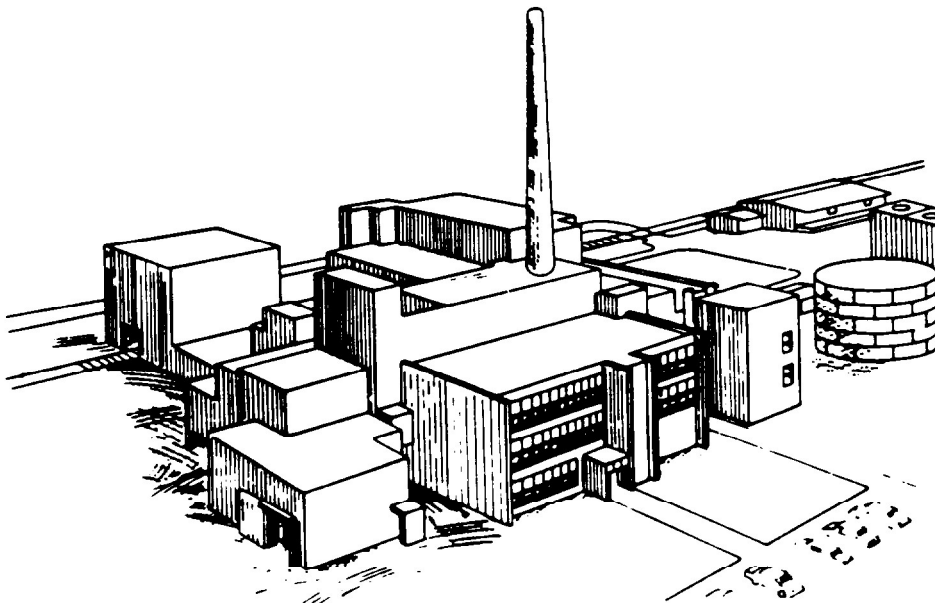




1983 Summary Report PRE-OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM WEST VALLEY DEMONSTRATION PROJECT

April 1984

West Valley Nuclear Services Company, Inc.



977

1983 SUMMARY REPORT
PREOPERATIONAL ENVIRONMENTAL MONITORING PROGRAM
WEST VALLEY DEMONSTRATION PROJECT

April 1984

Operated for the U.S. Department of Energy
by

West Valley Nuclear Services Company, Inc.

Rock Springs Road

West Valley, New York 14171-0191

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PREFACE

This report is prepared and submitted in accordance with the requirements of DOE Order 5484.1 and presents environmental monitoring data collected at the West Valley Demonstration Project (WVDP) site from January 1, 1983, through December 31, 1983. The WVDP objective is to solidify approximately 600,000 gallons of high-level liquid radioactive waste stored at the former Nuclear Fuel Services, Inc., reprocessing facility at West Valley, New York. Nuclear Fuel Services conducted an environmental monitoring program in accordance with U.S. Nuclear Regulatory Commission requirements which was appropriate during shutdown maintenance operations at the site. That program was embraced by West Valley Nuclear Services Company, Inc. (WVNS) at the time it accepted responsibility for operating the site for the Department of Energy (DOE) (February 26, 1982), and is being modified to establish comprehensive environmental surveillance in preparation for high-level waste solidification which is scheduled for startup in September 1988. As such, the data presented in this report are considered preoperational in nature in accordance with DOE Order 5484.1, Chapter III, Paragraph 1.

INTRODUCTION

On February 26, 1982, the responsibility for operation and maintenance of the former Nuclear Fuel Services, Inc. (NFS) reactor fuel reprocessing facility was transferred to the Department of Energy (DOE). Public Law No. 96-368, enacted in 1980, mandated the demonstration of technology for solidification of the liquid high-level radioactive waste which had been produced by commercial fuel reprocessing at the West Valley plant. This waste is now held in underground storage tanks at the facility. West Valley Nuclear Services Company (WVNS) was the contractor selected by the DOE to implement the provisions of this law.

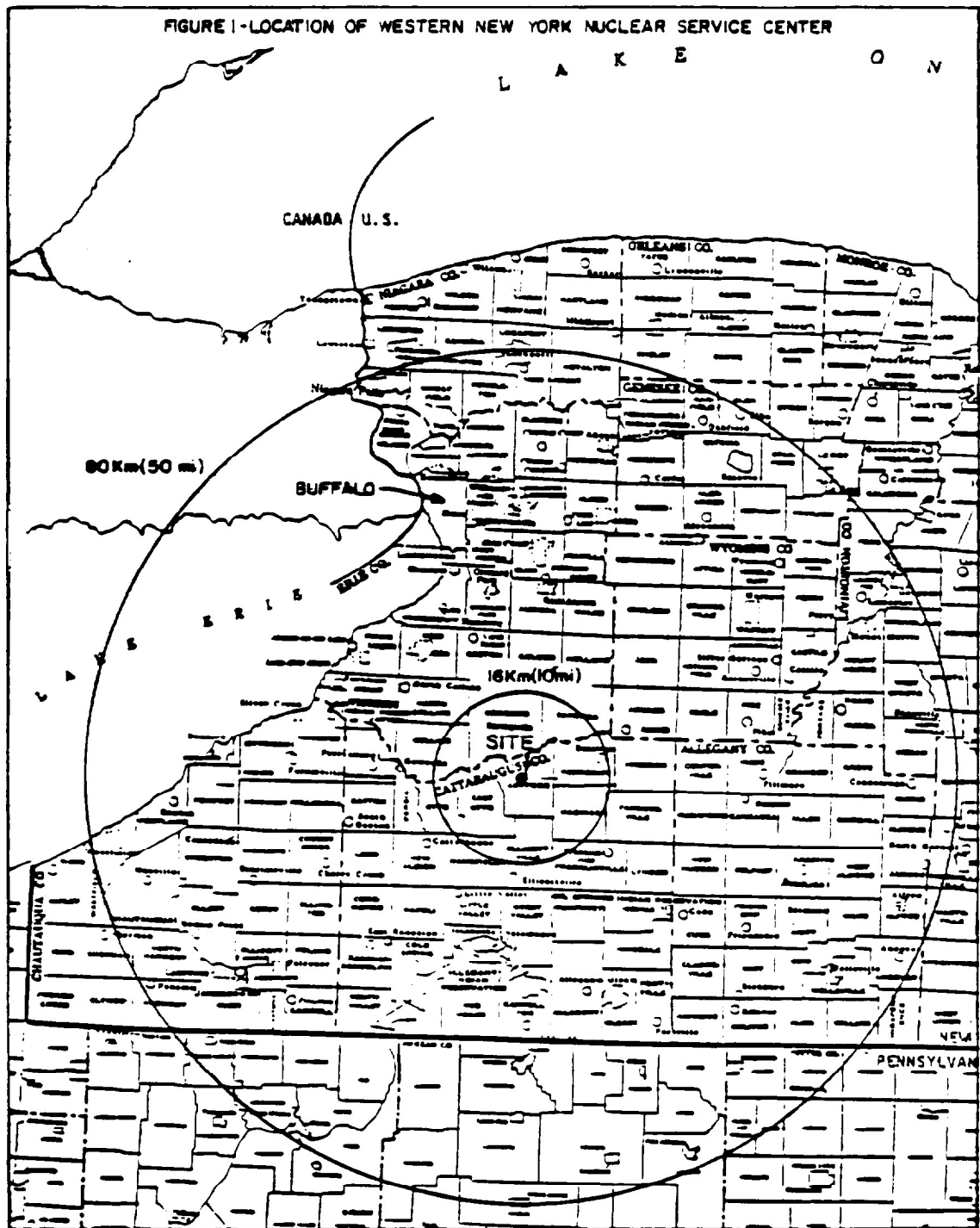
At the time operational control was assumed by WVNS, NFS was conducting an environmental monitoring program appropriate to the shutdown maintenance operating status of the facility in accordance with Technical Specification 5.1 under NRC License CSF-1. WVNS recognized that the NFS program required substantial change in order to prepare for high-level waste solidification operations which are currently scheduled for start-up in September 1988. WVNS initiated work in 1982 on implementation of a full-scale environmental surveillance program in support of these planned operations and will have an expanded program fully implemented by the beginning of 1985. This schedule will provide more than two years (as recommended in DOE Order 5484.1, Chapter III, Paragraph 1) to gather preoperational environmental baseline data before solidification operations begin.

This report is submitted in accordance with DOE Order 5484.1 and represents a summary of environmental monitoring data collected to meet the requirements of Technical Specification 5.1. The program developed and being implemented by WVNS will provide data in full compliance with DOE recommendations by calendar year 1985.

The reprocessing plant, although not now being used for its original purpose, is maintained in shutdown status which requires continual operation of basic services, including low-level radioactive waste management. The facility operation includes periodic disposal of solid radioactive waste from decontamination and maintenance activity (plant wastes) in the formerly licensed disposal area. Liquid wastes resulting from plant activities are processed on-site at the low-level waste treatment facility (LLWT) prior to discharge.

The WVDP site is located in a rural setting approximately 50 km (30 mi) south of Buffalo, New York (Figure 1), at an average elevation of 400 m (1,300 ft) on New York State's western plateau. The plant facilities being used by the project occupy approximately 100 hectares (250 acres) of chain-link fenced area within a 1,350 hectare (3,300 acre) reservation. This larger area constitutes the Western New York Nuclear Service Center (WNYNSC) and is under the control of the New York State Energy Research and Development Authority (NYSERDA). The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within 8 km (5 mi) of the plant. No human habitation, hunting, fishing, or public access is permitted on the WNYNSC, although several roads and one railway pass through the Center.

The average annual temperature in the region is 7.2°C (45.0°F) with recorded extremes of 37°C (98.6°F) and -42°C (-43.6°F). Rainfall is relatively high, averaging about 104 cm (41 in) per year. Precipitation is evenly distributed throughout the year and is markedly influenced by the presence of Lake Erie and Lake Ontario to the west and north, respectively. All surface drainage from the WNYNSC is to Buttermilk Creek which flows into Cattaraugus Creek and ultimately into Lake Erie. Regional winds are predominantly from the west and south at over 4 meters/second (9 miles/hour) during most of the year. WVNS is currently studying the influences of local topography



on site wind patterns. Wind rose data and site specific meteorological information are being developed at this time, and a final meteorological summary report will be issued in fiscal year 1985.

The WNYNSC lies within the northern hardwood forest region, with a diversity of vegetation typical of the area. The site is equally divided between forest and open land, providing habitats especially attractive to white-tailed deer and the various birds, reptiles, and small mammals indigenous to the region. No endangered species are known to be present on the reservation.

The site is geologically characterized by glacial deposits of varying thickness in the valley areas, underlain by sedimentary rocks which become exposed in the upper drainage channels in hillsides. The soil is principally silty till consisting of unconsolidated rock fragments, pebbles, sand, and clays. An aquifer exists in the upper 6 m (20 ft) of granular fluvial materials concentrated near the western edge of the site; high ground to the west and the Buttermilk Creek drainage to the east intersect this aquifer, precluding off-site continuity. Several shallow, isolated, waterbearing strata also occur at various other locations within the site boundary but do not appear to be continuous. The zone at which the till meets bedrock forms another aquifer, which ranges in depth from 2 m (6 ft) underground on the hillsides to 170 m (560 ft) deep just east of the boundary of the facility exclusion area.

SUMMARY

The results of the 1983 environmental monitoring program indicate that, with the exception of concentrations in surface water and fish, radioactivity in samples collected from the vicinity of the WNYNSC could not be distinguished from that which occurs naturally or has been deposited by fallout from weapons testing in the atmosphere. Although small concentrations of radioactivity were discharged during the course of project activities, concentrations in air and water effluents were well within the concentration guides of DOE Order 5480.1, Chapter XI, and the resultant dose estimates from these releases to the surrounding population were of negligible consequence with regard to predicted impacts on human health.

There was no statistical difference in concentrations of particulate beta activity in air measured at the site boundary and those reported from New York State Department of Environmental Conservation background samples. In samples of water obtained off-site from Cattaraugus Creek, the three detectable isotopes were tritium, cesium-137 and strontium-90. Although Buttermilk Creek is not used as a drinking water supply for humans, the water is accessible to dairy cattle at one location on the creek. Radionuclide concentrations in milk samples from this herd were below the detection limit. Thermoluminescent dosimeters placed around the site perimeter indicated that direct external radiation exposure was within the range expected from natural background in this region.

3.0

ENVIRONMENTAL MONITORING PROGRAM - DESCRIPTION AND RESULTS

The environmental monitoring network was retained essentially unchanged immediately after the transfer of operational responsibility from NFS to WVNS. An initial evaluation of this environmental program confirmed that it was acceptable for the plant operations at the time. It was also determined, however, that an expanded and upgraded monitoring program would be required to support future project activities. This report reflects some of the changes which have been implemented to provide an enhanced level of environmental surveillance in anticipation of high-level waste solidification activities. The complete surveillance program, as it will be operated by the end of 1984 including effluent, on-site, and off-site monitoring, is summarized in tabular form in Appendix A.

The major pathways for off-site movement of radionuclides are by surface water runoff and airborne transport. Therefore, the primary media collected for analysis include surface water, air, and geological samples. Another significant pathway is through the potential ingestion and assimilation of radionuclides by game animals and fish which include the WNYNSC in their range. In addition to the radiological environmental monitoring program, WVNS participates in the State Pollution Discharge Elimination System (SPDES) and operates under state-issued air and water discharge permits for plant effluents.

3.1

Radiological Monitoring

This section addresses the monitoring of air, water, and biological media for radioactive contamination. The data reported are those required by Technical Specification 5.1. Measured values are compared to appropriate limits, where applicable.

3.1.1 Radioactivity in Air

In 1983, airborne particulate radioactivity was sampled continuously by three air samplers at the locations shown in Figure 2. Each air sampler, mounted on a 4-meter high tower, maintains an average air flow of about 40 lpm ($1.5 \text{ ft}^3/\text{min}$) through a 47 mm glass fiber filter. The filters are collected weekly and are analyzed after a seven-day decay period to remove interference from short-lived naturally occurring radioactivity. Gross alpha and gross beta measurements of each filter are made using a low-background gas proportional counter.

In all cases, the measured activities were below the most limiting concentration guides listed in DOE Order 5480.1 for releases to uncontrolled areas. The standards and concentration guides from DOE Order 5480.1 are reproduced in Appendix B. Results of the analyses of perimeter air sample filters are presented in Table 1.

For comparison, the 1982 and 1983 data from the New York State Department of Health indicated a normal background concentration of gross beta activity in air which averaged $2 \times 10^{-14} \mu\text{Ci}/\text{ml}$ in Albany, New York (Reference 1). Based on these measurements, no discernible off-site influence on airborne radioactivity is evident from site activities.

The large volume samples from the plant ventilation stack provide the only practical means of determining the amount of specific radionuclides released at low concentrations, including Sr-90 and I-129. The average monthly concentrations for gross alpha and beta radioactivity released from the stack, based on the 52 weekly filter measurements, are shown in Table 2. The results of analyses for specific radionuclides in the four quarterly composites of stack effluent samples are also listed in Table 2. These measured

FIGURE 2- LOCATIONS OF ENVIRONMENTAL MONITORING STATIONS

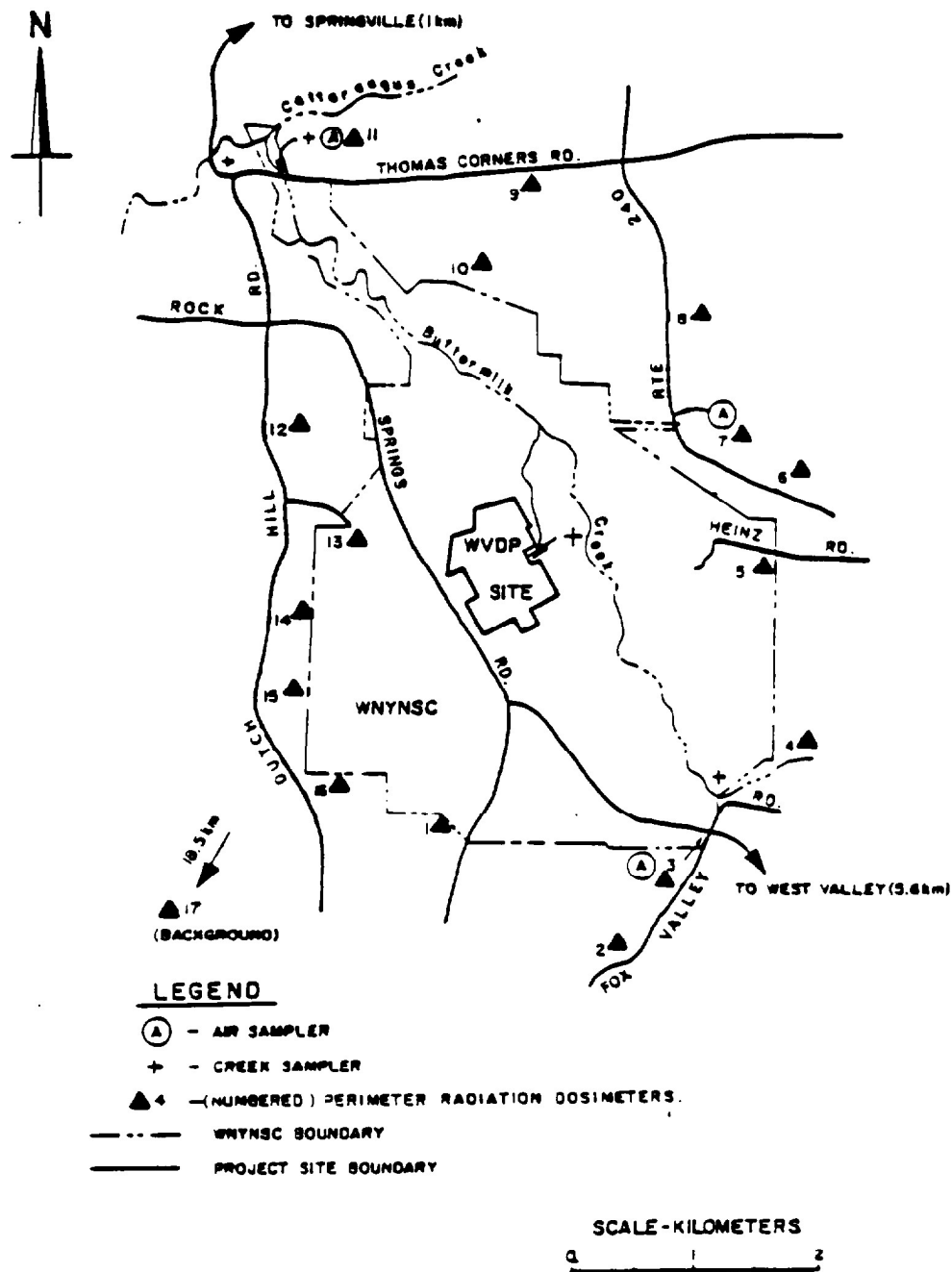


TABLE 1
MEASURED CONCENTRATIONS OF AIRBORNE PARTICULATE RADIOACTIVITY COLLECTED BY
PERIMETER AIR SAMPLERS ($\mu\text{Ci/ml}$)

Month	Fox Valley (3)*		Route 240 (7)		Thomas Corners (11)	
	Gross α $\times 10^{-16}$	Gross β $\times 10^{-14}$	Gross α $\times 10^{-16}$	Gross β $\times 10^{-14}$	Gross α $\times 10^{-16}$	Gross β $\times 10^{-14}$
Jan	<1.97	1.10 $\pm$ 0.41	<1.38	1.69 $\pm$ 0.72	<1.38	1.50 $\pm$ 0.58
Feb	<1.38	1.78 $\pm$ 0.47	<2.11	1.78 $\pm$ 0.73	<1.46	1.97 $\pm$ 0.65
March	<1.38	1.19 $\pm$ 0.40	<1.38	1.32 $\pm$ 0.64	<1.46	1.59 $\pm$ 0.57
April	<1.38	1.23 $\pm$ 0.42	<1.38	1.47 $\pm$ 0.69	<1.38	1.35 $\pm$ 0.57
May	<1.47	1.06 $\pm$ 0.43	<2.22	1.50 $\pm$ 0.77	<1.73	1.19 $\pm$ 0.60
June	6.61 $\pm$ 5.55	1.43 $\pm$ 0.41	<10.1	1.88 $\pm$ 0.83	<9.10	1.74 $\pm$ 0.57
July	8.39 $\pm$ 8.10	1.60 $\pm$ 0.28	<13.6	1.65 $\pm$ 0.45	<9.48	1.54 $\pm$ 0.36
August	11.46 $\pm$ 9.31	2.42 $\pm$ 1.40	19.4 $\pm$ 17.8	1.47 $\pm$ 0.59	<8.61	1.66 $\pm$ 0.37
Sept	20.58 $\pm$ 10.96	2.06 $\pm$ 0.33	24.2 $\pm$ 15.0	2.60 $\pm$ 0.51	29.96 $\pm$ 19.85	2.98 $\pm$ 0.40
Oct	9.33 $\pm$ 6.08	1.56 $\pm$ 0.25	13.0 $\pm$ 10.3	1.98 $\pm$ 0.43	10.55 $\pm$ 7.31	1.67 $\pm$ 0.28
Nov	9.26 $\pm$ 6.24	1.98 $\pm$ 0.28	<8.02	2.15 $\pm$ 0.41	11.22 $\pm$ 8.89	2.32 $\pm$ 0.41
Dec	9.22 $\pm$ 6.18	1.92 $\pm$ 0.27	8.67 $\pm$ 8.52	2.38 $\pm$ 0.44	10.32 $\pm$ 9.11	2.36 $\pm$ 0.32

* Numbers in parenthesis refer to locations of TLD direct radiation dosimeters identified in Figure 2

Notes: See Appendix B for applicable standards.
 Values are monthly averages of weekly samples.
 Counting error is $\pm$ two standard deviations.

TABLE 2

MEASURED CONCENTRATIONS OF PARTICULATE RADIOACTIVITYIN PLANT VENTILATION STACK EFFLUENT ($\mu\text{Ci/ml}$)

<u>Month*</u>	<u>Gross $\alpha \times 10^{-14}$</u>		<u>Gross $\beta \times 10^{-12}$</u>	
January	1.39 $\pm$ 1.18		0.70 $\pm$ 0.06	
February	<1.02		0.80 $\pm$ 0.07	
March	<0.85		0.68 $\pm$ 0.06	
April	2.41 $\pm$ 0.83		1.24 $\pm$ 0.09	
May	1.76 $\pm$ 0.69		1.05 $\pm$ 0.08	
June	<0.85		1.16 $\pm$ 0.08	
July	1.97 $\pm$ 1.37		0.44 $\pm$ 0.05	
August	1.75 $\pm$ 1.33		0.77 $\pm$ 0.06	
September	1.79 $\pm$ 1.31		1.05 $\pm$ 0.07	
October	<1.00		0.27 $\pm$ 0.04	
November	1.18 $\pm$ 1.10		1.64 $\pm$ 0.09	
December	2.13 $\pm$ 1.42		1.39 $\pm$ 0.08	

<u>Quarter**</u>	<u>Sr-90</u> <u>$\times 10^{-13}$</u>	<u>Ru-106</u> <u>$\times 10^{-14}$</u>	<u>I-129</u> <u>$\times 10^{-14}$</u>	<u>Cs-134</u> <u>$\times 10^{-14}$</u>	<u>Cs-137</u> <u>$\times 10^{-12}$</u>
<u>1982***</u>					
Fourth			4.32 $\pm$ 0.62		
<u>1983</u>					
First	0.79 $\pm$ 0.09	<1.50	3.60 $\pm$ 0.50	0.19 $\pm$ 0.08	0.29 $\pm$ 0.06
Second	1.81 $\pm$ 0.26	<3.99	3.22 $\pm$ 1.55	0.50 $\pm$ 0.16	0.79 $\pm$ 0.02
Third	1.69 $\pm$ 0.21	<2.06	5.79 $\pm$ 0.60	0.43 $\pm$ 0.18	0.93 $\pm$ 0.01
Fourth	2.21 $\pm$ 0.26	<3.37	4.64 $\pm$ 0.55	1.16 $\pm$ 0.27	2.30 $\pm$ 0.01

* Values reported are monthly averages from weekly samples. Counting uncertainty is $\pm$ two standard deviations.

** Values reported are from quarterly composites of weekly samples.

*** Not available for reporting in 1982 annual summary.

concentrations of airborne radioactivity sampled through the in-stack probe are well within the concentration guides for airborne radioactive materials released to unrestricted areas (see Appendix B).

3.1.2 Radioactivity in Surface Water and Sediment

Off-site water samples are collected continuously from Cattaraugus Creek at Felton Bridge, just downstream of the confluence with Buttermilk Creek, the major surface drainage from the WNYNSC (Figure 2). This Cattaraugus Creek sampler continuously removes a small volume of water from the creek (approximately 400 ml/hr); a stream stage-level chart recorder provides a means of flow-weighting the weekly composite based on relative stream depth. Gross alpha, beta, and tritium analyses are performed each week, and a weighted monthly composite is analyzed for Sr-90 and gamma emitting isotopes. A grab sample is taken monthly from a background location at Cattaraugus Creek upstream of the Buttermilk Creek confluence; it is analyzed for gross alpha, beta, and tritium. The most elevated concentration in samples from Cattaraugus Creek during 1983 show Sr-90 to be several orders of magnitude below the concentration guide for unrestricted effluent. Gross alpha and gamma emitting isotopes were so low as to be below the detection limit in Cattaraugus Creek water for 8 of the 12 months represented (Table 3). However, on the average, there is a detectable increase in the concentration of radioactivity after Buttermilk Creek joins Cattaraugus Creek.

During 1983, three additional surface water monitoring stations were put into service. These samplers currently operate in a time composite mode with a monthly analysis for tritium, gross alpha and gross beta radioactivity. These installations collect water from an upstream background location on Buttermilk Creek (Fox Valley

TABLE 3
MEASURED CONCENTRATIONS OF RADIOACTIVITY IN SURFACE WATER ($\mu\text{Ci/ml}$) AND SEDIMENT

Cattaraugus Creek

Bigelow Bridge (above Buttermilk)				Felton Bridge (below Buttermilk)				
Monthly Grab				Continuous Sampler Monthly Composite				
Month	Gross α $\times 10^{-10}$	Gross β $\times 10^{-8}$	Tritium $\times 10^{-7}$	Gross α $\times 10^{-10}$	Gross β $\times 10^{-8}$	Tritium $\times 10^{-7}$	Sr-90 $\times 10^{-9}$	Cs-137 $\times 10^{-8}$
<u>1982</u>								
Dec	<3.19	0.73 $\pm$ 0.25	16.6 $\pm$ 1.80	<5.10	0.90 $\pm$ 0.30	8.44 $\pm$ 1.74	3 $\pm$ 2	<0.44
<u>1983</u>								
Jan	<3.48	0.73 $\pm$ 0.28	3.31 $\pm$ 1.67	<3.61	1.02 $\pm$ 0.33	6.55 $\pm$ 1.87	2 $\pm$ 2	0.80 $\pm$ 0.61
Feb	<2.94	0.78 $\pm$ 0.27	3.89 $\pm$ 1.70	<7.22	1.42 $\pm$ 0.35	8.84 $\pm$ 1.85	2 $\pm$ 2	0.83 $\pm$ 0.72
Mar	<3.29	<0.22	4.88 $\pm$ 1.73	<3.40	0.50 $\pm$ 0.27	9.62 $\pm$ 1.87	6 $\pm$ 4	<0.63
Apr	<3.40	0.46 $\pm$ 0.27	4.98 $\pm$ 1.72	<4.60	0.90 $\pm$ 0.35	5.50 $\pm$ 1.81	2 $\pm$ 2	2.89 $\pm$ 2.0
May	<3.57	0.49 $\pm$ 0.27	5.27 $\pm$ 1.88	<5.06	0.84 $\pm$ 0.31	5.30 $\pm$ 1.97	4 $\pm$ 2	<2.3
June	<3.54	0.28 $\pm$ 0.14	<1.87	<2.61	0.26 $\pm$ 0.12	2.33 $\pm$ 1.91	<4	<3.2
July	<1.94	0.48 $\pm$ 0.12	<1.76	<2.91	0.65 $\pm$ 0.13	2.38 $\pm$ 1.90	<4	<2.8
Aug	<2.86	0.23 $\pm$ 0.12	<1.96	4.32 $\pm$ 3.97	0.18 $\pm$ 0.12	2.85 $\pm$ 1.95	<4	6.74 $\pm$ 2.2
Sept	<1.96	0.16 $\pm$ 0.08	<2.02	3.81 $\pm$ 2.98	0.46 $\pm$ 0.11	2.35 $\pm$ 1.91	<4	<3.0
Oct	<1.62	0.27 $\pm$ 0.09	<1.99	<2.06	0.42 $\pm$ 0.10	<2.02	4.91 $\pm$ 3.74	<8
Nov	3.50 $\pm$ 3.04	0.86 $\pm$ 0.13	3.40 $\pm$ 1.96	7.53 $\pm$ 4.26	0.74 $\pm$ 0.12	2.85 $\pm$ 1.80	<3.57	<8
Dec	<2.33	0.76 $\pm$ 0.13	5.77 $\pm$ 1.90	<2.60	0.72 $\pm$ 0.12	5.64 $\pm$ 1.79	<3.27	<3

*NOTE: See Appendix B for applicable standards for concentrations in water.

TABLE 3 (Continued)

MEASURED CONCENTRATIONS OF RADIOACTIVITY IN SURFACE WATER ($\mu\text{Ci/ml}$) AND SEDIMENT

Frank's Creek at 006 Sampler				Buttermilk Creek at Thomas Corners Road Sampler		
Month 1983	Gross α $\times 10^{-10}$	Gross β $\times 10^{-8}$	Tritium $\times 10^{-6}$	Gross α $\times 10^{-10}$	Gross β $\times 10^{-8}$	Tritium $\times 10^{-6}$
July	4.80 $\pm$ 4.41	3.60 $\pm$ 0.31	0.39 $\pm$ 0.20	4.32 $\pm$ 3.97	0.68 $\pm$ 0.16	0.32 $\pm$ 0.20
August	<3.77	6.52 $\pm$ 0.39	1.45 $\pm$ 0.22	10.6 $\pm$ 5.73	1.74 $\pm$ 0.22	0.55 $\pm$ 0.22
September	8.83 $\pm$ 4.91	2.73 $\pm$ 0.30	0.88 $\pm$ 0.21	5.37 $\pm$ 3.89	0.35 $\pm$ 0.10	1.07 $\pm$ 0.21
October	9.08 $\pm$ 4.70	6.06 $\pm$ 0.33	0.55 $\pm$ 0.23	3.91 $\pm$ 3.24	0.85 $\pm$ 0.14	0.24 $\pm$ 0.21
November	<2.60	8.85 $\pm$ 0.40	14.2 $\pm$ 0.44	5.22 $\pm$ 3.61	1.23 $\pm$ 0.16	1.07 $\pm$ 0.20
December	3.50 $\pm$ 3.04	4.75 $\pm$ 0.30	2.55 $\pm$ 0.21	6.38 $\pm$ 3.95	1.18 $\pm$ 0.16	0.34 $\pm$ 0.18

Buttermilk Creek at Fox Valley Road Sampler (above plant)				Radioactivity in Sediment ($\mu\text{Ci/gm}$) Buttermilk Creek Silt at Thomas Corners Road Sampler		
Month 1983	Gross α $\times 10^{-10}$	Gross β $\times 10^{-8}$	Tritium $\times 10^{-6}$	Quarter 1983	Gross α $\times 10^{-5}$	Gross β $\times 10^{-5}$
July	4.32 $\pm$ 3.97	0.23 $\pm$ 0.12	0.62 $\pm$ 0.21	First	0.7 $\pm$ 0.2	3.4 $\pm$ 0.4
August	6.41 $\pm$ 6.2	0.26 $\pm$ 0.13	0.38 $\pm$ 0.20	Second	0.5 $\pm$ 0.4	2.5 $\pm$ 1.0
September	<2.37	0.24 $\pm$ 0.09	0.48 $\pm$ 0.20	Third	0.9 $\pm$ 0.4	2.9 $\pm$ 1.0
October	5.63 $\pm$ 3.72	0.30 $\pm$ 0.09	<0.20	Fourth	1.4 $\pm$ 0.6	4.1 $\pm$ 1.0
November	<2.60	0.71 $\pm$ 0.12	0.83 $\pm$ 0.20			
December	3.50 $\pm$ 3.04	0.55 $\pm$ 0.11	0.32 $\pm$ 0.19			

Road), and a downstream location near the confluence of Cattaraugus Creek. The third station is on Franks Creek (also known as Erdman Brook) just upstream of the point where project site drainage leaves the security area. Radiological concentration data from these sample points are available only for the last part of 1983 (see Table 3).

Average radioactivity concentrations are generally higher in Buttermilk Creek below the WVDP site than above, presumably due to the small amount of activity that enters it from the site via Franks Creek.

Non-radiological water quality measurements are also taken at the Franks Creek location; these data are discussed in Section 3.2 of this report.

The largest single source of radioactivity released to surface waters is the discharge from the low-level waste treatment (LLWT) system through the Lagoon 3 weir (SPDES 001, see Figures 3 and 4) and into Erdman Brook. There were two batch releases from Lagoon 3 in 1983 which totaled about 29 million liters. The effluent was grab sampled daily during the 34 days of release and analyzed. The average concentrations and total amounts of activity in the effluent are listed in Table 4. Note that the activity released from Lagoon 3 included 0.42 Ci of tritium and 0.002 Ci of strontium-90, which originated in the New York State disposal area and not from previous or current plant operations.

FIGURE 3.- LOCATION OF EFFLUENT RADIOLOGICAL MONITORING POINTS ONSITE

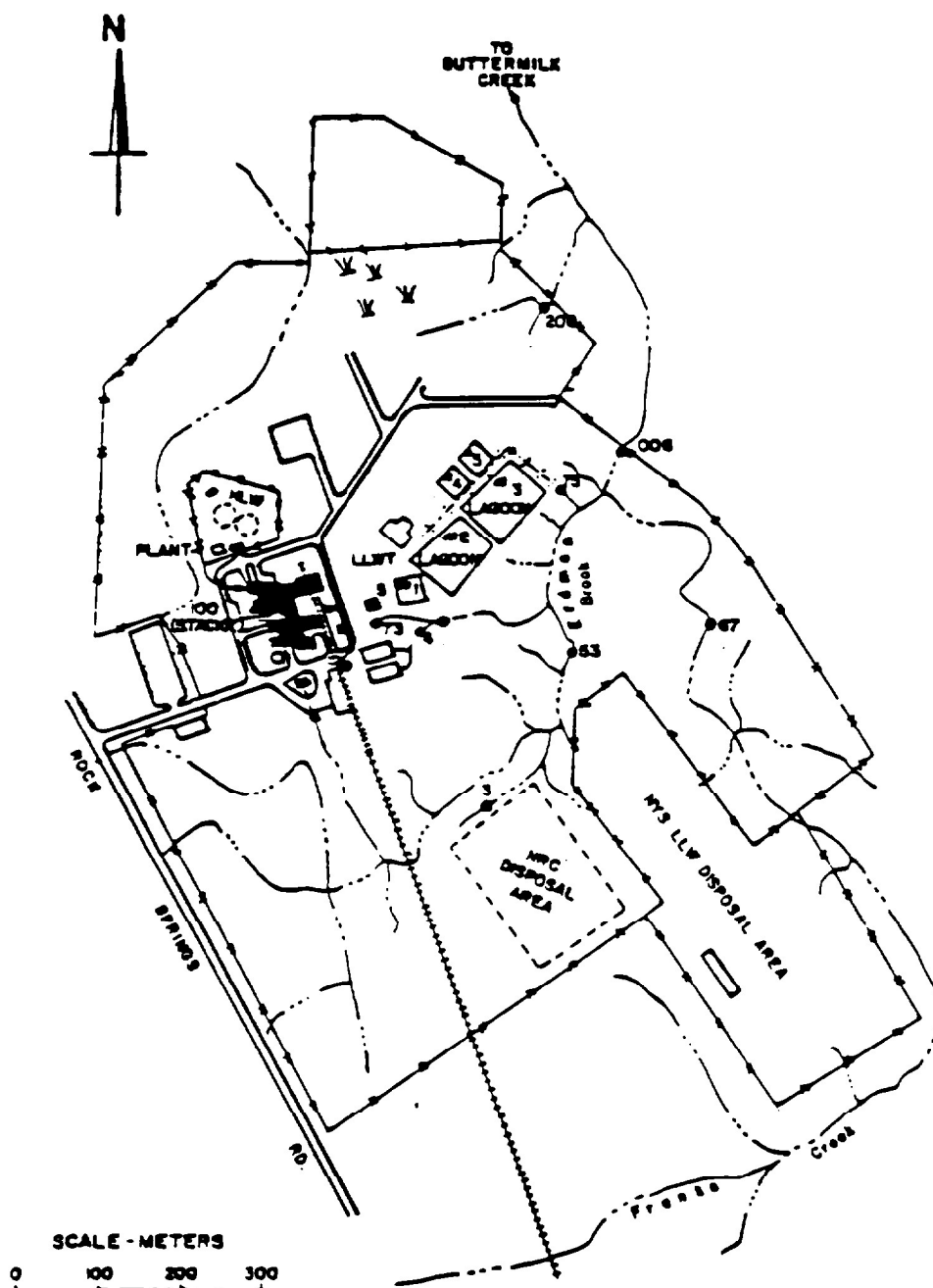


FIGURE 4- LOCATIONS OF SPOES MONITORING POINTS ONSITE

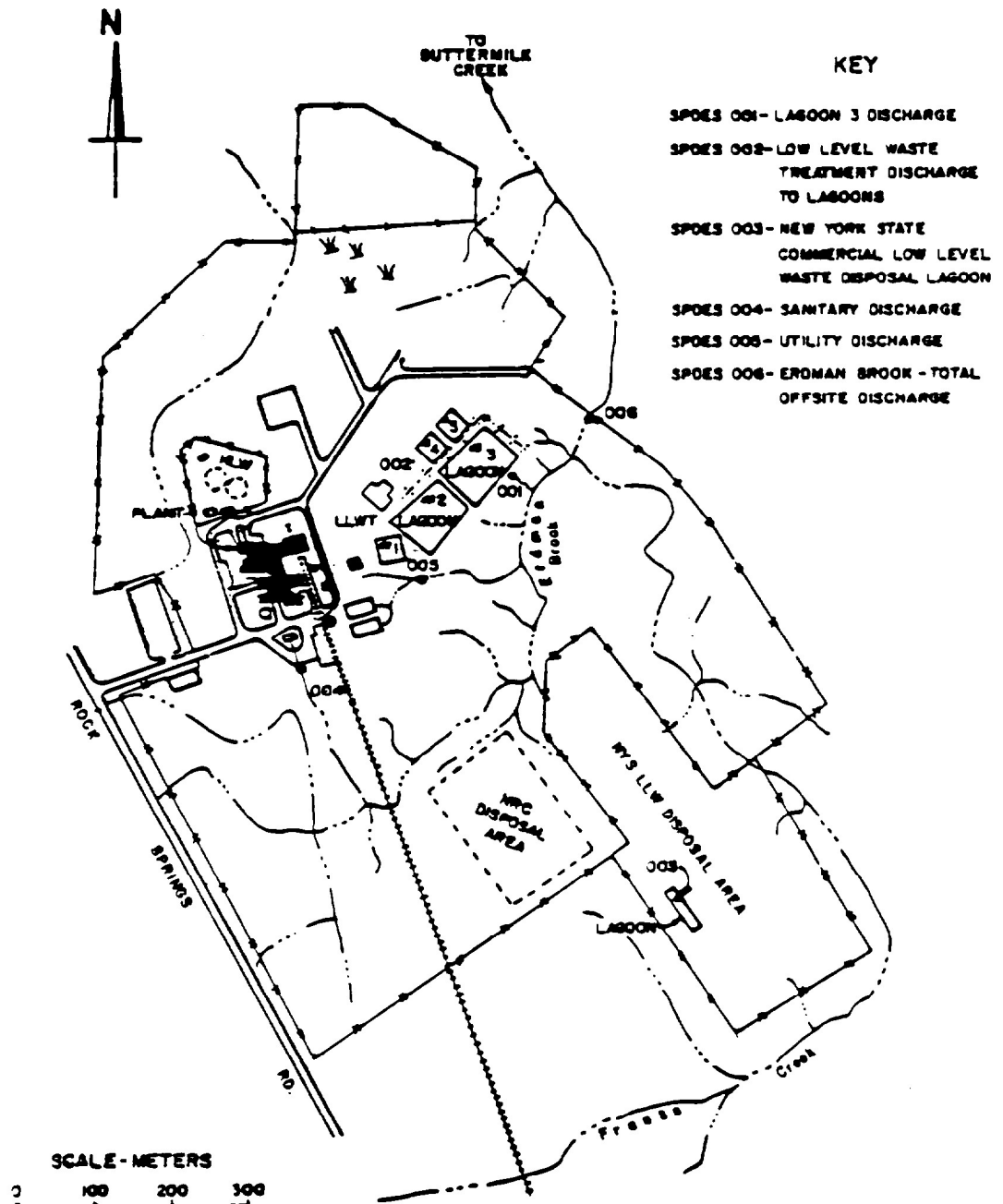


TABLE 4

RADIOACTIVITY DISCHARGED FROM THE LLWT SYSTEMTHROUGH LAGOON 3 IN 1983

<u>Release Period</u>	<u>Isotope</u>	<u>Concentration μCi/l</u>	<u>Total Ci Activity*</u>
May 2, 1983	H-3	$1.59 \pm 0.03 \text{ E-4}$	2.73
to	Sr-90	$1.40 \pm 0.18 \text{ E-7}$	2.41 E-3
May 20, 1983	Ru-106	$<1.6 \text{ E-7}$	$<2.75 \text{ E-3}$
	I-129	$2.2 \pm 2.0 \text{ E-9}$	3.78 E-5
Volume (ml) Released	Cs-134	$2.1 \pm 1.0 \text{ E-8}$	3.61 E-4
1.72 E+10	Cs-137	$7.09 \pm 0.30 \text{ E-7}$	1.22 E-2
November 7, 1983	H-3	$1.36 \pm 0.03 \text{ E-4}$	1.63
to	Sr-90	$1.85 \pm 0.22 \text{ E-7}$	2.22 E-3
November 23, 1983	Ru-106	$<1.94 \text{ E-7}$	$<2.33 \text{ E-3}$
	I-129	$9.53 \pm 2.24 \text{ E-9}$	1.14 E-4
Volume (ml) Released	Cs-134	$<8.46 \text{ E-9}$	1.02 E-4
1.20 E+10	Cs-137	$8.93 \pm 0.26 \text{ E-7}$	1.07 E-2

* 2 E-3 Ci of Sr-90 and 4.2 E-1 Ci of H-3 included in these totals were from the New York State low-level waste disposal area.

Note: See Appendix B for applicable standards.

3.1.3 Radioactivity in the Food Chain

Samples of fish and game animals were collected during periods of time when they would normally be taken for consumption by sportsmen. Milk from cows grazing near the site was also collected and analyzed during the second and third quarters of 1983. The results of these analyses are presented in Table 5.

Two semi-annual fish samples were taken during 1983 above the Springville dam from the portion of Cattaraugus Creek which receives WNYNSC drainage. Nine fish were collected from this section of stream during each period. The Sr-90 content in flesh and skeleton, and gamma emitting isotopes in flesh were determined for each specimen. Although several fish were also taken from waters that could not have been influenced by site runoff and analyzed in a similar manner, this control (natural background) sample was not truly representative of either the age or species collected in Cattaraugus Creek. However, these control data are included in the 1983 report to permit a general comparison with the concentrations found in fish taken from site-influenced drainage. The concentrations of strontium and cesium isotopes in the edible flesh shows a slight downward trend (Reference 2), although the Sr-90 content in the skeleton has remained at the same average level during recent years (Reference 3). The statistical treatment of the fish data presented in Table 5 is specified by the site reporting requirements.

A single deer was collected from a resident herd on the east side of the WNYNSC. The concentration of strontium and cesium in deer flesh was at a slightly higher level than in the 1982 sample. Strontium-89 was not detected in the skeleton. Whereas Sr-90 in bone was present almost two orders of magnitude above the 1982 sample, it was comparable to data on deer collected in the years preceding 1982. A control or background deer sample was not available in 1983 from the western New York area.

MEASURED CONCENTRATIONS OF RADIOACTIVITY IN MILK, DEER AND FISH

Milk - 1983					Deer - 1983				
Concentration ($\mu\text{Ci/ml}$)					Concentration ($\mu\text{Ci/kg}$)				
	Sr-90	I-129	Cs-134	Cs-137		Sr-89	Sr-90	Cs-134	Cs-137
NE Farm 2nd Qtr 1983	<4 E-10	<7.1 E-9	<1.48 E-8	<1.54 E-8	Flesh	--	3.61 $\pm$ 0.71 E-6	<4.45 E-5	2.94 $\pm$ 2.10 E-5
NE Farm 3rd Qtr 1983	<4 E-10	<8.3 E-9	<1.10 E-8	<7.74 E-9	Skeleton	<1.72 E-3	1.24 $\pm$ 0.17 E-3	--	--

Cattaraugus Creek Fish - 2nd Quarter 1983					Cattaraugus Creek Fish - 3rd Quarter 1983				
Concentration ($\mu\text{Ci/kg}$)					Concentration ($\mu\text{Ci/kg}$)				
	Sr-90	Flesh Cs-134	Cs-137	Skeleton Sr-90		Sr-90	Flesh Cs-134	Cs-137	Skeleton Sr-90
Median	8.95E-5	9.51E-4	9.66E-4	8.1E-4	Median	6.5E-5	3.63E-4	2.12E-4	7.3E-4
Average Geometric Deviation	1.7	1.35	1.36	1.45	Average Geometric Deviation	1.5	1.2	1.4	1.3
Maximum	1.12 $\pm$ 0.37E-4	<1.32E-3	<1.19E-3	1.15 $\pm$ 0.27E-3	Maximum	1.18 $\pm$ 0.21E-4	<4.06E-4	<3.10 $\pm$ 1.46E-4	8.30 $\pm$ 1.14E-4
Minimum	<3.92E-5	<6.26E-4	<6.55E-4	3.29 $\pm$ 1.55E-4	Minimum	2.28 $\pm$ 0.94E-5	<2.66E-4	<1.46E-4	3.76 $\pm$ 0.52E-4

Background Fish - 3rd Quarter 1983				
Concentration ($\mu\text{Ci/kg}$)				
	Sr-90	Flesh Cs-134	Cs-137	Skeleton Sr-90
Median	1.67E-4	1.96E-4	2.02E-4	9.43E-4
Average Geometric Deviation	1.31	1.33	1.22	1.04
Maximum	1.91 $\pm$ 0.26E-4	<2.16E-4	<2.16E-4	1.05 $\pm$ 0.12E-3
Minimum	1.09 $\pm$ 0.13E-4	<1.01E-4	<1.18E-4	9.26 $\pm$ 1.09E-4

Although the dairy cattle sampled in 1983 reside adjacent to the site and receive the maximum exposure to any dairy herd, the concentration of Sr-90 in milk from this herd was below the detection limit of 0.4 pCi/l. Iodine-129 and gamma emitting isotopes also were not detectable. Periodic control samples from the Albany, New York area analyzed by the New York State Department of Health laboratory showed an average concentration of 2 pCi/l of Sr-90 in milk (Reference 1).

Radionuclides present in the human food chain are discussed in Section 4 of this report in which their contribution to the radiation exposure of the public is assessed. Although, in many cases, the concentrations of specific radionuclides were below the analytical detection limit, for purposes of the dose assessment they were considered present at the minimum detectable concentration.

3.1.4 Direct Environmental Radiation

The measurement of ambient penetrating radiation in 1982 and the first half of 1983 was performed by a commercial dosimetry service. The monthly badges contained high-sensitivity $\text{CaSO}_4:\text{Tm}$ thermoluminescent dosimetry (TLD) material packaged such that energy correction could be factored into the final results. In anticipation of the fact that the commercial dosimetry services would be discontinued after June of 1983, an alternative dosimetry system was established in April 1983 to provide continuous monitoring around the site perimeter (Figure 2). The results (total exposure for each calendar quarter) for each type of TLD in each quarter of use are summarized in Table 6.

TABLE 6

DIRECT ENVIRONMENTAL RADIATION EXPOSURES (mR)
January through December 1983

<u>TLD Location⁺</u>	<u>CaSO₄ 1st Qtr</u>	<u>CaSO₄ 2nd Qtr</u>	<u>LiF 2nd Qtr</u>	<u>LiF 3rd Qtr</u>	<u>LiF 4th Qtr</u>	<u>Quarterly Average LiF^{**}</u>
001	19±2	19±4	19±5	19±9	21±19	20±7
002	19±2	19±2	15±2	19±13	14±11	16±7
003	19±3	18±2	14±2	20±12	15±15	16±7
004	20±2	21±4	16±5	19±8	18±08	18±4
005	19±3	20±2	16±2	18±8	21±15	18±7
006	18±2	19±2	18±2	17±9	18±10	18±5
007	19±2	18±2	15±4	16±15	17±22	6±10
008	18±2	18±1	16±1	19±16	18±25	18±11
009	19±2	19±2	16±4	16±13	18±14	17±7
010	19±1	19±2	17±4	21±11	21±6	20±5
011	22±3	20±3	20±4	21±13	21±12	21±7
012	19±3	19±1	17±3	18±5	19±10	18±4
013	22±1	19±4	17±2	23±11	23±14	21±7
014	18±2	20±3	16±4	20±14	24±18	20±10
015	19±2	18±3	19±3	17±12	18±22	18±10
016	15±3	17±2	18±4	21±10	23±27	21±10
017*	N/A	N/A	N/A	17±2	18±6	18±3

+ See Figure 2 for location of numbered TLD stations.

* Background location added July 1983.

**Using individual chip readings over three quarters.

In view of the existing site-operated personnel dosimetry equipment, a Harshaw T1-700 LiF TLD was selected so that the site TLD processing could be used, at the same time maintaining a special group of TLD chips for environmental dosimetry. Transfer of calibration using Cs-137 sources, and replication of an environmental five-chip dosimetry packaging technique used at the INEL site in Idaho was effected by April 1 so that one-quarter of overlap data was available for the two systems, the two types of dosimeters being placed at the same locations. Several aspects of the new system are notable in comparing the $\text{CaSO}_4:\text{Tm}$ and the LiF results. The $\text{CaSO}_4:\text{Tm}$ dosimeters, although much more sensitive to low radiation exposure, are more likely to be affected by fading and energy dependence. The 1983 LiF dosimeter data produced a wide uncertainty band due to procedural difficulties and the limited number of individual measurements available. The means of each quarterly measurement are, however, consistent from quarter to quarter for each station. The precision of the LiF data is expected to improve with refinements in technique. The exposure rates measured with the new LiF system and the previous energy-compensated method appears to be in excellent agreement.

In addition to the existing network, a remote background station was in place for six months of 1983. These data are included in Table 6 for comparison with the perimeter stations. Differences due to seasonal variations in snow cover were not evaluated for this short measurement period, but may be a significant factor in long-term evaluation.

Non-Radiological Monitoring

Non-radiological emissions and plant effluents are controlled and permitted under the New York State and USEPA pollution discharge elimination system. Airborne emissions from two natural gas-fired boilers, two nitric acid tank vents, and an office paper waste incinerator are all covered under New York State permits. Plant liquid effluents controlled by the National Pollution Discharge Elimination System (NPDES) include two points in the LLWT process stream (points 001 and 002), the sewage treatment plant effluent (004), the steam system condensate and water treatment filter drain (005), and the combined plant effluent discharge point (006). The location of these points is shown in Figure 4.

A third point in the LLWT stream, effluent from the New York State burial ground lagoon, is included in the permit as SPDES 003. This point is monitored only for radioactivity and volume but upper limits are not imposed as this stream is regulated after treatment at points 001, 002 and 006.

Although there are periodic New York State inspections of the air emissions points, routine sampling and analysis of non-radiological emissions from these points are not required. Discharges from these points are well below the levels requiring monitoring under the state permit system. The water effluent points are sampled for specific chemical parameters depending on the effluent stream characteristics. Liquid effluents are monitored for heavy metals (Ba, Cr, Cu, Pb, Mn, Ni, Zn), ammonia, suspended solids, pH, and temperature at point 001 during lagoon discharges. Suspended solids are also measured in the LLWT plant process stream (002), in the utility room discharge ditch (005) and the sewage treatment plant outfall (004). BOD and pH are measured at 004 as well. Point 006 is measured for total iron, ammonia, pH and temperature.

Radioactivity is reported also for points 001, 003 and 004 under the SPDES reporting system, but radionuclide discharge limits are not imposed by the state permits. The results of the 1983 SPDES monitoring and reporting program for all six outfalls are presented in Table 7.

In 1983 there were a total of twelve instances where WVDP discharges exceeded the maximum permitted limits. One instance occurred during April 1983 when an equipment failure in the sewage treatment facility caused a temporary increase of settleable solids in the effluent. The sewage treatment facility was also the source of a second noncompliance episode during August 1983 when the pH dropped to 5.8, below the lower limit of 6.0, for a brief period (less than one day).

The ten remaining instances all involved total iron concentrations measured at outfall 006 - Erdman Brook. Iron concentrations above the permit limit of 1.0 mg/l were observed during February, March, April, June, September, November and December 1983. The fluctuation of this parameter is shown in Figure 5, which shows a maximum concentration of 4.0 mg/l and an annual concentration of 1.01 mg/l - slightly above the discharge limit of 1.00 mg/l.

This problem was originally identified late in 1982. An initial investigation indicated iron is accumulating in the site potable water filter, and is released through outfall 006 when the filter is backwashed. Additional samples have been collected from the project water supply reservoirs and streams feeding into them in an effort to identify the iron source. Analytical results indicate that a naturally occurring level of iron in the plant reservoirs of close to 0.8 mg/l is the probable source. Once the cause of this problem is positively identified, corrective action will be implemented.

MEASURED CONCENTRATIONS AT SPDES DISCHARGE POINTS

SPDES OUTFALL 001 - LAGOON NO. 3

Months, 1983

Parameter (limit, units)	January	February	March	April	May	June	July	August	September	October	November	December	Non- Compliance
Barium (1.0 mg/l)	---	---	---	---	<0.1	---	---	---	---	---	<0.1	---	0
Chromium (0.05 mg/l)	---	---	---	---	<0.01	---	---	---	---	---	<0.03	---	0
Copper (0.2 mg/l)	---	---	---	---	<0.02	---	---	---	---	---	<0.02	---	0
Lead (0.03 mg/l)	---	---	---	---	0.006* 0.006	---	---	---	---	---	0.01	---	0
Manganese (1.0 mg/l)	---	---	---	---	0.02	---	---	---	---	---	0.04	---	0
Nickel (0.3 mg/l)	---	---	---	---	0.03	---	---	---	---	---	0.037	---	0
Zinc (0.3 mg/l)	---	---	---	---	0.024	---	---	---	---	---	0.037	---	0
Unionized Ammonia (0.15 mg/l)	---	---	---	---	0.006	---	---	---	---	---	<0.003	---	0
Suspended Solids (No Limit, mg/l)	---	---	---	---	27.1	---	---	---	---	---	18.0	---	0
Temperature (90°F)	---	---	---	---	54.0	---	---	---	---	---	39.0	---	0
Flow (No limit, MGD)	0	0	0	0	0.146	0	0	0	0	0	0.1	0	0
pH (6.0 9.0)	---	---	---	---	8.5	---	---	---	---	---	7.6	---	0
Gross Alpha (No Limit, pCi/l)	---	---	---	---	<17.5	---	---	---	---	---	<33	---	0
Gross Beta (No Limit, pCi/l)	---	---	---	---	1120*650	---	---	---	---	---	1650*580	---	0

0860K

MEASURED CONCENTRATIONS AT SPDES DISCHARGE POINTSSPDES OUTFALL 001 - LAGOON NO. 3

Months, 1983

Parameter (limit, units)	January	February	March	April	May	June	July	August	September	October	November	December	Non- Compliance
Tritium (No Limit, pCi/l)	---	---	---	---	1.52±0.03E5	---	---	---	---	---	1.36±0.03E5	---	0
Isotopic Gamma (No Limit, pCi/l)	---	---	---	---	---	---	---	---	---	---	---	---	0
Co-60	---	---	---	---	63.7±13.6	---	---	---	---	---	122±17	---	0
Cs-134	---	---	---	---	20.4±7	---	---	---	---	---	11.1±9.8	---	0
Cs-137	---	---	---	---	938±26	---	---	---	---	---	940±29	---	0
Strontium - 90 (No Limit, pCi/l)	---	---	---	---	136±19	---	---	---	---	---	167±20	---	0
Iodine - 129 (No Limit, pCi/l)	---	---	---	---	4.5±2.4	---	---	---	---	---	9.65±1.54	---	0

SPDES 002 LLWTF

Suspended solids (100 mg/l)	---	2.8	---	7.0	8.5	---	---	---	20.5	---	5.3	5.7	0
--------------------------------	-----	-----	-----	-----	-----	-----	-----	-----	------	-----	-----	-----	---

SPDES 003 - STATE LLW BURIAL

Flow (No Limit, MGD)	0	0	0	0	0.003	0	0	0	0	0	0	0	0
Gross Alpha (No Limit, pCi/l)	---	---	---	---	20.3±17.5	---	---	---	---	---	---	---	0
Gross Beta (No Limit, pCi/l)	---	---	---	---	1.05±0.10E4	---	---	---	---	---	---	---	0
Tritium (No Limit, pCi/l)	---	---	---	---	1.16±0.02E6	---	---	---	---	---	---	---	0
Isotopic Gamma (No Limit, pCi/l)	---	---	---	---	<MDL	---	---	---	---	---	---	---	0
Strontium - 90 (No Limit, pCi/l)	---	---	---	---	5450±680	---	---	---	---	---	---	---	0
Iodine - 129 (No Limit, pCi/l)	---	---	---	---	<3.8	---	---	---	---	---	---	---	0

MEASURED CONCENTRATIONS AT SPDES DISCHARGE POINTS

SPDES OUTFALL 004 - SANITARY

Months, 1983

Parameter (Limit, units)	January	February	March	April	May	June	July	August	September	October	November	December	Non- Compliance
pH (6.0 - 9.0)	7.6	6.2	6.4	6.9	6.0	6.8	7.6	5.8	6.0	6.0	6.6	6.8	1
BOD ₅ (45 mg/l)	5.0	---	---	9.0	---	---	11.0	---	---	<1.0	---	---	0
Suspended Solids (45 mg/l)	8.8	---	---	17.0	---	---	12.3	---	---	6.0	---	---	0
Settleable Solids (0.3 ml/l)	<0.1	<0.1	<0.1	1.0	0.2	0.1	0.1	0.2	0.1	<0.1	.02	<0.1	1
Gross Alpha (No Limit, pCi/l)	<13.5	---	---	---	---	---	<2.31	---	---	---	---	---	0
Gross Beta (No Limit, pCi/l)	<63.5	---	---	---	---	---	60.6±12.6	---	---	---	---	---	0
Tritium (No Limit, pCi/l)	1640±210	---	---	---	---	---	309±195	---	---	---	---	---	0
Isotopic Gamma (No Limit, pCi/l)	<MDL	---	---	---	---	---	<MDL	---	---	---	---	---	0
Strontium - 90 (No Limit, pCi/l)	64±5	---	---	---	---	---	49±8	---	---	---	---	---	0
Iodine 129 (No Limit, pCi/l)	<0.12	---	---	---	---	---	N/A	---	---	---	---	---	0

0860K

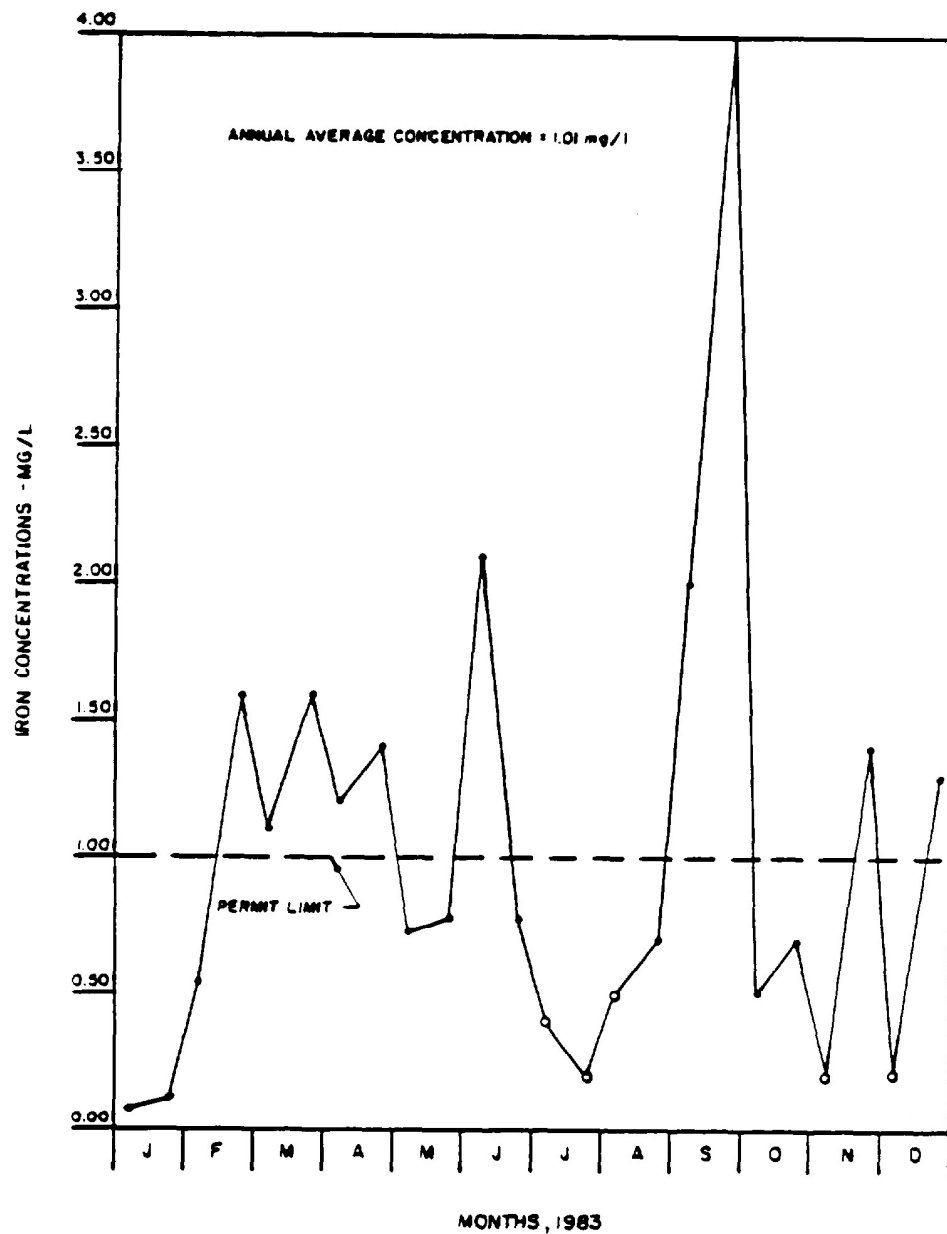
TABLE 7 (Continued)
MEASURED CONCENTRATIONS AT SPDES DISCHARGE POINTS
SPDES 005 UTILITY DITCH

Parameter (limit, units)	Months, 1983												Non- Compliance
	January	February	March	April	May	June	July	August	September	October	November	December	
Suspended Solids (100 mg/l)	13.7	13.2	1.9	23.0	21.8	30.8	9.9	14.0	10.2	20.5	8.8	8.1	0
pH (6.0-9.0)	7.4	7.4	7.5	7.2	7.0	7.6	7.3	7.7	7.6	7.6	7.6	7.6	0
<u>SPDES OUTFALL 006 - ERDMAN BROOK</u>													
Iron (1.0 mg/l)	0.09 0.12	0.55 1.6	1.1 1.6	1.2 1.4	0.73 0.79	2.1 0.78	<0.4 <0.2	<0.5 0.7	2.0 4.0	0.5 0.7	<0.2 1.4	<0.2 1.3	10
Ammonia (2.0 mg/l)	<0.11	<0.1	1.0	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	0.2	<0.1	0.2	0
Unionized Ammonia (0.15 mg/l)	<0.0005	<0.0003	0.0003	<0.0004	<0.005	0.0024	<0.0008	<0.004	<0.004	0.0068	<0.1	0.001	0
pH (6.0 - 9.0)	7.3	6.8	7.2	7.4	7.4	7.1	8.0	7.8	7.2	7.2	7.7	7.2	0
Temperature (32°C)	0.0	2.0	7.0	6.7	9.0	18.0	22.0	22.0	18.0	18.0	10.0	4.0	0

N/A = Not Available - Results Not Back From Contract Laboratory

<MDL = No detectable peaks

FIGURE 5 - FLUCTUATION OF TOTAL IRON CONCENTRATION AT SPOES 006 DURING 1983

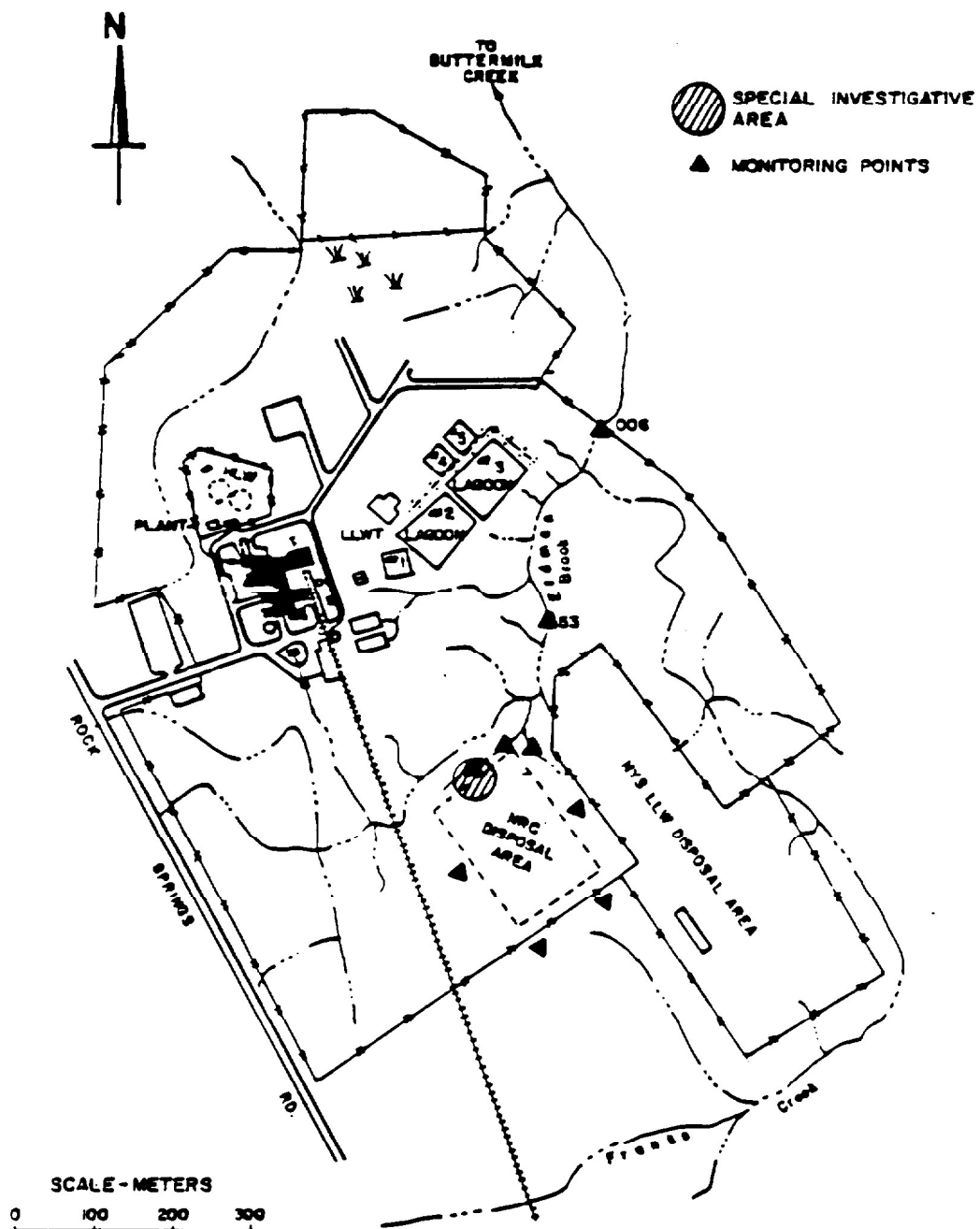


Although there have been numerous excursions from the permit limit for this parameter, the offsite impact is negligible, as there is a dilution factor of approximately 1,000 between SPDES 006 and Cattaraugus Creek at the site boundary (the nearest point of public access).

3.3 Special Monitoring

In November of 1983, contamination was encountered in a recently-drilled ground water monitoring well near the formerly licensed disposal area. The organic contaminant contained concentrations of alpha emitters on the order of 10^{-5} μ Ci/ml and beta/gamma emitters at about 10^{-4} μ Ci/ml in the samples analyzed. This led to an extensive examination of ground and surface water near that location. Samples were collected from closely spaced sampling wells and surface streams adjacent to the suspect area (Figure 6). Although subsequent evaluations and test borings did confirm the subsurface presence of a contaminated organic fluid, monitoring of surface water and wells adjacent to surface waters failed to show any transport away from the immediate vicinity of the disposal area. Efforts are continuing to remove the source and to assure that contaminants do not escape via hydrologic pathways.

FIGURE 6 - LOCATION OF SPECIAL GROUNDWATER MONITORING AREA



4.0 RADIOLOGICAL DOSE ASSESSMENT

4.1 Methodology

The potential radiological impacts resulting from the release of radioactivity during 1983 have been estimated by calculating radiation doses received by the maximally exposed off-site individual and the population within an 80 km radius of the WVDP facility. The potential pathways of exposure to the general public from radioactive effluents released by the WVDP operations are shown in Figure 7. The exposure modes considered in the dose calculations are:

- o Direct exposure from immersion in air containing radionuclides
- o Direct radiation from ground surfaces contaminated by deposited radionuclides
- o Immersion in contaminated water
- o Inhalation of airborne radionuclides
- o Ingestion of contaminated waters and food produced from the land and surface waters in the area.

The radiation dose commitment to the maximally exposed individual and the collective dose to the population within an 80 km radius of the WVDP facility were calculated using the computer code AIRDOS-EPA for the air pathway (Reference 5) and LADTAP II for the water pathway (Reference 6). The gaseous discharges were assumed to occur from a single vent at 10 meters above the ground level to compensate for the uneven terrain in the vicinity of the WVDP site. Meteorological data were collected from July to December 1983 at the WVDP site; however, it had not become available in usable form by the time the preparation of this report was undertaken. The most representative meteorological data available for dispersion calculations were those collected during November 1974 to September 1975. These data were used in this report. Americium-241 was assumed to represent all the

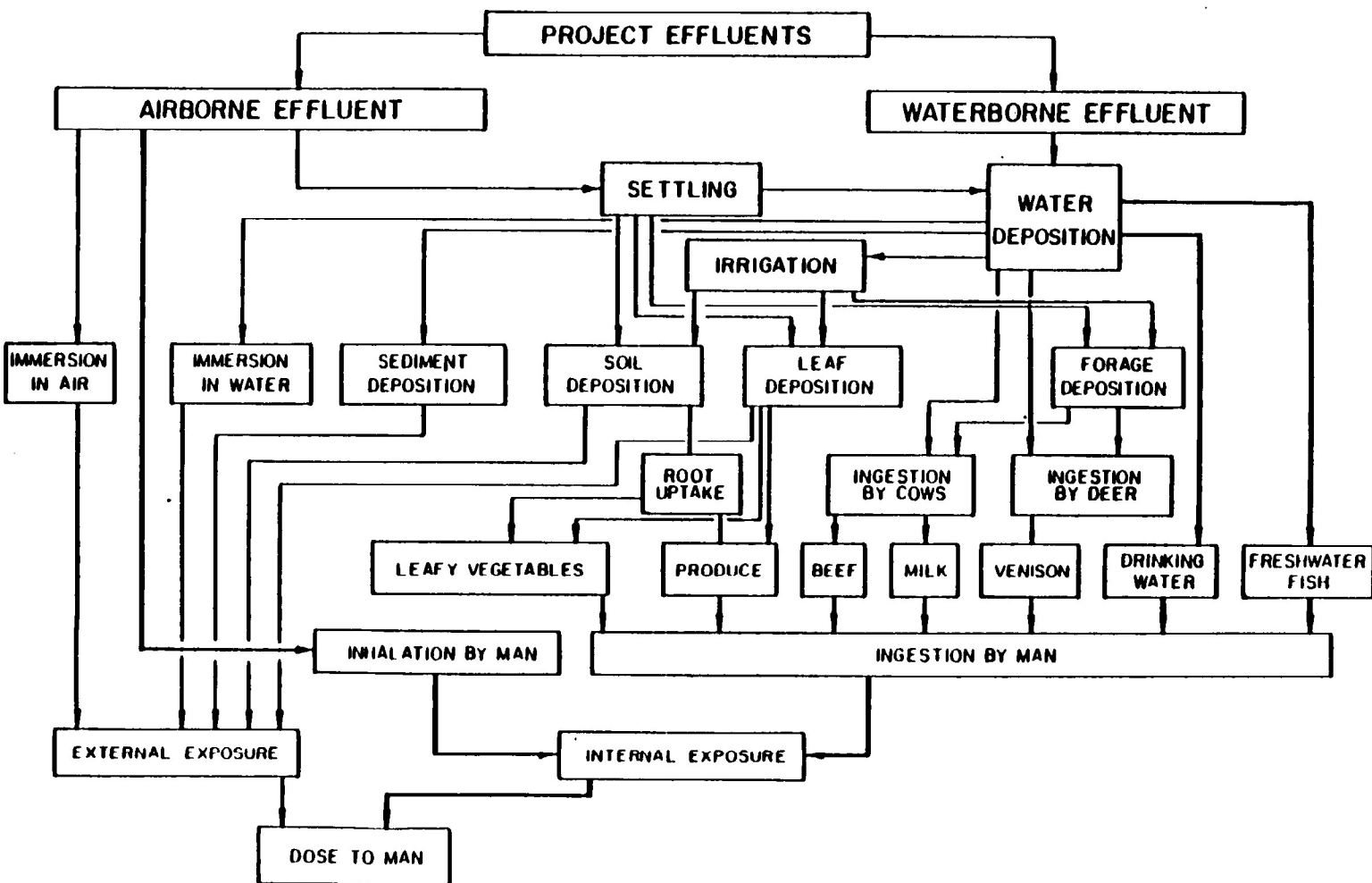


FIGURE 7 - COMPARTMENT MODEL OF PATHWAYS

gross alpha activity in both gaseous and liquid effluents. The gross beta/ gamma activity was assumed to consist of specific radionuclides distributed in the same proportion as the individually identified and measured radionuclides.

The dose estimates were made by calculating radionuclide concentrations in air, rates of deposition on ground surfaces, ground surface concentrations, intake rates via inhalation, and ingestion of meat, milk, and fresh vegetables. Site specific data on production and consumption of milk, meat and agricultural products was used in computing collective population dose.

The area surrounding the facilities is shown in Figure 1. It was overlaid with an 80 km radius grid system with the facility at its center. The grid system was further divided into 10 concentric regions and 16 compass directions. For each sector formed by the grid system, the specific human population, beef and dairy cattle population, and agricultural areas were assumed to be as described in Figures 8 through 15. The values for the sectors within a 10 mile radius are based on data from the FEIS (Reference 7).

For each radionuclide of concern, the inhalation dose conversion factors used are for an activity median aerodynamic diameter (AMAD) of 0.3 micrometer. For alpha emitters, the dose conversion factors are derived by using a quality factor of 20 as per ICRP recommendation (Reference 9). All of the doses from internal exposure are 50-year committed dose equivalents and are calculated for the 50-year period following inhalation or ingestion. The internal dose conversion factors used in this report are from Reference 9.

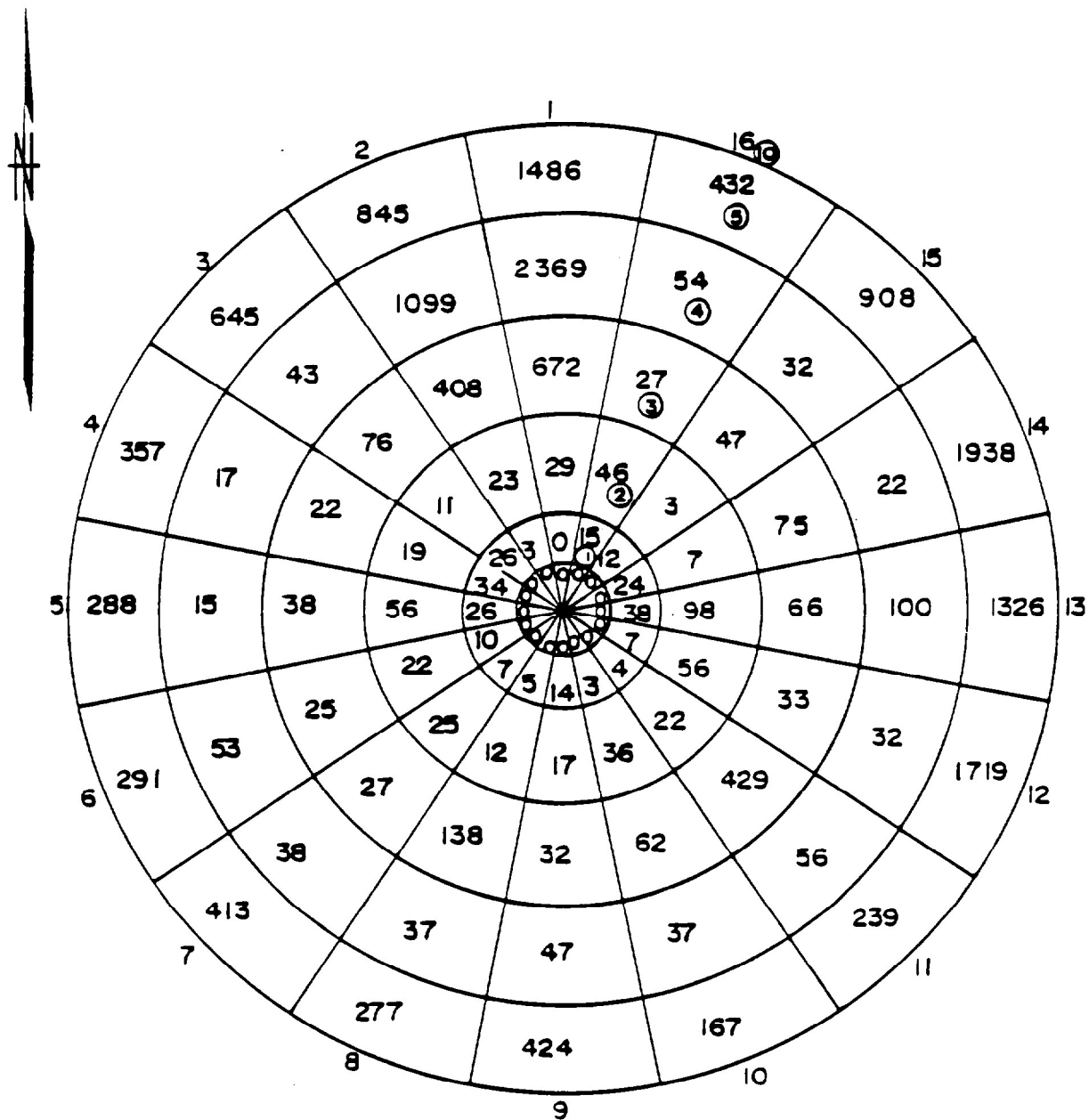


FIG. 8 - POPULATION DISTRIBUTION (0-10 MILES)

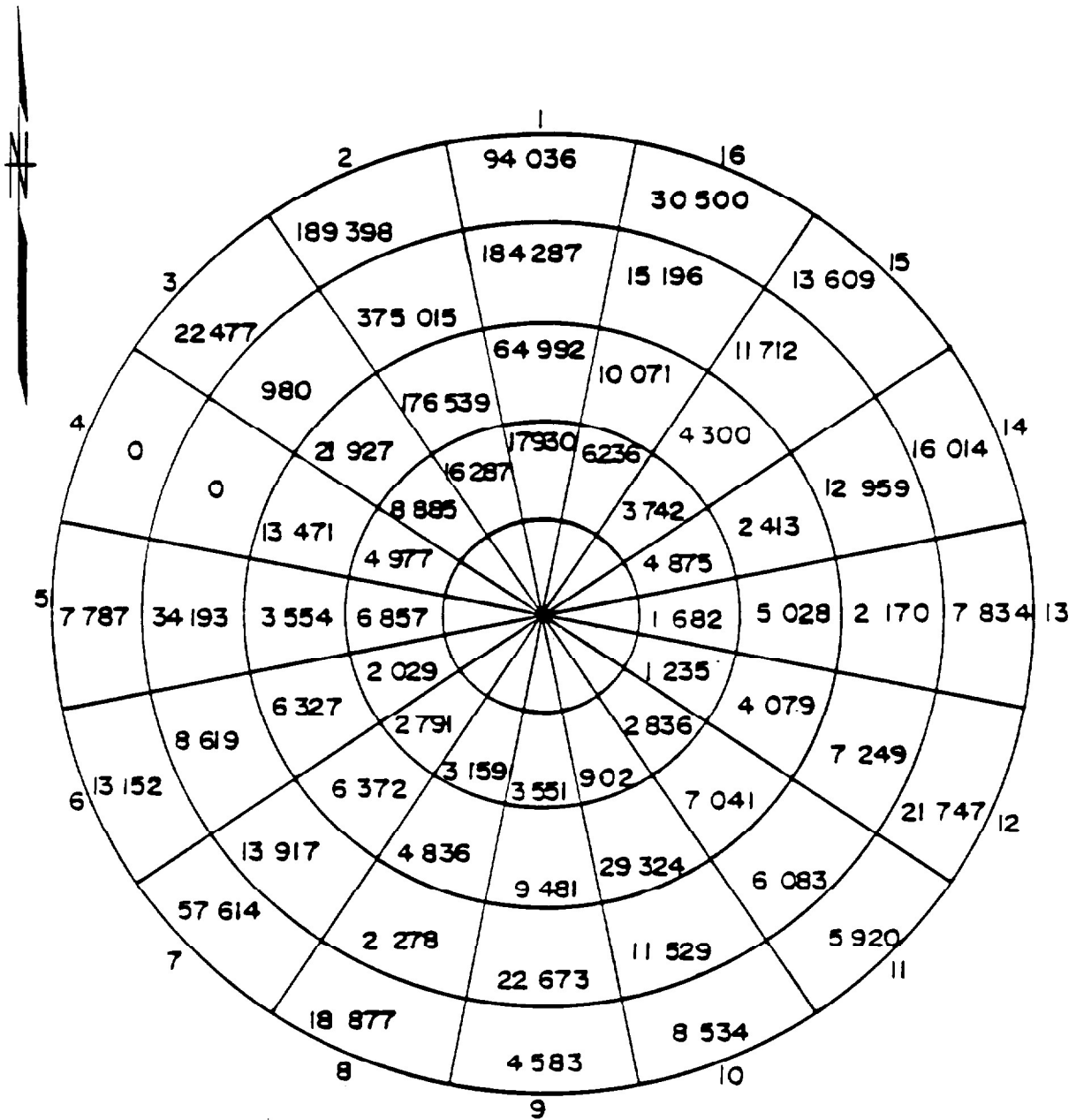


FIG. 9 - POPULATION DISTRIBUTION (10-50 MILES)

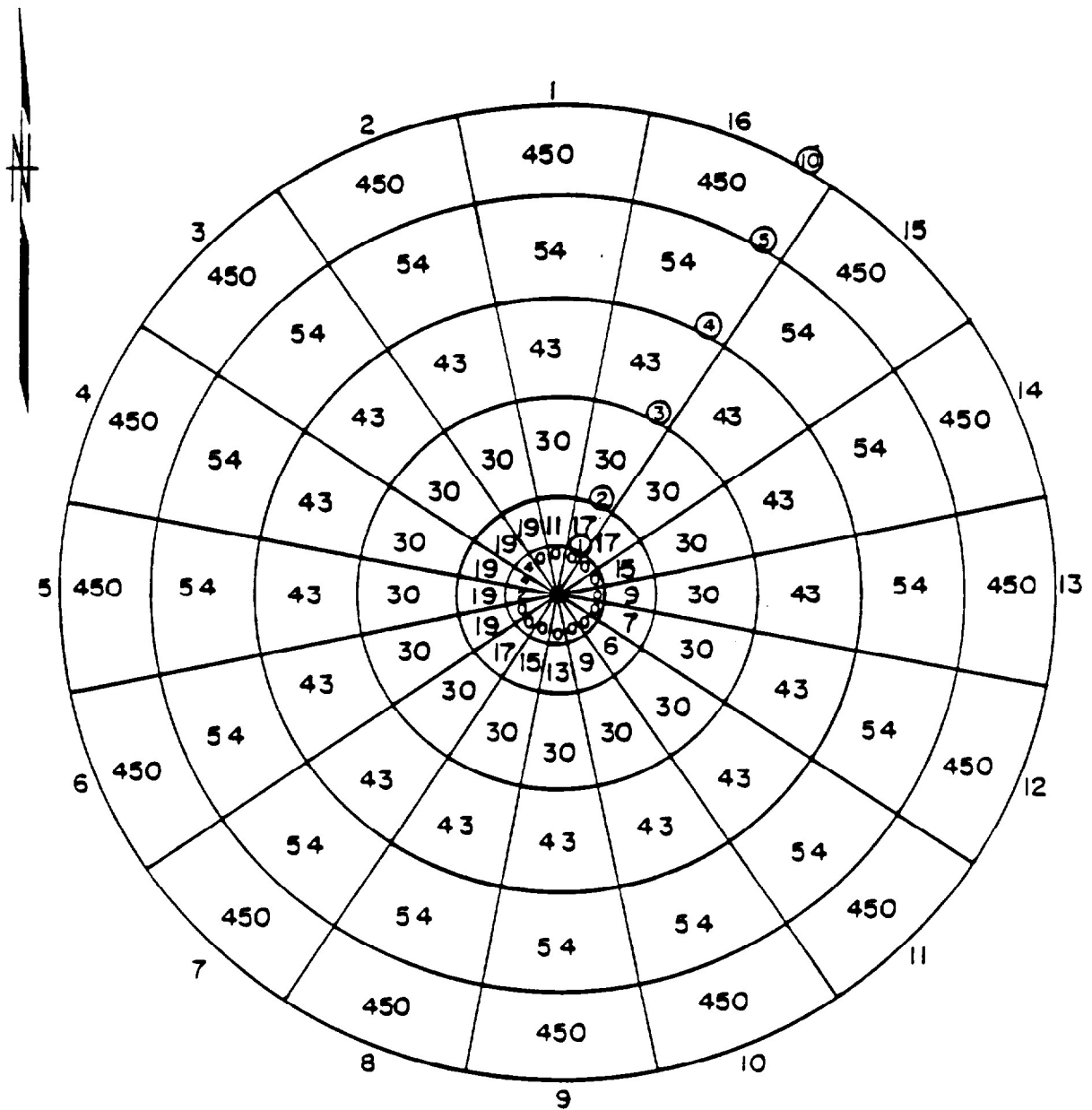


FIG. 10 - DAIRY COWS (0-10 MILES)

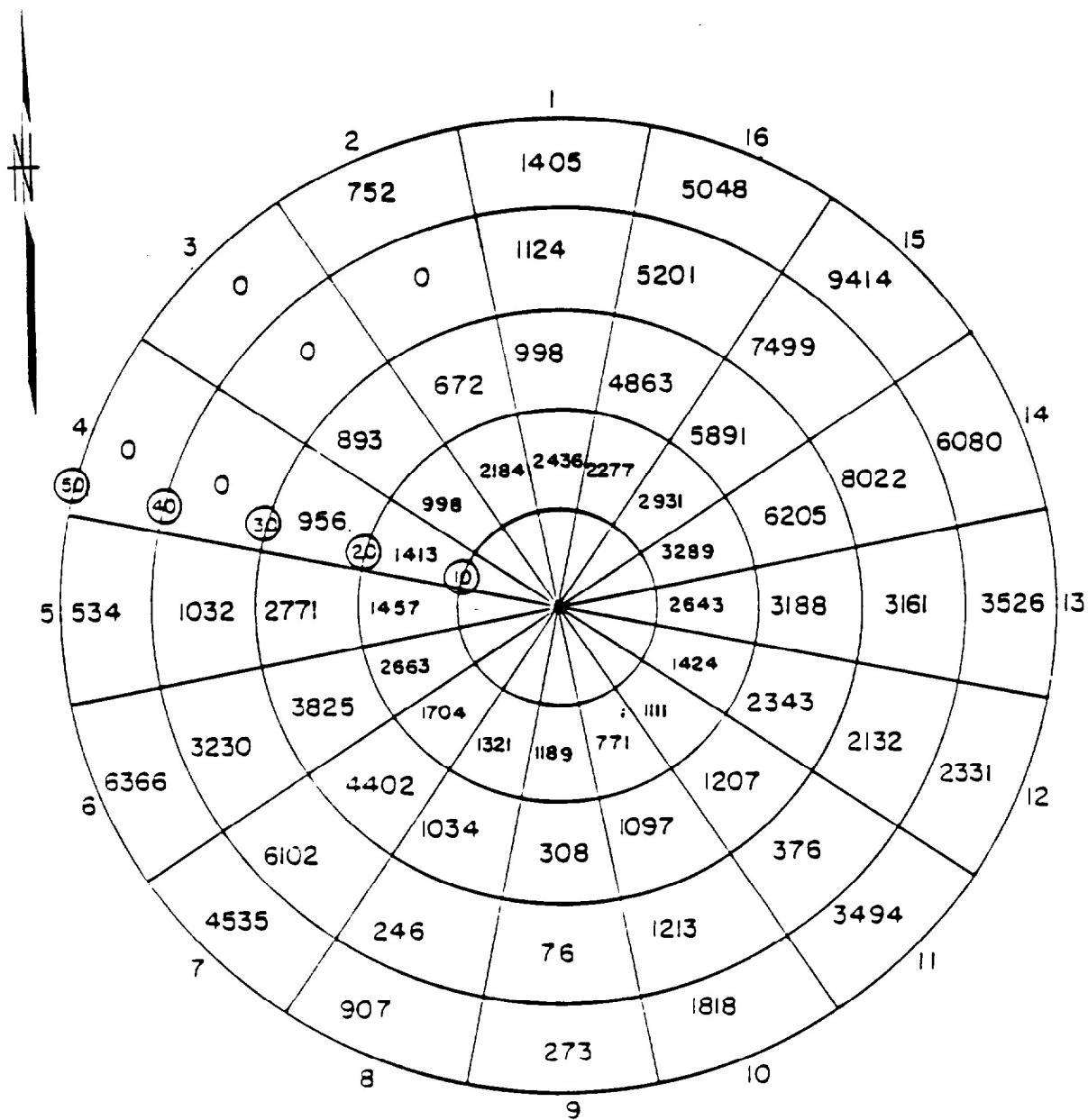


FIG. 11 - DAIRY COWS (10-50 MILES)

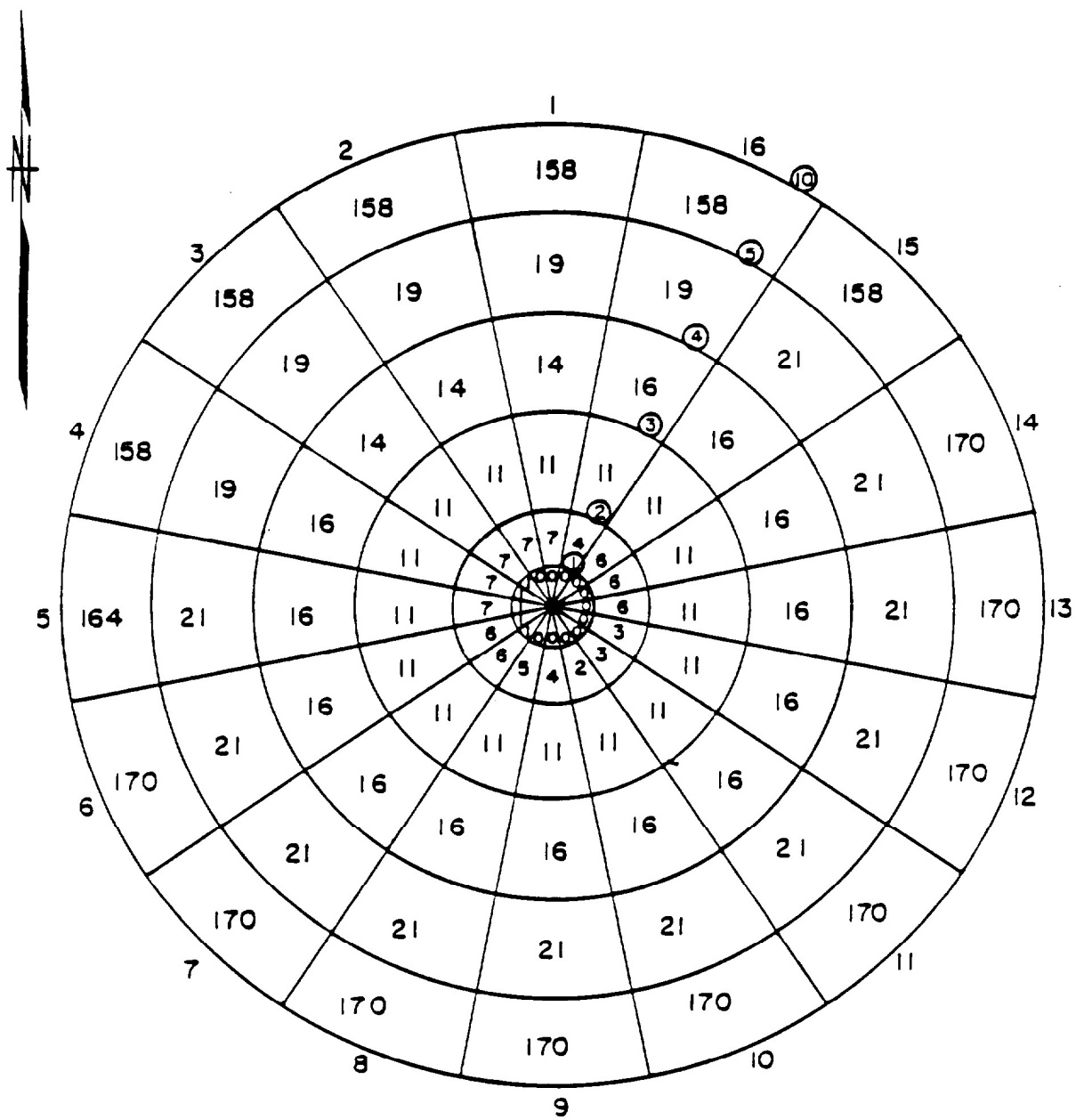


FIG. 12 - MEAT PRODUCING ANIMALS (0-10 MILES)

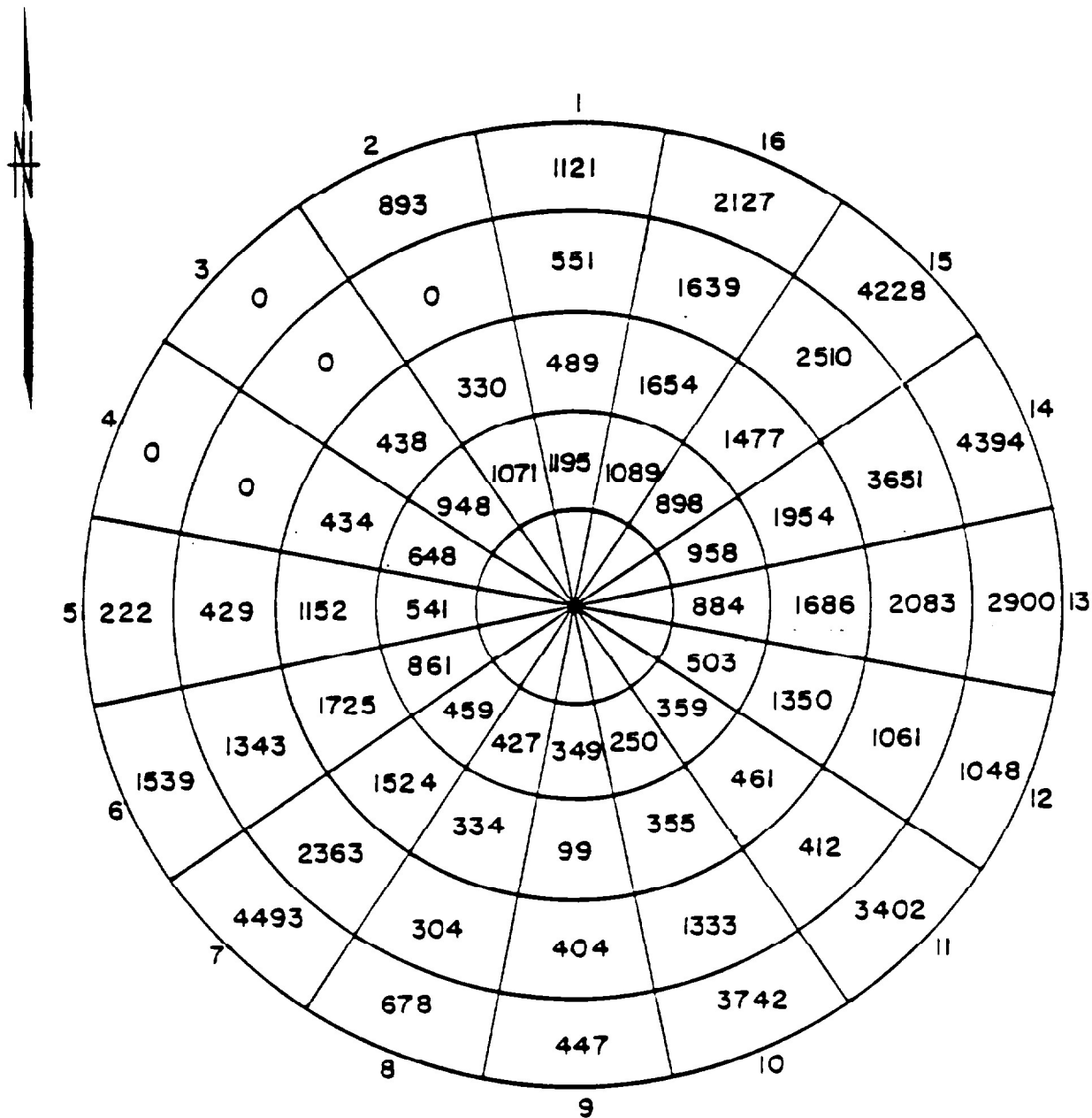


FIG .13- MEAT PRODUCING ANIMALS (10-50 MILES)

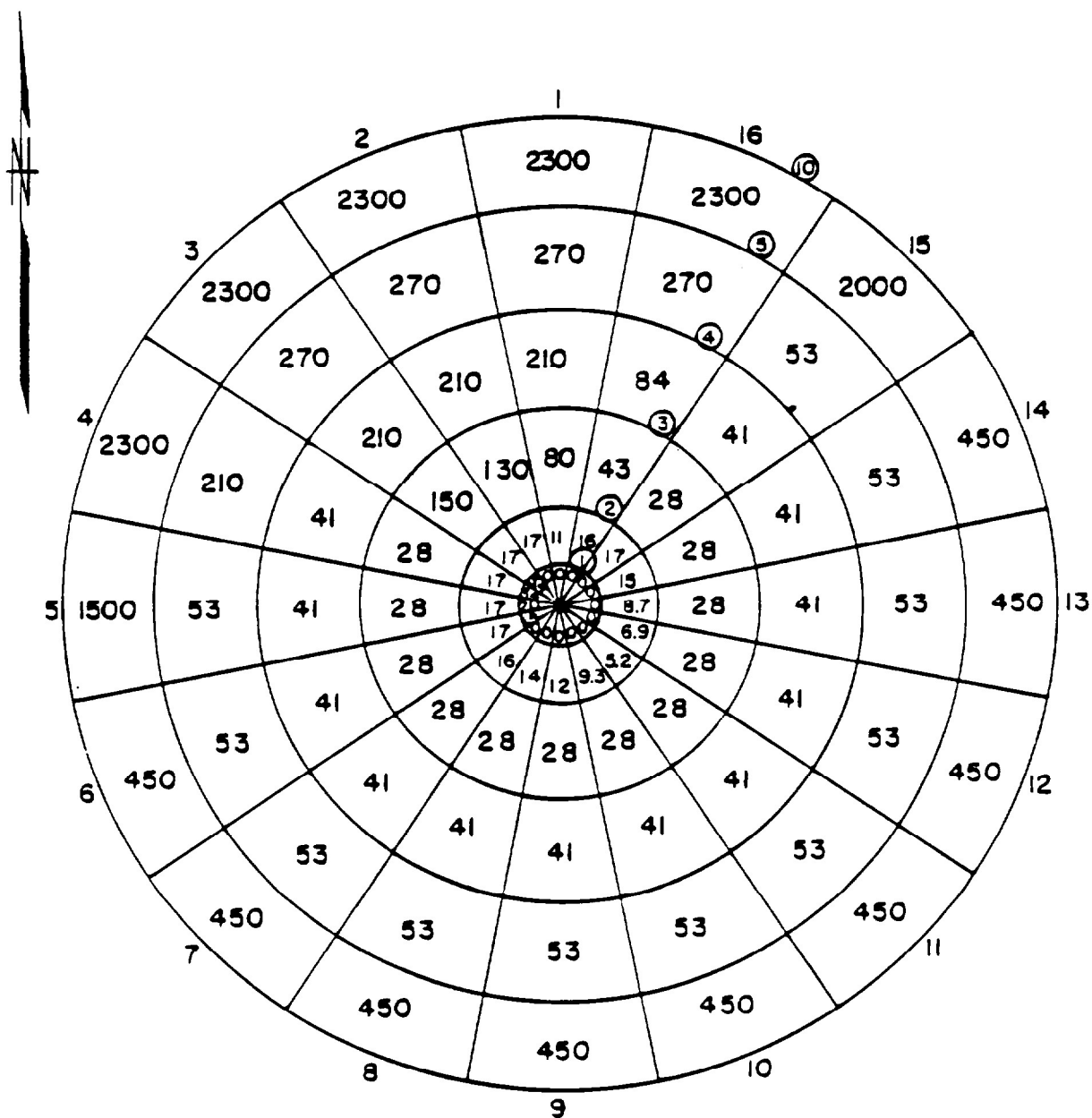


FIG. 14 - AREA USED FOR VEGETABLE CROPS ($\text{Km}^2 \times 10^3$) (0-10 MILES)

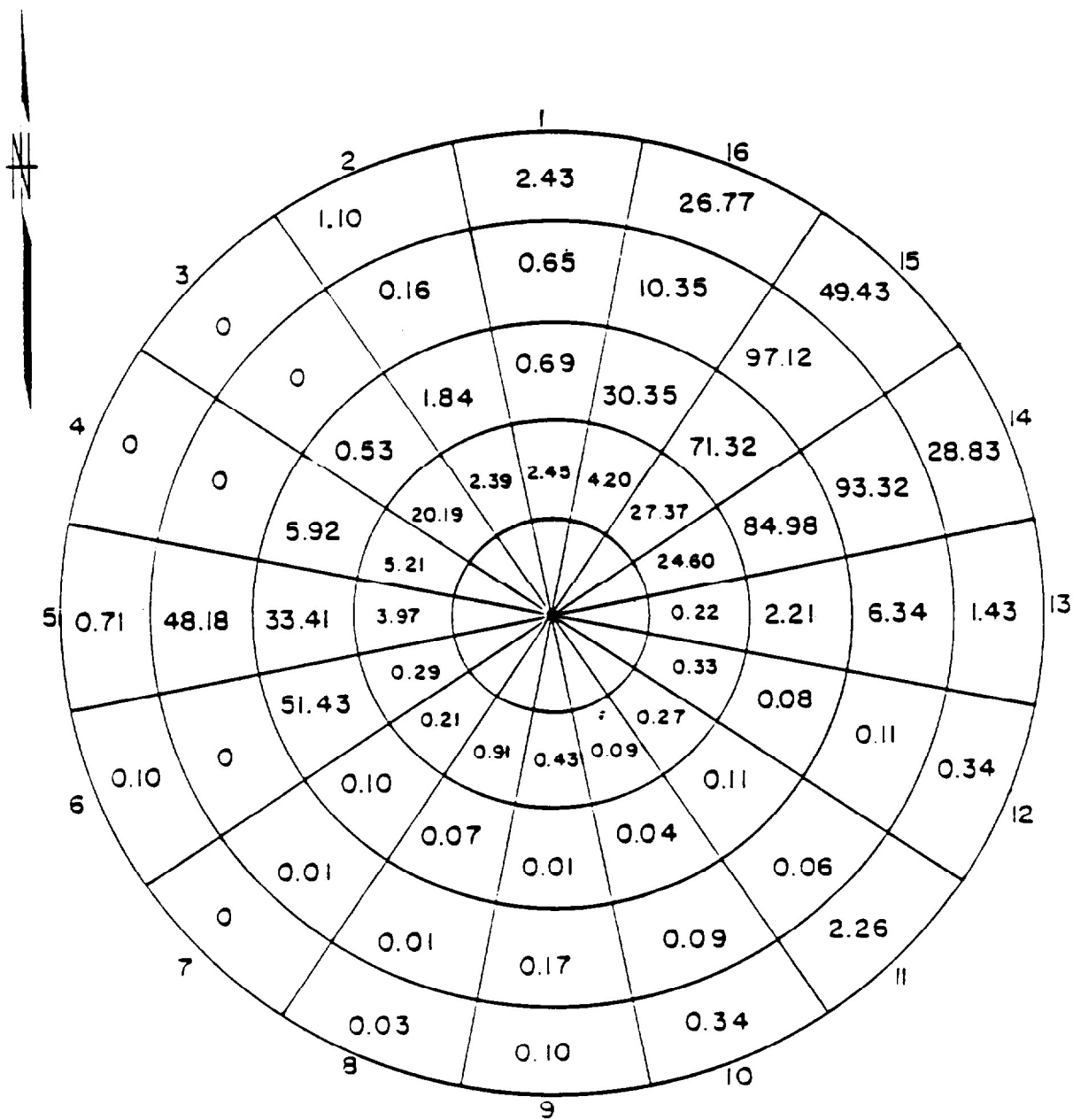


FIG. 15 - AREA USED FOR VEGETABLE CROPS (Km²) (10-50 MILES)

In this report, the effective dose equivalent, as well as the dose equivalent to the thyroid, lungs, bone, liver, kidneys and gastrointestinal tract were considered to determine the critical organs for various potential pathways of exposure. These estimates were based on parameters applicable to an average adult. The collective population dose estimate in man-rem is the effective dose equivalent to the whole body as calculated in accord with the recommendation of the ICRP (Reference 8).

In addition to these estimates of dose commitments based on dispersion modeling, the dose to a hypothetical maximally exposed individual who consumed locally produced milk, fish and venison (deer) was predicted. Measured radionuclide concentrations from samples of milk, fish and venison were used in these calculations. Many of the nuclides which may be present in these samples are often below the detectable limit. In such cases, the radionuclide concentration was assumed to be the limit of detection.

4.2 Source Term Estimates

4.2.1 Airborne Radioactive Effluents

There are three points on the plant site from which ventilation systems release low levels of airborne radioactivity. These three locations are:

- (1) Main plant process stack
- (2) Laundry exhaust vent
- (3) LLWT ventilation exhaust.

The air released from these vents is sampled continuously and the collected particulates are periodically analyzed. The results of measurements during 1983 are summarized in Table 8. A total of 1.2×10^{-5} Ci of gross alpha activity and 7.5×10^{-4} Ci of gross beta/gamma was released from these three vents during the year. More than 99 percent of the activity was discharged through the main plant stack.

4.2.2 Liquid Radioactive Effluents

There were three sources of liquid effluents from WVDP operations in 1983:

- (1) Lagoon No. 3 discharges (in May and November)
- (2) Sewage treatment outfall
- (3) Ground water releases from the swamp drain and french drain.

The volumes of the liquid effluents and the radioactivity they contained (reported in WVDP 1983 Effluent and On-Site Discharge Report, March 30, 1984) are summarized in Table 9. All liquids were discharged via Buttermilk Creek.

4.3 Potential Radiation Doses to the Public

4.3.1 Maximum Hypothetical Individual Radiation Exposure

The point of maximum potential radiation exposure at the site boundary from airborne radioactivity is located about 1 km WNW of the WVDP plant. A hypothetical maximum effective dose equivalent of 0.09 mrem was estimated to result from WVDP airborne releases during 1983 at this location when all possible pathways were considered. The calculated dose commitment to bone surface (the critical organ) at this location was 0.31 mrem. These maximum hypothetical exposures are about 0.02 percent of the allowable standard promulgated in DOE Order 5480.1.

TABLE 8

RADIOACTIVITY RELEASED TO THE ATMOSPHERE DURING 1983

<u>Release Point</u>	<u>Total Curies Released</u>			
	<u>Gross α</u>	<u>Gross β</u>	<u>Specific Nuclides</u>	
Main Plant Stack	1.2-05	7.4-04	Sr-90	1.3-04
			Ru-106	2.2-05
			I-129	3.4-05
			Cs-134	4.5-06
			Cs-137	8.6-04
Laundry Vent	8.7-08	2.4-06	None Identified	
LLWT Vent	1.4-07	4.1-06	None Identified	

TABLE 9
RADIOACTIVITY RELEASED IN LIQUID
EFFLUENTS DURING 1983

<u>Release Point</u>	<u>Volume Released (Liters)</u>	<u>Released Radioactivity (Ci)</u>					
		<u>Gross α</u>	<u>Gross β</u>	<u>H-3</u>	<u>Sr-90</u>	<u>I-129</u>	<u>Cs-137</u>
Lagoon 3*	2.9+07	6.7-04	3.4-02	3.9	2.6-03	1.5-04	2.3-02
Sewage Treatment Outfall	6.1+06	1.0-05	2.4-04	5.1-03	3.8-05	3.6-07	--
Swamp Drain	9.0+07	--	--	3.6-01	--	--	--
French Drain	6.8+06	--	--	2.2-01	--	--	--
TOTAL	1.3+08	6.8-04	3.4-02	4.5	2.7-03	1.5-04	2.3-02

* Lagoon 3 discharge included 2.3+05 liters containing 2.0-03 Ci of Sr-90 and 4.2-01 Ci of H-3 which originated from the New York State operated low-level waste disposal area. These quantities have not been included in the values tabulated above.

An important potential contributor to the dose commitment from radioactivity in the terrestrial food-chain is the atmosphere-pasture-cow-milk pathway. Measurements of radioactivity in the milk produced at the nearest dairy farm 4 kilometers northeast of the WVDP facility indicated that no Sr-90, I-129, Cs-134, or Cs-137 was present in concentrations above the limits of detection. The maximum dose to an individual from ingestion of about 1 liter of this milk per day was estimated by assuming that the nuclides were present in amounts equal to the detection limits. This conservative calculation predicts a dose commitment of 30 mrem to the thyroid and an effective dose equivalent commitment of 1.6 mrem. These calculated maximum potential doses are less than 2 percent of the allowable standards in spite of their extreme conservatism. Further improvement in the detection limit will permit more realistic estimates to be made of the dose commitment due to consumption of milk produced in the vicinity of the WVDP. These more realistic estimates undoubtedly will be substantially lower than the small maximum values quoted above.

Estimates were made of the hypothetical maximum dose commitments to an adult from consumption of 21 kg per year of fish caught in the Cattaraugus Creek. From the measured concentrations of radionuclides in the edible parts of the fish (see Table 5), the maximum organ dose commitment to an individual was estimated to be 3.2 mrem to bone surfaces. The maximum effective dose equivalent commitment to an individual was calculated to be 1.7 mrem from consumption of 21 kg of fish.

The hypothetical dose commitment also was estimated for an individual who consumed 45 kg of venison. The measured radionuclide concentrations (Table 5) in the flesh of a deer taken about a kilometer from the WVDP in the fourth quarter of 1983 was used as the basis for this estimate. The dose commitment was calculated to be 0.37 mrem to the bone surface and 0.21 mrem for an effective

dose equivalent commitment. Table 10 summarizes the potential radiation doses to individual adult members of the general public at the points of highest potential exposure from gaseous and liquid effluents from the WVDP facility operations during 1983.

4.3.2 Collective Dose to the Population

The collective effective dose equivalent commitment to the population within an 80-km radius of the WVDP from operations during 1983 was estimated to be 0.05 person-rem and 0.03 person-rem from gaseous effluents and liquid effluents, respectively. These estimates are based on the releases summarized in Tables 8 and 9 and the use of the AIRDOS-EPA and LADTAPII codes as described in Section 4.1.

These collective doses may be compared to an estimated 170,000 person-rem to the same population resulting from natural background radiation. The average effective dose equivalent to individuals residing within 80 km of the WVDP was about 4.7×10^{-5} mrem during 1983 (based on the collective dose given above and a total population of 1.7 million in the region), which is insignificant when compared to the average dose to each individual of approximately 100 mrem per year from natural sources.

TABLE 10

SUMMARY OF HYPOTHETICAL ESTIMATED DOSE COMMITMENTS
TO AN ADULT INDIVIDUAL AT LOCATIONS OF MAXIMUM EXPOSURE DURING 1983

		<u>50-Year Dose Commitment (mrem)</u>		
<u>Pathway</u>	<u>Location</u>	<u>Effective Whole Body Equivalent</u>	<u>Critical Organ</u>	
<u>Gaseous Effluents</u>				
All Pathways*	Nearest residence (1 km WNW)	0.09	0.31	Bone Surface
Milk	Produced 4 km NE	<1.6	<30	Thyroid
Venison	Deer taken within 2 km of WVDP	0.21	0.37	Bone Surface
<u>Liquid Effluents</u>				
Fish	Collected in Cattaraugus Creek Below WVDP	1.7	3.2	Bone Surface

* Estimates based on measured radioactivity in airborne effluents (Table 8) and AIRDOS-EPA computer code. All other values based on measured concentrations in food and consumption rates for maximally exposed individuals recommended in U.S. NRC Regulatory Guide 1.109.

Note: Annual average whole body dose from natural background sources in the U.S. is about 100 mrem.

5.0 STANDARDS AND QUALITY ASSURANCE

5.1 Environmental Standards and Regulations

The following environmental standards and regulations are applicable at the WVDP site boundary:

- o DOE Order 5480.1, "Requirements for Radiation Protection," August 1981.
- o U.S. Federal Radiation Council, Background Material for the Development of Radiation Protection Standard, Report No. 1, (1960) and Report No. 2 (1961), Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
- o U.S. Environmental Protection Agency, National Primary and Secondary Ambient Air Quality Standards, 40 CFR 50, 1980.
- o Department of Environmental Conservation, State of New York, Environmental Conservation Law of New York State, Title 8, Article 19, October 18, 1972.

The standards and guides for releases of radionuclides at the WVDP are those of DOE Order 5480.1, Chapter XI, dated August 13, 1981, entitled, "Requirements for Radiation Protection." Radiation protection standards and selected radioactivity concentration guides from Chapter XI are listed in Appendix B. The most restrictive guide is listed when there is a difference between soluble and insoluble chemical forms. These listed guides are virtually identical to those in the Code of Federal Regulations (CFR), Title, 10, Part 20. Ambient air and water quality standards contained in the individual SPDES permits issued for the facility are listed in Table 7.

5.2 Quality Assurance

The radiochemical analyses for the environmental samples collected during 1983 were performed by off-site laboratories. A documented laboratory quality assurance plan is used for these laboratories, including periodic interlaboratory cross-checks, prepared standard and blank analyses, routine instrument calibration, and use of documented procedures. Sample collection and radiometric counting at the site laboratory was in accordance with written procedures, including the use of appropriate calibration techniques, where applicable.

Non-radiological analyses are also performed by a qualified contract laboratory. WVNS subscribes to the SPDES cross-check program sponsored by the U.S. Environmental Protection Agency to assure the continuing accuracy of permitted laboratory results.

5.3 Statistical Reporting of Data

Individual analytical results are reported, except where noted, with plus or minus ($\pm$) two analytical standard deviations (2σ) indicating the counting uncertainty. The arithmetic averages were calculated using actual results, including zero and negative values. In the final results, if the 95 percent confidence interval included zero, the measurement was assumed to indicate no discernible activity. Less than ($<$) values indicate the lower limit of detection for that analysis.

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7. "Long Term Management of Liquid High-Level Radioactive Wastes Stored at the Western New York Nuclear Services Center, West Valley," DOE/EIS-0081, June 1982.
8. ICRP Publication 26. "Recommendations of the International Commission on Radiological Protection," Annals of the ICRP, Vol. 1, No. 3, 1977.
9. "Estimates of Internal Dose Equivalent from Inhalation and Ingestion of Selected Radionuclides," Donald E. Dunning, WIPP-DOE-176, undated.

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APPENDIX A

Effluent, On-Site and Off-Site Radiological Monitoring Program
1984 Implementation

EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Monitoring Point</u>	<u>Reason for Monitoring</u>	<u>Type</u>	<u>Sampling Frequency</u>	<u>Analyses</u>
<u>Airborne</u>				
1 Process Stack	Release point for airborne radioactive waste	Off-line air particulate monitor	Continuous collection, with daily filter tape advance (use to be discontinued during 1984)	Real time gross alpha and beta
		Off-line air particulate monitor ^a	Continuous collection on fixed filter	Real time alpha and beta monitoring
		Off-line air particulate and iodine sampler ^a	Weekly collection of filter paper and charcoal absorber	On collection: filters analyzed for gross alpha/beta Quarterly composites: filters analyzed for Sr-90, Ru-106, Cs-134/137. Charcoal analyzed for I-129
<u>Liquid</u>				
001 Lagoon 3 Weir	Primary point of liquid effluent release	Grab	Daily, during Lagoon 3 discharge	Daily: Gross beta; pH. Every sixth daily sample: gross alpha, gross beta, H-3, Cs-134/137

^aIsokinetic sampling with probe placed at the 80-foot level within the stack.

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EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Monitoring Point</u>	<u>Reason for Monitoring</u>	<u>Type</u>	<u>Sampling</u> <u>Frequency</u>	<u>Analyses</u>
001 Lagoon 3 Weir (continued)				Weighted monthly composite of daily samples: See SPDES 001; gross alpha/beta, H-3, Sr-90, I-129, isotopic gamma Quarterly weighted composite of daily samples: U isotopic, Pu isotopic
A-2 2 Drainage Ditch	Swamp drainage	Grab	Weekly	H-3
		Grab	Monthly*	Gross alpha, beta, and H-3
75 French Drain	Drains subsurface water from LLWT lagoon area	Grab	Weekly	H-3
		Grab	Monthly	Gross alpha, beta, and H-3
67 Stream E of Waste Burial	Drains NYS disposal area	Grab	Monthly*	Gross alpha, beta, and H-3
53 Erdman Brook	Drains NYS and NRC disposal areas	Grab	Weekly*	Gross alpha, beta, and H-3
3 Hull Burial Ditch	Drains NRC disposal area	Grab	Weekly	Gross beta and H-3

*Samples to be split (shared with NYSDOH).

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EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

	<u>Monitoring Point</u>	<u>Reason for Monitoring</u>	<u>Sampling</u>		<u>Analyses</u>
			<u>Type</u>	<u>Frequency</u>	
	73 Cooling Water Pipe	Discharges sand filter backwash	Grab	Monthly	Gross beta
	73 Condensate Pipe	Discharges drainage from utility ditch ^b	Grab	Monthly	Gross beta
	005 Condensate and Cooling Water Ditch	Combined drainage from pipes and settling ponds	Grab	Monthly	Gross beta
	4 Settling Basin Outfall	Drains settling basins that receive discharge from demineralizer backwash	Grab	Monthly	Gross alpha, beta, and H-3
A-3	006 Erdman Brook at security fence	Combined facility discharge	Continuous proportional sample	Monthly* (Composite of biweekly collections)	Gross alpha, beta, H-3, and chemical species; quarterly composite: gamma isotopic, Sr-90
	72 Sanitary Waste (004) Discharge	Liquid effluent point	Grab	Weekly	On collection: gross beta Monthly composite: gross alpha, beta, H-3, and Sr-90

^bUtility ditch drains steam condensate from traps along the south side of the utility room.

*Samples to be split (shared with NYSDOH).

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EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Monitoring Point</u>	<u>Reason for Monitoring</u>	<u>Type</u>	<u>Sampling</u> <u>Frequency</u>	<u>Analyses</u>
003 Burial Site Lagoon	See SPDES 003			
5 Interceptors	Untreated liquid to LLWT plant input lagoon	Grab	Once per transfer	Quarterly composite: gross alpha, beta, H-3, and Sr-90
<u>On-Site Wells</u>		Grab	Semiannual	H-3, gross alpha, beta
NFS wells B, D, G, H, L-2, M-5, J-2, J-5, J-8,				
USGS wells				
80-2, 80-3,				
80-4, 80-5,				
80-6, 80-7,				
82-1, 82-2,				
82-3, 82-4,				
82-5				

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OFF-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Media</u>	<u>Number of Samples and Locations</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Direct Radiation (TLD)*	(16) at each of 16 previous NFS locations (2) at corners of NYS LLW disposal area (1) at 1500 m NW of plant (1) at "5 points" landfill (background) (1) at Great Valley (to be added during 1984)	Quarterly	Quarterly gamma dose
Surface water	(1) Cattaraugus Creek at Felton Bridge location (1) Cattaraugus Creek upstream of Buttermilk Creek confluence at Bigelow Bridge	Continuous sampler operation with weekly collection Monthly grab	Weekly for gross alpha, beta, and H-3; monthly composite for gamma isotopic and Sr-90 Gross alpha, beta, and H-3 on collection

*Samples to be split (shared with NYSDOH).

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OFF-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Media</u>	<u>Number of Samples and Locations</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Surface water (continued)	(2) Buttermilk Creek, just upstream of Cattaraugus Creek confluence at Thomas Corners Road; control location near Fox Valley Road	Continuously operating time composite sampler, with monthly collection	Monthly for gross alpha, gross beta, and H-3 analyses. Quarterly for gamma isotopic and Sr-90 analyses
Air	1500 m NW near Preston residence	Continuous sampler operation with weekly collection of filter sample	Weekly (i.e., each filter) for gross alpha and gross beta activity
	(1) Background station 25 km SSW of the site (Great Valley)		
	(3) At the original NFS monitor locations		
Soil	(7) One at each proposed air particulate monitoring station	Once every three years*	At collection, for gamma isotopic, Sr-90, and Pu analyses

*Samples to be split (shared with NYSDOH).

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OFF-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Media</u>	<u>Number of Samples and Locations</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Soil (continued)	(3) One at each of the NFS air particulate stations		
Stream Sediments	(2) Upstream control locations, one on Cattaraugus Creek (near Bigelow Bridge) and one on Buttermilk Creek (near Fox Valley Road)* (1) Buttermilk Creek, near Thomas Corners Road (1) Cattaraugus Creek, near Felton Bridge (1) Behind Springville dam impoundment*	Semiannually	Isotopic gamma and Sr-90
Fish	(1) Cattaraugus Creek, downstream of the Buttermilk Creek confluence (1) Control sample from nearby stream not affected by the WVNS	Semiannually*	Isotopic gamma and Sr-90 in edible portions

*Samples to be split (shared with NYSDOH).

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OFF-SITE RADIOLOGICAL MONITORING PROGRAM
1984 IMPLEMENTATION

<u>Media</u>	<u>Number of Samples and Locations</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Milk	(1) Reed farm, outside site boundary due north of the plant	Monthly	Gamma isotopic, Sr-90, and I-129 analyses on quarterly composites
	(1) Control location (sample to be provided by NYSDOH)		
Fruit and Vegetables	(3) Nearby downwind location	Annually, at harvest	Gamma isotopic and Sr-90 analyses of edible portions
	(3) Remote locations		
Meat-Beef	(1) Beef animal from nearby farm in downwind direction	Semiannually*	Gamma isotopic analysis of meat
	(1) Beef animal from control location west of site		
Meat-Deer	(1) In vicinity of the site	Annually, during hunting season*	Gamma isotopic analysis of meat
	(1) Control animal	During year as available*	

*Samples to be split (shared with NYSDOH).

APPENDIX B

Standards and Concentration Guides

DOE Order 5480.1, Chapter XI

STANDARDS AND CONCENTRATION GUIDES
(DOE Order 5480.1, Chapter XI)

Radiation Protection Standards
Annual Whole-Body Dose Equivalent (mrem/year)

Individuals at Points of Maximum
Probable Exposure 500

Suitable Sample of the Exposed
Population 170

Concentration Guides for Effluent Releases to Uncontrolled Areas ($\mu\text{Ci/ml}$)

<u>Radionuclide</u>	<u>In Air</u>	<u>In Water</u>
Gross alpha ^a	2×10^{-14}	3×10^{-8}
Gross beta	1×10^{-12}	3×10^{-8}
Am-241	2×10^{-13}	4×10^{-6}
Sb-125	9×10^{-10}	1×10^{-4}
Ar-41	4×10^{-8}	--
Ba-140	1×10^{-9}	2×10^{-5}
Cs-134	4×10^{-10}	9×10^{-6}
Cs-137	5×10^{-10}	2×10^{-5}
H-3	2×10^{-7}	3×10^{-3}
I-129	2×10^{-11}	6×10^{-8}
I-131	1×10^{-10}	3×10^{-7}
Kr-85	3×10^{-7}	--
Kr-85m	1×10^{-7}	--
Kr-87	2×10^{-8}	--
Kr-88	2×10^{-8}	--
Pu-238	7×10^{-14}	5×10^{-6}
Pu-239	6×10^{-14}	5×10^{-6}
Pu-240	6×10^{-14}	5×10^{-6}
Ru-106	2×10^{-10}	1×10^{-5}
Sr-90	3×10^{-11}	3×10^{-7}
Xe-133	3×10^{-7}	--
Xe-135	1×10^{-7}	--
Xe-138	3×10^{-8}	--

^aBased on the most restrictive beta emitter (Ra-228)