

**LIPARI CANCER INCIDENCE FINAL UPDATE**

**A REPORT TO THE LIPARI HEALTH  
SUBCOMMITTEE**

**NEW JERSEY DEPARTMENT OF HEALTH  
ENVIRONMENTAL HEALTH SERVICES**

**OCTOBER 1994**

This report summarizes the final annual update of cancer incidence for the population living in the vicinity of Lipari Landfill, the number 1 Superfund site in the country.

The Lipari Landfill, located in Mantua and bordering Pitman, Glassboro, and Harrison, was the source of hazardous leachate which had migrated from the landfill into two nearby streams and a lake in the vicinity of residences, schools, and playgrounds. Operation of the landfill began in 1958 and ended in 1971. Based on available evidence, the period of greatest dumping, and probable exposure, occurred in the late 1960s.

In 1986 the Lipari Health Subcommittee was formed to explore avenues to address health concerns of residents in the area and was composed of representatives from the adjacent communities, local government agencies, federal government agencies, and the Environmental Health Services (EHS) of the New Jersey Department of Health. An epidemiological study of adverse health effects from potential chemical exposures related to the Lipari Landfill was conducted by EHS from 1986 to 1988. The health status of the community was assessed using birth records to determine low birth weights, and Cancer Registry data for cancer incidence. Since inhalation was the most likely route of exposure for residents in the area, radial distance from the landfill was chosen as a surrogate indicator of exposure. This was done by segregating the population by concentric rings around the landfill with radii of 1.0 kilometer (Area 1), 2.5 kilometers (Area 2), and the remainder of the population in the four adjacent municipalities (Area 3).

In 1989 the report of the health study was released to the public after peer review. The observed number of cancers was not found to be statistically significantly different from the expected number for any of the area designations. However, since cancer latency (the period between exposure and diagnosis of disease) could be several decades long and the period of greatest potential exposure (the late 1960s) occurred less than fifteen years prior to the beginning of the cancer study (1980) the Department of Health believed that continued cancer surveillance of the population was warranted. During a public presentation of the health results, the Department of Health made a commitment to the community to provide annual updates of cancer incidence.

The cancer statistics were updated in 1990, 1991, and 1992. This report adds an additional year (1989 data) of Cancer Registry information to the previous updates for a total period of ten years, 1980 through 1989. As in previous years for all age groups combined, no statistically significant increases in the observed to expected numbers were detected. However, childhood Hodgkin's Disease was elevated (3 cases) for Area 1 although no cases have occurred since 1983.

The following summary and tables provide more detailed results.

## SUMMARY OF RESULTS

- \* Analysis of all cancers combined and selected cancer sites for 1980-1989 showed similar results as those found in the 1989 Health Study Report and the 1990, 1991, and 1992 Update reports; there were no statistically elevated ratios (Tables 1-5).
  
- \* Analysis of all childhood cancers combined did not show an excess in Area 1 or Area 3, however, Area 2 was elevated when compared to average state childhood incidence rates but not elevated when compared to average Gloucester County childhood incidence rates (Tables 7-8).
  
- \* Analysis of childhood Hodgkin's disease detected no additional cases. However, the excess of Hodgkin's for Area 1 detected in the 1990, 1991, and 1992 Updates still remain (3 cases) even though no additional cases were found (Table 9).
  - small numbers make analysis difficult to evaluate;
  - no additional Hodgkin's cases found in Area 1 since 1983;
  - Area 1 Hodgkin's cases appear to be located closer to the border of Area 1 and 2 than to the landfill; and
  - each of the Hodgkin's cases do not appear to be near each other spatially.
  
- \* Analysis of cancer incidence for Area 1A for all cancers combined and selected cancer sites for 1980-1989 detected no statistically elevated ratios (Tables 10-11). In fact, cancer incidence for all sites combined was significantly lower than expected.
  
- \* Based on this evaluation of the cancer information, it is concluded that the level of cancer incidence for all designated areas, regardless of proximity to the landfill, was not found to be elevated when compared to average state rates.

TABLE 1

CANCER INCIDENCE BY TYPE AND AREA  
LIPARI LANDFILL  
(1980 - 1989)

CANCER TYPE	ALL AREAS	AREA			UNKNOWN AREAS
		1	2	3	
Buccal cavity	26	3	13	7	3
Esophagus	15	2	5	7	1
Stomach	17	2	7	8	0
Colon	161	35	54	57	15
Rectal	72	15	24	29	4
Pancreas	26	7	7	9	3
Liver	8	0	2	3	3
Gallbladder	8	1	2	4	1
Other digestive	3	0	2	1	0
Larynx	19	4	5	9	1
Lung/pleura	213	37	62	86	28
Other respiratory	8	2	2	2	2
Bones/joints	3	1	1	1	0
Soft tissue	8	0	6	1	1
Skin *	68	12	19	28	9
Breast	216	47	60	84	25
Cervix uteri	59	9	15	28	7
Corpus uteri	42	9	15	18	0
Ovary	39	4	16	18	1
Other female genital	7	0	3	3	1
Prostate	94	15	33	34	12
Other male genital	12	2	5	3	2
Bladder	71	16	21	27	7
Kidney	24	5	11	7	1
Eye	1	0	1	0	0
Brain/nervous system	31	3	10	13	5
Endocrine system	10	4	3	3	0
Hodgkin's disease	18	3	6	6	3
Non-Hodgkin's lymphoma	37	7	15	13	2
Multiple myeloma	9	1	2	4	2
Leukemia	32	6	10	13	3
Misc. reticuloendothelial	4	1	2	1	0
Unknown primary	51	11	16	21	3
Totals	1412	264	455	548	145
Percent of Total		18.70%	32.22%	38.81%	10.27%

\* Skin cancer does not include Basal cell since it's not reportable.

TABLE 2

TOTAL CANCER INCIDENCE  
BY YEAR, SEX, AND AREA  
LIPARI LANDFILL  
(1980 - 1989)

YEAR	SEX	ALL AREAS	AREA			UNKNOWN AREAS
			1	2	3	
1980	Male:	72	13	23	32	4
	Female:	66	16	21	23	6
1981	Male:	57	11	20	15	11
	Female:	67	17	24	23	3
1982	Male:	44	7	17	17	3
	Female:	82	17	25	36	4
1983	Male:	78	9	34	27	8
	Female:	69	16	26	20	7
1984	Male:	65	13	21	26	5
	Female:	56	9	15	25	7
1985	Male:	56	4	15	33	4
	Female:	85	13	21	43	8
1986	Male:	55	8	23	16	8
	Female:	90	19	30	35	6
1987	Male:	67	11	21	28	7
	Female:	67	19	26	14	8
1988	Male:	69	9	21	31	8
	Female:	71	15	23	29	4
1989	Male:	78	12	21	32	13
	Female:	118	26	28	43	21
ALL YEARS	Male:	641	97	216	257	71
	Female:	771	167	239	291	74

TABLE 3

NUMBER OF ALL INCIDENCE CANCER CASES  
 BY MUNICIPALITY AND SEX  
 LIPARI LANDFILL  
 (1980 - 1989)

Municipality	Male	Female	Total
Glassboro	196	225	421
Harrison	56	49	105
Mantua	133	172	305
Pitman	185	251	436

NOTE: Numbers do not include the 145 cases of unknown address.

TABLE 4

STANDARDIZED INCIDENCE RATIOS (SIR) FOR TOTAL CANCER INCIDENCE  
 BY MUNICIPALITY  
 LIPARI LANDFILL  
 (1980 - 1989)

MUNICIPALITY		EXPECTED	OBSERVED	SIR	95% C.I.	
					LOWER	UPPER
Glassboro	Male:	225.64	196	0.87	0.75	1.00
	Female:	241.51	225	0.93	0.81	1.06
Harrison	Male:	74.59	56	0.75 *	0.57	0.97
	Female:	67.16	49	0.73 *	0.54	0.96
Mantua	Male:	166.41	133	0.80 *	0.67	0.95
	Female:	159.07	172	1.08	0.93	1.26
Pitman	Male:	200.83	185	0.92	0.79	1.06
	Female:	249.61	251	1.01	0.88	1.14

\* Statistically low,  $p < 0.05$

NOTE: Observed numbers do not include cases of unknown address.

TABLE 5

STANDARDIZED INCIDENCE RATIOS (SIR)  
 BY PRIMARY CANCER TYPE AND AREA  
 COMPARED TO AVERAGE STATE RATES  
 LIPARI LANDFILL  
 (1980 - 1989)

SITE	AREA	EXPECTED	OBSERVED	SIR	95% C.I.	
					LOWER	UPPER
ALL SITES:	1	337.40	264	0.78 *	0.69	0.88
	2	524.97	455	0.87 *	0.79	0.95
	3	557.54	548	0.98	0.90	1.07
COLON:	1	36.36	35	0.96	0.67	1.34
	2	54.35	54	0.99	0.75	1.30
	3	58.68	57	0.96	0.72	1.24
PANCREAS:	1	7.59	7	0.92	0.37	1.90
	2	11.52	7	0.61	0.24	1.25
	3	12.44	9	0.72	0.33	1.37
LUNG/PLEURA:	1	49.28	37	0.75	0.53	1.03
	2	76.91	62	0.81	0.62	1.03
	3	80.60	86	1.07	0.85	1.32
BLADDER:	1	17.78	16	0.90	0.51	1.46
	2	26.95	21	0.78	0.48	1.19
	3	29.18	27	0.93	0.61	1.35
LYMPHOMA:	1	11.39	10	0.88	0.42	1.61
	2	18.11	21	1.16	0.72	1.77
	3	19.76	19	0.96	0.58	1.50
LEUKEMIA:	1	6.09	6	0.99	0.36	2.15
	2	9.35	10	1.07	0.51	1.97
	3	11.24	13	1.16	0.62	1.98
BRAIN/NS:	1	4.50	3	0.67	0.13	2.95
	2	7.21	10	1.39	0.66	2.55
	3	8.32	13	1.56	0.83	2.67
RECTAL:	1	15.63	15	0.96	0.54	1.58
	2	23.72	24	1.01	0.65	1.51
	3	25.61	29	1.56	0.76	1.63
STOMACH:	1	8.42	2	0.24 *	0.03	0.86
	2	12.71	7	0.55	0.25	1.13
	3	13.82	8	0.58	0.25	1.14

\* Statistically low,  $p < 0.05$

NOTE: Observed numbers do not include cases of unknown address.

TABLE 6

SENSITIVITY ANALYSIS OF THE STANDARDIZED INCIDENCE RATIOS (SIR)  
 FOR ALL CANCER AND SELECT CANCER SITES  
 (INCLUDING CASES OF UNKNOWN LOCATION)  
 LIPARI LANDFILL  
 (1980 - 1989)

AREA	CANCER TYPE	EXPECTED	OBSERVED	SIR	95% C.I.	
					LOWER	UPPER
1	ALL TYPES:	337.40	409	1.21 *	1.10	1.34
	LUNG:	49.28	65	1.32 *	1.02	1.68
	BRAIN/NS:	4.50	8	1.78	0.76	3.50
	LEUKEMIA:	6.09	9	1.48	0.67	2.81
	LYMPHOMA:	11.39	15	1.32	0.74	2.17
2	ALL TYPES:	524.97	600	1.14 *	1.05	1.24
	LUNG:	76.91	90	1.17	0.94	1.44
	BRAIN/NS:	7.21	15	2.08 *	1.16	3.43
	LEUKEMIA:	9.35	13	1.43	0.74	2.39
	LYMPHOMA:	18.11	26	1.44	0.85	1.97
3	ALL TYPES:	557.54	693	1.24 *	1.15	1.34
	LUNG:	80.60	114	1.41 *	1.18	1.71
	BRAIN/NS:	8.32	18	2.16 *	1.28	3.42
	LEUKEMIA:	11.24	16	1.42	0.81	2.31
	LYMPHOMA:	19.76	24	1.21	0.78	1.81

\* Statistically high,  $p < 0.05$

NOTE: The Sensitivity Analysis includes known cases for each Area and unknown address cases. As an example, for all cancer types in Area 1, the observed number equals 409 which equals 264 known cases for Area 1 plus 145 unknown address cases. The 145 unknown address cases are added to each Area in the same way. This is done as an exercise to look for the most extreme possible "worst case" scenario.

Unlocatable cases include: All Sites = 145  
 Lung = 28  
 Brain/CNS = 5  
 Leukemia = 3  
 Lymphoma = 5

TABLE 7

STANDARDIZED INCIDENCE RATIOS (SIR)  
 CHILDHOOD CANCER (less than 20 years of age)  
 COMPARED TO AVERAGE STATE AND COUNTY RATES  
 LIPARI LANDFILL  
 (1979 - 1989)

AREA	NUMBER OF CASES		SIR *	95 % C. I.	
	EXPECTED	OBSERVED		LOWER	UPPER
=====					
AREA 1 vs.					
STATE:	2.82	5	1.77	0.57	4.14
COUNTY:	4.35	5	1.15	0.37	2.68
AREA 2 vs.					
STATE:	4.42	11	2.50 *	1.24	4.47
COUNTY:	6.80	11	1.62	0.81	2.90
AREA 3 vs.					
STATE:	10.94	16	1.46	0.84	2.38
COUNTY:	16.88	16	0.95	0.54	2.54
SENSITIVITY ANALYSIS					
AREA 1 vs.					
STATE:	2.82	10	3.55 *	1.70	6.52
COUNTY:	4.35	10	2.30 *	1.10	4.23
AREA 2 vs.					
STATE:	4.42	16	3.63 *	2.07	5.90
COUNTY:	6.80	16	2.35 *	1.34	3.82
AREA 3 vs.					
STATE:	10.94	21	1.92 *	1.19	2.93
COUNTY:	16.88	21	1.24	0.77	1.90

=====

\* Statistically high, p<0.05

NOTE: The Sensitivity Analysis includes known cases for each Area and the 5 unknown address cases. As an example, for Area 1, the observed number equals 10 which equals 5 known cases for Area 1 plus 5 unknown address cases. The 5 unknown address cases are added to each Area in the same way. This is done as an exercise to look for the most extreme possible "worst case" scenario.

TABLE 8

CHILDHOOD CANCER INCIDENCE CASE LIST  
LIPARI LANDFILL  
(1979-1989)

AREA	AGE	CANCER TYPE
1	18	HODGKIN'S DISEASE
1	16	HODGKIN'S DISEASE
1	17	HODGKIN'S DISEASE
1	13	BONE
1	8	BRAIN
2	<1	MISC RETICULOENDOTHELIAL
2	12	HODGKIN'S DISEASE
2	<1	ENDOCRINE
2	15	LEUKEMIA
2	5	LEUKEMIA
2	2	EYE
2	14	BONE
2	19	NON-HODGKIN'S LYMPHOMA
2	15	HODGKIN'S DISEASE
2	5	BRAIN
2	5	BRAIN
3	9	HODGKIN'S DISEASE
3	17	LEUKEMIA
3	19	LEUKEMIA
3	15	TESTIS
3	12	SOFT TISSUE
3	10	BRAIN
3	17	BONE
3	14	OVARIAN
3	7	LEUKEMIA
3	8	HODGKIN'S DISEASE
3	17	HODGKIN'S DISEASE
3	13	MISC RETICULOENDOTHELIAL
3	12	BRAIN
3	4	LEUKEMIA
3	5	LEUKEMIA
3	2	OTHER RESPIRATORY
9	2	BRAIN
9	18	HODGKIN'S DISEASE
9	15	SOFT TISSUE
9	<1	SOFT TISSUE
9	12	BRAIN

NOTE: AREA 9 = UNLOCATABLE ADDRESSES OR P.O. BOXES.

TABLE 9  
 STANDARDIZED INCIDENCE RATIOS (SIR) FOR  
 CHILDHOOD HODGKIN'S DISEASE  
 LIPARI LANDFILL  
 (1979-1989)

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AREA                OBSERVED    EXPECTED    SIR *        95% C.I. **
                    for SIR
=====
1. STANDARD = STATE RATES

AREA 1:             3          0.38        7.98 @      1.60 - 23.31
AREA 2:             2          0.59        3.65        0.38 - 12.30
AREA 3:             3          1.46        2.06        0.41 - 6.01

PITMAN BORO:       1          0.59        1.69        0.02 - 9.43
GLASSBORO:         4          0.98        4.08 @      1.10 - 10.45
MANTUA:            4          0.62        6.45 @      1.73 - 16.50

2. STANDARD = GLOUCESTER COUNTY RATES

AREA 1:             3          0.78        3.86        0.78 - 11.28
AREA 2:             2          1.21        1.65        0.19 - 5.95
AREA 3:             3          3.01        1.00        0.20 - 2.91

PITMAN BORO:       1          1.22        0.82        0.01 - 4.56
GLASSBORO:         4          2.03        1.97        0.53 - 5.06
MANTUA:            4          1.28        3.66        0.84 - 7.99
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\* SIR - Standardized Incidence Ratio of Observed to Expected number of Cancers (Age Standardized). Statistically evaluated at the  $p < 0.05$  level.

\*\* 95% Confidence Interval. There is only 5% likelihood that the SIR is actually outside of this interval. If the confidence interval includes 1.0, then the SIR is not considered to be different from 1.0 using conventional definitions of "statistical significance".

# The 3 cases have been geographically plotted and do not appear to be clustered near each other. Furthermore, the cases reside closer to the border of areas 1 and 2 than to the Lipari landfill.

Statistically elevated,  $p < 0.05$

TABLE 11

STANDARDIZED INCIDENCE RATIOS (SIR)  
 BY PRIMARY CANCER TYPE FOR AREA 1A  
 COMPARED TO AVERAGE STATE RATES  
 LIPARI LANDFILL  
 (1980 - 1989)

SITE	AREA	EXPECTED	OBSERVED	SIR	95% C.I.	
					LOWER	UPPER
ALL SITES:	1A	66.57	49	0.74 *	0.54	0.97
COLON:	1A	7.17	7	0.98	0.39	2.01
PANCREAS:	1A	1.50	1	0.67	0.01	3.71
LUNG/PLEURA:	1A	9.72	6	0.62	0.23	1.34
BLADDER:	1A	3.51	2	0.57	0.06	2.06
LYMPHOMA:	1A	2.25	3	1.33	0.27	3.90
LEUKEMIA:	1A	1.20	2	1.66	0.19	6.01
BRAIN/NS:	1A	0.89	0	0.00	-	-
RECTAL:	1A	3.08	2	0.65	0.07	2.34
STOMACH:	1A	1.66	0	0.00	-	-

\* Statistically low. p<0.05