ENVIRONMENTAL IMPACT APPRAISAL

GENERAL ELECTRIC NUCLEAR TEST REACTOR

This appraisal is submitted in support of the request for renewal of License R-33, Docket 50-73.

To the best of my knowledge and belief, the information contained herein is accurate.

OFFICIAL SEAL
VIRGINIA C. CASQUEIRO
NOTARY PUBLIC - CALIFORNIA
ALAMEDA COUNTY
My comm. expires MAR 8, 1981

By: R. W. Darmitzel

R. W. Darmitzel, Manager
Irradiation Processing Operation

Submitted and sworn before me this third day of August, 1979.
Virginia C. Casqueiro, Notary Public in and for the County of Alameda, State of California.

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ENVIRONMENTAL IMPACT APPRAISAL
GENERAL ELECTRIC NUCLEAR TEST REACTOR

The purpose of this appraisal is to describe the past and future environmental effects of the operation of the General Electric Nuclear Test Reactor (NTR).

A. FACILITY

The NTR is located in Building 105 at the Vallecitos Nuclear Center (VNC). The location of Building 105 relative to other site facilities is shown in Figure 1. A floor plan of the building is shown in Figure 2. Building 105 is a single-story building with a partial basement. The building contains the NTR, offices, laboratories, and storage areas. The construction of Building 105 (1956–1957) had a negligible effect on the environment.

There are penetrations into the reactor cell to provide for passing water, electric power, and air into/out of the cell and to permit the movement of material and equipment. Apertures are provided to the North Room and South Cell for neutron radiography. Several spare penetrations are provided for future uses.

Cooling for the NTR is provided by a heat exchanger system located within the reactor cell. The primary loop of the system circulates through the reactor core at a nominal flow of 20 gpm with makeup water provided from the Building 105 deionizer unit. Heat is transferred to the secondary water system (nominal flow 35 gpm) by a heat exchanger. The secondary system is a gravity flow system maintained at a higher pressure than the primary system to prevent leakage from the primary system.

Water from the secondary system is discharged from the reactor cell through a 2-inch line to the site retention basins. These basins receive normally nonradioactive industrial waste water from the entire VNC site, and the specific contributions to the water quality from the NTR cannot be separately determined. Water from each retention basin is sampled and analyzed for radioactivity and other water quality parameters before discharge from the site in accordance with California Regional Water Quality Control Board Order No. 74-201, as amended.

Potentially contaminated liquid wastes (e.g., discharged primary coolant water) are transferred to the NTR retention tank. This tank is located in the reactor cell and is

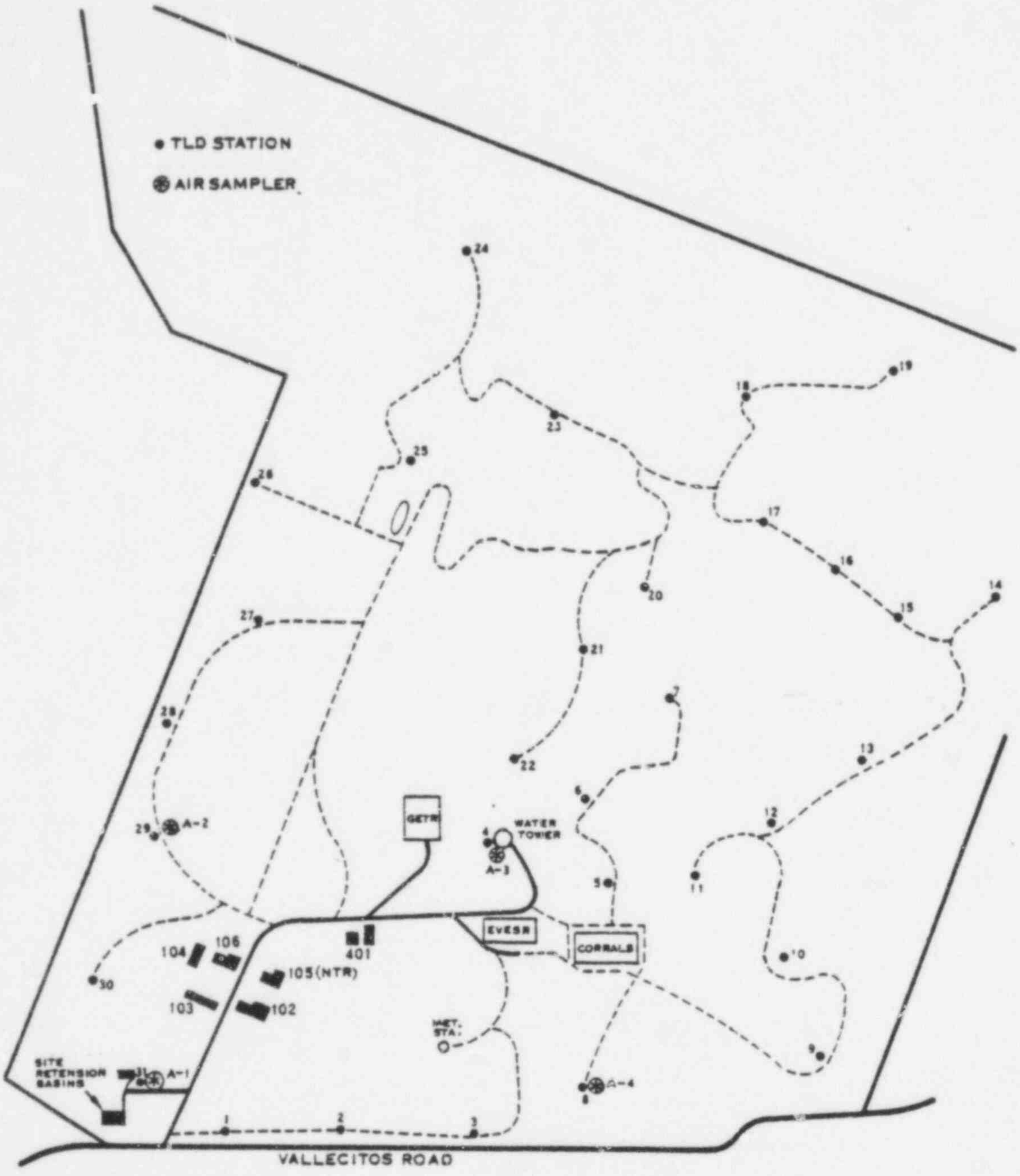

FIGURE 1. VALLECITOS NUCLEAR CENTER

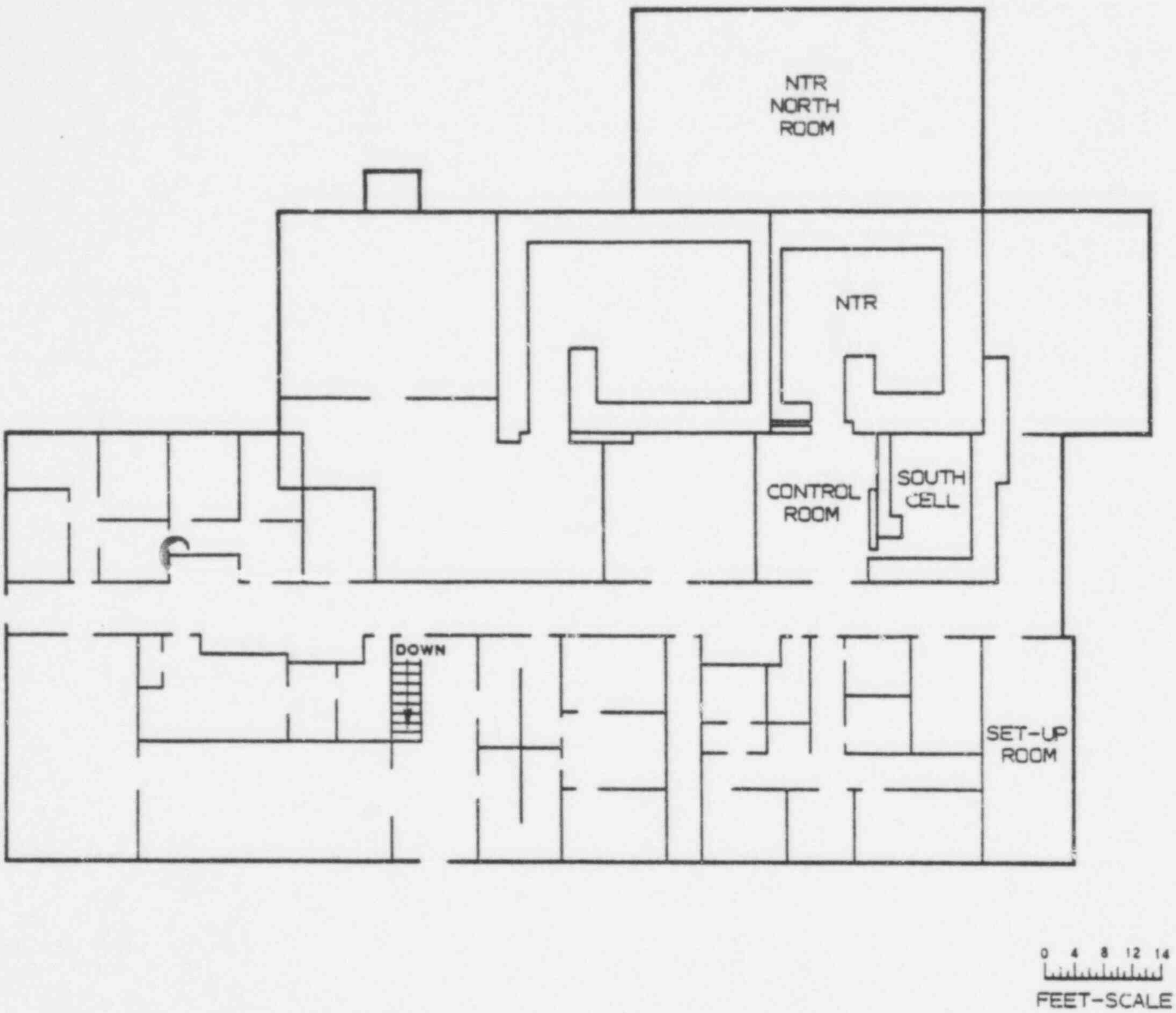

FIGURE 2. BUILDING 105 FLOOR PLAN

vented to the filtered ventilation exhaust system. If sufficient quantities of liquids accumulate in the tank, they are transferred to the VNC liquid waste evaporator. At the evaporator the liquids are reduced in volume, solidified, packaged, and delivered to a licensed waste disposal operator for transportation and burial.

Any solid wastes generated at the NTR are packaged in accordance with the appropriate regulations and delivered to a licensed waste operator for transportation and disposal.

Sanitary wastes from Building 105 are sent to the site sanitary waste treatment system. Treatment includes a septic tank, sand filtration, chlorination, and surface disposal by spraying in accordance with the California Regional Water Quality Control Board Order No. 74-201, as amended.

B. ENVIRONMENTAL EFFECTS OF FACILITY OPERATION

The NTR has a maximum power of 100 kWt (thermal) in the steady-state mode. As noted in Section A, core cooling is accomplished by a water to water heat exchanger system so there is no cooling tower or release of steam to the atmosphere.

The reactor is located within a heavily shielded cell-type concrete room. Gamma-ray field radiation monitors are located exterior to the cell in the Control Room and the North Room. The North Room monitors (2) normally read at less than 0.2 mR/h when the reactor is operating. The Control Room monitor normally reads approximately 0.6 mR/h during operation. The level may increase to approximately [illegible] mR/h when the aperture from the reactor cell to the South Cell is open for neutr[illegible] radiography operations. Gamma-ray field monitors are also located within the reacto[illegible] cell and the South Cell. However, no personnel entry is made into the reactor cell during reactor operation or into the South Cell during reactor operation when the neutron radiography aperature is open.

The VNC site consists of approximately 1600 fenced acres with an inner area of slightly less than 100 acres separately fenced. The inner area contains the site facilities which include the NTR, the General Electric Test Reactor (GETR), research and development facilities for reactor fuels, shielded facilities for irradiated reactor fuels examination and isotope production, and associated laboratories. The outer perimeter of the 1600-acre site is considered the boundary of the restricted area. To demonstrate that airborne concentrations remain below levels permitted in unrestricted areas, exhaust ventilation effluents from the NTR facility are sampled for beta-gamma particulates using a continuously monitored membrane filter, for iodine using a charcoal cartridge, and for noble gases using a continuously monitored Kanne chamber. The filter and the charcoal cartridge are changed weekly and evaluated at a site laboratory (counting room). Results of the stack monitoring program for 1977 and 1978 are shown in Table 1.

In addition, air samples are continuously taken at four locations on the VNC site using a membrane filter and a charcoal cartridge. The locations of these samples are shown in Figure 1, and the sample results for 1977 and 1978 are shown in Table 2.

Gamma field dose is monitored by 31 fixed dosimeter locations (Figure 1). Each location is supplied with a calcium-sulfate thermoluminescent dosimeter (TLD) (film badges before February 1978) which is exchanged monthly, weather permitting. Dosimeter results for 1977 and 1978 are shown in Table 3.

As previously noted, industrial waste water (including NTR secondary cooling water) which is not normally radioactive is routed to one of four site retention basins where it is sampled and evaluated before release. The discharge from these basins currently averages 80,000 to 125,000 gpd. However, when the GETR is operating, the discharge averages 240,000 gpd. Sampling results for 1977 and 1978 are shown in Table 4.

The VNC also maintains an extensive program of flora, water, and soil sampling. A complete description of this program is contained in the "GETR Environmental Information Report," NEDO-12623, July 1976. This report has been previously submitted to the Commission under Docket 50-70.

C. ENVIRONMENTAL EFFECTS OF ACCIDENTS

The Commission has previously determined that accidents ranging from failure of experiments to the largest core damage and fission product release considered possible result in doses of only a fraction of 10CFR Part 100 guidelines and are considered negligible with respect to the environment.*

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*Memo, "Environmental Considerations Regarding the Licensing of Research Reactors and Critical Facilities," D. R. Muller to D. Skovholt, January 23,1974.

TABLE 1. NTR Stack Effluent Data

1977	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alpha* μCi	0.012	0.016	0.016	0.012	0.013	0.015	0.011	0.012	0.012	0.011	0.015	0.011
Beta* μCi	0.65	1.20	1.70	3.30	6.40	1.30	1.70	1.90	2.00	1.20	2.90	2.30
I-131 μCi	20.2	60.3	88.4	337.0	325.0	166.0	153.0	253.0	292.0	207.0	341.0	210.0
Noble Gases Ci	25.9	31.2	35.8	64.6	80.5	33.9	38.9	19.8	25.8	31.1	46.7	23.2
1978												
Alpha* μCi	0.009	0.017	0.017	0.014	0.015	0.012	0.016	0.015	0.013	0.017	0.016	0.017
Beta* μCi	2.10	2.80	6.60	6.60	6.80	6.10	7.00	13.00	14.00	17.00	66.00	26.00
I-131 μCi	202.0	349.0	539.0	796.0	730.0	841.0	630.0	1420.0	1370.0	1180.0	1360.0	804.0
Noble Gases Ci	38.4	24.5	34.0	52.9	54.7	52.4	51.8	65.6	54.7	57.8	70.0	64.0

*Sample counted after 7-day decay period.

TABLE 2. VNC Site Environmental Air Samples

	Station 1			Station 2			Station 3			Station 4		
	Alpha $\times 10^{-15}$ µCi/cc	Beta $\times 10^{-13}$ µCi/cc	I-131 $\times 10^{-13}$ µCi/cc	Alpha $\times 10^{-15}$ µCi/cc	Beta $\times 10^{-13}$ µCi/cc	I-131 $\times 10^{-13}$ µCi/cc	Alpha $\times 10^{-15}$ µCi/cc	Beta $\times 10^{-13}$ µCi/cc	I-131 $\times 10^{-13}$ µCi/cc	Alpha $\times 10^{-15}$ µCi/cc	Beta $\times 10^{-13}$ µCi/cc	I-131 $\times 10^{-13}$ µCi/cc
1977												
January	4.2	1.12	4.59	4.2	1.24	4.60	4.2	1.39	4.66	4.2	2.47	4.66
February	3.9	1.70	4.60	3.9	1.83	4.61	4.3	1.08	4.68	4.0	1.83	4.69
March	4.0	1.45	4.4[illegible]	3.9	9.02	5.07	4.0	1.43	4.58	3.9	5.54	6.62
April	4.1	2.50	4.69	4.1	3.05	4.77	4.1	6.30	4.77	4.1	2.85	4.78
May	4.2	1.58	4.54	4.2	2.04	4.64	3.4	1.80	5.23	4.2	2.32	4.56
June	3.6	4.33	4.81	3.6	5.78	4.91	3.6	28.73	4.92	3.6	38.90	4.92
July	3.4	1.45	6.21	3.8	1.80	4.82	3.4	2.30	6.16	3.4	4.03	4.74
August	3.7	3.98	4.60	3.9	10.43	4.61	4.2	2.68	4.89	3.7	2.70	4.73
September	3.8	4.33	4.56	3.6	6.13	4.58	3.6	8.48	5.16	3.6	3.10	4.80
October	3.2	3.91	4.58	3.0	4.70	4.62	3.3	3.50	4.69	3.3	5.06	4.77
November	3.5	1.37	4.70	3.5	3.18	4.70	3.5	3.18	4.76	3.6	5.52	4.77
December	3.2	0.69	4.46	4.2	2.63	4.47	3.2	3.68	4.48	3.2	1.09	4.49
1978												
January	3.4	0.60	4.44	3.7	1.11	4.81	3.7	0.96	4.83	3.7	1.43	4.89
February	3.3	0.74	4.70	3.3	1.78	4.79	3.3	1.09	4.79	3.3	1.18	4.80
March	3.9	1.60	4.67	4.0	1.78	4.68	3.9	1.17	4.69	3.9	2.28	4.99
April	4.0	0.84	4.70	4.0	2.23	4.72	4.0	1.68	4.74	4.0	1.80	4.83
May	3.6	2.52	4.78	3.4	1.88	4.75	3.4	1.93	4.76	3.7	1.52	4.84
June	3.6	5.25	4.77	3.5	1.92	4.74	4.1	3.28	4.76	3.5	2.50	4.76
July	4.6	0.92	4.84	4.2	1.30	4.86	4.2	1.50	4.87	4.2	0.94	4.87
August	3.6	0.43	4.60	3.6	0.54	4.60	3.6	1.90	4.61	3.9	2.70	4.62
September	4.5	1.20	4.61	3.8	0.92	4.62	3.8	1.50	4.63	3.8	0.63	4.63
October	3.1	0.66	4.58	3.3	0.68	4.59	4.1	0.94	4.59	3.7	0.93	4.60
November	3.7	0.78	5.52	3.7	0.89	4.73	3.9	0.71	4.76	4.4	0.81	4.77
December	2.8	0.74	4.15	2.7	0.66	4.16	2.6	0.61	4.15	3.4	0.56	4.15

TABLE 3. VNC Site Dosimeter Results

1977 mR/mo.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
South Boundary[1]	4.5[2]	-	0[3]	2.3	0	3.0	0	0	0	0	0	-
East Boundary[1]	2.2[2]	-	0[3]	1.8	0	0	0	0	0	0	0	-
North Boundary[1]	11.2[2]	-	0[3]	0.6	0	2.4	0	0	0	0	0	-
West Boundary[1]	2.3[2]	-	0[3]	0	0	0	0	0	0	0	0	-
1978 mR/mo.												
South Boundary[1]	-	0[4]	-	-	0[5]	-	-	-	-	-	0.58[6]	-
East Boundary[1]	-	1.0[4]	-	-	0[5]	-	-	-	-	-	-	7
North Boundary[1]	-	0.6[4]	-	-	0[5]	-	-	-	-	-	-	7
West Boundary[1]	-	0.41[4]	-	-	0[5]	-	-	-	-	-	-	7

1. Values on averages of 4 to 6 stations per boundary.
2. Average reading for 12/76 and 1/77.
3. Average reading for 2/77 and 3/77.
4. Average reading for 12/77, 1/78, and 2/78.
5. Average reading for 3/78, 4/78, 5/78.
6. Average reading for 5/78 to 11/78.
7. Due to weather conditions and fire hazard conditions the dosimeters were not exchanged until 1979. The results are as follows:

   East Boundary 0 (5/78 to 5/79),
   North Boundary 0.42 (5/78 to 5/79),
   West Boundary 0.28 (5/78 to 5/79).

TABLE 4. VNC Retention Basin Samples – Monthly Ave ges

1977 pCi/l	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alpha	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	13	<10
Beta	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
Pu-239*	-	-	<10	-	-	<10	-	-	<10	-	-	<10
Sr-89,90*	-	-	<10	-	-	<10	-	-	<10	-	-	<10
H-3* $x10^4$	-	-	3.78	-	-	9.21	-	-	2.92	-	-	1.16
Cs-137*	-	-	<50	-	-	<50	-	-	<50	-	-	<50
Co-60*	-	-	<50	-	-	<50	-	-	<50	-	-	<50

1978 pCi/l	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alpha	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Beta	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
Pu-239*	-	-	<10	-	-	<10	-	-	<10	-	-	<10
Sr-89,90*	-	-	<10	-	-	<10	-	-	<10	-	-	< 7
H-3* $x10^4$	-	-	3.59	-	-	3.12	-	-	1.06	-	-	<0.20
Cs-137*	-	-	<50	-	-	<50	-	-	<50	-	-	<30
Co-60*	-	-	<50	-	-	<50	-	-	<50	-	-	<30

*3-Month Composite

D. UNAVOIDABLE EFFECTS OF FACILITY CONSTRUCTION AND OPERATION

The unavoidable effects of construction and operation involves the materials used in construction that cannot be recovered and the fissionable material used in the reactor. No adverse impact on the environment is expected from either of the unavoidable effects.

E. ALTERNATIVES TO CONSTRUCTION AND OPERATION OF THE FACILITY

There are no suitable or more economical alternatives which can accomplish the research and development objectives of this facility, particularly in the area of neutron radiography.

F. LONG-TERM EFFECTS OF FACILITY CONSTRUCTION AND OPERATION

The long-term effects of a research facility such as the NTR are considered to be beneficial as a result of the contribution to scientific knowledge. This is especially true in view of the minimal impact on the environment associated with a facility such as the NTR.

G. COSTS AND BENEFITS OF FACILITY AND ALTERNATIVES

At a relatively low cost of operation the NTR produces considerable benefits in the area of research and development with very little environmental impact. Some NTR activities could be conducted using particle accelerators or radioactive sources, but these alternatives are at once more costly and less efficient. There is no reasonable alternative to a nuclear research reactor for the type of activities conducted at the NTR.