

**U.S. Department of Energy**  
**Washington, D.C.**

**ORDER**

**DOE O 420.2B**

Approved: 7-23-04  
Certified 5-13-08

**SUBJECT: SAFETY OF ACCELERATOR FACILITIES**

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1. OBJECTIVE. To establish accelerator-specific safety requirements which, when supplemented by other applicable safety and health requirements, will serve to prevent injuries and illnesses associated with Department of Energy (DOE) or National Nuclear Security Administration (NNSA) accelerator operations.
2. CANCELLATION. DOE O 420.2A, *Safety of Accelerator Facilities*, dated 1-8-01. Cancellation of an Order does not, by itself, modify or otherwise affect any contractual obligation to comply with the Order. Cancelled Orders that are incorporated by reference in a contract remain in effect until the contract is modified to delete the references to the requirements in the cancelled Orders.
3. APPLICABILITY.
  - a. Primary DOE Organizations, Including NNSA Organizations. Except for the exclusions in paragraph 3c, this Order applies to any of those Primary DOE Organizations involved with accelerator facilities (accelerators and their operations) or modules thereof, including injectors, targets, beam dumps, detectors, experiments, experimental halls, etc. (See Attachment 1 for a complete list of Primary DOE Organizations. This list automatically includes Primary DOE Organizations created after the Order is issued.)

The Administrator of NNSA shall assure that NNSA employees and contractors comply with their respective responsibilities under this Order.

- b. Site/Facility Management Contractors.
  - (1) Except for the exclusions in paragraph 3c, the Contractor Requirements Document (CRD), Attachment 2, sets forth requirements of this Order that will apply to site/facility management contractors whose contracts include the CRD.
  - (2) This CRD must be included in site/facility management contracts that involve the management and operation of accelerators unless superseded by an alternative standard that is in accordance with the terms of the laws, regulations, and DOE directives clause of the contracts.
  - (3) This Order does not apply to other than site/facility management contractors. Any application of any requirements of this Order to other

than site/facility management contractors will be communicated separately from this Order.

- (4) The office identified in the responsibilities paragraph is responsible for notifying the contracting officer of which site/facility management contractors are affected. Once notified, the contracting officer is responsible for incorporating the CRD into the contracts of affected site/facility management contractors via the laws, regulations, and DOE directives clause of the contracts.
- (5) As the laws, regulations, and DOE directives clause of site/facility management contracts states, regardless of the performer of the work, site/facility management contractors with the CRD incorporated into their contracts are responsible for compliance with the requirements of the CRD.
  - (a) Affected site/facility management contractors are responsible for flowing down the requirements of this CRD to subcontractors at any tier to the extent necessary to ensure the site/facility management contractors' compliance with the requirements.
  - (b) Contractors must not unnecessarily or imprudently flow down requirements to subcontractors. That is, contractors will—
    - 1 ensure that they and their subcontractors comply with the requirements of the CRD and
    - 2 incur only those costs that would be incurred by a prudent person in the conduct of competitive business.

c. Exclusions.

- (1) Unmodified commercially available units that are acceptable for industrial applications, including (but not limited to) electron microscopes, ion implant devices, and x-ray generators.
- (2) Accelerator facilities not capable of creating radiological areas as defined in Title 10, Code of Federal Regulations (CFR), Part 835, "Occupational Radiation Protection; Final Rule."
- (3) Naval Nuclear Propulsion Program accelerators covered under Executive Order 12344 (42 United States Code 7158 Note).
- (4) Nonmedical x-ray devices with the capability of accelerating particles to energies not greater than 10 MeV, which are operated in accordance with American National Standards Institute N43.3-1993, *General Radiation Safety Standard for Installations Using Non-Medical X-Ray and Sealed*

*Gamma-Ray Sources, Energies Up to 10 MeV*, or in accordance with another applicable consensus standard as directed by the cognizant field element manager/NNSA field manager.

- (5) Low-voltage neutron generators incapable of creating high-radiation areas (as defined in 10 CFR 835, “Occupational Radiation Protection; Final Rule,”), which are operated in accordance with National Council on Radiation Protection Report 72-1983, *Radiation Protection and Measurements for Low-Voltage Neutron Generators*, or in accordance with another applicable consensus standard as directed by the cognizant DOE/NNSA field manager. For the purpose of this Order, a low-voltage neutron generator is defined as a bench-top scale, single-purpose device generating neutrons by accelerating deuterons or tritons into targets through a maximum accelerating potential not greater than 600 kV.
- (6) Entire DOE/NNSA accelerator facilities or modules thereof when and only when accelerators and their operations involve or produce a sufficient inventory of fissionable materials to create the potential for criticality.

4. REQUIREMENTS. DOE/NNSA elements must require the following of contractors.

a. Safety Assessment Document (SAD). A SAD must—

- (1) identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents;
- (2) contain sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks presented by the proposed operations;
- (3) provide appropriate documentation and detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) taken to eliminate, control, or mitigate hazards from operation;
- (4) include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation;
- (5) be prepared as a single document addressing the hazards of the entire accelerator facility or as separate SADs prepared for discrete modules of the facility such as injectors, targets, experiments, experimental halls, or other types of modules; and

- (6) be maintained current and consistent with the administrative control measures and physical configuration of the facility and major safety equipment.
- b. Accelerator Safety Envelope (ASE).
  - (1) A documented ASE must define the physical and administrative bounding conditions for safe operations based on the safety analysis documented in the SAD.
  - (2) Any activity violating the ASE must be terminated immediately, and the activity must not recommence before DOE/NNSA has been notified.
- c. Unreviewed Safety Issues. Activities that involve unreviewed safety issues must not be performed if significant safety consequences could result from either an accident or a malfunction of equipment that is important to safety or for which a safety analysis has not been performed. Activities involving identified unreviewed safety issues must not commence before DOE/NNSA has provided written approval.
- d. Accelerator Readiness Reviews (ARRs). ARR must be performed before approval for commissioning and routine operation and as directed by the DOE cognizant Secretarial Officer/NNSA Deputy Administrator or a DOE/NNSA field manager.
- e. Training and Qualification.
  - (1) Requirements must be established for each individual at an accelerator facility whose activities could affect safety and health conditions or whose safety and health could be affected by facility activities. Training and qualification must be documented and kept current.
  - (2) Only appropriately trained and qualified personnel, or trainees under the direct supervision of trained and qualified personnel, are permitted to perform tasks that may affect safety and health.
  - (3) All personnel assigned to or using the accelerator facility (including emergency response personnel) must be trained in the safety and health practices and emergency plans consistent with their involvement and the hazards present.
- f. Written Procedures.
  - (1) Written procedures and instructions for conducting activities safely must be maintained; must be clear, current, and consistent with management systems and the configuration of the facility and equipment; and must be

approved by a facility contractor's senior line manager who is actively involved in the day-to-day operation of the facility.

- (2) Procedures must include descriptions of the tasks to be performed; appropriate safety and health precautions and controls; and requirements for initial conditions to be verified, operating conditions to be maintained, and data to be recorded, as applicable.
- (3) At a minimum, the contractor must prepare procedures for—
  - (a) operation startup,
  - (b) normal operation,
  - (c) emergency conditions,
  - (d) conduct of maintenance,
  - (e) approval and conduct of experiments,
  - (f) review and approval of facility modifications,
  - (g) management of safety-related changes, and
  - (h) control of facility access.

g. Internal Safety Review System.

- (1) A system must be established and maintained to periodically assess and document the condition of the facility, equipment, and engineered safety systems.
- (2) Appropriateness and implementation of procedures, administrative controls, and personnel training and qualifications must be periodically reviewed and documented by the internal safety review system.

h. Shielding Policy. The contractor must approve and implement a written statement of the shielding policy for ionizing and nonionizing radiation.

5. RESPONSIBILITIES.

NOTE: For those activities designated as major or strategic systems as defined in DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets*, dated 10-13-00, the approvals listed in paragraphs 5a and 5b of this Order must be secured before request for approval to start operations by the appropriate acquisition executive authority.

- a. DOE Cognizant Secretarial Officer/NNSA Deputy Administrator.
- (1) For an accelerator facility or module that has potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment, approves the following:
    - (a) ASE,
    - (b) start of commissioning activities,
    - (c) start of routine operation activities, and
    - (d) exemptions from requirements of this Order.
  - (2) Approves restart of an activity at an accelerator facility after a shutdown ordered by the DOE cognizant Secretarial Officer/NNSA Deputy Administrator or Assistant Secretary for Environment, Safety and Health because of an unreviewed safety issue, violation of an ASE, or other safety concern.
  - (3) Provides to line organizations written guidance for implementing the requirements of this Order.
- b. DOE/NNSA Field Element Manager.<sup>1</sup>
- (1) Approves the start of commissioning for an accelerator facility (or module) that does not have potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment after evaluating the ASE, ARR, and SAD and determining—
    - (a) that a specific ASE will appropriately bound commissioning,
    - (b) that an appropriate ARR was conducted, and
    - (c) that the risks as analyzed in the SAD are acceptable when commissioning is conducted within the specified ASE.
  - (2) Approves start of routine operation for an accelerator facility (or module) that does not have potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment after evaluating the ASE, ARR, and SAD and determining—
    - (a) that the ASE will appropriately bound routine operation,
    - (b) that an appropriate ARR was conducted, and

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<sup>1</sup>The head of a field office or the head of a regional office of a federally staffed laboratory.

- (c) that the risks as analyzed in the SAD are acceptable when routine operations are conducted within the specified ASE.
  - (3) After completing the process defined in paragraphs 5b(1)(b) and 5b(1)(c), recommends to the DOE cognizant Secretarial Officer/NNSA Deputy Administrator approval for start of commissioning activities for an accelerator facility (or module ) that has the potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment.
  - (4) After completing the process defined in paragraphs 5b(2)(b) and 5b(2)(c), recommends to the DOE cognizant Secretarial Officer/NNSA Deputy Administrator approval for start of initial routine operation activities for an accelerator facility (or module) that has the potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment.
  - (5) Approves restart of an activity at an accelerator facility after shutdown that was ordered by a DOE/NNSA field manager because of an unreviewed safety issue, violation of an ASE, or other safety concern.
  - (6) Approves exemptions from requirements of this Order for an accelerator facility or module that does not have the potential for more than minor onsite or more than negligible offsite impacts to workers, the public, or the environment.
  - (7) Ensures that the CRD or alternative standard, consistent with paragraph 3b(2), is incorporated into the contract of each affected site/facility management contractor through the cognizant contracting officer.
6. CONTACT. Questions concerning this Order should be addressed to the Office of Science, 301-903-6800.

BY ORDER OF THE SECRETARY OF ENERGY:



KYLE E. McSLARROW  
Deputy Secretary

**PRIMARY DEPARTMENT OF ENERGY ORGANIZATIONS  
TO WHICH DOE O 420.2B, *Safety of Accelerator Facilities*, IS APPLICABLE**

Office of the Secretary  
Office of the Chief Information Officer  
Office of Civilian Radioactive Waste Management  
Office of Congressional and Intergovernmental Affairs  
Office of Counterintelligence  
Departmental Representative to the Defense Nuclear Facilities Safety Board  
Office of Economic Impact and Diversity  
Office of Electric Transmission and Distribution  
Office of Energy Assurance  
Office of Energy Efficiency and Renewable Energy  
Energy Information Administration  
Office of Environment, Safety and Health  
Office of Fossil Energy  
Office of General Counsel  
Office of Hearings and Appeals  
Office of Independent Oversight and Performance Assurance  
Office of Inspector General  
Office of Intelligence  
Office of Legacy Management  
Office of Management, Budget and Evaluation and Chief Financial Officer  
National Nuclear Security Administration  
Office of Nuclear Energy, Science and Technology  
Office of Policy and International Affairs  
Office of Public Affairs  
Office of Science  
Secretary of Energy Advisory Board  
Office of Security  
Office of Security and Safety Performance Assurance  
Bonneville Power Administration  
Southeastern Power Administration  
Southwestern Power Administration  
Western Area Power Administration



**CONTRACTOR REQUIREMENTS DOCUMENT**  
**DOE O 420.2B, *Safety of Accelerator Facilities***

Regardless of the performer of the work, the contractor is responsible for compliance with the requirements of this Contractor Requirements Document (CRD). The contractor is responsible for flowing down the requirements of this CRD to subcontracts at any tier to the extent necessary to ensure the contractor's compliance with the requirements. In doing so, the contractor must not unnecessarily or imprudently flow down requirements to subcontractors. That is, the contractor will ensure that it and its subcontractors comply with the requirements of this CRD to the extent necessary to ensure the contractor's compliance and only incur costs that would be incurred by a prudent person in the conduct of competitive business.

The following items are required of the contractor organization.

1. Safety Assessment Document (SAD). A SAD must—
  - a. identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents;
  - b. contain sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks presented by the proposed operations;
  - c. provide appropriate documentation and detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) taken to eliminate, control, or mitigate risks of operation;
  - d. include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation;
  - e. be prepared as a single document addressing the hazards of the entire accelerator facility or as separate SADs prepared for discrete modules of the facility such as injectors, targets, experiments, experimental halls, and other type modules; and
  - f. be maintained current and consistent with the administrative control measures and physical configuration of the facility and major safety equipment.
2. Accelerator Safety Envelope (ASE).
  - a. A documented ASE must define the set of physical and administrative bounding conditions for safe operations, based on the safety analysis documented in the SAD.

- b. Any activity violating the ASE must be terminated immediately and the activity must not be restarted before the Department of Energy (DOE)/National Nuclear Safety Administration (NNSA) has been notified.
- 3. Unreviewed Safety Issues. Activities that involve unreviewed safety issues must not be performed if significant safety consequences could result from either an accident or a malfunction of equipment that is important to safety and for which a safety analysis has not been performed. Activities involving identified unreviewed safety issues must not commence before DOE/NNSA has provided written approval.
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  - a. Training and qualification requirements must be established for each individual at an accelerator facility whose activities could affect safety and health conditions or whose safety and health could be affected by facility activities. Training and qualification must be documented and kept current.
  - b. Only appropriately trained and qualified personnel, or trainees under the direct supervision of trained and qualified personnel, are permitted to perform tasks that may affect safety and health.
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- 6. Written Procedures.
  - a. Written procedures for conducting activities safely must be maintained; must be clear, current, and consistent with management systems and the configuration of the facility and equipment; and must be approved by the facility contractor's senior line management who are actively involved in the day-to-day operation of the facility.
  - b. Procedures must include descriptions of the tasks to be performed; safety and health precautions and controls; and requirements for initial conditions to be verified, operating conditions to be maintained, and data to be recorded, as applicable.
  - c. At a minimum, the contractor must prepare procedures for—
    - (1) operation startup,

- (2) normal operation,
- (3) emergency conditions,
- (4) conduct of maintenance,
- (5) approval and conduct of experiments,
- (6) review and approval of facility modifications,
- (7) management of safety-related changes, and
- (8) control of facility access.

7. Internal Safety Review System.

- a. An internal safety review system must be established and maintained to periodically assess and document the condition of the facility, equipment, and engineered safety systems.
- b. Appropriateness and implementation of procedures, administrative controls, and personnel training and qualifications must be periodically reviewed and documented by the internal safety review system.

8. Shielding Policy. The contractor must approve and implement a written statement of the shielding policy for ionizing and nonionizing radiation.