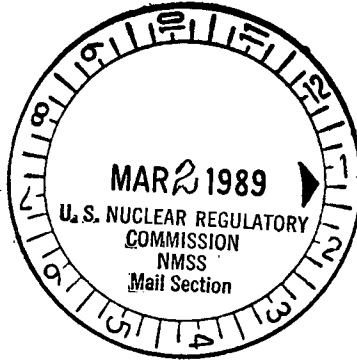
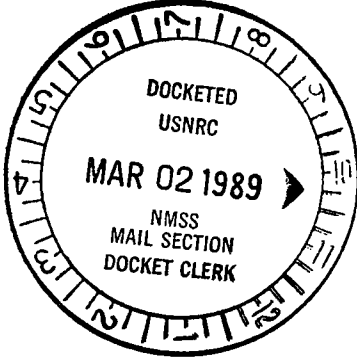


RETURN TO ~~396 SS~~ ³⁹⁴⁻¹³⁷

M-54
PDR



Nuclear Assurance Corporation
6251 Crooked Creek Road
Suite 200
Norcross, Georgia 30092
(404) 447-1144
Telex: 6827020
FAX # (404) 447-1797

Weinbergstrasse 9
8001 Zurich, Switzerland
1-470844
Telex: 57275

March 1, 1989
AHW/89/022/ETS

*** VIA FEDERAL EXPRESS ***

Mr. John Roberts
Fuel Cycle Safety Branch
Division of Fuel Cycle, Medical,
Academic and Commercial Use Safety
Office of Nuclear Material Safety & Safeguards
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Dear Mr. Roberts:

The enclosed letter to Mr. D. P. Batalo of Virginia Power Company from Nuclear Assurance Corporation (NAC) provides information on surface fluxes and dose rates that were obtained to support inclusion of the NAC-I28 S/T cask in the Surry Independent Spent Fuel Storage Installation (ISFSI) Safety Analysis Report (SAR).

Please assign a document number to this letter so that Virginia Power Company may properly reference these results in the Surry ISFSI SAR.

Thank you for your attention to this matter.

Sincerely,

NUCLEAR ASSURANCE CORPORATION

Alan H Wells

Alan H. Wells, PhD
Manager, Licensing and Analysis
Engineering and Transportation Systems

AHW/tko
Enclosures

8903130650 890301
PDR PROJ
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Additional info

25242

DOCKET NO. M-54
CONTROL NO. 25242
DATE OF DOC. March 1, 1989
DATE RCVD. March 2, 1989
FCUF PDR
FCAF LPDR
I & E REF.
SAFEGUARDS
FCTC OTHER
DATE 3/2/89 INITIAL JW

Nuclear Assurance Corporation
6251 Crooked Creek Road
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December 22, 1988
AHW/88/193/ETS

***** VIA FEDERAL EXPRESS *****

Mr. D. P. Batalo
Virginia Power Company
Engineering and Construction Department
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Dear Mr. Batalo:

Nuclear Assurance Corporation (NAC) has completed its analysis of the NAC Storage/Transport (S/T) cask containing 28 intact fuel assemblies with burnups of 22, 35, and 45 GWD/MTU. These analyses were performed with the BUGLE shielding library to better support your ISFSI computer program. The data that you requested, specifically the neutron fluxes in the BUGLE structure at the side and top of the cask, were generated directly by XSDRNPM. The BUGLE gamma structure consists of twenty energy groups, so it was necessary to collapse the fluxes into the seven-group energy bin required by the ISFSI computer program. The neutron fluxes, in the BUGLE structure, are enclosed along with the dose rate per energy group. Also enclosed are the gamma fluxes, in the BUGLE structure with the dose rate per energy group, and in the seven-group energy bin structure. The contact dose rates from gammas and neutrons are tabulated with each flux table. The last table enclosed is the source decay data for all burnups. The surface areas to be used in the ISFSI computer program for any NAC S/T cask are 274,236 cm² and 38,133 cm² for the side and top, respectively.

NAC has run the ISFSI code that you provided to evaluate the dose rate at 2560 meters. A comparison of dose rates is summarized below:

<u>GNS</u>	<u>NAC-I28 22 GWD/MTU</u>	<u>NAC-I28 35 GWD/MTU</u>	<u>NAC-I28 45 GWD/MTU</u>	<u>ISFSI LIMIT</u>
2.51×10^{-12}	3.86×10^{-13}	4.14×10^{-12}	1.38×10^{-11}	7.5×10^{-12}

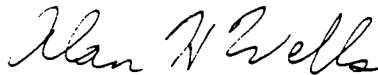
As you can see, the NAC-I28 satisfies your site limit for 35,000 MWD/MTU and the 22,000 that will actually be loaded. A revision to the site limit will be necessary for the 45,000. This is because NAC incorporates high energy neutron contributions, which GNS neglects, resulting in a higher dose rate at 2460 meters from the ISFSI.

Work is continuing on providing you with the same data for the NAC S/T cask containing 31 assemblies, 26 assemblies, and 28 consolidated canisters. This information will follow shortly.

Please call me if you have any additional questions.

Sincerely,

NUCLEAR ASSURANCE CORPORATION



Alan H. Wells, PhD
Manager, Licensing and Analysis
Engineering and Transportation Systems

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I28 SIDE FLUXES AND DOSES - BUGLE LIB - 45,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	1.641E-02	3.533E-03
2	1.287E+01	5.743E-02	1.097E-02
3	1.074E+01	2.107E-01	3.337E-02
4	9.071E+00	3.879E-01	5.704E-02
5	7.808E+00	6.659E-01	9.792E-02
6	6.513E+00	1.421E+00	2.116E-01
7	5.332E+00	1.925E+00	2.973E-01
8	4.108E+00	3.514E+00	5.154E-01
9	3.234E+00	2.921E+00	3.967E-01
10	2.821E+00	1.819E+00	2.364E-01
11	2.552E+00	2.050E+00	2.580E-01
12	2.399E+00	1.066E+00	1.336E-01
13	2.352E+00	2.381E-01	2.986E-02
14	2.269E+00	1.320E+00	1.659E-01
15	2.024E+00	4.057E+00	5.132E-01
16	1.742E+00	4.449E+00	5.675E-01
17	1.453E+00	6.441E+00	8.300E-01
18	1.120E+00	1.127E+01	1.474E+00
19	8.624E-01	7.183E+00	8.768E-01
20	7.948E-01	3.412E+00	3.996E-01
21	6.979E-01	6.998E+00	7.673E-01
22	5.714E-01	6.672E+00	6.610E-01
23	4.549E-01	8.107E+00	6.894E-01
24	3.450E-01	5.628E+00	3.731E-01
25	2.592E-01	9.320E+00	4.776E-01
26	1.591E-01	7.700E+00	2.543E-01
27	9.652E-02	5.692E+00	1.204E-01
28	5.854E-02	4.837E+00	6.909E-02
29	3.786E-02	1.857E+00	1.884E-02
30	2.991E-02	8.694E-01	7.332E-03
31	2.543E-02	1.371E+00	1.018E-02
32	2.341E-02	1.069E+00	7.440E-03
33	1.960E-02	2.721E+00	1.647E-02
34	1.239E-02	5.840E+00	2.467E-02
35	5.853E-03	4.757E+00	1.696E-02
36	2.765E-03	5.099E+00	1.848E-02
37	1.208E-03	9.262E+00	3.453E-02
38	3.742E-04	5.068E+00	1.989E-02
39	1.767E-04	5.373E+00	2.186E-02
40	7.996E-05	7.373E+00	3.113E-02
41	2.840E-05	9.511E+00	4.191E-02
42	8.799E-06	5.855E+00	2.663E-02
43	3.981E-06	6.947E+00	3.181E-02
44	1.529E-06	5.220E+00	2.360E-02
45	7.223E-07	4.915E+00	2.157E-02
46	3.093E-07	8.337E+00	3.456E-02
47	6.667E-08	6.952E+00	2.554E-02

TOTAL DOSE ON CONTACT -

10.95427 mrem/hr

I28 SIDE FLUXES AND DOSES - BUGLE LIB - 45,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	8.119E-02	1.081E-03
2	8.940E+00	1.302E+02	1.136E+00
3	7.500E+00	2.224E+02	1.704E+00
4	6.500E+00	7.614E+01	5.274E-01
5	5.500E+00	7.924E+01	4.906E-01
6	4.470E+00	9.284E+01	5.008E-01
7	3.460E+00	1.140E+02	5.238E-01
8	2.500E+00	3.370E+02	1.254E+00
9	1.750E+00	1.372E+03	4.021E+00
*10	1.250E+00	1.759E+03	4.080E+00
11	8.900E-01	1.113E+03	2.024E+00
12	7.500E-01	6.465E+02	1.037E+00
13	6.500E-01	7.382E+02	1.065E+00
14	4.900E-01	4.288E+03	4.883E+00
15	3.000E-01	5.170E+03	3.923E+00
16	1.400E-01	3.410E+03	1.218E+00
17	8.000E-02	2.226E+02	5.804E-02
18	4.500E-02	1.023E+00	3.243E-04
19	2.500E-02	2.459E-03	2.664E-06
20	1.500E-02	6.842E-04	1.959E-06

TOTAL DOSE ON CONTACT -

28.44656 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	0.4	8.805E+03
2	0.8	5.673E+03
3	1.3	2.184E+03
4	1.7	1.237E+03
5	2.2	8.908E+02
6	2.5	1.011E+02
7	2.8	8.834E+02

* The contribution from CO-60 has been added to this group

I28 TOP FLUXES AND DOSES - BUGLE LIB - 45,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	3.310E-03	7.124E-04
2	1.287E+01	1.353E-02	2.585E-03
3	1.074E+01	6.084E-02	9.634E-03
4	9.071E+00	1.344E-01	1.976E-02
5	7.808E+00	2.668E-01	3.924E-02
6	6.513E+00	6.765E-01	1.008E-01
7	5.332E+00	9.719E-01	1.501E-01
8	4.108E+00	1.831E+00	2.685E-01
9	3.234E+00	1.762E+00	2.392E-01
10	2.821E+00	1.361E+00	1.769E-01
11	2.552E+00	1.764E+00	2.219E-01
12	2.399E+00	9.651E-01	1.209E-01
13	2.352E+00	2.756E-01	3.457E-02
14	2.269E+00	1.443E+00	1.814E-01
15	2.024E+00	4.252E+00	5.378E-01
16	1.742E+00	5.394E+00	6.880E-01
17	1.453E+00	8.649E+00	1.114E+00
18	1.120E+00	2.089E+01	2.731E+00
19	8.624E-01	1.694E+01	2.068E+00
20	7.948E-01	8.073E+00	9.454E-01
21	6.979E-01	2.484E+01	2.724E+00
22	5.714E-01	3.123E+01	3.094E+00
23	4.549E-01	3.766E+01	3.202E+00
24	3.450E-01	3.338E+01	2.213E+00
25	2.592E-01	5.619E+01	2.880E+00
26	1.591E-01	5.150E+01	1.701E+00
27	9.652E-02	3.990E+01	8.437E-01
28	5.854E-02	3.770E+01	5.385E-01
29	3.786E-02	1.466E+01	1.488E-01
30	2.991E-02	7.435E+00	6.271E-02
31	2.543E-02	1.042E+01	7.736E-02
32	2.341E-02	7.521E+00	5.234E-02
33	1.960E-02	2.200E+01	1.332E-01
34	1.239E-02	4.967E+01	2.099E-01
35	5.853E-03	4.573E+01	1.631E-01
36	2.765E-03	5.235E+01	1.897E-01
37	1.208E-03	9.913E+01	3.695E-01
38	3.742E-04	5.915E+01	2.321E-01
39	1.767E-04	6.569E+01	2.672E-01
40	7.996E-05	9.453E+01	3.992E-01
41	2.840E-05	1.271E+02	5.601E-01
42	8.799E-06	8.014E+01	3.645E-01
43	3.981E-06	9.657E+01	4.421E-01
44	1.529E-06	7.290E+01	3.295E-01
45	7.223E-07	6.911E+01	3.033E-01
46	3.093E-07	1.181E+02	4.898E-01
47	6.667E-08	9.782E+01	3.594E-01

TOTAL DOSE ON CONTACT -

32.05766 mrem/hr

I28 TOP FLUXES AND DOSES - BUGLE LIB - 45,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	9.740E-03	1.296E-04
2	8.940E+00	2.995E+01	2.614E-01
3	7.500E+00	5.247E+01	4.021E-01
4	6.500E+00	1.741E+01	1.206E-01
5	5.500E+00	1.811E+01	1.121E-01
6	4.470E+00	2.044E+01	1.103E-01
7	3.460E+00	2.588E+01	1.189E-01
8	2.500E+00	6.555E+01	2.439E-01
9	1.750E+00	3.882E+02	1.137E+00
*10	1.250E+00	2.048E+04	4.751E+01
11	8.900E-01	3.501E+02	6.368E-01
12	7.500E-01	2.104E+02	3.375E-01
13	6.500E-01	2.446E+02	3.527E-01
14	4.900E-01	1.102E+03	1.255E+00
15	3.000E-01	1.304E+03	9.891E-01
16	1.400E-01	7.680E+02	2.743E-01
17	8.000E-02	4.756E+01	1.240E-02
18	4.500E-02	4.329E-01	1.373E-04
19	2.500E-02	1.007E-02	1.091E-05
20	1.500E-02	2.329E-03	6.668E-06

TOTAL DOSE ON CONTACT -

53.885467 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	0.4	2.120E+03
2	0.8	1.557E+03
3	1.3	2.062E+04
4	1.7	3.597E+02
5	2.2	2.460E+02
6	2.5	1.966E+01
7	2.8	1.971E+02

* The contribution from CO-60 has been added to this group

I28 SIDE FLUXES AND DOSES - BUGLE LIB - 35,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	4.849E-03	1.044E-03
2	1.287E+01	1.697E-02	3.242E-03
3	1.074E+01	6.225E-02	9.858E-03
4	9.071E+00	1.146E-01	1.685E-02
5	7.808E+00	1.967E-01	2.893E-02
6	6.513E+00	4.197E-01	6.252E-02
7	5.332E+00	5.686E-01	8.782E-02
8	4.108E+00	1.038E+00	1.523E-01
9	3.234E+00	8.630E-01	1.172E-01
10	2.821E+00	5.373E-01	6.982E-02
11	2.552E+00	6.057E-01	7.622E-02
12	2.399E+00	3.151E-01	3.947E-02
13	2.352E+00	7.033E-02	8.821E-03
14	2.269E+00	3.899E-01	4.900E-02
15	2.024E+00	1.199E+00	1.516E-01
16	1.742E+00	1.314E+00	1.677E-01
17	1.453E+00	1.903E+00	2.452E-01
18	1.120E+00	3.331E+00	4.355E-01
19	8.624E-01	2.122E+00	2.590E-01
20	7.948E-01	1.008E+00	1.181E-01
21	6.979E-01	2.067E+00	2.267E-01
22	5.714E-01	1.971E+00	1.953E-01
23	4.549E-01	2.395E+00	2.037E-01
24	3.450E-01	1.663E+00	1.102E-01
25	2.592E-01	2.753E+00	1.411E-01
26	1.591E-01	2.275E+00	7.514E-02
27	9.652E-02	1.682E+00	3.556E-02
28	5.854E-02	1.429E+00	2.041E-02
29	3.786E-02	5.486E-01	5.567E-03
30	2.991E-02	2.568E-01	2.166E-03
31	2.543E-02	4.051E-01	3.009E-03
32	2.341E-02	3.159E-01	2.198E-03
33	1.960E-02	8.037E-01	4.865E-03
34	1.239E-02	1.725E+00	7.289E-03
35	5.853E-03	1.405E+00	5.011E-03
36	2.765E-03	1.506E+00	5.460E-03
37	1.208E-03	2.736E+00	1.020E-02
38	3.742E-04	1.497E+00	5.875E-03
39	1.767E-04	1.587E+00	6.457E-03
40	7.996E-05	2.178E+00	9.198E-03
41	2.840E-05	2.810E+00	1.238E-02
42	8.799E-06	1.730E+00	7.867E-03
43	3.981E-06	2.052E+00	9.396E-03
44	1.529E-06	1.542E+00	6.971E-03
45	7.223E-07	1.452E+00	6.373E-03
46	3.093E-07	2.463E+00	1.021E-02
47	6.667E-08	2.054E+00	7.546E-03

TOTAL DOSE ON CONTACT -

3.236204 mrem/hr

I28 SIDE FLUXES AND DOSES - BUGLE LIB - 35,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	2.398E-02	3.192E-04
2	8.940E+00	3.846E+01	3.356E-01
3	7.500E+00	6.570E+01	5.034E-01
4	6.500E+00	2.249E+01	1.558E-01
5	5.500E+00	2.341E+01	1.449E-01
6	4.470E+00	2.743E+01	1.480E-01
7	3.460E+00	3.378E+01	1.552E-01
8	2.500E+00	1.024E+02	3.812E-01
9	1.750E+00	9.772E+02	2.863E+00
*10	1.250E+00	1.263E+03	2.930E+00
11	8.900E-01	7.895E+02	1.436E+00
12	7.500E-01	4.621E+02	7.412E-01
13	6.500E-01	5.268E+02	7.597E-01
14	4.900E-01	2.063E+03	2.350E+00
15	3.000E-01	2.634E+03	1.998E+00
16	1.400E-01	1.718E+03	6.136E-01
17	8.000E-02	1.118E+02	2.914E-02
18	4.500E-02	5.059E-01	1.604E-04
19	2.500E-02	7.296E-04	7.902E-07
20	1.500E-02	2.021E-04	5.786E-07

TOTAL DOSE ON CONTACT -

15.54525 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	.4	4.464E+03
2	.8	3.052E+03
3	1.3	1.559E+03
4	1.7	8.841E+02
5	2.2	6.068E+02
6	2.5	3.073E+01
7	2.8	2.625E+02

* The contribution from CO-60 has been added to this group

I28 TOP FLUXES AND DOSES - BUGLE LIB - 35,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	9.784E-04	2.106E-04
2	1.287E+01	4.000E-03	7.641E-04
3	1.074E+01	1.799E-02	2.848E-03
4	9.071E+00	3.973E-02	5.843E-03
5	7.808E+00	7.889E-02	1.160E-02
6	6.513E+00	2.000E-01	2.979E-02
7	5.332E+00	2.873E-01	4.438E-02
8	4.108E+00	5.412E-01	7.937E-02
9	3.234E+00	5.208E-01	7.072E-02
10	2.821E+00	4.025E-01	5.230E-02
11	2.552E+00	5.214E-01	6.561E-02
12	2.399E+00	2.853E-01	3.575E-02
13	2.352E+00	8.147E-02	1.022E-02
14	2.269E+00	4.266E-01	5.362E-02
15	2.024E+00	1.257E+00	1.590E-01
16	1.742E+00	1.595E+00	2.034E-01
17	1.453E+00	2.557E+00	3.295E-01
18	1.120E+00	6.175E+00	8.074E-01
19	8.624E-01	5.007E+00	6.112E-01
20	7.948E-01	2.386E+00	2.795E-01
21	6.979E-01	7.345E+00	8.053E-01
22	5.714E-01	9.233E+00	9.147E-01
23	4.549E-01	1.113E+01	9.466E-01
24	3.450E-01	9.868E+00	6.541E-01
25	2.592E-01	1.661E+01	8.513E-01
26	1.591E-01	1.522E+01	5.029E-01
27	9.652E-02	1.180E+01	2.494E-01
28	5.854E-02	1.114E+01	1.592E-01
29	3.786E-02	4.335E+00	4.398E-02
30	2.991E-02	2.198E+00	1.854E-02
31	2.543E-02	3.079E+00	2.287E-02
32	2.341E-02	2.224E+00	1.547E-02
33	1.960E-02	6.504E+00	3.937E-02
34	1.239E-02	1.468E+01	6.204E-02
35	5.853E-03	1.352E+01	4.821E-02
36	2.765E-03	1.548E+01	5.609E-02
37	1.208E-03	2.930E+01	1.092E-01
38	3.742E-04	1.749E+01	6.862E-02
39	1.767E-04	1.942E+01	7.900E-02
40	7.996E-05	2.795E+01	1.180E-01
41	2.840E-05	3.758E+01	1.656E-01
42	8.799E-06	2.369E+01	1.077E-01
43	3.981E-06	2.855E+01	1.307E-01
44	1.529E-06	2.155E+01	9.741E-02
45	7.223E-07	2.043E+01	8.967E-02
46	3.093E-07	3.492E+01	1.448E-01
47	6.667E-08	2.892E+01	1.062E-01

TOTAL DOSE ON CONTACT -

9.459991 mrem/hr

I28 TOP FLUXES AND DOSES - BUGLE LIB - 35,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	2.877E-03	3.829E-05
2	8.940E+00	8.846E+00	7.720E-02
3	7.500E+00	1.550E+01	1.188E-01
4	6.500E+00	5.141E+00	3.561E-02
5	5.500E+00	5.349E+00	3.311E-02
6	4.470E+00	6.039E+00	3.258E-02
7	3.460E+00	7.877E+00	3.618E-02
8	2.500E+00	2.204E+01	8.203E-02
9	1.750E+00	2.826E+02	8.279E-01
*10	1.250E+00	1.557E+04	3.690E+01
11	8.900E-01	2.559E+02	4.655E-01
12	7.500E-01	1.548E+02	2.484E-01
13	6.500E-01	1.798E+02	2.592E-01
14	4.900E-01	6.092E+02	6.938E-01
15	3.000E-01	7.903E+02	5.996E-01
16	1.400E-01	4.589E+02	1.639E-01
17	8.000E-02	2.838E+01	7.399E-03
18	4.500E-02	2.010E-01	6.373E-05
19	2.500E-02	2.976E-03	3.223E-06
20	1.500E-02	6.880E-04	1.970E-06

TOTAL DOSE ON CONTACT -

40.58202 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	.4	1.278E+03
2	.8	9.438E+02
3	1.3	1.601E+04
4	1.7	2.632E+02
5	2.2	1.740E+02
6	2.5	6.613E+00
7	2.8	5.978E+01

* The contribution from CO-60 has been added to this group

I28 SIDE FLUXES AND DOSES - BUGLE LIB - 22,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	4.549E-04	9.791E-05
2	1.287E+01	1.592E-03	3.041E-04
3	1.074E+01	5.840E-03	9.248E-04
4	9.071E+00	1.075E-02	1.581E-03
5	7.808E+00	1.845E-02	2.714E-03
6	6.513E+00	3.937E-02	5.865E-03
7	5.332E+00	5.334E-02	8.239E-03
8	4.108E+00	9.739E-02	1.428E-02
9	3.234E+00	8.096E-02	1.099E-02
10	2.821E+00	5.041E-02	6.550E-03
11	2.552E+00	5.682E-02	7.150E-03
12	2.399E+00	2.956E-02	3.703E-03
13	2.352E+00	6.598E-03	8.275E-04
14	2.269E+00	3.657E-02	4.597E-03
15	2.024E+00	1.124E-01	1.422E-02
16	1.742E+00	1.233E-01	1.573E-02
17	1.453E+00	1.785E-01	2.300E-02
18	1.120E+00	3.125E-01	4.086E-02
19	8.624E-01	1.991E-01	2.430E-02
20	7.948E-01	9.457E-02	1.108E-02
21	6.979E-01	1.940E-01	2.127E-02
22	5.714E-01	1.849E-01	1.832E-02
23	4.549E-01	2.247E-01	1.910E-02
24	3.450E-01	1.560E-01	1.034E-02
25	2.592E-01	2.583E-01	1.324E-02
26	1.591E-01	2.134E-01	7.049E-03
27	9.652E-02	1.578E-01	3.336E-03
28	5.854E-02	1.341E-01	1.915E-03
29	3.786E-02	5.146E-02	5.222E-04
30	2.991E-02	2.409E-02	2.032E-04
31	2.543E-02	3.800E-02	2.823E-04
32	2.341E-02	2.963E-02	2.062E-04
33	1.960E-02	7.540E-02	4.564E-04
34	1.239E-02	1.618E-01	6.838E-04
35	5.853E-03	1.318E-01	4.701E-04
36	2.765E-03	1.413E-01	5.122E-04
37	1.208E-03	2.567E-01	9.570E-04
38	3.742E-04	1.405E-01	5.512E-04
39	1.767E-04	1.489E-01	6.057E-04
40	7.996E-05	2.043E-01	8.629E-04
41	2.840E-05	2.636E-01	1.161E-03
42	8.799E-06	1.623E-01	7.380E-04
43	3.981E-06	1.925E-01	8.815E-04
44	1.529E-06	1.447E-01	6.539E-04
45	7.223E-07	1.362E-01	5.978E-04
46	3.093E-07	2.311E-01	9.579E-04
47	6.667E-08	1.927E-01	7.079E-04

TOTAL DOSE ON CONTACT -

.3035897 mrem/hr

I28 SIDE FLUXES AND DOSES - BUGLE LIB - 22,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	2.250E-03	2.995E-05
2	8.940E+00	3.608E+00	3.148E-02
3	7.500E+00	6.163E+00	4.722E-02
4	6.500E+00	2.110E+00	1.462E-02
5	5.500E+00	2.196E+00	1.360E-02
6	4.470E+00	2.573E+00	1.388E-02
7	3.460E+00	3.252E+00	1.494E-02
8	2.500E+00	1.219E+01	4.536E-02
9	1.750E+00	6.064E+02	1.777E+00
*10	1.250E+00	7.871E+02	1.822E+00
11	8.900E-01	4.889E+02	8.891E-01
12	7.500E-01	2.874E+02	4.610E-01
13	6.500E-01	3.274E+02	4.721E-01
14	4.900E-01	9.105E+02	1.037E+00
15	3.000E-01	1.243E+03	9.429E-01
16	1.400E-01	8.010E+02	2.860E-01
17	8.000E-02	5.189E+01	1.353E-02
18	4.500E-02	2.308E-01	7.320E-05
19	2.500E-02	7.124E-05	7.715E-08
20	1.500E-02	1.896E-05	5.428E-08

TOTAL DOSE ON CONTACT -

7.881295 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	.4	2.096E+03
2	.8	1.525E+03
3	1.3	9.687E+02
4	1.7	5.498E+02
5	2.2	3.663E+02
6	2.5	3.657E+00
7	2.8	2.600E+01

* The contribution from CO-60 has been added to this group

I28 TOP FLUXES AND DOSES - BUGLE LIB - 22,000 MWD/MTU

NEUTRON GROUP	MEAN ENERGY (MeV)	NEUTRON FLUX	DOSE
1	1.601E+01	9.212E-05	1.983E-05
2	1.287E+01	3.766E-04	7.195E-05
3	1.074E+01	1.693E-03	2.682E-04
4	9.071E+00	3.741E-03	5.501E-04
5	7.808E+00	7.428E-03	1.092E-03
6	6.513E+00	1.883E-02	2.805E-03
7	5.332E+00	2.705E-02	4.178E-03
8	4.108E+00	5.096E-02	7.473E-03
9	3.234E+00	4.903E-02	6.659E-03
10	2.821E+00	3.789E-02	4.924E-03
11	2.552E+00	4.909E-02	6.177E-03
12	2.399E+00	2.686E-02	3.366E-03
13	2.352E+00	7.671E-03	9.621E-04
14	2.269E+00	4.017E-02	5.048E-03
15	2.024E+00	1.183E-01	1.497E-02
16	1.742E+00	1.501E-01	1.915E-02
17	1.453E+00	2.407E-01	3.102E-02
18	1.120E+00	5.814E-01	7.602E-02
19	8.624E-01	4.715E-01	5.755E-02
20	7.948E-01	2.247E-01	2.632E-02
21	6.979E-01	6.916E-01	7.583E-02
22	5.714E-01	8.693E-01	8.612E-02
23	4.549E-01	1.048E+00	8.913E-02
24	3.450E-01	9.292E-01	6.159E-02
25	2.592E-01	1.564E+00	8.015E-02
26	1.591E-01	1.433E+00	4.735E-02
27	9.652E-02	1.111E+00	2.348E-02
28	5.854E-02	1.049E+00	1.499E-02
29	3.786E-02	4.081E-01	4.141E-03
30	2.991E-02	2.070E-01	1.745E-03
31	2.543E-02	2.899E-01	2.153E-03
32	2.341E-02	2.094E-01	1.457E-03
33	1.960E-02	6.124E-01	3.707E-03
34	1.239E-02	1.383E+00	5.842E-03
35	5.853E-03	1.273E+00	4.539E-03
36	2.765E-03	1.457E+00	5.281E-03
37	1.208E-03	2.759E+00	1.029E-02
38	3.742E-04	1.646E+00	6.461E-03
39	1.767E-04	1.828E+00	7.438E-03
40	7.996E-05	2.631E+00	1.111E-02
41	2.840E-05	3.538E+00	1.559E-02
42	8.799E-06	2.231E+00	1.015E-02
43	3.981E-06	2.688E+00	1.231E-02
44	1.529E-06	2.029E+00	9.171E-03
45	7.223E-07	1.924E+00	8.443E-03
46	3.093E-07	3.288E+00	1.363E-02
47	6.667E-08	2.723E+00	1.000E-02

TOTAL DOSE ON CONTACT -

3.559324 mrem/hr

I28 TOP FLUXES AND DOSES - BUGLE LIB - 22,000 MWD/MTU

GAMMA GROUP	MEAN ENERGY (MeV)	GAMMA FLUX	DOSE
1	1.500E+01	2.698E-04	3.591E-06
2	8.940E+00	8.296E-01	7.240E-03
3	7.500E+00	1.453E+00	1.114E-02
4	6.500E+00	4.821E-01	3.340E-03
5	5.500E+00	5.016E-01	3.105E-03
6	4.470E+00	5.674E-01	3.061E-03
7	3.460E+00	9.482E-01	4.355E-03
8	2.500E+00	4.482E+00	1.668E-02
9	1.750E+00	1.776E+02	5.205E-01
*10	1.250E+00	1.000E+04	2.320E+01
11	8.900E-01	1.613E+02	2.933E-01
12	7.500E-01	9.794E+01	1.571E-01
13	6.500E-01	1.136E+02	1.638E-01
14	4.900E-01	3.126E+02	3.559E-01
15	3.000E-01	4.389E+02	3.330E-01
16	1.400E-01	2.519E+02	8.995E-02
17	8.000E-02	1.556E+01	4.057E-03
18	4.500E-02	8.465E-02	2.684E-05
19	2.500E-02	2.801E-04	3.034E-07
20	1.500E-02	6.452E-05	1.847E-07

TOTAL DOSE ON CONTACT -

32.90857 mrem/hr

VEPCO 7 GAMMA GROUP ENERGY BIN

GROUP	UPPER ENERGY (MeV)	FLUX
1	.4	7.064E+02
2	.8	5.241E+02
3	1.3	1.007E+04
4	1.7	1.659E+02
5	2.2	1.075E+02
6	2.5	1.344E+00
7	2.8	7.024E+00

* The contribution from CO-60 has been added to this group

SOURCE DECAY TABLES

Fuel - 3.7 w/o, 22,000 MWD/MTU, 10 year cooled (Y = 10 yrs)

Cooling

<u>Time(Y+Yrs)</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
Gamma	1.0	0.91	0.84	0.79	0.74	0.71	0.68	0.65	0.63	0.60	0.59	0.57	0.55	0.54	0.52	0.51	0.50	0.48	0.47	0.46	0.45
Neutron	1.0	0.97	0.95	0.92	0.90	0.89	0.86	0.84	0.82	0.80	0.78	0.76	0.74	0.72	0.71	0.69	0.68	0.66	0.65	0.64	0.62

Fuel - 3.7 w/o, 35,000 MWD/MTU, 10 year cooled (Y = 10 yrs)

Cooling

<u>Time(Y+Yrs)</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
Gamma	1.0	0.91	0.83	0.77	0.72	0.69	0.65	0.63	0.60	0.58	0.57	0.55	0.53	0.52	0.50	0.48	0.47	0.46	0.45	0.43	0.42
Neutron	1.0	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74	0.72	0.69	0.67	0.65	0.63	0.61	0.59	0.58	0.56	0.55	0.54	0.52

Fuel - 3.7 w/o, 45,000 MWD/MTU, 10 year cooled (Y = 10 yrs)

Cooling

<u>Time(Y+Yrs)</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
Gamma	1.0	0.91	0.83	0.77	0.72	0.69	0.66	0.63	0.61	0.58	0.57	0.55	0.53	0.52	0.51	0.49	0.48	0.47	0.46	0.44	0.43
Neutron	1.0	0.96	0.88	0.83	0.79	0.74	0.71	0.67	0.65	0.62	0.60	0.58	0.56	0.54	0.52	0.50	0.49	0.47	0.45	0.44	0.42