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North Carolina State University

Nuclear Reactor Program
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19 February 1996

Radiation Program Manager
United States Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365

Subject: Radionuclide Annual Emissions Report for North Carolina State University
PULSTAR Research Reactor

Reference: 40 CFR 61.104

Dear Sir/Madam,

Attached is the North Carolina State University PULSTAR reactor facility's "Radionuclide Annual Emissions Report" for 1995. The reporting requirements from 40 CFR 61.104 (a)(1) are itemized on this attachment. Also included is the output from the computer code COMPLY version 1.5d. If you have any questions or comments please contact me at (919) 515-4602 or Gerald Wicks, CHP at (919) 515-4601.

"I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 U.S.C. 1001."

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A handwritten signature in cursive script, reading "Pedro B. Perez".

Pedro B. Perez
Associate Director,
Nuclear Reactor Program

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PDR ADOCK 05000297
R PDR

cc: G. Wicks, CHP, NCSU
C. Mayo, Ph.D., NCSU RSAC Chairman
M. Harrison, Ph.D., NCSU Radiation Protection Office
C. Bassett, U.S. Nuclear Regulatory Commission, Region IV

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ATTACHMENT
40 CFR 61.104 Reporting Requirements

40 CFR 61.104 (a)(1)

R E S P O N S E

- Item (i) North Carolina State University PULSTAR Nuclear Reactor
- Item (ii) Operation of facility: Chancellor Larry Monteith
Administered by: Pedro B. Perez, Associate Director - Nuclear Reactor Program
Preparation of report: Gerald Wicks, CHP, Reactor Health Physicist
- Items (iii) & (iv) North Carolina State University
Nuclear Reactor Program
Box 7909
Burlington Engineering Laboratory
Raleigh, NC 27695 - 7909
- Item (v) Special nuclear material, fission products, and activation products
(Reactor fuel and byproducts)
- Items (vi) & (vii) Nuclear fuel is used as allowed by our facility license R-120 issued by the US Nuclear Regulatory Commission and in accordance with the facility Technical Specifications and Final Safety Analysis Report. The reactor fuel is contained in fuel rods and surrounded by a pool of high quality water. Nuclear fission produces radioactive materials. Activation products are produced by neutron activation of reactor components and impurities in the pool of water. Monitoring methods are used to detect leakage of fission products from the fuel rods and activation products. Normally only activation products are present in the pool water. Radioactive materials in the pool water are processed by a filter/ion exchange demineralizer to maintain water quality. If pool water was to leak from the pool, it would be collected by the liquid waste collection system. The pool is open to the interior of a Confinement Building designed to confine the release of materials. The Confinement Building is maintained at a negative pressure with respect to the outside environment to ensure that contaminated air would not leak out of this building. Airborne activity leaving the open pool (by evaporation or diffusion) is monitored for radioactivity. If the airborne level exceeds a designated value, air is passed through a High Efficiency Particulate Absorber filter and charcoal filter before being exhausted to the outside environment through an elevated (100 feet) stack. This stack is the only release point of airborne effluents.
- Item (viii) Effluent controls used on the stack are:
- Particulate radiation monitor sensitive to 2 E-7 $\mu\text{Ci}/\text{ml}$ of ^{41}Ar , 6 E-7 $\mu\text{Ci}/\text{ml}$ of ^{86}Kr , and 4 E-6 $\mu\text{Ci}/\text{ml}$ of ^{133}Xe
 - Gaseous radiation monitor sensitive to 3 E-10 $\mu\text{Ci}/\text{ml}$ of ^{60}Co , 8 E-11 $\mu\text{Ci}/\text{ml}$ of $^{90}\text{Sr}/^{90}\text{Y}$, and 2 E-10 $\mu\text{Ci}/\text{ml}$ of ^{137}Cs
 - HEPA filter rated at 99.97% removal efficiency for particulates $> 0.3 \mu$
 - Charcoal filter rated at 99% removal efficiency for halogens
 - Diluting process air flow of 12,500 cfm from other building areas.
PULSTAR reactor air flow is 10,500 cfm for normal ventilation and 600 cfm if the HEPA and Charcoal filters are in use (confinement mode). Dilution factors of 2.2 and 18.5 are provided for normal and confinement mode of ventilation.

ATTACHMENT
40 CFR 61.104 Reporting Requirements continued

40 CFR 61.104 (a)(1)

R E S P O N S E

- Item (ix) Distances from point of release to nearest:
- Residence is taken as 200 m
 - School is taken as 200 m
 - Business is 200 m
 - Office is 17 m
 - Farm is taken as 200 m
- 200 m is the distance to the nearest street located off campus.
17 m is the distance from the top of the stack to the third floor of Burlington Engineering Lab (BEL). Offices and classrooms are present on the third floor of the BEL.
- Item (x) For 1995, the effective dose is calculated by the computer code COMPLY version 1.5d to be 3.9 mrem/y. (See attached printout)
- Item (xi) 1.9 Ci of ^{41}Ar was released as a gas from the 100 foot stack as determined by stack radiation monitors. No particulate radionuclides were detected as determined by stack radiation monitors or gamma spectroscopy of particulate filters.
- Item (xii) Stack volumetric flow: 10.38 m³/s (22,500 cfm)
Stack diameter: 0.5 m
Stack release height: 30 m (100 feet)
Effluent temperature: ~ 15 to 30 °C (~ 60 to 90 °F)
- Stack flow was determined from facility licensing documents and equipment specifications.
Stack diameter and height were determined by facility drawings.
Effluent temperature was determined from thermometer readings taken in the reactor building (room air is exhausted).
- Item (xiii) Height: 13 m as determined from facility drawings
Width: 54 m as determined from facility drawings
- Item (xiv) COMPLY Level 4 data was used. No specific wind rose data was used.
- Item (xv) None
- Item (xvi) See cover letter

COMPLY: V1.5d.

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40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH
THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS
FROM THE COMPLY CODE, VERSION 1.5d

Prepared by:

North Carolina State University
PULSTAR Nuclear Reactor
Raleigh, NC

Gerald Wicks, CHP, Reactor Health Physicist

(919) 515-4601

Prepared for:

U.S. Environmental Protection Agency
Office of Radiation Programs

COMPLY: V1.5d.

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Off Site Dose Calculation

SCREENING LEVEL 4

DATA ENTERED:

Nuclide	Release Rate (curies/YEAR)
AR-41	1.910E+00

Release height 30 meters.

Building height 13 meters.

The source and receptor are on the same building.

Stack diameter 0.50 meters.

Distance from the source to the receptor is 20 meters.

Building width 54 meters.

Default volumetric flow rate from the stack not used.
Volumetric flow rate is 10.380 cu m/sec.

Default mean wind speed used (2.0 m/sec).

Distance from the SOURCE to the FARM producing
VEGETABLES is 200 meters.

Distance from the SOURCE to the FARM producing
MILK is 200 meters.

Distance from the SOURCE to the FARM producing
MEAT is 200 meters.

NOTES:

Input parameters outside the "normal" range:

Stack flow is unusually HIGH.

COMPLY: V1.5d.

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RESULTS:

Effective dose equivalent: 3.9 mrem/yr.

*** Comply at level 4.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****