Washington Public Power Supply System
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

Docket No. 50-397

July 28, 1981
G02-81-197
NS-L-02-CDT-81-015

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U.S. NUCLEAR REGULATORY COMMISSION

Director, Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Gentlemen:

Subject: SUPPLY SYSTEM NUCLEAR PROJECT NO. 2
RESPONSES TO ROUND TWO QUESTIONS
RADIOLOGICAL ASSESSMENT BRANCH

Reference: Letter, R. L. Tedesco (NRC) to R. L. Ferguson, "Request for Additional Information Regarding Radiation Protection in the WNP-2 Facility", April 10, 1981.

Enclosed are sixty (60) copies of the responses to the Radiological Assessment Branch questions transmitted to us by the reference letter. These responses, and the applicable FSAR page changes, will be incorporated formally into the FSAR in an amendment within four months.

Very truly yours,

GD Bouchey

G. D. BOUCHEY
Director, Nuclear Safety

GDB:CDT:ct

Enclosure

cc: WS Chin, BPA
V. Stello, NRC
AD Toth, NRC, Resident Inspector
J. Plunkett, NUS Corporation
WNP-2 Files
R. Auluck, NRC
OK Earle, B&R

MXY

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dupe of 8108030369

Q. 331.025
(12.0)

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- Procedures for recommending design changes that incorporate both achievability and cost benefit analysis;
- Procedures for establishing a Health Physics - plant operations - upper management dialogue to implement, monitor, and document the As Low As Reasonably Achievable (ALARA) program;
- General Radiation Orientation Training and Nuclear Facility Training for all Supply System personnel;
- Initial and continuing training programs for "The Radiation Worker" with specific emphasis on job-related radiation protection practices;
- Procedure and policy commitments to provide the Radiation Safety Officer (RSO) with sufficient authority to prevent unsafe practices;
- Policy commitment(s) to provide for both corporate and plant Health Physics lines of authority. Significant in this chain is the Health Physics/Chemistry Manager's role as the Radiation Safety Officer (RSO);
- Procedures for establishing a dialogue where employees can suggest improvements and/or changes specifically relating to improving radiation protection practices and participating in the ALARA program.

CHAPTER 12

RADIATION PROTECTION

12.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)

12.1.1 POLICY CONSIDERATIONS

The Washington Public Power Supply System (WPPSS) Organization is committed to maintaining occupational radiation exposures at the lowest practicable level while performing all activities related to operation of their nuclear power plants. This commitment is reflected by providing for effective control of radiation exposure in the following major areas:

a. Management direction and support

b. Consideration during design of facilities and equipment

c. Development of good radiation practices, including preplanning and the proper use of appropriate equipment by qualified, well trained personnel.

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Response:

When practicable and feasible the guidance in Regulatory Guides 8.7 and 8.12 has been followed.

Major items in Regulatory Guide 8.7 include a sophisticated computerized radiation exposure record system incorporating data retrieval at convenient plant and corporate locations. Physical and computerized record system(s) provide for items as:

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a. Employing two detectors in the "New Fuel Vault";

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c. Surveillance testing of "Criticality Alarm Systems", including procedures that address methods and frequency of testing.

e. Leak tests - sources are checked for leakage or loss of material at least semi-annually.

f. Disposal - all licensed material disposals are in accordance with 10 CFR Part 20 requirements, or by transfer to an authorized recipient as provided in 10 CFR Parts 30, 40 or 70.

12.3.1.4.2 Facilities and Equipment

Facilities are provided for handling unsealed sources, such as the liquid standard solutions used for calibration of plant instrumentation. The radiochemical laboratory is equipped with a negative pressure fume hood with filtered exhaust. The hood work surface is designed to withstand heavy weights, so that shielding can be provided in the form of lead brick. Drains from the fume hood are routed to the liquid radwaste system.

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Portable radiation and contamination monitoring instrumentation is provided, as described in 12.5.2, for surveillance to maintain control of the sources.

12.3.1.4.3 Personnel and Procedures

The WNP-2 Health Physics/Chemistry Supervisor, Health Physics Supervisor, and the Plant Chemistry Supervisor are responsible for control and monitoring of sealed and unsealed source and byproduct materials. The WNP-2 Nuclear Engineer is accountable for special nuclear materials (SNM). Monitoring during handling of these materials is provided by the health physics group. Experience and qualifications of health physics personnel are described in Chapter 13.

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12.3.4.2 Description and Location

a. Area Radiation Monitors

Area radiation monitors consist of local detector alarm units and main control room mounted indicator trip units, alarms and recorders. ~~Area monitor detectors are located in fuel storage and handling areas in accordance with 10 CFR 70.24 (a)(1).~~ Other detector locations have been selected in accordance with good operating prac tice and from past operating experience with similar plants. Detector locations are shown in Figures 12.3-1 to 12.3-6. Annunciations are given in the main control room and locally at the sensors when radiation levels exceed a predetermined level. Point indication and recording are provided for in the main control room. Local detectors are wall-mounted approximately seven feet off the floor. The detectors have sufficient cable length to be taken from their normal positions to floor level for insertion into calibrating chambers to verify instrument accuracy. The area radiation monitoring system is designed to compliment portable monitors normally carried by personnel working in areas which are not freely accessible.

Insert attached

Insert to Page 12.3-11:

The generic Emergency Plan and the plant Emergency Plan Implementing Procedures provide instructions for:

a. designated evacuation routes;

b. assembly area(s)

c. procedures;

d. drills;

in accordance with ANS 8.3-1979.

Insert to Page 12.3-20:

Criticality monitors are located at the reactor building fuel pool area and new fuel storage area as recommended by Regulatory Guide 8.12.

Q. 331.027
(12.1.2)

Describe in Section 12.1.2.1 of the FSAR, those circumstances which would necessitate personnel entry into pump corridor C-125 while the systems in this corridor are operating.

Response:

Personnel will enter pump corridor C-125 while the adjacent systems are in operation to perform non-routine electrical or mechanical maintenance. With any non-routine event, radiological conditions will be evaluated to assess the radiological requirements for entry under operational conditions. All non-routine entries will be governed by a special radiation work permit. Routine entries will also be controlled by a Radiation Work Permit (RWP).

A change describing those circumstances which would necessitate personnel entry into pump corridor C-125 while the adjacent systems are operating has been made to 12.1.2.1 of the FSAR.*

*Draft FSAR page change attached.

b. Equipment Location:

1. Several radiation sources on the 437'-0" level of the Radwaste Building are located with two sources in each cubicle. This arrangement maintains occupational exposures "as low as reasonably achievable" (ALARA) by use of the following alternate ALARA methods:

   The waste collector tank and floor drain collector tank are in the same cubicle. These tanks share redundant pumps and cross tie piping. If abnormal conditions occur and one or both of these tanks becomes a major source of radiation, either one of the pumps can be used to empty the tanks prior to any maintenance.

   The chemical waste tank and distillate tank share the same cubicle. These tanks are not expected to be major sources of radiation. Based on the source terms described in Table 11.2-8, the dose rate at three feet from the surface of these tanks normally does not exceed 0.1 mrem/hr. In addition, redundant pumps and cross tie piping permit the transfer of tank contents should abnormally high radioactivity levels occur.

   Gas coolers and charcoal absorbers share the same cubicle. These items have no moving parts, and are highly reliable with no routine maintenance requirements. In addition, system redundancy and remote isolation capabilities eliminate the need for prompt entry into the cubicle. This permits the noble gases and radioiodines to significantly decay prior to entry.

   Placing the above sources in shared cubicles does not result in increased occupational exposures.

   Area radiation monitors 28 & 29 are located in corridor C-135 to detect abnormal radiological conditions. During reactor and radwaste operations and under the direction of a Radiation Work Permit entry to this area is expected only for non-routine observation and maintenance.

Q. 331.028
(12.3)

Using appropriate layout drawings as references, indicate the path to be travelled by a waste container when it is removed from the empty drum cask storage area and loaded onto the waste loading trailer. Provide justification for not providing any area monitors at elevation 437 feet in this area of the radwaste building where the waste containers are filled and stored (i.e., the area between grids N-1 and S, and 13.2 and 17).

Response:

The path is as follows:

a. Empty 50 $ft.^3$ containers, commonly referred to as "liners" are unloaded in the truck bay, coordinates (Q.5)(15.4).

b. The empty liners are put into the filling process at coordinates (N.9)(15.4) using the overhead crane to place them on a "dolly". The "dolly" rides, in an east-west direction, on a two-rail track.

c. The dolly is moved east to the "container filling station" at coordinates (N.3)(14.3).

d. The liner is filled and moved west to the "capping station", coordinates (N.3)(14.3).

e. The full, capped liner is moved west to the "wash down smear and testing area", coordinates (N.3)(14.9).

f. The processed and surveyed liner is moved west to a staging area prior to interim storage in the "storage area", coordinates (staging area (N.3)(16.5)) (storage area (15.9 to 17.0)(N.1 to 5).

g. The liner is transferred to a predetermined storage location using the storage area overhead crane.

Portable local alarming area radiation monitors will be employed at strategic loactions and times during processing and truck loading operations. The monitors can be easily moved to provide for both personnel protection and intensity data.

Draft FSAR page change attached.

l. Large pipe bend radii and piping elbows are used.

m. Butt welding by the open root method is used as described in 12.3.1.3.2.

n. Seal glands of pumps carrying concentrated radwaste or spent filter and demineralizer resins are flushed with condensate water during operation. After operation, the pumps are also flushed with condensate. Canned pumps are not used.

o. Where practicable, equipment used in the same process are located close together, resulting in short runs of interconnecting piping.

p. Pipes carrying slurries and resins are sized for turbulent flow to prevent any settling out of solids.

q. All equipment cubicles housing filters are equipped with removable ceiling plugs through which filter elements may be serviced or changed with the aid of tools to allow remote handling.

r. The drum filling and filled drum storage areas are shielded for personnel protection. The filling, process monitoring and storage operations are done remotely. Portable local alarming Area Radiation Monitors are placed, as required, in the 437' level for personnel protection and process monitoring.

s. Operating experience from other BWR plants is periodically reviewed. Problems are reviewed and the WNP-2 plant design is checked to ensure that similar problems will not occur.

t. All design changes that occur are reviewed by a radiation specialist to ensure that any resulting change to radiation levels are ALARA.

12.1.3 OPERATIONAL CONSIDERATIONS

12.1.3.1 Procedures and Methods of Operation

At WNP-2, a positive means of assuring that occupational radiation exposures are as low as is reasonably achievable has been incorporated into the Plant Procedures Manual (PPM) Preparation Program. Procedures are formally reviewed for ALARA considerations as part of the approval process. The subject review is made by the WNP-2 Health Physics/Chemistry section. The guidance provided by Regulatory Guide 8.8 is considered during this review.

Q. 331.029
(RSP)
(12.3)

We require that you shield all accessible portions of the spent fuel transfer tube during fuel transfer. In this regard, we would find removable shielding to be acceptable. This shielding should be such that the resultant contact radiation levels shall be no greater than 100 rads per hour. Moreover, all accessible portions of the spent fuel transfer tube shall be clearly marked with a sign stating that potentially lethal radiation fields are possible during fuel transfer. If removable shielding is used for the fuel transfer tubes, it must also be explicitly marked as described above. If other than permanent shielding is used, local radiation monitors which provide audible and visible alarms must be installed to alert personnel if the temporary fuel transfer tube shielding is removed during fuel transfer operations. Provide a description of your modified design to comply with these positions.

Response:

Personnel evacuation of the affected drywell area(s) and/or employing removable shielding at the "Fuel Pool Passage" are two methods used for personnel protection in the drywell during fuel handling operations. The shielding is designed such that radiation levels are no greater than 100 R/hr. at contact. Portable locally alarming radiation monitors and/or direct Health Physics monitoring is employed for addition personnel protection.

Draft FSAR page change attached.

The majority of the shielding calculations performed are of the "bulk shielding" type. Ordinary concrete, having a density of about 150 lbs/ft^3, is used for shielding except for special applications. In special applications, water, steel, high density concrete, lead and permali JN P/3% boron are used.

The effects of mechanical or electrical penetrations in shield walls on radiation exposure to personnel is minimized by locating penetrations to preclude direct view of radiation sources through the penetration. The effect of penetrations in shield walls is also minimized by keeping penetration openigs to the smallest practicable size. Penetrations are locatd away from immediate areas with personnel access. When these criteria cannot be implemented, penetrations are off-set.

Access into shielded areas is, in general, by labyrinths. Labyrinths are located to preclude direct personnel radiation exposure. Where labyrinths are not practicable, shield doors are used. Knock-out walls for equipment removal are constructed of brick arranged in staggered rows to preclude direct streaming.

Insert → attached

12.3.2.2 Methods of Shielding Calculations

Standard methods are used in computing the required shielding thickness for a given source. These methods are described in References 12.3-1 through 12.3-4. Specific methods of calculation and the computer codes used in the shielding design are discussed below.

The NRN computer code (Reference 12.3-5) is used to determine the shielding requirements for the core generated neutrons and to calculate the thermal neutron flux used to determine captured gamma sources outside the core. This code is based on a multi-group slowing down and diffusion system corrected by a multi-group first flight or removal neutron source. The neutron cross sections used with this code are from Oak Ridge National Laboratories with modifications which have resulted from comparisons with data in BNL-325 (Reference 12.3-6) and the ENDF/B data libraries.

The QAD-BR computer code, which is based on the QAD-P5 code (Reference 12.3-8) is the basic code used to determine shielding requirements for gamma ray sources. This code provides gamma flux, dose rate, energy deposition and other quantities which result from a point by point representation of a volume distributed source of radiation. Attenuation coefficients for water, iron and lead, used in this program are

Insert to Page 12.3-13:

Portable and removable shielding devices are used when practical and feasible. Portable shielding devices are easily moved from one location to another. Removable shielding devices are normally used at specific locations and can be removed when necessary. The reactor vessel to fuel pool transfer passage is a location where removable shielding is employed primarily for the protection of personnel working in the drywell.

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12.3.4.2 Description and Location

a. Area Radiation Monitors

Insert attached

Area radiation monitors consist of local detector alarm units and main control room mounted indicator trip units, alarms and recorders. ~~Area monitor detectors are located in fuel storage and handling areas in accordance with 10 CFR 70.24 (a)(1).~~ Other detector locations have been selected in accordance with good operating prac tice and from past operating experience with similar plants. Detector locations are shown in Figures 12.3-1 to 12.3-6. Annunciations are given in the main control room and locally at the sensors when radiation levels exceed a predetermined level. Point indication and recording are provided for in the main control room. Local detectors are wall-mounted approximately seven feet off the floor. The detectors have sufficient cable length to be taken from their normal positions to floor level for insertion into calibrating chambers to verify instrument accuracy. The area radiation monitoring system is designed to compliment portable monitors normally carried by personnel working in areas which are not freely accessible.

Insert to Page 12.3-11:

The generic Emergency Plan and the plant Emergency Plan Implementing Procedures provide instructions for:

a. designated evacuation routes;

b. assembly area(s)

c. procedures;

d. drills;

in accordance with ANS 8.3-1979.

Insert to Page 12.3-20:

Criticality monitors are located at the reactor building fuel pool area and new fuel storage area as recommended by Regulatory Guide 8.12.

Q. 331.027
(12.1.2)

Describe in Section 12.1.2.1 of the FSAR, those circumstances which would necessitate personnel entry into pump corridor C-125 while the systems in this corridor are operating.

Response:

Personnel will enter pump corridor C-125 while the adjacent systems are in operation to perform non-routine electrical or mechanical maintenance. With any non-routine event, radiological conditions will be evaluated to assess the radiological requirements for entry under operational conditions. All non-routine entries will be governed by a special radiation work permit. Routine entries will also be controlled by a Radiation Work Permit (RWP).

A change describing those circumstances which would necessitate personnel entry into pump corridor C-125 while the adjacent systems are operating has been made to 12.1.2.1 of the FSAR.*

*Draft FSAR page change attached.

b. Equipment Location:

1. Several radiation sources on the 437'-0" level of the Radwaste Building are located with two sources in each cubicle. This arrangement maintains occupational exposures "as low as reasonably achievable" (ALARA) by use of the following alternate ALARA methods:

   The waste collector tank and floor drain collector tank are in the same cubicle. These tanks share redundant pumps and cross tie piping. If abnormal conditions occur and one or both of these tanks becomes a major source of radiation, either one of the pumps can be used to empty the tanks prior to any maintenance.

   The chemical waste tank and distillate tank share the same cubicle. These tanks are not expected to be major sources of radiation. Based on the source terms described in Table 11.2-8, the dose rate at three feet from the surface of these tanks normally does not exceed 0.1 mrem/hr. In addition, redundant pumps and cross tie piping permit the transfer of tank contents should abnormally high radioactivity levels occur.

   Gas coolers and charcoal absorbers share the same cubicle. These items have no moving parts, and are highly reliable with no routine maintenance requirements. In addition, system redundancy and remote isolation capabilities eliminate the need for prompt entry into the cubicle. This permits the noble gases and radioiodines to significantly decay prior to entry.

   Placing the above sources in shared cubicles does not result in increased occupational exposures.

   Area radiation monitors 28 & 29 are located in corridor C-125 to detect abnormal radiological conditions. During reactor and radwaste operations and under the direction of a Radiation Work Permit entry to this area is expected only for non-routine observation and maintenance.

Q. 331.028
(12.3)

Using appropriate layout drawings as references, indicate the path to be travelled by a waste container when it is removed from the empty drum cask storage area and loaded onto the waste loading trailer. Provide justification for not providing any area monitors at elevation 437 feet in this area of the radwaste building where the waste containers are filled and stored (i.e., the area between grids N-1 and S, and 13.2 and 17).

Response:

The path is as follows:

a. Empty 50 $ft.^3$ containers, commonly referred to as "liners" are unloaded in the truck bay, coordinates (Q.5)(15.4).

b. The empty liners are put into the filling process at coordinates (N.9)(15.4) using the overhead crane to place them on a "dolly". The "dolly" rides, in an east-west direction, on a two-rail track.

c. The dolly is moved east to the "container filling station" at coordinates (N.3)(14.3).

d. The liner is filled and moved west to the "capping station", coordinates (N.3)(14.3).

e. The full, capped liner is moved west to the "wash down smear and testing area", coordinates (N.3)(14.9).

f. The processed and surveyed liner is moved west to a staging area prior to interim storage in the "storage area", coordinates (staging area (N.3)(16.5)) (storage area (15.9 to 17.0)(N.1 to 5).

g. The liner is transferred to a predetermined storage location using the storage area overhead crane.

Portable local alarming area radiation monitors will be employed at strategic loactions and times during processing and truck loading operations. The monitors can be easily moved to provide for both personnel protection and intensity data.

Draft FSAR page change attached.

l. Large pipe bend radii and piping elbows are used.

m. Butt welding by the open root method is used as described in 12.3.1.3.2.

n. Seal glands of pumps carrying concentrated radwaste or spent filter and demineralizer resins are flushed with condensate water during operation. After operation, the pumps are also flushed with condensate. Canned pumps are not used.

o. Where practicable, equipment used in the same process are located close together, resulting in short runs of interconnecting piping.

p. Pipes carrying slurries and resins are sized for turbulent flow to prevent any settling out of solids.

q. All equipment cubicles housing filters are equipped with removable ceiling plugs through which filter elements may be serviced or changed with the aid of tools to allow remote handling.

r. The drum filling and filled drum storage areas are shielded for personnel protection. The filling, process monitoring and storage operations are done remotely. Portable local alarming Area Radiation Monitors are placed, as required, in the 437' level for personnel protection and process monitoring.

s. Operating experience from other BWR plants is periodically reviewed. Problems are reviewed and the WNP-2 plant design is checked to ensure that similar problems will not occur.

t. All design changes that occur are reviewed by a radiation specialist to ensure that any resulting change to radiation levels are ALARA.

12.1.3 OPERATIONAL CONSIDERATIONS

12.1.3.1 Procedures and Methods of Operation

At WNP-2, a positive means of assuring that occupational radiation exposures are as low as is reasonably achievable has been incorporated into the Plant Procedures Manual (PPM) Preparation Program. Procedures are formally reviewed for ALARA considerations as part of the approval process. The subject review is made by the WNP-2 Health Physics/Chemistry section. The guidance provided by Regulatory Guide 8.8 is considered during this review.

Q. 331.029
(RSP)
(12.3)

We require that you shield all accessible portions of the spent fuel transfer tube during fuel transfer. In this regard, we would find removable shielding to be acceptable. This shielding should be such that the resultant contact radiation levels shall be no greater than 100 rads per hour. Moreover, all accessible portions of the spent fuel transfer tube shall be clearly marked with a sign stating that potentially lethal radiation fields are possible during fuel transfer. If removable shielding is used for the fuel transfer tubes, it must also be explicitly marked as described above. If other than permanent shielding is used, local radiation monitors which provide audible and visible alarms must be installed to alert personnel if the temporary fuel transfer tube shielding is removed during fuel transfer operations. Provide a description of your modified design to comply with these positions.

Response:

Personnel evacuation of the affected drywell area(s) and/or employing removable shielding at the "Fuel Pool Passage" are two methods used for personnel protection in the drywell during fuel handling operations. The shielding is designed such that radiation levels are no greater than 100 R/hr. at contact. Portable locally alarming radiation monitors and/or direct Health Physics monitoring is employed for addition personnel protection.

Draft FSAR page change attached.

The majority of the shielding calculations performed are of the "bulk shielding" type. Ordinary concrete, having a density of about 150 lbs/ft^3, is used for shielding except for special applications. In special applications, water, steel, high density concrete, lead and permali JN P/3% boron are used.

The effects of mechanical or electrical penetrations in shield walls on radiation exposure to personnel is minimized by locating penetrations to preclude direct view of radiation sources through the penetration. The effect of penetrations in shield walls is also minimized by keeping penetration openigs to the smallest practicable size. Penetrations are locatd away from immediate areas with personnel access. When these criteria cannot be implemented, penetrations are off-set.

Access into shielded areas is, in general, by labyrinths. Labyrinths are located to preclude direct personnel radiation exposure. Where labyrinths are not practicable, shield doors are used. Knock-out walls for equipment removal are constructed of brick arranged in staggered rows to preclude direct streaming.

Insert → attached

12.3.2.2 Methods of Shielding Calculations

Standard methods are used in computing the required shielding thickness for a given source. These methods are described in References 12.3-1 through 12.3-4. Specific methods of calculation and the computer codes used in the shielding design are discussed below.

The NRN computer code (Reference 12.3-5) is used to determine the shielding requirements for the core generated neutrons and to calculate the thermal neutron flux used to determine captured gamma sources outside the core. This code is based on a multi-group slowing down and diffusion system corrected by a multi-group first flight or removal neutron source. The neutron cross sections used with this code are from Oak Ridge National Laboratories with modifications which have resulted from comparisons with data in BNL-325 (Reference 12.3-6) and the ENDF/B data libraries.

The QAD-BR computer code, which is based on the QAD-P5 code (Reference 12.3-8) is the basic code used to determine shielding requirements for gamma ray sources. This code provides gamma flux, dose rate, energy deposition and other quantities which result from a point by point representation of a volume distributed source of radiation. Attenuation coefficients for water, iron and lead, used in this program are

Insert to Page 12.3-13:

Portable and removable shielding devices are used when practical and feasible. Portable shielding devices are easily moved from one location to another. Removable shielding devices are normally used at specific locations and can be removed when necessary. The reactor vessel to fuel pool transfer passage is a location where removable shielding is employed primarily for the protection of personnel working in the drywell.