Summary of ODCM bounding calc of U2 SFP water to the Environment

The following calc is an attempt to bound the offsite dose from a 100 ml per day leak from the U2 pool to the discharge canal.

I used no accounting for hold-up due to leaching or filtering in the soil or concrete.

I used the minimum dilution flow allowed by station procedures, normally 4 to 5 time higher than this (100,000 gpm was used). This value also does NOT account for any Service Water dilution.

I used CURRENT conservative U2 Pool water isotopic concentrations, with some additional conservative estimates for Beta emitters.

These parameters are all very conservative and result in doses that are probably 2 to 4 orders of magnitude higher than reality. However, this is intended as a worst case bounding calc.

Notice that a leak of 100 ml per day can be converted to annual dose by multiplying the final dose values by 365.

The doses calculated are for one day.

The one day calculated whole body dose is 5.24E-8 mrem.

Steve Sandike, IPEC effluents

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*     LIQUID WASTE RELEASE CALCULATIONS     from the ODCM  and RE-CS-050      *
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Test of U2 SFP water to Env at 100 mls per day with 100,000 gpm dilution
The total integrated doses calculated are for ONE DAY.

WASTE VOLUME	= 2.64000E-02 gal	DILUTION VOLUME	= 1.44000E+08 gal
RELEASE DURATION	= 1440 minutes	DILUTION FLOW RATE	= 1.00000E+05 gpm
AVG RELEASE RATE	= 1.833E-05 gpm	total MPCW eff	= 3.705E-04
CURIES (w/o H-3,GAS)	= 1.395E-07 Ci's	gamma MPCW eff	= 1.295E-05
NOBLE GAS CURIES	= 0.000E+00 Ci's	BETA CURIES	= 3.998E-06 Ci's

ISOTOPE	PRE DILUTION uCi/ml	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	4.00E-02	4.00E+00	7.33E-12	7.33E-10	4.00E+00
MN-54	5.00E-06	1.67E-02	9.17E-16	3.06E-12	5.00E-04
FE-55	2.00E-06	2.00E-03	3.67E-16	3.67E-13	2.00E-04
CO-58	2.00E-04	1.00E+00	3.67E-14	1.83E-10	2.00E-02
CO-60	2.00E-04	6.67E+00	3.67E-14	1.22E-09	2.00E-02
NI-63	2.00E-06	2.00E-03	3.67E-16	3.67E-13	2.00E-04
SR-90	2.00E-06	4.00E-01	3.67E-16	7.33E-11	2.00E-04
SB-125	3.00E-05	1.00E-01	5.50E-15	1.83E-11	3.00E-03
CS-134	4.00E-04	4.44E+01	7.33E-14	8.15E-09	4.00E-02
CS-137	5.50E-04	5.50E+01	1.01E-13	1.01E-08	5.50E-02
CO-57	5.00E-06	8.33E-02	9.17E-16	1.53E-11	5.00E-04
TOTAL	4.14E-02	**1.12E+02**	7.59E-12	2.05E-08	4.14E+00

This indicates that releasing 100 mls per day OF STRAIGHT POOL WATER to a DRY discharge canal could exceed 10CFR20 release rate limits in the canal. This calc is performed more for bounding part 50 integrated dose, rather than for evaluating 10CFR20, but it is clear that SOME dilution would be needed. Minimum dilution flow at IPEC is 100,000 gpm, not counting Service Water.

AGE GROUP	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
	< mrem >						
ADULT	4.15E-08	7.02E-08	5.24E-08	9.93E-12	2.31E-08	7.73E-09	8.25E-09
TEEN	4.35E-08	7.20E-08	3.01E-08	7.65E-12	2.36E-08	9.13E-09	5.75E-09
CHILD	5.40E-08	6.34E-08	1.23E-08	6.38E-12	2.01E-08	7.25E-09	2.08E-09

CRITICAL AGE GROUP : TEEN CRITICAL ORGAN : LIVER

The activities in the left most column indicate approx conservative values CURRENTLY in the unit 2 SFP, with no accounting for variable leach rate or holdup in the concrete or soil. Multiply doses above by 365 for annual doses.
It is a straight linear function if dilution volume is reduced, so, for example, if dilution was NOT 1E5, but only 1E3 gpm, the doses would be a factor of 100 higher. However, IPEC minimum dilution allowed is 1E5 gpm, and this does NOT include the added dilution from Service Water.

ADULT Doses by Isotope in the SW sector, @ 1.4 km, with % limits

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
	< mrem >						
H-3	0.00E+00	9.93E-12	9.93E-12	9.93E-12	9.93E-12	9.93E-12	9.93E-12
MN-54	0.00E+00	2.39E-11	4.58E-12	0.00E+00	7.08E-12	0.00E+00	7.30E-11
FE-55	5.65E-11	3.89E-11	9.08E-12	0.00E+00	0.00E+00	2.18E-11	2.24E-11
CO-58	0.00E+00	9.06E-11	2.02E-10	0.00E+00	0.00E+00	0.00E+00	1.83E-09
CO-60	0.00E+00	2.60E-10	5.74E-10	0.00E+00	0.00E+00	0.00E+00	4.89E-09
NI-63	8.75E-11	6.07E-12	2.94E-12	0.00E+00	0.00E+00	0.00E+00	1.27E-12
SR-90	1.11E-09	0.00E+00	2.73E-10	0.00E+00	0.00E+00	0.00E+00	3.20E-11
SB-125	8.21E-12	9.16E-14	1.95E-12	8.34E-15	0.00E+00	6.34E-12	9.03E-11
CS-134	1.46E-08	3.46E-08	2.83E-08	0.00E+00	1.12E-08	3.73E-09	6.05E-10
CS-137	2.57E-08	3.51E-08	2.30E-08	0.00E+00	1.19E-08	3.96E-09	6.78E-10
CO-57	0.00E+00	5.32E-13	8.84E-13	0.00E+00	0.00E+00	0.00E+00	1.35E-11
TOTAL	4.15E-08	7.02E-08	5.24E-08	9.93E-12	2.31E-08	7.73E-09	8.25E-09
PERCENT QRTLY LIMIT	8.30E-07	1.40E-06	3.49E-06	1.99E-10	4.62E-07	1.55E-07	1.65E-07
PERCENT ANNUAL LIMIT	4.15E-07	7.02E-07	1.75E-06	9.93E-11	2.31E-07	7.73E-08	8.25E-08

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TEEN Doses by Isotope

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
	< mrem >						
H-3	0.00E+00	7.64E-12	7.64E-12	7.64E-12	7.64E-12	7.64E-12	7.64E-12
MN-54	0.00E+00	2.35E-11	4.66E-12	0.00E+00	7.00E-12	0.00E+00	4.80E-11
FE-55	5.90E-11	4.17E-11	9.75E-12	0.00E+00	0.00E+00	2.66E-11	1.81E-11
CO-58	0.00E+00	8.98E-11	2.08E-10	0.00E+00	0.00E+00	0.00E+00	1.24E-09
CO-60	0.00E+00	2.60E-10	5.84E-10	0.00E+00	0.00E+00	0.00E+00	3.38E-09
NI-63	9.06E-11	6.41E-12	3.08E-12	0.00E+00	0.00E+00	0.00E+00	1.02E-12
SR-90	9.28E-10	0.00E+00	2.29E-10	0.00E+00	0.00E+00	0.00E+00	2.60E-11
SB-125	8.63E-12	9.45E-14	2.02E-12	8.21E-15	0.00E+00	7.52E-12	6.68E-11
CS-134	1.49E-08	3.51E-08	1.63E-08	0.00E+00	1.12E-08	4.26E-09	4.36E-10
CS-137	2.74E-08	3.65E-08	1.27E-08	0.00E+00	1.24E-08	4.83E-09	5.18E-10
CO-57	0.00E+00	5.50E-13	9.24E-13	0.00E+00	0.00E+00	0.00E+00	1.03E-11
TOTAL	4.35E-08	7.20E-08	3.01E-08	7.65E-12	2.36E-08	9.13E-09	5.75E-09
% Qrt Lim	8.69E-07	1.44E-06	2.01E-06	1.53E-10	4.72E-07	1.83E-07	1.15E-07

CHILD Doses by Isotope

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
	< mrem >						
H-3	0.00E+00	6.37E-12	6.37E-12	6.37E-12	6.37E-12	6.37E-12	6.37E-12
MN-54	0.00E+00	1.85E-11	4.93E-12	0.00E+00	5.19E-12	0.00E+00	1.55E-11
FE-55	8.01E-11	4.26E-11	1.32E-11	0.00E+00	0.00E+00	2.41E-11	7.87E-12
CO-58	0.00E+00	7.39E-11	2.27E-10	0.00E+00	0.00E+00	0.00E+00	4.31E-10
CO-60	0.00E+00	2.16E-10	6.41E-10	0.00E+00	0.00E+00	0.00E+00	1.20E-09
NI-63	1.21E-10	6.46E-12	4.10E-12	0.00E+00	0.00E+00	0.00E+00	4.35E-13
SR-90	8.24E-10	0.00E+00	2.09E-10	0.00E+00	0.00E+00	0.00E+00	1.11E-11
SB-125	1.11E-11	8.58E-14	2.34E-12	1.03E-14	0.00E+00	6.20E-12	2.67E-11
CS-134	1.81E-08	2.97E-08	6.27E-09	0.00E+00	9.22E-09	3.31E-09	1.60E-10
CS-137	3.48E-08	3.33E-08	4.94E-09	0.00E+00	1.08E-08	3.91E-09	2.09E-10
CO-57	0.00E+00	5.06E-13	1.03E-12	0.00E+00	0.00E+00	0.00E+00	4.15E-12
TOTAL	5.40E-08	6.34E-08	1.23E-08	6.38E-12	2.01E-08	7.25E-09	2.08E-09
% Qrt Lim	1.08E-06	1.27E-06	8.21E-07	1.28E-10	4.02E-07	1.45E-07	4.15E-08

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