Indian Point Energy Center

Water Mass Balance and Dose Calculation from Groundwater and Storm Water

An Assessment of 2005 Effluent Impact

GZA GeoEnvironmental, Inc
IPEC Chemistry and Rad Protection
DAQ, inc

March 3, 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 H^3 concentrations. As such, we believe that this analysis is significantly conservative, resulting in estimates of H^3 moving to the river (both directly and via the Discharge Canal) that will likely be proven to be substantially higher than actually exist with the acquisition of additional data.

Over the entire watershed catchment area of 3.2 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 H^3 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 H^3 concentrations based on the data available to date and the lack of likely H^3 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 H^3 concentrations based on the data available to date and the lack of likely H^3 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 H^3, and storm drain exfiltration into the GW flow zone is also unlikely to pick up H^3 (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).

A portion of the 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 H^3 and the SW itself is unlikely to contain H^3;
- **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 H^3 and the SW itself is unlikely to contain H^3;
- **ZONE C.** Storm drain exfiltration =25% - set to a relatively high value to result in higher than anticipated GW flow through the Unit 2 Transformer Yard which contains the highest H^3 GW values, so as 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 and limited impact on overall H^3 flux due to low H^3 concentrations.

H^3 concentrations have been established using 2005 data, and Strontium-90 has been included for groundwater flow Area 2.

- **GW flow AREA 1.** $[H^3]$ = 0 pCi/L given lack of likely H^3 source areas and flow path which appears not to flow through areas exhibiting H^3 concentrations in the GW ;
- **GW flow AREA 2.** $[H^3]$ = 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 H^3 in the GW moving to the river through the Unit 2 area to be substantially higher than actually exists);
- **GW flow AREA 3.** $[H^3]$ = 620 pCi/L which represents an upper average of the concentrations found in the Unit 1 and 3 Facility areas;
- **GW flow AREA 4.** $[H^3]$ = 0 pCi/L given lack of likely H^3 source areas and flow path which appears not to flow through areas exhibiting H^3 concentrations in the GW;

- **SW flow ZONE A.** $[H^3]$ = 0 pCi/L given that exfiltration from pipes in this zone are unlikely to contribute flow to GW which contains H^3 and the SW itself is unlikely to contain H^3;
- **SW flow ZONE B.** $[H^3]$ = 651 pCi/L given measured storm drain concentrations;
- **SW flow ZONE C.** $[H^3]$ = 2,900 pCi/L given measured storm drain concentrations;
- **SW flow ZONE D.** $[H^3]$ = 1,560 pCi/L given measured storm drain concentrations; and
- **SW flow ZONE E.** $[H^3]$ = 1,560 pCi/L given measured storm drain concentrations.

The infiltration rate in non-paved/building areas was established at 0.46 feet/year based on the 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 set at 3.74 feet/year based on onsite meteorological data.

Based on the above analysis, it is estimated that approximately 1.36 Ci/year of H^3 migrates directly to the river via the GW flow path. It is also estimated that less than 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 the H^3 concentrations adopted herein are expected to represent values which are significantly greater than those which actually exist given the conservatism exercised during parameter selection. An example of the conservatism employed in these calculations includes:

- H^3 concentrations selected for the various GW and SW flows are likely to be higher values than actually exist. It is believed that these values will be proven to be significantly 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 IPEC Facilities was biased toward placing more flow through the Unit 2 Transformer Yard where the highest H^3 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 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 significant GW infiltrates the storm drain during rainfall events, thus flowing to the Discharge Canal via SW rather than directly to the river as GW. In addition, it is noted that SW H^3 concentrations were typically obtained during non-storm events and thus represent the high end of H^3 values associated with low flow conditions. However, these high H^3 concentrations, were then applied to the much higher storm flows where much lower H^3 values should exist;
- 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 0.0000154 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 0.000840 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 1.53 Curies, which is less than 0.1 percent of the liquid tritium releases via other pathways.

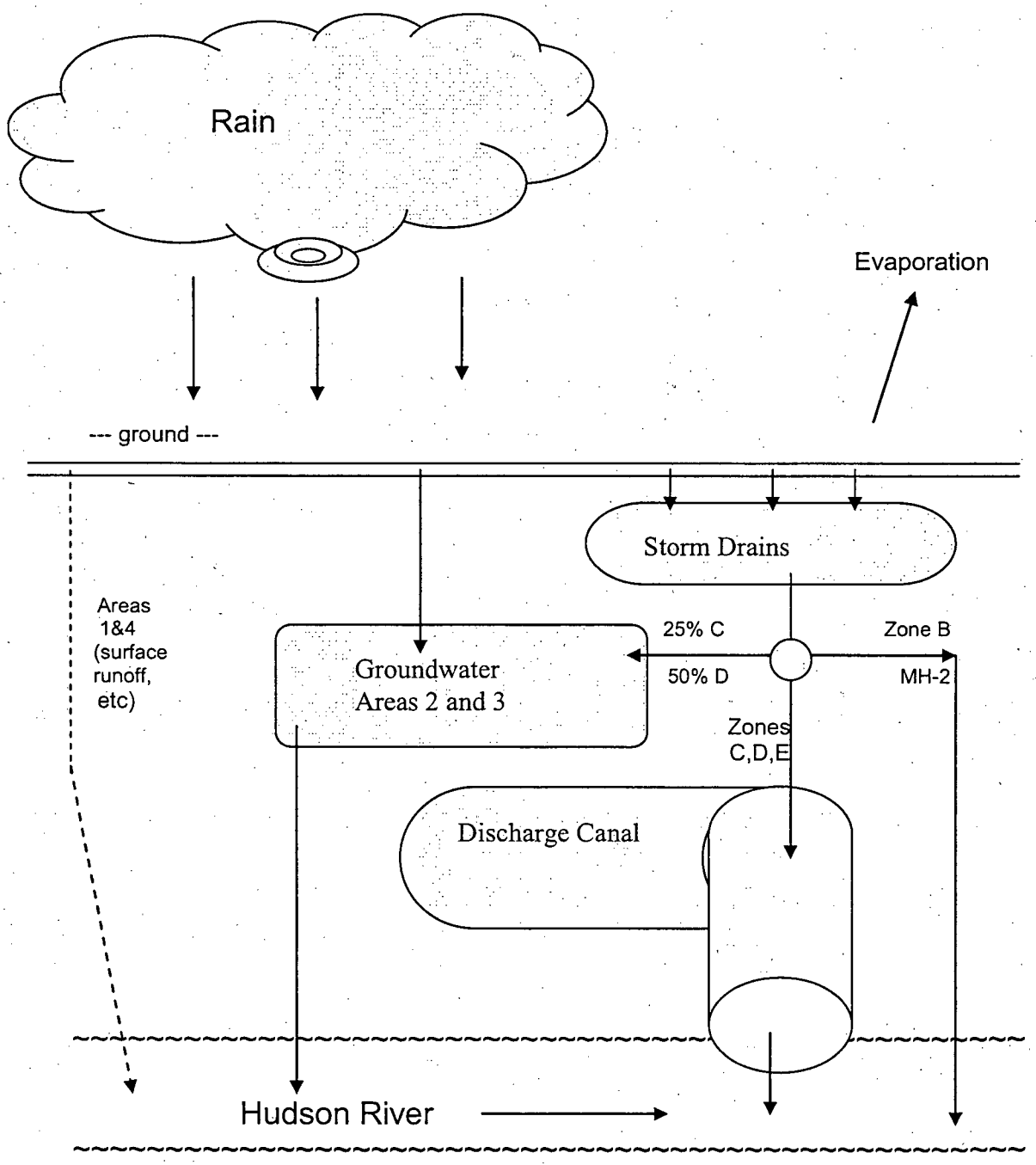
There are six tables attached:

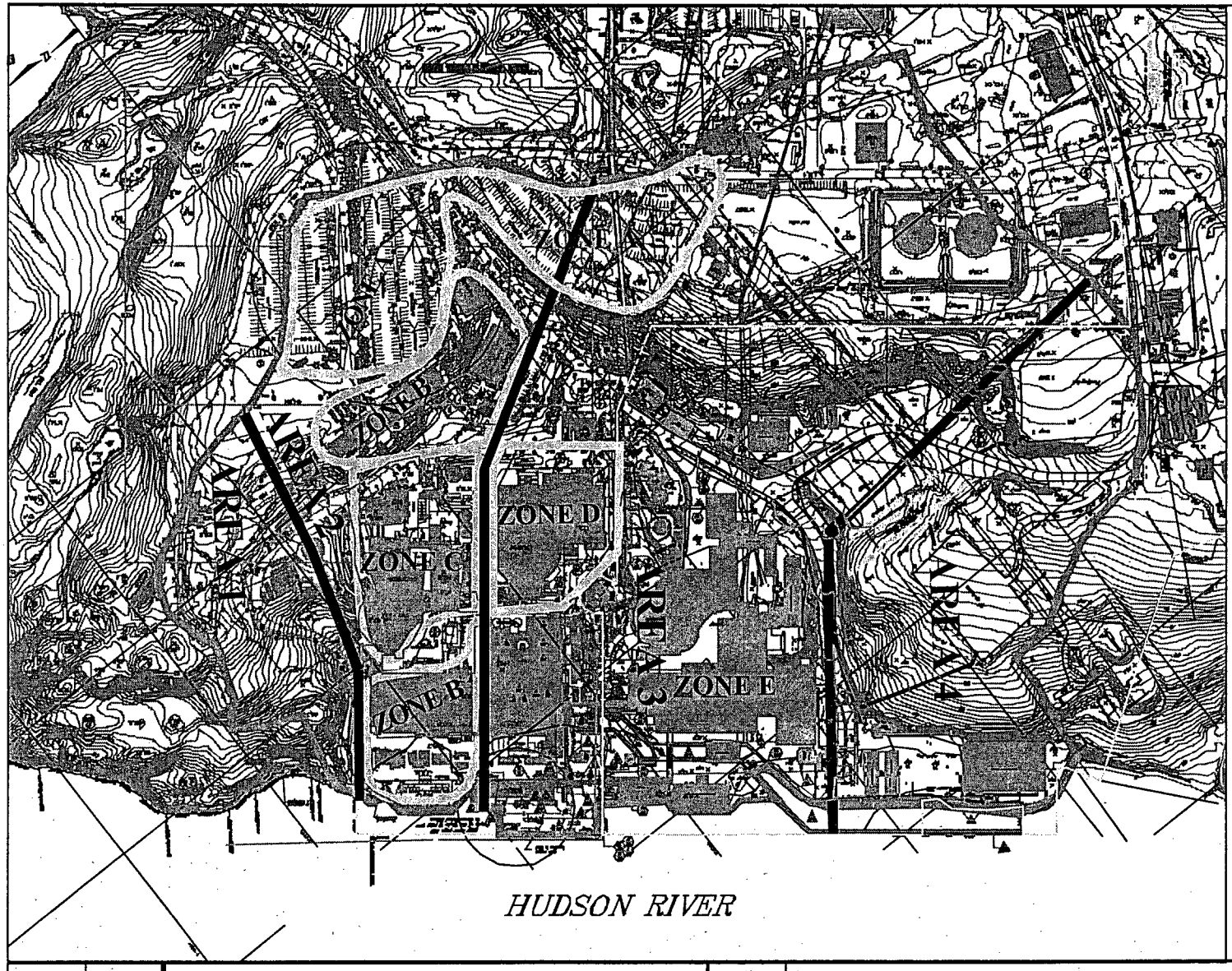
- A summary table of curies and dose,
- Three tables of curies and doses from storm water pathways, and
- Two tables of curies and doses from groundwater pathways

Figure 1 shows a representation of the conceptual water balance.
Figure 2 shows a map of the IPEC site, broken down into Areas and Zones referenced in the calculation.
Figure 3 shows precipitation data for the Indian Point site.

Figure 1

IPEC Ground Water and Storm Drain Conceptual Drawing





LEGEND:

- WATERSHED BOUNDARY
- GROUNDWATER FLOW AREAS
- SURFACE WATER FLOW ZONES

NOTES:

1. BASE MAP DEVELOPED FROM ELECTRONIC FILES, PREPARED BY BADEY AND WATSON SURVEYING & ENGINEERING PC, COLD SPRING, NY 10516.
2. SCALE: 1 INCH = 400 FEET.

FIGURE 2

PROJECT NO. 17869.10

INDIAN POINT ENERGY CENTER
BUCHANAN, NEW YORK

GROUNDWATER AREA AND
SURFACE WATER ZONE DELINEATION

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: MJB
DESIGNED BY: MJG
REVISED BY:

DRAWN BY: MJG
APPROVED BY: MJB
DATE: 03-04-06

GZA GeoEnvironmental, Inc.
38019 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

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
H-3	0.00E+00	1.52E-05	1.52E-05	1.52E-05	1.52E-05	1.52E-05	1.52E-05
Sr-90	8.40E-04	0.00E+00	2.06E-04	0.00E+00	0.00E+00	0.00E+00	2.42E-05
totals	8.40E-04	1.50E-05	2.21E-04	1.50E-05	1.50E-05	1.50E-05	3.92E-05

uCi H-3	uCi Sr-90
1.36E+06	n/a
n/a	3.35E+01
1.36E+06	**3.35E+01**

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
H-3	0.00E+00	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-07

uCi
1.46E+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
H-3	0.00E+00	2.82E-08	2.82E-08	2.82E-08	2.82E-08	2.82E-08	2.82E-08

uCi
1.58E+05

Totals Doses, in mrem

	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3 only	0.00E+00	1.54E-05	1.54E-05	1.54E-05	1.54E-05	1.54E-05	1.54E-05
H-3 and Sr-90	8.40E-04	1.54E-05	2.21E-04	1.54E-05	1.54E-05	1.54E-05	3.96E-05

uCi H-3	uCi Sr-90
1.53E+06	3.40E+01

Table 2

IPEC Liquid Effluent ODCM Calc

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

Release Rate 6.15E+07 ml/day or 1.62E+04 gpd or 11.28 gpm

Duration of Release, in days 365 Waste vol released = 5.93E+06 gal

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

Dil Factor 1.02E-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	6.62E-11	6.62E-09	1.46E+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	**6.51E-07**	**n/a**	**6.51E-05**	**6.62E-11**	**6.62E-09**	**1.46E+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	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-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	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-07	1.63E-07

Table 3

IPEC Liquid Effluent ODCM Calc

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

Release Rate 3.23E+07 ml/day or 8.54E+03 gpd or 5.93 gpm

Duration of Release, in days 365 Waste vol released = 3.12E+06 gal

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

Dil Factor 4.27E-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	1.24E-11	1.24E-09	3.42E+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**	**1.24E-11**	**1.24E-09**	**3.42E+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	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-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	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09

Table 4

IPEC Liquid Effluent ODCM Calc

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 2.17E+08 ml/day or 5.72E+04 gpd or 39.75 gpm

Duration of Release, in days 365 Waste vol released = 2.09E+07 gal

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

Dil Factor 2.86E-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	4.46E-11	4.46E-09	1.23E+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**	**4.46E-11**	**4.46E-09**	**1.23E+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	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-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	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08

Table 5

IPEC Liquid Effluent ODCM Calc

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 7.53E+07 ml/day or 1.99E+04 gpd or 13.81 gpm

Duration of Release, in days 365 Waste vol released = 7.26E+06 gal

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

Dil Factor 1.24E-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	7.71E-11	7.71E-09	1.70E+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**	**7.71E-11**	**7.71E-09**	**1.70E+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	1.91E-07	1.91E-07	1.91E-07	1.91E-07	1.91E-07	1.91E-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	1.91E-07	1.91E-07	1.91E-07	1.91E-07	1.91E-07	1.91E-07

Table 6

IPEC Liquid Effluent ODCM Calc

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: 1.84E+07 ml/day or 4.85E+03 gpd or 3.37 gpm

Duration of Release, in days: 365 Waste vol released = 1.77E+06 gal

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

Dil Factor 3.03E-05 *(dilution data per **IP-CHM-05-042** from Dr. John Hamawi.)*

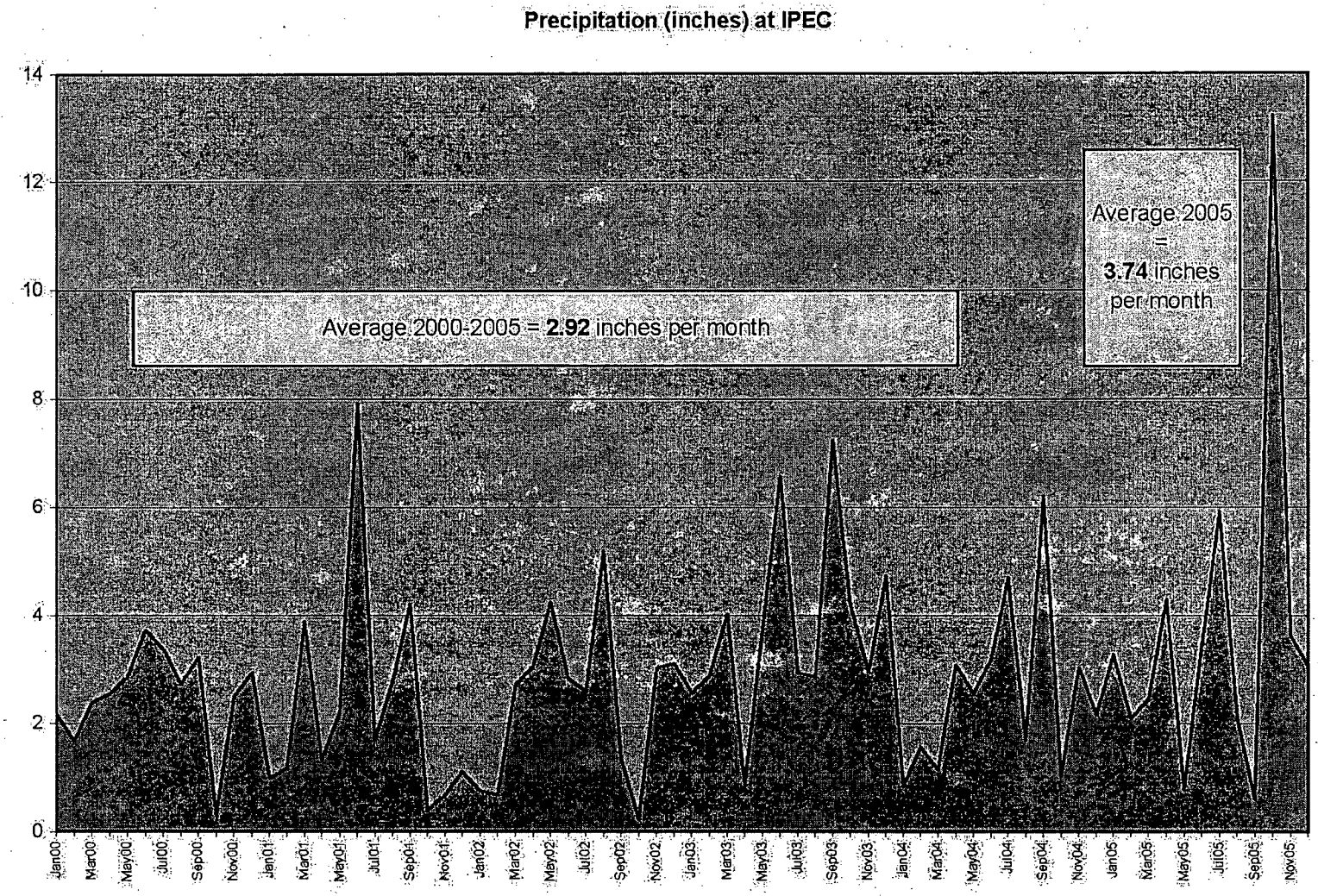
ISOTOPE	Activity Released uCi/ml	10CFR20 EC*10 conc limit	PRE DILUTION CONC/MPC	POST DILUTION uCi/ml	POST DILUTION CONC/MPC	MICRO-CURIES RELEASED
H-3	2.00E-04	1.00E-02	2.00E-02	6.07E-09	6.07E-07	1.34E+06
MN-54		3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55		1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.52E-13	3.03E-08	3.35E+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**	**6.07E-09**	**6.37E-07**	**1.34E+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	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-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	8.40E-04	0.00E+00	2.06E-04	0.00E+00	0.00E+00	0.00E+00	2.42E-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	8.40E-04	1.50E-05	2.21E-04	1.50E-05	1.50E-05	1.50E-05	3.92E-05

Figure 3


Precipitation (inches) at IPEC
Average 2000-2005 = 2.92 inches per month
Average 2005 = 3.74 inches per month
14
12
10
8
6
4
2
0
Jan00
Mar00
May00
Jul00
Sep00
Nov00
Jan01
Mar01
May01
Jul01
Sep01
Nov01
Jan02
Mar02
May02
Jul02
Sep02
Nov02
Jan03
Mar03
May03
Jul03
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Nov03
Jan04
Mar04
May04
Jul04
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Jan05
Mar05
May05
Jul05
Sep05
Nov05