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Date: 01/19/2007 5:59:06 PM
Subject: Assessment of Sr-90 results in fish/inv

All... Dennis Quinn and I have evaluated the fish/inv analyses results with an eye toward a conservative evaluation of dose impact, assuming of course, the recent analytical results are valid. This assessment is by no means final, but this doc provides an initial determination of worst case dose impact, and what IPEC would have to be releasing to produce this kind of concentration in fish.

<<chm-07-002.pdf>>

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Indian Point NPP

Jan 17, 2007
IPEC-CHM-07-002

MEMORANDUM TO: T. BURNS -NEM SUPERVISOR

FROM: S. SANDIKE - Sr. CHEMISTRY SPECIALIST

SUBJECT: DOSE ASSESSMENTS FROM Sr-90 IN THE HUDSON RIVER
FOR FISH AND INVERTEBRATES - JANUARY 2007 RESULTS

This report summarizes some worst-case assessments of the Sr-90 identified in early reports of the fall, 2006 batch of REMP samples sent to Areva. I used the 24.5 pCi/kg value in white perch and the 13.9 pCi/kg value in blue crab to bound the dose assessment.

This simple evaluation does NOT account or discuss any of the finer elements of error propagation, critical level, environmental BKGD, constants for non-random error, or other improvements we are discussing with labs. It conservatively assumes all fish and crab identified in the recent lab results are consumed by humans at the RG1.109 consumption rate, and at the highest concentrations reported from this batch of samples. Furthermore, we are assuming that these initially reported concentrations are accurate.

With these bounding conditions, we can obtain annual doses as follows:

		Reg Guide 1.109 and ODCM				
	Fish/Inv Conc, pCi/kg	mrem/pCi ingestion dose factor	Fish usage factor kg/yr	Inv usage factor kg/yr	human total dose expected, annually, mrem	percent of annual limit
Adult	25 / 14	7.58E-03	21	5	4.41	44.1%
Teen	25 / 14	8.30E-03	16	3.8	3.68	36.8 %
Child	25 / 14	1.70E-02	6.9	1.7	3.27	32.7 %
Infant	25 / 14	1.85E-02	0	0	0.00	n/a

The dose and usage factors above, obtained from Reg Guide 1.109 are identical to those used in the IPEC ODCMs (we do NOT use site specific data for these values).

This evaluation indicates that should all edible aquatic food in this location be consumed at the rates identified in Regulatory Guide 1.109 (at the highest reported concentrations of Sr-90), the maximum individual annual dose would be about 4.4 mrem, or 44% of the annual bone dose (combining the fish and invertebrate dose contribution at this concentration).

If we evaluate ALL the Sr-90 released in liquid effluent from IPEC since 2000, and INCLUDE a conservative assessment of Ground Water's contribution, we can project the IPEC-induced worst case concentration in fish. From the annual effluent reports (Reg Guide 1.21) and the ODCM's Bio-Accumulation Factor for Sr-90, we can conservatively produce the following table:

year	Routine Sr-90 Curies	GW Sr-90 Curies	Total Sr-90 Curies	Annual Discharge Canal Dilution Volume, Liters	Annual Dilution Volume Determined for Ground Water, Liters	Diluted Sr-90 concentration in water, outside IPEC, in pCi/L	Fish Bio-accum factor	Calculated expected fish pCi/kg
2000	4.00E-03	3.35E-04	4.34E-03	2.78E+12	2.21E+11	2.95E-03	30	8.86E-02
2001	5.00E-03	3.35E-04	5.34E-03	2.78E+12	2.21E+11	3.31E-03	30	9.94E-02
2002	2.45E-03	3.35E-04	2.79E-03	2.78E+12	2.21E+11	2.40E-03	30	7.19E-02
2003	7.30E-03	3.35E-04	7.64E-03	2.78E+12	2.21E+11	4.14E-03	30	1.24E-01
2004	1.74E-02	3.35E-04	1.77E-02	2.78E+12	2.21E+11	7.77E-03	30	2.33E-01
2005	6.42E-04	3.35E-04	9.77E-04	2.78E+12	2.21E+11	1.75E-03	30	5.24E-02
2006	3.80E-04	5.00E-04	8.80E-04	2.78E+12	2.21E+11	2.40E-03	30	7.20E-02
units	curies	curies	curies	liters	liters	pCi/L	pCi/kg per pCi/L	pCi/kg

Note: 2006 data is estimated, but should be relatively accurate.

While we should NOT discount the value originally determined by Areva, this evaluation indicates that we must perform additional investigation in an attempt to validate and understand the 25 pCi/L recently identified at our control location in Roseton.

Even in a very conservative model, total IPEC effluent of Sr-90 would need to approach 1.9 curies in a year to produce this concentration in fish. This is over 100 times the highest annual total and higher than the last 7 years combined.

Certainly, a small amount of Strontium can build up in fish over many years. However, since the average age of Hudson Valley White Perch is 3-4 years (and a maximum of approximately 7 years¹), it is NOT reasonable to assume that IPEC is releasing Sr-90 several hundred times that of the combined conservative measurements without a single effluent or other REMP sample showing this concentration, or the accompanying gamma concentrations. Nonetheless, this scenario should be evaluated along with other, more reasonable possibilities, such as lab error and environmental background components.

Also attached is an independent evaluation from D. Quinn, itemizing dose from each species analyzed.

SS/ss

cc: J. Adler P. Donahue D. Gray D. Wilson

1) Wong, Russell, NC State University, Zoology Dept, 2002; Cooper, 1939; Normandeau, 2007

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Evaluating 2005 data from the annual effluent report:

Based on ODCM values and 2005 1.21 Report Data

Total Sr-90 Released	6.40E-04	Ci
Volume of Dilution Water	2.78E+12	flow (L)
Ci Sr-90 per L of water	2.30E-16	
Ci - pCi conversion factor	1.00E+12	
Total Sr-90 Released	2.30E-04	pCi/L
	30	BFI (pCi/Kg/pCi/L)
Calculated expected Sr90 in Fish	6.91E-03	pCi/kg

Dennis then evaluated the Strontium dose in ALL species from the last batch of sample results from Areva:

Dose from Sr-90 in Fish assuming RG 1.109 Parameters

[illegible]