U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-373/90008(DRSS); 50-374/90009(DRSS)

Docket Nos. 50-373; 50-374 Licenses No. NPF-11; NPF-18

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, IL 60690

Facility Name: LaSalle County Station, Units 1 and 2

Inspection At: LaSalle County Station, Marseilles, Illinois

Inspection Conducted: April 22-27, 1990

Inspectors: M. Schumacher for 6-6-90
R. A. Paul Date

C. F. Gill 6/6/90
C. F. Gill Date

A. G. Januska 6/6/90
A. G. Januska Date

Accompanied By:
C. S. Hinson, NRC, NRR
R. L. Nimitz, NRC, RI
B. Dionne, NRC Contractor, BNL
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Approved By: William Snell 6/6/90
William Snell, Chief Date
Radiological Controls and
Emergency Preparedness Section

Inspection Summary

Inspection from April 22-27, 1990 (Reports No. 50-373/90008(DRSS); No. 50-374/90009(DRSS))
Areas Inspected: Special, announced assessment of the ALARA program (IP 83728).
Results: The licensee has implemented an adequate ALARA program, that with further development has all the elements necessary to become a good program. However, there were many areas identified where actions could be taken to improve the program. Some of the areas where significant improvement could be achieved included training, dose reduction for major job tasks, HP staffing for ALARA activities, and ALARA procedures. No violations or deviations were identified.

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DETAILS

1. Persons Contacted

NRC Inspection Team

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R. Paul, NRC, RIII
A. Januska, NRC, RIII
C. Gill, NRC, RIII
C. Hinson, NRC Headquarters
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Licensee

D. Galle, VP, BWR Operations
G. Diederich, Station Manager
D. Hieggelke, Health Physics Supervisor
W. Luett, Operational Lead HP
C. Kelley, ALARA Coordinator
J. Renwick, Production Superintendent
F. Rescek, Radiation Protection Director, Corporate
J. Atchley, Operating Engineer
W. Sheldon, Assistant Superintendent Maintenance
F. Lawless, Regulator Assurance, Corporate
P. Nottingham, Chemistry Services Supervisor
T. Shaffer, Training Supervisor
W. Huntington, Technical Superintendent
J. Walkington, Services Director
T. Hammerich, Regulatory Assurance Supervisor
D. Berkman, Assistant Superintendent Work Planning
L. Bryant, Rad Protection Foreman
J. Steinnetz, ENC-NO Construction Superintendent
H. Massin, Project Management
L. Lauterbach, Onsite Nuclear Safety Supervisor

All of the above personnel, except for J. Baum of the NRC inspection team, attended the exit meeting on April 27, 1990. In addition to the above persons, additional licensee and NRC personnel attended the exit meeting, and additional licensee personnel were contacted during the course of the inspection.

2. Dose Evaluation

The licensee began the implementation of the program to maintain occupational exposure as low as reasonably achievable (ALARA) during initial startup in April 1982. Commonwealth Edison Company (CECo) instituted the company's ALARA policy statement in 1976. Reducing radiation exposures to levels that are ALARA has long been an acknowledged goal for LaSalle County Station, as well as for CECo in general.

This inspection was prompted in large part by the high annual collective dose experienced in 1988 at the LaSalle County Nuclear Generating Station. An analysis of the licensee's radiological dose data was performed in an attempt to identify causes for the high collective doses, as well as to evaluate the effectiveness of the licensee's efforts to reduce dose at LaSalle (Attachments 1-4). The inspection also included a systematic review of the major elements of the licensee's ALARA program and an evaluation of the effectiveness of its implementation. Recommendations to strengthen the program are documented in this report.

The collective dose per reactor from 1986 to 1989 for LaSalle was compared with that for the average U.S. Boiling Water Reactor (BWR) (Attachment 1). In 1986 LaSalle was 27% below the average collective dose for BWRs. This increased in 1987 and 1988 to +36% and +134%, respectively. The collective dose per reactor for LaSalle dropped from 1236 in 1988 to 692 person-rem in 1989, and is expected to be between 40 to 60% greater than the average U.S. BWR in 1989. LaSalle's collective dose ranked 11th highest out of 30 U.S. BWRs in 1986, 5th out of 33 U.S. BWRs in 1987, 2nd out of 34 U.S. BWRs in 1988, and is expected to rank in the upper quartile of the group in 1989.

A review of the average individual dose was performed for the period 1986 to 1988 (Attachment 1). LaSalle's average individual dose was twice the average annual dose for BWR radiation workers in 1987 and 1988. The average individual dose decreased in 1989 at LaSalle to 560 mrem/yr, but is still expected to be about 40-50% higher than the BWR average.

A review of the daily collective dose per reactor was performed to determine if the average daily doses being expended during non-outage and outage periods were higher than that being experienced at other BWRs (Attachment 1). LaSalle's daily collective dose per reactor was 70% higher than other BWRs during non-outage periods and 25% higher during outage periods.

In an attempt to determine if the increased exposures were due to higher than average plant dose rates, a comparison of shutdown radiation levels was performed. Attachment 2 presents a comparison of LaSalle's radiation levels during the most recent shutdowns. This table compares LaSalle's dose rates with those which have been published in the literature. A limited review of this information indicated that LaSalle's dose rates are generally low compared to those presented in NRC, EPRI and Stone & Webster reports.

To further identify the potential causes for the elevated collective doses, a review of the repetitive high-dose jobs from both outage and non-outage periods was conducted. The collective doses for LaSalle repetitive high-dose jobs from L2R01 (LaSalle Unit 2, refuel outage Number 1), L1R02, L2R02, and L1R03 were compared against those reported in NUREG/CR-4254 (Attachment 3). All repetitive high-dose jobs from refueling outages appeared to be within the range of collective doses published in NUREG/CR-4254.

The collective doses for LaSalle's repetitive high-dose jobs which were conducted during routine operations and non-refuel outages were also compared against those reported in the above NUREG (Attachment 3). Primary valve maintenance and repair; plant decontamination; operations-surveillances, routines and valve lineups; and radwaste systems repair, operation and maintenance, were in general greater than the collective dose range reported in the NUREG/CR-4254.

A review of the non-repetitive outage high-dose jobs was performed to determine the effect the large amount of modification work and it's associated dose had in the high exposures incurred in 1987 and 1988 (Attachment 4). During 1987, 572 person-rem was expended on the major modifications and repairs performed during L2R01. This represents about 40% of the total station collective dose. During 1988, 1146 person-rem was expended on the major modification and repairs performed during L1R02 and part of L2R02. This represents about 45% of the 1988 total station collective dose. During 1989, 467 person-rem was expended on the major modifications performed during part of L2R02 and L1R03. This represents about 35% of the 1989 total station collective dose. Therefore, it appears that the dose associated with major modifications and repairs has accounted for a large portion of the total dose at LaSalle between 1987 and 1989. Discussions with licensee representatives indicated they had not conducted the "big picture" type of reviews conducted above as a means of identifying the major causes of high doses at LaSalle.

Based on the above review, this portion of the licensee's program is adequate. However, the following item is recommended to strengthen the ALARA program.

- Conduct continuing comparisons of radiation dose data at LaSalle with that for average U.S. BWRs to identify areas where improvement is warranted, and evaluate/implement corrective actions as appropriate to reduce doses.

3. ALARA Program/Organization

a. ALARA Program

LaSalle's ALARA policy statement is documented in CECo's Production Instruction No. 1-3-N-2 and described in the company ALARA Manual. The primary objective of the ALARA concept is to reduce personnel radiation exposure to the lowest levels achievable commensurate with sound economic and operating practice. CECo's ALARA Manual contains a detailed description of the companies' ALARA program and defines the resources/requirements necessary to meet the ALARA objectives. One of these requirements is strong management support for the persons responsible for carrying out the day-to-day activities of

protecting radiation workers. It appears that management has become much more sensitive to ALARA and supportive of the ALARA program progressively over the last five years. Management's concern with ALARA is evidenced by the fact that the meeting of dose goals is one of the elements in each employee/management performance appraisal. Management's support of ALARA is apparent in some of the "big picture" ALARA advances being studied at the corporate level for implementation at the CECo plants. The company's Plan-For-Excellence goals include corporate evaluation of such ALARA initiatives as cobalt reduction in various plant components and the use of hydrogen addition.

b. Corporate Organization

The Corporate Office has a staff of 10 professionals in the field services and ALARA function, including one certified health physicist. Of these, one is assigned to LaSalle and spends about 30-40% of his time on ALARA activities with about 50% of this time on-site. In addition, the Corporate Radiation Protection Director has been at LaSalle on several occasions during the past three years and an additional health physics professional spent three to four months on-site during 1988.

At the corporate level, the Radiation Protection Director is tasked with carrying out the ALARA program. He appears to have a good rapport with the station radiation protection department and meets with the station Health Physics Services Supervisor on at least a monthly basis. The Radiation Protection Director is the head of the Nuclear Services Radiation Protection Organization. This organization allocates resources to and serves as an internal consultant for the six CECo nuclear stations. This organization also performs an ALARA assessment function for the CECo stations and disseminates information to these stations on the latest industry advances in ALARA.

Corporate Senior Management support and oversight occurs through the Corporate ALARA Committee (CAC) which reports to the Senior Vice President, Nuclear Operations. The purpose of the CAC is to guide corporate ALARA activities and evaluate overall corporate performance in maintaining radiation doses ALARA. The CAC meets on a quarterly basis and one of the committee's functions is to review the station's dose reduction goals and review ways to reduce station dose to meet these goals.

The Corporate Nuclear Services Radiation Protection (NSRP) department is responsible for providing specific direction and support of the stations' ALARA programs. Some of the actions taken by the NSRP have included the performance of several ALARA assessments for stations experiencing significant person-rem overruns when compared to their goals, modification of the station person-rem goal development process to include senior management review and approval, and approval for use of $5000 per person-rem for performing cost benefit evaluations.

c. Station Organization

The station ALARA programs are guided by the Station ALARA Committee (SAC) which is comprised of upper management station personnel including the Station Manager, Health Physics Services Supervisor, ALARA Analyst, and heads of the Production, Technical, Services, and Site Construction groups. The SAC is responsible for developing the ALARA goals for the station, making recommendations for reducing personnel exposure, and providing guidance and recommendations on aspects of radiological operations. The SAC provides periodic progress reports to the CAC. The SAC meets on a monthly basis and is well attended by the SAC members and other site personnel.

The station Radiation Protection Department, headed by the Health Physics Supervisor, coordinates the ALARA effort at the plant. Within the department an Operational Health Physics Support Group is responsible for ALARA in addition to such tasks as exposure and contamination control and respiratory protection. The Radiation Protection Department complement is 60, including 34 Radiation Protection Technicians (RPTs) and six radiation protection foremen. During major outages the RPT crew complement is typically more than doubled by the addition of contractor RPTs. In addition to the Radiation Protection Department personnel, there are currently three ALARA Coordinators who are part of the site contractor organization. They work to ensure appropriate contract worker participation in the ALARA program and assist the station ALARA Analyst in formulating the station annual dose goals.

The six individuals comprising the Operational Health Physics Support Group each have lead responsibility for a separate program area such as ALARA, respiratory, shielding, etc.; backup responsibility for one of the other group members program area; and responsibility for assigned special projects. Only one of these individuals is assigned ALARA as their primary responsibility (ALARA Analyst), while the others have related and supporting responsibilities. During plant outages the expanded responsibilities and work load of these assigned program areas, in conjunction with additional project assignments, strains the capabilities of the Operational Health Physics Support Group. This is especially true for the ALARA analyst, whose duties include working with the SAC, department heads, and contractor ALARA Coordinators in formulating the annual dose goals. During outage periods, he must also be concerned with dose goal overruns and doses from unplanned jobs. The inspector's discussions with the staff indicated a considerable amount of overtime is used to accomplish work. For example, one individual (not the ALARA Analyst) was noted to have worked an average of about 70-80 hours per week during the first part of the Unit 2 outage. The fact that the work was not ALARA related means the remaining staff had to carry out the ALARA work activities with less people at a time when the workload had increased. This may indicate a need for additional staff in the area of ALARA activities during major outages.

It appears that the ALARA Analyst could also benefit from additional assistance. One of the responsibilities of the ALARA Analyst is the maintenance of detailed job history files containing pre-job interviews, job descriptions and working conditions, RWPs, and post-job meeting notes with lessons learned. The job history files are used for future job planning and dose goal estimates. It appears, based on an interview with one of the ALARA Coordinators, that the demands of the job prevent him from adequately compiling lists of lessons learned to be included in each job history package. Lessons learned are a very important part of the ALARA program, which can contribute to lower doses being realized during performance of future jobs.

d. Qualifications

The inspectors reviewed the qualifications of several of the health physics personnel. The Radiation Protection Director has been employed in the radiation protection field with the company for the past 14 years and appears to be very well qualified for the position. The Health Physics Services Supervisor has held various health physics positions at LaSalle since plant startup and meets the Regulatory Guide 1.8 guidelines for the plant Radiation Protection Manager. Thirty-one of the thirty-four RPTs meet the 2-year ANSI 18.1 experience criteria for qualified RPTs. Two ALARA Coordinators interviewed appeared to be well qualified for the jobs they held.

e. ALARA Suggestion/Incentive Program

A good ALARA suggestion/incentive program can be an important part of a plant's ALARA program. A good ALARA suggestion program can result in the receipt of useful dose reduction ideas that can be used to lower the station's total collective dose. The addition of incentives for good suggestions usually results in a greater number of suggestions being received. LaSalle currently does not have an ALARA suggestion/incentive program. The inception of such a program at LaSalle could increase overall employee awareness of ALARA and could result in the receipt of some useful dose reduction suggestions.

Based on the above review, this portion of the licensee's program is adequate. However, the following item is recommended to strengthen the ALARA program.

- Implement an ALARA suggestion/incentive program.

4. Corporate Involvement

As a result of higher than predicted collective doses at LaSalle County and Zion Stations in early 1988, a multi-disciplinary group was commissioned by the Corporate ALARA Committee (CAC) to perform special

reviews at each site. A four-member team performed the review at LaSalle on May 9-13, 1988, and a written report with several suggested improvements was completed.

The CAC directs corporate ALARA activities, meets quarterly, and evaluates corporate performance in maintaining radiation doses ALARA. Vice President's Instruction No. 1-0-27 was completed on December 1, 1989. It established and authorized the CAC which had already been functioning through guidance given in the ALARA Manual since about 1983. The V.P. Instruction outlines responsibilities, rules of operation, frequency of meetings, and minimum topics of discussion. A review of minutes of CAC meetings, and year-end reports reveals appropriate topics are being addressed and that the committee is providing useful guidance. A health physicist from the Corporate staff is currently visiting several non-CECo utilities to search out potential dose reduction actions. There is need for continuing identification of dose reduction actions with long-term benefit, performing engineering cost-benefit studies, and prioritizing the various possibilities in terms of dose reduction cost effectiveness ($/person-rem). CECo studies on cobalt reduction, Zn injection and decontamination of primary systems are examples, but the list should be expanded and periodically updated as conditions change and new possibilities arise. This is an area where corporate help could be important since many items such as cobalt in valves have multi-plant applicability.

Prior to this assessment, the licensee was requested to respond to a 51-item questionnaire related to ALARA activities at the LaSalle Station and corporate. Based on answers to the questionnaire, and subsequent discussions and materials reviewed, it is apparent that important dose control and dose reduction actions, and equipment upgrades were implemented. The licensee has implemented studies concerning improved operation and cleaning of resin beds, possible reduction of Co-60 release by extending depressurization time during shutdown, use of hydrogen water chemistry, material transport, and valve packing.

Overall, the corporate support is broad and generally effective as evidenced by support in the areas of management training (e.g., holding "ALARA-Radiation Protection Awareness Day" seminars), encouragement of communication between plants, development of cost-benefit criteria ($/person-rem), computer assistance in task analysis, development of job (RWP) specific computer-assisted dose tracking, assistance in developing and tracking five-year strategic goals and plans, and the inclusion of a performance goal, based on a percentage of the plant collective dose for the year, in the various plant department managers performance ratings.

Based on the above review, this portion of the licensee's program is adequate.

5. Training

The inspectors reviewed the licensee's ALARA training program, including radiation worker, radiation protection technician (RPT), mockup, and general employee training (GET). Also reviewed were facilities; instructor qualifications; ALARA staff professional development; and the interface between operations, maintenance, radiation protection, and training departments.

a. Personnel ALARA Training

The inspectors reviewed the radiation protection GET program to determine the adequacy of ALARA/RWP instruction, including lesson plans, handout material, instructor manual, visual aids, training facilities, sample examinations, and instructor qualifications. It was concluded that the ALARA/RWP portion of the course covered the necessary fundamentals, examinations adequately tested the students' knowledge (both theoretical and practical applications), facilities were somewhat primitive but adequate, and there was appropriate instructor/student interface to reasonably assure that students adequately understood fundamental concepts. Additionally, the review of the RPT training led to the conclusion that the formalized qualification/OJT program for staff RPTs reasonably assured appropriate RP/ALARA/RWP training. However, because contractor RPT training consisted mostly of a screening examination and procedural familiarization, there is less assurance that these individuals will perform RP/ALARA/RWP duties in an appropriate manner.

The licensee does not presently conduct an advanced radiation worker training class beyond the teaching of RP/ALARA/RWP fundamental concepts during the one-day GET course. Although the licensee is considering the development at all licensee nuclear stations of a three or four-day course which would provide practical application training of RP/ALARA/RWP concepts for those workers who routinely must wear protective clothing, work in contaminated areas, and contend with significant dose rate environments, the full implementation of the proposed program may not occur for several years (according to licensee representatives). Section 7 describes several examples of workers who were observed during this assessment to demonstrate inadequacies in their fundamental ALARA training by waiting in relatively high dose rate areas, rather than moving to nearby known low dose rate areas.

Although the licensee does not have an advanced radiation worker training course, the contractor who supplies general laborers and craft workers has developed and implemented an RWP/ALARA/PC training course for all new station contract employees. This training course is given after completion of the licensee GET and consists of five hours of instruction regarding ALARA awareness, radiological work practices, and good general work practices. The training includes

practical factors by instructing the workers to follow the requirements of a mock licensee work package, including RWP, dosimetry, and dose card requirements. The attendees are required to pass a practical factors short answer/essay examination before being granted site access. After being granted site access, the contract workers are given an orientation plant tour. Also, contract workers who have had little or no prior nuclear experience are given practical protective clothing training which is an extension of the PC training given during licensee GET. The inspectors reviewed the lesson plans and discussed the details and objectives of these training courses with the contractor ALARA Coordinator; no problems were noted. The contractor's RWP/ALARA/PC training beyond the fundamental GET is an example of good performance at the LaSalle Station and is an interim program enhancement, pending development and implementation of a licensee advanced radiation worker training course for both licensee and contractor employees.

The inspectors interviewed selected members of the HP Operational Support/ALARA/RWP staff, reviewed their qualifications, and assessed their professional development program. The seven staff members all had the appropriate radiation protection background and appeared to have been assigned tasks which were appropriate to station ALARA programmatic goals. However, the ALARA personnel occupy management positions and therefore do not participate in RPT qualification/OJT training, or any other formal training program pertinent to their ALARA assignments. This lack of a formalized training program to ensure ALARA personnel are generally knowledgeable regarding ALARA programs and are kept apprised of current ALARA developments, appears contrary to the licensee's stated policy of aggressively pursuing ALARA program improvement initiatives. Also, all staff members have similar professional backgrounds (RP) and thus may collectively lack sufficient breadth to optimize the ALARA process when coordinating activities with other departments. It appears desirable to add ALARA staff members with significant background in other disciplines (such as maintenance and operations) and to assure that staff members with primarily RP backgrounds have an adequate professional development program which would allow the members to become sensitive to the needs of worker task assignments and associated radiological hazards. The inspectors also discussed the benefits of participation in various industry ALARA seminars and workshops, exchange programs with other utilities during special outage activities, participation in licensee system training courses, and temporary assignments for special plant maintenance related activities. Although the licensee has occasionally been involved in some of these activities, this effort to date appears to have been minimal.

The inspectors reviewed the status of the licensee's program for ALARA training classes for design engineers. The potential concern was that if equipment, system components, or tools were not designed with the application of appropriate ALARA concepts, additional worker radiation exposure might occur. Although the station routinely develops special equipment and tools for application to the maintenance, repair, and operation of plant systems, the licensee has not developed a training course for the station personnel involved with the design and fabrication of special tools and equipment. However, for certain design modifications specified by Corporate Engineering and Construction Procedure No. ENC-QE-06, the modification reviews, including ALARA, are assigned to the Corporate Nuclear Engineering Department (NED) as required by the Corporate QA Manual. Exhibit A of this procedure is an 18-page ALARA Design Review Checklist which appear to contain appropriate ALARA review items. In December 1988, the licensee with consultant assistance prepared a 40-page ALARA design guide to provide instructions on review details associated with each ALARA checklist item. Approximately one year ago, a two-day corporate course was given to selected design engineers on the use of the ALARA checklist and design guide. In part, because the developer of the training course has been reassigned, the class was never fully developed and the design engineers are using the guidance documents without benefit of formalized training.

b. Departmental Interfaces

The inspectors reviewed the ALARA training interfaces between the operations, maintenance, radiation protection, and training departments. In general, training department group leaders are assigned to coordinate training with departmental (operations, maintenance, and services) training coordinators. It appeared to the inspectors that these practices are generally effective. The training department has several mechanisms to incorporate ALARA concerns/suggestions/lessons-learned into the training program. These include internal memoranda, general information notifications, and quarterly management and continuing training meetings during which training department members meet with their counterparts from the operations, maintenance, and services departments. The procedure which describes the methods, documentation and approvals required to revise and develop training materials is No. LAP-620-2, Revision of Training Program Materials. When feedback is received which indicates changes are needed to support training on a given task, the necessary information is incorporated into the action assignment form (Program Development/Maintenance Record). The inspectors' selective review of the documentation associated with this process indicated it was generally well implemented. However, very few of the modifications reviewed appeared to be prompted by ALARA concerns. Inspector documentation reviews and personnel interviews indicated the potential for ALARA training program changes, based on task related lessons-learned, rely mainly on the training department's review of the station outage reports. Because

these reports often do not directly state that some task-related problems may be due to ineffective training, the present system of incorporating lessons-learned into the training program does not appear effective.

Licensee representatives were interviewed to solicit opinions on possible means of rectifying this apparent deficiency. Among the suggestions were assigning training department members to attend and participate in post-job reviews and soliciting better outage work feedback on the ALARA training program from the operations, maintenance, and radiation protection departments.

c. Mockup Training

The inspectors reviewed mockup training and facilities for control rod drive (CRD) removal, rebuild, and installation; recirculation pump seal replacement; and valve repair. Also reviewed were the lesson plans and the instructor qualifications. In addition, the inspectors discussed with appropriate licensee personnel the scope of the training courses, how well the mockup training reflected the as-found field conditions, and the level of involvement of RP/ALARA personnel in the development of and participation in mockup training. The training department group leaders and mockup training instructors appeared well qualified, dedicated to high training standards, and worked well with departmental (operations, maintenance, and services) training coordinators. However, the reviews and discussions indicated that, generally, licensee mockup training has concentrated on teaching attendees about the equipment components and task details without adequately simulating expected field conditions such as the wearing of PC and respirators, space restrictions, anticipated RP hold points, and the details of the work evolution to assure minimal dose under anticipated work conditions. Individuals interviewed also indicated that there had been occasions, in their opinions, of insufficient RP/ALARA involvement in the development of and participation in mockup training courses. According to several members of the licensee's management staff, the problems associated with unrealistic mockup training during the current outage were demonstrated by workers being unprepared for certain field conditions, which increased the time necessary to complete the scheduled tasks and appeared to unnecessarily increase worker radiation exposure.

Based on the above review, this portion of the licensee's program is adequate. However, the following items are recommended to strengthen the ALARA program.

- Develop formalized training programs for advanced radiation worker training and ALARA staff qualification/OJT and professional development.

- Complete implementation of the formalized ALARA training course regarding design engineering.

- Improve the system for modification of the ALARA training program in response to lessons learned.

- Improve the quality of the mockup training to ensure it adequately reflects field conditions.

6. Management Goals

To assist each station in measuring its performance and to identify radiation work that requires additional exposure reduction and planning and ALARA action, CECo has implemented a radiation exposure goals program which is described in its ALARA Manual. Each year each station department is requested to develop annual estimates for collective radiation exposures, percent of general access area contaminated, and personnel contamination events (PCEs).

The inspector reviewed the licensee's process for calculating annual collective radiation exposure goals for the LaSalle plant. The process begins three to six months before the end of the year by establishing dose estimates for each station department for the following year based on predicted work load, with the knowledge of historical dose and manpower information included when available. These initial estimates are reviewed and refined by the joint effort of the ALARA Coordinator and each department. Eventually these estimates become goals agreed to by the department and the Station ALARA Committee (SAC). The sum of the individual departmental goals becomes the stations ALARA goal. This goal is reviewed by the SAC to ensure that it is both challenging and realistic; if deemed too high, SAC can lower this goal as it did in 1990 when the goal was changed from 950 to 875 person-rem.

Although the licensee's goal setting practices are not covered by formal procedures, the system appears to work well. Throughout the goal setting process, the ALARA Coordinator works with the SAC to refine and reduce the dose estimates through the application of ALARA techniques such as shielding, work preplanning, and the use of fewer workers.

The approved station dose goals are forwarded to the Corporate ALARA Committee (CAC) for review and comparison with the industry average and the better performing plants in the country. Sometimes, suggestions from this review are forwarded to the Station Manager for consideration in changing the station's goal.

Final dose goals are established by the end of the year for the following year. The annual dose goals for each department are broken down into monthly goals and are also broken down by major jobs (jobs estimated to exceed 20 person-rem). The Radiation Protection Department monitors plant performance daily relative to these goals and sends comparisons between actual dose and the dose goals each month to the Station Manager and the department heads. This monthly tabulation includes explanations for any department dose overruns. During the year, station goals may be changed if required. For example, if it becomes necessary to perform an

unplanned high dose job that will cause the plant dose goal to be exceeded, the ALARA Analyst will meet with the respective job department head beforehand and decide whether it warrants revision of the plant dose goal.

The station annual goals for 1987 and 1988 were revised upward during the year, but were still exceeded by the end of the year (Attachment 6). However, in 1989 the licensee did not exceed its original dose goal of 1400 person-rem. The 1990 dose goal is 875 person-rem and as of April 15, 1990, the licensee had accrued 421 person-rem compared with the projected dose goal of 340 person-rem for this date. However, the annual goal still appears reasonable because a significant fraction of the high dose outage work was completed ahead of schedule.

The dose estimates used by the licensee appear to be sound and fairly accurate. Each year the dose goals appear to more accurately reflect the actual doses. This is probably due to availability of more historical job person-rem and man-hour data as the plant ages. The continued fine tuning of the plant dose goals coupled with an increased worker awareness of the importance of not exceeding these dose goals should result in better dose projections and in an overall reduction in station doses at LaSalle.

Based on the above review, this portion of the licensee's program is adequate.

7. ALARA/RWP Procedure Implementation

a. ALARA/RWP Procedures

The licensee uses a radiation work permit to delineate the radiological control requirements to be implemented for radiological work activities. Procedure LAP-100-22, Revision 6, Radiation Work Permit, provides an explanation and flow path for use of the radiation work permit (RWP) program. The procedure provides criteria for issuing an RWP, approving an RWP, and implementing the RWP.

There are two types of RWPs. The Type 1 RWP is required for all routine access or work in radiologically controlled areas where personnel are not expected to exceed a whole body dose equivalent of 50 mrem/day. The Type 1 is valid for one year and is reviewed weekly by a radiation protection supervisor and the job supervisor. If a Type 1 RWP is deactivated, it will be reviewed by a radiation protection supervisor prior to reactivation.

A Type 2 RWP is required for all access or work in radiologically controlled areas where personnel are expected to exceed a whole body dose equivalent of 50 mrem/day. In addition, a Type 2 RWP may be required for jobs involving significant contamination and/or airborne radioactivity. Type 2 RWPs are valid for the duration of the job and require a shiftly review by radiation protection supervisors.

Both Type 1 and Type 2 RWPs require that operating supervisors read and understand them, that a periodic review frequency be determined or if a periodic review by an operations supervisor is not required, that the reason for not performing the review be documented, that Type 1 RWPs have an initial survey prior to the start of the work on that RWP, and that all active Type 1 RWPs be resurveyed.

An ALARA "checklist" is required to be completed for each Type 1 and Type 2 RWP. The checklist is completed by radiation protection personnel. The checklist provides criteria, which if met, require the performance of an ALARA action review. The checklist is required to be signed by the job supervisor and radiation protection supervisor. All ALARA reviews greater than 30 person-rem are required to be reviewed by the Station ALARA Committee (SAC) or cognizant persons that can appraise exposure reduction for the task. A review of the various forms contained in the RWP package indicated they are not human factored to allow workers to readily identify their responsibilities relative to ALARA.

The ALARA action review procedure requires that person-rem saved through the ALARA action review process be documented in the ALARA action review follow-up and tabulated on the RWP reports system. Although the procedure does not require that unnecessary exposure (e.g., due to re-work or error) be documented and trended or evaluated, the reason for the unnecessary exposure was being documented; however, it was not being trended.

The ALARA action review procedure also provides for ALARA outage preparation for high exposure jobs, high contamination potential jobs or other work which could benefit greatly from ALARA pre-planning. The pre-outage review is used as an aid to ensure that outage supplies are adequate and/or ordered in advance of the outage start dates. However, the procedure does not define appropriate lead times for submittal of RWPs to ensure sufficient time to perform ALARA reviews is provided.

The licensee established a Radiation Protection/ALARA Work Request Traveler (Memo No. 31) on January 17, 1990. This is not a formal procedure but rather a memorandum of understanding as to how the radiation protection and maintenance groups will work together on processing a work request. A maintenance work analyst fills out the section and routes it to the ALARA personnel. While there are no mechanisms to ensure the ALARA personnel obtain a work traveler in sufficient time to perform an ALARA review commensurate with the degree of expected exposure, inspector discussions with ALARA personnel indicated timeliness has not been a problem. The

Radiation Protection/ALARA Work Request Traveler does not provide for review of tasks on a sub-task basis. The work principally is reviewed from an aggregate exposure standpoint for the completed task. The licensee is currently developing a radiation work permit request which includes evaluation of sub-tasks from an ALARA perspective. This will provide for closer scrutiny of individual subtasks of a large work activity.

The ALARA personnel recommend insertion of ALARA flags into work packages. If the work analyst disagrees with the ALARA flag, then the ALARA personnel are notified. The work traveler is not required to be reviewed or commented on by the operations radiation protection group who issues the RWP. The ALARA review assigns or recommends certain ALARA actions based on total exposure.

The licensee has established administrative procedures that describe the preparation, revision, and review of station procedures. These procedures are in the LAP-820 series and include LAPs-820-6, 820-7, 820-9, and 820-10. The licensee's procedures do not require or provide for review of other department procedures from an ALARA standpoint (e.g., maintenance). The ALARA group, however does review special procedures for certain work activities (e.g., reactor reassembly) that have significant radiological concerns. This is done during initial work planning.

In general, the RWP/ALARA procedures in conjunction with internal memoranda have provided an adequate framework for ensuring ALARA is factored into work activities. However, there are a number of areas in which the procedures can be upgraded to enhance the implementation of the ALARA program.

b. <u>ALARA Input to Job Planning</u>

Work planning is accomplished at outage planning meetings. Outage meetings start about six months before an outage. The ALARA personnel also attend system meetings where each system is discussed. Although the ALARA personnel normally receive RWP requests one month before an outage, attendance at these meetings give them advance knowledge of planned outage work.

The ALARA analyst attends the station modification meetings where all modifications are reviewed. Although meetings are held, there are no specific guidelines for holding pre-planning meetings for the purposes of discussing ALARA. Work supervisor input to the ALARA process for jobs less than three rem is not required.

Estimated man-hours for tasks are provided by the work analyst for the total job. The ALARA group evaluates the estimate based on previous history if available, if not the estimate is accepted as provided. The licensee's ALARA staff does not routinely solicit outside information on work history (e.g., man-hours including person-rem) for particular tasks done at other utilities. The licensee tracks daily accumulated man-hours and person-rem by use of "dose cards." The cards are filled out when any whole body exposure could be received.

The inspectors reviewed the adequacy of the licensee's estimates for man-hours and person-rem for the completed and active radiation work permit for the current outage on Unit 2. The review found that overall, the licensee's estimates (man-hours and person-rem) appeared to be adequate. The inspector estimated that the man-hours were over estimated in about 13% of the RWPs generated. A number of the over estimates were due to use of man-hour estimates from previous outages. Because of a change in scope of work or improvements in performance techniques, the licensee was able to complete the work in less time. For example, hydrolazing of the scram discharge header was able to be completed in 50% of the previous time. However, the inspector did note that a number of the man-hour estimates (particularly those associated with contractor labor support) were significantly over estimated. For example, the estimate being tracked by the ALARA group for set-up and tear down of the Unit 2 Drywell Bull Pen Area was estimated at about 2,200 man-hours. The licensee's ALARA personnel however projected that the work would be completed with 186 man-hours. A similar example involved labor support for Unit 2 reactor vessel disassembly and reassembly. The work was estimated at 1100 man-hours to complete. The licensee's ALARA personnel projected about 258 actual man-hours to complete the work.

The inspectors identified very few RWPs where the man-hours were underestimated. If man-hours were underestimated, this could result in underestimating the accumulated exposure; consequently, ALARA actions may not be taken where needed. The inspector concluded that overall, the licensee's estimate for man-hours and person-rem to complete a task appeared reasonable.

c. Procedure Implementation

The inspector's review of the ALARA controls outlined in the RWP procedure and the ALARA action requests indicate that these implementing procedures address basic elements of a program for performing pre-planning, ongoing job review, and post-job evaluation of radiological work activities. The inspectors review of RWPs at the Unit 2 Drywell Control Point indicated the permits were implemented in accordance with procedure requirements. ALARA checklists and action reviews were also completed as required. However, the following concerns were identified:

- The RWP ALARA checklist (Attachment F to Procedure No. LAP-100-22) provides the initial criteria used to evaluate work activities from an ALARA perspective. This checklist is completed by the radiological control technician preparing the RWP. The checklist:

  - focused on job specific ALARA requirements and did not ensure that repetitive jobs that would be performed over the life of the facility would be reviewed for potential dose savings;

  - did not contain all appropriate items to be considered for each level of exposure for dose reduction, including: movement of the work to lower dose rate areas; use of video cameras for monitoring work activities remotely, particularly for repetitive tasks; the need for mock-up training; the need for special procedures; or the use of other alternatives to meet the intent of the original task. The checklist considered a number of these items, but only for higher exposure values.

- The RWP ALARA checklist provides criteria to be used to evaluate the need to refer the work activities to the ALARA coordinator for review. Several of the criteria are subjective and do not provide sufficient guidance for properly assessing or ensuring that particular criterion are met. For example, one criterion addresses whether the job has "serious potential problems associated with it." It is unclear what a serious potential problem is. Another criterion asks if the exposure expenditure will be 1 person-rem. It is unclear whether this is job specific or over the life of the facility. In addition, one criterion is whether the air inside a respirator will be 25% of an MPC. It is unclear as to how this will be determined.

d. ALARA Job Reviews

The RWP and ALARA program procedures do not provide the methods or criteria to be used to perform ongoing job reviews of radiological work activities. The licensee is using an informal method to track ongoing work using the RWP system. The licensee looks at aggregate person-hours to complete a job and calculates an estimated aggregate exposure to complete the task. The licensee compares percent job completed against accrued exposure to determine if problems are being encountered.

The inspector met with ALARA representatives to determine the extent of ALARA reviews performed by the ALARA personnel for ongoing outage work. The licensee established an outage goal of 481.5 person-rem for the Unit 2 third refueling outage. The inspector's discussions with the ALARA representative indicated that 87% of ongoing outage exposure had received a formal ALARA review by the ALARA personnel. The remaining 13% had received an ALARA review performed by the radiation protection staff. The inspector concluded that despite weaknesses in the RWP and ALARA program procedures, a substantial portion of the estimated aggregate exposure for ongoing outage work had received some level of ALARA review.

There was also no formalized post-job ALARA review criteria. The licensee has an informal criteria of one person-rem in excess of the original estimate or over five person-rem. Inspector discussions with ALARA personnel indicated that post-job reviews had been completed on only about 10% of all work (including outage work) for 1990.

e. <u>ALARA Related Observations</u>

The inspectors reviewed general ALARA practices during plant tours. The inspectors concluded that personnel appeared to be sensitive to the need to maintain their exposures ALARA. However, the following examples indicate instances where personnel were not as cognizant of the need to plan for or wait in lower dose rate areas as they should have been.

- Low dose wait areas are not posted throughout the Unit 2 Drywell. The inspector observed a firewatch on the 710' elevation of the Unit 2 Drywell on April 23, 1990, standing in a 30 mR/hr field performing the firewatch function. An unposted area, that exhibited a dose rate of about 7 mR/hr, was about five feet away. The firewatch could have performed his duty at that location.

- Inspectors observed five individuals sitting in the Unit 2 Control Rod Drive Disassembly and Rebuild Room. The workers, including the foreman, were sitting in a 5 mR/hr field for at least 20 minutes. The workers were directed to wait in this area by a radiation protection technician because the technician thought they were needed for an impending job. After the inspectors questioned the technician about the workers sitting in the area, the technician directed the workers to wait at the Unit 2 Drywell Control Point, which measured about 0.6 mR/hr.

- Because of concerns about potential loss of control of contaminated tools coming out of the Unit 2 Drywell, the licensee required workers to place their tools and equipment at the exit of the equipment hatch to be checked for contamination. Although radiation protection technicians are instructed to have workers waiting for a tool check stay in low background areas, one worker was observed waiting in a 5 mR/hr field. The worker could have moved to an area near the check-point and observed the tools and equipment while waiting in essentially a 0.6 mR/hr field.

- Inspectors observed personnel suiting up workers in bubble hoods and plastic suits to perform work activities in the Unit 2 Drywell on the 67 B valve. Inspectors also observed that one worker was resuited several times. Also, the workers were held-up while the dosimetry of one of the workers was re-positioned. These activities were performed in a radiation field ranging from 5-30 mR/hr.

The inspectors also reviewed the licensee's ALARA planning for the clean-up and repair of tanks and tank rooms (e.g., ultrasonic resin tank and waste sludge tanks) in the Unit 1 turbine building 603' elevation. The licensee was cleaning up the room as part of a bigger work activity to repair waste tanks. The inspector noted that personnel made an entry into the ultrasonic resin and waste sludge room on April 12, 1990. Workers were required to sift through dry residue, several inches deep, to search for debris that would hinder a robot which was to be used in the room. The dry residue exhibited general area dose rates measuring up to about 2 R/hr. Workers received about 400-500 mrem whole body dose for a 15-minute entry. The inspector noted that the licensee had not performed a detailed ALARA evaluation of the entire radwaste system repair operation to evaluate all ALARA options to decontaminate and cleanup the various room areas and tanks. The work had been planned from a mechanical point of view. The workers did not wear extremity dosimetry for the feet. The inspector noted that the dosimetry procedures did not require the use of extremity dosimetry but recommended its use if an extremity would receive 300 mrem and the extremity dose was twice the whole body dose. (A separate management meeting will be held regarding the radwaste contamination control and extremity exposure aspects of this matter.)

Based on the above review, this portion of the licensee's program is adequate. However, the following areas are recommended to strengthen the ALARA program.

- Improve overall quality, content and guidance contained in RWP and ALARA procedures to ensure jobs are reviewed on sub-task bases and all appropriate ALARA techniques are considered for exposure reduction. Eliminate the use of memoranda to control ALARA program activities.

- Sensitize workers and supervisors regarding the need to eliminate extraneous doses by waiting in low radiation areas.

- Formalize and upgrade the criteria for the ongoing job review and post-job evaluation process.

8. ALARA Initiatives/Operational Practices

The inspectors observed inplant ALARA initiative (D/W shielding), reviewed records/data, and discussed station dose reduction initiatives with licensee representatives. Engineering ALARA controls used for dose reduction include, but are not limited to shielding, chemical decontamination, flushing, and hydrolazing. Maintenance of good water chemistry, reduction of personnel involvement in high dose jobs and initiation of new programs to identify sources of dose are also being implemented successfully by the licensee.

The chemistry program was discussed with a licensee representative. Analytical results were examined and found to be within the EPRI guidelines. The representative stated that maintaining the best water chemistry possible is a factor in dose control and that no other programs currently available to BWR's (hydrogen water chemistry, zinc addition, etc.) have been implemented at the station. However, hydrogen water chemistry will be evaluated again in the future.

A Plan for Excellence to address cobalt reduction has been initiated by Corporate to establish a cohesive program encompassing efforts and studies to date and initiatives. The Plan will identify and prioritize methods and results in an action plan to reduce cobalt in reactor systems and provide a cost benefit analysis for the elements of the action plan. The licensee specifies low cobalt bearing materials for use in reactor and support system replacement.

Cost benefit analyses to evaluate person-rem savings associated with chemical decontamination of the recirculation system via the LOMI process have been made for past and the current outage (L2R03). While the benefits did not in all cases justify a chemical decontamination, it was performed as part of L1R02, L1R03 and L2R02, resulting in general area decontamination factors of 1.88 - 2.52. The chemical decontamination cost benefit evaluation for L2R03 concluded that the person-rem savings would be insufficient to justify decontamination for this outage.

Reactor cavity cleaners and other decontamination techniques such as glass bead blasters and high pressure hydrolazing of reactor recirculation pump bowls, cavity drains in the reactor cavity and dryer separator pits and other piping systems, reactor vessel nozzles and primary system valves have been used effectively. The use of a scavenger robot and strippable coating on the reactor cavity are being investigated.

Flushing of the ECCS before flood up to reduce dose and a final flush of the system to reduce iron remaining in the system due to a condenser open to the atmosphere was another example of effective decontamination implemented by the licensee. A CRD water tank is used during drive disassembly to provide both a decontamination medium and total body shielding.

A source term reduction program was initiated in July 1989 in an effort to reduce dose rates by initiatives such as shielding, system flush, and hydrolazing port installation. Approximately 50 hot spots/lines have been identified by survey results and a report with appropriate recommendations is being compiled. In one instance modification of fuel pool recirculation reduced local dose rates by a factor of two without cost. A leak reduction program recently introduced is projected to save approximately 10 person-rem in 1990.

Various remote (automated) equipment is used during outages to reduce the time of exposure and reduce the dose rates that contribute to exposure. Included are a faster, second generation control rod drive handling machine, multiple head tensioners, remote MSIV maintenance equipment, quick disconnect insulation, remote tools, and CRD cleaning and disassembly equipment. Two of the more significant contributors to person-rem reduction are the use of the GERIS technique to inspect vessel welds, and multiple head tensioners. The licensee's estimate of the GERIS system savings is 475 person-rem for the current outage. In addition to dose savings multiple tensioners reduce outage time and critical path time.

The licensee appears to be aggressively addressing dose reduction with respect to programs and equipment initiatives. Most effective have been chemical decontamination, increased shielding, hydrolazing and the use of GERIS for remote weld inspection. Efforts to identify dose reduction aspects indicate positive results for two new programs, leak reduction and hot spot/line source. Aggressive use of new and upgraded equipment has reduced dose and should aid in outage reduction and critical path adherence.

Based on the above review, this portion of the licensee's program is adequate.

9. Assessment/Self Evaluation

The licensee evaluates ALARA performance by conducting QA audits/ surveillances, post-job reviews, ALARA lessons-learned outage reports, and special assessments by external organizations. The inspectors selectively reviewed QA audit/surveillance reports of the ALARA program from 1988 to present. These reports appeared to result in an adequate self assessment of the ALARA program with a sufficient number of performance based observations. The inspector also selectively reviewed portions of a recent ALARA outage report and post-job reviews. Although it appeared desirable for the licensee to somewhat improve the quality of post-job reviews, the lessons-learned presented in the ALARA outage report appeared adequate to result in significant future dose-saving if appropriately implemented. According to the licensee, during 1987-1989 there were ten special external assessments of the ALARA program. A selected review of the assessment reports showed that most of these external appraisals identified areas of the licensee's ALARA program which needed significant improvement. Although the licensee proceeded to implement most of the suggested improvement items, it may be necessary to more aggressively pursue dose-saving recommendations as evidenced by continuing high radiation exposure.

By documentation reviews and interviews with licensee personnel, the inspectors assessed whether root cause analyses of maintenance rework and equipment history files of unreliable equipment were adequate to appropriately minimize personnel radiation exposure. It was noted that the licensee regularly obtains component failure comparison data from the Component Failure Analysis Report (CFAR) option of the Nuclear Plant Reliability Data System (NPRDS). This data appeared to be well utilized to increase component reliability and thus minimize radiation exposure by significantly reducing maintenance rework. However, since the CFAR data are only applicable to safety-related equipment and certain components important to safety, the licensee also needs an effective, but separate, method to minimize maintenance rework of Balance of Plant (BOP) equipment.

The licensee keeps track of BOP maintenance and equipment problems with the use of several systems, including Discrepancy Record Trending (DRT Procedure No. LTP-200-8), Total Job Management (TJM, Procedure No. LAP-1300-1 and No. LAP-300-11), and Problem Analysis Data Sheets (PADS, Maintenance Department Memorandum No. 27). DRT trends discrepancy root causes, including those for the mechanical, electrical, and instrument maintenance gauges. TJM delineates the administrative controls necessary to properly generate and process Work Requests (WRs), and specifies the use of the Computerized Maintenance History Program (CMHB). CMHB is used to issue Maximum Occurrence Reports (MORs) if a component fails three times within a 12-month period. Maintenance work analysts use the CMHB to generate equipment history records and MORs to aid in preparing ALARA Travelers as part of WR packages. The ALARA Traveler requires ALARA Planning input early in the development of the WR to factor lessons-learned into the planning process, and to identify measures such as shielding, ventilation, and other radiological controls that should be considered by the work analysts.

Although the BOP maintenance rework and equipment problem tracking and trending systems appeared to be well utilized by the licensee when developing individual WR packages, they have not been integrated together to formulate a broadscope effective method to minimize radiation exposure by significantly reducing BOP maintenance rework, such as has been accomplished for safety-related equipment by the NPRDS CFAR. The licensee recognizes this programmatic deficiency as a result of the NRC Maintenance Team Inspection conducted on May 1-25, 1989 (Inspection Reports No. 50-373/89010(DRS); No. 50-374/89010(DRS)). In response to inspection findings, the licensee has opened three internal items to track corrective actions to resolve the following identified concerns: (1) lack of comprehensive trending program for corrective maintenance, (2) trending program does not consider component significance, and (3) work request cause codes are not used for trending. The licensee indicated that little progress has been made to resolve these action items.

The inspectors discussed with a Senior Licensee Manager the above concern and the apparent desirability of integrating ALARA initiatives into maintenance trending programs. (The licensee presently does not formally factor anticipated radiation exposure into the component reliability program.) The Senior Manager indicated that the licensee's Task Force on the Conduct of Maintenance at Nuclear Power Stations would review the above concerns at a future meeting. The Task Force members include an assistant maintenance superintendent from each of the six licensee nuclear power stations and two licensee corporate senior managers. The inspectors discussed with the LaSalle County Station task force member additional details regarding the Task Force charter, governing Nuclear Operations Directive No. NOD-MA.2, and licensee speculation on when the aforementioned corrective action items would be completed and potential means of integrating ALARA initiatives into maintenance trending programs.

Based on the above review, this portion of the licensee's program is adequate. However, the following item is recommended to strengthen the ALARA program.

- Develop a comprehensive BOP maintenance rework and equipment problem tracking and trending system to minimize radiation exposure by increasing component reliability.

10. Exit Meeting

The scope and findings of the inspection were summarized on April 27, 1990, with those persons indicated in Section 1. The inspectors described the areas inspected, indicating that although the licensee had an adequate ALARA program, there was still room for considerable improvement in almost all areas of the program (see the Executive Summary, Enclosure 1 to the Cover Letter). The licensee acknowledged the inspection findings without exception. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection.

ATTACHMENT 1

Occupational Dose Comparison
for
LaSalle Nuclear Generating Station
versus
Average U.S. Boiling Water Reactors (BWRs)

Collective Dose Per Reactor (Person-Rem/Year) (NUREG/CR-0761)

	1986	1987	1988	1989
LaSalle 1, 2	475	697	1236	692
Average BWR	652	513	529	*
% of Average	-27%	+36%	+134%	*
Rank (Highest)	11th out of 30	5th out of 33	2nd out of 34	*

* Data Unavailable

Annual Individual Dose (mrem/year) (NUREG/CR-0761)

	1986	1987	1988	1989
LaSalle 1,2	590	800	900	560
Average BWR	420	400	450	*
% of Average	+40%	+100%	+100%	*

* Data Unavailable

Daily Collective Dose per Reactor (mrem/day) (Hinson, NRC, 1990)

	Non-Outage Dose Rate	Outage Dose Rate
LaSalle 1,2 (1986-1988)	750	5000
Average BWR	441	4000
% of Average	+70%	+25%

Attachment 2

Comparison of BWR Radiation Levels During Shutdown from Available Literature on Selected Components and Systems versus LaSalle Exposure Rates (Hazzan, et. al., Nuclear Technology, Vol 69, June 1985)

Location	Type of Measurement	NUREG/CR-0672 Dose Rate (mR/h)	EPRI-404-2 Dose Rate (mR/h)	SWEC Program Dose Rate (mR/h)	LaSalle 1 3rd Outage Nov 1989 (mR/h)	LaSalle 2 3rd Outage April 1990 (mR/h)
Low pressure core spray piping	Contact	10 to 180		80 to 400	3 to 6	5 to 10
RHR system						
Pump	Contact	16 to 27		80 to 400	-	10 to 45
Pump piping	Contact	35 to 55		200 to 1200	250	10 to 150
Pump	General Area	20 to 50		10 to 50	5 to 30	10 to 200
RCIC system						
Pump	Contact	2 to 8		60 to 90	2 to 3	2 to 5
Pump piping	Contact	50 to 60		150 to 1000	-	-
Pump	General Area	5 to 10		5 to 60	2 to 3	2 to 5
Control-rod drive system						
Pump filter	Contact	80		200 to 800	50 to 500	300 to 1500
Pump	Contact	1 to 2		10 to 480	1 to 5	3 to 15
Pump	General Area	15		8 to 150	1 to 5	3 to 15
Pump piping	Contact	15		10 to 1900	10 to 30	5 to 45
Reactor water recirculation pump	Contact	100 to 370	55 to 300	15 to 300	50	50
Piping at bottom of pump	Contact	35 to 60		90 to 300	50 to 120	110
Return piping to reactor	Contact	80 to 90		300 to 900	25 to 180	100 to 600
Stem relief valve from main steam line (in drywell)	Contact	40 to 43		2 to 100	5 to 10	5 to 10
Main steam system						
Piping	Contact	35 to 70		10 to 300	1 to 5	1 to 5
Valves	Contact	5 to 40		2 to 450	5 to 40	5 to 40
TIP drive mechanisms	Contact	15		100 to 800	< 5	< 5
Reactor building equipment drain sump	Contact	5		100 to 600	3 to 50	3 to 50
TIP room	General Area	30 to 50		20 to 60	15	10 to 35
TIP probe shields in TIP room	Contact	50 to 200		600 to 2500		350 to 1800
Control-rod drive modules	Contact	2 to 45		2 to 100	2 to 5	2 to 5
RWCU system						
Pumps	Contact	100 to 1200	350 to 7000	40 to 4000	25 to 110	50 to 130
Piping	Contact	70 to 220	250 to 10000	200 to 8000	800 to 2500	150 to 2300
Drain	Contact	160 to 210		700 to 1500		170 to 1700
Heat exchanger	Contact	300 to 10000	600 to 900	50 to 5000	300 to 500	200 to 350
Heat exchanger	General Area	20 to 750		10 to 600	200 to 500	200 to 350
RHR system						
Heat exchanger	Contact	50 to 250	60 to 8000	100 to 2500	50 to 130	100 to 200
Heat exchanger piping	Contact	800	100 to 1500	250 to 1500	100 to 250	100 to 300
Heat exchanger	General Area	160 to 600	10 to 500	10 to 500	30 to 90	70 to 110
Fuel pool cooling equipment	General Area	100		50 to 1600	20 to 160	80 to 260
Standby gas filter unit	General Area	25		1 to 4	< 1	< 1

Attachment 3

Repetitive High Dose Jobs During Refuel Outages (NUREG/CR-4254, May 1985)

LaSalle versus General Electric BWRs
Collective Dose Summaries for Outage High Dose Jobs

Job Title	Collective Dose (person-rem) Min	Max	Avg	Population Size	LaSalle 2 1st Outage 01/03/87 -05/30/87 (person-rem)	LaSalle 1 2nd Outage 03/13/88 -07/08/88 (person-rem)	LaSalle 2 2nd Outage 10/15/88 -02/10/89 (person-rem)	LaSalle 1 3rd Outage 08/15/89 -01/10/90 (person-rem)
Snubber Inspection & Repair	2.6	1400	290	15	157.6	251.6	135.7	6.7
In-Service Inspection	32	380	150	15	27.3	14.0	11.2	105.1
CRD Removal/Rebuild & Replacement	6.3	230	60	15	64.2	62.0	59.9	51.9
Scaffold Installation/Removal	24	120	57	3	23.8	60.5	91.9	30.3
Insulation Removal/Replacement	0.6	170	44	8	44.2	55.0	77.2	20.5
Safety Valve Repair & Inspection	9.3	80	39	14	81.5	30.0	39.5	34.6
RHR System Repair & Maintenance	11	48	34	5	22.6	36.6	37.5	21.5
Reactor Disassembly/Assembly	7.8	51	24	15	16.9	24.5	25.3	39.0
MSIV Repair & Inspection	2.7	67	20	13	3.2	3.1	5.6	3.3
Fuel Shuffle/Sipping & Inspection	3.8	58	19	15	1.6	-	-	1.9
Instrumentation Repair & Calibration	3.2	41	15	4	10.8	7.2	13.1	37.0
TIP/SRM/IRM or PRM Calibration, Repair & Maintenance	3.5	41	11	14	11.9	14.4	19.2	26.0
Recirculation Pump Seal Replacement	1.5	23	7.8	11	0.5	1.9	5.0	3.1
Turbine Overhaul & Repair	0.2	21	6.2	14	0.3	0.3	0.4	2.3

Repetitive High Dose Jobs During Routine Operations & Outages (NUREG/CR-4254, May 1985)

LaSalle versus General Electric BWRs
Collective Dose Summaries for Routine Operations & Outage High Dose Jobs

Job Title	Collective Dose (person-rem) Min	Max	Avg	Population Size	Operations & Outage 1987 (person-rem)	Operations & Outage 1988 (person-rem)	Operations & Outage 1989 (person-rem)
Primary Valve Maintenance & Repair	7	150	57	6	169.6	165.3	71.7
Plant Decontamination	9.4	65	37	12	102.1	125.9	36.8
Operations - Surveillance, Routines & Valve Lineups	11	53	24	9	20.9	44.9	56.4
Radwaste Systems Repair, Operation & Maintenance	7.7	28	16	4	49.9	70.1	53.1

<u>ATTACHMENT 4</u>

Commonwealth Edison Company's
LaSalle Nuclear Generating Station
Collective Radiation Exposures for
Non-Repetitive High Dose Jobs

<u>1987</u>

<u>(Hinson, 1989)</u>

<u>LaSalle 1, 2 (1,394 rems)</u>

- Recirculation pump maintenance (197 rem)
- Snubber reduction, testing, removal (126 rem)
- Drywell cooling installation (123 rem)
- Mechanical stress improvement program (10 year) (63 rem)
- Drywell cleanup and decontamination (63 rem)

Total: 572 person-rem

<u>1988</u>

<u>(Hinson, 1989)</u>

<u>LaSalle 1, 2 (2471 rems)</u>

- Install and remove scaffolding and gratings (142 rem)
- Snubber reduction, testing, removal (135 rem)
- Drywell cooling installation - Unit 1 (125 rem)
- Remove mechanical snubbers and support steel in drywell (122 rem)
- Drywell decontamination/fire watch (115 rem)
- Mechanical stress improvement program (95 rem)
- Drywell cooling installation - Unit 2 (94 rem)
- Remove interferences for Unit 2 reactor recirculation pump (66 rem)
- Remove and install Unit 2 drywell insulation (50 rem)
- Install reactor vessel level instrumentation system (60 rem)
- Inspect/repair reactor recirculation pumps (142 rem)

Total: 1146 person-rem

<u>1989</u>

<u>(LaSalle County Station Radiation Protection Outage Report for L1R03)</u>

<u>LaSalle 1, 2 (1380 rems)</u>

- Drywell cooling modification (L2) (32 rem)
- Remove/rebuild/replace 20 CRD (67 rem)
- In service inspector (92 rem)
- Drywell cooling installation (L1) (160 rem)
- Snubbers (8 rem)
- SRV (13 rem)
- 67 A/B receive discharge valve repair (34 rem)
- Decontamination (34 rem)
- Shielding (27 rem)

Total: 467 person-rem

ATTACHMENT 5

Dose Reduction Techniques for Repetitive High-Dose Jobs Conducted During Routine Operations and Outages

Primary Valve Maintenance and Repair

Dose Rate Reduction Techniques:

- Hydrolase local piping and valve internals
- Flush local pipes and valves if practical
- Remove valve or operator to a low-dose-rate area
- Evaluate need for local shielding
- Establish low-dose-rate waiting areas
- Provide beta protection if required
- Use mobile shield rack
- Design and fabricate custom shielding package for unshielded valves

Timesaving Techniques:

- Place description of all valve locations and/or pictures of valve location on door of cubicle
- Use specialized tools to remove and replace packing and valve seat
- Provide mockup training on valve repair if practical
- Provide lighting and scaffolding if necessary
- Use photographs and drawings of valves to familiarize workers
- Prefabricated packing of parts
- Use of ribbon packing or line load packing
- Remove interferences

Contamination-Reduction Techniques:

- Utilize glove bags or catch pans
- Provide local ventilation if practical
- Place plastic or blotter paper under valve
- Decontaminate area under valve periodically
- Contain packing material and valve internal following removal
- Moisten valve internals
- Install diaphragm inside valve body
- Thoroughly vacuum valve internals prior to reassembly
- Bead blast valve internals

Operations-Surveillance, Routines, and Valve Lineups

Dose-Rate-Reduction Techniques:

- Use reach rods and "T" handles for high-dose-rate area valves
- Assure continuous dose-rate monitoring (digital electronic dosimeters) in high-radiation areas
- Schedule rounds or surveillance when operating conditions yield the lowest dose rate
- Assure that hot spots and low-dose-rate areas are all posted
- Move step-off pads close to the operator observation point
- Locate instrument readouts in a low-dose-rate area
- Use water windows, TV, and mirrors
- Flush instrument periodically
- Reduce surveillance frequency in high-radiation areas if possible

Timesaving Techniques:

- Attach pictures or drawings of valve locations onto cubicle doors
- Provide floor and wall markers pointing at valve locations
- Use highly visible easy-to-read valve tags
- Provide valve checklist with written description of valve locations
- Use colored ribbon to identify faulty equipment
- Use lead shielded barrel carts

Plant Decontamination

Dose-Rate-Reduction Techniques:

- Use lead shielding on fork lift and drum carrier
- Measure dose rates on all waste bags, drums, and bins prior to transport
- Use remote control cleaning equipment e.g., robotic hydrolaser
- Segregate waste by radiation level

Timesaving Techniques:

- Employ dedicated decontamination technicians
- Use carts to move laundry and dry active waste
- Use floor-scrubber and wall-washing machines
- Use steam-cleaning machines
- Use air-operated vacuum cleaners
- Use high pressure freon, glass bead, electropolishing and ultrasonic cleaning equipment
- Provide judicious planning of areas to be deconned
- Use the most appropriate decon technique
- Test all mechanical and electrical equipment before use

Contamination-Reduction Techniques:

- Repair leaks immediately upon discovery
- Use mop bucket plastic liners
- Use dry cleaners to reduce liquid radwaste handling
- Use strippable decontamination coating

Radwaste System Repair, Operation, and Maintenance

Dose-Rate-Reduction Techniques:

- Use drum survey shield
- Evacuate areas along resin piping during resin transfers
- Flush lines and shield prior to insulation, heat trace, or repair
- Use overhead crane, fork truck, and remote handling tools
- Use reach rods on high-dose-rate valves
- Supply mobile solidification system
- Provide remote control automated drumming facility
- Install lead housing over resin transfer pump
- Use rope pulley and snap hook to remotely move filters and place in drum
- Survey filters and demineralizer beds remotely through holes bored in walls
- Use mobile shield racks
- Provide remote waste-sampling points

Timesaving Techniques:

- Modify filter cartridge housings to facilitate opening and filter removal
- Replace unreliable motors, pump, and valves with those which are more reliable
- Employ dedicated radwaste operators and handlers

Contamination-Reduction Techniques:

- Decontaminate floor and equipment routinely
- Provide remote drum decon station
- Use strippable paint in drum and waste processing area

ATTACHMENT 6

Annual Dose Goals vs Actual for the LaSalle County Station

Dose (Rems)

Year	(Initial Goal)	(Revised Goal)	(Actual)
1987	900	1149	1394
1988	1100	2000	2469
1989	1400	1400	1386
1990	875		

ALARA TEAM INSPECTION GUIDANCE

1. Background

   1.1 Review dose history, including significant high dose jobs.

   1.2 Review ALARA program history.

   1.3 Compare exposure for major jobs with the national average.

2. ALARA Program/Organization

   2.1 Verify that an adequate written management policy, statement has been issued to cover the ALARA program.

   2.2 Through interviews and inspector assessment, determine management and worker participation and knowledge of the ALARA program.

   2.3 Is management committed towards ALARA as demonstrated by its allocation of manpower and resources, along with verbal and written endorsements to this commitment?

   2.4 Is there an ALARA suggestion/incentive program? If yes, is it effectively used?

   2.5. Is ALARA considered in employee/management performance appraisals?

   2.6 Determine whether the following positions exist, and whether the assigned personnel are qualified for the positions:

      2.6.1 Full time ALARA Coordinator.
      2.6.2 ALARA Committee.

   2.7 Verify that responsibilities for conducting the ALARA program have been assigned to the following positions:

      2.7.1 Corporate ALARA organization.
      2.7.2 Plant Manager.
      2.7.3 ALARA Coordinator.
      2.7.4 ALARA Committee.
      2.7.5 Radiation Protection Manager
      2.7.6 Health Physics Department.
      2.7.7 Design Engineering.
      2.7.8 Outage Coordinator.
      2.7.9 Individual workers.
      2.7.10 Maintenance Department.

3. Corporate Involvement

   3.1 Is Corporate support for ALARA aggressive and effective?
   3.2 To what degree and under whose direction does the licensee integrate Corporate initiatives into the plant's ALARA program?

5.3 Are there department man-rem goals established and periodically reviewed?

5.4 Does the licensee's ALARA program achieve it's goals and objectives?

6. ALARA/RWP Procedure Implementation

6.1 Assess mechanics of ALARA reviews: pre and post job review criterial enforcement of ALARA controls and RWP requirements; input from job supervisor; method by which ALARA controls and RWP requirements are relayed to workers; how actual dose for job is tracked, team size determination.

6.2 Are ALARA Coordinators in the field? Are RWPs reviewed? Check the method for estimating the number of man-hours per job. What are the trigger levels for ALARA review and are they effective?

6.3 How are plant procedures reviewed? Is ALARA adequately integrated into the procedures and the review process?

7. Planning/Scheduling

7.1 Do departments have ALARA coordinators/representatives, or work planning organization with ALARA involvement? What are their functions?

7.2 Review the ALARA Committee: function and charter, attendance records, organizational structure (how many?, who's in charge), meeting frequency, final product of meetings, accomplishments, meeting minutes

7.3 Verify that the ALARA organization is allowed sufficient lead time to review proposed design changes, modifications, and maintenance work.

7.4 Verify that an ALARA package is initiated and processed for individual jobs.

7.5 Verify that an ALARA checklist/evaluation with job specific ALARA recommendations, as appropriate, is part of each ALARA package.

7.6 Does the ALARA program provide for the continual dose tracking of ongoing jobs to identify whether ALARA projections may be exceeded? Is there a provision to update or modify dose projections as the work progresses?

7.7 Verify that the ALARA program has adequate programs for modifying or terminating jobs that deviate from the original objectives.

7.8 How are tools staged, shielding installed, and decon performed?

7.9 Are mockup training or videotapes provided for high dose jobs that are unique, repetitive or time consuming?

7.10 Does ALARA job planning include equipment setup time?

7.11 Do planners walk down jobs? What is their input to ALARA reviews (scaffolding, lighting, scheduling, tools, etc.)?

7.12 Are job history files maintained and used?

7.13 Is a video-library or photo-library of plant areas, components, and equipment setup used for pre-job briefings?

7.14 Is a minimum man-rem limit established for requiring a formal ALARA review? (See Section 6.2)

7.15 Verify that adequate action levels have been established for each job such as: _less than 1 man-rem only requires RWP; _greater than 5 man-rem to less than _20 man-rem requires ALARA Coordinator approval; and greater than _20 man-rem requires ALARA Committee approval. Other triggers could be: work in high rad areas greater than 5 minutes; work in 5 MPC; work in highly smearable area (1 Rad/100 cm^2).

7.16 What is the content/protocol for pre-job meetings?

7.16.1 Are they initiated on a minimum dose man-rem estimate?

7.16.2 Do meetings include all jobs assigned workers and coverage technicians?

7.16.3 Are records kept of meetings

7.16.4 Are lessons learned from previous meetings discussed?

7.17 Does the licensee use designated and experienced crews for decon, installation and removal of scaffolding, tents, temporary shielding, and portable HEPA units; and other high dose jobs such as ISI, steam generator work (jumping, sludge lancing, bolt or stud hole repair, CRD in-vessel, SRM/IRM/LPRM/TIPs) and diving.

7.18 Determine whether the ALARA program provides for discussions of work conditions and ALARA experience with other utilities that have participated in similar outages/maintenance. If so, at what level are the issues discussed?

7.19 Are excessive numbers of unplanned work items added to the schedule that don't allow for adequate planning?

8. <u>ALARA Initiatives/Operational Practices</u>

8.1 Are industry identified methods of reducing source term and innovative methods and techniques planned/implemented?
Have the Environmental T/S's addressed these methods/techniques?

8.2 Determine whether a routine (e.g., weekly) program exists to physically inspect high radiation and very high radiation areas to verify proper controls.

8.3 Is preventative maintenance being formed, and if so, is the frequency of the maintenance adequate? Are they being performed at the most dose effective time?

8.4 Does the licensee have a leak reduction program?

8.5 Is the licensee replacing high cobalt components such as: feedwater regulator valves (BWR's), CVCS flow controllers (PWR's) components of other valves and pumps, control blades, fuel channels, incore instruments, CRDM bearings (BWR's), and steam generator tubes and fuel grids (PWR's)?

8.6 Dose the licensee use strippable coatings, steam cleaners, hydrolazing grit blasting, dry ice blastings, rotating hones (brushes with nylon bristles tripped with silicon carbide), rotating steel brushes and cylindrical core devices (pigs) with silicon carbide or wire bristles, and floor scabblers?

8.7 Are video cameras and communications equipment used for job coverage and/or surveillances in high radiation or high contamination areas?

8.8. Are robotics and remote tools used for high dose surveillance, survey, decon, cleaning, cutting, transporting, and manipulating jobs? For example, are robots used for eddy current testing and sludge lancing in steam generators, diving, and ISI (PWR's)?

8.9 Is a high-powered pump used for sump cleaning?

8.10 Are automatic, multi-stud tensioners and cleaners used for the reactor head and manways?

8.11 Are steam generator manway shield plugs/manway doors used (PWR's)?

8.12 Are automatic manway removers, such as hydraulic lift tables used (PWR's)?

8.13 Are control rod drive handling machines used?

8.14 Are control rod drive flange shields used?

8.15 Is an ultrasonic tank (or electropolishing) used for cleaning control rod drivers?

8.16 Is hydrolazing of control rod drive scram discharge header performed? Are permanent hydrolazing ports installed?

8.17 Are in-pool temporary filtering systems used? If so, are they of an acceptable type?

8.18 Is the smallest mesh size practicable used for filters in the coolant filtering systems, including the letdown lines reactor coolant pump seals?

8.19 Is a reactor head shield used (PWR)?

8.20 Do maintenance procedures contain steps to ensure that debris from maintenance, such as cobalt-bearing debris from valve flapping, are cleaned out of the system before the system is closed?

8.21 Are component layup procedures used during outages?

8.22 Is electropolishing performed of new steam generator channel heads or replacement recirc pipes, possibly followed by prefilming?

8.23 Are communications headsets used?

8.24 Are automatic packing machines used?

8.25 Are automatic welders, weld prepping and pipe cutting machines, valve seat refinishers or other similar techniques employed?

8.26 Chemistry controls.

8.26.1 Is chemical decon performed?

8.26.2 Is hydrogen peroxide addition performed in PWR's prior to shutdown to induce crud burst?

8.26.3 Is oxygen concentration maintained at 200-400 ppb during hot functional tests in BWR's before power ascension to allow a protective film to form on piping surfaces?

8.26.4 Are BWR Chemistry Guidelines followed as detailed in EPRI document NP-3589-SR-LD?

8.26.5 Is water conductivity maintained below 0.2 microS/cm in BWR's during operation?

8.26.6 Is zinc injection (and Hydrogen Water Chemistry with or without zinc injection) performed in BWR's?

8.26.7 Is extended hot functional testing performed in good quality water to prefilm steam generator tubes?

8.26.8 Does the licensee avoid sudden drops in pH; maintain pH constant at 6.9; or possibly raise the pH to 7.4? Is a coordinated Li/B Chemistry Program implemented? (PWR's)

8.26.9 Is an overpressure of hydrogen (typically 25-30 cc/kg) maintained in PWR primary coolant to keep oxygen below 5 ppb?

8.26.10 Review the adequacy of the H_2 addition program versus high total body doses.

8.27 Does a program or approach exist to determine if a design change or if a modification that reduces dose is cost beneficial?

8.28 Do design engineers or radiological engineers review designs at the conceptual phase to ensure that provisions have been included that will reduce dose and the spread of radioactivity?

8.29 Does documentation exist to demonstrate that ALARA design reviews were performed?

8.30 Does the licensee have specific radiological design criteria which must be met by all designs?

8.31 Do the licensee's 10 CFR 50.59 modification program consider ALARA in their safety reviews?

8.32 How is the licensee addressing: source term reduction efforts; environmental T/S involvement to reduce stellite material (e.g., CRDM's, check valve seats); long term plant modifications to clean up source term?

9. Assessment/Self Evaluations

9.1 How does the licensee evaluate ALARA performance?

9.2 Review and determine the effectiveness of actions taken on internal and contractor audits and assessments.

9.3 Are internal audits substantive? How effective is the audit system? What is the frequency of the audits?

9.4 Are the qualifications of the personnel performing the audits of the ALARA program adequate?

9.5 Are post-job critiques conducted?

9.5.1 Is there a minimum man-rem total that needs to be exceeded to initiate a post-job review?

9.5.2 Do critiques include all workers and technicians?

9.5.3 Are records kept of meetings?

9.6 Are annual or outage ALARA reports compiled and distributed? What use is made of them?

9.7 Verify that the ALARA program provides for continued review and corrective action for chronic plant radiation problem areas (e.g., hot spots, contaminated drains and pipes in personnel access areas, unnecessary entries into high radiation areas, etc.). Does any

action plan provide for the involvement of system engineers to assist in proposing modifications for those systems with chronic problems?

9.8 Are maintenance reworks reviewed to determine root cause: personnel error during repair, wrong parts, inaccurate diagrams, etc.?

9.9. Are equipment history files reviewed to identify unreliable equipment? Are corrective actions taken to replace this equipment with more reliable equipment?

9.10 What percent of jobs had to be reworked because of personnel error, wrong parts, etc.?

10. Summary

ALARA TEAM INSPECTION

SUMMARY GUIDANCE

In the conduction of the inspection the big-picture results that we are trying to achieve should be kept in mind. To assist each inspector in focusing their efforts, think in terms of addressing the following questions in a summary section to each of the main inspection areas. It is acknowledged that many of these questions are unanswerable based on one or two inspections, but if the information is available and can be discussed with an eye towards coupling it with the results of future inspections, than we should try to do so.

1. Background

Has dose history improved, declined or stayed about the same?
Have any changes been obviously attributable to major programatic changes in the ALARA program?

Why were the high dose jobs so high? Was there any aspects of the jobs that stood out as a major contributor to the high dose, or was it the result of numerous factors?

How does this licensee compare to the industry?

2. ALARA Program/Organization

Is management clearly supportive of maintaining and improving their ALARA program?

Does the overall level of knowledge, attitude and understanding of ALARA by licensee personnel (staff and management) have a noticeable impact on the overall implementation of the program?

Are the defined ALARA program positions (e.g., Coordinator) truly useful positions, with adequate levels of authority, or are some more of a token job with an inadequate amount of input into task decisionmaking.

Does the ALARA suggestion program appear to work? If yes or no, is there an apparent feature that either make it work well or keep it from being effective?

3. Corporate Involvement

Is Corporate involvement in ALARA a help or a hindrance to the plant? Where can they improve and what are they doing that appears to be beneficial?

4. Training

Are personnel being adequately trained in ALARA? Are the right people being trained and is the training sufficient in scope and depth? Is it a good or poor training program? Are the instructors capable and well qualified? What are the program weaknesses, if any?

5. Management Goals

Are the goals established reasonable? Is there a sound basis for the goals that are established, or are they "politically" motivated? Does having goals help the program achieve lower doses?

6. ALARA/RWP Procedure Implementation

Are the procedures adequate in scope and depth to enable the ALARA program to function without being either burdensome or overlooked?

Do they adequately implement the ALARA program? What are the program strengths and what are the weaknesses that need to be improved?

Did staff appear to be adequately incorporating good ALARA practices into their work assignments, or did they appear to do only do the minimum necessary to get by?

7. Planning /Scheduling

Are the projected doses for jobs reasonable? Or do they tend to be habitually over or under the estimate doses? If so, can we ascertain why?

Is job planning adequate in lead time and depth to allow for adequate implementation of the ALARA program?

Do they adequately implement the ALARA program? What are the program strengths and what are the weaknesses that need to be improved?

8. ALARA Initiatives/Operational Practices

Is the licensee aggressive in trying to implement new operational methods and practices in the pursuit of maintaining doses ALARA?

Do they adequately implement their operational initiatives and practices to obtain the maximum benefit from them, or are they poorly and/or slowly carried out?

9. Assessment/Self Evaluations

Is the licensee learning from previous experiences and adequately incorporating lessons learned into future work?
Has the licensee been good at identifying weaknesses in their program, or do they appear to be making the same mistake?

What is the cause of significant overexposure at the plant?

Is there a common root cause for significant overexposures?

10. Summary

Does their ALARA program overall appear to be effective? Are there particular portions of the program that stand out as particularly good or particularly poor? What should the licensee continue to do, and where do they need to improve?