Accelerator Readiness Review (ARR)
Guidance

Final Guide for Interim Use
May 6, 1996

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Attachments

Introduction

An Accelerator Readiness Review (ARR) verifies the contractor's readiness to conduct specific activities with an accelerator facility. ARRs are conducted in accordance with the requirements established in DOE Order 5480.25, "Safety of Accelerator Facilities." The contractor's declared readiness to proceed is established by findings that personnel, hardware, and procedures are ready for safely commissioning a system, for beginning routine operation, or for resuming an activity following a DOE-ordered shutdown. Serious consideration should also be given to conducting an ARR after significant modifications to either the accelerator or the experimental program, or after an extended shutdown. The ARR is not intended as an evaluation of the overall ES&H program at a facility.

The Order places the requirement to perform ARRs solely on the contractor and requires that DOE ensure that the contractor's review was conducted with appropriate scope and depth. DOE also has the responsibility to verify that the findings/observations of the readiness review have been satisfactorily addressed/resolved by the contractor.

The purpose of this informal guidance is to provide a non-mandatory framework which, when followed using a graded approach, can provide adequate assurance that the ARR will satisfy the requirements of DOE 5480.25 in an efficient and cost-effective manner. This guidance is also intended to provide a suggested approach to the planning and post-review activities associated with the ARR process. The Guidance is designed to serve as a helpful resource for contractors conducting ARRs. The Guidance is not intended as an audit/assessment tool and should not be used as such without prior agreement between the contractor and DOE. The Guidance may be used in whole or in part by as deemed appropriate by facility management. Facility management may also choose an alternate method by which to conduct the ARR. The responsible DOE Site/Operations Office should review any ARR method chosen by the contractor to ensure appropriate scope and depth.

1.0 General

1.1 Purpose

a. The purpose of an Accelerator Readiness Review (ARR) is to verify that the contractor's personnel, hardware and procedures are ready to permit the activity to be undertaken in a safe and environmentally sound manner. An ARR is not a method for achieving readiness but for verifying it. It is the responsibility of the contractor's line management to ensure readiness.

b. DOE 5480.25 requires contractors to conduct ARRs prior to commissioning any segment of the accelerator facility, prior to routine operation, and prior to resumption of an activity ordered stopped by DOE because of an ES&H concern.

[1] The purpose of a pre-commissioning ARR is to verify readiness to proceed with commissioning (or the next phase of commissioning). The pre-commissioning ARR should confirm, to the extent necessary to safely proceed with commissioning (or the next phase of commissioning), that construction is sufficiently complete, necessary construction tests have been performed and accepted, required safety-related systems are installed and operational, relevant procedures have been approved, and appropriate personnel have been assigned and adequately trained.

[2] The purpose of a pre-routine-operation ARR is to confirm that the facility is fully ready for routine operation, including that construction is complete, systems are fully tested and operational, procedures are established and operationally verified, staffing is complete, and personnel are fully trained.

[3] The purpose of a restart ARR is to confirm that the facility is fully ready to recommence an activity ordered by DOE to be shutdown. This ARR should focus on the changes which occurred during the shutdown.

c. The contractor should consider conducting an ARR if a facility has been shutdown for an extended period of time, or when significant modifications have been made to either the accelerator or the experimental program.

d. Where commissioning of an accelerator facility is accomplished in discrete segments, the ARR must also be performed incrementally.

1.2 Conditions for Conducting an ARR

a. Combined with the straightforward purpose of an ARR as stated above, it is intended that the process be flexible and that full use be made of a graded approach so that the necessary

readiness is verified, but unnecessary costs and delays are avoided. Therefore, a readiness review may be undertaken and accomplished under a variety of circumstances, **provided** that it truly verifies the readiness of whatever activity facility management **declares to be ready**. This is the basic intent of any ARR.

b. Given this intent, the readiness review process should be sufficiently flexible to permit the review to be accomplished in a timely and efficient manner while not sacrificing the synergy available only from a team effort. While it may be more efficient or cost-effective to conduct portions of the ARR during particular windows of opportunity, such efforts should be used judiciously so as not to adversely impact or preclude the synergism of interactions among team members.

c. The ARR should include applicable portions of support functions such as training, maintenance, health physics, environmental monitoring and waste management.

d. While this guidance addresses verifying the readiness of items important to ES&H, the scope of an ARR can be expanded as desired by the contractor's senior management to address other "best management practice" topics when such joint treatment is judged to be cost-effective.

1.3 The Role of DOE

a. The role of DOE Operations Offices (Area/Site Offices) in the ARR process is to:

- Request the contractor to prepare a proposed ARR Plan of Action and submit it to DOE for acceptance;

- Evaluate the contractor's proposed Plan of Action, if submitted to assure appropriate scope and depth, and formally notify the contractor when it is found to be acceptable;

- Provide sufficient real-time oversight, supplemented where needed by first-hand sampling to support a determination by DOE of the appropriateness of the contractor's ARR results (Depending on the complexity of the activity being reviewed and other pertinent factors, DOE may elect to satisfy its determination by conducting its own ARR to verify the readiness of the proposed activity);

- Authorize the contractor to proceed with a moderate or high hazard class activity addressed by an ARR only after HQ Program Office approval has been granted, and when satisfied that the findings identified by the ARR have been taken care of;

- Provide authorization to proceed for all other activities covered by an ARR (except those shutdown solely by the contractor) when satisfied that the findings identified by the ARR have been taken care of;

- Keep Headquarters informed of the progress and results of ARRs; and,

- Require the contractor to perform an ARR when it determines other circumstances warrant.

b. The role of the cognizant DOE Headquarters organization in the ARR process is to:

- Provide guidance to the Operations Offices concerning ARRs;

- Monitor ARRs through the activities of the Operations Office to ensure appropriate scope and depth; and,

- For moderate or high hazard class activities, participate in all activities prescribed in Section 1.3.a. and provide authorization to proceed with the activity addressed by the ARR.

2.0 Pre-review Activities

2.1 Scope of the ARR

a. The ARR's objectives should be specified by the contractor senior manager who appointed the ARR Team.

b. From the objectives provided, the scope of the ARR should be defined by the Team Leader in consultation with the management of the facility to be reviewed. This scope should be documented and used in identifying the technical expertise needed for the ARR. A work breakdown structure or MORT diagram may be used to address the subjects mentioned in Sections 3, 4, and 5 of this guidance document to the extent they are appropriate for the review.

2.2 ARR Team Selection

The following considerations should be addressed when appointing an ARR Team:

a. An appropriate member of the contractor's senior management group (usually that individual having ultimate line responsibility for the facility to be reviewed) should appoint, in writing, an ARR Team Leader and ARR Team;

b. The size and specific capabilities of the ARR Team should be based upon the scope of the ARR;

c. The team members should be appointed based on their demonstrated objectivity and their expertise in one or more of the topics to be reviewed. Between them, the team members should have expertise in all relevant topics;

d. The team leaders and members should have no current involvement with the activity being reviewed, and past involvement should be sufficiently distant or of such a nature that team members are not in any way being asked to review a product that they had a significant part in creating (i.e., they should have reasonable independence from the activity they are being asked to review); and,

e. The ARR Team can be appointed and begin planning its review activities before facility management declares the proposed activity to be ready.

2.3 Planning for On-Site Facility Review

To conduct an effective ARR, an on-site review of the proposed activity is necessary. The following considerations should be addressed during the planning:

a. ARR Team Members should be asked by the ARR Team Leader to prepare a Plan of Action for their component of the review which summarizes their proposed methodology and acceptance criteria. (Review methodologies include those aspects of each requirement that the reviewer plans to address by some combination of evaluating procedures and/or other documentation, conducting interviews and performing first-hand observations or inspections). ARR Team Members should give careful consideration to the subjects addressed in Sections 3, 4, and 5 of this guidance document to the extent appropriate.

b. The extent to which the team can remain together rather than work as individuals in conducting the review should be carefully considered. An orientation to the proposed activity should be received by the entire team early in the review effort, and periodic team discussions are desirable to discuss concerns or promote consensus.

c. Team members should develop their review schedules with adequate time for the completion of their review activities, having given consideration to the availability of appropriate facility staff.

d. Facility management should confirm that measures have been taken to ensure team access to necessary personnel and to appropriate locations (security clearance ascertained, Personal Protective Equipment supplied where appropriate).

e. The Team Leader should arrange with facility management for the logistic support necessary for an efficient review (workspace, access to personnel and necessary information, and availability of support equipment such as computers, telephones, etc).

2.4 Conducting the Readiness Review

a. ARR Team members will receive general direction from the ARR Team Leader, who is immediately responsible for assuring that a quality review is performed and documented.

b. ARR's should be conducted to the extent possible using a "hands-on" approach involving observations of the condition of hardware and of the performance of personnel involved in the activity under review.

c. The final draft conclusions of the ARR should be communicated verbally to appropriate staff of the activity under review immediately upon the conclusion of the review. This meeting between the ARR Team and the involved personnel should be interactive so that the final conclusions resulting from the review are accurate. Major disagreements between the ARR

Team and the involved personnel need not be resolved, but should be identified in the ARR Report, which should be finalized promptly after the meeting with facility personnel.

3.0 The Review: Documents

3.1 Accelerator Safety Envelope

The ARR should verify that:

a. An Accelerator Safety Envelope (ASE) has been developed in accordance with paragraphs 8.d. and 10.d. of DOE Order 5480.25;

b. The ASE has been reviewed by an independent safety review system internal to the contractor's organization. The results of that review have been received by contractor management and considered;

c. DOE has approved the ASE for the proposed activity or, as a minimum, has received the proposed ASE for approval; and,

d. The procedures addressing ASE required equipment and systems specify the minimum necessary system components and monitoring devices to allow operation. In the event these minimums are not met, actions are specified.

3.2 Safety Assessment Document

The ARR should verify that:

a. A Safety Assessment Document (SAD) (or its equivalent) exists, has been reviewed by the contractor's internal independent safety review system, and the comments and recommendations resulting from that review have been adequately addressed by management; and,

b. Contractor management has documented its conclusion that the activity analyzed in the SAD is an accurate evaluation of the ES&H consequences of undertaking the activity, and that the mitigated risks of the activity to employees, the public, and the environment are acceptably low.

3.3 Procedures

The ARR should verify that:

a. Procedures necessary for safe operation of the activity have been developed, reviewed, verified (by performance where applicable), and approved;

b. A procedure control system has been established which defines the processes for procedure preparation, review, approval, verification, distribution, and training;

c. Maintenance activities involving the safety aspects of the activity being reviewed have been identified and maintenance procedures for these activities have been developed, reviewed, verified, and approved;

d. There is a system for assuring that procedures for safety-related operations and maintenance are kept current [See para. 9f of DOE 5480.25]; and,

e. Procedures to deal with off-normal and emergency situations have been prepared and are approved for use.

3.4 Compliance with DOE ES&H Requirements

The ARR should verify that:

a. Facility management has required a review to be made of the activity's conformance to applicable ES&H requirements;

b. Nonconformances have been identified and schedules and resources for achieving compliance have been established and approved by the appropriate level of management;

c. Appropriate implementation of Attachment I to DOE 5480.19 "Guidelines for the Conduct of Operations at DOE Facilities", for the proposed activity, has been accomplished;

d. There is a process for reviewing changes to the proposed activity for impacts on hardware, procedures, training, and Unreviewed Safety Issue (USI) implications, and;

e. Processes exist for evaluating the readiness of radiological control measures and other ES&H items applicable to the proposed activity.

3.5 Resolution of Findings and Observations

The ARR should verify that:

a. A process exists to identify, evaluate, and resolve findings made by internal and external oversight and audit groups, and;

b. Previous findings made by internal and external oversight and audit groups, including prior Accelerator Readiness Reviews of this accelerator which are relevant to the activity under review, have been satisfactorily completed or have corrective actions underway. ("Observations" do not require action on the part of the contractor).

4.0 The Review: Hardware

4.1 Hardware Readiness

The ARR should verify that:

a. Equipment and systems having safety importance meet criteria described in the SAD and have been appropriately tested. This includes, but is not limited to:

- shielding
- electrical system isolation
- protection against credible fires
- protection from oxygen-deficient environments
- cryogen storage, transfer, and use
- beam transport
- high-power beam dumps
- Personnel protection systems, including secured area interlock system
- Fixed and portable radiation monitoring equipment
- Other instrumentation for monitoring safety and health conditions
- Systems for controlling environmental, safety, and health parameters

b. The results of testing conducted to confirm the readiness of hardware to undertake the activity safely have been documented, evaluated to ensure adequacy, and meet quality assurance requirements.

4.2 Hardware Operability

a. A program is in place to periodically reconfirm the status and operability of hardware systems having safety importance.

b. The performance of the physical systems that provide assurance of the viability of the ASE and that maintain the activity within the Operations Envelopes (when used), have been verified, and records of appropriate tests and calibrations of these systems exist and are up to date.

5.0 The Review: Personnel

5.1 Training Program

The ARR should verify that:

a. Training and qualification programs have been established for general safety orientation, accelerator operations personnel, maintenance and support personnel, experimenters using the facility and emergency responders. These training and qualification programs are documented to encompass the range of duties required to be performed in accordance with the SAD, and;

b. A process to evaluate training program effectiveness on a periodic basis has been established and documented and specifically includes the following considerations:

[1] Classroom and individualized instruction are appropriate for the facility, and instructor performance is periodically evaluated by facility management;

[2] A systematic evaluation of training program effectiveness, including feedback from job performance, is used to ensure the training program conveys all the required skills and knowledge;

[3] The personnel protection training program is specific to the facility's hazards and provides the knowledge and skills necessary for individuals to perform their assigned job functions while avoiding exposure to specific facility hazards such as high voltage, cryogens and oxygen deficient environments, and minimizing their exposure to radiation and chemicals to as low as reasonably achievable; and,

[3] Training and qualification of personnel, as specified in Paragraph 12 of DOE 5480.25, has been achieved.

5.2 Qualified Personnel

The ARR should verify that:

a. The numbers of trained and qualified operations, maintenance and support persons meet SAD or ASE requirements;

b. Individual assignments, responsibilities, authorities, and reporting relationships are defined, documented, and included in training, and;

c. Qualifications or exceptions to specified areas of training, based upon education or experience, have been granted and documented by a designated contractor manager.

6.0 Post ARR Efforts

6.1 ARR Report

a. An ARR report should be prepared as soon as possible after the completion of the review. The ARR Team Leader should obtain input from all team members and the team should reach consensus on the readiness of the facility to commence the activity for which the ARR was performed.

b. The conclusions reached by each team member are the principal end-product of the ARR. They should be carefully drawn so that they unambiguously reflect the true intent of the team member, and they should be supported just as carefully. Suggestions of the types of information that will help support the conclusions include: methodology used in pursuing the review, personnel contacted and their positions, documents reviewed, evolutions/operations witnessed, spaces visited, etc.

c. A conclusion drawn as a result of the ARR effort may lead to one or more findings and/or observations. Findings are more serious and require documented closure. Findings reported by the team should be categorized as Prestart or Post-start Findings. A Prestart Finding is one which, in the Team's opinion, must be corrected before an activity can be started. A Post-start Finding can be corrected after the start of the activity under review. One possible approach to categorizing findings is presented in Attachment B.

d. The final ARR Report should be directed to the designated contractor senior management official, with an information copy to the appropriate DOE Operations Office Manager (or designee) and to the DOE/HQ Program Office. Each team member should also receive a copy of the ARR Report. The senior management official will be responsible for any further distribution of the report.

e. The following format for the ARR Report is suggested but not prescribed; different formats may be used as agreed upon by the ARR Team Leader and the senior management official.

- **Title/Cover Page** - State the subject and date of the ARR.

- **Signature Page** - Include the signatures of all team members, signifying their agreement with the report and its conclusions. If a signature cannot be obtained for logistical reasons, the ARR Team Leader should obtain concurrence verbally or by facsimile and sign for the member.

- **Table of Contents** - Identify all sections (including page numbers), subsections, illustrations, tables, charts and appendices.

- **Executive Summary** - Provide a summary of the review, findings and facility readiness. Suggested considerations include:

  - A brief synopsis of the review;
  - A determination as to readiness of the facility to undertake the activity;
  - A statement regarding the adequacy of management systems to oversee the activity;
  - A synopsis of the significant problems and strengths found by the ARR; and,
  - A brief summary of the findings including numbers of prestart or post-start findings.

- **Introduction** - Provide background information regarding the activity under review. This should include:

  - Purpose, scope and objectives of the ARR;
  - Review process and methodologies;
  - Composition of the ARR Team; and,
  - Definitions applicable to the ARR.

- **Conclusions** - Address each subject identified in the scope and discuss the facility's readiness in each area. State each finding succinctly and unequivocally, and characterize as prestart or post-start. Provide the basis for each finding.

- **Observations** - Identify those items which, in the opinion of the ARR team member, do not require action by the contractor but would likely enhance the ES&H status of the facility.

- **Readiness Determination** - Provide an overall recommendation as to the readiness of the facility to commission, restart or routinely operate.

- **Appendices** - Append data/documents to support the report. These should include:

  - Review criteria and approach;
  - Team roster with relevant qualifications of each member; and,
  - Differing opinions (when applicable).

6.2 Lessons Learned

It may be useful to future ARR Teams and to the contractor's senior management group to document any lessons learned from the ARR. Problems and successes encountered during the ARR process should also be addressed. Either the ARR Team or the facility management could prepare this document, or it could be jointly prepared.

6.3 Team Disbandment

With the delivery of the ARR Report to the designated contractor senior management official, the team should be formally disbanded by that official (this commonly will also have been the appointing official).

6.4 Disposition of ARR Findings

a. The designated contractor senior management official should transmit the ARR Report with its findings, including any specific commentary and instructions that this official feels are appropriate, to the facility's management. This transmittal should request a written response.

b. The management of the evaluated facility should provide a written response to the designated contractor senior management official which addresses each finding individually. The response should include a plan which defines the actions that will be taken in response to the finding, including a schedule for completion.

c. At the senior management official's discretion, ARR team members should be requested to evaluate the responses to their findings, and provide that evaluation in writing to the requesting official.

d. The need for follow up visits by former ARR Team members or other experts, as well as the scope of the visits, should be based on the significance of the findings, as well as on the facility management's responsiveness to the findings.

e. All follow up visits should be documented to identify the scope and purpose of the visit and to provide a determination as to the adequacy of the facility's action(s) with respect to the findings for which the visit took place. The documentation generated by all follow up visits should be included in the official review file.

f. If a follow up visit identifies additional findings or insufficient progress on commitments made to address the ARR Report's findings, the management of the evaluated facility should also provide a written response to those items.

6.5 Approval to Proceed

a. When the contractor's senior management determines that the activity is ready to be undertaken, this determination is to be formally communicated to the DOE Operations Office Manager (or his/her designee) with an information copy sent to the Program Office.

b. DOE authorization to undertake the activity is to be in accordance with the conditions provided in paragraph 11 of DOE 5480.25.

c. The contractor is not to undertake the activity without the prior written authorization of the DOE, except for the resumption of activities shut down solely by the contractor.

APPENDIX A

GLOSSARY

GLOSSARY

a. Accelerator Facility is the accelerator and associated plant and equipment utilizing, or supporting the production of, accelerated particle beams to which access is controlled to protect the safety and health of persons. It includes experimental enclosures and experimental apparatus utilizing the accelerator, regardless of where the apparatus may have been designed, fabricated, or constructed.

b. Accelerator Readiness Review is a structured method for verifying that hardware, personnel, and procedures associated with Commissioning or Routine Operation are ready to permit the activity to be undertaken safely

c. Accelerator Safety Envelope is a set of physical and administrative conditions that define the bounding conditions for safe operation at an accelerator facility.

d. Commissioning is the process of testing an accelerator facility, or portion thereof, to establish the performance characteristics. It starts with the first introduction of a particle beam into the system.

e. Experimenters are all persons directly involved in experimental efforts at the accelerator facility utilizing the accelerator or its beams, including visiting scientists, students and others who may not be employees of the operating contractor.

f. Finding is an item that requires resolution.

(1) Prestart Findings must be resolved prior to start or restart approval.

(2) Post-start Findings may be resolved after start or restart of the activity under review.

g. Maintenance Personnel means not only those in the crafts generally associated with maintenance activities, but also accelerator operations staff and experimenters to the extent that they undertake to repair, maintain, or improve safety-related equipment.

h. Observation is a recommendation which does not require action by the contractor, but in the opinion of the reviewer, may enhance the ES&H status of the facility.

i. Routine Operation of an accelerator commences at that point where DOE authorization has been granted either (1) because of the Commissioning effort is sufficiently complete to provide confidence that the risks are both understood and acceptable and the operation has appropriate safety bounds, or (2) to permit the re-introduction of a particle beam after being directed to cease operation by DOE because of an environmental, safety, or health concern.

j. Safety Assessment Document is the document containing the results of a safety analysis for an accelerator facility pertinent to understanding the risks of the proposed undertaking.

k. Unreviewed Safety Issue exists if a proposed change, modification or experiment will:

(1) Significantly increase the probability of occurrence (through reduction in the margin of safety or otherwise) or the consequences of an accident or malfunction of equipment important to safety from that evaluated previously by safety analysis; or

(2) Introduce an accident or malfunction of a different type than any evaluated previously by safety analysis which could result in significant safety consequences.

APPENDIX B

FINDING CLASSIFICATION CRITERIA

FINDING CLASSIFICATION CRITERIA

This checklist should be used by the ARR team to evaluate if a finding must be corrected prior to startup.

A. Initial Screening

1. Does this issue involve equipment or a system having safety importance?

2. Does this issue involve Unreviewed Safety Issues or processes, functions or components identified in the Accelerator Safety Envelope?

3. Does this issue involve potential adverse environmental impact exceeding regulatory or site specific release limits?

4. Does this issue impact non-safety processes, functions or components which could adversely impact processes, functions or components having safety importance?

5. Is this issue non-compliant with a company or Operations Office approved startup directive?

6. Does this issue indicate a lack of adequate procedures or administrative systems having safety importance?

7. Does this issue indicate operational or administrative non-compliance with procedures or policy having safety importance?

8. Has this issue occurred with a frequency that indicates past corrective actions have been lacking or ineffective?

9. Does this issue require operator training having safety importance not specified in existing facility training requirements?

10. Does the issue involve a previously unknown risk to worker or public safety and health or previously unknown threat of environmental insult or release?

If the response to any of the above is yes, further evaluation, in accordance with the issue impact criteria below, is required. If the response to all of the above is no, the issue may be resolved after restart.

B. Issue Impact Criteria

If the response to any of the questions below is yes, the item should be considered a prestart activity.

1. Does the loss of operability of the item prevent safe shutdown, or cause the loss of essential monitoring?

2. Does the loss of operability of the item cause operation outside the Accelerator Safety Envelope?

3. Does the finding indicate a lack of control which can have a near term impact on the operability or functionality of equipment or subsystems having safety importance?

4. Does the finding involve a violation or potential violation of worker safety or environmental protection regulatory requirements which poses a significant danger to workers, the public, or of environmental insult or release?

APPENDIX C

The following appendix contains summaries of ARR approaches used by three DOE accelerator facilities. Since these ARRs were conducted prior to the development of the ARR guide, these summaries should not be expected to match the guidance. They are included to illustrate the flexibility and tailored approach intended for the ARR process. There are many approaches which satisfy DOE Order 5480.25 when applied with appropriate rigor.

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Advanced Photon Source
Accelerator Readiness Review Process Summary

Throughout its design, construction and commissioning the Advanced Photon Source management has followed the accelerator readiness review process defined in DOE Order 5480.25. As specified in the Order, APS management assumed responsibility for, and has managed, the process of assuring that technical reviews are conducted, procedures developed and that due consideration has been given to safety. The modular approach to commissioning, as specified in DOE Order 5480.25, was adopted as it best approximated the design, construction and testing sequence being followed in the assembly of APS system components prior to the implementation of the Order.

At the APS, the Division Directors responsible for the system to be commissioned coordinate the necessary reviews in preparation for commissioning. Throughout this process, emphasis is placed on communication of essential information form the technical specialty groups to management, operations staff and ring managers. This is driven by the fact that to start commissioning, the responsibility for operation of hazardous accelerator subsystems is transferred for the designers and builders (who have comprehensive knowledge of the design, operation and safety features of the subsystems they have designed, constructed and tested) to the commissioning personnel. Several internal and external oversight mechanisms are in place to provide assurances to senior APS management that safety and technical aspects of design, procurement, construction test and installation of accelerator subsystems have been addressed and were not overlooked during the Division Directors review process.

The Accelerator System Safety Assessment Document (SAD) has been revised to address each of the stages of the accelerator assembly, amplifying on the previous SAD revision as needed, so the final SAD completed for the Accelerator System addressed all the hazards associated with the accelerator operation and maintenance. The purpose of the SAD has been to communicate accelerator systems and subsystems hazards to APS, Argonne National Laboratory, and DOE personnel who are required to maintain, operate or oversee the activities at the APS.

Once each of the subsystems was ready to be commissioned the APS Project Director identified a team leader and assembled a review team for the commissioning readiness review and defined the team's charge. The readiness review teams have been composed of members from line organizations outside of APS and, where necessary, outside of the Laboratory.

The Teams have been charged to advise APS management if:

1) The hardware of technical and conventional facilities is ready to be commissioned or operated.

2) Managerial control and procedures are ready.

3) Personnel associated with the proposed activities are adequately trained and ready.

In addition to these three items, the review team is asked to verify that there are no outstanding items for the safety assessment review performed by the Safety Review Committee which reviewed and approved the Safety Assessment Document that would preclude commissioning.

The review materials provided to the review team centers around a readiness tree containing three main branches: hardware, management system, and personnel training. The readiness tree, together with supporting documents, describes the commissioning/operating requirements that must be complete. Each readiness tree branch has sublevel blocks identified that represent readiness of a particular component of the main branch. Each sublevel block on the readiness tree is represented by a sign-off sheet contained in an accompanying document. The detailed sign-off sheets are broken down into individual items that must be complete prior to beginning commissioning activities. These are further classified into safety ("S") or non-safety critical items. The review team is asked specifically to confirm that "S" items have been adequately identified as well as completed.

The review team attends presentations by facility personnel, and tours the facility segment under consideration. The team members are directed by the team leader to preform spot checks and completeness verification as deemed necessary. The team provides to the facility management a written finding of the review, and may schedule subsequent meetings of the team and APS personnel, if necessary.

The initial commissioning readiness review team conducted numerous spot checks and completeness verifications to confirm that the APS readiness management system was in place and functioning as described. Later commissioning readiness review teams focused on specific issues involved with the commissioning stage being reviewed and performed few spot checks as it had been demonstrated to the review teams' satisfaction that the APS internal verification process of completion was well established and being followed.

Upon completion of this independent review process and in accordance with DOE Order 5480.25, approval for commissioning of each stage was solicited from DOE.

Appropriate DOE personnel from AAO, CH and HQ have participated in the review process as observers to ensure DOE personnel awareness of the review and its contents.

"PHASED ACCELERATOR READINESS REVIEW"
Advanced Light Source

Facility Description: Total renovation of an existing accelerator facility into a new $100M synchrotron radiation "DOE User Facility."

Location: SF Bay area; within 40 minutes of the Oakland Operations Office and several major existing accelerator facilities.

Program Considerations: Several industry Users express urgency to get started with research. HQ program office desires to exhibit "can do" capability to industry.

Type of Accelerator Readiness Review: "Phased." As each individual element of the MORT-type readiness tree is readied for review, the facility management certifies to the independent review team leader and the DOE validation team leader that the element is complete ready for operation. The independent reviewer then performs his review of that element. The DOE validator verifies that the reviewer is qualified, that the review has been appropriately in-depth, and may perform an additional "sampling" type of independent review.

Reason for Selection of Type of ARR: Achieves a thorough ARR with minimal schedule impact. Facilitated early accommodation of Users. This type of review, however, can only be performed where there are convenient, nearby resources of available independent reviewers and DOE validators.

Documentation of Findings: Each independent reviewer and DOE validator is required to plan their reviews and develop a one page list of topics/items to be reviewed/checked. During reviews, the reviewer/validator annotate their review lists with short notes of what was checked/observed and who was interviewed. The hand annotated lists are maintained as part of the ARR record to provide objective evidence of the thoroughness of the review and the rationale behind any findings. Any findings by the independent reviewer are documented on a "Comment/Issue" form. The facility cognizant person must concur with the finding and must develop a resolution; the independent reviewer must concur with the resolution. If the ODE validator has any additional findings, the independent reviewer must concur with the finding and resolve the finding with the facility as just described.

Resolution of Disputes: This ARR method -- where the independent reviewer and the facility cognizant person must concur on findings and resolutions, and where the DOE validator findings must be accepted by the independent reviewer -- produces very few disputes which must be elevated. The facility cognizant person, the independent reviewer, and the DOE validator are similar expertise and are capable of resolving conflicts and reaching consensus between themselves.

Lessons Learned: The obvious benefit of this method is that it minimizes schedule impact. A less obvious benefit is that it facilitates early identification of problem areas which, if not identified early, could delay operation of the facility. The major disadvantage of this method is that it demands more effort by reviewers to review each element as it is certified as ready, and it demands more effort by the ARR coordinator(s) to keep track of what is ready for review, what has been reviewed, and the disposition of findings.

"CEBAF ACCELERATOR READINESS REVIEW"

The CEBAF ARR was conducted using a four-phased approach. As the installation of each major actions of the facility was completed, the section was subjected to the ARR process; the injector, 1st LINAC, full accelerator and loop, and 1st experimental hall. Each reviewed used a logic tree to identify the ARR scope, followed by the development of assessment criteria to determine the readiness status of each sub-system. Dr Boyle stressed two points: 1) the basis of the CEBAF process was a three-tiered reviewed consisting of sub-system self-assessments conducted by managers responsible for the subsystem, followed by an internal review by in-house cognizant experts in the same professional discipline, and finally examination by a panel of nationally recognized professional from outside the CEBAF organization, and 2) in-depth planning of the scope and review criteria significantly decreases the amount of time required for on-site verification.

Facility Description: "CEBAF is a 4 GeV continuous electron beam accelerator facility using superconducting technology to provide three fixed target experimental hall with basic nuclear physics research capabilities."

Location: Newport News, Virginia.

Program Considerations: Installation schedule required pre-commissioning tests for some components at the same time that other components were being installed. Furthermore, the experimental halls sequentially become available for Users ('94, '95, & '96).

Type of Accelerator Readiness Review: "Phased." The CEBAF Readiness Plan was negotiated with the DOE review readiness for five key machine milestone points: Injector; Low power linac tests; Higher power linac and beam transport tests; Full accelerator, recirculation, beam switchyard, and beam to first experimental hall; and Final two experimental halls. Readiness self-assessments (by cognizant and responsible subsystem line managers), internal review (by knowledge CEBAF experts in the specific professional field - ARR Team member), and independent external review committee (nationally recognized experts in the fields of inquiry) occurred prior to each part of the facility becoming available for pre-commissioning and commissioning tests. DOE CEBAF Site Office and others for the DOE observed the process.

Reason for Selection of Type of ARR: Achieved a thorough ARR at the appropriate point in the project to maximize safety and Readiness confidence.

Documentation of Findings: Line managers performed self-assessment based on criteria developed by the ARR Team. A one-page summary document certified the readiness status at the time of the assessment. The objective evidence was the reviewed by a knowledge expert in the field of the subsystem being examined. Both line mangers and ARR Team reviewer signed the summary document. Findings identified are then tracked to closure with other summary pages. All specific documents are maintained by the subsystem line manager. Only the summary documents are maintained by the ARR Team Leader.

Resolution of Disputes: Any comment or concern is automatically assigned the next highest category of Finding whenever disputes occur. (e.g., If a line manger identifies a finding as a "concern" and the ARR Team disputes the identification, then the finding automatically becomes an "issue" which must be close prior to achieving Readiness.)

Lessons Learned: Work out the ARR plan with the DOE. Charter the Team by the Director. Have Team develop the readiness tree and the readiness criteria. Develop a firm closure process.