ILLINOIS POWER COMPANY
CLINTON POWER STATION

CPS No.	0AP1895.01N
Revision No.	1

TITLE: ALARA REVIEWS

Scope of Revision:

Rev. 1: Added clarification of cost/benefit study and examples of methodology. Changed titles in accordance with CPS changes. Added requirement for numbering of ALARA Reviews on Cover Sheet. Added section on resolving "OPEN" items. Added more references.
Changed Cover Sheet to be consistent with new ALARA Committee composition. Added an "Other" category to Reviews C001 and C002 for additional concerns not previously denoted.

FOR INFORMATION ONLY

SIGNATURES				
	Rev. 1			
Prepared by	R.E. Harris			
Interface Review				
Department Head/ Group Supervisor				
Assistant Power Plant Manager				
Compliance Supervisor				
FRG Approval				
Power Plant Manager Approval				
Date of Issue	4/10/81			

ILLINOIS POWER COMPANY
CLINTON POWER STATION

CPS No. OAP1295.01N
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TITLE: ALARA REVIEWS

Scope of Revision:

FOR INFORMATION ONLY

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Prepared by	Eugene			
Interface Review	D.J. Cain			
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1.0 PURPOSE

The purpose of this procedure is to describe the CPS ALARA Review process as it relates to ensuring that plant design, construction, modifications, and operational activities maintain occupational exposure "as low as reasonably achievable" (ALARA).

2.0 DISCUSSION/DEFINITIONS

2.1 Discussion

2.1.1 The relationship between radiation dose and biological effects is reasonably well known only for doses that are high compared to current annual dose limits and only when such doses are delivered at high dose rates. The radiation protection goal is to reduce exposure wherever and whenever reasonably achievable, thereby reducing the risk to personnel

2.1.2 Merely controlling the maximum dose to individuals is not sufficient; the collective dose to the group (in man-rem) also should be kept as low as reasonably achievable.

2.2 Definitions

Reasonably achievable - Reasonably achievable is judged by considering the state of the technology and the economics of improvements in relation to all of the benefits from these improvements.

In assessing the economic portion of potential modifications or programs the following guidelines should be used. When only the health benefits to the general public or plant radiation workers need be considered the 10CFR50 value of $1000 (1975 dollars) per man-rem, integrated over the period of exposure, should be used. When a potential dose reduction

affects plant radiation workers because of the added cost of replacement workers, a dollar value of $6000 (1975 dollars) per man-rem per year, averaged dose rate reduction, should be used. This figure represents an economic equivalent of a dose rate reduction (dose per year) and cannot be integrated over the period of exposure. However, an additional value of $1000 per man-rem, integrated over the period of exposure, should be added to this calculation to account for the health benefits to the radiation workers (see example).

It should be emphasized that a dollar value, as calculated above, is not sufficient justification alone in deciding on the merits of a given modification. Instead, careful consideration of all factors followed by prudent judgment related to this consideration will dictate the final decision.

1

EXAMPLE 1

A proposed modification results in a savings of 5 man-rem every other year for the life of the plant.

Average man-rem/yr reduction = 5/2 = 2.5 man-rem/yr

ALARA cost = replacement cost + health cost

Replacement cost = $6000 x 2.5 = $15,000

Health cost = $1000 x 2.5 x 40 = $100,000

ALARA cost = $115,000

EXAMPLE 2

For a one-time reduction of 2.5 man-rem (all in the same year) the ALARA cost would be:

$6000 x 2.5 + $1000 x 2.5 = $17,500

3.0 RESPONSIBILITY

1 The Power Plant Manager is responsible for implementation of this procedure. The Supervisor - RadChem is responsible for review of this procedure. The Supervisor-Radiation Protection is responsible for the implementation and conduct of ALARA Reviews.

4.0 PRECAUTIONS

None

5.0 PREREQUISITES

An ALARA Review shall be initiated for any of the following conditions:

1 a. If the dose is either estimated or known from past experience to be greater than ten man-rem total for the particular job.

1 b. If the dose is greater than ten man-rem per year for routine recurring jobs.

c. If operational plant activities have a potential to cause or have caused significant radiation exposures to personnel.

1 d. If new or modified plant facilities and/or equipment would cause a detrimental affect on existing radiation levels or which can affect radiation exposure to personnel.

6.0 LIMITATIONS AND ACTIONS

None

7.0 MATERIALS AND/OR TEST EQUIPMENT

None

8.0 PROCEDURE

1 8.1 The Supervisor - Radiation Protection shall determine the need for an ALARA Review per Section 5.0 of this procedure and assign an individual from the RadChem Department to complete the reveiw.

8.2 Conducting an ALARA Review

8.2.1 The assigned individual shall obtain either a copy of CPS No. 0AP1895.01C001, CPS ALARA REVIEW-DESIGN/CONSTRUCTION/MODIFICATION CHECKLIST for reviews to be conducted during
1 plant design, plant construction or plant/ equipment modification, or obtain a copy of CPS No. 0AP1895.01C002, CPS ALARA REVIEW-OPERATIONS CHECKLIST for reviews to be conducted for operational activities.

8.2.2 Complete the required information at the top of the checklist: Date, System/Component/ Subject, and System/Component Designator (if applicable).

8.2.3 Check off the item on the checklist if it is determined that the ALARA concept is being fulfilled. If an area of concern is encountered, assign it a sequential numeric designator, then note and fully explain the area of concern and if possible, recommend possible solutions
1 to the problem on CPS No. 0AP1005.01F002, CPS COMMENT CONTROL FORM (or equivalent document).

NOTE

A cost/benefit calculation may be performed to substantiate or refute the need for change. It should be performed in accordance with the guidance provided in Section 2.2

8.2.4 All reference material utilized in completing the ALARA Review shall be listed at the end of the appropriate checklist.

8.2.5 When the ALARA Review is completed, attach the CPS COMMENT CONTROL FORMS to the appropriate checklist and submit the review to the Supervisor - Radiation Protection.

8.3 Resolution of Noted Concerns

8.3.1 Upon receipt of a completed ALARA review, the Supervisor - Radiation Protection shall attach CPS No. 0AP1895.01F001, ALARA REVIEW COVER SHEET to the ALARA review and complete the following information:

1

a. Circle the appropriate review:

Design/Construction/Modification/ Operation

1 b. Assign a sequential number, year and number, and record appropriately.

c. System/Component/Subject

d. System/Component Designator (if applicable)

e. Review conducted by:

f. Date

1 8.3.2 The Supervisor - Radiation Protection shall review the document and resolve all concerns, if possible. Actions required to alleviate the radiological hazard may be accomplished via CPS No. 0AP1029.01F001, MAINTENANCE WORK REQUEST or CPS No. 0AP1016.01F001, CPS CONDITION REPORT.

8.3.3 At the required frequency or as requested by two or more ALARA Committee members, an ALARA Committee meeting shall be scheduled. Approximately one week prior to a normally scheduled ALARA Committee meeting, the Supervisor - Radiation Protection should submit to the committee members the meeting agenda, status of "open" items, and a copy of all ALARA Reviews generated since the last meeting. 1

8.3.4 Items which are identified as concerns shall be addressed at the committee meeting. Items which are considered "open" items shall be listed on the CPS ALARA REVIEW COVER SHEET. These should be addressed at subsequent meetings until considered "closed". 1

8.3.4.1 Concerns which are identified at an ALARA Committee meeting, but for which there is no formal ALARA Review, should be thoroughly documented in the minutes of the meeting and an ALARA Review conducted, if appropriate, following the meeting. 1

8.3.4.2 A concern shall be considered "open" if it is determined by the ALARA Committee to be "reasonably achievable". 1

8.3.4.3 A concern shall be considered "closed" if it is determined by the ALARA Committee not to be a valid concern or if the resolution to the concern is not "reasonably achievable".

8.3.5 At the completion of the ALARA Committee meeting at which a formal review was initially presented, attendees shall be listed on the CPS ALARA REVIEW COVER SHEET along with the date of the meeting.

8.3.6 When all ALARA Review concerns are "closed", the ALARA Chairperson shall sign and date CPS ALARA REVIEW COVER SHEET. 1

8.4 Resolving "Open" ALARA Items

8.4.1 Items which are approved for resolution by the ALARA Committee should be assigned to the RadChem Engineer or a designee to pursue for implementation as the coordinator.

8.4.2 The coordinator shall make all arrangements with appropriate personnel or groups, and draft necessary paperwork, etc. for implementation. 1

8.4.3 All correspondence shall be attached to the ALARA documentation to substantiate action.

8.4.4 Upon completion of the work the coordinator shall prepare a summation of the task accomplished for presentation to the ALARA Committee and shall conduct any testing or verification as appropriate to "Close" the item.

8.5 Record Retention

8.5.1 The RadChem Department shall maintain control of all ALARA Reviews which are not complete.

8.5.2 Completed ALARA Reviews shall be maintained in accordance with CPS No. 0AP1917.01N, RADCHEM RECORDS. 1

9.0 ACCEPTANCE CRITERIA

None

10.0 FINAL CONDITIONS

None

11.0 REFERENCES

1 11.1 Regulatory Guide 8.8, Rev. 3 (June, 1978) "Information Relevant to Ensuring That Occupational Exposure at Nuclear Power Station Will Be As "Low As Reasonably Achievable".

11.2 CPS Technical Specification, Section 6.0

11.3 CPS No. 0AP1005.01F002, CPS COMMENT CONTROL FORM

11.4 CPS No. 0AP1016.01F001, CPS CONDITION REPORT

1 11.5 CPS No. 0AP1029.01F001, MAINTENANCE WORK REQUEST

11.6 CPS No. 0AP1895.00N, ALARA PROGRAM

11.7 CPS No. 0AP1895.02N, ALARA COMMITTEE

11.8 CPS No. 0AP1917.01N, RADCHEM RECORDS

12.0 APPENDICES

None

13.0 DOCUMENTS

A. CPS No. 0AP1895.01C001, CPS ALARA REVIEW - DESIGN/ CONSTRUCTION/MODIFICATION CHECKLIST

B. CPS No. 0AP1895.01C002, CPS ALARA REVIEW - OPERATIONS CHECKLIST

C. CPS No. 0AP1895.01F001, CPS ALARA REVIEW COVER SHEET

Date: _____

CPS ALARA REVIEW

(DESIGN/CONSTRUCTION/MODIFICATION CHECKLIST)

System/Component/Subject _____

System/Component Designator _____

Check item off if it is determined that the ALARA concept is being fulfilled. If an area of concern is encountered, assign it a sequential numeric designator, then note and explain the concern fully on CPS COMMENT CONTROL FORM 0AP1005.01F002 and attach it to the review. If an area is not applicable, place NA in the box.

Access Control of Radiation Areas

- ☐ Positive control of ingress, shielding, source removal, etc.
- ☐ Standard Operating Procedures in the event of transfer of radioactive materials.
- ☐ Means for prompt accessibility for inspection and/or servicing of components.

Radiation Shields and Geometry

- ☐ Shielding between individual components that constitute substantial radiation exposure.
- ☐ Reduction in exposure by providing maximum distance between serviceable components and the substantial radiation source in the area and/or providing temporary shielding around components that contribute substantially to the dose rate.

- ☐ Use of labyrinths, (or other design features), ensuring ability of components to be readily removed for repair and/or replacement.
- ☐ Layout such that streaming prevented, use of shadow shields (shields of limited size to prevent streaming).
- ☐ Use of shielded chases for piping runs containing radioactive materials.
- ☐ Shielding, insulation, etc., designed for rapid removal and reinstallation.
- ☐ Laydown space allotted for maintenance in cubicles.
- ☐ Ability for prompt removal and reinstallation of components for repair replacement in area of high radiation levels.
- ☐ Radwaste system sumps, piping, etc., located in shielded areas or shielded pipe chases.

Process Instrumentation and Controls

- ☐ Use of reach rods or remotely-operated valves or controls, (consider maintenance on these items).
- ☐ Ensure readouts or control points located in low radiation areas.
- ☐ The use of instrumentation that is selected and located with consideration for long service life, ease and low frequency of maintenance and calibration, and of low crud accumulation.
- ☐ Use of instrumentation which contains minimal quantities of contaminated working fluids.

Control of Airborne Contaminants and Gaseous Radiation Sources

- ☐ Use of air pressure gradients and air flow from areas of low potential airborne contaminants to areas of higher potential contamination.
- ☐ Ventilation and gaseous treatment systems designed for ease of maintenance and located to prevent exposure from adjacent equipment, etc.
- ☐ Use of portable ventilation systems/portable equipment utilizing existing ventilation equipment for control of localized airborne contamination (e.g., machining, sampling, tanks, etc.).
- ☐ Utilization of wet transfer or storage for contaminated components.

Crud Control

- ☐ Use of low nickel and low cobalt bearing materials (limits production of Co-58 and Co-60).
- ☐ On load bearing surface, the use of lubricants and favorable geometries and the use of controlled leakage on journal sleeves to prevent entry of particles into the reactor coolant.
- ☐ The use of chemistry controls in the reactor systems.
- ☐ Use of decontamination, flushing, filtration on reactor systems. Providing for laminar flow and smooth surfaces for primary systems and by minimizing crud traps in the system to the extent practicable.

Isolation and Decontamination

☐ Decrease deposition of radioactive materials in piping by: avoiding stagnant legs, connections located above pipe centerlines, using sloping rather than horizontal runs for pipe and drains provided at low points in system.

☐ Use of measures that reduce probability of release, reduce amount of release, and reduce spread of contaminant from the source (e.g., HVAC, curbing, sloping floors to local drain, sumps, etc.).

☐ Use of recirculation/flushing lines to allow from chemical or physical removal of radioactive material.

☐ Use of redundant systems to allow for maintenance or shutdown for repairs (e.g., processing or ventilation systems).

☐ Design systems which carry radioactive materials for the lifetime of the plant. Prevents contamination of clean systems/surfaces if the system fails.

☐ Appropriate finishing work on surfaces where contamination can be expected (i.e., use of surfaces which have smooth, non-porous surfaces and are free of cracks and sharp corners).

☐ Features which will provide for alternate decontamination methods if anticipated failure of a critical component would prevent decontamination of important systems by normal means.

☐ The use of treatment systems to allow for removal of contaminants from tanks (e.g., spent fuel, radwaste tanks, etc.). The use of agitators to reduce the settling of crud on surfaces in the tanks.

Radiation Monitoring Systems

☐ Readout capability at the main radiation protection control area.

☐ Placement of detectors for optimum coverage of areas.

☐ Circuitry which indicates component failure.

☐ Local alarm and readout.

☐ Clear and unambiguous readout.

☐ Ranges adequate to ensure readout of the highest and lowest anticipated readings.

☐ Capability to record the readout of all systems.

Resin and Sludge Treatment System

☐ Accumulation of radioactive materials in components can be reduced by use of:

- short runs of piping
- large diameter pipe
- reduced number of pipe fitting
- avoiding dead legs and low points in system
- use of gravitational flow to extent practicable
- minimize flow restrictions of processed material

☐ Need for maintenance and the presence of intense local radiation sources can be reduced by:

- use of full ported valves
- avoiding cavities in valves

- ☐ Smooth interior pipe surfaces achieved by butt welds and the use of consumable pipe inserts.
- ☐ When use of tees required, normal flow through the straight run of the tee and the branch of tee located above run.
- ☐ Ability to backflush lines which are subject to plugging. Use of sparging systems to fluidize slurries or sludges in storage tanks.
- ☐ Prevent loss of solids from tanks into overflows by use of screens, filters, etc.

Miscellaneous Features

- ☐ The selection of radiation damage resistant materials for use in radiation areas.
- ☐ The use of stainless steel for use as lining in piping or for construction of components, where it is compatible, to limit corrosion.
- ☐ Standardization of filters and the remote servicing of components which constitute substantial radiation sources.
- ☐ Providing accessibility for the servicing of valves and components.
- ☐ The use of "best available" valves and orienting them correctly in systems to prevent radioactive material accummulation.
- ☐ The use of canned pumps where compatible. The use of seal flushing when mechanical seals are utilized for

slurry service and the use of drains on pump housing can decrease radiation field accummulated during service.

- ☐ The use of sloping tank bottoms and the use of sprays or spargers to allow for sedimentation removal when required for maintenance.
- ☐ Spare connections on tanks located in higher radiation areas to allow for flexibility in operation.
- ☐ For inspections, the use of quick removal insulation/ shielding, special tools/instruments for remote operation/ inspection on components containing potential radiation sources.
- ☐ The use of live loaded packing or bellows seals on valving in radiation systems.
- ☐ Expeditious removal of components from a system located in a higher readiation area.
- ☐ Adequate working environment (i.e., lighting, ventilation, working space, etc.).
- ☐ Use of extended service lighting components.
- ☐ Adequate emergency lighting systems.
- ☐ Other _____

(note each concern separately and attach additional pages as necessary.)

References :

Date: _____

CPS ALARA REVIEW
OPERATIONS CHECKLIST

System/Component/Subject _____

System/Component Designator _____

Check item off if it is determined that the ALARA concept is being fulfilled. If an area of concern is encountered, assign it a sequential numeric designator, then note and explain the concern fully on CPS COMMENT CONTROL FORM, CPS No. 0AP1005.01F002, and attach it to the review. If an area is not applicable, place NA in the box.

Access Control

- ☐ Positive control of ingress and egress to area.
- ☐ Individual assigned to contribute to and coordinate ALARA efforts.
- ☐ Performance of a "preoperational" brief for personnel who will perform services in high radiation areas.
- ☐ Utilization of "dry runs" on mock up equipment to train personnel, identify problems, and selecting and qualifying special tools and procedures.
- ☐ Maintenance and/or inspections scheduled such that sources of radiation are allowed to decay off.
- ☐ Completion of the Radiation Work Permit.

Surveys and Inspections

- ☐ Ensure completion of radiation, contamination, airborne contamination surveys.
- ☐ Ensure that nature of the radiation fields are determined during inspection (e.g., hot spots, piping runs, tanks, etc.).
- ☐ Ensure that mechanical difficulties which may be encountered are noted.

Insulation and Shielding

- ☐ Use of recirculation/flushing lines to allow for chemical or physical removal of radioactive material to reduce radiation levels.
- ☐ Use ability to drain/flush tanks containing radioactive liquids to reduce radiation levels.
- ☐ Reduction in exposure by providing temporary shielding around components that contribute substantially to the dose rate.
- ☐ Reduction in exposure by removal and transport of component to an area of lower radiation levels.

Control of Containments

- ☐ Use of portable ventilation systems/portable equipment for control of localized airborne containments.
- ☐ Ensure air pressure gradients and air flow from areas of low potential contamination to areas of high potential contamination are maintained

☐ Use of continuous air monitoring systems in areas where there is a high potential for airborne contamination (e.g., machining, grinding, etc.)

Miscellaneous

☐ Adequate auxiliary lighting and a comfortable environment (e.g., ventilation, heating, etc.)

☐ Contingency planning to cope with potential accidents expeditiously.

☐ Other _____

(Note each concern separately and attach additional pages as necessary)

References:

CPS No. 0AP1895.01F001
(Rev. 1)

CPS
ALARA REVIEW COVER SHEET

ALARA Review - Design/Construction/Modification/Operation No. _____

System/Component/Subject _____

System/Component Designator _____

Review conducted by _____ Date _____

ALARA Committee Attendees Date of Meeting _____

_____
Power Plant Manager/Designee

_____
Assistant Power Plant Manager/Designee

_____
Supervisor - RadChem/Designee

_____
Supervisor - Radiation Protection/Designee

_____
Member-at-Large

_____
NSE Representative

Open concerns:

All concerns closed:

_____ _____
Chairperson ALARA Committee Date