AUG 8 1984

The Honorable Robert S. Walker
United States House of Representatives
Washington, D.C. 20515

Dear Congressman Walker:

On July 12, 1984, you sent for NRC consideration, a copy of a June 7, 1984, letter from Hy Mayerson which enclosed a Pottstown MERCURY article dated May 2, 1984 along with a copy of a related petition. We are pleased to respond to your request.

The newspaper article, except for three typographical errors in the last column (Yttrium-93 should read 0.0026 curies, Iodine-134 should read 0.0040 curies and Other should read 0.0054 curies), has responsibly and accurately presented the calculated release of radioactive materials in air (gaseous effluents) and to the river (liquid effluents) per year per reactor for the Limerick facility.

As indicated in the article, these low level, normal operation releases (which will be kept to a minimum by state-of-the-art radioactive waste treatment systems, will be rigidly monitored prior to release, and will be controlled by enforceable operating license Technical Specifications) are expected to be well within recognized safety limits.

In summary, prudent measures have been taken in the design and will be required in the routine operation of the Limerick facility to assure that there will be no measurable impact on any member of the public from such operation.

For perspective, we are also enclosing excerpts from the NRC's Limerick Final Environmental Statement which was issued in April, 1984.

I trust that this reply is responsive to your request for information on this matter. If you have further questions, pleas contact us.

Sincerely,

(Signed) Jack W. Roe
William J. Dircks
Executive Director for Operations

Enclosure:
Limerick FES,
Section 5.9.3.2 and
Appendix D

DL:LB#2/BC	OELD	DL:AD/L	DL:DIR	NRR	NRR
ASchwencer:bdm	GCunningham	TMNovak	DGEisenhut	EGCase	HRDenton
7/24/84*	7/26/84*	8/ 2/84*	8/ 2/84*	8/ /84	8/6/84

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ENCLOSURE

NUREG-0974

Final Environmental Statement

related to the operation of Limerick Generating Station, Units 1 and 2

Docket Nos. 50-352 and 50-353

Philadelphia Electric Company

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

April 1984

The following excerpts from this document are attached:

Section 5.9.3.2 Radiological Impact on Humans

APPENDIX D - Examples of Site-Specific Dose Assessment Calculations

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5.9.3.2 Radiological Impact on Humans

Although the doses calculated in Appendix D are based primarily on radioactive-waste treatment system capability and are below the Appendix I design objective values, the actual radiological impact associated with the operation of the facility will depend, in part, on the manner in which the radioactive-waste treatment system is operated. Based on its evaluation of the potential performance of the ventilation and radwaste treatment systems, the NRC staff has concluded that the systems as now proposed are capable of controlling effluent releases to meet the dose-design objectives of Appendix I to 10 CFR 50.

Operation of the Limerick facility will be governed by operating license Technical Specifications that will be based on the dose-design objectives of Appendix I to 10 CFR 50. Because these design-objective values were chosen to permit flexibility of operation while still ensuring that plant operations are ALARA, the actual radiological impact of plant operation may result in doses close to the dose-design objectives. Even if this situation exists, the individual doses for the member of the public subject to maximum exposure will still be very small when compared to natural background doses (~100 mrems/year) or the dose limits (500 mrems/year - total body) specified in 10 CFR 20 as consistent with considerations of the health and safety of the public. As a result, the NRC staff concludes that there will be no measurable radiological impact on any member of the public from routine operation of the Limerick facility.

Operating standards of 40 CFR 190, the Environmental Protection Agency's Environmental Radiation Protection Standards for Nuclear Power Operations, specify that the annual dose equivalent must not exceed 25 mrems to the whole body, 75 mrems to the thyroid, and 25 mrems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials (radon and its daughters excepted) to the general environment from all uranium-fuel-cycle operations and radiation from these operations that can be expected to affect a given individual. The staff's position as stated in NUREG-0543 is, as long as a nuclear plant site operates at a level below the relatively more conservative Appendix I dose design objectives and reporting requirements, it is operating in compliance with 40 CFR Part 190. Therefore, the NRC staff concludes that under normal operations the Limerick facility is capable of operating within these EPA standards.

The radiological doses and dose commitments resulting from a nuclear power plant are well known and documented. Accurate measurements of radiation and radioactive contaminants can be made with very high sensitivity so that much smaller amounts of radioisotopes can be recorded than can be associated with any possible observable ill effects. Furthermore, the effects of radiation on living systems have for decades been subject to intensive investigation and consideration by individual scientists as well as by select committees that have occasionally been constituted to objectively and independently assess radiation dose effects. Although, as in the case of chemical contaminants, there is debate about the exact extent of the effects of very low levels of radiation that result from nuclear-power-plant effluents, upper bound limits of deleterious effects are well established and amenable to standard methods of risk analysis. Thus the risks to the maximally exposed member of the public outside of the site boundaries or to the total population outside of the boundaries can be readily calculated and recorded. These risk estimates for the Limerick facility are presented below.

The risk to the maximally exposed individual is estimated by multiplying the risk estimators presented in Section 5.9.3.1.1 by the annual dose-design objectives for total-body radiation in 10 CFR 50, Appendix I. This calculation results in a risk of potential premature death from cancer to that individual from exposure to radioactive effluents (gaseous or liquid) from 1 year of reactor operations of less than one chance in one million.* The risk of potential premature death from cancer to the average individual within 80 km (50 miles) of the reactors from exposure to radioactive effluents from the reactors is much less than the risk to the maximally exposed individual. These risks are very small in comparison to natural cancer incidence from causes unrelated to the operation of the Limerick facility.

Multiplying the annual U.S. general public population dose from exposure to radioactive effluents and transportation of fuel and waste from the operation of this facility (that is, 83 person-rems) by the preceding somatic risk estimator, the staff estimates that about 0.01 cancer death may occur in the exposed population. The significance of this risk can be determined by comparing it to the natural incidence of cancer deaths in the U.S. population. Multiplying the estimated U.S. population for the year 2000 (~260 million persons) by the current incidence of actual cancer fatalities (~20%), about 52 million cancer deaths are expected (American Cancer Society, 1982). For purposes of evaluating the potential genetic risks, the progeny of workers are considered members of the general public. Multiplying the sum of the U.S. population dose from exposure to radioactivity attributable to the normal annual operation of the plant (that is, 82 person-rems), and the estimated dose from occupational exposure (that is, 1254 person-rems) by the preceding genetic risk estimators, the staff estimates that about 0.3 potential genetic disorder may occur in all future generations of the exposed population. Because BEIR III indicates that the mean persistence of the two major types of genetic disorders is about 5 generations and 10 generations, in the following analysis the risk of potential genetic disorders from the normal annual operation of the plant is conservatively compared with the risk of actual genetic ill health in the first 5 generations rather than the first 10 generations. Multiplying the estimated population within 80 km (50 miles) of the plant (~8,100,000 persons in the year 2000) by the current incidence of actual genetic ill health in each generation (~11%), about 890,000 genetic abnormalities are expected in the first 5 generations of the 80-km population (BEIR III).

The risks to the general public from exposure to radioactive effluents and transportation of fuel and wastes from the annual operation of the Limerick facility are very small fractions of the estimated normal incidence of cancer fatalities and genetic abnormalities in the year 2000 population. On the basis of the preceeding comparison, the NRC staff concludes that the risk to the public health and safety from exposure to radioactivity associated with the normal operation of the Limerick facility will be very small.

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*The risk of potential premature death from cancer to the maximally exposed individual from exposure to radioiodines and particulates would be in the same range as the risk from exposure to the other types of effluents.

APPENDIX D
EXAMPLES OF SITE-SPECIFIC DOSE ASSESSMENT CALCULATIONS

1. Calculational Approach

As mentioned in the main body of this report, the quantities of radioactive material that may be released annually from the Limerick facility are estimated on the bas's of the description of the radwaste systems in the applicant's ER and FSAR and by using the calculational models and parameters developed by the NRC staff in NUREG-0016. These estimated effluent release values for normal operation, incuding anticipated operational occurrences, along with the applicant's site and environmental data in the ER and in subsequent answers to NRC staff questions, are used in the calculation of radiation doses and dose commitments.

The models and considerations for environmental pathways that lead to estimates of radiation doses and dose commitments to individual members of the public near the plant and of cumulative doses and dose commitments to the entire population within an 80-km (50-mile) radius of the plant as a result of plant operations are discussed in detail in Regulatory Guide (RG) 1.109, Revision 1. Use of these models with additional assumptions for environmental pathways that lead to exposure to the general population outside the 80-km radius is described in Appendix B of this statement.

The calculations performed by the NRC staff for the releases to the atmosphere and hydrosphere provide total integrated dose commitments to the entire population within 80 km of this facility based on the projected population distribution in the year 2000. The dose commitments represent the total dose that would be received over a 50-year period, following the intake of radioactivity for 1 year under the conditions existing 20 years after the station begins operation (that is, the mid-point of station operation). For younger persons, changes in organ mass and metabolic parameters with age after the initial intake of radioactivity are accounted for.

2. Dose Commitments from Radioactive Effluent Releases

The NRC staff's estimates of the expected gaseous and particulate releases (listed in Table D-1) along with the site meteorological considerations (summarized in Table D-2) were used to estimate radiation doses and dose commitments for airborne effluents. Individual receptor locations and pathway locations considered for the maximally exposed individual in these calculations are listed in Table D-3.

Annual average relative concentration (χ/Q) and relative deposition (D/Q) values at specific receptor points were calculated using the variable trajectory plume segment model described in NUREG/CR-0523. This model includes spatial and temporal variations in airflow. Releases through the turbine enclosure vent (north stack) and the reactor enclosure vent (south stack) have been considered to be partially elevated, with vent flow from both units based on the criteria contained in RG 1.111 for all transport directions except northwest through north through northeast. Because of the airflow around the cooling towers, the concentration and deposition values in these northerly directions were deemed to be represented best by the assumption that the vent releases were at ground level with mixing allowed for the turbulence in the wake of these structures. A 1-year period of record (1974) of onsite meteorological data was used in this evaluation.

Also X/Q and D/Q values for specific receptor points, representing a release duration of 400 hours, were calculated and used with radioactive releases to the environment from the mechanical vacuum pump. For this evaluation, the atmospheric dispersion model for intermittent releases, as described in NUREG/CR-2919, was utilized. This model is also consistent with the variable trajectory model described in NUREG/CR-0523. A 1-year period of record (1974) of onsite data was used as input to the model.

Annual average χ/Q and D/Q value arrays to 80 km (50 miles) for use in population dose assessment were based on the straight-line gaussian atmospheric dispersion model, described in RG 1.111, modified to reflect potential spatial and temporal variations in airflow, using the conservative correction factors in NUREG/CR-2919. Releases through the turbine enclosure and the reactor enclosure vents have been considered to be partially elevated, based on the criteria in RG 1.111 for all transport directions except north-northwest, north, and north-northeast. Because of airflow around the cooling towers, releases from these vents were assumed to be at ground level, with mixing allowed for the turbulent wake of reactor structures for the transport directions of north-northwest, north, and north-northeast. A 5-year period of record (January 1972-December 1976) of onsite meteorological data was used for this evaluation.

In these evaluations, wind speed and direction data were based on measurements at the 9.1-m level, and atmospheric stability was defined by the vertical temperature gradient measured between the 52.2-m and 7.9-m levels.

In addition, the NRC staff estimates of the expected liquid releases (listed in Table D-4), along with the site hydrological considerations (summarized in Table D-5), were used to estimate radiation doses and dose commitments from liquid releases.

(a) Radiation Dose Commitments to Individual Members of the Public

As explained in the text, calculations are made for a hypothetical individual member of the public (that is, the maximally exposed individual) who would be expected to receive the highest radiation dose from all pathways that contribute. This method tends to overestimate the doses because assumptions are made that would be difficult for a real individual to fulfill.

The estimated dose commitments to the individual who is subject to maximum exposure at selected offsite locations from airborne releases of radioiodine and particulates, and waterborne releases are listed in Tables D-6, D-7, and D-8. The maximum annual total body and skin dose to a hypothetical individual and the maximum beta and gamma air dose at the site boundary are presented in Tables D-6, D-7, and D-8.

The maximally exposed individual is assumed to consume well above average quantities of the potentially affected foods and to spend more time at potentially affected locations than the average person as indicated in Tables E-4 and E-5 of Revision 1 of RG 1.109.

(b) Cumulative Dose Commitments to the General Population

Annual radiation dose commitments from airborne and waterborne radioactive releases from the Limerick facility are estimated for two populations in the year 2000: (1) all members of the general public within 80 km (50 miles) of the station (Table D-7) and (2) the entire U.S. population (Table D-9). Dose commitments beyond 80 km are based on the assumptions discussed in Appendix B. For perspective, annual background radiation doses are given in the tables for both populations.

3. References

U.S. Nuclear Regulatory Commission, NUREG-0016, F. P. Cardile and R. R. Bellamy, eds, "Calculation of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors," Revision 1, January 1979.

---, NUREG/CR-0523, D. C. Powell, H. L. Wegley, and T. D. Fox, "MESODIF-II: A Variable Trajectory Plume Segment Model to Assess Ground-Level Air Concentrations and Deposition of Effluent Releases from Nuclear Power Facilities, "Battelle Memorial Instiute, Pacific Northwest Laboratory, March 1979.

---, NUREG/CR-2919, J. F. Sagendorf, S. T. Goll, and W. F. Sandusky, "User Guide for XOQDOQ: Evaluating Routine Effluent Releases at Commercial Nuclear Power Stations," Battelle Memorial Institute, Pacific Northwest Laboratories, September 1982.

---, Regulatory Guide (RG) 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977.

---, RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Reactors," Revision 1, 1977.

Table D-1 Calculated releases of radioactive materials in gaseous effluents from the Limerick nuclear facility (Ci/yr per reactor)

Nuclides	Turbine enclosure vent release (north stack) plus reactor enclosure vent release (south stack) (continuous)*	Turbine enclosure vent release (north stack) (intermittent, 400-hr/yr)*	Total
Ar-41	15		15
Kr-83m	a	a	a
Kr-85m	29	a	29
Kr-85	240	a	240
Kr-87	63	a	63
Kr-88	95	a	95
Kr-89	610	a	610
Xe-131m	7	a	7
Xe-133m	a	a	a
Xe-133	550	1300	1900
Xe-135m	990	a	990
Xe-135	740	500	1200
Xe-137	1300	a	1300
Xe-138	1000	a	1000
		Total Noble Gases	7400
Cr-51	0.00023	b	0.00023
Mn-54	0.00046	b	0.00046
Fe-59	0.000097	b	0.000097
Co-58	0.00011	b	0.00011
Co-60	0.0011	b	0.0011
Zn-65	0.0011	b	0.0011
Sr-89	0.000090	b	0.000090
Sr-90	0.0000033	b	0.0000033
Nb-95	0.0011	b	0.0011
Zr-95	0.00032	b	0.00032
Mo-99	0.0066	b	0.0066
Ru-103	0.00024	b	0.00024
Ag-110m	0.00000042	b	0.00000042
Sb-124	0.000022	b	0.000022
Cs-134	0.00077	b	0.00077
Cs-136	0.00011	0.0000019	0.00011
Cs-137	0.0011	b	0.0011
Ba-140	0.0023	b	0.0023
Ce-141	0.00031	b	0.00031
		Total Particulates	0.016
I-131	0.066	0.041	0.11
I-133	0.87	0.43	1.3
H-3	92	b	92
C-14	9.5	b	9.5

*Mixed mode releases for all transport directions except for the NW, NNW, N, NNE, and NE, where the releases are assumed to be ground level. See text of Appendix D, Section 1.

[a]Less than 1.0 Ci/yr for noble gases and C-14; less than 10^{-4} Ci/yr for iodine.

[b]Less than 1% of total for this nuclide.

Table D-2 Summary of atmospheric dispersion factors (χ/Q) and relative deposition values for maximum site boundary and receptor locations near the Limerick nuclear facility*

Location**	Source***	χ/Q (sec/m³)	Relative Deposition (m⁻²)
Nearest effluent-control boundary (0.79 km NE of Units 1 and 2)	A B	1.1×10^{-5} 3.6×10^{-5}	1.7×10^{-8} 8.7×10^{-8}
Nearest residence and garden (1.0 km NE of Units 1 and 2)	A B	7.6×10^{-6} 2.6×10^{-5}	1.1×10^{-8} 6.2×10^{-8}
Nearest milk cow (4.3 km NE of Units 1 and 2)	A B	6.6×10^{-7} 2.7×10^{-6}	8.0×10^{-10} 4.2×10^{-9}
Nearest milk goat (1.8 km ESE of Units 1 and 2)	A' B'	3.2×10^{-7} 1.6×10^{-6}	2.9×10^{-9} 1.1×10^{-8}
Nearest meat animal (1.6 km NNE of Units 1 and 2)	A B	1.7×10^{-6} 7.8×10^{-6}	4.2×10^{-9} 2.0×10^{-8}

*The values presented in this table are corrected for radioactive decay and cloud depletion from deposition, where appropriate, in accordance with Regulatory Guide 1.111, Rev. 1, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Reactors," July 1977.

**"Nearest" refers to that type of location where the highest radiation dose is expected to occur from all appropriate pathways.

***Sources:

A - Reactor-building (south stack), or Turbine building (north stack), Unit 1 or 2, continuous, ground level release.

A' - Reactor-building (south stack) or Turbine-building (north stack), Unit 1 or 2, continuous, mixed mode release.

B - Turbine-building (north stack), Unit 1 or 2, 400 hours/yr, intermittent, ground level release.

B' - Turbine-building (north stack), Unit 1 or 2, 400-hours/yr, intermittent, mixed mode release.

Table D-3 Nearest pathway locations used for maximally exposed individual dose commitments for the Limerick nuclear facility

Location	Sector	Distance (km)
Nearest effluent-control boundary*	NE of Units 1 and 2	0.79
Residence and garden**	NE	1.0
Milk cow	NE	4.3
Milk goat	ESE	1.8
Meat animal	NNE	1.6

*Beta and gamma air doses, total body doses, and skin doses from noble gases are determined at the effluent-control boundaries in the sector where the maximum potential value is likely to occur.

**Dose pathways including inhalation of atmospheric radioactivity, exposure to deposited radionuclides, and submersion in gaseous radioactivity are evaluated at residences. This particular location includes doses from vegetable consumption as well.

Table D-4 Calculated release of radioactive materials in liquid effluents from Limerick nuclear facility, Units 1 and 2

Nuclide	Ci/yr per reactor*	Nuclide	Ci/yr per reactor
Corrosion and Activation Products		Fission Products (cont'd)	
Na-24	0.0076	Tc-101	0.000070
P-32	0.00038	Ru-103	0.00033
Cr-51	0.016	Tc-104	0.00018
Mn-54	0.0047	Ru-105	0.00077
Mn-56	0.011	Ru-106	0.00030
Fe-55	0.011	Ag-110m	0.00060
Fe-59	0.00019	Te-129m	0.000040
Co-58	0.0095	Te-131m	0.000090
Co-60	0.016	I-131	0.0058
Cu-64	0.022	I-132	0.011
Ni-63	0.00025	I-133	0.042
Ni-65	0.00006	I-134	0.0040
Zn-65	0.00022	Cs-134	0.011
Zn-69m	0.0015	I-135	0.026
W-187	0.00026	Cs-136	0.00080
Np-239	0.0078	Cs-137	0.017
		Cs-138	0.0014
Fission Products		Ba-139	0.00090
		Ba-140	0.0013
Br-83	0.0012	Ba-141	0.000020
Br-84	0.000090		
Rb-89	0.000080	Ce-141	0.00023
Sr-89	0.00022	La-142	0.00061
Sr-90	0.000070	Ce-143	0.000030
		Pr-143	0.000040
Sr-91	0.0025	Ce-144	0.0035
Y-91	0.00021		
Sr-92	0.0023	All Others	0.0054
Y-92	0.0043		
Y-93	0.0026	Total (except H-3)	0.27
		H-3	12
Zr-95	0.0015		
Nb-95	0.0018		
Nb-98	0.00015		
Mo-99	0.0020		
Tc-99m	0.011		

*Nuclides whose release rates are less than 10^{-5} Ci/yr per reactor are not listed individually but are included in "all others."

Table D-5 Summary of hydrologic transport and dispersion for liquid releases from the Limerick nuclear facility*

Location	Transit Time (hours)**	Dilution Factor**
<u>ALARA Dose Calculations</u>		
Nearest drinking-water intake (Royersford, Pennsylvania)	1.5	85
Nearest sport-fishing location (discharge area)***	0.1	28
Nearest shoreline (bank of Schuylkill River near discharge area)	0.1	28
<u>Population Dose Calculations</u>:		
Sport fishing, shoreline usage, swimming, boating at the following segments of the Schuykill River downstream from the Limerick discharge area:		
0-16 km	4	85
16-32 km	16	87
32-48 km	27	99
48-64 km	50	110
64-80 km	50	110
Drinking Water intakes:		
Citizens Utility Home Water Company (Royersford)	1.5	85
Phoenixville Water Authority	10	85
Philadelphia Suburban Water Company	16	85
Keystone Water Company (Norristown)	27	99
City of Philadelphia	50	110

*See Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

**With the exception of those for the plant discharge area, the transit times and the dilution factors for other locations were from ER-OL Table 5.2-8.

***Assumed for purposes of an upper limit estimate; detailed information not available.

Table D-6 Annual dose commitments to a maximally exposed individual near the Limerick nuclear station

Location	Pathway	Doses (mrems/yr per unit, except as noted)				
		Noble Gases in Gaseous Effluents				
		Total Body	Skin	Gamma Air Dose (mrads/yr/unit)	Beta Air Dose (mrads/yr/unit)	
Nearest* site boundary (0.79 km NE)	Direct radiation from plume	1.5	4.0	2.4	3.9	
		Iodine and Particulates in Gaseous Effluents**				
		Total Body		Organ		
Nearest*** site boundary (0.79 km NE)	Ground deposition	a	(T)	a	(C)	(thyroid)
	Inhalation	a	(T)	3.0	(C)	(thyroid)
Nearest residence and garden (1.0 km NE)	Ground deposition	a	(C)	a	(C)	(thyroid)
	Inhalation	a	(C)	2.7	(C)	(thyroid)
	Vegetable consumption	1.6	(C)	7.4	(C)	(bone)
Nearest milk cow (4.3 km NE)	Ground deposition	a	(I)	a	(I)	(thyroid)
	Inhalation	a	(I)	0.22	(I)	(thyroid)
	Cow milk consumption	0.15	(I)	2.6	(I)	(thyroid)
Nearest milk goat (1.8 km ESE)	Ground deposition	a	(I)	a	(I)	(thyroid)
	Inhalation	a	(I)	0.14	(I)	(thyroid)
	Goat milk consumption	a	(I)	7.6	(I)	(thyroid)
Nearest meat animal (1.6 km NNE)	Meat consumption	a	(C)	0.28	(C)	(bone)
		Liquid Effluents**				
		Total Body		Organ		
Nearest drinking water	Water ingestion	0.0055(I)		0.16(I) (thyroid)		
Nearest fish at plant-discharge area	Fish consumption	0.21(A)		0.58(C) (bone)		
Nearest shore access near plant-discharge area	Shoreline recreation	0.0073(A or T)		0.0086 (A or T) (skin)		

*"Nearest" refers to that site boundary location where the highest radiation doses as a result of gaseous effluents have been estimated occur.

**Doses are for the age group and organ that results in the highest comulative dose for the location: A-adult, T-teen, C-child, I-infant. Calculations were made for these age groups and for the following organs: gastrointestinal tract, bone, liver kidney, thyroid, lung, and skin.

***"Nearest" refers to the location where the highest radiation dose to an individual from all applicable pathways has been estimated.

[a] Less than 0.10 mrem/year

Table D-7 Calculated Appendix I dose commitments to a maximally exposed individual and to the population from operation of Limerick nuclear facility

	Annual Dose per Reactor Unit	
	Individual	
	Appendix I Design Objectives*	Calculated Doses**
Liquid effluents		
Dose to total body from all pathways	3 mrems	0.22 mrem
Dose to any organ from all pathways	10 mrems	0.59 mrem (bone)
Noble-gas effluents (at site boundary)		
Gamma dose in air	10 mrads	2.4 mrads
Beta dose in air	20 mrads	3.9 mrads
Dose to total body of an individual	5 mrems	1.5 mrem
Dose to skin of an individual	15 mrems	4.0 mrems
Radioiodines and particulates***		
Dose to any organ from all pathways	15 mrems	7.7 mrems (thyroid)
	Population Dose Within 80 km, person-rems	
	Total Body	Thyroid
Natural-background radiation†	800,000.	
Liquid effluents	0.77	2.5
Noble-gas effluents	5.3	5.3
Radioiodine and particulates	9.7	56

*Design Objectives from Sections II.A, II.B, II.C, and II.D of Appendix I, 10 CFR Part 50 consider doses to maximally exposed individual and to population per reactor unit.

**Numerical values in this column were obtained by summing appropriate values in Table D-6. Locations resulting in maximum doses are represented here.

***Carbon-14 and tritium have been added to this category.

†"Natural Radiation Exposure in the United States," U.S. Environmental Protection Agency, ORP-SID-72-1, June 1972; using the average background dose for Pennsylvania of 99 mrems/yr, and year 2000 projected population of 8,100,000 persons within 80 km radius of the Limerick facility (Table 2.1-12, Environmental Report, Operating License Stage, Limerick Generating Station, Units 1 and 2, Revision 8, December 1982, Philadelphia Electric Company).

Table D-8 Calculated RM-50-2 dose commitments to a maximally exposed individual from operation of the Limerick nuclear facility*

	Annual Dose per Site	
	RM-50-2 Design Objectives**	Calculated Doses
Liquid effluents		
Dose to total body or any organ from all pathways	5 mrems	1.2 mrems
Activity-release estimate, excluding tritium (Ci/yr)	10	0.54
Noble-gas effluents (at site boundary)		
Gamma dose in air	10 mrads	4.8 mrads
Beta dose in air	20 mrads	7.8 mrads
Dose to total body of an individual	5 mrems	3.0 mrems
Dose to skin of an individual	15 mrems	8.0 mrems
Radioiodines and particulates***		
Dose to any organ from all pathways	15 mrems	15 mrems child bone or infant thyroid
I-131 activity release (Ci/yr)	2	0.22

*An optional method of demonstrating compliance with the cost-benefit Section (II.D) of Appendix I to 10 CFR Part 50.

**Annex to Appendix I to 10 CFR Part 50.

***Carbon-14 and tritium have been added to this category.

Petition to our state representatives, congressman, State & U.S. Senators, township officers & financial investors of Phila Electric Co.

We do not want any poison nor radioactive material released into our air in the Limerick area nor into the Schuylkill River. We hereby petition you to do whatever is humanly possible to prevent this, including if necessary the ceasing of operations of & at this plant.

1. [illegible] Sky Farm 19421
2. Maxine Scherf Box 44 Birchrunville 19421
3. Pamela [illegible] Box 21 Birchrunville
4. [illegible] Box 2 Birchrunville
5. F. [illegible] RFD Birchrunville PA 1942[illegible]
6. Patrick McGill Birchrunville PA 19421
7. Barbara Streteigh, Birchrunville PA 19421
8. Kenneth Carroll, Birchrunville PA 19421
9. [illegible]
10. JAKE COFFIN 286 frenchcreek rd. Phoenixville 19460
11. George Keegan PO Box 12 Birchrunville 1942[illegible]
12. Mary Buchlart, Timothy Farm " "
13. [illegible], Coventryville, PA
14. [illegible]
15. [illegible], Birchrunville 19421
16. George [illegible] Box 66 Birchrunville 19421
17. M. Joyce B[illegible], 6 Sheffield [illegible]
18. Mrs. [illegible] Di Domenico 169 Wall ST Spring City
19. [illegible] 16[illegible] Wall Spring City
20. Chris Henry Birchrunville 19421
21. [illegible]
22. Douglas R Shore Chester Springs 19425
23. Michele Y Lefkowitz Birchrunville PA 19421

24. KATHY RIEDER Birchrunville PA 19421
25. [illegible]
26. Jennifer Wilcos Birchrunville 19421
27. Jan Buhl [illegible] Rd Chester Springs 19425
28. [illegible] - Birchrunville 19421
29. [illegible] Birchrunville Pa
30. ~~Sue Pedersen~~, Birchrunville Pa 19421
31. Jane Acena, Birchrunville PA 19421
32. Rita Halsey Birchrunville, Pa 19421
33. Mary Anne [illegible] Birchrunville, Pa 19421
34. [illegible]
35. [illegible]
36. [illegible] Kimberton Pa [illegible]
37. J. Pennypacker Birchrunville, Pa [illegible]
38. ~~[illegible], Birchrunville Pa~~ 1942[illegible]
39. [illegible]
40. Gwen [illegible]
41. Ashley L Holskin Birchrunville PA 19421
42. Linda [illegible] Birchrunville Pa 19421
43. Pat Calhoon Birchrunville Pa 19421
44. [illegible]
47. Jeanne Cashour Shepherd, Birchrunville, PA, 19421
already in 48. ~~[illegible]~~ Birchrunville Pa 19421
49. Callum J. Koos Harleman 19421
50. Maureen Mulligan Chester Springs Pa 19425