approval prior to implementation	Within 5 years from operating license issuance, and from previous updated FSAR submittals
10 CFR 50.75(d)	Decommissioning Report as Required by 50.33(k)	Approximately 2 years prior to the projected end of operations
10 CFR 73.54 10 CFR 73.77	Cyber Security Event Notifications	Verbal notifications and written reports as required per the regulations
10 CFR Part 19 and 10 CFR 20, Subpart M (20.2201 – 20.2207)	Reports (Will be specifically listed in the FSAR)	Verbal notifications and written reports as required per the regulations
10 CFR 21.21	Notification of failure to comply or existence of a defect and its evaluation (Will be specifically listed in the FSAR)	Verbal notifications and written reports to applicable vendor and NRC per the regulations
40 CFR	Reports as required by the Environmental Protection Agency and State of Idaho environmental regulators (Will be specifically listed in the FSAR)	As required by applicable regulations.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-22

12.6 RECORDS

The AAI Records Management Program includes the identification, generation, authentication, maintenance, and disposition of records. Records will be stored in AAI's electronic data management system. Required information may be contained in single or multiple records. Records of the following activities shall be maintained and retained for the periods specified below.

12.6.1 Lifetime Record

The following records are to be retained for the lifetime of the AAI facility:

- Gaseous and liquid radioactive effluents released to the environs
- Off-site environment-monitoring surveys required by the technical specifications
- Radiation exposure for all monitored personnel
- Updated drawings of the AAI facility.

Applicable annual and other routine reports, if they contain all of the required information, may be used as records in this section.

12.6.2 Five Year Record

The following records are to be maintained for a period of at least five years or for the life of the component involved if less than five years:

- Normal AAI facility operation (but not including supporting documents such as checklists, log sheets, etc., which shall be maintained for a period of at least one year)
- Principal maintenance operations
- Reportable occurrences
- Surveillance activities required by the technical specifications
- Facility radiation and contamination surveys where required by applicable regulations
- Radioactive material inventories, receipts, and shipments
- Approved changes in operating procedures
- Records of meetings, reviews, and audit reports of the IRC.

12.6.3 Records To Be Retained For At Least One Certification Cycle

Records of training and qualification of operations personnel who are licensed pursuant to 10 CFR Part 55 shall be maintained for the duration of the individual's employment or until the license is renewed. These may include:

- Job postings
- Job applications



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-23

- Candidate evaluations
- Position description including minimum entry-level requirements
- Hiring information
- Entry-level requirements verification
- Individual training record
- Course or training/qualification curriculum
- Course or training/qualification attendance or participation records
- Examination contents
- Examination results
- Performance evaluations
- Performance improvement plans
- Training-related issues and corrective active records
- Correspondence with NRC regarding licensed operator training and qualification plans

12.7 EMERGENCY PLANNING

AAI's Emergency Plan (EP) is prepared with consideration of 10 CFR 20, 10 CFR 50.34, 10 CFR 50.54(q), 10 CFR Part 50 Appendix E and 10 CFR 70.22. The EP describes the processes to establish and maintain a staff of sufficient size and technical competence that can safely implement AAI's Emergency Program to provide reasonable assurance of adequate protection of the public health and safety. The preliminary emergency Plan is included with the PSAR as Appendix 12B.

This Emergency Plan is formatted per Regulatory Guide (RG)-2.6, "Emergency Planning and Preparedness for Research and Test Reactors and Other Non-Power Production and Utilization Facilities," and American National Standards Institute, ANSI/ANS-15.16-2015, "Emergency Planning for Research Reactors," to show compliance to the acceptance criteria in NUREG-0849, "Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors."

The AAI Emergency Response Organization (ERO) and points of contact between onsite and offsite supporting personnel and agencies (Federal, State, county, local) have specific duties and responsibilities that will be defined in the EP. Provisions for prompt notification to external agencies will be established and include information which may be required for offsite agency response. A recovery and re-entry plan will describe the management, technical, and administrative organization necessary to execute timely and effective recovery of the facility based on assessments of facility conditions and desired end states.

12.8 SECURITY PLANNING

AAI's Security Plan will be developed and incorporated by reference in Appendix 12C of the AAI FSAR. The AAI Security Plan will include information required by 10 CFR 50.34(c), (d), and (e), and applicable sections of 10 CFR 73, "Physical Protection of Plants and Materials," and 10 CFR Part 25, "Access Authorization." AAI will protect controlled unclassified information, including Safeguards Information if any, as it is required to be protected from unauthorized access or disclosure, in accordance with its procedure for managing this type of information and technology.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-24

12.8.1 Fitness for Duty

AAI is exempted from the requirements of 10 CFR Part 26, "Fitness for Duty Programs," per 10 CFR 73.6, "Exemption for Certain Quantities and Kinds of Special Nuclear Material."

12.8.2 Access Authorization

The purpose of the AAI Access Authorization Program is to provide high assurance that individuals, as identified in this section, are trustworthy and reliable, such that they do not constitute an unreasonable risk to public health and safety or the common defense and security, including the potential to commit radiological sabotage. AAI will develop its Access Authorization Program and implementing procedures in accordance with 10 CFR 73.57 for access to certain facility locations, and with applicable portions of 10 CFR Part 25, Access Authorization, relative to classified information.

12.9 QUALITY ASSURANCE

The NRC's guidance document, NUREG-1537 Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content" Section 12.9 "Quality Assurance," recommends the applicant consider the guidance in RG-2.5, Rev 1, "Quality Assurance Program Requirements for Research and Test Reactors," which states that ANSI/ANS-15.8-1995 provides an acceptable method of complying with the program requirements of 10 CFR 50.34. AAI's QAP is also prepared with consideration of 10 CFR 50.54, 50.71, 10 CFR Part 70 and Part 71.

AAI's initial QAP was based on nuclear power QA standards and guidance. However, based on NRC feedback during its initial audits of the draft AAI PSAR, AAI has updated its QAP to utilize the ANSI/ANS-15.8-1995 standard. The updated AAI QAP is appended in Appendix 12A of this PSAR.

12.10 OPERATOR TRAINING AND REQUALIFICATION

This section addresses training and qualification for ROs and for SROs.

AAI will develop and implement an RO/SRO Training and Requalification Program Plan in accordance with applicable requirements of 10 CFR 50.54 and 10 CFR 55.59(c). Guidance from ANSI/ANS 15.4-2016 will be considered in development of this Plan.

It will address information regarding the following, as applicable:

- Organization structure relative to operator training and requalification
- Initial training and qualification (including written exam and annual operating test per NRC-approved program)
- Requalification schedule (not to exceed 24 months)
- Lectures, reviews, and examinations on topics such as
 - nuclear theory and principles of operation for the reactors,
 - facility design and general and specific operating characteristics,



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-25

- instrumentation and control systems,
- reactor protection system,
- engineered safety features,
- normal, abnormal, and emergency operating procedures, including applicable administrative procedures that may be necessary to implement these procedures,
- radiation control and safety,
- technical specifications,
- criticality control features and management measures required for each process involving SNM, and
- applicable regulations, guidance, and standards,
- Other FST
- On-the-job training, including performance demonstrations
- Inactive operators, including evaluation and retraining
- Qualification documentation and records
- Qualification document review and audit
- Notifications and reports

The Plan will further describe applicable requirements and how they are implemented. It will be incorporated by reference in Appendix 12D of the AAI FSAR. The plan will be implemented within 3 months following NRC's issuance of an operating license to AAI.

AAI's facility will not include a reactor simulator.

12.11 STARTUP PLAN

This section addresses the Mietner-1 Startup Plan that will be developed to ensure and verify operability of items important to safety are well understood, and match predicted behavior, prior to conducting normal operations. Measurements of selected parameters of the reactor will be compared to calculated values to verify analytical methods and to ensure that meaningful acceptance criteria have been established from calculational methods. The acceptance criteria will ensure that the facility is functioning within the bounds for which it was designed and analyzed and that the license and the technical specifications are satisfied.

As specified in NUREG-1537 Part 1 & ISG, the Mietner-1 Startup Plan will include these aspects, as applicable:

- A well-planned systematic set of subcritical multiplication measurements or an inverse multiplication approach to critical measurement during fuel loading, and confirmation that subcritical multiplication or critical fuel loading is within pre-established acceptable limits.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-26

- An experimental measurement plan to determine the important operational reactor physics parameters (such as control rod worth, excess reactivity, reactor thermal power, coefficients of reactivity, and power peaking factors) and thermal-hydraulic parameters (such as fuel, cladding, and coolant temperatures, reactor coolant system flow rates, and pressure drops, if appropriate); comparisons with predictions and acceptance criteria; and investigation and discussions of any discrepancies that may have arisen.
- Measurements of magnitudes of area radiation fields and radioactive effluents, and comparisons with predictions in the SAR and pre-established acceptance criteria.
- Measurements of performance of other systems (e.g., ventilation, engineered safety features, or emergency power), and comparisons with predictions in the SAR and pre-established acceptance criteria.

The AAI Startup Plan will be described in much greater detail and included as Appendix 12E in the AAI FSAR. A Startup Report will be submitted to the NRC following completion of startup per the Start-up Plan.

12.12 VACATED (FORMERLY “ENVIRONMENTAL REVIEW,” MOVED TO CHAPTER 19)

12.13 MATERIAL CONTROL AND ACCOUNTING PROGRAM

This section addresses the AAI Material Control and Accounting (MC&A) Program for SNM. This program will ensure that all SNM in AAI facilities will be properly accounted for and that specific objectives prescribed by 10 CFR 74, “Material control and accounting of special nuclear material”, will be met. NUREG-1065, “Acceptable standard format and content for the fundamental nuclear material control (FNMC) plan required for low-enriched uranium facilities”, will be consulted in development of this program.

The program will include the following elements:

- MC&A organization
- Measurements
- Measurement control program
- Statistics
- Physical inventories
- Item control
- Shipper-receiver comparisons
- Assessment and review of the MC&A Program
- Resolving indications of missing uranium or other SNM of significance
- Informational aid for assisting in the investigation and recovery of missing uranium
- Recordkeeping

AAI’s MC&A Program Plan will be developed and submitted as Appendix 12F in the AAI FSAR. The MC&A Program Plan will list and describe implementing procedures for the Program.



CHAPTER 12

CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-27

12.14 REFERENCES

American National Standards Institute (ANSI). ANSI/ANS 15.1-2007 (R2023), "The Development of Technical Specifications for Research Reactors." Approved 4/27/23, American Nuclear Society (ANS).

——— ANSI/ANS 15.4-2016 (R2021), "Selection and Training of Personnel for Research Reactors." Approved 7/23/21, ANS.

——— ANSI/ANS 15.8-1995 (R2023), "Quality Assurance Program Requirements for Research Reactors." Approved 11/27/23, ANS.

——— ANSI/ANS 15.16-2015 (R2024), "Emergency Planning for Research Reactors." Approved 12/9/2024, ANS.

Nuclear Regulatory Commission (NRC). 1983. NUREG-0849, Rev. 0 "Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors."

——— NUREG-1065, Rev. 2, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities." Dec. 1995.

——— NUREG-1537 Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content," 1996.

——— 2012. Final Interim Staff Guidance (ISG) Augmenting NUREG-1537 Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content," and NUREG-1537 Part 2, ".... Non-Power Reactors: Standard Review Plan and Acceptance Criteria."

——— 2022. NRC Safety Evaluation Report for AAI QAPD R0-A, August 2022, EPID L-2020-LLL-0025.



CHAPTER 12 CONDUCT OF OPERATIONS

AAI-PSAR-12

Rev 0

Page 12-28

12.15 APPENDICES

- **Appendix 12A** – AAI Quality Assurance Program (QAP) Description (PDD-001)
- **Appendix 12B**– AAI Mietner-1 Emergency Plan
- **Appendix 12C** – AAI Mietner-1 Security Plan (To be provided in FSAR)
- **Appendix 12D** – AAI Mietner-1 Reactor Operator Training and Requalification Plan (To be provided in FSAR)
- **Appendix 12E** – AAI Meitner-1 Startup Plan (To be provided in FSAR)
- **Appendix 12F** – AAI Mietner-1 Material Control and Accountability Plan (To be provided in FSAR)