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Nuclear Regulatory Commission
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Washington, DC 20555

**DOCKET 50-155 – LICENSE DPR-6, BIG ROCK POINT PLANT –
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT FOR THE
PERIOD JANUARY 2000 – DECEMBER 2000**

In accordance with the Big Rock Point Defueled Technical Specifications Section 6.7.3, attached is the Annual Radioactive Effluent Release Report for the period January 1, 2000 to December 31, 2000. This report includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility. The material provided is consistent with the objectives outlined in the Offsite Dose Calculation Manual and the Process Control Program, and complies with the requirements of 10 CFR 50.36(a) and Section IV.B.1 of Appendix I to 10 CFR 50.



Gregory C Withrow
Acting Site General Manager

CC: Administrator, Region III, USNRC
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ATTACHMENTS

IE48

**Big Rock Point Restoration Project
2000 Annual Radioactive Effluent Release Report**

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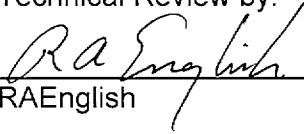


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Consumers Energy Company
Big Rock Point Plant
Docket 50-155

BIG ROCK POINT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

BIG ROCK POINT ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January 1, 2000 to December 31, 2000

This report provides information relating to radioactive effluent releases and solid radioactive waste disposal at Big Rock Point for all of 2000. The report format is detailed in Big Rock Point Offsite Dose Calculation Manual, Section III, item 1.

The Big Rock Point Nuclear Plant ceased operations in August 1997. During 2000 site activities resulted in removal of many decommissioned systems and equipment. The Defueled Technical Specifications no longer contain requirements for the BRP radiological effluent program but rather refer to the Big Rock Point Offsite Dose Calculation Manual (ODCM) for applicable effluent discharge requirements. Big Rock Point maintains gaseous and liquid radioactive effluent programs similar to its operational period; however, the number and quantity of gaseous and liquid effluent releases has been significantly reduced since plant operations ceased. Due to the decay time since ceasing plant operations, short-lived radionuclides are neither expected nor reported. This includes iodines and noble gasses other than Krypton-85.

1. Supplemental Information

A. Batch Releases

Information relating to continuous and batch releases of gaseous and liquid effluents is provided in Table 1 (Attachment 1).

B. Abnormal Releases

None

C. Lower Limits of Detection (LLDs) for gaseous and liquid effluents are provided in Attachment 5.

D. Radioactive Effluent Monitoring Instrumentation

Big Rock Point Offsite Dose Calculation Manual Section I requires that with less than the minimum number of radioactive effluent monitoring instrument channels operable, the action shown in Table I.A-1 be

performed: "Exert best efforts to return the instruments to operable status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Report why the inoperability was not corrected in a timely manner."

No radioactive effluent monitoring instrument channels were inoperable for more than 30 days during this reporting period.

2. Gaseous Effluents

Table 2 (Attachment 2) lists and summarizes all gaseous radioactive effluents released during the reporting period. The unidentified beta was 1.7E-03% of the total release.

Gaseous Effluents did not result in any Airdose at the site boundary in 2000, as noble gases are no longer present/released from the site during the decommissioning activities. Overall, gaseous radioactivity released in 2000 (Particulates and Tritium) was approximately equivalent to 1999, with no noble gasses or iodines released. Whole body and organ doses for 2000 were also comparable to those calculated in 1999¹.

3. Liquid Effluents

Table 3 (Attachment 3) lists and summarizes all liquid radioactive effluents released during the reporting period. The unidentified beta was 2.6% of the total release. The maximum liquid effluent release concentration for 2000 occurred during the first quarter at 4.34E-09 $\mu\text{Ci/ml}$. During the third quarter of 2000, no liquid batch releases from the site were conducted. A total of 17 liquid batch releases were performed during the first, second and fourth quarters.

Liquid effluent radioactivity released in 2000 was slightly higher than 1999 releases (2.92 E-02 Ci vs. 1.82 E-02 Ci), due primarily to an increase in the number of batch releases during 2000. While radioactivity released via liquid effluents increased in 2000, the calculated wholebody and organ doses were lower (by a factor of approximately three) due primarily to an increase in total dilution flow for the year. (The Circulating Water Pump was run continuously in 2000 versus intermittently in 1999.)

¹ Calculated organ doses for 2000 are higher than those for the plant prior to 1999. This is the result of a conservative decision (beginning in 1999) that all critical receptors are assumed to be located at the site boundary with the highest Chi/Q value.

4. Solid Waste

Table 4 (Attachment 4) summarizes all solid radwaste volume shipped, classification, processing employed, sources, curie and nuclide content. Radwaste shipments were made either to the Barnwell Waste Management Facility in Barnwell, South Carolina, or Envirocare of Utah via a radwaste processing facility. While the total volume of material shipped during 2000 was approximately a factor of 10 greater than 1999, the total shipment radioactivity designated for burial in 2000 was significantly less than in 1999. Disposal of irradiated components from the Spent Fuel Pool during the first quarter comprises the majority of the radioactivity sent for burial in 2000.

5. Summary of Radiological Impact on Man

The ODCM, Section III, Item 1.6 specifies that the Annual Effluent Release Report shall provide potential dose calculations based on measured effluent to liquid and gaseous pathways if estimates of dose exceed 1 millirem to an organ or total body of any individual or more than 1 person-rem to the population within 50 miles. During the year 2000 no quarterly or annual dose calculations exceeded 1 millirem or 1 person-rem from releases to either liquid or gaseous pathways. Although not required, potential doses to individuals and populations were calculated using LADTAP and GASPAP computer program codes. The quarterly values for curies released were input for each nuclide and summarized as follows:

- A. The maximum total body dose to an individual in unrestricted water-related exposure pathways was

First Quarter	1.05E-01 millirem (adult)
Second Quarter	1.26E-02 millirem (adult and teenager)
Third Quarter	0.00 millirem
Fourth Quarter	6.61E-03 millirem (teenager)

The maximum organ doses were:

First Quarter	1.67E-01 millirem (teenage liver)
Second Quarter	2.38E-02 millirem (teenage liver)
Third Quarter	0.00 millirem
Fourth Quarter	1.25E-02 millirem (teenage liver)

- B. The offsite air dose at the site boundary (0.57 mi E) due to noble gases was:

0.00 millirad beta and 0.00 millirad gamma for all four quarters (no noble gasses released).

- C. The most restrictive organ dose to an individual in an unrestricted area (based on identified critical receptors) from gaseous effluent releases (tritium and particulate) were:

First Quarter	9.53E-04 millirem (child bone)
Second Quarter	1.60E-04 millirem (child bone)
Third Quarter	2.63E-04 millirem (child bone)
Fourth Quarter	2.85E-04 millirem (child bone)

- D. Integrated total body doses to the general population and average doses to individuals within the population from liquid effluent release pathways to a distance of 50 miles from the site boundary were

First Quarter	7.02E-02 person-Rem and 3.85E-04 millirem
Second Quarter	1.18E-02 person-Rem and 6.48E-05 millirem
Third Quarter	0.00 person-Rem and 0.00 millirem
Fourth Quarter	6.34E-03 person-Rem and 3.48E-05 millirem

- E. Integrated total body dose to the general population and average doses to individuals within the population from gaseous effluent release pathways to a distance of 50 miles from the site boundary were:

First Quarter	6.04E-05 person-Rem and 3.32E-07 millirem
Second Quarter	2.44E-05 person-Rem and 1.34E-07 millirem
Third Quarter	2.80E-05 person-Rem and 1.54E-07 millirem
Fourth Quarter	2.81E-05 person-Rem and 3.48E-07 millirem

6. Process Control Program (PCP)

The Process Control Program describes solid waste processing and disposal methods utilized by the Big Rock Point site; no revisions to the PCP occurred in 2000.

7. Offsite Dose Calculation Manual (ODCM)

In 2000 the ODCM was revised one time to include liquid Design Basis Quantity values corresponding to dilution flow modifications. Table 2.2 of the revised ODCM, (Revision 20) is contained in Attachment 6 of this report. These changes have been reviewed in accordance with plant procedures and have been determined not to reduce the accuracy or reliability of dose calculations or setpoint determinations.

ATTACHMENT 1
1 Page

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT

BATCH RELEASES

January - December 2000

TABLE 1
BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT

SUMMATION OF ALL RELEASES

January 1, 2000 to December 31, 2000

A. GASEOUS - Continuous Release

B. LIQUID	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Number of Releases		6	4	0	7
Total Release Time	Minutes	1395	905	N/A	939
Maximum Release Time	Minutes	536	297	N/A	200
Average Release Time	Minutes	233	226	N/A	134
Minimum Release Time	Minutes	91	40	N/A	71

ATTACHMENT 2
3 Pages

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT
GASEOUS EFFLUENTS - SUMMATION OF RELEASES

January - December 2000

TABLE 2
**BIG ROCK POINT RADIOACTIVE
 EFFLUENT REPORT**

SUMMATION OF ALL RELEASES

GASEOUS EFFLUENTS

January 1, 2000 to December 31, 2000

A. FISSION AND ACTIVATION GASES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total release	Ci	0.00	0.00	0.00	0.00	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	

B. IODINES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total Iodine	Ci	0.00	0.00	0.00	0.00	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	

C. PARTICULATES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Particulates with half-life >8 day	Ci	6.51E-05	1.38E-05	1.78E-06	1.70E-05	33.91
2. Average release rate for period	μCi/sec	8.37E-06	1.76E-06	2.24E-06	2.13E-06	
3. Percent of annual avg EC	%	1.56E-06	3.24E-07	4.69E-07	5.05E-07	
4. Gross alpha radioactivity	Ci	2.42E-07	3.65E-07	7.74E-07	7.48E-07	

D. TRITIUM	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
1. Total Release	Ci	2.94E-01	2.97E-01	3.00E-01	3.00E-01
2. Average release rate for period	μCi/sec	3.78E-02	3.78E-02	3.78E-02	3.78E-02
3. Percent of annual avg EC	%	1.96E-06	1.96E-06	1.96E-06	1.96E-06

E. WHOLE BODY DOSE	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
1. Beta Air dose at Site Boundary due to Noble Gases (ODCM Section I, 1.3.1 a (1) (2))	mrads	0.00	0.00	0.00	0.00
2. Percent limit	%	N/A	N/A	N/A	N/A
3. Gamma Air dose at Site Boundary due to Noble Gas (ODCM Section I, 1.3.1 a (1) (2))	mrads	0.00	0.00	0.00	0.00
4. Percent limit	%	N/A	N/A	N/A	N/A

F. ORGAN DOSE (ODCM Section I, 1.3.b (1) (2))	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
1. Maximum organ dose to public based on Critical Receptors	mrem	9.53E-04	1.60E-04	2.63E-04	2.85E-04
2. Percent of limit (7.5 mrem/quarter)	%	1.27E-02	2.13E-03	3.51E-03	3.80E-03

TABLE 2
**BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT**

SUMMATION OF ALL RELEASES

GASEOUS EFFLUENTS

January 1, 2000 to December 31, 2000

1. FISSION GASES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Krypton-85m	Ci	0.00	0.00	0.00	0.00
Krypton-87	Ci	0.00	0.00	0.00	0.00
Krypton-88	Ci	0.00	0.00	0.00	0.00
Xenon-133	Ci	0.00	0.00	0.00	0.00
Xenon-133m	Ci	0.00	0.00	0.00	0.00
Xenon-135	Ci	0.00	0.00	0.00	0.00
Xenon-135m	Ci	0.00	0.00	0.00	0.00
Xenon-138	Ci	0.00	0.00	0.00	0.00
Total for Period	Ci	0.00	0.00	0.00	0.00

2. IODINES					
Iodine-131	Ci	0.00	0.00	0.00	0.00
Iodine-132	Ci	0.00	0.00	0.00	0.00
Iodine-133	Ci	0.00	0.00	0.00	0.00
Iodine-134	Ci	0.00	0.00	0.00	0.00
Iodine-135	Ci	0.00	0.00	0.00	0.00
Total for Period	Ci	0.00	0.00	0.00	0.00

TABLE 2
**BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT**

SUMMATION OF ALL RELEASES

GASEOUS EFFLUENTS

January 1, 2000 to December 31, 2000

3. PARTICULATES*	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	1.08E-07	<LLD	<LLD
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	6.06E-06	5.49E-06	4.18E-06	3.74E-06
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Silver-110m	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	4.70E-05	5.75E-06	9.94E-06	9.06E-06
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD
Strontium-89	Ci	2.31E-07	3.74E-07	2.43E-07	2.69E-07
Strontium-90	Ci	1.31E-07	1.83E-07	1.43E-07	1.35E-07
Net unidentified beta	Ci	1.17E-05	1.90E-06	3.34E-06	3.76E-06
Total	Ci	6.51E-05	1.38E-05	1.78E-05	1.70E-05

* Particulates with half-life > 8 days

ATTACHMENT 3
2 Pages

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT
LIQUID EFFLUENTS - SUMMATION OF RELEASES

January - December 2000

TABLE 3
**BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT**

SUMMATION OF ALL RELEASES

LIQUID EFFLUENTS

January 1, 2000 to December 31, 2000

A. FISSION AND ACTIVATION PRODUCTS	Units	1ST QTR	2ND QTR	3RDQTR	4TH QTR	Est Total Error %
1. Total release (not including tritium, gases, alpha)	Ci	1.27E-02	9.94E-03	0.00	7.24E-03	8.25
2. Average diluted concentration during period	μCi/ml	3.43E-09	1.13E-09	N/A	5.67E-10	
3. Percent of EC	%	3.51E-01	5.16E-02	N/A	2.61E-02	
B. TRITIUM						
1. Total release	Ci	1.72E-07	6.02E-02	0.00	9.78E-03	4.18
2. Average diluted concentration during period	μCi/ml	4.49E-08	6.76E-09	N/A	7.72E-10	
3. Percent of EC	%	4.49E-03	6.67E-04	N/A	7.72E-05	
C. DISSOLVED AND ENTRAINED GASES						
1. Total release	Ci	0.00	0.00	0.00	0.00	N/A
2. Average diluted concentration during period	μCi/ml	N/A	N/A	N/A	N/A	
3. Percent of EC	%	N/A	N/A	N/A	N/A	
D. GROSS ALPHA RADIOACTIVITY	Ci	6.26E-06	2.78E-06	0.00	3.67E-06	
E. VOLUME OF WASTE RELEASED (Prior to dilution)	Liters	8.44E+04	7.80E+04	0.00	9.50E+04	
F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	3.82E+09	8.90E+09	1.07E+10	1.28E+10	
G. MAXIMUM DOSE COMMITMENT WHOLEBODY	mrem	1.05E-01	1.26E-02	0.00	6.61E-03	
Percent of ODCM Section I, 2.3.1 a (1.5 mrem)	%	7.00E00	8.40E-01	N/A	4.41E-01	
H. MAXIMUM DOSE COMMITMENT - ORGAN	mrem	1.67E-01	2.38E-02	0.00	1.25E-02	
Percent of ODCM Section I, 2.3.1 b (5.0 mrem)	%	3.34E00	4.76E-01	N/A	2.50E-01	

TABLE 3
**BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT**

SUMMATION OF ALL RELEASES

LIQUID EFFLUENTS

January 1, 2000 to December 31, 2000

1. NUCLIDES RELEASED*	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
Manganese 54	Ci	1.85E-03	1.00E-03	<LLD	4.10E-04
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	1.27E-02	6.73E-03	<LLD	5.33E-03
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Strontium-89	Ci	2.82E-07	2.04E-07	<LLD	1.82E-07
Strontium-90	Ci	2.95E-05	2.46E-05	<LLD	7.38E-06
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Silver-110m	Ci	<LLD	<LLD	<LLD	<LLD
Iodine-131	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-134	Ci	3.59E-05	<LLD	<LLD	<LLD
Cesium-137	Ci	6.66E-03	1.93E-03	<LLD	1.46E-03
Antimony-125	Ci	1.81E-04	5.97E-05	<LLD	<LLD
Tin-113	Ci	<LLD	<LLD	<LLD	<LLD
Net Unidentified Beta	Ci	2.39E-03	1.37E-04	<LLD	3.78E-05
Fission & Activation Product Total	Ci	2.38E-02	9.94E-03	0.00	7.24E-03
Xenon-133	Ci	<LLD	<LLD	<LLD	<LLD
Tritium	Ci	1.72E-01	6.02E-02	<LLD	9.87E-03
Grand Total	Ci	1.96E-01	7.01E-02	<LLD	1.71E-02

ATTACHMENT 4
1 Page

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT
SOLID WASTE

January - December 2000

Table 4
BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT

SOLID WASTE

January 1, 2000 to December 31, 2000

<u>Waste Class</u>	<u>Source of Waste</u>	<u>Solidification Agent</u>	<u>Container Type</u>	<u>Volume (Cu. Ft.)</u>	<u>Total Curies*</u>	<u>Principal Radionuclides*</u>
AU	DAW from plant demolition	N/A	Metal Box	56,230.8	5.47 E+00	Co-60, H-3, Mn-54, Fe-55, Ni-63, Cs-137
AS	Irradiated metals (CRD system)	N/A	Metal Box	211.0	1.28 E+00	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
AS	Resin from water processing	N/A	HIC	202.1	7.86 E+00	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
B	Resin from water processing	N/A	HIC	481.0	2.55 E+01	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
C	Irradiated metal (fuel channels and reactor internals)	N/A	Steel Liner	277.0	5.39 E+03	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
C	DAW (piping from systems)	N/A	HIC	134.0	9.24 E-01	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
C	Filters from water processing	N/A	HIC	493.3	2.93 E+01	Co-60, Mn-54, Fe-55, Ni-63, Cs-137
			TOTAL	58,029.2	5.46 E+03	

* Gamma isotopes are measured quantities, all others are estimated from scaling factors.

ATTACHMENT 5
1 Page

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT
LOWER LIMIT OF DETECTION FOR BIG ROCK EFFLUENTS

January - December 2000

TABLE 5
BIG ROCK POINT RADIOACTIVE
EFFLUENT REPORT

LOWER LIMITS OF DETECTION FOR BIG ROCK POINT EFFLUENTS

Gaseous Effluents

Nuclide	LLD ($\mu\text{Ci/cc}$)*
Mn-54	6 E-14
Co-58	5 E-14
Fe-59	2 E-13
Co-60	9 E-14
Zn-65	2 E-14
Nb-95	6 E-14
Zr-95	8 E-14
Ag-110m	5 E-14
Sb-125	2 E-14
Cs-134	5 E-14
Cs-137	6 E-14
Ce-144	3 E-13
Am-241	2 E-13

Liquid Effluents

Nuclide	LLD ($\mu\text{Ci/ml}$)*
Mn-54	1 E-07
Co-58	2 E-07
Fe-59	1 E-07
Co-60	3 E-07
Zn-65	3 E-07
Nb-95	1 E-07
Zr-95	3 E-07
Ag-110m	2 E-07
Sb-125	2 E-07
Cs-134	2 E-07
Cs-137	2 E-07
Ce-144	5 E-07
Am-241	4 E-07

* Based on gamma isotopic analysis for a typical stack filter and typical liquid batch release.

ATTACHMENT 6
2 Pages

Consumers Energy
Big Rock Point

RADIOACTIVE EFFLUENT RELEASE REPORT

OFFSITE DOSE CALCULATION MANUAL

Revised Sections

BIG ROCK POINT DESIGN OBJECTIVE ANNUAL QUANTITIES FOR
 LIQUID EFFLUENTS AS DETERMINED BY LADTAP

Design objective annual quantities for liquid effluents were calculated utilizing the computer code LADTAP, a program for calculating radiation exposure to man from routine releases of nuclear reactor liquid effluents (reference NUREG/CR-1276).

Input parameters used are as follows:

<u>Pathway</u>	<u>Age Group</u>	<u>Usage</u>	<u>Dilution</u>	<u>Process Times (Hr)</u>
Fish	Adult	21.0 kg/yr	15.0	24.0
	Teen	16.0	15.0	24.0
	Child	6.9	15.0	24.0
	Infant	0.0	15.0	24.0
Drinking	Adult	730.0 L/yr	800.0	4.6
	Teen	510.0	800.0	4.6
	Child	510.0	800.0	4.6
	Infant	330.0	800.0	4.6
Shoreline	Adult	12.0 hr/yr	2.0	0.0
	Teen	67.0	2.0	0.0
	Child	14.0	2.0	0.0
	Infant	0.0	2.0	0.0
Swimming	Adult	12.0 hr/yr	2.0	0.0
	Teen	67.0	2.0	0.0
	Child	14.0	2.0	0.0
	Infant	0.0	2.0	0.0
Boating	Adult	100.0 hr/yr	15.0	0.0
	Teen	100.0	15.0	0.0
	Child	50.0	15.0	0.0
	Infant	0.0	15.0	0.0

The usage figures are obtained from Regulatory Guide 1.109 and are default values. Dilutions and the process time for drinking water were taken from the NUS study dated June 4, 1976. The minimum process times that can be utilized for fish and drinking are 24.0 hours and 12.0 hours respectively. (LADTAP adds 12.0 hours to the process time listed above for the Drinking Pathway.)

TABLE 2.2

BIG ROCK POINT DESIGN OBJECTIVE ANNUAL QUANTITIES FOR
 LIQUID EFFLUENTS AS DETERMINED BY *LADTAP

<u>Nuclide</u>	<u>Dose Conversion Factors (mrem/Ci)</u>	<u>Individual/Organ</u>	<u>Design Objective Annual Quantity (Curies)</u>
H-3	5.72E-06	Adult/TB	5.24E+05
Sc-46	3.04E-02	Teen/TB	9.87E+02
Mn-54	2.05E-01	Adult/GI(LLI)	4.88E+01
Fe-55	1.34E-02	Child/Bone	7.46E+02
Co-57	6.85E-03	Teen/TB	4.38E+02
Co-58	1.70E-02	Teen/TB	1.76E+02
Co-60	7.09E-01	Teen/TB	4.23E+00
Zn-65	5.23E-01	Child/TB	5.74E+00
Sr-89	4.72E-01	Child/Bone	2.12E+01
Sr-90	8.16E+00	Adult/Bone	1.23E+00
Zr-95	9.34E-03	Teen/TB	3.21E+02
Ag-110m	1.16E-01	Teen/TB	2.59E+01
Cd-113m	1.80E-01	Adult/GI(LLI)	5.56E+01
Sb-124	2.28E-02	Teen/TB	1.32E+02
Sb-125	7.66E-02	Teen/TB	3.92E+01
Te-127m	4.18E-01	Teen/Kidney	2.39E+01
Cs-134	8.54E+00	Adult/TB	3.51E-01
Cs-137	5.08E+00	Adult/TB	5.91E-01
Ce-144	9.98E-03	Adult/GI(LLI)	1.00E+03
Eu-152	4.86E-01	Teen/TB	6.17E+00

* Based on a constant dilution flow rate of 20,000 gpm for isotopes with
 > 50 day half-life.