

RETURN TO REGULATORY CENTRAL FILES
ROOM 819

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Regulatory File 07
Revised with 10-1-70

METROPOLITAN EDISON COMPANY
THREE MILE ISLAND NUCLEAR STATION
Units 1 & 2

ENVIRONMENTAL REPORT
September 1, 1970

RETURN TO REGULATORY CENTRAL FILES
ROOM 819



POOR ORIGINAL

CENTRAL FILES

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GENERAL DESCRIPTION

Metropolitan Edison Company has been conducting a pre-operational environmental radioactivity survey in the vicinity of the Three Mile Island site since January 1968. This survey was undertaken to provide data which will serve as a basis for comparing environmental radioactivity levels after the two plants are in operation. The survey program has been in progress for over two years during which time a total of 317 samples have been collected.

Meetings were held with the Commonwealth of Pennsylvania's Department of Health, Radiological Health Section and an outline of the program was submitted to the State Health Physicist for comments and/or recommendations. These meetings with the State included a site visit, discussion of instrument sensitivity, fish sampling locations. It was decided that the State will be sent a sample of Susquehanna River water for analysis on a monthly basis.

Metropolitan Edison Company routinely collects and performs the analyses on the samples collected. Additional samples are collected on a quarterly basis and forwarded to an outside vendor for analysis.

The environmental survey includes the following samples and sample locations:

Well Water

Well water is sampled and analyzed for gross alpha and gross beta-gamma activity. Four locations within a five mile radius of

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of the plant site were sampled every 12 weeks.

River Water

Surface water of the Susquehanna River is taken on the west side of Three Mile Island every 4 weeks. These samples are analyzed for gross alpha and gross beta-gamma activity.

River Sediment

River sediment is collected on the west side of Three Mile Island and is analyzed for gross alpha and gross beta-gamma activity every 4 weeks.

Fish

Fish samples are collected in the York Haven Dam every twelve weeks. The fish samples are sent to an outside concern and analyzed for gross alpha, gross beta, K^{40} , Cs^{137} , Co^{60} , Zn^{65} , I^{131} , and Co^{58} .

Soil

Soil samples, one on-site and four off-site locations, are analyzed for gross alpha and gross beta-gamma activity every 12 weeks.

Vegetation

Vegetation consisting primarily of grass is sampled at one on-site and four off-site locations. These samples are analyzed for gross beta-gamma activity every 12 weeks.

Milk

Milk samples are collected periodically from local dairies in the Three Mile Island vicinity. The milk samples are sent to an outside vendor and analyzed for gross alpha, gross beta, K^{40} , Sr^{90} , I^{131} , and Cs^{137} .

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BIOLOGICAL SURVEY OF THE SUSQUEHANNA RIVER

In addition to the environmental radioactivity survey, Metropolitan Edison Company has retained Dr. Charles B. Wurtz who has conducted a biological survey based on macroinvertebrate organisms in the Susquehanna River. This survey has been conducted in the vicinity of the York Haven Dam in 1967, 1968, and 1969.

Metropolitan Edison Company has entered into an agreement with Dr. Wurtz to continue his biological survey for the year 1970.

Enclosed in Section V are the results of the survey.

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SECTION II

ANALYSIS SCHEDULE

A complete sample analysis is performed during each twelve-week sample cycle. Certain analyses are performed only once in the twelve week cycle while as many as three identical analyses were performed during the same time interval.

Every four weeks, river water and river sediment are sampled and analyzed. Well water, fish, soil, vegetation and milk samples are collected and analyzed every 12 weeks.

Table II-2 is the analysis schedule for the various sample media.

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TABLE II-1

In House Analysis Schedule
Pre-Operation Environmental Radiation Survey
Three Mile Island Nuclear Station
Metropolitan Edison Company

<u>Sample</u>	<u>Analysis Performed</u>	<u>Analysis Frequency</u>
River Water	Gross Alpha & Gross Beta	Every 4 weeks
River Sediment	Gross Alpha & Gross Beta	Every 4 weeks
Well Water	Gross Alpha & Gross Beta	Every 12 weeks
Soil	Gross Alpha & Gross Beta	Every 12 weeks
Vegetation	Gross Beta	Every 12 weeks

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TABLE II-2

Vendor Analysis Schedule
Pre-Operational Environmental Radiation Survey
Three Mile Island Nuclear Station
Metropolitan Edison Company

<u>Sample</u>	<u>Analysis Performed</u>	<u>Analysis Frequency</u>
River Water	Gross Alpha, Gross Beta, K^{40} , I^{131} , Co^{58} , Co^{60} , Zn^{65}	Every 12 weeks
River Sediment	Gross Alpha, Gross Beta, K^{40} , Cs^{137} , Co^{58} , Co^{60} , Zr^{95} , Ru^{106}	Every 12 weeks
Well Water	Gross Alpha, Gross Beta, I^{131} , Cs^{137} , Co^{60} , Ru^{106}	Every 12 weeks
Soil	Gross Alpha, Gross Beta, K^{40} , Cs^{137} , Co^{58} , Co^{60} , Zr^{95} , Ru^{106}	Every 12 weeks
Vegetation	Gross Alpha, Gross Beta, K^{40} , I^{131} , Cs^{137} , Co^{60} , Ru^{106}	Every 12 weeks
Milk	Gross Alpha, Gross Beta, Sr^{90} , I^{131} , Cs^{137}	Periodically
Fish	Gross Alpha, Gross Beta, Co^{137} , Co^{60} , Zn^{65} , I^{131} , Co^{58}	Every 12 weeks

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Section III

RADIOLOGICAL ANALYTICAL PROCEDURES

All analyses were performed by Metropolitan Edison personnel or an outside vendor in accordance with procedures described below.

METROPOLITAN EDISON PROCEDURES

ALPHA AND BETA ACTIVITY IN VEGETATION

Vegetation is cut into small particles. Ten gram aliquots are weighed and ashed in a muffle furnace for one to two hours at 500°C. The ash is transferred to a stainless steel counting planchet and compacted evenly on the planchet by evaporation of the sample after moistening with a laboratory aerosol. The sample is then counted for beta activity and alpha activity in a gas flow proportional counter. The sensitivity for Beta is 2.15×10^{-7} uc/gr. and Alpha 1.02×10^{-8} uc/gr. at the 95% confidence level for a 10 gram sample which is counted for 5 minutes.

ALPHA AND BETA ACTIVITY IN SOIL AND SILT

Soil samples are dried, pulverized, and strained through a #20 sieve. Aliquots of 3 grams of the strained samples are weighed and transferred to stainless steel counting planchets. The samples are evenly compacted on the planchets by evaporation with laboratory aerosol. The samples are then counted for alpha and beta activity in a gas flow proportional counter. The sensitivity for beta is 7.21×10^{-7} uc/g and alpha is 3.45×10^{-8} uc/gr. at the 95% confidence level for a 3 gram sample counted for 5 minutes.

ALPHA AND BETA ACTIVITY IN RIVER WATER & WELL WATER

One liter water samples are evaporated in a beaker then transferred to a stainless steel counting planchets. The samples are evenly compacted on the planchets by evaporation with laboratory aerosol. The samples are then

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alpha and beta counted in a gas proportional counter. The sensitivity for alpha is 1.02×10^{-10} uc/cc for Beta 2.15×10^{-9} uc/cc at the 95% Confidence level for a one liter sample.

ALPHA AND BETA ACTIVITY IN FISH

The whole fish is cut into small pieces and homogenized in a blender. The tissue is ashed in a muffle furnace for one hour at 500°C. The ash is transferred to a stainless steel counting planchet and compacted evenly by evaporating to dryness with laboratory aerosol. The sample is then counted for alpha and beta activity in a gas flow proportional counter. The sensitivity for Beta is 2.15×10^{-7} uc/g. and alpha is 1.02×10^{-8} uc/g. at the 95% confidence level for a 10 gram sample counted for 5 minutes.

VENDOR COUNTING TECHNIQUES

Every twelve weeks samples were sent to an outside vendor for radioanalysis. The following are the radiological analytical procedures.

River Water and Well Water - Gross beta-alpha

Filter an aliquot of the sample through type HA, 0.047 mm millipore membrane. Place filter membrane and residue in planchet for radio assay. Evaporate the aliquot of the filtrate onto another planchet. Assay in an internal gas flow proportional counter. The sensitivity for alpha is 1×10^{-10} uc/cc for beta 2×10^{-10} uc/cc at the 95% confidence level for a 1 liter sample.

Soil and Silt - Gross beta-alpha

Prepare sample by drying in oven and transfer to a tared planchet. Determine weight of portion to be analyzed. Assay in an internal gas flow proportional counter. The sensitivity for alpha is 1×10^{-7} uc/gr. for beta 2×10^{-7} uc/gr. at the 95% Confidence level.

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Vegetation - Gross beta & alpha

Prepare the sample by grinding and then place in a muffle oven and ash at 450°C. Transfer portion of ash to preweighed planchet and determine the weight of ash. Assay in an internal gas flow proportional counter. The sensitivity for alpha is 1×10^{-7} uc/gr and beta 2×10^{-7} uc/gr at the 95% Confidence level.

Fish - Gross beta

The fish is ground, homogenized and ashed at 450°C. The ash sample is transferred to a preweighed planchet. Beta emitters are assayed in low-level, gas flow, thin window Geiger counters. The sensitivity for beta is 2×10^{-7} uc/gr at the 95% Confidence level.

Milk - Gross beta and alpha

Prepare sample by drying in oven at 450°C. and transfer to a 2" planchet. Determine weight of portion to be analyzed. Assay in an internal gas flow proportional counter. The sensitivity for alpha is 1×10^{-10} uc/cc at the 95% Confidence level for a 1 liter sample.

Gamma spectrum analysis was performed by placing a Marinelli Beaker over a NaI crystal and analyzed by the procedure listed below.

GAMMA SPECTRUM ANALYSIS FOR SPECIFIC ISOTOPES

When a computer program was used for gamma spectrum analysis, a linear least-squares analysis of multicomponents of unknown spectra against known library standards at the same geometry was used. The more important options included the following:

1. Mathematical compensation for instrument zero drift.
2. Mathematical compensation for instrument gain shift.
3. Cubic-polynomial smoothing routines for low activity samples.

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4. Weighing options to stress activity level of greatest interest.
5. Channel clipping to stress energy regions of greatest interest.
6. Print out of actual data, calculated spectrum and residuals for each channel.
7. Three-cycle, semilog plotting of the actual spectrum, calculated spectrum, and of residuals composited for ease in identification of nuclides and verification of the quality of fit.

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SECTION IV
DATA FROM OUTSIDE VENDOR

<u>River Water</u> (Readings in pci/l)	March 10 1970	October 21 1969	July 10 1969	June 12 1968	March 20 1968
α	< 0.2	0.2	< .2	1.4 \pm .7	7.4 \pm 0.2 .16 \pm 0.6
B- γ					
B	6.7 \pm 0.7	12.9 \pm 1.3	8.7 \pm .79	9.4 \pm 2	
K-40	< 120	< 12.0	< 120	500 \pm 25	
Zn-65	< 9.0	< 9.0	< 9.0	< 5	
Cs-137	< 7.0	< 7.0	< 7.0	6.1 \pm 2.2	
I-131	< 6.0	< 6.0	< 6.0	4.0	
Co-58	< 7.0	< 7.0	< 7.0	5.0	
Co-60	< 7.0	< 7.0	< 7.0	7.0	

<u>Vegetation</u> (Readings in pci/gr)	March 10 1970	October 25 1969	August 10 1968
α	6.1 \pm 3.1	5.3 \pm 2.6	
B	192 \pm 6	162 \pm 4	6.8 \pm 3
K-40	3.1 \pm 1.0	2.3 \pm 1.0	8.9 \pm .5
Cs-137	< 0.1	< .1	.05 \pm .01
I-131	< 0.1	< .1	< .002
Co-60	< 0.2	< .2	< .003
Co-58			< .003
Ru-106	< 0.1	< .1	

<u>Fish</u> (Readings in pci/gr)	March 10 1970	October 25 1969	June 1969
α	< .2	< .2	< .1
B	2.3	41.5 \pm 6.0	2.47 \pm .11
Cs-137	.18	.10 \pm .05	.11 \pm .01
Co-60	< .09	< .09	1.39 \pm .11
Co-58	< .07	< .07	.13 \pm .01
Zn-65	< .09	< .09	.38 \pm .02
Sy-90	.15	< .06	.05 \pm .01
I-131	< .06		< .07
K-40		< 1.2	

<u>Milk</u> (Readings in pci/l)	March 10 1970	October 25 1969
α	< 0.2	< .02
B	1549 \pm 110	1447 \pm 100
Sy-90	12.3 \pm .08	11.4 \pm .09
I-131	< 1.0	4.7 \pm 1.1
K-40	1400 \pm 120	1315 \pm 110
Cs-137	12.6 \pm 3.8	14.2 \pm 40

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DATA FROM OUTSIDE VENDOR

<u>Well Water</u> (Readings in pci/l)	March 10 1970	October 25 1969
α	< 0.2	< .2
B	6.4 ± 1.0	4.5 ± .8
K-40	< 12.0	< 12.0
I-131	< 6.0	< 6.0
Cs-137	< 7.0	< 7.0
Co-58	< 7.0	< 7.0
Co-60	< 7.0	< 7.0
Zn-65	< 9.0	< 9.0
<u>Soil Samples</u> (Readings in pci/gr)	March 10 1970	October 21 1969
α	15.3 ± 6.1	11.3 ± 5.6
B	37.1 ± 4.3	36.1 ± 4.5
K-40	< 12.0	< 12.0
Cs-137	2.8 ± 1.4	2.6 ± 1.1
Co-58	< 0.3	< .3
Co-60	< 0.2	< .2
Zr-95	< 0.2	< .2
Ru-106	< 0.3	< .3
<u>Silt Samples</u> (Readings in pci/gr)	March 10 1970	October 25 1969
α	18.3 ± 2.1	7.6 ± 3.4
B	20.3 ± 2.1	9.5 ± 2.0
K-40	< 12.0	< 12.0
Cs-137	2.7 ± 1.2	2.1 ± 1.0
Co-58	< 0.3	< .3
Co-60	< 0.2	< .2
Zr-95	< 0.2	< .2
Ru-106	< 0.3	< .3

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SUSQUEHANNA RIVER WATER

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uc/ml</u>
West Shore of Three	1968	12	$< 3.3 \times 10^{-8}$
	1969	12	* $< 1.65 \times 10^{-9}$
Mile Island	1970	6	$< 1.67 \times 10^{-9}$

SUSQUEHANNA RIVER SEDIMENT

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uc/gm</u>
West Bank of Three	1968	12	$< 3.3 \times 10^{-5}$
	1969	12	* $< 1.66 \times 10^{-6}$
Mile Island	1970	8	$< 1.66 \times 10^{-6}$ to $7.95 \pm 2.54 \times 10^{-6}$

SOIL

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uc/gm</u>
North	1968	4	$< 3.3 \times 10^{-5}$
	1969	4	* $< 2.5 \times 10^{-6}$
	1970	4	$< 7.17 \times 10^{-7}$ to $8.79 \pm 2.62 \times 10^{-6}$
South	1968	4	$< 3.3 \times 10^{-5}$
	1969	4	* $< 2.5 \times 10^{-6}$
	1970	4	$< 7.17 \times 10^{-7}$ to $1.0 \pm .27 \times 10^{-5}$
East	1968	4	$< 3.3 \times 10^{-5}$
	1969	4	* $< 2.5 \times 10^{-6}$ to $1.2 \pm .9 \times 10^{-5}$
	1970	4	$< 7.17 \times 10^{-7}$ to $7.63 \pm 2.61 \times 10^{-6}$
West	1968	4	$< 3.3 \times 10^{-5}$
	1969	4	* $< 2.5 \times 10^{-6}$
	1970	4	$< 7.17 \times 10^{-7}$ to $7.95 \pm 2.6 \times 10^{-6}$
Site	1968	4	$< 3.3 \times 10^{-5}$
	1969	4	* $< 2.5 \times 10^{-6}$
	1970	4	$< 7.17 \times 10^{-7}$ to $8.35 \pm 2.62 \times 10^{-6}$

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* Installed instrumentation with greater sensitivity.

FISH

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. Of Samples</u>	<u>Range uc/gm</u>
Susquehanna	1968	2	$< 3.3 \times 10^{-6}$
River West	1969	All 1969 samples done by outside vendor	
Side of Three	1970	2	* $1.94 \pm .344 \times 10^{-5}$ to $2.4 \pm .351 \times 10^{-5}$
Mile Island			

SOIL

GROSS ALPHA

<u>Location</u>	<u>Year Collected</u>	<u>No. Of Samples</u>	<u>Range uci/gm</u>
North	1968	4	$< 2.34 \times 10^{-6}$
	1969	4	* $< 8.25 \times 10^{-8}$
	1970	4	$1.48 \pm 2.0 \times 10^{-7}$ to $4.61 \pm 3.38 \times 10^{-7}$
South	1968	4	$< 2.34 \times 10^{-6}$
	1969	4	* $< 8.25 \times 10^{-8}$
	1970	4	$3.21 \pm 1.28 \times 10^{-7}$ to $4.92 \pm 3.42 \times 10^{-7}$
East	1968	4	$< 2.34 \times 10^{-6}$
	1969	4	* $< 8.25 \times 10^{-8}$
	1970	4	$< 8.25 \times 10^{-8}$ to $1.8 \pm 2.26 \times 10^{-7}$
West	1968	4	$< 2.34 \times 10^{-6}$
	1969	4	* $< 8.25 \times 10^{-8}$ to $5.37 \pm 6.67 \times 10^{-7}$
	1970	4	$< 8.25 \times 10^{-8}$ to $4.18 \pm 3.26 \times 10^{-7}$
Site	1968	4	$< 2.34 \times 10^{-6}$
	1969	4	* $< 8.25 \times 10^{-8}$
	1970	4	$< 1.86 \times 10^{-8}$ to $6.2 \pm 3.84 \times 10^{-7}$

RIVER SEDIMENT

GROSS ALPHA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uci/gm</u>
Susquehanna	1968	12	$< 2.34 \times 10^{-6}$
River West	1969	12	* $3.72 \pm 5.78 \times 10^{-7}$ to $7.0 \pm 7.45 \times 10^{-7}$
Side of Three	1970	6	$1.99 \pm 2.26 \times 10^{-7}$ to $5.1 \pm 3.5 \times 10^{-7}$
Mile Island			

* Installed instrumentation with greater sensitivity.

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RIVER WATER

GROSS ALPHA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uci/ml</u>
Susquehanna	1968	12	$< 3.34 \times 10^{-9}$
River West	1969	12	$* < 6.7 \times 10^{-11}$
Side of Three	1970	10	$< 6.7 \times 10^{-10}$ to $3.03 \pm 4.69 \times 10^{-10}$
Mile Island			

WELL WATER

GROSS ALPHA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uci/gm</u>
North	1968	4	$< 3.34 \times 10^{-9}$
	1969	4	$* < 6.7 \times 10^{-11}$
	1970	4	$< 6.7 \times 10^{-11}$
South	1968	4	$< 3.34 \times 10^{-9}$
	1969	4	$* < 6.7 \times 10^{-11}$
	1970	4	$< 6.7 \times 10^{-11}$
East	1968	4	$< 3.34 \times 10^{-9}$
	1969	4	$* < 6.7 \times 10^{-11}$
	1970	4	$< 6.7 \times 10^{-11}$ to $7.45 \pm 6.6 \times 10^{-10}$
West	1968	4	$< 3.34 \times 10^{-9}$
	1969	4	$* < 6.7 \times 10^{-11}$
	1970	4	$< 6.7 \times 10^{-11}$

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VEGETATION

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uc/gr.</u>
North	1968	4	$< 3.3 \times 10^{-6}$ to 7.1×10^{-6}
	1969	4	* $< 2.4 \times 10^{-6}$ to $1.21 \pm .12 \times 10^{-5}$
	1970	4	$4.22 \pm .85 \times 10^{-6}$ to $1.25 \pm .125 \times 10^{-5}$
South	1968	4	$< 3.3 \times 10^{-6}$ to 5.05×10^{-6}
	1969	4	* $< 2.19 \times 10^{-6}$ to $1.23 \pm .12 \times 10^{-5}$
	1970	4	$3.85 \pm .78 \times 10^{-6}$ to $1.32 \pm .127 \times 10^{-5}$
East	1968	4	$< 3.3 \times 10^{-6}$ to 4.53×10^{-6}
	1969	4	* $< 2.4 \times 10^{-6}$ to $9.85 \pm 1.3 \times 10^{-6}$
	1970	4	$3.25 \pm .78 \times 10^{-6}$ to $1.14 \pm .122 \times 10^{-5}$
West	1968	4	$< 3.3 \times 10^{-6}$ to 3.7×10^{-6}
	1969	4	* $< 2.4 \times 10^{-6}$ to $9.25 \pm 1.09 \times 10^{-6}$
	1970	3	$3.49 \pm .815 \times 10^{-6}$ to $2.03 \pm .153 \times 10^{-6}$
Site	1968	4	$< 3.3 \times 10^{-6}$ to 4.2×10^{-6}
	1969	4	* $< 2.19 \times 10^{-6}$ to $6.5 \pm .97 \times 10^{-6}$
	1970	4	$5.98 \pm .937 \times 10^{-6}$ to $1.73 \pm .137 \times 10^{-5}$

WELL WATER

GROSS BETA-GAMMA

<u>Location</u>	<u>Year Collected</u>	<u>No. of Samples</u>	<u>Range uc/ml</u>
North	1968	4	$< 3.7 \times 10^{-8}$
	1969	4	* $< 1.69 \times 10^{-9}$
	1970		$< 1.14 \times 10^{-9}$
South	1968	4	$< 3.7 \times 10^{-8}$
	1969	4	* $< 1.69 \times 10^{-9}$
	1970		$< 1.14 \times 10^{-9}$
East	1968	4	$< 3.7 \times 10^{-8}$
	1969	4	* $< 1.69 \times 10^{-9}$
	1970		$< 1.4 \times 10^{-9}$
West	1968	4	$< 3.7 \times 10^{-8}$
	1969	4	* $< 1.69 \times 10^{-9}$
	1970		$< 1.33 \times 10^{-9}$

*Installed instrumentation with greater sensitivity.

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SECTION V

The following Data is a biological survey of the Susquehanna River in the vicinity of York Haven, Pa. (Three Mile Island) prepared for Metropolitan Edison Company and Pennsylvania Power & Light Company.

The specific objectives are to assess the species composition of macroinvertebrate above and below the island and their relative abundance in the vicinity.

Enclosed are Dr. Wurtz results.

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