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SAVANNAH RIVER SITE ALARA PROGRAM APPRAISALS (U)

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DISCLAIMER

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SAVANNAH RIVER SITE
ALARA PROGRAM APPRAISALS

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ABSTRACT

ALARA Program audits are recommended in PNL-6577,[1] "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)." The Department of Energy (DOE) Order 5480.11,[2] "Radiation Protection For Occupational Workers," requires contractors to conduct internal audits of all functional elements of the radiological protection program, which includes the ALARA program, as often as necessary, but at a minimum every three years. At the Savannah River Site (SRS), these required audits are performed as part of the Health Protection Internal Appraisal Program. This program was established to review the Site radiological protection program, which includes the ALARA program, on an ongoing basis and to provide recommendations for improvement directly to senior Health Protection management. This paper provides an overview of the SRS Health Protection Internal Appraisal program. In addition, examples of specific performance criteria and detailed appraisal guidelines used for ALARA appraisals are provided.

INTRODUCTION

The SRS Health Protection (HP) Department developed a formal internal appraisal program in 1989 to monitor the effectiveness of the radiological protection program at SRS facilities and to ensure compliance with applicable procedures and regulatory requirements. The internal appraisal staff periodically evaluates all major functional elements of the radiological protection program, including the Site ALARA program. The appraisal program is designed to meet the requirements of DOE Order 5480.11, "Radiation Protection For Occupational Workers." The HP Internal Appraisal Program is conducted in a manner that meets the requirements set forth in DOE Order 5482.1B,[3] "Environment, Safety, and Health Appraisal Program."

APPRAISAL PROGRAM DESCRIPTION

The HP Internal Appraisal Program is administered by the Program Assessment and Support Services Section of the HP Department. The appraisal staff are experienced health protection professionals with applied HP experience in both commercial nuclear power and DOE nuclear facility operations. The HP Internal Appraisal Program consists of routine appraisals and special appraisals.

Description of Routine Appraisals

Routine appraisals are used to evaluate the performance aspects of all functional elements of the radiological protection program at various SRS facilities. Each major functional element is assessed against specific performance criteria using detailed appraisal guides to ensure thorough and consistent appraisals. In addition, HP policies, procedures, organization, administration, staffing, training, communication, and program documentation are reviewed during the course of the routine appraisals. The appraisals are conducted at a frequency that ensures all major functional elements of the radiological

protection program are reviewed at least every three years. To ensure independence and objectivity, the appraisals are conducted by persons not directly responsible for the performance of the activities being appraised. To facilitate the preparation and conduct of the routine appraisals, the radiological protection program was separated into 12 major functional elements listed below in Table 1.

Table 1. Major Functional Elements of the Radiological Protection Program

- Contamination Control
- External Exposure Control (ALARA)
- Respiratory Protection
- Internal Dose Assessment
- External Dosimetry
- Radiological Surveys and Surveillance
- Radioactive Waste Management
- Instrument Calibration and Control
- Health Protection Training and Qualification
- Effluent Monitoring
- Industrial Hygiene Surveys
- Organization and Administration

The overall ALARA program is thoroughly reviewed during appraisals of the External Exposure Control functional element. In addition, ALARA philosophy and concepts are examined during appraisals of other functional elements of the radiological protection program, e.g., Contamination Control, Respiratory Protection, and Radioactive Waste Management, since the effectiveness of these functional elements have a direct bearing on the overall effectiveness of the Site ALARA program. The performance criteria and appraisal guide used to evaluate the SRS ALARA program are provided in Appendix A and Appendix B respectively. The ALARA appraisal guide provides detailed instructions for performing the appraisal and includes applicable references and specific lines of inquiry.

A schedule for routine appraisals is normally developed by the appraisal staff at the beginning of each calendar year. The same major functional area is appraised at all SRS facilities concurrently to enable the appraisers to compare programs and procedures among the various facilities. Appraisal findings, responses, and commitments are tracked in the HP Commitment Tracking System.

Description of Special Appraisals

Special appraisals are performed, as needed, to review unusual incidents or when directed by management to review particular aspects of a program. During infrequent operations and/or maintenance activities which may involve significant radiological hazards, special appraisals may be performed to evaluate the adequacy of ALARA activities related to the job. Special appraisals may also be performed before start-up of new facilities or before restart of existing facilities.

Periodic facility inspections are another type of special appraisal. Periodically, appraisers make unannounced plant tours for inspection of facility conditions and to observe radiological protection related work activities, including ALARA practices. The purpose of the periodic facility inspections (walk through inspections) is to provide HP managers with a quick general appraisal of conditions in their facilities. These inspections may be performed anytime deemed appropriate by the appraisal staff or as

directed by management. Walk-through inspections are not intended to be an in-depth look at radiological conditions, but to point out obvious discrepancies.

Appraisal criteria and assessment guides are normally not used for special appraisals, and formal findings and recommendations are normally not made. Deficiencies are identified as observations and are normally not entered into the HP Commitment Tracking System, unless deemed appropriate by HP management.

Appraisal Methodology

Routine appraisals are performed in accordance with the annual schedule. The appraisals are normally conducted by a single person, but in some cases an appraisal team is utilized. When a team is used, one member of the team serves as the team leader to direct the appraisal and is responsible for preparing the appraisal report.

Before the appraisal, the appraiser reviews all applicable procedures, regulations, and standards pertaining to the major functional element being evaluated. During this review, deficiencies in procedures are identified. Approximately two weeks before the start of a routine appraisal, the appraiser verbally contacts the appropriate HP section manager to set up an entrance meeting. Appropriate HP personnel and Line Management representatives are requested to attend the entrance meeting, as well as applicable division/department ALARA Coordinators for ALARA appraisals. During the entrance meeting, the scope of the appraisal is discussed and a tentative appraisal agenda is agreed upon. This ensures that appropriate personnel are available to meet with the appraiser with minimum disruption of work. Effective coordination and cooperation from the line organization are essential for a successful appraisal.

All pertinent facts pertaining to program strengths, potential findings and observations are documented. Program strengths and weaknesses are easily identified by observing various radiological protection work practices. This is also an excellent way to determine if effective ALARA practices are implemented. An observation is simply what the appraiser saw while touring the facility or watching a particular work activity. Findings are either positive or negative conclusions the appraiser makes based upon observations. The appraiser provides periodic verbal briefings to facility managers to inform them of the appraisal progress, including potential findings. Program strengths are mentioned in the appraisal report as a positive finding only if a particular aspect of the program is noted to clearly exceed acceptable standards. Negative findings are made for inefficient or ineffective work practices as well as for violations of procedures or regulations.

An exit meeting is held with the applicable HP and Line Management representatives to discuss the results of the appraisal. All findings, observations, and recommendations identified during the appraisal are discussed. The exit meeting serves as a forum to ensure that any concerns related to the content of the appraisal findings or recommendations are identified and resolved.

Routine appraisal findings are assigned severity categories and causal factors to facilitate trending and to aid in identifying programmatic deficiencies. The severity categories and causal factors are listed in the appraisal report to help managers determine appropriate priority and apparent cause of deficiencies to ensure that appropriate corrective action can be taken. Observations from special walk-through inspections are normally not assigned severity categories or causal factors and are not tracked or trended.

The causal factors used at SRS are identical to those used by DOE Tiger Teams. A complete list of all causal factors with definitions is provided in Appendix C. The definition of the five severity categories used are presented below in Table 2.

Table 2. Severity Categories For Appraisal Findings

Category 1	Health & Safety Significant potential for personnel injury.
Category 2	Radiation & Contamination Significant potential for radiation exposure above administrative limits, internal assimilation, or the spread of contamination outside the RCA.
Category 3	Compliance Violation of DOE Orders, prescribed policies or referenced standards, or WSRC policy or procedures.
Category 4	Level of Performance Performance does not comply with DOE recommended standards, industry good practices or INPO Guidelines. Concern may be based on professional judgment in pursuit of excellence.
Category 5	Observation Practice or condition noted by the appraiser that may need management attention but is less severe or not covered by any of the above categories.

Appraisal Documentation

Appraisals are documented in a summary report within 20 working days upon completion of the appraisal. Appraisal reports are reviewed and approved by the Appraisal Group Leader and forwarded to the applicable HP section manager with copies to other HP and line organization managers as appropriate. A written response to all findings is required within 30 working days of receipt of the report. If the responsibility for corrective action lies with other line operating organizations, the HP section manager coordinates the response with appropriate line management to ensure appropriate corrective action is planned and implemented. The status of all appraisal findings and recommendations are maintained on the computerized HP Commitment Tracking System.

SUMMARY

The effectiveness of a site or facility ALARA program is significantly improved through the use of audits. ALARA program audits are effectively incorporated into a routine HP internal appraisal program. SRS has found this integrated approach to be very effective. In addition to the specific appraisal of the ALARA functional element, it is also appropriate to review ALARA philosophy and concepts as they relate to the other functional elements of the radiological protection program. This review is important since the effectiveness of these program elements have a direct bearing on the overall effectiveness of the ALARA program.

A successful internal audit program helps ensure the fundamental goals of the ALARA program are met and that responsible personnel are made aware of areas in which the ALARA program might be strengthened. At SRS, ALARA program audits have enhanced the Site's ability to maintain radiation exposures ALARA.

REFERENCES

1. PNL-6577, Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA).
2. DOE Order 5480.11, Radiation Protection For Occupational Workers.
3. DOE Order 5482.1B, Environment, Safety, and Health Appraisal Program.

APPENDIX A

EXTERNAL EXPOSURE CONTROL (ALARA) CRITERIA

PERFORMANCE OBJECTIVE
External radiation exposure controls should minimize personnel radiation exposure.

CRITERIA

1. Major aspects of the external exposure control program (i.e. RWP, ALARA, exposure tracking, administrative controls) are described in approved procedures.

2. Radiation Work Permits (RWPs) or similar administrative controls are used to control personnel exposures in work areas where radiation hazards are present.

3. Accurate and timely radiological survey information is utilized when determining radiological protection requirements for RWPs.

4. RWPs correctly reflect the job and radiological conditions in the work area.

5. Routine or "Standing RWPs" are used for recurring jobs that are routine in nature and have minimal or predictable radiological hazards (i.e. inspection, surveillance, valve operation, etc.).

6. Radiological protection requirements listed on RWPs are adequate to protect workers from all expected radiological hazards.

7. Radiological Controlled Areas, Radiation Areas, High Radiation Areas, Very High Radiation Areas, and "Hot Spots" are clearly defined and properly posted to warn personnel of radiation hazards.

8. Proper controls are used to minimize beta exposure to the skin and eyes.

9. Administrative controls utilized to control and limit personnel radiation exposure are effective.

10. Workers adhere to prescribed radiological protection requirements and procedures.

11. Radiation sources (X-ray equipment and gamma sources) used in radiography operations are operated in accordance with Ebasco Services Incorporated (ESI) approved procedures.

12. Appropriate exposure reduction techniques are utilized, when feasible, to maintain personnel exposure ALARA.

13. An ALARA Coordinator or other staff has been designated with specific ALARA responsibilities. These responsibilities are documented and integrated into the radiation protection program.

14. ALARA reviews are routinely performed for jobs with significant exposure potential prior to issuing Radiation Work Permits.

15. Jobs are reviewed in the conceptual and early planning stages to identify specific job-related exposure reduction techniques.

16. Personnel traffic is routed through lower exposure rate areas; and waiting, staging, and office areas are established in low background areas.

17. Collective radiation exposure goals and action plans are established that are measurable and realistic.

18. Exposure trends are monitored and actual exposures are compared to established ALARA goals.

19. Adequate staff and resources are available to effectively implement the exposure control program.

APPENDIX B

EXTERNAL EXPOSURE CONTROL (ALARA) APPRAISAL GUIDE

DOE Orders:

1.	DOE 5480.11,	Radiation Protection for Occupational Workers.
2.	DOE 5482.1B,	Environmental Safety & Health Appraisal Program.
3.	DOE 5483.1A,	Occupational Safety & Health Program For DOE Contractor Employees at Government-Owned Contractor-Operated Facilities.
4.	DOE 6430.1,	General Design Criteria.

SRS Documents:

1.	WSRC 5Q,	Radiological Controls Manual.
2.	WSRC 5Q1.1,	SRS Radiation & Contamination Control Procedures.
3.	WSRC 5Q1.2,	Procedure 480, Survey and Audit of Radiography Operations at SRS.
4.	WSRC 5Q1.2,	Procedure 481, Survey & Audit of X-Ray Producing Equipment.
5.	WSRC 5Q1.3,	Radiation Survey Instruments.
6.	WSRC-IM-90-140,	SRS ALARA Guide.

Reference Documents:

1.	PNL-6577,	Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA).

ASSESSMENT TECHNIQUES:

A. Review applicable facility procedures before the appraisal.

1. Identify technical or typographical errors.
2. Are procedures current?
3. Are procedures clear and easy to understand?
4. Are major aspects of the program covered in written procedures?
5. Do RWP procedures and job plans address the need for ALARA action before start of job?
6. Make notes of procedural items that may need additional followup.

APPENDIX B

EXTERNAL EXPOSURE CONTROL (ALARA) APPRAISAL GUIDE

B. Review RWPs and radiological survey information.

1. Are routine RWPs (standing RWPs) used?

    a. Is scope of allowed work excessive?
    b. Have adequate radiological surveys been performed in the work areas?
    c. How were the protection requirements established, and are they adequate?
    d. Are dose rate instruments required for entry into High Radiation Areas?

2. Review non-routine RWPs.

    a. Is scope of work clearly defined?
    b. Have current radiological conditions in the work area been determined?
    c. Are protection requirements adequate?
    d. Is continuous or periodic Health Protection coverage required? Is this sufficient?
    e. Are high exposure jobs in progress? Has an ALARA review been performed?
    f. Are man-hour and man-rem estimates made? By whom?

3. Are RWP and associated records maintained in accordance with facility procedures?

C. Review administrative exposure control methods.

1. How is access to the RCA controlled?

    a. Are entry and exit times recorded? How and by whom?
    b. Are dosimeter readings "in" and "out" recorded? How and by whom?
    c. Is the method of access control effective?

2. How are pocket dosimeters issued and controlled? Is it effective?
3. How are daily exposure limits or guidelines determined and/or maintained?
4. May Administrative Dose Limits be extended? If so, is this practice minimized?
5. Are exposure control procedures being followed?

D. Review radiation exposure records.

1. Have any workers exceeded the Site monthly exposure reference level (600 mrem)?
2. Have any workers exceeded the Site Annual Administrative Limit (2 rem)?
3. Have any workers exceeded the Site Annual Goal (1.65 rem)?
4. Have any workers exceeded the DOE Annual Limit (5 rem)?
5. Are exposure records maintained in accordance with Site procedures?
6. Is there an effective method for tracking Employee Radiation Exposure Cards for accountability?

APPENDIX B

EXTERNAL EXPOSURE CONTROL (ALARA) APPRAISAL GUIDE

E. Tour facility to observe zone postings, jobs in progress, exposure control methods, and compliance with radiological protection procedures.

1. Are areas zoned correctly?

   a. Are signs, labels, etc. the proper size, shape, and color?
   b. Are entrances to Radiologically Controlled Areas clearly defined?
   c. Are radioactive material storage areas properly posted?
   d. Spot check dose rates in some areas to verify correct postings.
   e. Are "Hot Spots" clearly identified?
   f. Do signs at High Radiation Areas indicate that a dose rate instrument is required for entry?
   g. Are "Very High Radiation Areas" (> 5 rem/hr) locked or access controlled in accordance with DOE Orders?

2. Is personnel exposure being minimized?

   a. Are workers waiting or loitering in radiation areas?
   b. Are efforts taken to shield Hot Spots or flush the piping to lower the dose rate?
   c. Are containers of radioactive material or waste stored in readily accessible locations that contribute needlessly to personnel exposure?
   d. Does each container of radioactive material have a durable, clearly visible label identifying the material with enough information to permit personnel to take precautions to minimize exposure?
   e. Are all radioactive waste containers properly labeled?
   f. Are radiation levels posted on cabinets, samples, glove boxes, etc. when needed?

3. Review jobs in progress.

   a. Do jobs have an RWP or work plan?
   b. Does the scope of work on the RWP match the scope of the work actually in progress?
   c. Are workers in compliance with the RWP requirements?
   d. Are the protection requirements adequate?
   e. Are Health Protection personnel present if continuous coverage is required?
   f. What exposure reduction methods are being utilized? Has an ALARA evaluation been performed?
   g. If working in a High Radiation Area, do the workers have a dose rate instrument?
   h. Is extremity dosimetry needed?
   i. Has an extremity dosimetry study been made in the facility? If so, is there a record of the study on file?

F. Review tritium sampling and monitoring techniques.

1. Are hood monitoring valves identified?
2. Is the work area papered and clearly delineated?
3. Are workers wearing plastic suits that are most impermeable to tritium?
4. Have process lines been purged or "baked out" before line break?
5. Are receptacles on hand to catch or absorb water and/or oil during line breaks?
6. Is there a "back-up" operator on hand while work is in progress?
7. Is the "back-up" operator qualified to cut personnel out of plastic suits?
8. Is there a spare plastic suit available for the "back-up" operator?
9. Is there an HP inspector at the job site and also at the monitor panel continuously, and are they maintaining radio contact?

G. Review sub-contractor methods of using X-ray and gamma cameras for radiography operations.

1. Are all X-ray and gamma source handlers certified in their job? If not, are they working under the supervision of a certified radiographer? Does the certified radiographer have certification papers at the job site?
2. Is the work area properly roped and posted with appropriate warning signs?
3. Are personnel beyond the wall of the work area aware of radiography operations in the adjacent area?
4. Has a radiation survey been made on all sides of the work area while X-ray and gamma source is in use?
5. Does the radiographer leave the control key in the X-ray machine after making an exposure?
6. Is the gamma camera locked and placed in a locked box after completion of operation?
7. Are permanent X-ray facilities audited quarterly for operable interlock, shutters, alarms, lights, etc. Is the radiation dose rate to the operator at 30 cm from the machine < 1 mR/hr?
8. Are checks made for leaks in facility shielding, including doors? Are signs posted outside a facility where the maximum dose rate is > 1 mR/hr? Is an annual audit of the facility made for DOE?

H. Review administration of the ALARA program.

1. Discuss the ALARA program with the HP Facility Manager.

    a. Is a record of monthly dose to facility workers disseminated to appropriate supervisors?
    b. Is there a mechanism to communicate dose information down to the workers?
    c. Are personnel with highest dose rotated to jobs with lower exposure rates?

2. Does the facility have an ALARA Coordinator designated for specific ALARA responsibilities?

   a. Is ALARA action documented?
   b. Do job plans, procedures, or RWPs list ALARA action to be completed before start of job?

3. Are the following items considered in the ALARA review process, and applied when appropriate to minimize radiation exposure?

   a. Use of portable or permanently installed shielding.
   b. Use of special or extended tools and manipulators.
   c. Have process lines been flushed and monitored to determine effectiveness of flush?
   d. Have tritium lines been "baked out?
   e. Has a pre-plan meeting been held with all workers assigned to the job and briefed on work procedures and special radiological considerations?
   f. Has specialized training and mock-up equipment been used for jobs of high dose potential?
   g. Is the minimum number of personnel being used to perform the job successfully with the least exposure?
   h. Are routes to and from the job, waiting, staging, and office areas in the lowest background areas?

4. Are collective radiation exposure goals and action plans measurable and realistic?

   a. Are radiation exposure goals presented to workers as an obtainable challenge?
   b. Are goals and status publicized to facility workers?
   c. Are goals monitored monthly, and actual exposures compared to the ALARA goals?
   d. Is a report issued to facility work groups periodically showing how prorated goals compare with actual performance?

I. Review staffing and resources.

1. Are there sufficient personnel and resources to perform all functions of the exposure control program?
2. Is training of HP inspectors and first line supervisors adequate to fully implement the ALARA program?

APPENDIX C

CAUSAL FACTORS

Policy:	Ineffective, outdated, or nonexistent policies contributed to the finding.
Policy Implementation:	Written policies, reflecting federal, state, and local laws and regulations, codes, and standards were not appropriately disseminated, implemented, and updated.
Procedures:	Written procedures were not prepared to effectively implement Site policy, DOE Orders, and federal, state, and local laws and regulations. A lack of familiarity or availability of the procedures may have contributed to the finding.
Personnel:	Lack of educational and/or work experience for personnel holding responsible positions or the level of personnel knowledge about the technical and safety aspects of their jobs contributed to the finding.
Resources:	The number of personnel assigned to the job was inappropriate or inadequate facilities and equipment contributed to the finding.
Training:	Inadequate personnel training on implementing site policy, DOE Orders, and applicable Federal, state, and local laws and regulations was a contributing factor to the finding.
Change:	Changes in Site mission, function, operation, and established requirements, which rendered existing policies or procedures inadequate or inappropriate, were contributing factors to the finding. Timeliness and effectiveness of changes to Site and DOE policy, and the implementing procedures, may have been a contributing factor to the finding.
Risk:	Site personnel responsible for a situation contributing to a finding have not assessed and/or were not aware of the relative degree of risk involved in the action.
Safety:	Inadequacies in the Site safety program contributed to the finding, or an inappropriate level of importance has been given to tne safety aspects of the operation(s) being evaluated.
Appraisals, Audits/Reviews:	Ineffective or insufficient appraisals, audits, and reviews, and/or inadequate follow-up, contributed to the finding.
Design:	Inadequate design of a system contributed to the finding.
Human Factors:	Human factors, such as fatigue or deliberate circumvention of a safety system, contributed to the finding.

APPENDIX C

CAUSAL FACTORS

Quality Assurance/Control:	Inadequacies in the quality assurance/control program contributed to the finding.
Barriers & Controls:	Inadequacies in established barriers and controls, both administrative and physical, including operational readiness, routine inspections and preventive maintenance, and/or a lack of these controls contributed to the finding.
Supervision:	Ineffective supervisory controls for implementing policies, directives, procedures, standards, laws, etc. contributed to the finding.

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DATE FILMED

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