2 L

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Date: 2/27/06 9:38PM
Subject: Draft dose calc for ground water releases-2005

Attached are draft dose calcs and info from GZA for assessing the water transport flow rates.

<<IPEC GW&SW Dose.pdf>>

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C/3

Indian Point Energy Center

Water Mass Balance and Dose Calculation from Groundwater and Storm Water

DRAFT

Feb 2006

IPEC Water Mass Balance and Dose Calculation from Groundwater and Storm Water

The basic methodology for this dose calculation is based on an overall mass balance driven by precipitation. The hydrology portion of this calculation was performed by IPEC's consultant, Matthew Barvenik, of GZA GeoEnvironmental, Inc. IPEC concurs with this methodology. This "watershed analysis" partitions the precipitation falling on the watershed catchment area (i.e., that portion of the Facility area where the surface topography is sloped towards the river) into water that infiltrates the ground to become groundwater (GW), water that flows off the surface as storm water (SW) and that water which directly moves back into the atmosphere via evapotranspiration and other processes. See Figure 1, "IPEC Groundwater and Storm Drain Conceptual Drawing". This method of analysis is based on well established hydrologic principles and the parameter selection we've employed is heavily biased towards larger flows and higher H3 concentrations. As such, we believe that this analysis is significantly conservative, resulting in estimates of H3 moving to the river (both directly and via the Discharge Canal) that will likely be proven to be substantially higher than actual with the acquisition of additional data.

Over the entire watershed catchment area of 4.8 million ft^2, the GW and SW has been segmented relative to the areas of the Facility through which it flows (primarily established based on H3 concentrations in the various Facility areas. See Figure 2, "Indian Point Site Overview" depicting groundwater areas and storm water zones.

Overall, the partitioning was established as follows for infiltration areas contributing to GW flow (does not include paved or building areas):

GROUNDWATER AREAS:

- **AREA 1.** The northwestern most area where GW appears to move directly to the river, but passes to the north of the Unit 2 Turbine Building Road (area of 0.25 million ft^2). This GW is unlikely to contain appreciable H3 concentrations based on the data available to date and the lack of likely H3 sources;
- **AREA 2.** The area where the GW appears to move through Unit 2 facilities (area of 0.57 million ft^2);
- **AREA 3.** The area where the GW appears to move through Unit 1/3 facilities (area of 1.7 million ft^2);
- **AREA 4.** The southwestern most area where GW appears to move directly to the river, but passes to the south of the Unit 3 Turbine Building Road (area of 0.67 million ft^2). This GW is unlikely to contain appreciable H3 concentrations based on the data available to date and the lack of likely H3 sources.

SW flow from paved areas and building roof areas has also been partitioned into various zones within the above Facility GW areas as follows:

STORM WATER AREAS:

- **ZONE A.** The eastern most parking lots which likely drain along flow paths where the SW is unlikely to contain H3, and storm drain exfiltration into the GW flow zone is also unlikely to pick up H3 (area of 0.35 million ft^2);
- **ZONE B.** Within the Unit 2 Facility, the eastern and western zones where SW appears to discharge to the river, but does not pass through the Unit 2 Transformer Yard (area of 0.21 million ft^2);
- **ZONE C.** Within the Unit 2 Facility, the middle zone where SW flows to the Discharge Canal, and does pass through the Unit 2 Transformer Yard (area of 0.15 million ft^2);
- **ZONE D.** Within the Unit 1 Facility where SW flows to the Discharge Canal (area of 0.13 million ft^2); and
- **ZONE E.** Within the Unit 3 Facility where SW flows to the Discharge Canal (area of 0.75 million ft^2).

Some SW has been assumed to leak out of storm drains and thus increases the GW flow to the river as follows:

- **ZONE A.** Storm drain exfiltration =0% - set to 0% because exfiltration from pipes in this zone are unlikely to contribute flow to GW which contains H3 and the SW itself is unlikely to contain H3;
- **ZONE B.** Storm drain exfiltration =0% - set to 0% because exfiltration from pipes in this zone are unlikely to contribute flow to GW which contains H3 and the SW itself is unlikely to contain H3;
- **ZONE C.** Storm drain exfiltration =25% - set to a relatively high value to result in higher than anticipated GW flow through this area which contains the highest H3 GW values to be conservative ;
- **ZONE D.** Storm drain exfiltration =50%; set very high given current knowledge of these drains; and
- **ZONE E.** Storm drain exfiltration =10%; set to a nominal value given current lack of specific data.

H3 concentrations have been established using 2005 data, and Strontium-90 has been included for groundwater flow Area 2.

- **GW flow AREA 1.** [H3] = 0 pCi/L given lack of likely H3 source areas and flow path which appears not to flow through areas exhibiting H3 concentrations in the GW ;
- **GW flow AREA 2.** [H3] = 200,000 pCi/L which represents an upper bound average of the concentrations found in the Unit 2 Transformer Yard (it is expected that the pending Phase I and II data will prove this assumed value for H3 in the GW moving to the river through the Unit 2 area is likely substantially higher than actual);
- **GW flow AREA 3.** [H3] = 620 pCi/L which represents an upper average of the concentrations found in the Unit 1 and 3 Facility areas;
- **GW flow AREA 4.** [H3] = 0 pCi/L given lack of likely H3 source areas and flow path which appears not to flow through areas exhibiting H3 concentrations in the GW;

- **SW flow ZONE A.** [H3] = 0 pCi/L given that exfiltration from pipes in this zone are unlikely to contribute flow to GW which contains H3 and the SW itself is unlikely to contain H3;;
- **SW flow ZONE B.** [H3] = 651 pCi/L given that exfiltration from pipes in this zone are unlikely to contribute flow to GW which contains H3 and the SW itself is unlikely to contain H3;
- **SW flow ZONE C.** [H3] = 2,900 pCi/L given measured storm drain concentrations;
- **SW flow ZONE D.** [H3] = 1,560 pCi/L given measured storm drain concentrations; and
- **SW flow ZONE E.** [H3] = 1,560 pCi/L given measured storm drain concentrations.

The infiltration rate in non-paved/building areas was established at 5.5 inches /year based on a USGS report: Water Use, Groundwater Recharge and Availability, and Quality in the Greenwich Area, Fairfield County, CT and Westchester County, NY, 2000 - 2002. The precipitation rate for the area was conservatively set at 48 inches/year based on onsite meteorological data.

Based on the above analysis, it is estimated that approximately 1.38 Ci/year of H3 migrates directly to the river via the GW flow path. It is also estimated that approximately 0.02 Ci/year flows directly to the river via SW. It is further estimated that approximately 0.16 Ci/year flows to the river with SW via the Discharge Canal.

It is noted that these H3 levels are expected to represent upper bounds based on conservative parameter selection. An example of the conservatism employed in these calculations includes:

- H3 concentrations selected for the various GW and SW flows are likely to be upper bound values. It is believed that these values will be proven to be substantially too high with the acquisition of additional Phase I and II data. This is particularly true for the 200,000 pCi/L adopted for the Unit 2 Transformer Area;

- The areas contributing GW flow through various IP Facilities was biased toward placing more flow through the Unit 2 Transformer Yard where the highest H3 concentrations were used;
- All GW flow has been assumed to discharge directly to the river. Some of this GW flow must infiltrate the Discharge Canal thus reducing the apportionment to the the river;
- All storm drain pipe leakage has been assumed to be exfiltration which will increase GW flow values. However, current data in the Unit 2 Transformer Yard indicates that some GW infiltrates the storm drain during rainfall events, thus flowing to the Discharge Canal via SW rather than directly to the river as GW;
- All precipitation falling on paved/building areas was assumed to result in SW flow. Some of this water actually evaporates directly to atmosphere from pavement and buildings; and
- The very large value of GW flow extracted from the GW system via the Unit 1 curtain and footing drains has not been subtracted from the GW flows adopted in the analysis.

Results:

The results of the calculations are shown in Table 1, and they show that the annual dose from the groundwater and storm water pathways due to tritium is 0.000013 millirem per year to the whole body (less than 0.1 percent of the 3 millirem per year liquid pathway limit). If Sr-90 is included in the calculation, the dose to the critical organ (bone) is 0.00075 millirem per year, which is less than 0.1 percent of the 10 millirem per year critical organ limit. The total tritium activity calculated to be released via this pathway is 1.6 Curies, which is less than 0.1 percent of the liquid tritium releases via other pathways.

There are seven tables attached, including one summary table, three tables of doses from storm water pathways, two tables of doses from groundwater pathways, and an additional groundwater dose table including Sr-90. Figure 3 shows precipitation data for the Indian Point site.

Figure 1

IPEC Ground Water and Storm Drain Conceptual Drawing

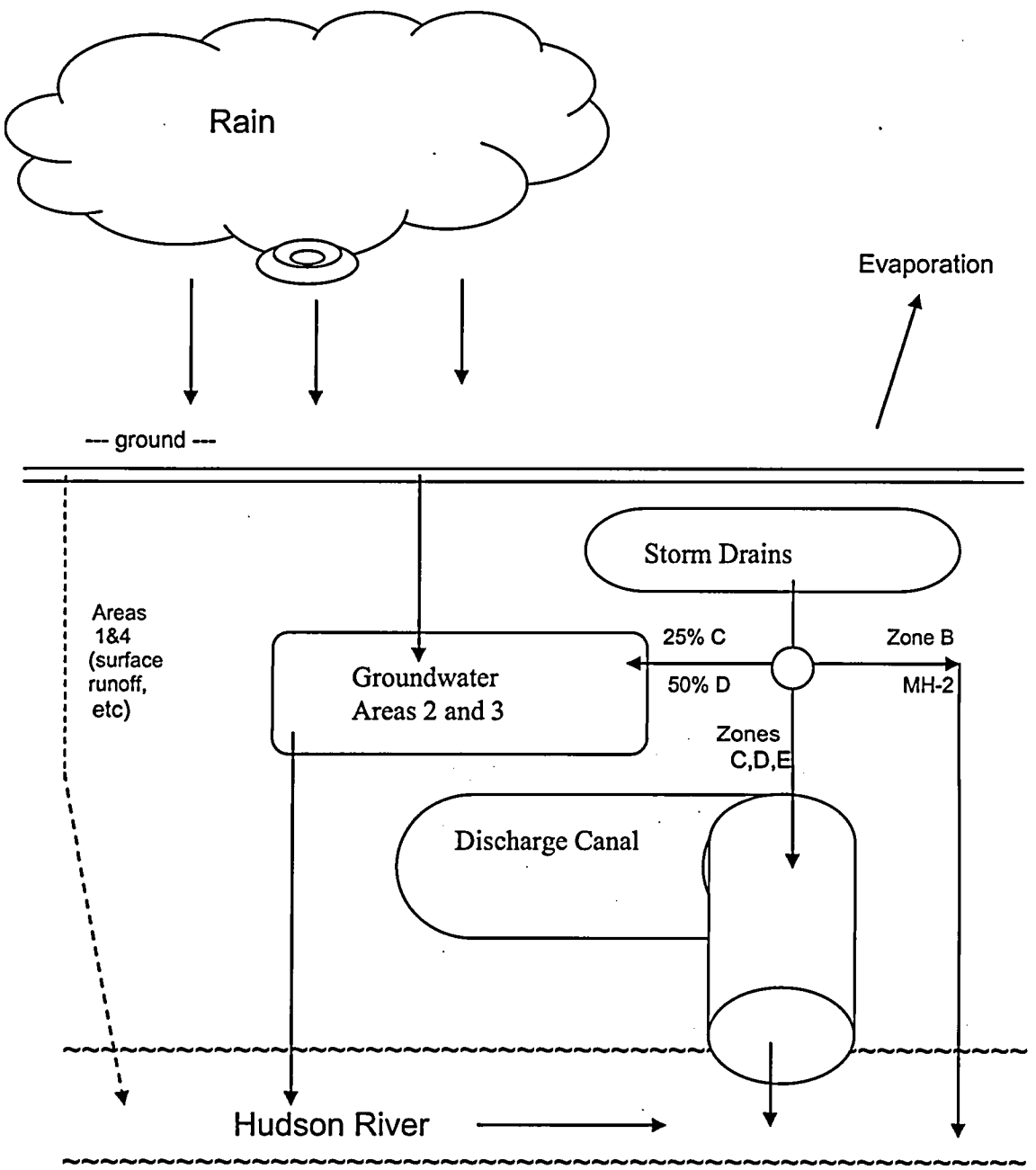


Figure 2.. Indian Point Site Overview

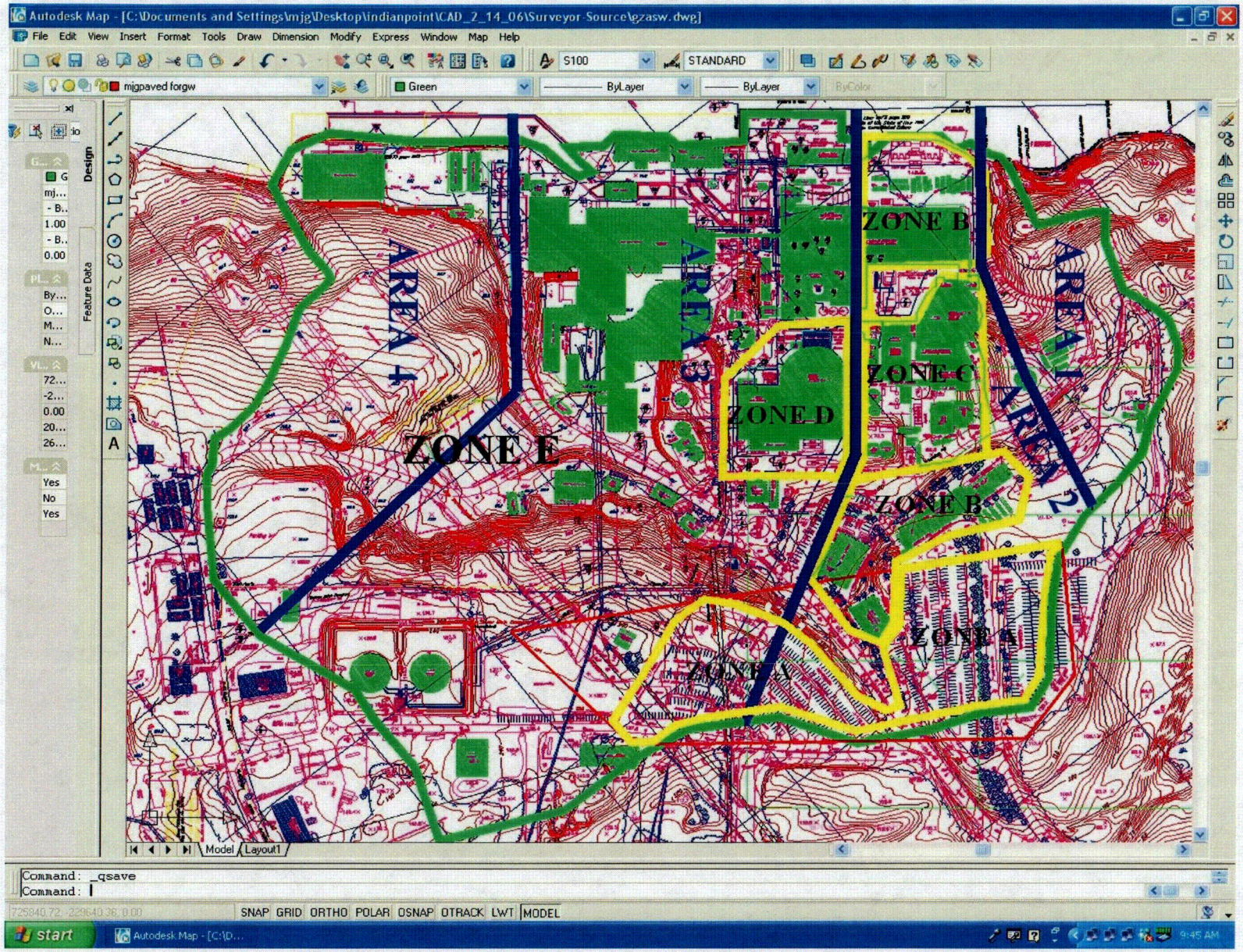


Table 1.

Total IPEC Summary for Ground Water releases in 2005 (H-3 and Sr-90)

Sum of two monitoring well calculations, IP2 and IP3, Areas 2 and 3

Doses, in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi H-3
H-3	0.00E+00	1.35E-05	1.35E-05	1.35E-05	1.35E-05	1.35E-05	1.35E-05	1.21E+06

Storm Drain Water from Zone B, East/West Unit 2, near MH-2, going to river directly

Doses, in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi H-3
H-3	0.00E+00	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.55E+04

Storm Drain Water from Zones C and D/E (Central U2 & U1/U3) to Discharge Canal

Doses, in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi H-3
H-3	0.00E+00	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	1.62E+05

Total mrem	0.00E+00	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	
Total Curies								1.39E+00

Unit 2 Ground Water (MW) pathway with Sr-90 added (Area 2)

Doses, in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	Total uCi
H-3	0.00E+00	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.19E+06
Sr-90	7.48E-04	0.00E+00	1.83E-04	0.00E+00	0.00E+00	0.00E+00	2.15E-05	2.98E+01
Total	7.48E-04	1.34E-05	1.97E-04	1.34E-05	1.34E-05	1.34E-05	3.49E-05	1.19E+06

Table 2

Storm Drain Zone B (MH-2 East & West Unit 2) to the Hudson River directly, 2005

Release Rate 6.54E+07 ml/day or 1.73E+04 gpd or 1.20E+01 gpm

Duration of Release, in days 365 Waste vol released = 6.31E+06 gal

Dilution flow 1.11E+05 gpm Diltution vol released = 5.83E+10 gal

Dil Factor 1.08E-04 *(dilution data per **IP-CHM-05-042** from Dr. John Hamawi)*

ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	6.51E-07	1.00E-02	6.51E-05	7.04E-11	7.04E-09	1.55E+04
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90		5.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**6.51E-07**	**n/a**	**6.51E-05**	**7.04E-11**	**7.04E-09**	**1.55E+04**

NUREG 0133 "Applicable Factor" for Near Field Dilution = 1.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07

Table 3

Central Unit 2 Storm Drain Releases of Tritium to the Hudson River via the Discharge Canal in 2005 (Zone C)

Release Rate 3.27E+07 ml/day or 8.64E+03 gpd or 6.00E+00 gpm

Duration of Release, in days 365 Waste vol released = 3.15E+06 gal

Dilution flow 1.39E+06 gpm Diltution vol released = 7.31E+11 gal

Dil Factor 4.32E-06 *(dilution from actual 2005 data)*

ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3 *	2.90E-06	1.00E-02	2.90E-04	1.25E-11	1.25E-09	3.46E+04
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90		5.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**2.90E-06**	**n/a**	**2.90E-04**	**1.25E-11**	**1.25E-09**	**3.46E+04**

* No gamma identified in storm drains, and 2.9E-6 was avg effluent H-3 in 2005 from MH-4a.

NUREG 0133 "Applicable Factor" for Near Field Dilution = 5.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	6.18E-09	6.18E-09	6.18E-09	6.18E-09	6.18E-09	6.18E-09
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	6.18E-09	6.18E-09	6.18E-09	6.18E-09	6.18E-09	6.18E-09

Table 4

Storm Drain Releases of Tritium to the Hudson River via the Discharge Canal in 2005 from Units 1 and 3 (Zones D and E)

Release Rate 2.23E+08 ml/day or 5.90E+04 gpd or 4.10E+01 gpm

Duration of Release, in days 365 Waste vol released = 2.15E+07 gal

Dilution flow 1.39E+06 gpm Diltution vol released = 7.31E+11 gal

Dil Factor 2.95E-05 *(dilution from actual 2005 data)*

ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3 *	1.56E-06	1.00E-02	1.56E-04	4.60E-11	4.60E-09	1.27E+05
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90		5.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**1.56E-06**	**n/a**	**1.56E-04**	**4.60E-11**	**4.60E-09**	**1.27E+05**

* No gamma identified in storm drains, and 1.56E-6 was average of effected Storm Drains in 2005

NUREG 0133 "Applicable Factor" for Near Field Dilution = 5.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08

Table 5

IP3 Tritium Released to Hudson River via Bedrock Pathway in 2005

(from the area near IP3 waterfront, as determined by samples from Monitoring Wells - Area 3)

Release Rate 7.63E+07 ml/day or 2.02E+04 gpd or 1.40E+01 gpm

Duration of Release, in days 365 Waste vol released = 7.36E+06 gal

Dilution flow 1.11E+05 gpm Diltution vol released = 5.83E+10 gal

Dil Factor 1.26E-04 *(dilution data per **IP-CHM-05-042** from Dr. John Hamawi)*

ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	6.20E-07	1.00E-02	6.20E-05	7.82E-11	7.82E-09	1.73E+04
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90		5.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**6.20E-07**	**n/a**	**6.20E-05**	**7.82E-11**	**7.82E-09**	**1.73E+04**

NUREG 0133 "Applicable Factor" for Near Field Dilution = 1.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.93E-07	1.93E-07	1.93E-07	1.93E-07	1.93E-07	1.93E-07
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	1.93E-07	1.93E-07	1.93E-07	1.93E-07	1.93E-07	1.93E-07

Table 6

IP2 Tritium Released to Hudson River via Bedrock Pathway, 2005

(from the area near IP2 transformer yard, as determined by samples from Monitoring Wells - Area 2)

Release Rate 1.64E+07 ml/day or 4.32E+03 gpd or 3.00E+00 gpm

Duration of Release, in days 365 Waste vol released = 1.58E+06 gal

Dilution flow 1.11E+05 gpm Diltution vol released = 5.83E+10 gal

Dil Factor 2.70E-05 *(dilution data per **IP-CHM-05-042** from Dr. John Hamawi)*

ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	2.00E-04	1.00E-02	2.00E-02	5.41E-09	5.41E-07	1.19E+06
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90		5.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**2.00E-04**	**n/a**	**2.00E-02**	**5.41E-09**	**5.41E-07**	**1.19E+06**

NUREG 0133 "Applicable Factor" for Near Field Dilution = 1.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05

Table 7

IP2 Tritium and Sr-90 Released to Hudson River via Bedrock Pathway, 2005

(from the area near IP2 transformer yard, as determined by samples from Monitoring Wells - Area 2)

Release Rate 1.64E+07 ml/day or 4.32E+03 gpd or 3.00E+00 gpm

Duration of Release, in days 365 Waste vol released = 1.58E+06 gal

Dilution flow 1.11E+05 gpm Diltution vol released = 5.83E+10 gal

Dil Factor 2.70E-05 *(dilution data per **IP-CHM-05-042** from Dr. John Hamawi)*

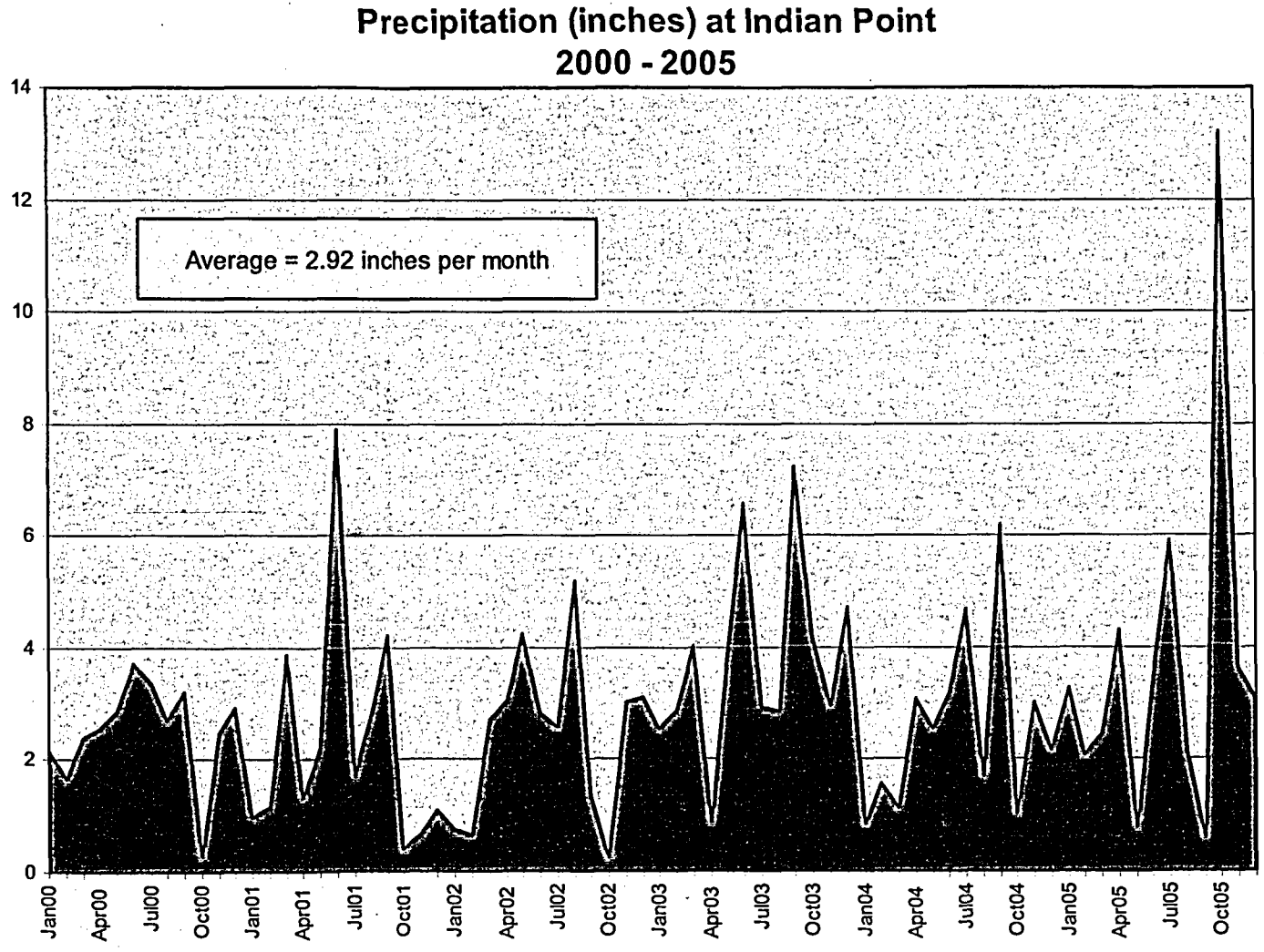
ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	2.00E-04	1.00E-02	2.00E-02	5.41E-09	5.41E-07	1.19E+06
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58		2.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60		3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	5.00E-09	5.00E-06	1.00E-03	1.35E-13	2.70E-08	2.98E+01
SB-125		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134		9.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137		1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57		6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	**2.00E-04**	**n/a**	**2.10E-02**	**5.41E-09**	**5.68E-07**	**1.19E+06**

NUREG 0133 "Applicable Factor" for Near Field Dilution = 1.00E+00

Adult Total Body mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05
MN-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	7.48E-04	0.00E+00	1.83E-04	0.00E+00	0.00E+00	0.00E+00	2.15E-05
SB-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	7.48E-04	1.34E-05	1.97E-04	1.34E-05	1.34E-05	1.34E-05	3.49E-05

Figure 3


Precipitation (inches) at Indian Point
2000 - 2005
Average = 2.92 inches per month
14
12
10
8
6
4
2
0
Jan00
Apr00
Jul00
Oct00
Jan01
Apr01
Jul01
Oct01
Jan02
Apr02
Jul02
Oct02
Jan03
Apr03
Jul03
Oct03
Jan04
Apr04
Jul04
Oct04
Jan05
Apr05
Jul05
Oct05