

# Boeing - SSFL EHS Manual

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## **SM-40.401, RADIOLOGICAL CONTROLS MANUAL: RADIOLOGICAL SAFETY GUIDELINES, JULY 13, 2012, JAMES BARNES**

**DOCUMENT CHANGE SUMMARY** – This document replaces issue dated November 27, 2007. Periodic review. Updates references to SOP C-401.

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## **APPLICABILITY**

This procedure applies to radiological activities conducted at the Boeing Santa Susana Field Laboratory (SSFL) campus ("Boeing - SSFL").

The terms "shall," "should," "may," etc. indicate procedural requirements or suggestions for good practices. These terms are intended to convey meanings typically used in quality assurance or standards documents (e.g., ANSI).

- "Shall" in this procedure denotes a mandatory requirement.
- "Should" denotes a recommended practice, but which is not required. "Should" is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.
- "May" denotes an option. "May" indicates a course of action permissible within the limits of the procedure.

This procedure implements the requirements of SOP C-401, *Radiation Safety Program*. This procedure is intended to provide additional guidance to the requirements of the SOP. Stipulations of this procedure are to be interpreted in light of the SOP C-401 requirements.

Note that DOE dosimetry terminology has been changed. This procedure utilizes the former terminology. SOP C-401, Table 8 describes terminology equivalency.

## **PART 1 Boeing - SSFL Radiological Controls**

### **Radiological Control**

A fundamental principle underlying Radiation Safety is:

"There *should* not be any occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure."

Boeing - SSFL is firmly committed to having a radiological control program of the highest quality. This applies to those activities that involve radiation and radioactive materials and that may potentially result in radiation exposure to workers, the public and the environment.

Boeing - SSFL's Radiological Control Policy summarizes the elements of the Radiation Protection Program, and is intended to guide the actions of every person involved in radiological work throughout the Division.

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## **BOEING - SSFL RADIOLOGICAL CONTROL POLICY**

### **ALARA**

Personal radiation exposure **shall** be maintained As-Low-As-Reasonably-Achievable (ALARA).

Radiation exposure of the work force and public **shall** be controlled such that radiation exposures are well below regulatory limits and that there is no radiation exposure without commensurate benefit.

### **OWNERSHIP**

Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined and cautious attitude toward radiation and radioactivity.

### **EXCELLENCE**

Excellent performance is evident when radiation exposures are maintained well below regulatory limits, contamination is minimal, radioactivity is well controlled and radiological spills or uncontrolled releases are prevented.

Continuing improvement is essential to excellence in radiological control.

## **112 Program Applicability and Control**

This Program establishes practices for the conduct of radiological control activities at all Boeing - SSFL facilities utilizing radiation or radioactive materials. The Program states Boeing - SSFL's positions and views on the best courses of action currently available in the area of radiological controls. Accordingly, the provisions in the Program describe acceptable techniques, methods or solutions for using radioactive materials or radiation producing devices.

The Program is not a substitute for Regulations; it is intended to be consistent with all relevant statutory and regulatory requirements and **shall** be revised whenever necessary to ensure such consistency. Some of the Program provisions, however, challenge the user to go well beyond minimum requirements. Following the course of action delineated in the Program will result in achieving and surpassing related statutory or regulatory requirements.

1. This Program is a living document. Boeing - SSFL intends to review and update provisions on a periodic basis to incorporate lessons learned and suggestions for improvement. The Manager, Health, Safety & Radiation Services group of the Environmental, Health and Safety [EHS] organization is responsible for this task. Recommendations to correct or improve this Program are encouraged. The recommended wording of the change, as well as the basis and justification for the change, *should* be included.

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2. Boeing - SSFL intends to incorporate by reference the provisions in this Program into plans and procedures as appropriate.
3. This procedure applies to all Boeing - SSFL activities. Exceptions to the provisions of this procedure may be explicitly proceduralized where NRC or State regulations stipulate alternate actions, limits, or activities.

Department of Energy (DOE) activities **shall** be conducted in accordance with 10 CFR 835. Compliance to these procedures will meet this requirement.

4. The Program descriptions **shall** be kept current and *should* be entered into the Boeing - SSFL document control system.
5. Nothing in this procedure shall be construed as limiting actions that may be necessary to protect health and safety.

## 113 Compliance

1. This Program sets forth Boeing - SSFL's views on the proper course of action in the area of radiological control. If a user fully implements a provision, the user will have complied with, and most likely exceeded, any related statutory, regulatory, or contractual requirement. The words "**shall**" and "*should*" have the meaning below when a provision is incorporated into a contract.
2. The terms "**shall**" and "*should*" are described in the Applicability section of this procedure.
3. Certain situations and events may be reportable to appropriate regulatory agencies. Unusual events ("incidents") and program assessments **shall** be evaluated by the Radiation Safety Officer (or designee) in order to establish the need for reporting to external agencies. The following regulatory guidelines provide the criteria for such reporting:
  - For activities and locations subject to State of California regulations, reporting requirements and criteria are described in:
    - CCR 17.30295, *Notification of Incidents*; and,
    - 10 CFR 20.2203, *Reports of Exposures, Radiation Levels, And Concentrations Of Radioactive Material Exceeding The Limits*, as amended by CCR 17.30253.
  - For activities and locations subject to Department of Energy regulations, reporting requirements and criteria are described in:
    - DOE Order 232.1A-1, *Occurrence Reporting And Processing Of Operations Information*.

Reporting to the DOE ORPS system shall be done through the Price-Anderson Amendments Act (PAAA)/ORPS Coordinator. Boeing is a participant in the Noncompliance Tracking System (NTS), and will inform DOE of any significant instances of non-compliance to radiological regulations.

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4. For those activities that are required by 10 CFR 835.102 (Internal Audits), 835.901(e) (Biannual Retraining), 835.1202(a) (Source Inventory), and 835.1202(b) (Leak Tests), the time interval to conduct these activities may be extended by a period not to exceed 30 days to accommodate scheduling needs.

## **114 Site-Specific Program**

1. DOE operations are conducted under the Radiation Protection Plan submitted in compliance with the requirements of 10 CFR 835. The State of California requires a documented radiation protection program describing operations under Boeing's Broad Scope "A" license. The SOP C-400-series and SM-40.400 series provide implementation and operational guidance to assure compliance to these regulatory requirements.

Note that DOE and State regulatory requirements may differ. In these situations, the RSO may determine the appropriate compliance requirements for a specific application.

2. Subcontractors to Boeing - SSFL **shall** comply with this Radiological Control Program (or with vendor procedures complying to the Boeing – SSFL Radiation Protection Plan, as appropriate) while performing work in Boeing - SSFL facilities involving radioactive materials or radiation producing devices.

Unless specifically exempted by Radiation Safety, subcontractors and subcontracted employees **shall** be subject to the Boeing - SSFL radiation safety program. Subcontractors and subcontracted employees **shall** meet the same requirements and expectations as Boeing - SSFL staff in the area of radiological matters. Subcontractors and subcontracted staff are expected to comply with the directions of Radiation Safety personnel responsible for oversight of projects being performed by subcontractors. Subcontractors and subcontracted staff are to have comparable training to that required for Boeing - SSFL staff who perform similar work. Bidders should be informed of these requirements, and contracts and specifications for subcontracted work *should* include instructions to the subcontractor regarding these issues<sup>1,2</sup>.

3. The Program incorporates requirements mandated by the Department of Energy (See SOP C-401, Section 3; "Scope"). Procedure changes that are determined by Radiation Safety to significantly impact compliance to 10 CFR 835 and the associated Radiation Protection Plan shall not be implemented without the prior approval of the Department of Energy.

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<sup>1</sup> This provision applies **only** to radiation safety. Generally, health and safety of sub-contracted personnel is the responsibility of the contractor, not Boeing-Boeing - SSFL.

<sup>2</sup> Relocated from Article 125.9.

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## **115 Application of Requirements**

1. The degree of program formality and extent of the associated administrative process are expected to be commensurate with the radioactive material contamination and dose potential. Specific program requirements for individual projects are established through project specific procedures, Use Authorizations issued under the auspices of the Radiation Safety Committee, Radiation Work Permits, and *ad hoc* field directions of Radiation Safety staff.
2. Radiation Safety may periodically issue additional policies, procedures, guides, desk instructions, and other documents to further explain and describe requirements of this Program.

## **PART 2 Leadership in Radiological Control**

For the Radiation Protection Program to properly function, the following duties and responsibilities must be addressed.

### **121 Management Commitment**

1. The radiological control program **shall** establish and maintain high performance standards. Through training, briefings and other types of communication channels, these standards and expectations are communicated to the workforce. Senior managers **shall** periodically review and revise these standards as needed.
2. Senior management **shall** allocate sufficient resources for the operation of the Radiation Safety program. These allocations **shall** include resources for adequate staffing and for adequate training to ensure workers are qualified for their assigned duties.
3. Orientation, training and indoctrination **shall** reinforce rules and guidelines for each worker to minimize radiation exposure and control radioactivity. Managers **shall** periodically review the training and indoctrination process for effectiveness and pertinence.
4. Workers and their supervisors are accountable for radiological control performance. Relevant knowledge and performance *should* be assessed as a specific part of each person's performance evaluation. This assessment *should* not be limited to those who perform radioactive work, since many other workers have an impact on the radiological control program. Managers **shall** ensure that workers and supervisors are aware of these expectations, and **shall** appropriately assess workers' and supervisors' performance against these expectations.
5. Radiation Safety **shall** ensure Senior management is periodically briefed on the state of the program and of radiological operations. Senior managers *should* solicit feedback from their radiological control professionals, line management and workers on radiological control performance.

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6. Training and orientation programs *should* promote a positive attitude toward radiological control that encourages initiatives to identify concerns at an early stage, to prevent problems from deteriorating and to promote doing the right job correctly the first time. Senior Management **shall** periodically assess the effectiveness of the program in promoting these attitudes<sup>3</sup>.
7. Prevention of the spread of radioactivity is less costly than remediation. Measures to prevent the spread of contamination may increase the near-term costs of work activities, but these costs can be counterbalanced against the far-term costs of remediation of facilities. Management **shall** assess these long-term vs. near-term costs during project planning, and **shall** ensure that adequate resources are allocated for the implementation of effective contamination control measures. Management *should* be willing to accept change that will improve radiological control and *should* foster this mindset throughout the organization.
8. Senior managers **shall** require and approve radiological improvement goals. Goals *should* be measurable, realistic, auditable and challenging. Established goals *should* not be changed without technical justification and senior management approval. Senior management *should* review program progress on a periodic basis.
9. A performance indicator program for measuring and trending the effectiveness of the radiological control program against predetermined goals *should* be established and maintained.
10. Management **shall** establish a comprehensive and effective radiological control training program. The authority and responsibility for the content and use of the program *should* be assigned to Radiation Safety, line managers, and their subordinates. Training, in most cases, *should* be provided by dedicated training personnel, but the responsibility for quality and effectiveness rests with line management.
11. Senior management **shall** establish programs to minimize the generation of radiological waste and discharges to the environment. Senior managers *should* be alert to opportunities for minimizing the generation of radiological waste and discharges to the environment, controlling contamination at its source and reducing radiation exposure to workers and the public.
12. Managers **shall** be responsible for identifying, reporting, and mitigating radiological incidents. Reporting a problem to a superior does not absolve the manager from promptly fixing or mitigating a situation.

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<sup>3</sup> Such assessments may be performed as part of overall assessment of the corporate training program.

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### 122 Worker Attitude

Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation.

1. Each worker needs to understand that proper radiological control is an integral part of their daily duties. Appropriate training and counseling is provided to facilitate the development of this attitude in workers.
2. Improving the attitude of the work force *should* be supported by the training program. To achieve this, training personnel need to be knowledgeable about the work environment and those aspects of radiological control that are important to developing a better worker attitude and perspective.
3. The attitude that constant improvement is required in radiological work needs to be developed at all levels of management and in the work force. Cooperation between the work force and the Radiation Protection Organization has to be developed and fostered. The workers *should* not look upon radiological controls as hurdles or restrictions to be bypassed.
4. Although Radiation Safety has a responsibility for the enforcement of Radiation Safety policies and rules, Radiation Safety personnel are expected to be helpful in showing workers how to follow the rules. This spirit of cooperation needs to be developed without subverting the control functions of the Radiation Safety Technicians (see Article 642). A situation in which radiological controls are left solely to the Radiation Safety Organization is unacceptable.

### 123 Worker Responsibilities

Personnel training **shall** instruct workers to recognize that their actions directly affect contamination control, personnel radiation exposure and the overall radiological environment associated with their work. The following radiological control rules are applicable to each person in the workplace. A poster that displays the worker responsibilities listed below *should* be produced and displayed at appropriate access points and work areas.

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[Text of Radiological Work Rules Poster]

TO MINIMIZE YOUR RADIATION EXPOSURE AND TO CONTROL RADIOACTIVITY, OBSERVE THE FOLLOWING RULES:

## OBEY

- Posted, written and oral radiological control instructions and procedures, including instructions on Radiation Work Permits.
- "Evacuate" and "stop work" orders from radiological protection personnel promptly.

## DO NOT

- Loiter in radiation areas.
- Smoke, eat, drink or chew in Contamination Areas, High Contamination Areas and Airborne Radioactivity Areas.

## BE SURE TO

- Wear personnel monitoring devices where required by Radiation Work Permits, signs, procedures or by radiological protection personnel. Report immediately the loss, damage or unexpected exposure of personnel monitoring devices or off-scale readings of self-reading dosimeters to Radiation Safety.
- Keep track of your radiation exposure status and avoid exceeding radiological Administrative Control Levels.
- Wear Personal Protective Equipment and clothing properly whenever required by Radiological Work Permits or postings.
- Be alert to the potential for radioactive spills. Minimize the spread of radioactive spills and promptly notify the appropriate personnel of all spills.
- Avoid contact of skin, clothing and equipment with contaminated surfaces.
- Place contaminated tools, equipment and solid waste items on disposable surfaces, such as plastic sheets, when not in use.
- Notify radiological protection personnel of alarming or faulty radiological control equipment. If radiation protection personnel are not readily available, they can be notified by contacting Security.
- Notify radiological protection personnel of off-site occupational radiation exposures so that worker dosimetry records can be updated.

## PRIOR TO ENTERING AREA

- Assure that you are mentally alert and in physically sound condition.
- Limit the amount of material taken into contaminated areas to minimize radioactive waste and future decontamination.

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- Have necessary materials and equipment on hand to complete your task, thereby minimizing time and exposure.
- Notify radiological protection personnel of the presence of open wounds, sores or rashes before entering an area where contamination exists and exit immediately if a wound occurs while in such an area.

### UPON LEAVING AREA

- Properly remove Personnel Protective Equipment and clothing to minimize the spread of contamination.
- Frisk or be frisked for contamination when leaving posted Contamination, High Contamination or Airborne Radioactivity Areas and associated Radiological Buffer Areas and notify radiological protection personnel when contamination is found.

[END OF POSTER TEXT]

## 124 Radiation and Risk Communications

Due to the continuing concerns of many people related to low radiation exposure and health impacts, managers *should* be trained to deal with the perceptions concerning radiation risks held by personnel. Managers and first-line supervisors *should* be sensitive to the fact that workers have to understand the fundamentals of radiation, its risks and their role in minimizing exposure. It is not sufficient to rely solely on regulatory limits for establishing or defining acceptable work practices and work environments.

1. Appropriate personnel *should* receive training which is helpful in their dealing with workers who have anxiety about radiation. This training *should* include the following:
  - A. Guidance on handling such personnel interactions
  - B. Emphasis on being factual
  - C. Fundamentals of communicating risks
  - D. Importance of keeping management informed.
2. Some personnel, such as those who may have internal deposition of radionuclides from prior years, are concerned about future exposures. Such instances warrant special attention on the part of the manager. Counseling with such personnel *should* be the preferred way to consider relevant factors. In some cases Special Control Levels (Article 216) *should* be applied.

## 125 Conduct of Radiological Operations

1. The scope and basis of the Radiation Safety Program is described in SOP C-401.
2. Managers at all levels are expected to be involved in the planning, scheduling and conduct of radiological work. Assurance of adequate radiological safety **shall** not be compromised to achieve financial, production, remediation or research objectives.

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3. Supervisors *should* be technically knowledgeable and inquisitive and *should* ask questions of the work force concerning radiological work details to assure and demonstrate worker understanding and comprehension.
4. Line managers **shall** periodically monitor work areas to observe personnel at work and to identify radiological deficiencies and concerns. Frequent inspections and walk-throughs, including off-hours and weekends (where appropriate), are essential to reinforce management expectations to the work force.
5. Accurate, clear, written procedures **shall** be prepared for the conduct of radiological work. Managers, supervisors and workers *should* be involved in the development these procedures. If during the use of procedures a written requirement cannot be responsibly followed, the work **shall** be stopped and guidance obtained.
6. Radiological control deficiencies and concerns **shall** be identified and addressed. Supervisors and managers *should* encourage the work force to identify radiological control deficiencies and concerns. Prompt, risk-graded action **shall** be taken to address and eliminate identified issues and prevent recurrence. Retraining, indoctrination and procedure review are useful in addressing these issues.
7. Managers and supervisors *should* establish working conditions that encourage improved radiological control. This includes temperature, humidity and lighting as well as the more difficult considerations of accessibility. Work conditions *should* be considered in planning work.
8. Cleanliness and good housekeeping are essential. A good radiological control program cannot exist in a sloppy, dirty workplace. Cleaning up after operations *should* be automatic for each person. It is not reasonable to expect radiological control to be separated from the work environment.
9. [Relocated to Article 114.2]
10. Conditions that could cause or promote the spread of contamination, such as a leaking roof or piping, *should* be identified and corrected on a priority basis. Priority *should* be established based upon a risk-graded assessment of the potential hazard from such spread of contamination.

### **126 Improving Worker Awareness of Radiological Conditions**

In performing assigned duties within radiological areas, workers are expected to be familiar with the area radiological conditions and to be aware of the possibility that changes may occur due to unforeseen reasons. Although the conduct of radiological surveys is viewed as a traditional role of Radiation Safety Technicians, experience has shown that properly trained and qualified workers are capable of performing supplemental radiological surveys in the course of work. This process results in exposure savings and improved contamination control.

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Specific examples of surveys that may be effectively performed by workers and result in ALARA exposure reductions include self-monitoring of dose rates during High Radiation Area entries and the monitoring of tools and equipment for contamination as a qualitative check during work in Contamination Areas. The performance of legal record surveys such as workplace monitoring and facility/grounds release surveys remains the responsibility of qualified Radiation Safety Technicians.

## 127 Critiques

A formal process *should* be established to obtain pertinent facts following an unusual radiological situation or at the satisfactory conclusion of a new or unusual operation involving radiological controls. Off-normal events that have radiation safety implications are reported through the Boeing - SSFL Incident Reporting Process.

This process complements the Occurrence Reporting System of DOE Order 231.1 and similar requirements of other regulatory agencies. The process *should* be used to quickly establish facts in chronological order so that the underlying reasons or causes for the success or failure are well understood.

Work force participation *should* be encouraged.

Critiques are a management tool and *should* not be used to "fix blame" or "shoot the messenger."

Radiological work practices *should* be continually scrutinized and questioned so that opportunities for improvement can be identified, assessed and incorporated into this Program.

## 128 Facility Modifications and Radiological Design Considerations

1. During the design of new facilities or modification of existing facilities, the following objectives **shall** be adopted.
  - Optimization methods **shall** be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls.
  - Regarding the control of airborne radioactive material, the design objective **shall** be, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA. Confinement and ventilation shall normally be used.
  - The design or modification of a facility and the selection of materials **shall** include features that facilitate operations, maintenance, decontamination, and decommissioning.

In addition, the following practices *should* be considered:

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- The release of radioactive liquids to the environment may be permitted under certain circumstances. Specific release criteria designated in appropriate Boeing - SSFL procedures *should* be implemented as design goals. Radioactive liquids *should* be controlled in such a manner that unmonitored releases to the environment are prevented.
- Radioactive materials should be contained in order to prevent unnecessary generation of contaminated materials, articles, equipment, facilities, and grounds.
- Efficiency of maintenance, decontamination and operations *should* be maximized
- System components *should* be selected to minimize the accumulation and spread of radioactivity
- Support facilities *should* be provided for personnel to don and remove protective clothing, for personnel monitoring, and, where appropriate, for Radiation Safety support staff.

For DOE operations:

- The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) **shall** be to maintain exposure levels below an average of 0.5 mrem (5 microsieverts) per hour and as far below this average as is reasonably achievable. Note that this is a *design objective* and **is not** to be construed as a dose limit.
  - The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above **shall** be ALARA and **shall not** exceed 20 percent of the applicable regulatory standards in SOP C-401, Table 5, "Summary of Administrative Control Levels (ACLs) and Regulatory Dose Limits." Note that this is a *design objective* and **is not** to be construed as a dose limit.
2. Facilities currently under construction *should* be evaluated and the above criteria applied where practicable.
  3. Existing facility designs that have office space and lunchrooms or eating areas within Radiation Areas, High and Very High Radiation Areas, Contamination and High Contamination Areas, Airborne Radioactivity Areas, Radioactive Material Areas and Radiological Buffer Areas (Radiological Areas) require special review. Generally:
    - A. Locating lunch rooms or eating areas, restrooms, drinking fountains, showers and similar facilities and devices within radiological areas is not appropriate. Location of these facilities within the confines of a Controlled Area is permissible when approved by the RSO.
    - B. Locating office spaces within radiological areas *should* be limited to the support of activities that are directly related to operations occurring in the area. To the extent that such space is essential to support radiological work, steps *should* be taken to preclude unnecessary occupancy.

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4. Decontamination and decommissioning projects may present unique situations regarding the application of “facility modification” requirements. Refer to SM-40.403, Part 7, for additional guidance about these types of projects.

## **PART 3 Improving Radiological Performance**

### **131 Radiological Performance Goals**

The Radiation Safety organization *should* use goal setting as a management technique for program improvement. Goals are intended as a measure of and a motivation for improvement, not an end in themselves. Metrics *should* be used to measure progress toward these Goals. These metrics are not to be viewed narrowly as merely numerical goals. These metrics *should* be used as tools to assist management in focusing their priorities and attention.

Metrics *should* be designed to provide insight into program performance. Certain metrics may be routinely compiled; others may be periodically compiled from retained records if a trend analysis is needed. The maintenance of metrics where the values are predominantly “zero” is generally not warranted.

The following metrics are examples of those currently maintained by Radiation Safety. This list may be modified from time to time as need is determined by the Radiation Safety Officer.

1. Progress Status of Radiological Facility Cleanup and Release
2. Milestone Progress of Special Projects
3. Dose Distribution Histogram; Calendar Quarter
4. Highest Dose to Individual; Trend by Calendar Quarter
5. Average Dose to Workers; Trend by Calendar Quarter

### **132 Management of Radiological Performance Goals**

1. The Manager, Health, Safety and Radiation Services, **shall** establish, approve and maintain a radiological performance goals program.
2. The performance goals *should* be measurable, achievable, auditable challenging, and meaningful in promoting improvement.
3. Goals need to be developed primarily by those responsible for performing the work.
4. Radiological performance goals *should* be reviewed at least annually and revised as appropriate. Normally, more stringent goals *should* be set annually to reflect the improved radiological performance at the facility. Occasionally, a goal may be made less stringent to accommodate changes in work load or mission.

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### 133 Radiological Performance Reports

1. Where such reporting has been demonstrated to enhance management control of radiological projects, Radiation Safety *should* provide a periodic summary report of radiological conditions and status to appropriate managers. When utilized, this report **shall** be prepared on a periodic basis, but nominally *should* be prepared quarterly. This report *should* include at least the appropriate radiological performance goals established in accordance with Article 131. Metrics *should* be contained in the report for the quarter as well as appropriate tracking and trending for the prior periods. The content of such reports may be modified from time to time, as deemed appropriate by Radiation Safety and interested management. Such routine activities as Internal Program Review "IPR" briefings, monthly activity reporting, or similar administrative functions are acceptable forms of such reporting. Reports may be distributed by electronic means; no separate hardcopy distribution is required.
2. Radiation Safety *should* provide radiation exposure information to supervisors and managers on a frequent enough basis to permit priority management of exposure control. The frequency *should* be consistent with the nature of the workload and the radiation exposure potential.
3. To promote worker awareness of their radiation exposure status, selected indicators related to their work group *should* be posted in the workplace.

### 134 Assessments

1. Internal audits of all functional elements of the radiation protection program shall be conducted no less frequently than every three years. Such audits may be conducted on a staggered basis, as long as each element of the program is audited at least every three years.
2. All functional elements *should* be assessed for program performance, applicability, content and implementation. These *should* be performed by the Quality Assurance Organization, Boeing Corporate auditing organizations, or other qualified organizations (such as qualified third-party auditing services vendors). In the absence of other qualified organizations or personnel, Radiation Safety may perform the audits.

For the purposes of this review, the functional program elements are defined as:

- Program Administration
- Access Control and Posting
- External dosimetry
- Internal dosimetry
- Respiratory protection (only as regards work in radiological areas)
- ALARA
- Source Control
- Radiation Safety Training

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3. This requirement is not to be construed to require duplicative audit efforts of the Boeing - SSFL radiation protection program for different regulatory agencies. The ETEC Site Closure project is a client of Boeing - SSFL's divisional program. Radiation Safety also services clients operating under the State of California license. Many programmatic requirements are common to State and DOE regulations.

Accordingly, if it is established at some time during the three year review cycle that requirements unique to 10 CFR 835 are being satisfied, then an audit of the common elements of the divisional program will satisfy the requirements of the RPP for 10 CFR 835.

4. Results of assessments *should* be incorporated into the ongoing process of improving radiological control.
5. A prioritization system to implement actions for resolving the deficiencies *should* be implemented.
6. In developing corrective action plans for assessment activities, managers *should* address basic underlying reasons for the identified deficiencies or concerns, not just the specific symptoms identified by the reviewer.
7. Feedback on findings from assessments, root-cause analyses, status of corrective actions and adherence to action plan schedules *should* be frequently provided to management.

### **135 Workplace Awareness**

1. Management initiatives to facilitate the expression of concerns on the part of the work force, to address such concerns and to solve them are strongly encouraged to ensure the proper respect for and understanding of radiation.
2. An event reporting process **shall** be utilized to report and track abnormal events, conditions, or other unusual activities. The process *should* track resolution of concerns, provide feedback to managers and employees, and document results of reported events. The process *should* prepare, display, and evaluate trends. The system *should* be utilized in such a way as to encourage continuous evaluation and improvements., This is accomplished using the Boeing Enterprise Incident Reporting System (IRS).

### **136 Internal Exposures**

Control and prevention of internal exposure from long-lived radionuclides in the workplace present special challenges to a radiological control program and warrant particular attention. Even though internal exposure is measured in the same units as external exposure and carries the same risk per unit effective dose equivalent, the perception may exist that it is of greater significance since the exposure is the result of radioisotopes retained within the body.

Administration of internal dose assessment is costly in dollars and worker time. Control and analysis of samples is also more complicated than the elements of external dosimetry.

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Internal exposures are expected to be reduced to the minimum practicable level. Internal exposures can be minimized by controlling contamination at the source and reducing the size and number of Airborne Radioactivity, Contamination and High Contamination Areas. The use of respiratory protection devices **shall not** be substituted for proper work planning and workplace engineering controls.

Personnel who plan and conduct operations that may generate airborne radioactivity *should* be aware of and address the following issues inherent in airborne radioactivity control:

- Workers may be exposed to unanticipated levels of elevated airborne radioactivity. The time necessary to collect representative airborne radioactivity samples and the time required for technicians or automated instruments to determine the precise airborne concentration of radionuclides may delay warnings to workers. This could inadvertently contribute to increased worker intakes of radioactivity. Internal depositions of radionuclides can occur in a short period of time. To the extent practical, engineering or process controls **shall** be applied to anticipate and control such "bursts" of airborne radioactivity.
- The continued exposure of workers to airborne radioactivity over extended periods of time can create worker concerns. Accordingly, screening and bioassay sampling *should* be conducted at a frequency appropriate to the hazards presented by the process.
- Doses from some internal radionuclides are difficult to quantify. Although some radionuclides, such as cesium and tritium, can be readily detected at levels that produce only a few mrem of committed dose, some long-lived radionuclides, like plutonium, require long-term analysis for accurate committed dose determinations. Because of the difficulty inherent in quantifying these isotopes, additional fault-tolerant process or engineering controls may be appropriate.
- Medical intervention, such as the administration of blocking and chelating agents, to mitigate internal deposition adds risks by introducing additional biologically active chemicals into the body. The use of these agents must be balanced against the potential threat presented by the radioisotope.
- Sampling of body excretions and whole-body or organ counting techniques encourage worker perceptions of internal exposure significance.

### 137 Neutron Exposures

[Note: Boeing - SSFL facilities currently do not utilize any sources of neutron radiation.]

Neutron exposures have the following characteristics which indicate need for specialized control programs:

- The specific biological effects of neutrons are not as well understood as those effects produced by X-ray or Gamma radiation.

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- The human body may not repair damage from neutrons as well as it repairs damage from gammas.
- Neutron dose equivalent is more difficult to accurately assess than gamma dose equivalent.

Because of the difficulty of quantifying these effects of neutron exposure, prudence suggests that those sites and facilities with radiation fields containing neutrons *should* focus particular attention on minimizing collective neutron dose. Aggressive goals for collective neutron exposures *should* be established (see Article 131).

### **138 ALARA**

The As-Low-As-Reasonably-Achievable (ALARA) process of reducing radiation exposures is a fundamental requirement of every radiological control program. There is considerable leeway in determining how far is reasonable. Reducing exposure is desirable because of the direct relation to the health and safety of workers and the public. Reducing radiation exposure improves the quality of the workplace and in the long run saves resources.

- Management *should* seek ways to improve progress toward minimizing radiation exposure and radiological releases.
- Management *should* evaluate items such as construction and design of facilities and systems, planned major modifications or work activities, as well as experimental test plans for exposure, waste and release minimization.
- Management *should* also receive, as a minimum, the results of all reviews and audits, both internal and external, and *should* review the overall conduct of the radiological control program on a periodic basis.
- As provided in SOP C-401, the Manager, Health, Safety and Radiation Services may convene a Radiation Safety Committee to assist in the review of radiological operations and ALARA performance assessments.

## **PART 4 Radiological Control Organization**

### **141 Radiation Safety**

1. A Radiation Safety function is established to provide relevant support to line managers and workers. To effectively function, Radiation Safety is independent of the line organizational element responsible for production, operation or research activities and has an equivalent reporting level. The Radiation Safety organization provides services to the entire Boeing - SSFL complex, providing health physicists to specific facilities on an as-needed basis.

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2. Radiation Safety personnel **shall** promote adherence to the Radiation Protection Program (as defined in various program documents and procedures) and be available to the facility line manager for radiological support to the work force. To effectively function in this capacity, they *should* receive their day-to-day work schedule priorities from facility managers. To ensure independence in making correct radiological decisions, that they are accountable to the Radiation Safety Officer, who in turn reports to the Manager, Radiation Safety.
3. [DELETED]
4. The Radiation Safety Officer **shall** have unfettered access to any cognizant senior manager in order to address radiological control matters involving activities under that manager's purview.

### 142 Professional Staff Qualifications

1. The **Radiation Safety Officer** supports the Boeing-SSFL organization with technical and regulatory issues. The Radiation Safety Officer bears primary responsibility for the design, implementation, and effectiveness of the Radiation Protection Program. The individual is specifically named on the Radioactive Materials License for the State of California.
  - The individual *should* have a minimum of a bachelor's degree or the equivalent in science or engineering, including some formal training in radiological control.
  - The individual *should* have at least three years of professional experience in applied radiological control work. Advanced academic degrees can count as experience where course work related to radiological control is involved.
  - Certification by the American Board of Health Physics provides equivalency to the above.
3. Persons assigned to or being considered for the Radiation Safety Officer *should* participate in a structured program leading to certification by the American Board of Health Physics (ABHP). Individual's possessing ABHP certification *should* maintain the certification in force.
4. [DELETED]

### 143 Radiation Safety Functions and Staffing

1. The senior staff of the Radiation Safety *should* include health physicists and other professionals with four-year degrees in science or engineering. These senior individuals **shall** participate in a continuing training program as directed by the Manager, Health, Safety and Radiation Services.

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Pursuit of certification by the American Board of Health Physics (ABHP) for senior and professional staff members is encouraged. Personnel possessing ABHP certification or National Registry of Radiation Protection Technologists (NRRPT) registration *should* maintain these certifications in an active status.

2. Radiological support personnel provide health physics and radiological engineering, dosimetry, bioassay, independent oversight, instrumentation and calibration functions. These personnel *should* have technical qualifications pertinent to their assigned duties.

### **144 Relationship Between Radiation Safety Technicians and Workers**

**Radiation Safety Technicians** and their supervisors perform the functions of assisting and guiding workers in the radiological aspects of the job.

1. Radiation Safety Training **shall** include instruction on how to maintain safe radiological conditions, and how to recognize the symptoms of a deteriorating situation (i.e., alarm recognition, instrumentation responses, etc.). Workers *should* be encouraged to seek advice from **Radiation Safety Technicians** and their supervisors if they have any questions regarding work conditions.
2. **Radiation Safety Technicians** and their supervisors **shall** have the responsibility and authority to stop work or mitigate the effect of an activity if they suspect that the initiation or continued performance of a job, evolution or test will result in the violation of radiological control standards or result in imminent danger or unacceptable risk. Any worker may request an assessment of radiological conditions through his supervisor or Radiation Safety personnel. If it is determined that a stop work order is appropriate, one may be given by the personnel authorized to do so by Article 345.
3. The actions or presence of radiological protection personnel does not absolve the workers of their responsibility for properly conducting radiological aspects of the job. Radiological protection personnel are not present to compensate for poor management of the work force and *should* not be required to do so.

### **145 Marginal Radiological Control Performance**

1. When radiological control performance is determined to be less than adequate, line management and Radiation Safety **shall** correct work processes to provide adequate radiological control.
2. In cases where the work force does not have the required level of sensitivity for radiological work practices, additional management attention is needed to assure the proper outcome. In these situations, Line management is accountable for implementation of the radiological control program. Initial actions *should* include:
  - A. More direct line supervision in the work space
  - B. Curtailment of work schedules

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- C. Deferral of work
  - D. Addition of extra radiological protection personnel
  - E. Conduct of additional training.
3. When the workers and supervisors achieve the proper level of radiological performance, the number of radiological protection personnel may be reevaluated.

### **PART 5 Regulatory Agencies**

- 1. The Radiation Protection Program is operated under the provisions of the following licenses or authorizing agencies:
  - A. State of California Broad Scope "A" License 0015-19,
  - B. California Code of Regulations (CCR) Title 17, Subchapter 4; "Radiation."
  - C. 10 CFR 835, "Occupational Radiation Protection." [DOE Operations at the former ETEC].
- 2. The Radiation Safety organization **shall** cooperate with the legal and proper inspection activities of the various regulatory bodies.
- 3. Regulatory personnel are expected to comply with the provisions of this procedure. Issues involving access to radiological areas without compliance to the provisions of this Program **shall** be resolved with the Radiation Safety Officer; the Manager, Health, Safety & Radiation Services, and EHS management.