VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
UNIT NOS. 1 & 2

HEALTH PHYSICS SURVEY - AIR SAMPLING

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SAFETY RELATED

HEALTH PHYSICS SURVEY - AIR SAMPLING

1.0 PURPOSE

1.1 This procedure establishes the equipment, techniques and calculations to be followed for air sampling.

2.0 REFERENCES

2.1 10CFR20

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Air samples are to be obtained as scheduled in Procedure HP-3.3.1, Health Physics Survey - Station.

3.2 Air samples are to be taken as stated on current RWP's.

3.3 Sampling of ventilation ducts is described in Procedure HP-3.2.2, Radioactive Gaseous Waste Sampling and Release Rate.

3.4 Any area accessible to personnel with a beta-gamma air concentration in excess of 1×10^{-9} μCi/ml or alpha in excess of 1×10^{-11} is to be posted: CAUTION AIRBORNE RADIOACTIVITY AREA. RWP REQUIRED FOR EXTRANCE.

3.5 In lieu of 3.4 above, if the concentration of the radionuclides present have been established, the ratios of the concentration to the MPC of each nuclide may be summed to determined if posting is required. If the sum is greater than one (1) <u>or</u> if individuals are expected to be in the area greater than 10 hours per week and the sum is greater than point two five (0.25) posting is required. (See 10CFR20.203(d).)

3.0 PRECAUTIONS AND LIMITATIONS (cont.)

3.6 Records of the results of all air samples taken to comply with this procedure shall be kept for the life of the station. The results may be entered on or attached to HP Survey Forms, or entered in the HP Log, or on separate sheets or forms for that purpose.

4.0 INSTRUCTIONS

4.1 Noble Gases - Sampling

4.1.1 The following equipment is required.

1) 100 cc chamber with mylar window.

2) Hand aspirator bulb with short length of tubing attached (optional).

4.1.2 Obtain the sample as follows:

1) Method One:

a) Remove the top of the chamber and wave the chamber in the atmosphere to be sampled.

b) Replace top securely.

2) Method Two:

a) Attach hand aspirating bulb to chamber and open both petcocks.

b) Purge chamber sufficiently (Adequate purging of the collection chamber is accomplished by drawing air through the collection chamber using the hand aspirating bulb. Approximately 10 aspirations will provide a representative gas sample).

4.0 INSTRUCTIONS (cont.)

c) Upon completion of purging close petcocks.

4.2 Particulates - Sampling

4.2.1 The following equipment is required:

1) Sampling pump with flow meter and sampling head attached.

2) 47 mm Gelman Type A/E filter or equivalent.

4.2.2 Obtain the sample as follows:

1) Install the filter in the sampling head.

2) Select an appropriate sampling flow rate and time interval to obtain sufficient sample for the activity sought.

NOTE: If radioiodine is to be sampled, the particulate filter from that sample may be used in place of this sample.

4.3 Radioiodine Sampling

4.3.1 The following equipment is required:

1) Sampling pump with flow meter and sampling head suitable for filter cartridge attached.

2) 47 mm Gelman Type A/E filter or equivalent and a Silver Zeolite cartridge or equivalent.

4.3.2 Obtain the sample as follows:

1) Install the filter in the sampling head with the Type A/E filter upstream of the filter cartridge.

2) Select an appropriate sampling flow rate and time interval to obtain sufficient sample for the activity sought.

4.0 INSTRUCTIONS (cont.)

4.4 Tritium Sampling

4.4.1 The following equipment is required:

1) MSA portable sampling pump or equivalent.

2) Midget impinger with 20 mls of demineralized water added.

3) Filter holder plus particulate filter.

4) Tubing to connect the above items.

4.4.2 Obtain the sample as follows:

1) Assemble sampling apparatus such that the filter is upstream of the impinger and the impinger is upstream of the pump.

2) Start pump and adjust flow to 2 scfh and sample for appropriate time interval.

4.5 Subatmospheric Containment Sampling Considerations

Air sample volumes to be determined using information obtained from a flow rate meter float under a vacuum (or pressure) other than standard pressure of 14.7 PSIA need the flow rate corrected before calculating the volume.

4.5.1 If the air sampler has a vacuum gauge attached correct the indicated flow rate to standard pressure flow rate:

1) Determine total PSIA of Containment sampled from the Control Room.

2) Note the inches of Mercury shown on the pump's vacuum gauge.

3) Calculate standard pressure flow rate by:

$$\text{Flow Rate} = \frac{\text{Indicated Flow}}{\left(\dfrac{29.93}{(2.036 \times \text{PSIA}) - \text{Pump Vacuum}}\right)^{1/2}}$$

4.0 INSTRUCTIONS (cont.)

4.5.2 If the air sampler does not have a vacuum gauge attached correct the indicated flow rate to standard pressure flow rate:

1) Determine total PSIA of Containment sampled from the Control Room.

2) Calculate standard pressure flow rate by:

$$\text{Flow Rate:} \quad \frac{\text{Indicated Flow}}{\left(\frac{14.7}{\text{PSIA}}\right)^{\frac{1}{2}}}$$

4.5.3 Flow rates referred to in calculating air sample activity in the procedure are to be the corrected flow rates.

4.5.4 When entering or exiting a containment with a closed 100 cc chamber rotate the petcocks periodically to prevent pressure damage to the mylar window.

4.6 Constant Air Monitoring

4.6.1 To use a portable constant air monitor as an alert or alarm monitor for airborne particulate activity in a given area follow the steps below which are based on 2 hours of exposure in any one day, an MPC of 1×10^{-9} µCi/ml, a flow rate of 1 cfm and a counter efficiency of 25%.

1) Install a clean filter in the sampler.

2) Set the alarm point at 2000 cpm above background.

3) Start pump and adjust flow to 1 cfm.

4) If no alarm has occurred at the end of two hours the filter may be replaced, or the alarm point may be reset as current cpm plus 2000, or leave the set point as is.

4.0 INSTRUCTIONS (cont.)

4.6.2 To use a constant air monitor to obtain continuous samples of airborne particulate activity, set up as follows:

1) Install a clean filter in the sampler.

2) Set the alarm point for MPC based on the anticipated run time of the sample.

3) Start pump and set flow rate, noting the date, time and flow rate.

4) Remove filter at the end of the run, noting date, time and flow rate.

4.6.3 Emergency Iodine samples, using RadeCo He 809V-1 and Silver Zeolite cartridges.

(1) Install a Silver Zeolite cartridge in the air sampler.

(2) Consider precautions when entering airborne areas, such as full anti "c's", SCBA, preset flow to air sampler and record flow rate.

(3) Go to the area of interest.

(4) Start H-809V-1. Note date, time and use pre-set flow rate.

(5) Leave the area until time has elapsed on sampler for approximately 1 SCF.

(6) Return to area sampler, pick up the sampler and return to a "clean" area.

(7) Place the Silver Zeolite cartridge in a small plastic bag. Record flow rate, times, date and radiation reading.

4.0 INSTRUCTIONS (cont.)

(a) If the radiation intensity is too high, precautions will have to be taken prior to counting, i.e., changing the geometry.

NOTE: Silver Zeolite has a retention efficiency for Xenon of less than 5 x 10^{-6} per cent.

4.6.4 Emergency Iodine sampling of process and ventilation vents, using in line samplers and Silver Zeolite cartridges.

(a) Replace the existing charcoal cartridges with a Silver Zeolite cartridge.

(b) Record the flow rate, time, date, etc.

(c) Leave the area if high exposures are observed, until the necessary flow rate has elapsed. A sample of approximately 1 SCF should be sufficient.

(d) Return to in-line sampler and replace the used Silver Zeolite cartridge with another Silver Zeolite cartridge, again record time, date and flow rate.

(e) Place the used Silver Zeolite cartridge in a plastic bag with time, date, total flow rate and check with appropriate radiation detection instrument.

(f) If the radiation reading is above 1 mr/hr, take the necessary precautions prior to counting, i.e., change the geometry, shorter count time, etc. Make sure the ND 6650 is calibrated for a different geometry.

4.0 INSTRUCTIONS (cont.)

4.7 Counting Air Samples

4.7.1 Noble Gases

1) Ensure the 100 cc chamber is free from removable external contamination or place in clean poly bag.

2) Count the sample for gamma emitters using a GeLi detector and Procedure HP-3.4.1.3. Mylar window is to be facing the detector.

3) Results are to be expressed as μCi/ml for each nuclide identified.

4.7.2 Particulates, Gross Beta-Gamma or Alpha

1) Use either the PC-4 or PC-5 Proportional counter and Procedure HP-3.4.1.2 or HP-3.4.1.5 respectively and count for activity sought in sample.

2) Calculate the μCi/ml by:

$$\frac{\mu Ci}{ml} = \frac{\mu Ci \text{ of activity}}{2.83 \times 10^{4} \times \text{CFM flow rate} \times \text{minutes sampled}}$$

3) Results are to be expressed as μCi/ml beta-gamma or μCi/ml alpha.

4.7.3 Particulates - Gamma Isotopic

1) Place the filter paper in a poly bag or equivalent.

2) Count the sample for gamma emitters using a GeLi detector and Procedure HP-3.4.1.3.

3) Results are to be expressed as μCi/ml for each nuclide identified.

4.7.4 Radioiodine

1) Place both filters in a poly bag or equivalent with filter next to the upstream face of the cartridge.

4.0 INSTRUCTIONS (cont.)

2) Place the upstream face of the cartridge next to a GeLi Detector and count for gamma emitters per Procedure HP-3.4.1.3.

3) Results are to be expressed as µCi/ml for each radioiodine identified.

4.7.5 Tritium

1) Transfer 3 mls of water from the impinger to a liquid scintillation counting vial and add 12 mls of scintillation solution. Shake to mix.

2) Count sample for tritium using the LS-100C and Procedure HP-3.4.1.1. This procedure will give µCi per sample.

3) Calculate µCi/ml by:

$$\frac{\mu Ci}{ml} = \frac{\mu Ci \text{ per sample} \times 0.014}{\text{cfh flow rate} \times \text{min. sampled}}$$

$$\text{where } 0.014 = \frac{20 \text{ ml}}{3 \text{ ml}} \times \frac{60 \text{ min.}}{\text{hr}} \times \frac{1 \text{ ft}^3}{2.83 \times 104 \text{ ml}}$$

4) Results are to be expressed as µCl/ml tritium.

4.8 Radon Daughter Interference

Radon 222 has an MPC of 3×10^{-8} µCi/ml and is a common naturally occurring nuclide. It is a gas which has 10 different radioactive particulate daughters which may or may not be in equilibrium with their parent. Radon or its daughters emit alpha, beta and gamma radiation and since Radon has a higher MPC than the Station's MPC's for beta-gamma or alpha, contribution from this source must be recognized and accounted for. Alpha airborne activity should normally not result from Station operations.

4.0 INSTRUCTIONS (cont.)

4.8.1 Suspect Radon daughter activity if an air sample indicates greater than 1×10^{-9} µCi/ml beta-gamma and a possible source of airborne activity from Station operations is not apparent.

4.8.2 The following methods can be used, as appropriate, to indicate if the activity is from Radon 222.

1) Obtain another air sample in a different location which can reasonably be assumed to be free from airborne activity of Station origin. If results are similar, the activity is probably naturally occurring.

2) Count the sample for alpha activity, the presence of alpha would indicate radon daughters.

3) Count the sample (for either alpha or beta-gamma) at spaced time intervals. A decreasing activity would indicated radon daughters which will decay with approximately a 30 minute half-life due to Lead 214.

4) Take a high volume air sample and count for gamma emitters to identify source.