Progress Energy

Serial: NPD-NRC-2012-001
January 23, 2012

10 CFR 52.79

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

**SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 2 AND 3**
**DOCKET NOS. 52-022 AND 52-023**
**SUPPLEMENT 1 TO RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 078 RELATED TO RADIATION PROTECTION DESIGN FEATURES - CONSTRUCTION WORKER DOSE**

References:
1. Letter from Donald Habib (NRC) to John Elnitsky (PEC), dated February 15, 2011, "Request for Additional Information Letter No. 078 Related to SRP Section 12.3-12.4, Radiation Protection Design Features, for the Shearon Harris Units 2 and 3 Combined License Application"

2. Letter from John Elnitsky (PEC) to U. S. Nuclear Regulatory Commission, dated March 28, 2011, "Response to Request for Additional Information Letter No. 078 Related to Radiation Protection Design Features – Construction Worker Dose," Serial: NPD-NRC-2011-020

Ladies and Gentlemen:

Progress Energy Carolinas, Inc. (PEC) hereby submits a supplemental response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in Reference 1.

A supplemental response to NRC questions 12.03-12.04-3 & 12.03-12.04-4 is addressed in the enclosure. The enclosure also identifies changes that will be made in a future revision of the Shearon Harris Nuclear Power Plant Units 2 and 3 application.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (727) 820-4481.

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

Executed on January 23, 2012.

Sincerely,

John Elnitsky
Vice President
New Generation Programs & Projects

Enclosure/Attachment

**Progress Energy Carolinas, Inc.**
P.O. Box 1551
Raleigh, NC 27602

D084
NRO

cc : U.S. NRC Region II, Regional Administrator
U.S. NRC Resident Inspector, SHNPP Unit 1
Mr. Brian Hughes, U.S. NRC Project Manager

**Shearon Harris Nuclear Power Plant Units 2 and 3**
**Supplement 1 to Response to NRC Request for Additional Information Letter No. 078**
**Related to SRP Section 12.3-12.4 for the Combined License Application,**
**Dated February 15, 2011**

| NRC RAI # | Progress Energy RAI # | Progress Energy Response |
|---|---|---|
| 12.03-12.04-3 | H-0662 & H-0702 | March 28, 2011; NPD-NRC-2011-020 and supplemental response enclosed – see following pages |
| 12.03-12.04-4 | H-0663 & H-0702 | March 28, 2011; NPD-NRC-2011-020 and supplemental response enclosed – see following pages |

**NRC Letter No.:** HAR-RAI-LTR-078

**NRC Letter Date:** February 15, 2011

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER:** 12.03-12.04-3 & 12.03-12.04-4

**PGN RAI ID #:** H-0702

**PGN Response to NRC RAI:**

This supplemental response to NRC RAI questions 12.03-12.04-3 and 12.03-12.04-4 is provided to answer the following two NRC questions related to the determination of gaseous doses [as discussed in the response to NRC RAI 12.03-12.04-3 item (ii) provided in Progress Energy letter dated March 28, 2011; Serial NPD-NRC-2011-020]:

1) In the applicant's proposed revision to Subsection 12.4.1.9.3.2.1 of the Harris FSAR, the applicant states that the airborne doses to HAR 2 workers would be bounded by the maximum individual off-site dose due to radioactivity in gaseous effluents from HNP operations. The applicant's response assumes that the dose to the HAR 2 construction workers located in the vicinity of HAR 2 is bounded by the maximum individual off-site dose without giving any justification for this conclusion.

2) In the applicant's proposed revision to Subsection 12.4.1.9.3.2.2 of the Harris FSAR, the applicant references a quote from Subsection 12.4.1 of the AP1000 DCD which states that "Past experience demonstrates that the dose from airborne activity is not a significant contributor to the total doses" to show that the doses to HAR 3 construction workers would be small. The applicant then states that, "to be conservative, the airborne dose due to gaseous effluents for HAR 2 is assumed to be equivalent to the dose from gaseous effluents from HNP." The quote from Subsection 12.4.1 of the AP1000 DCD referenced by the applicant is not applicable to the doses from offsite effluents from HAR 2. The referenced quote refers to the contribution to the collective doses to HAR 2 workers from airborne concentrations inside the plant as being not a significant contributor to the total collective doses to plant workers.

**Background:**

This response will clarify the process used to apply HNP Annual Effluent Release Report data, HNP ODCM dose calculation methodology and HAR GASPAR II dose calculation methodology in the determination of gaseous effluent dose to HAR 2 & 3 construction workers.

A total dose exposure comparison determined that HAR 3 construction worker exposure was the most limiting and bounds HAR 2 construction worker exposure therefore the remaining discussion addresses HAR 3 construction worker exposure.

In determining the dose to HAR 3 construction workers, the following site layout characteristics, radiation sources and dose determination methods are considered:

- HAR 2 is located approximately 427 m (1400 feet) north and west of the HNP containment. HAR 3 is located approximately 290 m (950 feet) north and west of HAR 2 and approximately 716 m (2350 feet) north and west of the HNP containment.

- HNP gaseous effluent releases used HNP ODCM methodology, then the dose was adjusted for the Chi/Q for the worst meteorological sector and the location of the HAR 3 construction workers.

- HAR 2 gaseous effluent releases used HAR GASPAR II program methodology, then the dose was adjusted for the Chi/Q for the worst meteorological sector and the location of the HAR 3 construction workers.

**Response to NRC Question (1):**

HNP gaseous effluent release exposure was determined by using HNP Annual Effluent Release Report data for gaseous effluents and the calculation of the dose at the Exclusion Area Boundary using the methodology presented in Subsection 3.3.1 of the HNP ODCM. The methodology was then used to adjust the dose using the Chi/Q of the worst meteorological sector and the location of HAR 3 construction workers. The dose from HNP gaseous effluent releases at the location of HAR 3 construction workers (716 m or 2350 ft. from HNP) is 14.6 mrem/yr. When adjusted for construction worker residence time on the site (2080 hours/8760 hours = 0.24) the dose to a construction worker located at HAR 3 from HNP is 3.5 mrem/yr.

HAR 2 gaseous effluent release exposure was based on the dose from the gaseous effluent release at the Exclusion Area Boundary as determined by the GASPAR II program. The GASPAR II methodology was then used to adjust the dose using the Chi/Q at the worst meteorological sector (SSW) and the location of HAR 3 construction workers (290 m or 950 feet). The HAR 3 construction worker dose was calculated to be 11.9 mrem/yr. When adjusted for construction worker residence time on the site (2080 hours/8760 hours = 0.24) the dose to a construction worker located at HAR 3 from HAR 2 is 2.9 mrem/yr.

HAR 3 Construction Worker Gaseous Effluent Dose Contribution to Total Dose

| | Direct Radiation | Gaseous | Liquid | |
|---|---|---|---|---|
| HNP | 31 mrem/yr | 3.5 mrem/yr | 0.124 mrem/yr | |
| HAR 2 | negligible | 2.9 mrem/yr | 0.7 mrem/yr | |
| | | | | |
| Subtotals | 31 mrem/yr | 6.4 mrem/yr | 0.8 mrem/yr | |
| | | | | |
| Total | | | | 38.2 mrem/yr |

Direct radiation and liquid effluent dose contributions were discussed in Progress Energy letter NPD-NRC-2011-020, dated March 28, 2011, and are summarized in the table above. Since no reduction in the 31 mrem/yr HNP direct radiation dose is applied

for either the distances between the HNP Protected Area Boundary and HAR 2 or 3 construction sites, or any potential HNP direct radiation shielding by HAR 2 for HAR 3, the assumed exposure to HAR 3 is 31 mrem/yr.

The largest contributor to the (total effective dose equivalent) TEDE would be the external dose assumed from the active HNP operations (31 mrem/yr). Doses contributed by liquid effluents from HNP and HAR 2 provide an additional 0.8 mrem/yr. Doses contributed by gaseous effluents from HNP and HAR 2 provide an additional 6.4 mrem/yr. Additionally, It is concluded that annual construction worker total dose for the proposed construction areas for HAR 2 and 3 are a fraction of those limits specified in 10 CFR Part 20 and 10 CFR Part 50 Appendix I.

**Response to NRC Question (2):**

HAR FSAR Subsection 12.4.1.9.3.2.2 will be revised to remove the reference to DCD Subsection 12.4.1 and provide a discussion on the HAR gaseous effluent releases as discussed in the response to Question (1) above.

An updated FSAR Chapter 12 Subsection 12.4, Dose Assessment, is provided to implement the combined HAR-RAI-LTR-078 response (NPD-NRC-2011-020 dated March 28, 2011) and this supplemental response, including additional clarifications/enhancements to other parts of 12.4. These changes will be made to the HAR FSAR in a future revision, and replace the FSAR text and table revisions provided in NPD-NRC-2011-020.

**Associated HAR COL Application Revisions:**

The attachment provides an updated FSAR Chapter 12 Subsection 12.4, Dose Assessment, which implements the combined HAR-RAI-LTR-078 response and this supplemental response, and includes additional clarifications/enhancements to other parts of 12.4. These changes will be made to the HAR FSAR in a future revision, and replace the FSAR text and table revisions provided in NPD-NRC-2011-020.

**Attachments/Enclosures:**

Updated HAR FSAR Chapter 12, Subsection 12.4, Dose Assessment

Attachment to

NRC RAI NUMBER: 12.03-12.04-3 & 12.03-12.04-4

[PGN RAI ID #: H-0702]

Updated HAR FSAR Chapter 12,

Subsection 12.4, Dose Assessment

[9 pages attached following this cover page]

## 12.4 DOSE ASSESSMENT

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

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HAR SUP 12.4-1

Add the following new subsection after DCD Subsection 12.4.1.8:

### 12.4.1.9 Dose to Construction Workers

This section assesses the potential radiological dose impacts to those who will construct the proposed Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR) and be exposed to the existing Shearon Harris Nuclear Power Plant, Unit 1 (HNP) and HAR 2 during construction of HAR 3.

#### 12.4.1.9.1 Site Layout

Figure 2.1.1-203 indicates the locations of HAR 2 and 3 relative to the layout of various HNP facilities. HAR 2 is located approximately 427m (1400 feet) north and west of the HNP containment. HAR 3 is located approximately 290 m (950 feet) north and west of HAR 2 and approximately 716 m (2350 feet) north and west of the HNP containment. The major activities during the construction of HAR 2 and 3 are expected to take place outside the HNP protected area boundary, but inside the restricted area boundary.

#### 12.4.1.9.2 Radiation Sources

HAR 2 & 3 construction workers could be exposed to any elevated background levels and effluent discharges from current HNP reactor operations. Once HAR 2 is operational, workers involved with the construction of HAR 3 could be exposed to radiation sources from HAR 2.

Total dose exposure comparison for HAR 2 and HAR 3 determined that HAR 3 construction worker exposure was the most limiting and thus bounds HAR 2 construction worker exposure.

In determining the dose to HAR 3 construction workers, the following radiation sources are considered:

- Direct radiation exposure from HNP.
- Direct radiation exposure from HAR 2.
- HNP gaseous effluent releases.
- HAR 2 gaseous effluent releases.
- HNP and HAR 2 liquid effluent releases to Harris Lake that is the source of drinking water for HAR 2 & 3 construction workers.

Exposure of HAR 3 workers to radioactive liquid effluents due to shared systems between HAR 2 and HAR 3 was not evaluated because the discharge structure and blowdown piping for HAR 3 will be completed during HAR 2 construction.

12.4.1.9.3 Measured Radiation Dose Rates and Liquid/Airborne Concentrations

During construction of the HAR 2 facility, construction workers may be exposed to direct radiation and to the radioactive effluents emanating from the routine operation of the HNP. During construction of the HAR 3 facility, construction workers may be exposed to direct radiation from HAR 2 and to the radioactive effluents emanating from the routine operation of the HNP and HAR 2.

Total dose exposure comparison for HAR 2 and HAR 3 determined that HAR 3 construction worker exposure was the most limiting and thus bounds HAR 2 construction worker exposure.

12.4.1.9.3.1 Liquid Effluent Doses

12.4.1.9.3.1.1 HNP Liquid Effluent Doses

Radioactive liquids are routinely released as batches from the waste evaporator condensate tank and the treated laundry and hot shower tank. Batch releases may also originate from the secondary waste sample tank and the waste monitor tank at the HNP. Based on analysis of the tank contents, the tank release rate is adjusted, based on the cooling tower blowdown line flow rate, to dilute the tank activities to 50 percent of the allowable concentrations at the release point to Harris Lake (Reference 202). The liquid effluent release point is at the point of discharge from the cooling tower blowdown line into Harris Lake. The cooling tower blowdown line provides liquid effluent dilution prior to release to Harris Lake. Concurrent batch releases do not occur at the HNP. The secondary waste sample tank and the normal service water system have a low potential for radioactive effluent releases. Effluent monitors on the secondary waste sample tank and the normal service water lines check these releases (Reference 202).

Since it is unlikely that the HAR construction workers will be exposed to liquid effluent pathways, it is assumed that the liquid effluent dose rates to which the workers will be exposed are the same as those for the maximally exposed member of the public. The estimated maximum individual off-site doses due to radioactivity released in the HNP's liquid effluent release pathway for the period from 1999 through 2010 was 1.86 E-02 mrem per year (mrem/yr) total body and 2.63 E-02 mrem/yr maximum organ in 2004; and 1.99 E-02 mrem/yr total body and 1.99 E-02 mrem/yr maximum organ in 2007 (Reference 201 and Reference 205). This dose is considered to be a negligible contributor to a HAR 2 or HAR 3 construction worker total dose. The annual releases for 2004 and 2007 were selected because they resulted in the maximum exposure to the public among the years 1999-2010 (Reference 201 and Reference 205).

Liquid effluent dose associated with tritium released into the Harris Lake is applicable to HAR 2 & 3 construction workers. During the period of January 1, 2008 through December 31, 2008 (Reference 203), the tritium dose from drinking water obtained from Harris Lake to the worker at the Wake County Fire Training Center was equal to 1.24 E-01 mrem. Construction workers are assumed to use Harris Lake as a drinking water source. The exposure to construction workers due to liquid effluents discharged by HNP into Harris Lake is considered to be equivalent to the exposure of the worker at the Wake County Fire Training Center in 2008. The January 1, 2008 through December 31, 2008 period was chosen because it identifies the maximum tritium drinking water dose since the drinking water pathway was identified for inclusion in the total dose determination.

12.4.1.9.3.1.2 HAR 2 Liquid Effluent Doses

In accordance with plant procedures, small amounts of liquid radioactive effluents (below regulatory limits) will be mixed with the cooling water and discharged to Harris Lake. Construction workers are assumed to use Harris Lake as a drinking water source. The LADTAP II computer program was used to calculate the construction worker doses from the liquid pathway via the ingestion of drinking water from Harris Lake. Calculations resulted in a whole body dose of 0.7 mrem per year (mrem/yr). PEC maintains USEPA drinking water standards for water taken from Harris Lake for use as drinking water at the Harris Site.

12.4.1.9.3.2 Gaseous Effluent Releases

12.4.1.9.3.2.1 HNP Gaseous Effluent Releases

At HNP, four gaseous effluent discharge points exist: Plant Vent Stack 1, Turbine Building Vent Stack 3A, and the Waste Processing Building Vent Stacks 5 and 5A. During refueling outages, when the equipment hatch is removed, there is the potential for airborne particulate releases. All gaseous effluent releases at the plant are considered ground releases (Reference 202).

If the reactor has been shut down for greater than 30 days, the condenser vacuum pump discharge during initial hogging operations at plant start-up and prior to turbine operation may be routed as dual exhaust to (1) the Turbine Building Vent Stack 3A and (2) the atmosphere directly (Reference 202).

The stack effluent monitor setpoints ensure that the dose rates from noble gases at the HAR site boundary do not exceed the applicable regulatory limits established for releases to unrestricted areas (Reference 202). Data from the HNP Radioactivity Effluent Release Report for the period of January 1, 2010 through December 31, 2010 provided the maximum doses to the public for the 1999-2010 period (Reference 206).

HNP gaseous effluent release exposure was determined by using the HNP Annual Effluent Release Report data for gaseous effluents and the calculation of

the dose at the Exclusion Area Boundary using the methodology presented in Subsection 3.3.1 of the HNP ODCM (Reference 202). The methodology was then adjusted for the Chi/Q of the worst meteorological sector and the location of HAR 3 construction workers. The dose from HNP gaseous effluent releases at the location of HAR 3 construction workers (716 m or 2350 ft. from HNP) is 14.6 mrem/yr. When adjusted for construction worker residence time on the site (2080 hours/8760 hours = 0.24) the dose to a construction worker located at HAR 3 from HNP is 3.5 mrem/yr.

12.4.1.9.3.2.2 HAR 2 Gaseous Effluent Releases

The determination of construction worker doses from HAR 2 operation depends on the airborne effluent released and the atmospheric transport to the worker location. The methodology contained in the GASPAR II program was used to determine the doses for gaseous pathways. This program implements the radiological exposure models described in Regulatory Guide 1.109 for radioactivity releases in gaseous effluent.

Dose rate estimates were calculated for construction workers exposed to gaseous radioactive effluents through the following pathways:

- Direct radiation from immersion in the gaseous effluent plume and from particulates deposited on the ground.

- Inhalation of gases and particulates.

HAR 2 gaseous effluent release exposure was based on the dose from the gaseous effluent release at the Exclusion Area Boundary as determined by the GASPAR II program. The GASPAR II methodology was then used to adjust the dose using the Chi/Q at the worst meteorological sector (SSW) and the HAR 3 construction worker location of 290 meters (m) (950 feet). The HAR 3 construction worker dose was calculated to be 11.9 mrem/yr. When adjusted for construction worker residence time on the site per year (2080 hours/8760 hours = 0.24) the dose to a construction worker located at HAR 3 from HAR 2 is 2.9 mrem/yr.

12.4.1.9.3.3 Direct Radiation Measurements

12.4.1.9.3.3.1 Direct Radiation Exposure from HNP

Direct radiation exposure input was determined from HNP protected area fence line Thermo Luminescent Dosimeter (TLD) readings that have been compiled over approximately 7 years, from the 1st quarter of 1999 through the 3rd quarter of 2006 (Reference 204). There are 16 TLD locations along the HNP protected area fence line as shown on Figure 12.4-201.

Selecting the individual TLD dose data for the TLDs that are closest to the HAR 2 construction boundary (TLDs 6, 7 and 8 per Figure 12.4-201), identifies the highest peak dose to be approximately 32 mrem for any 90-day period (from TLD # 7) (Reference 204). TLDs 15 and 24 have peak dose rates higher than TLD # 7; however, TLD # 15 is located on the opposite end of HNP with respect to the HAR 2 construction site and TLD # 24 is located on the 4th floor of K Building. Neither TLD # 15 nor TLD # 24 would provide dose measurements representative of construction worker doses.

The maximum dose of gamma radiation over any 90-day period for TLD # 7 was approximately 32 mrem (without background correction) as shown on Figure 12.4-202. Using the 32 mrem per 90-day period value for TLD # 7 for estimating the doses to construction workers is considered both reasonable and conservative because:

- The HAR facilities will be located outside the HNP protected area fence line and will be away from any HNP radiation sources. The HNP TLD locations that are the closest to HAR 2 are TLD # 6, 7, and 8. These TLDs are over 300 feet from the closest HAR 2 structures.

- TLD # 7 has the highest peak dose over any 90-day period of the TLDs located closest to the construction workers.

- The majority of the construction workers will be located in the HAR 2 and HAR 3 nuclear and turbine island construction areas which are further from the HNP operating radiation sources than the distances identified in the closest HAR 2 structures reflected in the protected area fence line TLD # 6, 7 and 8 locations.

- No credit for the reduction in potential dose is given for the distance from the HNP protected area fence line TLD locations to the HAR facility construction areas or the potential shielding effects HAR 2 would provide to construction workers at HAR 3.

The direct radiation exposure for construction workers was based on a 2,080-hour work year and an exposure rate of 14.8 µrem/hr or 31 mrem/yr.

12.4.1.9.3.3.2 Direct Radiation Exposure from HAR 2

The dose calculated for HAR 2 construction workers does not take credit for the reduction in potential dose rate due to the separation distance of the plants. AP1000 DCD Subsection 12.3.2.2.1 states, "During reactor operation, the shield building protects personnel occupying adjacent plant structures and yard areas from radiation originating in the reactor vessel and primary loop components. The concrete shield building wall and the reactor vessel and steam generator compartment shield walls reduce radiation levels outside the shield building to less than 0.25 mrem/hr from sources inside containment. The shield building completely surrounds the reactor coolant system components." With a design basis dose rate directly outside the HAR 2 shield building of less than

0.25 mrem/hr, the dose at the fence around the HAR 2 protected area would be negligible. Thus, the contribution to construction workers from the HAR 2 containment and other buildings would be negligible. Therefore, the doses to HAR 3 construction workers from active HAR 2 operations would be negligible.

12.4.1.9.4 Construction Worker Dose Estimates

Annual potential radiological dose impacts to construction workers have been conservatively estimated based on the following factors:

- Total dose exposure comparison for HAR 2 and HAR 3 determined that HAR 3 construction worker exposure was the most limiting and bounds HAR 2 construction worker exposure.

- The liquid effluent release dose (other than tritium) is considered to be a negligible contributor to a HAR 2 or 3 construction worker total dose.

- The estimated maximum construction worker on-site dose due to the drinking water pathway from HNP liquid effluent releases to Harris Lake was 1.24 E-01 mrem/yr (Reference 203).

- The estimated maximum construction worker on-site dose due to the drinking water pathway from HAR 2 liquid effluent releases to Harris Lake was 0.7 mrem/yr.

- Thus, the total estimated construction worker dose due to the drinking water exposure pathway for liquid effluents from both HNP and HAR 2 is approximately 0.8 mrem/yr.

- The estimated radiological exposure to a construction worker from the operation of the HNP via the gaseous effluent release pathway is 3.5 mrem/yr. This is based on the HNP annual effluent release report for gaseous effluents and the calculation of the dose at the exclusion area boundary (EAB) using the methodology of the Off-Site Dose Calculation Manual (ODCM) and then adjusting the dose for the Chi/Q in the worst meteorological sector and the location of the construction workers at HAR 3.

- The estimated radiological exposure to a construction worker from the operation of the HAR via the gaseous effluent release pathway is 2.9 mrem/yr. This is based on the dose from effluent gaseous release calculated at the EAB using GASPAR II and then adjusting the dose for the Chi/Q in the worst meteorological sector and the location of the construction workers at HAR 3.

- No reduction in dose is applied for either the distances between the HNP Protected Area Boundary and HAR 2 or 3 construction sites, or any potential HNP direct radiation shielding by HAR 2 for HAR 3.

The direct radiation exposure was based on a 2,080-hour work year and an exposure rate of 14.8 µrem/hr yielding a total dose of 31 mrem/yr.

The annual collective dose to the construction workforce is estimated to be 120.3 person-rem (that is, the maximum individual dose multiplied by the number of people exposed). This estimate assumes 3,150 persons based on a construction worker dose of 38.2 mrem/yr.

The largest contributor to the total effective dose equivalent (TEDE) would be the external dose assumed from the active HNP operations (31 mrem/yr). Doses contributed by liquid effluents from HNP and HAR 2 provide an additional 0.8 mrem/yr. Doses contributed by gaseous effluents from HNP and HAR 2 provide an additional 6.4 mrem/yr. It is concluded that annual construction worker doses attributable to HNP operations for the proposed construction areas for HAR 2 and 3 are a fraction of those limits specified in 10 CFR Part 20 and 10 CFR Part 50 Appendix I.

It has been assumed that a construction worker exposure time is 40 hours per week for 52 weeks. Since construction projects can involve significant overtime for construction workers the annual dose to a construction worker could be higher. The dose would be higher in proportion to the amount of time over 40 hours per week. If the construction worker worked 60 hours per week for 52 weeks the dose presented in Table 12.4-201 would increase by 50%. Even considering the most limiting case of 84 hours per week, when compared to the dose limits presented in Table 12.4-201, the dose to the construction worker is still well below the 10 CFR 20.1301 public dose limit.

12.4.1.9.5. Operating Unit Radiological Surveys

STD SUP 12.4-1

The operating unit conducts radiological surveys in the unrestricted and controlled area and radiological surveys for radioactive materials in effluents discharge to unrestricted and controlled areas in implementing 10 CFR 20.1302. These surveys demonstrate compliance with the dose limits of 10 CFR 20.1301 for construction workers.

## 12.4.4 REFERENCES

HAR SUP 12.4-1

201. Progress Energy Carolinas, Inc. (PEC), "Shearon Harris Nuclear Power Plant Annual Radioactive Effluent Release Report: January 1, 2004 to December 31, 2004".

202. Progress Energy Carolinas, Inc., "Shearon Harris Nuclear Power Plant Off-Site Dose Calculation Manual (ODCM)," Revision 17, Docket No. STN-50-400," November 30, 2004.

203. Progress Energy Carolinas, Inc. (PEC), "Shearon Harris Nuclear Power Plant Annual Radioactive Effluent Release Report: January 1, 2008 through December 31, 2008".

204. Nuclear Generation Group, "Area Thermoluminescent Dosimeter (TLD) Monitoring," DOS-NGGC-0010, Revision 7, 2006, Nuclear Generation Group Standard Procedure Volume 99 Book/Part 99, information obtained from the HNP TLD monitoring group via a request for information.

205. Progress Energy Carolinas, Inc. (PEC), "Shearon Harris Nuclear Power Plant Annual Radioactive Effluent Release Report: January 1 2007 to December 31, 2007".

206. Progress Energy Carolinas, Inc. (PEC), "Shearon Harris Nuclear Power Plant Annual Radioactive Effluent Release Report: January 1 2010 to December 31, 2010".

HAR SUP 12.4-1

**Table 12.4-201**
**Comparison of HAR Construction Worker Estimated Radiation Doses Compared to 10 CFR 20.1301 Public Dose Criteria**

| Type of Radiation Dose | Public Dose Limits 10 CFR 20.1301 | Estimated HAR Construction Worker Dose |
|---|---|---|
| Total effective dose equivalent (TEDE) | 100 mrem/yr | Approximately 38.2 mrem/yr[(a)] |
| Maximum dose in any one hour | 2 mrem | Less than 1 mrem |

(a) The largest contribution to the TEDE is from the external dose assumed from active HNP operations (31 mrem/yr). Doses contributed by liquid effluents from HNP and HAR 2 provide an additional 0.8 mrem/yr. Doses contributed by gaseous effluents from HNP and HAR 2 provide an additional 6.4 mrem/yr.