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RADIOLOGICAL IMPACT EVALUATION OF WATER LEAK AT INDIAN POINT UNIT 2

1.0 DESCRIPTION

This report documents a preliminary evaluation of the potential radiation doses to offsite receptors resulting from the leakage of contaminated water from Indian Point Unit 2 (IP2) to the Hudson river. The exposure pathways considered are the ingestion of contaminated fresh-water fish and of salt-water invertebrates. It is noted that the drinking-water pathway is not included in the Indian Point Land Use Census or in the Offsite Dose Calculation Manual (ODCM). Nonetheless, for informational purposes, results are also presented for a scenario where the drinking of contaminated water is an additional exposure pathway.

2.0 INPUT VARIABLES AND ASSUMPTIONS

The present analysis was based on ENTECH's AQUADOS computer code, which makes use of the models and data in Regulatory Guide 1.109, with one exception. In the present application, and in line with the IP2 ODCM, the AQUADOS data base was modified to make use of the site-specific (Indian Point) fish bioaccumulation factor for Cs; this is equal to [224 (pCi/kg) per pCi/liter of water], about an order of magnitude lower than the regulatory value of 2000.

The basic assumptions and input variables employed in the analysis were as follows:

- (a) The source of the water contamination identified in the on-site monitoring wells was assumed to be the spent fuel pool (SFP).
- (b) The radionuclide concentration in the leaking water to the river was assumed to be the same as the worst-case measured value in the water collected from the cracks in the SFP concrete wall, as shown in Table 1 below.
- (c) The contaminated-water leakage rate to the river was assumed to be 10 liters/day.
- (d) The exposure interval of the offsite receptor was assumed to be 91 days (1 quarter).
- (e) The entire activity in the leaking water during the quarter was assumed to enter the river without any in-transit decay. As such, the activity released into the river during one quarter is as follows:

Table 1 - Radionuclide Concentrations in Leak Water and Potential Activity Released to the River

Radionuclide	SFP Concentration ($\mu\text{Ci}/\text{ml}$)	Activity Released to River During 1 Calendar Quarter (Ci)
H3	2.20E-02	2.00E-02 *
CS134	6.80E-07	6.19E-07
CS137	1.14E-05	1.04E-05
CO60	1.70E-07	1.55E-07
SR90	5.40E-07	4.91E-07
NI63	4.10E-07	3.73E-07

* $2.20\text{E-}02 (\mu\text{Ci}/\text{ml}) \times 10,000 (\text{ml}/\text{day}) \times 91 (\text{days}) \times 1.0\text{E-}06 (\text{Ci}/\mu\text{Ci}) = 2.00\text{E-}02 (\text{Ci})$

- (e) The activity released during the entire quarter is further assumed to get released into the river during a single 6-hour half-tidal cycle, and to mix uniformly with the average water mass that traverses the Indian Point site during the same time interval. This dilution volume is equal to $5.49\text{E+}07 \text{ m}^3$ ($1.45\text{E+}010$ gal) when there is no fresh-water

inflow from the estuaries (from Calculation IP3-CALC-RAD-00016, pg 45, based on the UFSAR). The scenario is equivalent to a slug of water, equal to $5.49E+07$ m³, moving back and forth by the Indian Point site carrying the same concentration listed above for an entire quarter, without additional dilution. As an example, the tritium concentration in the river water, for an entire quarter, would be equal to $[2.00E-02$ (Ci) / $5.49E+07$ (m³)] x 0.001 (m³/liter) x $1.0E12$ (pCi/Ci) = 0.364 (pCi/liter). Refer to one of the AQUADOS computer outputs in Sec. 5 for the concentrations of the other radionuclides.

(f) Decay correction during the 91-day exposure interval was not accounted for. Due to the long half-lives of the radionuclides of interest, decay correction in the present application is insignificantly small.

(g) Doses were calculated by considering the following exposure pathways:

Case 1: Ingestion of contaminated fresh-water fish and salt-water invertebrate, and

Case 2: Ingestion of contaminated fresh-water fish, salt-water invertebrate, and drinking water.

As noted above, the drinking-water pathway is not included in the Indian Point Land Use Census or in the ODCM. Nonetheless, Case 2 above was analyzed for informational purposes and/or use, should there be an interest or a need in assessing the potential radiological impact from the ingestion of contaminated water.

3.0 RESULTS

The AQUADOS computer outputs for the two cases analyzed are presented in Sec. 5. Refer to that section for complete details.

Summaries of the results are presented in Table 2 for the scenario without the drinking-water pathway (Case 1), and in Table 3 for the scenario with the drinking pathway included (Case 2). It is seen that the worst-case total body and critical organ doses are as follows:

Case 1 (without the drinking-water pathway):	2.50E-05 mrem/quarter, adult total body	— $1E-4$ mrem/year
	4.15E-05 mrem/quarter, child bone.	$1.66E-4$
Case 2 (with the drinking-water pathway):	3.77E-05 mrem/quarter, adult total body	$1.508E-4$ mrem/year
	6.94E-05 mrem/quarter, child bone.	$2.776E-4$

For informational purposes and comparative analysis, Table 4 presents the annual doses from liquid releases from the entire site, for the calendar years 2000 to 2004. From this table, it is seen that the lowest annual doses to the total body and critical organ are $3.4E-03$ mrem and $1.06E-02$ mrem, respectively, for 2004. The corresponding quarterly doses are $8.5E-04$ and $2.65E-03$ mrem/quarter. These are at least 30 times higher than the conservatively calculated doses (without the water-ingestion pathway) from the potential leakage of contaminated water to the river

Table 2 - Upper-Bound Doses (mrem/quarter) Resulting from the Postulated Leakage of Contaminated Water into the Hudson River, and the Ingestion of Contaminated Fresh-Water Fish and Salt-Water Invertebrates - Case 1

AGE GROUP	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
ADULT	3.61E-05	3.28E-05	2.50E-05	2.25E-07	1.12E-05	3.88E-06	1.39E-06
TEENAGER	3.57E-05	3.40E-05	1.48E-05	1.73E-07	1.16E-05	4.61E-06	1.07E-06
CHILD	4.13E-05	3.08E-05	7.18E-06	1.44E-07	1.01E-05	3.72E-06	5.03E-07
INFANT	.00E+00						

Table 3 - Upper-Bound Doses (mrem/quarter) Resulting from the Postulated Leakage of Contaminated Water into the Hudson River and the Ingestion of Contaminated Fresh-Water Fish, Salt-Water Invertebrates, and Drinking Water - Case 2

AGE GROUP	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
ADULT	5.15E-05	4.38E-05	3.77E-05	7.21E-06	1.96E-05	1.13E-05	8.83E-06
TEENAGER	4.81E-05	4.28E-05	2.35E-05	5.10E-06	1.78E-05	1.00E-05	6.32E-06
CHILD	6.94E-05	4.84E-05	2.28E-05	9.57E-06	2.22E-05	1.41E-05	1.03E-05
INFANT	2.25E-05	1.95E-05	1.35E-05	9.26E-06	1.20E-05	1.04E-05	9.46E-06

Table 4 - Liquid Effluent Doses from the Entire Indian Point Site (From Reg. Guide 1.21 Annual Reports)

Calendar Year	Total Body Annual Dose (mrem)	Critical Organ Annual Dose (mrem)
2000	6.18E-02	1.01E-01
2001	1.73E-02	2.79E-02
2002	1.21E-02	4.18E-02
2003	5.32E-03	1.57E-02
2004	3.40E-03	1.06E-02

4.0 CONCLUSIONS

Despite the overly conservative assumptions employed in the analysis, it is seen that the doses to any organ of an offsite receptor, due to the potential leakage of contaminated water from IP2 to the river, are less than $1.0E-04$ mrem/quarter, significantly lower than the ODCM quarterly limits of 1.5 mrem to the total body and 5 mrem to any organ. In addition, these doses are at least 30 times lower than the doses from all liquid releases from the site. As such, an elaborate analysis utilizing a more refined river-dilution model is not warranted. It is also noted that the worst-case dose contributors are Sr90 and Cs137, which may not even get into the river because of their expected long transit time through the ground, from the site to the river. Indeed, only tritium has been identified as a contaminant in the control wells at the site.

As a final remark, it is noted that scoping analyses based on the use of the Committed Effective Dose Equivalent (CEDE) dose conversion factors in Federal Guidance Report 11 for the ingestion pathway demonstrated that the CEDEs would be numerically very close to the whole body doses listed above. The same conclusion would also apply to the Total Effective Dose Equivalents (TEDEs) in the present application, since there is no external radiation exposure.

5.0 AQUADOS OUTPUT

AQUADOS CASE 1 (Excludes the water-drinking pathway)

AQUADOS (REG. GUIDE 1.109 - AQUATIC PATHWAY RADIATION EXPOSURES) NYPA / ENTECH ENGINEERING 2-Nov-05 PAGE 1

INPUT DATA LISTING - FILE 4

LINE	1	2	3	4	5	6	7	8
SEQ.	1234567890123456789012345678901234567890123456789012345678901234567890							
1	IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path							
2	1.0	6.0	3.934E-04	3.934E-04	0.0			
3	2190.0	2190.0	0.0	0.0				
4	0.0	0.0	0.0	0.0	0.0			
5	H3	2.00E-02	CO60	1.55E-07	NI63	3.73E-07	SR90	4.91E-07
6	CS134	6.19E-07	CS137	1.04E-05				
7								

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

DISPERSION FACTOR - FISH INGESTION PATHWAY (sec/m3)	3.934E-04
DISPERSION FACTOR - DRINKING WATER PATHWAY (sec/m3)	3.934E-04
DISPERSION FACTOR - SHORELINE DEPOSITS (sec/m3)	.000E+00
TRANSIT/BIOACCUMULATION DECAY TIME (FISH INGESTION, hrs)	.000E+00
TRANSIT TIME (DRINKING WATER PATHWAY, hrs)	.000E+00
TRANSIT TIME (SHORELINE DEPOSITS, hrs)	.000E+00
SHORELINE DEPOSIT PRE-EXPOSURE ACCUMULATION TIME (yrs)	.000E+00
SHORELINE WIDTH FACTOR	.000E+00
RELEASE DURATION (hrs)	6.000E+00
EXPOSURE INTERVALS (hrs)	
FRESH WATER AQUATIC FOODS	2.190E+03
SALT WATER AQUATIC FOODS	2.190E+03
DRINKING WATER	.000E+00
SHORELINE DEPOSITS	.000E+00

AGE-SPECIFIC USAGE FACTORS

PATHWAY	ADULT	TEENAGER	CHILD	INFANT
FRUITS & VEGET. (kg/yr)	520.0	630.0	520.0	.0
LEAFY VEGETABLES (kg/yr)	64.0	42.0	26.0	.0
MILK (liters/yr)	310.0	400.0	330.0	330.0
MEAT AND POULTRY (kg/yr)	110.0	65.0	41.0	.0
FISH (kg/yr)	21.0	16.0	6.9	.0
OTHER SEAFOOD (kg/yr)	5.0	3.8	1.7	.0
DRINKING WATER (liters/yr)	730.0	510.0	510.0	330.0
SHORELINE RECREAT. (hr/yr)	12.0	67.0	14.0	.0
INHALATION (m3/yr)	8000.0	8000.0	3700.0	1400.0

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIONUCLIDE RELEASE INVENTORY

NUCLIDE	Rel. (Ci)						
B3	2.000E-02 **	C14	.000E+00	NA24	.000E+00	P32	.000E+00
CR51	.000E+00	MN54	.000E+00	MN56	.000E+00	TE55	.000E+00
FE59	.000E+00	CO58	.000E+00	CO60	1.550E-07 **	NI63	3.730E-07 **
NI65	.000E+00	CU64	.000E+00	ZN65	.000E+00	ZN69	.000E+00
BR83	.000E+00	BR84	.000E+00	BR85	.000E+00	RB86	.000E+00
RB88	.000E+00	RB89	.000E+00	SR89	.000E+00	SR90	4.910E-07 **
SR91	.000E+00	SR92	.000E+00	Y90	.000E+00	Y91M	.000E+00
Y91	.000E+00	Y92	.000E+00	Y93	.000E+00	IR95	.000E+00
ER97	.000E+00	NR95	.000E+00	MO99	.000E+00	TC99M	.000E+00
TC101	.000E+00	RU103	.000E+00	RU105	.000E+00	RU106	.000E+00
AG110M	.000E+00	TE125M	.000E+00	TE127M	.000E+00	TE127	.000E+00
TE129M	.000E+00	TE129	.000E+00	TE131M	.000E+00	TE131	.000E+00
TE132	.000E+00	I130	.000E+00	I131	.000E+00	I132	.000E+00
I133	.000E+00	I134	.000E+00	I135	.000E+00	CS134	6.190E-07 **
CS136	.000E+00	CS137	1.040E-05 **	CS138	.000E+00	BA139	.000E+00
BA140	.000E+00	BA141	.000E+00	BA142	.000E+00	LA140	.000E+00
LA142	.000E+00	CE141	.000E+00	CE143	.000E+00	CE144	.000E+00
PR143	.000E+00	PR144	.000E+00	ND147	.000E+00	W187	.000E+00
NP239	.000E+00						
TOTAL	2.001E-02						

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIOISOTOPE CONCENTRATIONS (pCi/liter) AT EXPOSURE SITE - AQUATIC FOOD INGESTION PATHWAY

[RADIOACTIVE DECAY TIME (hrs) = .000E+00]

NUCLIDE	Concentr.	NUCLIDE	Concentr.	NUCLIDE	Concentr.	NUCLIDE	Concentr.
H3	3.643E-01 **	C14	.000E+00	NA24	.000E+00	P32	.000E+00
CR51	.000E+00	MN54	.000E+00	MN56	.000E+00	FE55	.000E+00
FE59	.000E+00	CO58	.000E+00	CO60	2.823E-06 **	NI63	6.793E-06 **
NI65	.000E+00	CU64	.000E+00	ZN65	.000E+00	ZN69	.000E+00
BR83	.000E+00	BR84	.000E+00	BR85	.000E+00	RB86	.000E+00
RB88	.000E+00	RB89	.000E+00	SR89	.000E+00	SR90	8.943E-06 **
SR91	.000E+00	SR92	.000E+00	Y90	.000E+00	Y91M	.000E+00
Y91	.000E+00	Y92	.000E+00	Y93	.000E+00	ZR95	.000E+00
ER97	.000E+00	MB95	.000E+00	MO99	.000E+00	TC99M	.000E+00
TC101	.000E+00	RU103	.000E+00	RU105	.000E+00	RU106	.000E+00
AG110M	.000E+00	TE125M	.000E+00	TE127M	.000E+00	TE127	.000E+00
TE129M	.000E+00	TE129	.000E+00	TE131M	.000E+00	TE131	.000E+00
TE132	.000E+00	I130	.000E+00	I131	.000E+00	I132	.000E+00
I133	.000E+00	I134	.000E+00	I135	.000E+00	CS134	1.127E-05 **
CS136	.000E+00	CS137	1.894E-04 **	CS138	.000E+00	BA139	.000E+00
BA140	.000E+00	BA141	.000E+00	BA142	.000E+00	LA140	.000E+00
LA142	.000E+00	CE141	.000E+00	CE143	.000E+00	CE144	.000E+00
PR143	.000E+00	PR144	.000E+00	ND147	.000E+00	W187	.000E+00
NP239	.000E+00						
TOTAL	3.645E-01						

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER FISH
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00	1.807E-07	1.807E-07	1.807E-07	1.807E-07	1.807E-07	1.807E-07
CO60	.000E+00	1.586E-09	3.498E-09	.000E+00	.000E+00	.000E+00	2.979E-08
NI63	4.637E-07	3.213E-08	1.555E-08	.000E+00	.000E+00	.000E+00	6.705E-09
SR90	1.068E-05	.000E+00	2.620E-06	.000E+00	.000E+00	.000E+00	3.085E-07
CS134	8.246E-07	1.962E-06	1.604E-06	.000E+00	6.351E-07	2.108E-07	3.434E-08
CS137	1.775E-05	2.428E-05	1.590E-05	.000E+00	8.242E-06	2.740E-06	4.700E-07
TOTAL	2.972E-05	2.646E-05	2.033E-05	1.807E-07	9.059E-06	3.131E-06	1.030E-06
AGE GROUP: TEENAGER							
H3	.000E+00	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07
CO60	.000E+00	1.587E-09	3.574E-09	.000E+00	.000E+00	.000E+00	2.066E-08
NI63	4.810E-07	3.397E-08	1.630E-08	.000E+00	.000E+00	.000E+00	5.408E-09
SR90	8.907E-06	.000E+00	2.200E-06	.000E+00	.000E+00	.000E+00	2.500E-07
CS134	8.455E-07	1.990E-06	9.233E-07	.000E+00	6.323E-07	2.414E-07	2.475E-08
CS137	1.901E-05	2.529E-05	8.808E-06	.000E+00	8.605E-06	3.343E-06	3.598E-07
TOTAL	2.924E-05	2.745E-05	1.209E-05	1.390E-07	9.376E-06	3.724E-06	7.997E-07
AGE GROUP: CHILD							
H3	.000E+00	1.148E-07	1.148E-07	1.148E-07	1.148E-07	1.148E-07	1.148E-07
CO60	.000E+00	1.288E-09	3.798E-09	.000E+00	.000E+00	.000E+00	7.134E-09
NI63	6.305E-07	3.375E-08	2.145E-08	.000E+00	.000E+00	.000E+00	2.273E-09
SR90	7.867E-06	.000E+00	1.995E-06	.000E+00	.000E+00	.000E+00	1.060E-07
CS134	1.019E-06	1.673E-06	3.529E-07	.000E+00	5.184E-07	1.860E-07	9.017E-09
CS137	2.393E-05	2.291E-05	3.381E-06	.000E+00	7.465E-06	2.686E-06	1.435E-07
TOTAL	3.345E-05	2.473E-05	5.869E-06	1.148E-07	8.099E-06	2.987E-06	3.827E-07

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER FISH
[Exposure Interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CD60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFF LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (uram) DUE TO INGESTION OF CONTAMINATED FRESH WATER INVERTEBRATE
[Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: TEENAGER							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: CHILD							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER FISH
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: TEENAGER							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: CHILD							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER FISH
[Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.180E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00	4.446E-08	4.446E-08	4.446E-08	4.446E-08	4.446E-08	4.446E-08
CO60	.000E+00	7.552E-09	1.666E-08	.000E+00	.000E+00	.000E+00	1.419E-07
NI63	2.760E-07	1.913E-08	9.256E-09	.000E+00	.000E+00	.000E+00	3.991E-09
SR90	1.695E-06	.000E+00	4.158E-07	.000E+00	.000E+00	.000E+00	4.896E-08
CS134	1.963E-07	4.672E-07	3.820E-07	.000E+00	1.512E-07	5.019E-08	8.176E-09
CS137	4.227E-06	5.781E-06	3.787E-06	.000E+00	1.962E-06	6.523E-07	1.119E-07
TOTAL	6.394E-06	6.319E-06	4.655E-06	4.446E-08	2.158E-06	7.470E-07	3.594E-07
AGE GROUP: TEENAGER							
H3	.000E+00	3.411E-08	3.411E-08	3.411E-08	3.411E-08	3.411E-08	3.411E-08
CO60	.000E+00	7.536E-09	1.698E-08	.000E+00	.000E+00	.000E+00	9.816E-08
NI63	2.856E-07	2.017E-08	9.681E-09	.000E+00	.000E+00	.000E+00	3.211E-09
SR90	1.410E-06	.000E+00	3.483E-07	.000E+00	.000E+00	.000E+00	3.959E-08
CS134	2.008E-07	4.726E-07	2.193E-07	.000E+00	1.502E-07	5.734E-08	5.878E-09
CS137	4.514E-06	6.006E-06	2.092E-06	.000E+00	2.044E-06	7.941E-07	8.545E-08
TOTAL	6.411E-06	6.540E-06	2.720E-06	3.411E-08	2.228E-06	8.855E-07	2.664E-07
AGE GROUP: CHILD							
H3	.000E+00	2.923E-08	2.923E-08	2.923E-08	2.923E-08	2.923E-08	2.923E-08
CO60	.000E+00	6.347E-09	1.872E-08	.000E+00	.000E+00	.000E+00	3.515E-08
NI63	3.883E-07	2.079E-08	1.321E-08	.000E+00	.000E+00	.000E+00	1.400E-09
SR90	1.292E-06	.000E+00	3.276E-07	.000E+00	.000E+00	.000E+00	1.741E-08
CS134	2.511E-07	4.121E-07	8.693E-08	.000E+00	1.277E-07	4.583E-08	2.222E-09
CS137	5.897E-06	5.644E-06	8.331E-07	.000E+00	1.839E-06	6.618E-07	3.534E-08
TOTAL	7.828E-06	6.113E-06	1.309E-06	2.923E-08	1.996E-06	7.368E-07	1.208E-07

IP2 SFF LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/O WATER Path

SUMMARY OF RADIATION EXPOSURES (mrem)

PATHWAY	EXPOSURE								
	TIME (hrs)	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI	SKIN
AGE GROUP: ADULT									
FRESH WATER FISH	2.19E+03	2.97E-05	2.65E-05	2.03E-05	1.81E-07	9.06E-06	3.13E-06	1.03E-06	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	6.39E-06	6.32E-06	4.65E-06	4.45E-08	2.16E-06	7.47E-07	3.59E-07	
DRINKING WATER	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		3.61E-05	3.28E-05	2.50E-05	2.25E-07	1.12E-05	3.88E-06	1.39E-06	.00E+00
AGE GROUP: TEENAGER									
FRESH WATER FISH	2.19E+03	2.82E-05	2.75E-05	1.21E-05	1.39E-07	9.38E-06	3.72E-06	8.00E-07	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	6.41E-06	6.54E-06	2.72E-06	3.41E-08	2.23E-06	8.86E-07	2.66E-07	
DRINKING WATER	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		3.57E-05	3.40E-05	1.48E-05	1.73E-07	1.16E-05	4.61E-06	1.07E-06	.00E+00
AGE GROUP: CHILD									
FRESH WATER FISH	2.19E+03	3.35E-05	2.47E-05	5.87E-06	1.15E-07	8.10E-06	2.99E-06	3.83E-07	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	7.83E-06	6.11E-06	1.31E-06	2.92E-08	2.00E-06	7.37E-07	1.21E-07	
DRINKING WATER	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		4.13E-05	3.08E-05	7.18E-06	1.44E-07	1.01E-05	3.72E-06	5.03E-07	.00E+00
AGE GROUP: INFANT									
FRESH WATER FISH	2.19E+03	.00E+00							
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	.00E+00							
DRINKING WATER	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		.00E+00	.00E+00						

* * * * * END OF ANALYSIS * * * * *

AQUADOS CASE 2 (Includes the water-drinking pathway)

AQUADOS (REG. GUIDE 1.109 - AQUATIC PATHWAY RADIATION EXPOSURES) NYPA / ENTECH ENGINEERING

2-Nov-05 PAGE 1

INPUT DATA LISTING - FILE 4

LINE	1	2	3	4	5	6	7	8
SEQ.	123456789012345678901234567890123456789012345678901234567890							
1	IP2 SFF LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path							
2	1.0	6.0	3.934E-04	3.934E-04	0.0			
3	2190.0	2190.0	2190.0	0.0				
4	0.0	0.0	0.0	0.0	0.0			
5	H3	2.00E-02 CO60	1.55E-07 WI63		3.73E-07 SR90		4.91E-07	
6	CS134	6.19E-07 CS137	1.04E-05					
7								

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

DISPERSION FACTOR - FISH INGESTION PATHWAY (sec/m3)	3.934E-04
DISPERSION FACTOR - DRINKING WATER PATHWAY (sec/m3)	3.934E-04
DISPERSION FACTOR - SHORELINE DEPOSITS (sec/m3)	.000E+00
TRANSIT/BIOACCUMULATION DECAY TIME (FISH INGESTION, hrs)	.000E+00
TRANSIT TIME (DRINKING WATER PATHWAY, hrs)	.000E+00
TRANSIT TIME (SHORELINE DEPOSITS, hrs)	.000E+00
SHORELINE DEPOSIT PRE-EXPOSURE ACCUMULATION TIME (yrs)	.000E+00
SHORELINE WIDTH FACTOR	.000E+00
RELEASE DURATION (hrs)	6.000E+00
EXPOSURE INTERVALS (hrs)	
FRESH WATER AQUATIC FOODS	2.190E+03
SALT WATER AQUATIC FOODS	2.190E+03
DRINKING WATER	2.190E+03
SHORELINE DEPOSITS	.000E+00

AGE-SPECIFIC USAGE FACTORS

PATHWAY	ADULT	TEENAGER	CHILD	INFANT
FRUITS & VEGET. (kg/yr)	520.0	630.0	520.0	.0
LEAFY VEGETABLES (kg/yr)	64.0	42.0	26.0	.0
MILK (liters/yr)	310.0	400.0	330.0	330.0
MEAT AND POULTRY (kg/yr)	110.0	65.0	41.0	.0
FISH (kg/yr)	21.0	16.0	6.9	.0
OTHER SEAFOOD (kg/yr)	5.0	3.8	1.7	.0
DRINKING WATER (liters/yr)	730.0	510.0	510.0	330.0
SHORELINE RECREAT. (hr/yr)	12.0	67.0	14.0	.0
INHALATION (m3/yr)	8000.0	9000.0	3700.0	1400.0

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIOISOTOPE RELEASE INVENTORY

NUCLIDE	Rel. (Ci)						
H3	2.000E-02 **	C14	.000E+00	NA24	.000E+00	F32	.000E+00
CR51	.000E+00	MN54	.000E+00	MN56	.000E+00	FE55	.000E+00
FE59	.000E+00	CO58	.000E+00	CO60	1.550E-07 **	NI63	3.730E-07 **
NI65	.000E+00	CU64	.000E+00	ZN65	.000E+00	ZM69	.000E+00
BR83	.000E+00	BR84	.000E+00	BR85	.000E+00	RB86	.000E+00
RB88	.000E+00	RB89	.000E+00	BR89	.000E+00	SR90	4.910E-07 **
SR91	.000E+00	BR92	.000E+00	Y90	.000E+00	Y91M	.000E+00
Y91	.000E+00	Y92	.000E+00	Y93	.000E+00	ZR95	.000E+00
ZR97	.000E+00	MB95	.000E+00	MO99	.000E+00	TC99M	.000E+00
TC101	.000E+00	RU103	.000E+00	RU105	.000E+00	RU106	.000E+00
AG110M	.000E+00	TE125M	.000E+00	TE127M	.000E+00	TE127	.000E+00
TE129M	.000E+00	TE129	.000E+00	TE131M	.000E+00	TE131	.000E+00
TE132	.000E+00	I130	.000E+00	I131	.000E+00	I132	.000E+00
I133	.000E+00	I134	.000E+00	I135	.000E+00	CS134	6.190E-07 **
CS136	.000E+00	CS137	1.040E-05 **	CS138	.000E+00	BA139	.000E+00
BA140	.000E+00	BA141	.000E+00	BA142	.000E+00	LA140	.000E+00
LA142	.000E+00	CE141	.000E+00	CE143	.000E+00	CE144	.000E+00
PR143	.000E+00	PR144	.000E+00	MD147	.000E+00	W187	.000E+00
NP239	.000E+00						
TOTAL	2.001E-02						

IPZ SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIONUCLIDE CONCENTRATIONS (pCi/liter) AT EXPOSURE SITE - AQUATIC FOOD INGESTION PATHWAY

[RADIOACTIVE DECAY TIME (hrs) = .000E+00]

NUCLIDE	Concentr.	NUCLIDE	Concentr.	NUCLIDE	Concentr.	NUCLIDE	Concentr.
H3	3.643E-01 **	C14	.000E+00	NA24	.000E+00	P32	.000E+00
CR51	.000E+00	MN54	.000E+00	MN56	.000E+00	FE55	.000E+00
FE59	.000E+00	CO58	.000E+00	CO60	2.823E-06 **	NI63	6.793E-06 **
NI65	.000E+00	CU64	.000E+00	EN65	.000E+00	EN69	.000E+00
BR83	.000E+00	BR84	.000E+00	BR85	.000E+00	RB86	.000E+00
RB88	.000E+00	RB89	.000E+00	SR89	.000E+00	SR90	8.943E-06 **
SR91	.000E+00	SR92	.000E+00	Y90	.000E+00	Y91M	.000E+00
Y91	.000E+00	Y92	.000E+00	Y93	.000E+00	ER95	.000E+00
ER97	.000E+00	NR95	.000E+00	MO99	.000E+00	TC99M	.000E+00
TC101	.000E+00	RU103	.000E+00	RU105	.000E+00	RU106	.000E+00
AG110M	.000E+00	TE125M	.000E+00	TE127M	.000E+00	TE127	.000E+00
TE129M	.000E+00	TE129	.000E+00	TE131M	.000E+00	TE131	.000E+00
TE132	.000E+00	I130	.000E+00	I131	.000E+00	I132	.000E+00
I133	.000E+00	I134	.000E+00	I135	.000E+00	CS134	1.127E-05 **
CS136	.000E+00	CS137	1.894E-04 **	CS138	.000E+00	BA139	.000E+00
BA140	.000E+00	BA141	.000E+00	BA142	.000E+00	LA140	.000E+00
LA142	.000E+00	CE141	.000E+00	CE143	.000E+00	CE144	.000E+00
PR143	.000E+00	PR144	.000E+00	ND147	.000E+00	WL87	.000E+00
NP239	.000E+00						
TOTAL	3.645E-01						

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER FISH
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00	1.807E-07	1.807E-07	1.807E-07	1.807E-07	1.807E-07	1.807E-07
CO60	.000E+00	1.586E-09	3.498E-09	.000E+00	.000E+00	.000E+00	2.979E-08
NI63	4.637E-07	3.213E-08	1.555E-08	.000E+00	.000E+00	.000E+00	6.705E-09
SR90	1.068E-05	.000E+00	2.620E-06	.000E+00	.000E+00	.000E+00	3.085E-07
CS134	8.246E-07	1.962E-06	1.604E-06	.000E+00	6.351E-07	2.108E-07	3.434E-08
CS137	1.775E-05	2.428E-05	1.590E-05	.000E+00	8.242E-06	2.740E-06	4.700E-07
TOTAL	2.972E-05	2.646E-05	2.033E-05	1.807E-07	9.058E-06	3.131E-06	1.030E-06
AGE GROUP: TEENAGER							
H3	.000E+00	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07
CO60	.000E+00	1.587E-09	3.574E-09	.000E+00	.000E+00	.000E+00	2.066E-08
NI63	4.810E-07	3.397E-08	1.630E-08	.000E+00	.000E+00	.000E+00	5.408E-09
SR90	8.907E-06	.000E+00	2.200E-06	.000E+00	.000E+00	.000E+00	2.500E-07
CS134	8.455E-07	1.990E-06	9.233E-07	.000E+00	6.323E-07	2.414E-07	2.475E-08
CS137	1.901E-05	2.529E-05	8.808E-06	.000E+00	8.605E-06	3.343E-06	3.598E-07
TOTAL	2.924E-05	2.745E-05	1.209E-05	1.390E-07	9.376E-06	3.724E-06	7.997E-07
AGE GROUP: CHILD							
H3	.000E+00	1.148E-07	1.148E-07	1.148E-07	1.148E-07	1.148E-07	1.148E-07
CO60	.000E+00	1.288E-09	3.798E-09	.000E+00	.000E+00	.000E+00	7.134E-09
NI63	6.305E-07	3.375E-08	2.145E-08	.000E+00	.000E+00	.000E+00	2.273E-09
SR90	7.867E-06	.000E+00	1.995E-06	.000E+00	.000E+00	.000E+00	1.060E-07
CS134	1.019E-06	1.673E-06	3.529E-07	.000E+00	5.184E-07	1.860E-07	9.017E-09
CS137	2.393E-05	2.291E-05	3.381E-06	.000E+00	7.465E-06	2.686E-06	1.435E-07
TOTAL	3.345E-05	2.473E-05	5.869E-06	1.148E-07	8.099E-06	2.987E-06	3.827E-07

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER FISH
[Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: TEENAGER							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: CHILD							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED FRESH WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER FISH
 (Exposure interval (hrs) = 2.190E+03)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: TEENAGER							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						
AGE GROUP: CHILD							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER FISH
[Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00						
CO60	.000E+00						
NI63	.000E+00						
SR90	.000E+00						
CS134	.000E+00						
CS137	.000E+00						
TOTAL	.000E+00						

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO INGESTION OF CONTAMINATED SALT WATER INVERTEBRATE
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00	4.446E-08	4.446E-08	4.446E-08	4.446E-08	4.446E-08	4.446E-08
CO60	.000E+00	7.552E-09	1.666E-08	.000E+00	.000E+00	.000E+00	1.419E-07
NI63	2.760E-07	1.913E-08	9.256E-09	.000E+00	.000E+00	.000E+00	3.991E-09
SR90	1.695E-06	.000E+00	4.158E-07	.000E+00	.000E+00	.000E+00	4.896E-08
CS134	1.963E-07	4.672E-07	3.820E-07	.000E+00	1.512E-07	5.019E-08	8.176E-09
CS137	4.227E-06	5.781E-06	3.787E-06	.000E+00	1.962E-06	6.523E-07	1.119E-07
TOTAL	6.394E-06	6.319E-06	4.655E-06	4.446E-08	2.158E-06	7.470E-07	3.594E-07
AGE GROUP: TEENAGER							
H3	.000E+00	3.411E-08	3.411E-08	3.411E-08	3.411E-08	3.411E-08	3.411E-08
CO60	.000E+00	7.536E-09	1.698E-08	.000E+00	.000E+00	.000E+00	9.816E-08
NI63	2.856E-07	2.017E-08	9.681E-09	.000E+00	.000E+00	.000E+00	3.211E-09
SR90	1.410E-06	.000E+00	3.483E-07	.000E+00	.000E+00	.000E+00	3.959E-08
CS134	2.008E-07	4.726E-07	2.193E-07	.000E+00	1.502E-07	5.734E-08	5.878E-09
CS137	4.514E-06	6.006E-06	2.092E-06	.000E+00	2.044E-06	7.941E-07	8.545E-08
TOTAL	6.411E-06	6.540E-06	2.720E-06	3.411E-08	2.228E-06	8.855E-07	2.664E-07
AGE GROUP: CHILD							
H3	.000E+00	2.923E-08	2.923E-08	2.923E-08	2.923E-08	2.923E-08	2.923E-08
CO60	.000E+00	6.347E-09	1.872E-08	.000E+00	.000E+00	.000E+00	3.515E-08
NI63	3.883E-07	2.079E-08	1.321E-08	.000E+00	.000E+00	.000E+00	1.400E-09
SR90	1.292E-06	.000E+00	3.276E-07	.000E+00	.000E+00	.000E+00	1.741E-08
CS134	2.511E-07	4.121E-07	8.693E-08	.000E+00	1.277E-07	4.583E-08	2.222E-09
CS137	5.897E-06	5.644E-06	8.331E-07	.000E+00	1.839E-06	6.618E-07	3.534E-08
TOTAL	7.828E-06	6.113E-06	1.309E-06	2.923E-08	1.996E-06	7.368E-07	1.208E-07

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO DRINKING OF CONTAMINATED WATER
 [Exposure interval (hrs) = 2.190E+03]

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: ADULT							
H3	.000E+00	6.980E-06	6.980E-06	6.980E-06	6.980E-06	6.980E-06	6.980E-06
CO60	.000E+00	1.103E-09	2.432E-09	.000E+00	.000E+00	.000E+00	2.071E-08
NI63	1.612E-07	1.117E-08	5.406E-09	.000E+00	.000E+00	.000E+00	2.331E-09
SR90	1.237E-05	.000E+00	3.036E-06	.000E+00	.000E+00	.000E+00	3.574E-07
CS134	1.280E-07	3.045E-07	2.490E-07	.000E+00	9.855E-08	3.271E-08	5.329E-09
CS137	2.755E-06	3.768E-06	2.468E-06	.000E+00	1.279E-06	4.252E-07	7.294E-08
TOTAL	1.541E-05	1.106E-05	1.274E-05	6.980E-06	8.358E-06	7.438E-06	7.439E-06
AGE GROUP: TEENAGER							
H3	.000E+00	4.923E-06	4.923E-06	4.923E-06	4.923E-06	4.923E-06	4.923E-06
CO60	.000E+00	1.011E-09	2.278E-09	.000E+00	.000E+00	.000E+00	1.317E-08
NI63	1.533E-07	1.083E-08	5.197E-09	.000E+00	.000E+00	.000E+00	1.724E-09
SR90	9.463E-06	.000E+00	2.337E-06	.000E+00	.000E+00	.000E+00	2.657E-07
CS134	1.203E-07	2.832E-07	1.314E-07	.000E+00	8.998E-08	3.435E-08	3.522E-09
CS137	2.705E-06	3.598E-06	1.253E-06	.000E+00	1.224E-06	4.758E-07	5.120E-08
TOTAL	1.244E-05	8.816E-06	8.653E-06	4.923E-06	6.237E-06	5.433E-06	5.258E-06
AGE GROUP: CHILD							
H3	.000E+00	9.428E-06	9.428E-06	9.428E-06	9.428E-06	9.428E-06	9.428E-06
CO60	.000E+00	1.904E-09	5.615E-09	.000E+00	.000E+00	.000E+00	1.055E-08
NI63	4.660E-07	2.495E-08	1.585E-08	.000E+00	.000E+00	.000E+00	1.680E-09
SR90	1.938E-05	.000E+00	4.914E-06	.000E+00	.000E+00	.000E+00	2.611E-07
CS134	3.364E-07	5.520E-07	1.164E-07	.000E+00	1.711E-07	6.139E-08	2.975E-09
CS137	7.897E-06	7.559E-06	1.116E-06	.000E+00	2.463E-06	8.863E-07	4.733E-08
TOTAL	2.808E-05	1.757E-05	1.560E-05	9.428E-06	1.206E-05	1.038E-05	9.752E-06

IP2 SFP LEAK; 1Q RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

RADIATION EXPOSURE (mrem) DUE TO DRINKING OF CONTAMINATED WATER
(Exposure interval (hrs) = 2.190E+03)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AGE GROUP: INFANT							
H3	.000E+00	9.256E-06	9.256E-06	9.256E-06	9.256E-06	9.256E-06	9.256E-06
CO60	.000E+00	2.515E-09	5.939E-09	.000E+00	.000E+00	.000E+00	5.985E-09
NI63	3.553E-07	2.197E-08	1.233E-08	.000E+00	.000E+00	.000E+00	1.093E-09
SR90	1.365E-05	.000E+00	3.475E-06	.000E+00	.000E+00	.000E+00	1.704E-07
CS134	3.506E-07	6.539E-07	6.604E-08	.000E+00	1.683E-07	6.901E-08	1.776E-09
CS137	8.157E-06	9.548E-06	6.766E-07	.000E+00	2.563E-06	1.038E-06	2.985E-08
TOTAL	2.251E-05	1.948E-05	1.349E-05	9.256E-06	1.199E-05	1.036E-05	9.465E-06

IP2 SFP LEAK; IQ RELEASE IN 6-HR TIDAL FLOW w/o FURTHER DILUTION; W/WATER Path

SUMMARY OF RADIATION EXPOSURES (mrem)

PATHWAY	EXPOSURE								
	TIME (hrs)	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI	SKIN
AGE GROUP: ADULT									
FRESH WATER FISH	2.19E+03	2.97E-05	2.65E-05	2.03E-05	1.81E-07	9.06E-06	3.13E-06	1.03E-06	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	6.39E-06	6.32E-06	4.65E-06	4.45E-08	2.16E-06	7.47E-07	3.59E-07	
DRINKING WATER	2.19E+03	1.54E-05	1.11E-05	1.27E-05	6.98E-06	8.36E-06	7.44E-06	7.44E-06	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		5.15E-05	4.38E-05	3.77E-05	7.21E-06	1.96E-05	1.13E-05	8.83E-06	.00E+00
AGE GROUP: TEENAGER									
FRESH WATER FISH	2.19E+03	2.92E-05	2.75E-05	1.21E-05	1.39E-07	9.38E-06	3.72E-06	8.00E-07	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	6.41E-06	6.54E-06	2.72E-06	3.41E-08	2.23E-06	8.86E-07	2.66E-07	
DRINKING WATER	2.19E+03	1.24E-05	8.82E-06	8.65E-06	4.92E-06	6.24E-06	5.43E-06	5.26E-06	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		4.81E-05	4.28E-05	2.35E-05	5.10E-06	1.78E-05	1.00E-05	6.32E-06	.00E+00
AGE GROUP: CHILD									
FRESH WATER FISH	2.19E+03	3.35E-05	2.47E-05	5.87E-06	1.15E-07	8.10E-06	2.99E-06	3.83E-07	
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	7.83E-06	6.11E-06	1.31E-06	2.82E-08	2.00E-06	7.37E-07	1.21E-07	
DRINKING WATER	2.19E+03	2.81E-05	1.76E-05	1.56E-05	9.43E-06	1.21E-05	1.04E-05	9.75E-06	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		6.94E-05	4.84E-05	2.28E-05	9.57E-06	2.22E-05	1.41E-05	1.03E-05	.00E+00
AGE GROUP: INFANT									
FRESH WATER FISH	2.19E+03	.00E+00							
FRESH WATER INVERT.	2.19E+03	.00E+00							
SALT WATER FISH	2.19E+03	.00E+00							
SALT WATER INVERT.	2.19E+03	.00E+00							
DRINKING WATER	2.19E+03	2.25E-05	1.95E-05	1.35E-05	9.26E-06	1.20E-05	1.04E-05	9.46E-06	
SHORELINE DEPOSITS	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
TOTAL (ALL PATHS)		2.25E-05	1.95E-05	1.35E-05	9.26E-06	1.20E-05	1.04E-05	9.46E-06	.00E+00

* * * * * END OF ANALYSIS * * * * *