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C-A OPERATIONS PROCEDURES MANUAL

9.5.1 C-A ALARA Policy and Responsibilities

Text Pages 2 through 10

Attachments

Hand Processed Changes

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Approved: _____ *Signature on File* _____
Collider-Accelerator Department Chairman Date

E. Lessard

9.5.1 C-A ALARA Policy and Responsibilities

1. Purpose

- 1.1 This document establishes the policy and responsibilities for the C-A system of dose limitation and reduction:
 - 1.1.1 No job, experiment or practice involving radiation dose shall be adopted by the C-A unless its introduction produces a positive net benefit.
 - 1.1.2 C-A staff shall keep all individual and collective doses as low as reasonably achievable, with operational, economic and social factors taken into account.
 - 1.1.3 The dose to individuals shall not exceed the dose limits set for the appropriate circumstances by applicable DOE Orders and Federal Rules.
- 1.2 This procedure is primarily concerned with the second of these components of the system of dose limitation and reduction. Additionally, this procedure provides a description of the C-A organization used to keep radiation dose as low as reasonably achievable.
- 1.3 ALARA Policy
 - 1.3.1 It is the policy of Brookhaven National Laboratory to conduct its operations and research in a manner to protect the health and safety of employees, contractors, and the public. The management of Brookhaven National Laboratory is committed, in all its activities, to reduce any safety or health risks associated with radioactive materials and ionizing radiation to levels that are as low as reasonably achievable. Individual and collective doses, as well as the release of radionuclides to the environment, shall be maintained as far below the limits specified by DOE regulatory requirements as technical, economic, practical, and public policy considerations permit.
 - 1.3.2 The as low as reasonably achievable process of reducing radiation dose is desirable because of the direct relation of such reduction to the health and safety of both employees and the public. Reducing radiation dose improves the workplace and, in the long run, saves resources. This process is therefore a fundamental requirement of the Laboratory's Radiological Control Program.
 - 1.3.3 The high energy and nuclear physics facilities covered by this procedure consist of the Tandem Van de Graaff Accelerators, the Alternating Gradient Synchrotron complex, and the Relativistic Heavy Ion Collider. Three basic approaches to the as low as reasonably achievable process must be followed in these facilities:

- 1.3.4 Radiological and safety design considerations will be applied to the design and modification of facilities to reduce dose to individuals and releases to the environment.
- 1.3.5 Radiological controls will be carried out during operations, research, maintenance, and other support activities to minimize dose.
- 1.3.6 Monitoring of radioactive material and radiation, together with measurements of worker radiation dose, will be performed to validate and document that dose is being maintained as far below the regulatory limits as is reasonably achievable.

2. Definitions

- 2.1 ACLs -- Administrative Control Levels that are dose guidelines set down in this procedure by Brookhaven National Laboratory and the C-A Department.
- 2.2 AGS - an acronym for Alternating Gradient Synchrotron.
- 2.3 ALARA -- as low as reasonably achievable.
- 2.4 AtR -- an acronym for AGS to RHIC transfer line.
- 2.5 BLIP spur -- the beam line in Linac that brings beam to the Brookhaven Linac Isotopes Producer (BLIP).
- 2.6 Booster -- 1.5 GeV synchrotron accelerator.
- 2.7 C-A -- an acronym for Collider-Accelerator Department. The C-A includes the Tandem, AGS & RHIC Facilities, Booster Lines, NSRL, Accelerator, Transfer Lines and Experimental Halls.
- 2.8 Collective dose -- the sum of dose equivalent of all individuals in an exposed group.
- 2.9 DOE Dose Limits -- dose limits set down in 10CFR835.
- 2.10 Dose -- effective dose equivalent; sometimes referred to as the whole-body dose equivalent. The 'dose' includes internal emitters plus external irradiation.
- 2.11 FEB -- an acronym for Fast Extracted Beam lines that include the U and V lines.
- 2.12 g-2 -- an acronym for the experimental area whose facilities include B919 and the V1 line.

- 2.13 Linac -- 200 MeV linear accelerator.
- 2.14 NSRL – NASA Space Radiation Laboratory.
- 2.15 RHIC -- an acronym for Relativistic Heavy Ion Collider, whose facilities include the RHIC Ring, W, X and Y lines and experimental halls (PHENIX, PHOBOS, STAR, BRAHMS).
- 2.16 RWP -- an acronym for Radiation Work Permit.
- 2.17 SEB -- an acronym for Slow Extracted Beam; including Building 912 and A, B, C and D lines.
- 2.18 Tandem -- the facilities comprising the two Van de Graaff accelerators in Building 901.
- 2.19 TTB -- an acronym for Tandem to Booster transfer line.

3. **Responsibilities**

3.1 ALARA Committee Charge

- 3.1.1 Review germane Collider-Accelerator facilities, experiments or projects, for ALARA issues as part of their initial design process.
- 3.1.2 Review accelerator 'conduct of operations' that have a direct impact on creating activated materials, irradiating nearby facilities, or causing radioactive emissions or waste streams.
- 3.1.3 Review Radiological Control Division (RCD)'s Health Physics at C-A for 'conduct of operations' that have a direct impact on dose reduction efforts, or on measuring and reporting dose or dose rate to C-A management.

3.2 Specific ALARA Responsibilities

Note:

Any person may stop work when conditions and practices are unsafe and/or would violate DOE orders and safety policy. Immediately report work stoppage to the C-A and RCD Management.

- 3.2.1 See [C-A-OPM-ATT 9.5.1.a](#) for a listing of the C-A organizations with specific ALARA responsibilities.
- 3.2.2 See [C-A-OPM-ATT 9.5.1.b](#) for a listing of specific ALARA responsibilities.

- 3.2.3 Annually, the ALARA Committee shall review any established ALARA goals. Before setting goals, the Committee shall review the levels of occupational dose, radioactive waste generation and ambient radiation levels in and around the Collider and Tandem complexes. Where appropriate, the Committee may choose to establish goals for personnel dose for specific major efforts or for specific groups within the complexes. Where data are available, goals for radioactive effluent discharge and radioactive waste volume may also be established.
- 3.2.4 The ALARA Committee Chair is responsible for scheduling promptly an ALARA review of a project, experiment or job. The ALARA Committee Chair is responsible for seeing that the minutes of the meetings are written and distributed.
- 3.2.5 The ALARA Committee is responsible for reviewing the estimated radiation doses for jobs or projects when requested and for reviewing the methods for reducing dose.
 - 3.2.5.1 The ALARA Committee Chair shall review any worker's exposure expected to exceed 750 mrem in one year. The Chair and a minimum of three committee members shall conduct the review.
- 3.2.6 The C-A personnel assigned to oversee a project, experiment or specific task (e.g., project leaders, liaison physicists, liaison engineers, supervisors) are responsible to consider if there are associated ALARA issues. Triggers for the ALARA Committee reviews are given in [C-A-OPM 9.5.2](#), [C-A-OPM 9.5.4](#) and [C-A-OPM 9.5.5](#). If applicable, personnel assigned to oversee a project, experiment or specific task must request that the project, experiment or task be reviewed by the ALARA Committee. They must provide a written description of the ALARA issues and the proposed methods to reduce doses to as low as reasonably achievable.
- 3.2.7 The ALARA Committee shall track recommendations through to completion. The Committee shall keep all records that relate to facility, experiment or project reviews that are performed by the Committee.

4. Implementation

4.1 Scope of ALARA Reviews

Regardless of whether or not an ALARA Committee review is required, line supervisors, liaison physicists, liaison engineers and project leaders shall review the following for ALARA issues:

- 4.1.1 All experiments.
- 4.1.2 All capital improvement proposals (AIPs, GPPs).
- 4.1.3 All tasks requiring a Radiation Work Permit.

4.1.4 All new accelerator systems, subsystems, and modifications.

4.2 Administration of Dose

4.2.1 C-A management must keep the dose to workers as low as reasonably achievable and in no case shall the dose to trained Radiation Workers exceed the following administrative Control Levels (ACL):

4.2.1.1 A DOE ACL of 2000 mrem per year has been set. DOE Headquarters must approve in advance each request for an extension of this level.

4.2.1.2 The BNL ACL of 1250 mrem per year is established for Radiation Workers at all BNL site facilities. Approval to exceed this Control Level must be granted by the Laboratory Director, or designee, and RCD Manager, in advance.

4.2.1.3 The ACL at C-A is 1000 mrem per year. The C-A Department has established a formal process for approval of extensions from the level of 1000 mrem up to 1250 mrem.

4.2.1.3.1 The ALARA Committee Chair shall notify the Department Chair in writing regarding personnel exposures expected to exceed 750 mrem in one year.

4.2.1.4 The daily dose to trained Radiation Workers shall be less than 100 mrem. A first line supervisor may approve a dose between 100 and 200 mrem. The Facility Support (FS) Representative shall be notified that such an approval was given.

4.2.1.5 The C-A ACLs will be evaluated annually by the Chair of the ALARA Committee and the C-A Department Chair.

4.2.2 Additional Administrative Levels

4.2.2.1 The C-A ACL for a declared pregnant worker shall not exceed 350 mrem per gestation period. Substantial variation above 40 mrem per month to the pregnant worker shall be avoided.

4.2.2.2 After a female Radiological Worker voluntarily notifies the C-A Supervisor or Experiment Spokesperson and the C-A FS Representative in writing that she is pregnant, for the purpose of fetal/embryo dose protection, the classification of a declared pregnant worker is in effect until the worker submits a signed and dated statement to her Supervisor or Spokesperson indicating that she is

withdrawing her formal declaration of pregnancy, or until the end of the gestation period (see [HP-SOP-019](#))

4.2.2.3 C-A Supervisors shall provide at least two options for the limitation of the dose to the embryo or fetus:

4.2.2.3.1 Option 1: The option of a mutually agreeable assignment of work tasks, without loss of pay or promotional opportunity, such that further occupational radiation exposure is unlikely.

Note:

IF the dose to the embryo/fetus is determined to have already exceeded 500 mrem per gestation period when a worker notifies her Supervisor of the pregnancy, THEN the worker shall not be assigned to tasks where additional occupational radiation exposure is likely during the remainder of the gestation period.

4.2.2.3.2 Option 2: The declared pregnant worker may choose to continue working as a radiological worker up to the 350 mrem per gestation period ACL.

4.2.2.4 The employee may complete the form for withdrawal of pregnancy at any time. The worker submits a signed and dated form to her Supervisor or Experimental Spokesperson indicating that she is withdrawing her formal declaration of pregnancy or the gestation period is completed. No additional explanation or justification is necessary.

4.2.2.5 After notification has been made, it is the Supervisor's responsibility to remove any imposed work or area restrictions.

4.2.2.6 To obtain counseling or additional information on the subject of fetal exposure, the C-A FS Representative shall identify a listing of employees with expertise in Radiological Safety or radiology that are designated as contacts for female radiological workers.

4.2.2.7 The RCD shall be responsible for determining the dose to the fetus.

4.2.2.8 For guests or visitors without training, minors and minor students, an ACL of 25 mrem per year is established.

Note:

Minors visiting the C-A (as opposed to working at the C-A) are allowed without the need for obtaining written permission; the ACL is 25 mrem per year, as stated above.

4.2.3 Approvals

4.2.3.1 Prior to individuals exceeding the C-A ACL, approval of the C-A Department Chair, or ESHQ Associate Chair, and the C-A FS Representative, must be obtained.

4.2.3.2 To increase the ACL for guests or visitors without training, minors, or minor students from 25 mrem to 100 mrem per year requires approval by the C-A Department Chairman, and the Radiological Controls Division Head.

4.2.3.2.1 Exposures to minors shall be administratively controlled by not allowing students under the age of 18 to WORK in Controlled or Radiological Areas without written permission.

4.2.3.3 Prior to any individual exceeding the Laboratory Administrative Control Level of 1250 mrem per calendar year, approvals of the Laboratory Director and the RCD Head shall be obtained.

4.2.3.4 Approvals for exceeding the 2000 mrem/year DOE Administrative Level must have the signature from the DOE Secretarial Office or designee.

4.2.4 Documenting Approvals

4.2.4.1 Forms contained in [HP-SOP-022](#) shall be used to document the authorization to exceed the ACL, and to notify RCD Personal Monitoring of the dose extension authorization.

4.2.4.2 The Health Physics Section of the RCD shall be sent a copy of all approvals for minors to enter radiation areas and to exceed 25 mrem dose.

4.2.4.3 The information on all forms is personal and confidential and must always be treated as such.

4.3 ALARA Documents

The following documents were developed to carry out a formal ALARA program:

4.3.1 ALARA Design Review Procedure ([C-A-OPM 9.5.2](#))

4.3.2 ALARA Audit Procedure ([C-A-OPM 9.5.3](#))

- 4.3.3 Radiation Work Permit ([C-A-OPM 9.5.4](#))
- 4.3.4 ALARA Job/Experiment Review Procedure ([C-A-OPM 9.5.5](#))
- 4.3.5 Cost/Benefit Analysis ([C-A-OPM 9.5.6](#))
- 4.3.6 ALARA Goal Procedure ([C-A-OPM 9.5.7](#))
- 4.3.7 ALARA Program, ([HP-SOP-020](#))

5. Procedure

None

6. Documentation

None

7. References

- 7.1 Occupational Dose Reduction at Department of Energy Facilities, Study of ALARA Programs - Good Practice Documents, DOE/EH, July 1991.
- 7.2 [BNL Radiological Control Manual](#).
- 7.3 Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable, PNL-6577, June 1988.
- 7.4 Cost-Benefit Analysis in the Optimization of Radiation Protection, Annals of the ICRP, ICRP 37, V10 No. 12/3, 1983.
- 7.5 DOE N441.1, Radiological Protection for DOE Activities.
- 7.6 [SBMS](#)
- 7.7 Title 10 Federal Code of Regulations Part 835, "Occupational Radiation Protection".
- 7.8 [HP-SOP-019 "Declaration of Pregnancy"](#)
- 7.9 [HP-SOP-020 "ALARA Program"](#)
- 7.10 [HP-SOP-022 "Radiation Dose Limits and ACL's"](#)

8. Attachments

8.1 [C-A-OPM-ATT 9.5.1.a, "ALARA Program Organization for C-A".](#)

8.2 [C-A-OPM-ATT 9.5.1.b, "Specific ALARA Responsibilities".](#)