PMNorthAnna3COLPEmails Resource

From: Kevern, Thomas
Sent: Tuesday, June 09, 2009 9:57 AM
To: Regina.Borsh@dom.com
Cc: NorthAnna3COL Resource; Dominion.Naps3ColaRAI@DOM.COM; Hinson, Charles; Berrios, Ilka
Subject: FW: Construction Worker ALARA program
Attachments: CCNPP construction worker dose response.pdf

Gina:

The staff recently issued North Anna 3 RAI 12.03-12.04-12. To clarify the staff's expectations for your response to this RAI, we are forwarding an acceptable response from another COL applicant for an analogous RAI.

Please contact me if you have questions.

Tom

From: Hinson, Charles
Sent: Monday, June 08, 2009 5:42 PM
To: Kevern, Thomas
Cc: Bernal, Sara; Frye, Timothy
Subject: FW: Construction Worker ALARA program

Tom
Attached is the response that Calvert Cliffs provided to Sara Bernal's response to the construction worker dose question. This is the kind of response that I would expect to see from North Anna, especially the section added to the FSAR entitled Radiation Protection and ALARA Program. Can we ask Dominion to model their response similar to Calvert Cliff's response? Thanks
Charlie

From: Bernal, Sara
Sent: Monday, June 08, 2009 3:04 PM
To: Hinson, Charles
Subject: Construction Worker ALARA program

Hi Charlie,

Attached is CCNPP's response to my RAI on maintaining doses ALARA.

Sara M. Bernal
~~~~~~~~~~~~~~
Health Physicist
NRO/DCIP/CHPB
T7-A1B, MS: T6-D23
(301) 415-1027
~~~~~~~~~~~~~~

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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

April 16, 2009

UN#09-192

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the
Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 60, Question 12.03-12.04-2, Radiation Protection Design Features

References: 1) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No. 60 CHPB 1870.doc (PUBLIC)" email dated February 17, 2009

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated February 17, 2009 (Reference 1). This RAI addresses the Radiation Protection Design Features, as discussed in Section 12.3.5 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 4.

The enclosure provides our response to RAI No. 60, Question 12.03-12.04-2. COLA impacts associated with this RAI response are noted with the question response. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA. Our response to Question 12.03-12.04-2 does not include any new regulatory commitments.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 495-2436.

D096
NRO

I declare under penalty of perjury that the foregoing is true and correct.

Executed on April 16, 2009

Greg Gibson

Enclosure: Response to NRC Request for Additional Information, RAI No. 60, Question 12.03-12.04-2, Radiation Protection Design Features, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: John Rycyna, NRC Project Manager, U.S. EPR COL Application
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

Enclosure

Response to NRC Request for Additional Information
RAI No. 60, Question 12.03-12.04-2, Radiation Protection Design Features,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 60

Question 12.03-12.04-2

1. In the applicant's FSAR, Revision 3, Section 12.3.5.1, "Overall Plant Doses," under the heading "Cumulative Dose Rates" the following statement is made:

"The maximum dose rates for all other Construction Zones are less than 25 mrem/yr (0.25 mSv/year). This value is less than the limits specified above for members of the public."

This statement is incorrect because there are no "limits for members of the general public" that are discussed in Section 12.3 of the FSAR. Therefore it is not clear what limits are being referred to in the above sentence. In addition, 25 mrem is a 40 CFR 190 dose limit for the offsite general public, and therefore does not apply to construction workers who will be located onsite. Please correct this statement.

In addition, from the above reference, it appears that the applicant has classified the Unit 3 construction workers as members of the public subject to 10 CFR Part 20, Subpart D, "Radiation Dose Limits for Individual Members of the Public," rather than as radiation workers subject to 10 CFR Part 20, Subpart C, "Occupational Dose Limits." Confirm that construction workers will be treated as members of the public, and discuss how the applicant will ensure that this continues to be appropriate throughout construction, as well as the actions that will be taken should it become necessary to train and monitor construction workers as radiation workers in accordance with the requirements of 10 CFR Parts 19, 20, and 50.120.

2. It is not clear from the description provided in Section 12.3.5.1 of the FSAR what methodology was used to calculate the collective dose for construction workers. Provide a more detailed summary of how the numbers presented in Table 12.3-13 – Projected Collective Dose for Construction Worker by Zone, were calculated.

3. The equations presented in FSAR, revision 3, Section 12.3.5.1 have changed from Revision 2. It appears that all the exponents have been reformatted so that instead they look like numbers that are being multiplied, subtracted or added to the equation. Please reformat the equations under FSAR subsections "Gaseous Dose Rates" and "ISFSI Dose Rates," such that the exponents are clear.

4. FSAR, Revision 3, Section 12.3.5.1, states that there are significant temporal variations in the thermoluminescent dosimeter readings surrounding the ISFSI and the Interim Resin Storage Area. These variations are due to ISFSI loading operations, as well as significant variations in the sources and source strengths located in the Interim Storage Area.

Given the variations in dose rate associated with the Resin Storage Area and the ISFSI, as well as the uncertainty in construction start and end dates and therefore ISFSI average dose rates, describe any dose-reducing measures that will be taken to ensure that construction worker dose will be maintained ALARA in accordance with 10 CFR 20.1101(b).

Response

The information presented in FSAR Section 12.3.5.1 has been revised to correct errors presented in the equations. Additionally, a summary and description of the methodology used to calculate the dose rates in construction zones has been provided. The collective dose for construction workers is a best estimate based on worker census and occupancy by construction zone.

During construction of CCNPP Unit 3, the construction workers will be exposed to radiation sources from routine operation of CCNPP Units 1 and 2. Sources that have potential to expose CCNPP Unit 3 workers are listed in FSAR Table 12.3-1. Radiation sources other than those from CCNPP Units 1 and 2 are considered background and are not included in the assessment. The four main sources of radiation to CCNPP Unit 3 construction workers are gaseous effluents, liquid effluents, the Independent Spent Fuel Storage Installation (ISFSI), and the Resin Storage Area. Dose rates from the four sources combined were calculated for each construction zone. The maximum construction zone dose rates in mrem/year are shown in FSAR Table 12.3-9.

The regulations that govern dose rates to members of the general public are 10 CFR20.1301 and 10 CFR 20.1302. The design objectives of 10 CFR 50, Appendix I apply relative to maintaining doses as low as reasonably achievable (ALARA) for construction workers. Additionally, 40 CFR 190 applies as it is referred to in 10 CFR 20.1301. 10 CFR 20.1301 limits annual doses from licensed operations to members of the public to 0.1 rem TEDE. In addition, the dose from external sources to unrestricted areas must be less than 0.002 rem in any one hour. For an occupational year, i.e., 2200 hours onsite, the maximum dose would be on the road by the ISFSI or Resin Storage Area, where the dose would be 0.0388 rem and less than 0.002 rem in any one hour. This value is less than the limit specified in 10 CFR 20.1301 for members of the public. Therefore, construction workers can be considered to be members of the public for the purposes of not requiring radiation protection training and monitoring.

The 10 CFR 50, Appendix I criteria apply only to effluents. The purpose of the criteria is to assure adequate design of effluent controls. The annual limits for liquid effluents are 3 mrem to the total body and 10 mrem to any organ. For gaseous effluents, the pertinent limits are 5 mrem to the total body and 12 mrem to organs including skin. FSAR Table 12.3-10 shows that there is no dose rate to workers in a construction zone from effluents that exceeds these limits. Therefore, the criteria have been met.

The 40 CFR 190 criteria apply to annual doses received by members of the general public exposed to nuclear fuel cycle operations. Therefore, these regulations apply to CCNPP Unit 3 construction workers on the plant site, just as they apply to members of the public who live offsite. The most limiting part of the regulations states, "The annual dose equivalent (shall) not exceed 25 millirems (per year) to the whole body." In the case of CCNPP Unit 1 and 2 effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met. Table 12.3-9 shows that the maximum dose rate in any of the construction zones is 39 mrem/2200 hours. The ALARA program will employ methods included in Regulatory Guides 8.8 and 8.10, as applicable, to maintain construction worker doses as low as reasonably acheivable. The maximum dose rates for all other construction zones are less than 25 mrem/year. Therefore, the requirements of 40 CFR 190 will be met for all construction workers.

The implementation of the Radiation Protection and ALARA Program for CCNPP Unit 3, in cooperation and coordination with the Radiation Protection and ALARA Program for CCNPP

Unit 1 and Unit 2, will maintain construction worker dose ALARA. Potential radiation doses resulting from Resin Storage, ISFSI or other CCNPP Unit 1 and Unit 2 operations that could affect the construction zone doses will be evaluated and reasonable dose minimization techniques will be implemented.

Appropriate classification of construction workers as members of the public will be maintained through the implementation of the Radiation Protection Program and ALARA Program for CCNPP Unit 3, in cooperation and coordination with the Radiation Protection Program and ALARA Program for CCNPP Unit 1 and Unit 2. The implementation of the Radiation Protection Program and ALARA Program will manage the construction worker dose by monitoring the dose rates in the Construction Zones and limiting access to areas of the site when necessary. This will ensure that general re-classification of construction workers as radiation workers will not be necessary and that radiation protection training and monitoring of construction workers will not be required. The CCNPP Unit 3 Radiation Protection Program will initiate radiation worker training and monitoring when appropriate, consistent with the radiological conditions at the site.

COLA Impact

FSAR Sections 12.3.5.1 and 12.3.7 will be updated as follows in a future COLA revision:

12.3.5.1 Overall Plant Doses

Site Layout

The physical location of CCNPP Unit 3 relative to the existing CCNPP Units 1 and 2 on the CCNPP site is presented on Figure 12.3-1. As shown, except for the CCNPP Unit 3 ~~UHS~~ Makeup Water Intake Structure ~~and Circulating Water System Intake Structure~~, CCNPP Unit 3 will be located southeast of the protected area from CCNPP Units 1 and 2. Hence, the majority of construction activity will take place outside the protected area for the existing units, but inside the Owner Controlled Area for the CCNPP site.

Offsite Gaseous and Liquid Effluent Doses

The doses listed in Table 12.3-2 are to the maximally exposed member of the public due to the release of gaseous and liquid effluents from CCNPP Units 1 and 2 and are calculated in accordance with the existing units' ODCM (CCNPP, 2005). The maximum individual doses are from historical CCNPP Units 1 and 2 Annual Radiological Environmental Operating Reports and, prior to that, the Radiological Environmental Monitoring Program Annual Reports. ~~While these off-site doses provide perspective on the variation of effluent releases through the history of the operation of CCNPP Units 1 and 2, on-site workers will be exposed to fewer pathways. For example, workers will not ingest food (edible plants or fish) grown in effluent streams as part of their work activity. Therefore, only external and inhalation pathways will be considered in the calculation of dose to workers.~~

The Annual Radioactive Effluent Release Report for 2005 provides a whole body dose of 0.005 mrem (0.05 Sv) and a critical organ dose of 0.095 mrem (0.95 Sv) to the maximally exposed member of the public due to the release of gaseous effluents from the existing units. The Annual Radioactive Effluent Release Report for 2005 provides a whole body dose of 0.004 mrem (0.04 Sv) and a critical organ dose of 0.017 mrem (0.17 Sv) to the maximally exposed member of the public due to the release of liquid effluents from the existing units. The controlling pathway was the fish and shellfish pathway. Construction workers will not ingest food (edible plants or fish) grown in effluent streams as part of their work activity, therefore, only external pathways will be considered.

Projected Dose Rates at CCNPP Unit 3

Dose rates from all sources combined were calculated for each 100 x 100 foot square on the plant grid. These dose rates were in terms of mrem/year. For purposes of dose rate calculations, a 100% occupancy is assumed. (For purposes of collective dose calculations, the occupancy for construction workers is 2,200 hours per year.) The dose rates were the sum of the dose rates from four main sources; gases, liquids (only on the shoreline), the ISFSI, and the Resin Storage Area. They are shown in Figure 12.3-7 for the year 2015, the last year of construction. It is this year that the dose rate will be greatest, primarily because the ISFSI will have the largest number of spent fuel storage casks. ~~No credit is taken in the calculations for any additional shielding other than that present in measured doses.~~

$$\bar{\dot{D}}_Z = \frac{1}{N_Z} \sum_{(\text{all } x,y \text{ in } Z)} \dot{D}_{x,y}$$

where N_Z is the number of squares in the zone.

The equation for collective dose for the construction period is:

$$D = \frac{2200}{8760} \sum_t \sum_Z \bar{\dot{D}}_Z FTE_{Z,t}$$

where

$$\frac{2200}{8760} = \text{fraction of work hours per year}$$

$\bar{\dot{D}}_Z$ = average dose rate in zone, Z.

$FTE_{Z,t}$ = Full Time Equivalents in zone Z during year t.

The equation for full time equivalents is:

$FTE_{Z,t} = P_Z \, Census_t$

where P_Z = probability y of worker in zone, Z

$Census_t$ = FTE of worker on site in year t.

The probability of a worker in each zone, P_z, reflects the average construction worker and is based on a rough idea of how much time the average worker spends in each zone. For example, the time in the parking lot and road is low, in the construction areas is high, and in the offices is less. These are best estimates based on construction experience.

The spatial distribution of zones on the site is shown (red letters indicating a zone code in each square) in Figure 12.3-7. There are many locations where construction workers are not expected to be, so they are not marked in the figure. Those squares that are marked were chosen because of planned activities at those locations, for example, the parking lots are marked on site drawings, as are roads, and most importantly, the construction area.

Gaseous Dose Rates

The annual Total Effective Dose Equivalent (TEDE) dose rate from gaseous effluents to construction workers on the CCNPP Unit 3 site is bounded by the following equation:

$$D(r) = 220256\ r^{-1.8}\ \text{(mrem/year)}$$

Where r is the distance from the stack to the worker location in feet

The skin dose rate equation bounds organ doses from Iodines and particulates.

$$D(r) = 1066039\ r^{-1.8}\ \text{(mrem/year)}$$

Where r is the distance from the stack to the worker location in feet

These parametric equations are based on annual average, undepleted, ground level χ/Qs that are based on CCNPP site specific meteorology for the years 2000 to 2006. Note that only those wind directions which could carry gaseous effluents from the stacks to the CCNPP Unit 3 workers were included in the present analysis. Thus, the directions from ENE through S, through SSW are included. The χ/Q data used are provided in Table 12.3-6. A bounding curve was then fitted to a power equation as shown in Figure 12.3-8.

The equation is:

$$\chi/Q\ (r) = 60\ r^{-1.8}$$

Where r is the stack to target distance ~~from the stack to the worker location~~ in feet.

Liquid Dose Rates

The dose from liquid effluents is conservatively calculated assuming all the exposure is from deposition on the shoreline. The historical liquid effluents and dilution rates for the years 2001 through 2006 are given in Figure 12.3-8, the dose at the shoreline is 0.32 mrem/year (3.2 µSv/yr).

Thus,

D_{Liq} = 0.32 (mrem/yr) on shoreline

= 0 not near the water.

The actual discharge from CCNPP Units 1 and 2 is 850 ft (259 m) away from shore. The dilution factor at the shore would provide a significant reduction but is conservatively ignored. The LADTAPII computer code (NRC, 1986) was used to make these calculations. LADTAPII assumes a 12 hours/year occupancy rate which had to be scaled up by the factor 8766/12 for annual dose rate calculations.

ISFSI Dose Rates

The dose rate had to be calculated at various distances and directions from the ISFSI. The dose rate also had to be projected into the future as more spent fuel was loaded into storage canisters and stored at the ISFSI from CCNPP Units 1 and 2. TLD readings around the ISFSI as shown in Figure 12.3-9 were used to develop the following equation for 2005 dose rate as a function of location:

$D_{N,2005} = 76\omega e^{-0.00195x}$ (mrem/year)

Where x = source surface to target distance (ft), and

ω = solid angle of ISFSI ~~bunkers~~source and an equivalent air scattering volume above it.

The equation for solid angle is derived empirically from dosimetry and distance measurements at the ISFSI site. The height, H, and radius R, are effective values from the fit. They are 400 and 124 feet respectively. The equation is:

$$\omega = 2\arcsin\left(\left(\frac{H}{\sqrt{H^2+r^2}}\right)\left(\frac{R}{\sqrt{R^2+r^2}}\right)\right)$$

This is a reasonable approximation for the North end, i.e., ISFSI-N, which was about 72% loaded with spent fuel at the end of 2005. The exterior perimeter distance, x, to ISFSI-N is calculated assuming a source center at N9703, E7936. Then, it was assumed that all post-2005 spent fuel loading went into ISFSI-S whose source center was N9403, E7936. The source term for ISFSI-S was an extrapolation of the historic dose rate increase from ISFSI-N as shown in Figure 12.3-10. The dose rate from ISFSI-S as a function of calendar year 2005 is:

~~$DR\_S(t) = DR_{N,2005}\ F\_S(t)$ (Mrem/year)~~

~~Where, $F\_S(t) = -170.8456 + 0.08521\,t$~~

$D_{S,t} = (-170.8456 + 0.08521\,t)\, D_{N,2005}$

~~and~~ where t is in absolute year (such as 20105.)

Note that these provide annual average dose rates. There are significant temporal variations, for example, during ISFSI loading operations the dose rate will go up. These variations are included in the annual average.

Cumulative Dose Rates

The maximum dose rates by zone are given in Table 12.3-9. For an occupational year, i.e., 2,200 hours onsite, the maximum dose would be on the road by the ISFSI or the Resin Storage Area where the dose would be 39 mrem/2200 hours (390 mSv/2200 hours) and less than 2 mrem (0.02 mSv) in any one hour.

The annual values are expressed to be clear that an occupancy of 2200 hours is assumed. The use of 2,200 hours assumes the worker takes 2 weeks vacation or sick time per year, works 40 hours per week for 50 weeks per year, and works 10% overtime per year. Note, that this dose rate is for the maximum dose rate locations adjacent to the ISFSI and Resin Storage Areas. The ALARA program described above will not allow workers to linger or work full shifts at these locations.

The maximum dose rates for all other Construction Zones are less than 25 mrem/year (0.25 mSv/year). This value is less than the limits specified above for all members of the public.

Table 12.3-10 shows that the dose rate to workers from effluents does not exceed 1 mrem/year (10 μSv/year) in any construction zone.

Example Dose Rate Calculation

As an example, the dose rate to the location N8050, E9150 is calculated. This location is at the center of the square that is nearest to the center of the containment of the new plant. The ISFSI will be at its maximum load for the construction period, i.e. as projected in 2015. The distances between the sources and the receptor are shown in the following table. Note that the first grid coordinate on the map is shown as N8050, but, mathematically is -8050. The distance, in feet, between the gas stack and the receptor is

$$r = \sqrt{(-10474 - -8050)^2 + (9996 - -8050)^2} = 2567$$

The other distances are similarly calculated

Location	N	E	r (ft)
Receptor	-8050	9150	
Gas Stack	-10474	9996	2567
ISFSI North Half	-9703	7936	1927
ISFSI South Half	-9403	7936	1694
Resin Area	-10100	7600	2570

The dose rate from gases released from the stack are

$$D_{gas} = 220256 * 2567^{-1.8} = 0.16064$$

The dose rate from liquids is zero because the receptor is not near the shoreline nor near any effluent liquids. The dose rate from ISFSI is calculated assuming the 2005 load at both the north and south halves. Both dose calculations depend upon the solid angles in streradians (sr) which is calculated as follows:

$$\omega_N = 2\arcsin\left(\left(\frac{400}{\sqrt{400^2+1927^2}}\right)\left(\frac{124}{\sqrt{124^2+1927^2}}\right)\right) = 0.02611sr$$

Similarly for the south half:

$$\omega_S = 2\arcsin\left(\left(\frac{400}{\sqrt{400^2+1694^2}}\right)\left(\frac{124}{\sqrt{124^2+1694^2}}\right)\right) = 0.03356sr$$

Note, that arcsin( ) calculates the planar angle in degrees or radians. Units of degree are converted by θ(degrees) = θ(radians)π/180. The dose rate from the north half of the ISFSI is

$$D_{N,2005} = 76 * 0.02611 * e^{-0.00195 \times 1927} = 0.04631$$

From the south half the dose rate is calculated assuming it is loaded like the north half in 2005:

$$D_{N,2005} = 76 * 0.03356 * e^{-0.00195 \times 1694} = 0.09381$$

Correcting for ISFSI loading out to the year 2015:

$$D_{S,t} = (-170.8456 + 0.08521 * 2005)\ 0.04631 = 0.07998$$

The dose rate from resins is:

$$D_{resin} = \frac{2.23E6e^{-0.000951\,x\,2570}}{2570^2} = 0.2931$$

Thus, the dose rate near the center of the containment in 2015 is:

$$D = 0.16064 + 0 + 0.04631 + 0.07998 + 0.02931 = 0.316 \text{ (mrem/year)}$$

Compliance with Dose Rate Regulations

CCNPP Unit 3 construction workers are, for the purposes of radiation protection, members of the general public. This means that the dose rate limits are considerably lower than the 100 mrem/year limit to be considered a radiation worker. The construction workers (with the exception of certain specialty contractors loading fuel or using industrial radiation sources for radiography) do not deal with radiation sources.

The regulations that govern dose rates to members of the general public are provided in 10 CFR 20.1301 (CFR, 2007a) and 10 CFR 20.1302 (CFR, 2007b). Compliance with 10 CFR 20.1302 is discussed in the Radiation Protection and ALARA Program.

The design objectives of 10 CFR 50, Appendix I (CFR, 2007c) apply relative to maintaining dose ALARA for construction workers. Also, 40 CFR 190 (CFR, 2007d) applies as it is referred to in 10 CFR 20.1301. Note that 10 CFR 20.1201 through 20.1204 do not apply to the construction workers as they are considered members of the public and not radiation workers.

10 CFR 20.1301

The 10 CFR 20.1301 (CFR, 2007a) limits annual doses from licensed operations to individual members of the public to 0.1 rem (1 mSv) TEDE (total effective dose equivalent.) In addition, the dose from external sources to unrestricted areas must be less than 0.002 rem (0.02 mSv) in any one hour. This applies to the public both outside of and within controlled areas. Given that the relevant sources are relatively constant in time, the hourly limit is met if the annual limit is met. The maximum dose rates by zone are given in Table 12.3-9. For an occupational year, i.e., 2,200 hours onsite, the maximum dose would be on the road by the ISFSI or the Resin Storage Area, where the dose would be 0.0388 rem (388 mSv) and less than .002 rem (0.02 mSv) in any one hour. This assumes the worker stood on the road for 2,200 working hours in one year. This value is less than the limits specified above for members of the public. Therefore, construction workers can be considered to be members of the general public for the purpose of not requiring radiation protection training or monitoring.

10 CFR 50, Appendix I

The 10 CFR 50, Appendix I criteria (CFR, 2007c) apply only to effluents. The purpose of the criteria are to assure adequate design of effluent controls. The annual limits for liquid effluents are 3 mrems (30 Sv) to the total body and 10 mrems (100 Sv) to any organ. For gaseous effluents, the pertinent limits are 5 mrems (50 Sv) to the total body and 15 mrems (150 Sv) to organs including skin. Table 12.3-10 shows that there is no dose rate to workers in a construction zone from effluents that exceeds these limits. Therefore, the criteria have been met. Note that CCNPP Unit 3 occupational zones, during construction, are treated, for purposes of these criteria, as unrestricted areas.

40 CFR 190

The 40 CFR 190 (CFR, 2007d) criteria apply to annual doses, herein called dose rates because the units are in mrem per year, received by members of the general public exposed to nuclear fuel cycle operations, i.e., nuclear power plants. Therefore, these regulations apply to CCNPP Unit 3 construction workers on the plant site, just as they apply to members of the general public who live offsite. The most limiting part of the regulation states "The annual dose equivalent (shall) not exceed 25 millirems (per year) to the whole body." In the case of CCNPP Units 1 and 2 effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met.

Table 12.3-9 shows that the maximum dose rate in any of the construction zones is 39 mrem/2,200 hours (390 mSv/2,200 hours). The units are expressed to be clear that an occupancy of 2200 hours is assumed. The use of 2,200 hours assumes the worker takes 2 weeks vacation or sick time per year, works 40 hours per week for 50 weeks per year, and works 10% overtime per year. Note, that this dose rate is for the maximum dose rate locations adjacent to the ISFSI and Resin Storage Areas. The ALARA program described below will not allow workers to linger or work full shifts at these locations. The maximum dose rates for other Construction Zones are less than 25 mrem/year (0.25 msievert/year). Therefore, the requirements of 40 CFR 190 will be met for all construction workers.

Radiation Protection and ALARA Program

Due to the exposures from CCNPP Units 1 and 2 normal operations, there will be a radiation protection and ALARA program for CCNPP Unit 3 construction workers. This program will meet the guidance of Regulatory Guide 8.8 (NRC, 1978) to maintain individual and collective radiation exposures ALARA. This program will also meet the requirements of 10 CFR 20.1302.

Because the construction workers are not radiation workers, but are, for the purposes of radiation protection, members of the general public, individual monitoring and training of construction workers on CCNPP Unit 3 is not required. Construction workers will be treated, for purposes of radiation protection, as if they are members of the general public in unrestricted areas.

However, they are exposed to effluent radioactivity and direct radiation sources from CCNPP Units 1 and 2. The most important reason for the ALARA program is that these source levels may vary over time from the projections made here. There may also be additional sources, unaccounted for by the above projections.

Some features of the CCNPP Unit 3 Construction ALARA Program will be:

- The CCNPP Unit 3 ALARA Committee will operate in parallel with the CCNPP Units 1 and 2 ALARA Committee. The Committee will meet quarterly, will review monitoring, and review worker dose rate and dose projections. The Committee will be empowered to stop work if the "general public" status of any construction worker(s) is jeopardized. The Committee will publish a dose and dose rate report for construction workers.

- Unit 3 radiation protection personnel will report to the Committee. The Radiation Protection Department will be in charge of radiation monitoring, worker census, source census, and use this data to project worker doses and dose rates on a monthly basis into the next quarter, and will report to the Committee.

- The CCNPP Units 1 and 2 ODCM and other CCNPP Unit 1 and 2 processes, such as the ISFSI projected loading process, will be updated to link dose important CCNPP Unit 1 and 2 activities to projected CCNPP Unit 3 construction worker ALARA dose.

- The Committee will periodically identify and direct construction management to control the occupancy of areas, such as the road between the ISFSI and the Resin Storage Area, where dose rates can be high enough that workers might exceed 40 CFR 190 limitations, for example, when spent fuel casks are being transported to the ISFSI.

- The Committee will establish a radiation monitoring program to assure 40 CFR 190 regulations are met for CCNPP Unit 3 construction workers. It is expected that monitoring will require either special instruments and/or measurements closer to sources, and projected by calculation further out to where workers will be.

- The Committee will require, before any high dose rate evolutions, such as the transport of fuel to the ISFSI, or transport of resins to the Resin Storage Area, or transport onsite of large, radioactive components, that the CCNPP Unit 3 ALARA evaluation be revised.

- Consumption of edible plants growing onsite or fishing onsite will not be allowed.

- The program will survey the radiation levels in construction areas and will survey radioactive materials in effluents released to construction areas to demonstrate compliance with dose limits for CCNPP Unit 3 workers.

- The program will comply with the annual dose limit in 10 CFR 20.1301 by measurement or calculation, to verify the total effective dose equivalent to the individual worker likely to receive the highest dose from any onsite operation does not exceed the annual dose limit.

12.3.7 REFERENCES

{**ANSI, 1999.** Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities, ANSI/HPS N13.1-1999, American National Standards Institute, 1999.

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