M-32




# WEST VALLEY DEMONSTRATION PROJECT
# SAFETY ANALYSIS REPORT

## VOLUME I

## PROJECT OVERVIEW AND GENERAL INFORMATION




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# INTRODUCTION AND GENERAL DESCRIPTION OF THE WEST VALLEY DEMONSTRATION PROJECT

## A.1.1 INTRODUCTION

This Safety Analysis Report (SAR) was prepared to meet the requirements of the U. S. Department of Energy Order DOE-5481.1A (US DOE, 1981), Idaho Operations Office Order ID-5481.1 (US DOE-ID, 1981), and West Valley Nuclear Services Company, Inc. (WVNS) Policy and Procedure WV-906 (WVNS, 1984). The purpose of this analysis is to support the Department's decisions with respect to the specific means of accomplishing the various aspects of the West Valley Demonstration Project (WVDP).

The WVDP is being undertaken by the Department pursuant the West Valley Demonstration Project Act (P.L. 96-368; the "Act"). The Act directs the Secretary of Energy to undertake five major activities as follows:

[1] Solidify the liquid High-Level Waste (HLW) stored at the Western New York Nuclear Service Center (WNYNSC) into a form suitable for transportation and disposal;

[2] Develop containers for the solidified HLW which are suitable for permanent disposal of the HLW;

[3] Transport the waste to a federal repository for disposal;

[4] Dispose of Low-Level Waste (LLW) and Transuranic (TRU) waste produced by the Project; and

[5] Decontaminate and decommission:

a. the HLW storage tanks
b. the HLW solidification facilities, and
c. any material and hardware used in connection with the Project.

The site of the WVDP (the "Project Premises") is situated within the boundaries of the WNYNSC or the "Center" and is the location of the former Nuclear Fuel Services (NFS) spent nuclear fuel reprocessing facility. The WNYNSC is located about 55 km south of Buffalo in the Town of Ashford, Cattaraugus County. (See Figure A.3.1-1 for a map showing the site location.)

Beyond the activities mandated by the Act, several ancillary tasks and supporting activities must be accomplished in conjunction with the WVDP. The main task and ancillary activities are as follows:

- Existing Plant and Operations,
- Component Test Stand Vitrification Facility,
- Supernatant Treatment System,
- Sludge Mobilization System,
- Vitrified High-Level Waste Storage,
- Cement Solidification System,
- Liquid Waste Treatment System Upgrades,
- Size Reduction System,
- Lag Storage Facility,
- Disposal Area Operations, and
- Final Decontamination, Decommissioning and Waste Shipment.

These activities are the subject of this SAR.

## A.1.2 OVERVIEW OF THE EXISTING PLANT OPERATION AND PRESOLIDIFICATION DECONTAMINATION

The Department of Energy's takeover of the Project site on February 25, 1982 brought with it the responsibility of operating the existing facilities in their shutdown status. As part of the pretakeover activities, US DOE and WVNS reviewed the SAR prepared by NFS in conjunction with their U. S. Nuclear Regulatory Commission (US NRC) licensing efforts. After this review, the Technical Specifications which were a part of the NFS license (the NFS license has been suspended by US NRC) were adopted by the Project for interim operation. One of the purposes of this SAR is to provide the basis for modifying and/or eliminating the existing Technical Specifications (called Operational Safety Requirements, or OSRs by US DOE) to bring them into line with the ongoing operations of the existing plant (See Volume VI).

One aspect of the existing operations which has already been subjected to safety reanalysis and re-review is fuel handling and shipment.

Several portions of the existing plant will be modified for use in conjunction with the WVDP. In order to permit these various cells to be put to new uses, they must be decontaminated and in most cases stripped of the equipment they contain. Initially, these presolidification decontamination activities have been analyzed and reviewed on a case-by-case basis. However, most of the safety questions which arise in conjunction with these analyses are common from cell to cell. Such issues as control of airborne contamination, worker exposure, waste handling and packaging, criticality control, and so forth are under consideration in virtually all the decontamination efforts. In order to streamline the review and orderly progress of the presolidification decontamination activities, an analysis of these common safety questions is presented in Volume II.

## A.1.3 DESCRIPTION OF THE MANDATED WVDP ACTIVITIES

### A.1.3.1 OVERVIEW OF HLW HANDLING AND VITRIFICATION

The HLW to be vitrified is stored in two tanks containing two different waste forms. Alkaline PUREX wastes are stored in Tank 8D-2, and acidic THOREX wastes are stored in Tank 8D-4. Tank 8D-2 has a total capacity of 2.8 million litres and contains approximately 2.1 million litres of the PUREX waste. Tank 8D-4 has a capacity of 57,000 litres and contains approximately 31,000 litres of the THOREX waste. Both tanks are backed up with respectively identical tanks (8D-1 for 8D-2 and 8D-3 for 8D-4) for emergency transfer and condensate collection.

The acidic THOREX wastes exist in essentially a single, liquid phase (although there is some indirect evidence of evaporite "caking" on the tank walls). However, the PUREX wastes exist in two distinct phases referred to as the supernatant and solids (or sludge) phases. Table A.1.3-1 provides an isotopic distribution of the major radioactive constituents of the West Valley HLW.

Figure A.1.3-1 is a simplified schematic of the HLW transfer and vitrification process to be employed at West Valley. In an early and separate campaign, the supernatant phase of the PUREX HLW will be decanted from Tank 8D-2 and into the Supernatant Treatment System (STS). The STS consists of a cooler, a feed tank, three zeolite ion exchange columns connected in series, a filter, and a bounce tank. The ion exchange columns will be installed inside Tank 8D-1. As the columns become loaded, the zeolite will be sluiced into the modified Tank 8D-1 that surrounds the ion exchange columns. The decontaminated supernatant will be pumped to the Radwaste Treatment System (RTS) where it will be filtered, concentrated, and mixed with cement in the Cement Solidification System (CSS).

The sludge fraction of the HLW in Tank 8D-2 will be mobilized by a series of low-pressure recirculating sluicers. When the vitrification process is ready to receive HLW, the mobilized sludge, loaded zeolite resin, and THOREX waste will be transferred to the Feed Concentrator Make-up Tank in the Vitrification Cell where the glass formers will be blended together with these wastes and transferred to the Melter Feed Tank. From this tank the feed will be delivered to the Slurry-Fed Ceramic Melter (SFCM) where it is joule heated to form the molten, waste-loaded, borosilicate glass. The molten glass is then airlifted from the Melter into stainless steel canisters which are positioned by a carousel which rotates the canister to be filled under the SFCM. Once a canister is filled, it remains in the carousel until it is indexed to a position out from under the Melter where it can be removed for further cooling and canister lid welding. Once the canister lids are welded, the canisters are loaded on a transfer cart which will then move on rails into the Equipment Decon Room (EDR) of the existing plant. In the EDR surface contamination will be reduced to acceptable levels. After decontamination, the canisters are transferred to the Chemical Process Cell (CPC) in the existing plant for storage in racks until such time as they can be shipped to the federal repository.

Off-gas from the SFCM will be routed through a Submerged Bed Scrubber (SBS) and a High Efficiency Mist Eliminator (HEME). It then exits the Vitrification Cell via a pipeline to the 01-14 Building where it is processed further through a primary and a secondary $NO_x$ scrubber, entrainment separator, roughing and iodine filters, and finally a HEPA filter before being released to the plant stack.

### A.1.3.2 OVERVIEW OF WASTE MANAGEMENT, STORAGE, AND DISPOSAL

The various operations at the WVDP will produce considerable amounts of low-level wastes. Plant operations, decontamination, vitrification, supernatant treatment, etc. will all have low-level waste streams to be treated and prepared for disposal or shipment. Liquid wastes will be filtered, in some cases subjected to ion exchange, and concentrated by evaporation. Filter backwashes, loaded ion exchange resins, and concentrates will then be batched to the Cement Solidification System to be blended with cement and any necessary additives in twin high-shear mixers. Once blended, the waste-loaded cement is discharged from the mixer to 208-litre drums which are capped, smeared, allowed to set-up, and then are outloaded for transfer to Lag Storage or Waste Disposal.

A 780 $m^2$ Lag Storage Building has been constructed to store LLW awaiting a disposal campaign and TRU waste awaiting shipment. This facility has already been subjected to safety analysis and review, but the description and analysis is included in Volume IV for completeness.

LLW disposal operations are being subjected to extensive environmental evaluation. When a disposal method is selected, a safety analysis will be performed for LLW handling and disposal operations and will be included as part of Volume IV.

### A.1.3.3 OVERVIEW OF FINAL DECONTAMINATION AND DECOMMISSIONING

Section Reserved

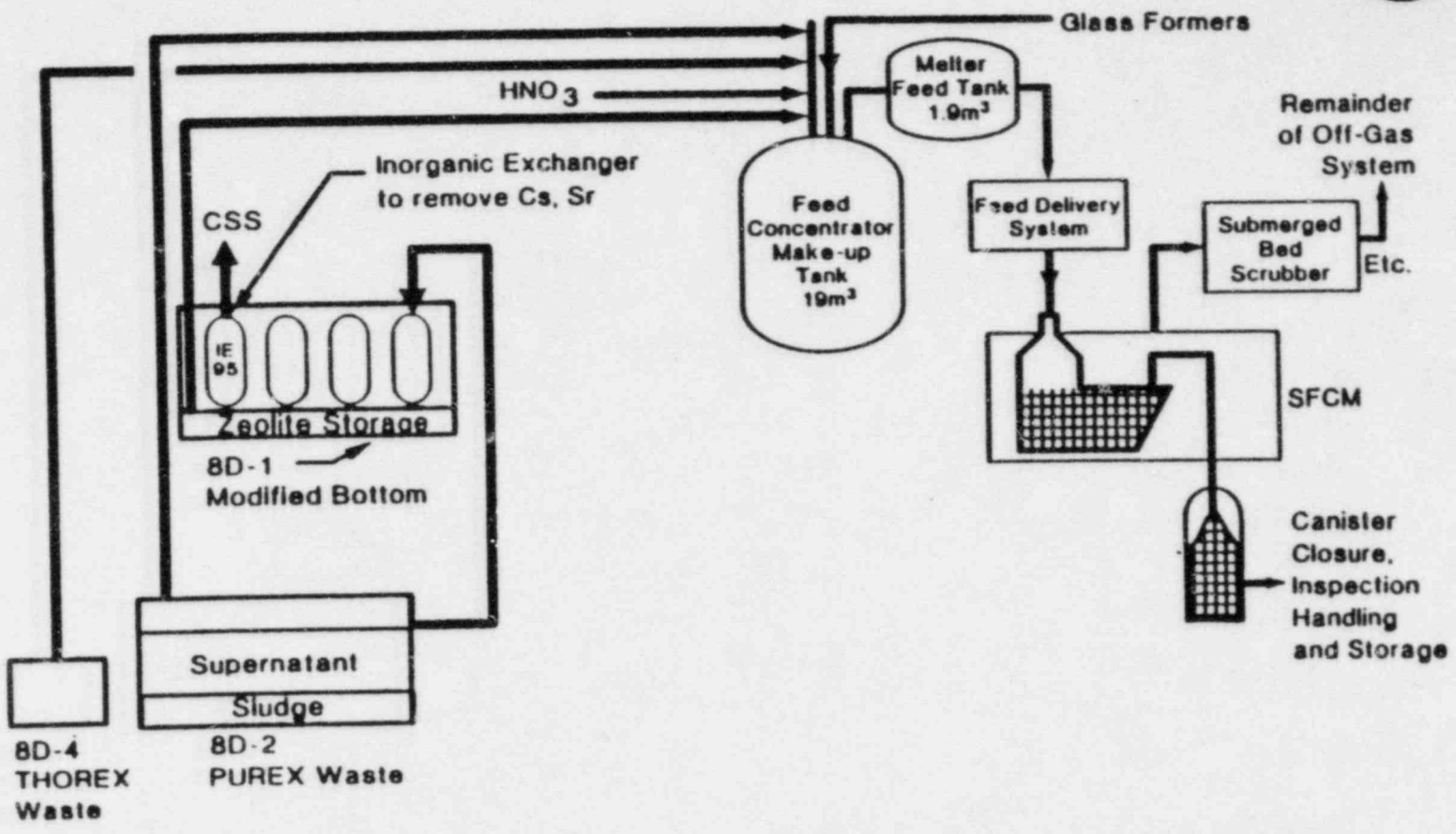
TABLE A.1.3-1

CURIE CONTENT OF TANKS 8D-4 AND 8D-2

| Isotope | Principal Decay Mode | Total Curies 8D-4 Tank* | 8D-2 Supernatant* | 8D-2 Solids* |
|---|---|---|---|---|
| Cs-137 | β | $5.63 \times 10^5$ | $8.08 \times 10^6$ | ~0 |
| Ba-137m | Y | $5.29 \times 10^5$ | $7.60 \times 10^6$ | ~0 |
| Sr-90 | β | $5.52 \times 10^5$ | $3.22 \times 10^3$ | $7.74 \times 10^6$ |
| Y-90 | β | $5.52 \times 10^5$ | $3.22 \times 10^3$ | $7.74 \times 10^6$ |
| Cs-134 | β | $1.27 \times 10^3$ | $6.67 \times 10^3$ | ~0 |
| H-3 | β | <10 | $1.23 \times 10^2$ | ~0 |
| I-129 | β | $<2 \times 10^{-1}$ | $2 \times 10^{-2}$ | ~0 |
| Rare Earths | β | $1.90 \times 10^4$ | $5.98 \times 10^2$ | $1.55 \times 10^6$ |
| Misc. β (incl. Pu-241) | β | $2.92 \times 10^3$ | $4.76 \times 10^3$ | $1.32 \times 10^5$ |
| Misc. Y | Y | ~0 | ~0 | $2.3 \times 10^2$ |
| Pu | α | $5.79 \times 10^2$ | $1.78 \times 10^2$ | $1.19 \times 10^4$ |
| U | α | 2.7 | $8.6 \times 10^{-1}$ | 12.9 |
| Other TRU | α | $2.97 \times 10^2$ | ~0 | $2.29 \times 10^4$ |
| Total Y | | $5.29 \times 10^5$ | $7.60 \times 10^6$ | $2.3 \times 10^2$ |
| Total β | | $1.69 \times 10^6$ | $8.10 \times 10^6$ | $1.72 \times 10^7$ |
| Total α | | $8.79 \times 10^2$ | $1.79 \times 10^2$ | $3.48 \times 10^4$ |

* Note: Samples were taken about 9 months apart

# HLW PROCESSING FLOW SHEET




8744 DW09940 047

FIGURE A.1.3-1

## A.1.4 IDENTIFICATION OF AGENTS AND CONTRACTORS

The US DOE-ID has been assigned the responsibility for implementing the WVDP. US DOE-ID has established a project office (WVPO) for the on-site administration of the Project.

Since the State of New York is the owner of the site and is required by the Act to participate in the funding of the Project, a Cooperative Agreement between the Department and the State has been established (US DOE/NYSERDA, 1981). The State is represented by the New York State Energy Research and Development Authority (NYSERDA) in this relationship and is represented on-site.

The Act also requires the US DOE to consult with the US NRC concerning the substantive aspects of the Project, and US NRC approval of the Final Decontamination and Decommissioning Plan to be implemented upon completion of the Project. The relationship between the US DOE and US NRC in this regard has been outlined in a memorandum of understanding (MOU;46 FR 56960) between the two agencies.

The Act also requires the Department to consult with the U.S. Department of Transportation (US DOT), the U.S. Environmental Protection Agency (US EPA), and the U.S. Geological Survey (USGS) in matters relating to their respective areas of expertise and concern. These relationships have been established, though somewhat less formally than those with the State and the US NRC.

The Department has retained the West Valley Nuclear Services Company, Inc. (WVNS, a wholly-owned subsidiary of the Westinghouse Electric Corporation) as the prime contractor for operation of the site facilities, and design and implementation of the WVDP. Dames and Moore (D and M) joined with WVNS in the original procurement to provide geotechnical, environmental, and safety assessment services for the Project.

Ebasco Services, Inc., Pacific Northwest Laboratories (PNL) and Societe Generale pour les Techniques Nouvelles (SGN) have been retained for design services.

The Project also consults with and is engaged in technology transfer on a national level with the Commercial Waste Treatment Program and Defense Waste Processing Facility, and on an international level with German, French, and Japanese nuclear program organizations.

These relationships are illustrated in Figure A.1.4-1

# PROJECT INTERFACES

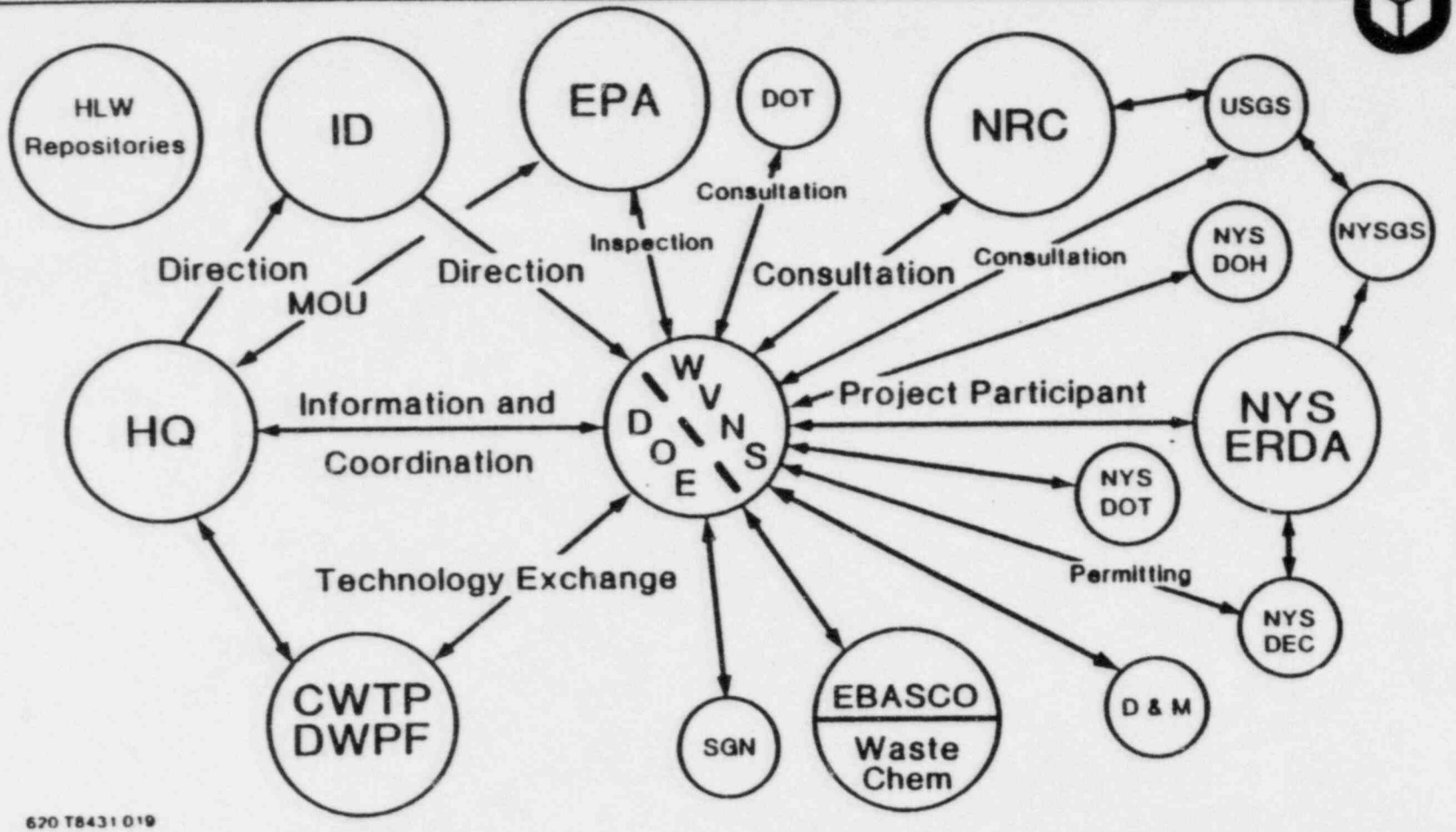



FIGURE A.1.4-1

## A.1.5 STRUCTURE OF THIS SAFETY ANALYSIS REPORT

### A.1.5.1 FUNCTIONAL STRUCTURE OF THE WEST VALLEY DEMONSTRATION PROJECT SAFETY ANALYSIS REPORT

Most of the major components of the WVDP are functionally interrelated; however, many of these components can and will function independently as well. For example, the Supernatant Treatment System functions to strip the cesium and strontium from the liquid phase of the PUREX HLW. These materials are then to be blended with the THOREX waste and the sludge phase of the PUREX waste and, together with the glass formers, are to be fed to the melter. Thus, the Supernatant Treatment System has a clear interrelationship with both the Sludge Mobilization System and the vitrification process (as well as with others). Notwithstanding these interrelationships, the Supernatant Treatment System will be operated independently (in time) of the Sludge Mobilization System and the vitrification process.

The concept of bringing systems on line independently is due in part to the complex nature of the WVDP, the fact that several major components require significant predesign developmental work, and the realities of funding constraints.

In order to avoid a situation where the safety analysis preparation and review cycle becomes an impediment to the advancement of the Project as a whole, the concept of a modular safety analysis was developed. This scheme permits the individual major Project components to be conceptualized, designed, analyzed, reviewed, constructed, and operated on more or less independent schedules while an integrated safety analysis covering the entire Project is evolving over time. Table A.1.5-1 lists the parts of this modular document.

Volume I provides an overview of the scope and purpose of the WVDP. It is the volume in which the summary safety analyses for all the Project components are compiled as they are developed. Volume I also includes the site characterization and generic discussions of the safety classification system and design standards, the radiation protection program, the organizational structure of the WVDP, and the quality assurance program. Volume II provides the detailed safety analysis of the existing plant as it is being operated in its shutdown status, decontaminated and decommissioned. Volumes III, IV, and V will present the detailed facility- or activity-specific safety analyses as shown in Table A.1.5-1. As they are developed, the OSRs (Tech. Specs.) for the entire Project will be compiled in Volume VI for easy reference.

Pursuant to the requirements of the US DOE-ID Order ID-5481.1 and the WVNS Policy and Procedure WV-906 implementing this order, there will never be an activity or system under operation with an unreviewed safety question. Over the life of the WVDP, however, the safety analysis will be revised frequently as new parts are added and as preliminary analyses are replaced with final analyses. At some point after the HLW has been vitrified and just prior to the initiation of the final decontamination and decommissioning of the Project facilities, the Project safety analysis will be complete.

### A.1.5.2 OUTLINE OF THE WEST VALLEY DEMONSTRATION PROJECT SAFETY ANALYSIS REPORT

Chapter I of US DOE-ID Operations Office Order ID-5481.1 provides direction with respect to the content of a safety analysis. An outline for the WVDP SAR has been developed to be consistent with this direction. This outline is based upon the "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants - US NRC Reg. Guide 3.26" with slight modification and is described fully in "Technical and Administrative Approach for the WVDP Safety Program" (WVNS - 1984).

### A.1.5.3 SAFETY ANALYSIS REPORT DISTRIBUTION, REVIEW, AND APPROVAL

WVNS Policy and Procedure, WV-906, establishes the administrative steps for the initiation, preparation, and in-house and independent review of safety analyses. Once a given safety analysis has been approved by the WVNS Radiation and Safety Committee and a determination has been made that the activity under review constitutes either (1) a moderate or high hazard, or (2) is subject to review pursuant to the Memorandum of Understanding between the US DOE and the US NRC (46 FR 56960), regardless of the hazard classification, 18 controlled copies will be forwarded to the Department's West Valley Project Office (WVPO). The WVPO will coordinate the review of the safety analysis beyond its interface with WVNS pursuant to US DOE-ID Operations Office Order ID-5481.1, the Memorandum of Understanding, and such other arrangements it may have with other parties.

WVPO representatives have indicated that comments on a given safety analysis would be collected, screened, and forwarded to WVNS within 90 days of WVNS's delivery of such an analysis to the WVPO. The time required for WVNS to respond to comments will be a function of the nature of those comments but it is estimated to be a maximum of 60 days. For planning purposes, it is anticipated that the approval of a particular safety analysis would be forthcoming within 30 days after responses to comments have been forwarded to the WVPO by WVNS.

## REFERENCES FOR SECTION A.1


Memorandum of Understanding Between the Nuclear Regulatory Commission and the Department of Energy, Implementation of the West Valley Demonstration Project Act of 1980. FR Doc. 81-33439, Filed 11/18/81.

U.S. Nuclear Regulatory Commission, 1975. Regulatory Guide 3.26: Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants.

West Valley Demonstration Project Act, October 1, 1980. Public Law 96-368.

U.S. Department of Energy Order DOE-1D 5481.1, Safety Analysis and Review System for DOE-ID Managed Activities.

U.S. Department of Energy Order DOE-5481.1A, Safety Analysis Review System.

West Valley Nuclear Fuel Services, Inc., 1984. Technical and Administrative Approach for the West Valley Demonstration Project Safety Program.

West Valley Nuclear Services, Inc., 1984. Policy and Procedure WV-906, Safety Review Program.

TABLE A.1.5-1

STRUCTURE OF THE WEST VALLEY DEMONSTRATION PROJECT SAFETY ANALYSIS REPORT

| Volume | Title | Part |
|---|---|---|
| I | Project Overview and General Information | A |
| II | Existing Plant and Operations | B |
| III | High-Level Waste Vitrification | |
| | o CTS/Vitrification Facility | C |
| | o Supernatant Treatment System | D |
| | o Sludge Mobilization System | E |
| IV | Waste Management, Storage and Disposal | |
| | o Vitrified High-Level Waste Storage | F |
| | o Cement Solidification System | G |
| | o Liquid Waste Treatment System Upgrades | H |
| | o Size Reduction Facility | I |
| | o Lag Storage Facility | J |
| | o Disposal Area Operations | K |
| V | Final Decontamination, Decommissioning and Waste Shipment | L |
| VI | Operational Safety Requirements (Technical Specifications) | M |

## A.2.0 SUMMARY SAFETY ANALYSIS

A summary of the various safety analyses performed for facilities at the WVDP is presented in this chapter. Additional details on these analyses can be found in appropriate sections of this and other volumes. Section A.2.1 presents a discussion of the site-specific features of the Center in relationship to their influence on safety. Section A.2.2 summarizes the radiological impact of normal operations. Section A.2.3 summarizes the radiological impact of abnormal operations. A summary of the accidents analyzed and their radiological impact is given in Section A.2.4. Finally, conclusions related to safety are given in Section A.2.5.

## A.2.1 SITE ANALYSIS

An analysis of the site-specific characteristics of the West Valley area has shown that the site is compatible with safe conduct of the Project. Site characteristics enter into the analysis in two ways:

[1] As potential causes of accidents (e.g., natural phenomena); and

[2] As mechanisms which can alleviate the impacts of accidents (e.g., meteorology, population distribution).

Mechanisms which can cause accidents are analyzed explicitly. Dispersive mechanisms in the environment are analyzed for all accidents with the potential for releasing radioactivity off-site.

### A.2.1.1 NATURAL PHENOMENA

Natural phenomena which can affect the safety of operations at the center include earthquakes, tornadoes, and floods. The site is situated in a region that has experienced a moderate amount of relatively minor seismic activity. The record of earthquake activity in Western New York and the surrounding area dates back over 100 years. The only significant (Modified Mercalli: Intensity 2 VII) earthquake activity in Western New York has occurred in the vicinity of the Clarendon-Linden Fault. Several small shocks in the Buffalo-Hamilton area were probably due to glacial rebound effects, i.e., local stress concentration as a triggering mechanism for earthquakes by causing minor crustal readjustments.

Outside of the immediate West Valley area, there is a zone of major seismic activity near LaMalbaie, Quebec, in the lower St. Lawrence River Valley. Major earthquakes (MMI IX or X) have occurred in this area several times and most recently in 1925. The earthquakes were felt over the entire Eastern section of Canada and the Northeastern United States. The West Valley area probably experienced no more than MMI IV from any of these events; this would be the greatest level of ground motion experienced at the site in historical time.

The design basis earthquake for the Project has been established as having a recurrence time of 1,000 to 5,000 years, with a peak acceleration of 0.1 g. This recurrence interval is considered conservative given the relatively short life time of the Project (1.5 years for HLW vitrification) compared to nominal life times of 30 to 40 years for nuclear facilities for which a recurrence time of 1,000 to 10,000 years is typical.

The frequency and intensity of tornadoes in Western New York is low in comparison to other parts of the United States. An average of about two tornadoes of short and narrow path length strike localized areas of New York State each year. For the period of 1950 through 1970, 16 tornadoes were reported within 80 km of the center. The design basic tornado for the Project was developed based upon detailed analyses of all tornado occurrences in Western New York State. The characteristics of the design basis tornado are:

Recurrence time: $10^6$ years
Maximum wind speed: 260 Kph
Potential speed: 180 Kph
Translational speed: 80 Kph
Radius of maximum rotational wind: 46 m
Total atmospheric pressure change: 2.4 kPa
Rate of pressure drop: 1.0 KPa/sec.

Even though the amount of precipitation in West Valley is relatively high (averaging about 104 cm per year), flooding is not expected to be a major hazard due to the local topography and the relatively even distribution of precipitation throughout the year. Thunderstorms are infrequent because of the stabilizing influence of Lake Erie. For these reasons, flooding is not a hazard addressed in this safety analysis.

### A.2.1.2 SITE CHARACTERISTICS AFFECTING THE SAFETY ANALYSIS

The pathways by which radioactive effluents may be dispersed into the off-site environment may be broadly categorized as airborne or liquid. For airborne releases, the capacity of the atmosphere to dilute and disperse radioactive effluents is of prime importance in evaluating the environmental effects of site operations under both normal and abnormal conditions. The dispersive capability of the atmosphere is a function of wind speed and direction and atmospheric stability. Local climatological data were obtained from an on-site meteorological tower where wind speed and direction are measured at 10 and 60 metres from the base. Atmospheric stability classes are determined from the temperature difference between 10 and 60 metre elevations.

Because the ridge and hills in the vicinity of the site frequently channel the winds, strong systematic deviations from straight line airflow are to be expected. To realistically account for the terrain effects on airflow, a fine-grid, two dimensional wind field model was developed from additional wind monitoring stations in the site vicinity. Such a model can account for the effects of local terrain on atmospheric dispersion of airborne effluents.

Major surface-water drainage features of the site area are Cattaraugus Creek and Buttermilk Creek (principally the latter). Buttermilk Creek originates south of the site, but its lower portions, including its confluence with Cattaraugus Creek, are wholly within the boundaries of the site. Buttermilk Creek drains approximately 76 $km^2$, about 14 $km^2$ of which are within the site boundaries. The average flow rate of the creek is 1.8 $m^3/s$.

The total drainage area of Cattaraugus Creek is about 1400 $km^2$, including 560 $km^2$ above its confluence with Buttermilk Creek to the north of the site. Peak flow rates in Cattaraugus Creek occur in November-December and in March. In the vicinity of the site, the typical maximum flowrate is 20 $m^3/s$. Cattaraugus Creek enters Lake Erie near the eastern end of the lake, about 45 km southwest of Buffalo.

The West Valley site is underlain by two aquifer zones, neither of which can be considered highly permeable. The upper aquifer consists of surficial, gravelly deposits. On the west side of the site this unit consists of alluvial fan deposits; on the eastern side, it consists of fluvial, gravelly or sandy deposits. The thickness of these surficial deposits ranges from about 1.5 to 6.0 m. The second aquifer zone consists of a zone of decomposed shale and rubble at the contact between the overlying till and bedrock. This zone is generally less than 0.5 m in thickness.

The groundwater flow patterns pertinent to the site relate to the recharge and down gradient movement for these two aquifers. Groundwater in the surficial unit tends to move in an easterly or northeasterly direction from the western boundary of the site, close to Rock Springs Road. Most, if not all, of the groundwater in this unit discharges into Frank's Creek or into small tributaries of that creek. Groundwater recharging the weathered shale and rubble zone will tend to move eastward toward the thalweg (locus of the lowest points in the cross section of the buried valley) of the buried valley, located about 300 to 350 m to the west of Buttermilk Creek. Once attaining the thalweg, the direction of groundwater movement would shift to the direction of the thalweg, about north 25° west, and proceed toward the northwest.

### A.2.1.3 EFFECT OF NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

There are no nearby industrial, transportation, or military facilities that will affect the safety of Project operations.

No major industrial activities are located within 16 km of the West Valley site; the nearest major industrial activities occur in Buffalo and its surrounding communities. There are no nearby military facilities.

The site is located in a rural area about 50 km south of Buffalo. Road access to the site is from Rock Springs Road; the nearest major highway is State Route 219, located about 3 km to the west. A spur off the Chessie System provides rail access to the site.

## A.2.2 RADIOLOGICAL IMPACT OF NORMAL OPERATIONS

The doses to off-site individuals from normal operations will be small. The results of environmental monitoring programs indicate that, with the exception of concentrations in surface water and fish, radioactivity in samples collected from the vicinity of the center 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 will be discharged during the course of Project activities, concentrations in air and water will be well within the concentration guides of US DOE Order 5480.1A, Chapter XI; the resultant doses from these releases to the surrounding population will be of negligible consequence for human health.

Occupational doses are carefully monitored during all stages of Project activity. Doses will be maintained with Project goals which are below guidelines provided in US DOE Order 5480.1A, Chapter XI and in compliance with US DOE's "As Low As Reasonably Achievable" (ALARA) philosophy. There will be no significant radiological impact to workers during normal operations.

### A.2.3 RADIOLOGICAL IMPACT FROM ABNORMAL OPERATIONS

Process upsets or operation of equipment or facility beyond design limits are considered abnormal operations. Abnormal operation does not include accidents, which are addressed separately.

The radiological impact from abnormal operations will be somewhat greater than but similar to impacts from normal operations.

The potential abnormal impacts for each operation will be identified and discussed in the individual process-specific SAR modules.

## A.2.4 ACCIDENTS FROM ONGOING OPERATIONS AND PRESOLIDIFICATION DECONTAMINATION

As a result of accidents associated with on-going activities at the Center as well as those which may occur during presolidification decontamination activities, radioactive material could be released from the site and the general public could consequently incur a radiation dose. The important factors affecting the environmental consequences of postulated accidents are the chemical and physical behavior of the radionuclides, the efficiencies of the effluent treatment systems, and the dispersion mechanisms in the environment.

This section summarizes the radiological impacts associated with accidents postulated to occur from operation of existing facilities at the Center and during presolidification activities. The radiological impacts are given in terms of the doses to the maximally exposed off-site individual. Additional details on the accidents analyzed and the methods used to predict the dose to the maximally exposed member of the general public are given in appropriate sections of this document.

In analyzing postulated accidents, it is first necessary to estimate the radiological source term for each accident. In some instances, a given initiating event (e.g., tornado, earthquake) can cause several types of accidents. In such instances, the accident involving the largest source term was analyzed. This was done to envelope the consequences of similar accidents with smaller source terms.

### A.2.4.1 ONGOING OPERATIONS

Seven accidents associated with ongoing activities at the center were analyzed in this safety analysis. They are:

[1] Design basis earthquake resulting in the failure of lagoon walls;

[2] Design basis tornado resulting in airborne releases from the lagoon system;

[3] Uncontrolled liquid release from the lagoon system;

[4] Main vent HEPA filter failure; and

[5] Three waste handling accidents:

a. FRS resin tank,
b. FRS filter media tank (normal loading), and
c. FRS filter media tank (maximum loading).

Detailed descriptions of these accidents and the assumptions made to estimate radiological impacts are provided in Volume II, Section B.9.

The radiation doses to the maximally exposed individual for these seven accidents are summarized in Table A.2.4-1. The largest dose would result from the design basis tornado passing over the lagoon system, mobilizing contaminated water and particulates and transporting them off-site. The dose from this accident is estimated to be 35 mrem. Except for the uncontrolled liquid release from the lagoon system, the dose to the maximally exposed off-site individual from the other six accidents will be smaller than the dose from the design basis tornado accident, but on the same order of the magnitude. The uncontrolled liquid release accident from the lagoon system will have a dose so low that it will be undistinguishable from natural background radiation.

### A.2.4.2 PRESOLIDIFICATION DECONTAMINATION

Six credible accidents associated with presolidification decontamination activities were analyzed. They are:

[1] Mixing of incompatible chemicals;

[2] Spill of contaminated liquids;

[3] Loss of local airborne contamination control;

[4] Segmentation of equipment not chemically decontaminated using a plasma torch;

[5] Fire involving contaminated clothing or combustible waste; and

[6] Fire involving plywood overpack of a large process vessel.

Detailed descriptions of these accidents and the assumptions made to estimate radiological impacts are given in Section B.9.0 of Volume II.

The radiation doses to the maximally exposed individual for these six accidents are summarized in Table A.2.4-2. The doses resulting from accidental releases of radioactivity during decontamination activities will be less than 1 mrem. Doses this small would be undetectable from natural background radiation. The doses from these accidents are small since the existing ventilation system is assumed to remain operational.

TABLE A.2.4-1

ESTIMATED DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FROM ACCIDENTS ASSOCIATED WITH ON-GOING OPERATIONS

| Accident | Type of Release | Dose (mrem)[a] |
|---|---|---|
| Natural Phenomena: | | |
| Design Basis Earthquake Resulting in Failure of Lagoon Walls | Liquid | 3.6 |
| Design Basis Tornado Resulting in Airborne Release from Lagoon System | Airborne | 35 |
| Uncontrolled Liquid Release from the Lagoon System | Liquid | $3.9 \times 10^{-4}$ |
| Main Vent HEPA Filter Failure | Airborne | 21 |
| Waste Handling Accident | | |
| FRS Resin Tank | Airborne | 3.6 |
| FRS Filter Media Tank | | |
| Normal Loading | Airborne | 9.8 |
| Maximum Loading | Airborne | 23 |

[a] Effective whole body dose equivalent

TABLE A.2.4-2

ESTIMATED DOSE TO THE MAXIMALLY EXPOSED INDIVIDUAL FROM ACCIDENTS[a] ASSOCIATED WITH PRESOLIDIFICATION DECONTAMINATION

| Accident | Dose (mrem)[b] |
|---|---|
| Mixing of Incompatible Chemicals | $2.0 \times 10^{-4}$ |
| Spill of Contaminated Liquids | $2.0 \times 10^{-5}$ |
| Loss of Local Airborne Contamination Control | $2.0 \times 10^{-1}$ |
| Segmentation of Equipment Not Chemically Decontaminated Using a Plasma Torch | $3.6 \times 10^{-2}$ |
| Fire Involving Contaminated Clothing or Combustible Waste | $3.6 \times 10^{-7}$ |
| Fire Involving Plywood Overpack of a Large Vessel | $3.6 \times 10^{-8}$ |

[a] All releases are airborne releases through the existing ventilation system.

[b] Effective whole body dose equivalent.

## A.2.5 CONCLUSIONS

Consideration of the site and design-related data presented in this safety analysis results in the following principal conclusions:

[1] The site characteristics, including anticipated natural phenomena, are compatible with the construction and operation of facilities to implement the WVDP.

[2] There are no nearby industrial, transportation, or military facilities in the region that could adversely affect the safety of operations at the Center.

[3] The procedures presently in place to maintain portions of the Center not directly related to the Project will keep releases of radioactivity from the site well within established Federal guidelines and as low as reasonably achievable.

[4] Decontamination of facilities (principally the large reprocessing plant) required for use by the Project can be safely implemented in a manner which will have a negligible environmental impact.

## REFERENCES FOR SECTION A.2

U.S. Department of Energy, DOE Order 5480.1A, Environmental Protection, Safety and Health Protection Program for DOE Operations.

## A.3.0 SITE CHARACTERISTICS

## A.3.1 GEOGRAPHY AND DEMOGRAPHY

### A.3.1.1 SITE LOCATION

The WVDP site is located in Ashford Township, Cattaraugus County, New York, at coordinates 42.45°N and 78.646°W. The UTM coordinates are 4,702,310 metres N and 692,730 metres E. The location of the site with respect to major natural and manmade features in Western New York State is shown in Figure A.3.1-1. Details of the site vicinity are shown in Figures A.3.1-2 and A.3.1-3.

The facility is 3.8 km southeast of Cattaraugus Creek at its nearest approach. Cattaraugus Creek forms the boundary between Cattaraugus and Erie Counties, New York. Buttermilk Creek, a tributary to Cattaraugus Creek, is 0.8 km east of the plant site. The nearest village is Springville, New York, 0.8 km north of Cattaraugus Creek and 5.6 km north of the plant site.

### A.3.1.2 SITE DESCRIPTION

The WVDP site (officially termed the "Project Premises") is on a plateau at approximately 420 m above Mean Sea Level (MSL). Details of the site topography, water bodies, and roadways with respect to the site boundaries and exclusion zone are shown in Figures A.3.1-4 and A.3.1-5. Buttermilk Creek flows through the site vicinity from southeast to northwest. Site drainage is toward Buttermilk Creek.

The topography within several kilometres of the site varies greatly, from less than 5 percent slope to over 25 percent slope, with 5-15 percent slope predominant. Within 2 km of the site, slope exceeding 25 percent is common. Terrain in the site vicinity reaches elevations of approximately 650 m.

The exclusion zone surrounding but not including the site consists of the WNYNSC owned and controlled by NYSERDA, and is officially termed the "Retained Premises." By Cooperative agreement between NYSERDA and US DOE, NYSERDA shall not use or authorize the use of the exclusion zone in a manner which interferes with US DOE carrying out the waste solidification project, and US DOE assumes exclusive use and possession of Project Premises (the site) for the purposes of carrying out the Project and for no other purpose. In carrying out the Project, US DOE agrees to comply with all legal requirements applicable to its participation in the Project. It follows that NYSERDA shall not authorize the use of the exclusion zone in a manner which interferes with US DOE's compliance with the US DOE-US NRC Memorandum of Understanding (46 FR 56960, November 19, 1981) which would require delineation of an exclusion zone around the facility.

During the term of the Project US DOE shall, by agreement, provide general surveillance and security services for the entire Retained Premises and the WVDP site facilities.

Rock Springs Road, a county road, traverses the exclusion zone west of the WVDP site. Access to this road can be controlled by Cattaraugus County authorities. An agreement between the WVDP and the County will be made to restrict access along this road if required by an emergency situation at the Project.

A.3.1.2.1 **Site Boundary**

The New York State licensed low-level waste burial ground (currently inactive) is located within the site boundary but is not considered part of the Project. There are no activities conducted within the site boundary and exclusion area which are incompatible with the waste solidification operations.

### A.3.1.2.2 Boundaries for Establishing Effluent Release Limits

The OSR limits on the release of gaseous effluent, including the milk exposure pathway, will be met at the boundary of the exclusion area.

## A.3.1.3 POPULATION DISTRIBUTION AND TRENDS

Population distribution is an important parameter in the calculation of impacts associated with nuclear facilities. Such data are used as input to various dose assessment codes to determine off-site radiological impacts of routine and accident releases. Typically, these codes calculate population doses out to a distance of 80 km. Because the WVDP may be operating into the 1990's, population estimates will be needed up until the year 2000. The following section provides such data and discusses their importance.

### A.3.1.3.1 Current Population

The area within 16 km of the site lies within Cattaraugus and Erie counties. The 1970 and 1980 resident populations of populated places within this area are presented in Table A.3.1-1. The populations of New York and Pennsylvania counties within 80 km of the site are presented in Table A.3.1-2.

Cattaraugus County is a predominantly rural county, 3,460 sq km in size with a population density of 24.7 persons per sq km. This relatively low population density is characteristic of rural-agricultural communities. The County population occurs primarily in rural residential areas and villages with populations less than 2,000. There are two incorporated cities in the County: Olean (population 18,207) and Salamanca (population 6,890) located 43.5 km southeast and 32 km south, respectively. The county contains 32 townships and 16 villages.

Between 1970 and 1980 Cattaraugus County population grew from 81,666 to 85,697, an increase of 4.9 percent. This increase, while not large, exceeds that of neighboring Erie County (-8.8 percent) and the average for New York State (-3.8 percent) during the same period. It also exceeds the County's population growth from 1960 to 1970 (1.8 percent).

Erie County, population 1,015,472, is not as homogeneous as Cattaraugus County. The southern third of Erie County, near the WVDP site is collectively termed "The Southtowns." It consists of rural townships in which the population is concentrated primarily in small villages and along roadways, much like Cattaraugus County. Traditionally, the majority of people residing here worked in agriculture or nearby small industries. This contrasts sharply with the City of Buffalo and surrounding metropolitan area which dominates the northern portion of Erie County. Overall, the County is experiencing a rapid population outmigration. During the decade 1970-1980 the population of the City of Buffalo declined by 22.7 percent. The Southtowns generally have not had the same experience, and several have increased in population such that the population decline was held to 8.8 percent for Erie County as a whole during the decade (U.S. Bureau of the Census, March 1981).

The nearest village in Erie County is Springville, 5.6 km north of the plant site. Springville had a 1980 resident population of 4,285, a decline of 1.5 percent from 1970. The only other village within 16 km of the site is Delevan, 14.5 km east-northeast, which had a 1980 resident population of 1,113, up 12 percent from 1970. The nearest hamlets are more than five km away. Since unincorporated hamlets do not have defined boundaries, population statistics are not generally available. The West Valley area, approximately 5.5 km southeast, is estimated to have a resident population of 600, making it one of the most populous unincorporated places in Ashford Township.

### A.3.1.3.2 Population Distribution and Projections

The population distributions and projection were prepared by a computer model (DEMOG2) and are based upon U.S. Bureau of the Census population data. These projections are stepped down to the local by a ratio technique. The model, DEMOG2, was originally developed for use on nuclear power plant projects (Greenberg and Krueckeberg, 1973). Supplement A.3.1-A details the assumptions on which the population projections are based.

#### A.3.1.3.2.1 Population Within 16 km

The 1980 population within 16 km is 17,460, and is projected to increase to 18,472 and 18,718 by 1990 and 2000, respectively. These represent population increases of 5.8 percent and 1.3 percent for the next two decades.

The current population distribution for the area within 16 km of the plant site is shown on Figure A.3.1-6, and tabulated by distance and direction in Table A.3.1-3. Population projections for this area are shown on Figures A.3.1-7 and A.3.1-8, and are tabulated in Tables A.3.1-4 and A.3.1-5.

#### A.3.1.3.2.2 Population Between 16 km and 80 km

The 1980 population within 80 km is 1,683,065, and is projected to increase to 1,731,932 and 1,767,277 by 1990 and 2000, respectively. These represent population increases of 2.9 percent and 2.0 percent for the next two decades, respectively.

The current population distribution for the area between 16 km and 80 km of the plant site is shown on Figure A.3.1-9 and tabulated by distance and direction in Table A.3.1-6. Population projections for this area are shown on Figures A.3.1-10 and A.3.1-11, and tabulated in Tables A.3.1-7 and A.3.1-8.

These projections assume that the migration experience of the period 1970-1975 will apply to the projection period, but this high outmigration may abate in future years and result in populations greater than those presented above.

Sudden shifts in economic policy, energy costs, and other unforeseen factors could conceivably alter the migration pattern significantly over a relatively short period of time. Although it is doubtful that migration would be reduced to zero during the projection period, the zero migration assumption is used to produce a second set of population projections shown in Tables A.3.1-9 through A.3.1-12. This is considered less likely to occur, however, and this set of projections is not included on the figures (maps).

### A.3.1.3.3 Transient Population

The transient population around the site includes transportation, daily and seasonal transients. The first two categories are insignificant and therefore are not included in the population distribution and projection figures above. The seasonal transient population is associated with the area's numerous small recreation sites. Where significant, this transient population is included in the distribution and projection figures. A detailed discussion of all of the transient populations and how they affect distributions and projections is given in Supplement A.3.1-B.

### A.3.1.3.4 Population Density

Population density (persons per square kilometre) averaged by distance from the site out to 48 km is represented by the density curve shown in Figure 3.1-12. The maximum 1980 density occurs between 32-48 km at 61.4 persons per square kilometre; and the maximum density in year 2000 occurs between 32-48 km at 69.5 persons per square kilometre.

## A.3.1.4 USES OF NEARBY LAND AND WATERS

### A.3.1.4.1 Site Vicinity Land Use

Surrounding land use within 8 km (5 miles) is predominantly agriculture. The major exception is the village of Springville in Erie County, approximately 5.6 km to the north. Other major nonagricultural land uses in the site vicinity are as follows:

| | |
|---|---|
| Residential Hamlet of West Valley | 5.5 km southeast |
| County Forest | 6 km south |
| Campground | 8 km southwest |

The dominant agricultural activity is related to the dairy industry, with meat-producing animals occurring on a smaller scale. In order to produce a spatial distribution of dairy and meat production for a small area, such as the area within 16 km of the site, the land area which is suitable for agricultural activities related to this production must be known. Averaging production by all of the land area in a county distorts the picture by including lands which are clearly not suitable (i.e., water bodies, forests and old fields, developed land, and steep terrain). For this reason, they are excluded from consideration in the present analysis. Basically, two types of farmland are considered important for the spatial distribution of milk cow and meat-producing animals--cropland and active pasture. These determine the carrying capacity of the land with respect to livestock grazing and the production of feed. In the site vicinity, these lands are identified from several sources. The 1967-1978 New York State Land Use and Natural Resources

Inventory (LUNR) for the site vicinity is shown in Figures A.3.1-13 and A.3.1-14. Recent site visits and a comparison with 1980 aerial photography and 1977 Cattaraugus County land use data indicate that little change has occurred since these were developed.

The number of dairy cows in the site vicinity is estimated by distance and direction, producing the distributions shown in Figures A.3.1-15 and A.3.1-16. This estimate is based upon county statistics on dairy cows/meat-producing animals obtained from the 1982 U.S. Census of Agriculture and local agriculture extension service data, and estimates of agricultural lands as described in Supplement A.3.1-C. These data indicate that in the site vicinity, dairy cows occur at the rate of approximately one head for each 4.4 ha of active pasture land/cropland. Meat-producing animals of all types occur at a rate of approximately one head for each 4.6 ha. Meat-producing animals include cull cows, heifers, calves, beef cows, sheep, and lambs. The distribution of these animals is shown in Figures A.3.1-17 and A.3.1-18.

Agricultural production statistics are available for counties, but are not disaggregated by township. However, the amount of cropland and pastureland for each township in the site vicinity is known from Soil Conservation reports. For the purposes of this analysis, it is assumed that the quantity of cropland and pastureland in each township is proportional to each township's share of county agricultural production. Production and sale of the important agricultural commodities (with potential for uptake directly or through the food chain) in Cattaraugus County and the estimates for site vicinity townships are shown in Table 3.1-14. Some of the townships shown are only partially within 8 km of the site; therefore, the data tend to overestimate agricultural activity in the site vicinity. Concord Township in Erie County is excluded since Springville occupies a major part of the (small) portion of the township's agricultural land that is within the 8-kilometre (5-miles) site vicinity.

Annual milk production per cow averaged 5,035 kg in 1980 in Cattaraugus County (N.Y. State Crop Reporting Service, June 1981). Approximately 1 ha of cropland was required to produce 7,258 kg (dry) of food annually for each head of cattle. Most of the silage and hay crop produced locally are consumed by the local livestock population; therefore, much of the reported "cropland" actually serves the same function as "pasture" (Ryder, 1982). This is supplemented by concentrates (feed) purchased from other sources, an average of 6 kg per cow/day for New York farms in 1980. Towns located entirely or partially within the site vicinity (8 km) produced 6,397 ha of corn silage and hay crops in 1980, sufficient to support 6,320 head of cattle, which could in theory produce a total of 31.75 million kg of milk at the (above) average production of 5,035 kg per head. Table A.3.1-14 indicates that actual production in these towns was closer to 27.4 million kg.

Agricultural lands which are cultivated to produce fruits and vegetables are not as pervasive as the cropland/pasture devoted to dairy cow production. Fields also tend to be smaller and are not distributed in proportion to the occurrence of farmland in general; rather it has been determined that fewer towns contain disproportionately larger shares of these lands. The distribution of these lands in the site vicinity relies on estimates of each town's share of its county's (Cattaraugus and Erie) productive lands, which were provided by County Agricultural Extension Agents (Nelson 1983, written communication; Deibel 1984, personal communication). These lands are, however, assumed to occur in each sector, in direct relation to the proportion of town land contained within that sector. Crops include lettuce, cabbage, broccoli, spinach, snap beans, tomatoes, sweet corn, potatoes, grapes, and apples. Total land area devoted for this produce in Erie and Cattaraugus Counties is estimated at 4,152 ha and 939 ha respectively. The estimated distribution of this land in the site vicinity is shown in Figures A.3.1-19 and A.3.1-20.

Supplement A.3.1-C contains further information on uses of land in Cattaraugus and Erie Counties.

### A.3.1.4.2 Community Facilities and Institutions

The area is rural and there are very few places in the site vicinity where people are grouped in large numbers except for the schools and hospital which serve Springville and the Town of Ashford. These are described in Table A.3.1-15, and the locations are shown on Figure A.3.1-21.

### A.3.1.4.3 Water Use

Upper Cattaraugus Creek extends from Springville to Gowanda (32 km downstream from the site), and lower Cattaraugus extends from Gowanda to Lake Erie (62 km downstream from the site).

In March, 1974, NFS conducted a survey to confirm land and water use in and near Cattaraugus Creek from the confluence of Buttermilk Creek to Lake Erie. That survey concluded that land use patterns downstream of the site are primarily rural. No public water supplies use Cattaraugus Creek as a source of water, and the Creek is not developed for organized water contact recreation activities.

Fishing occurs primarily near the mouth of the Creek at Lake Erie, and to a much lesser extent at the Springville Dam. Boating is generally limited to the stretch of water within 3 km of the mouth of the Creek. Occasional canoeing occurs at Zoar Valley west of the site when water depth permits it.

### A.3.1.4.3.1 Lake Erie Commercial Fishery

Recent information on commercial fishing in the New York waters of Lake Erie is contained in the 1984 Annual Report to the Great Lakes Fishery Commission's Lake Erie Committee, by the New York Department of Environmental Conservation (NY DEC). The following, unless otherwise noted, is abstracted from this report.

The commercial fishing industry operating today in New York waters of Lake Erie is a fraction of the fishery that flourished in the latter part of the nineteenth century and the first half of the twentieth century. That fishery concentrated on the deep-water fish community and reaped bountiful harvests of lake trout, lake herring, lake whitefish and blue pike. By 1960, the high-value species of the deep-water fish community had been eliminated or drastically reduced in abundance by a combination of overfishing, environmental degradation and the expansion and naturalization of exotic fish populations, primarily rainbow smelt. The deep-water niche became occupied primarily by smelt, which are now the target of a major commercial fishing industry on the Ontario side of Lake Erie, but not in U.S. waters.

Since 1960, New York commercial fishing effort has focused on walleye and yellow perch, which are the most marketable components of the inshore fish community. The relatively deep Eastern Basin, which includes all of New York's Lake Erie waters, does not provide inshore percid habitat comparable to that found in western Lake Erie, so landings of yellow perch and walleye from New York were usually never more than a small fraction (less than five percent) of total Lake Erie landings for those species. The loss of the deep-water fish community from commercial production and the switch to yellow perch and walleye resulted in about a 75 percent drop in yield to the commercial fishery.

The commercial fishery in New York's Lake Erie waters is in controversy because of conflicts with sport fishing interests, primarily because walleye and yellow perch are highly valued by both the sport and commercial fisheries. More recently, the by-catch of trout and salmon in gill nets fished for yellow perch and walleye has become an increasing concern of sport fishermen. These conflicts have resulted in mounting pressure to ban the use of gill nets entirely.

The economic and political significance of sport fishing is expanding as sport fishing interest and activity grows throughout the Great Lakes region, including New York's Lake Erie coastline. Future commercial fishing in US waters of Lake Erie, particularly with gill nets, is uncertain. The NY DEC has made proposals for research and development to facilitate transition to nongill net fisheries for underutilized species such as suckers, freshwater drum and carp.

According to NY DEC policy, sport fishing is the paramount, "best use" of fishery resource, but well-controlled commercial fishing, when compatible with sport fishing, is a desirable use of that resource. Future regulatory action by NY DEC pertaining to commercial fishing in New York waters will depend upon determining the effect of commercial fishing on the fishery resource and/or the sport fishery. Commercial fishery regulations instituted in 1980 established a closed season for gill netting from March 15 until the first Saturday in May and limited gill netting effort to waters greater than 16.5-m (55-ft) deep. In 1982 a moratorium on the issuance of new commercial fishing licenses was established. In the absence of funding appropriations to permit development of alternative commercial fisheries, the moratorium will likely remain in effect.

Table A.3.1-16 summarizes commercial landings from New York waters of Lake Erie during 1983. In this year the harvest totaled 126,684 kg (279,290 lb), taken under 13 fishing licenses. In addition, an estimated 2,460 trout and salmon were caught incidentally in the commercial fish nets; 83 percent of the trout were two years old.

### A.3.1.4.3.2 Lake Erie Sport Fishing

The NY DEC conducted a limited creel census between June 20 and September 11, 1984, at Dunkirk Harbor and Sturgeon Point, New York, two popular fishing locations on eastern Lake Erie. Because of the limited scope of the survey, it is not possible to accurately assess the full nature of the nearshore Lake Erie sport fishery based upon the data provided by this survey. The total catch was undoubtedly greater, by some accounts as much as 5 to 6 times the catch recorded by the survey.

The survey results (1984 Annual Report, NY DEC) indicate 10,717 shore angler trips during the period, and 14,006 boat angler trips at both locations. The overall catch (all species) at Dunkirk was 10,951 fish, and at Sturgeon Point 15,284 fish. The species caught include walleye, yellow perch, and small mouth bass. The average catch is approximately 1 per trip.

### A.3.1.4.3.3 Cattaraugus Creek Sport Fishery

A creel census/angler survey was conducted by NY DEC on Cattaraugus Creek from September 10 - October 31, 1982, to assess the fall stream fishery for coho and chinook salmon (Lang, 1983). The results, presented to the Great Lakes Fishery Commission's Lake Erie Committee, conclude that catch rates for all species are very low and that most fishermen are local. It is suggested that a major reason for this is the time lapse between stocking and a major spawning run resulting from that stocking. Because the expanded stocking program for the Lake Erie tributaries only began in 1982, the major spawning runs would not be expected before 1983 or 1984. The salmon caught during the

course of the 1982 survey were probably the result of a relatively small stock of 75,000 coho introduced into Lake Erie tributaries in 1980, 75,000 chinook stocked into Canadaway Creek in 1981, and strays from plantings by other states. The study report anticipates that future stocks of these species, and consequently the catch rate, will improve from the 1982 level as the effects of an expanded program are realized. However, the results of a 1983 Cattaraugus Creek electrofishing survey indicate that while the run of chinook salmon in Cattaraugus Creek was encouraging, the run of adult coho salmon was disappointingly small in view of the large number (138,600) that were stocked in 1982. The reason for this is not clear.

The 1982 creel survey provides the following estimates of Cattaraugus Creek salmon sport fishery:

| | |
|---|---|
| Number of Angler Trips | 13,348 |
| Angler Hours | 41,296 |
| Average Fishing Time, Upper Cattaraugus (hours) | 3.3 |
| Average Fishing Time, Lower Cattaraugus (hours) | 3.0 |
| Coho Salmon Taken | 1,549 |
| Chinook Salmon Taken | 575 |
| Average Salmon per Trip | 0.16 |
| Average Length (mm) of Coho | 582 |
| Average Length (mm) of Chinook | 720 |

A comprehensive year-long creel survey of Lake Erie and the New York tributaries, including Cattaraugus Creek, was conducted during 1984. The results of this survey will be made available during 1985, and will include other important sport fish species occurring in Cattaraugus Creek, including trout.

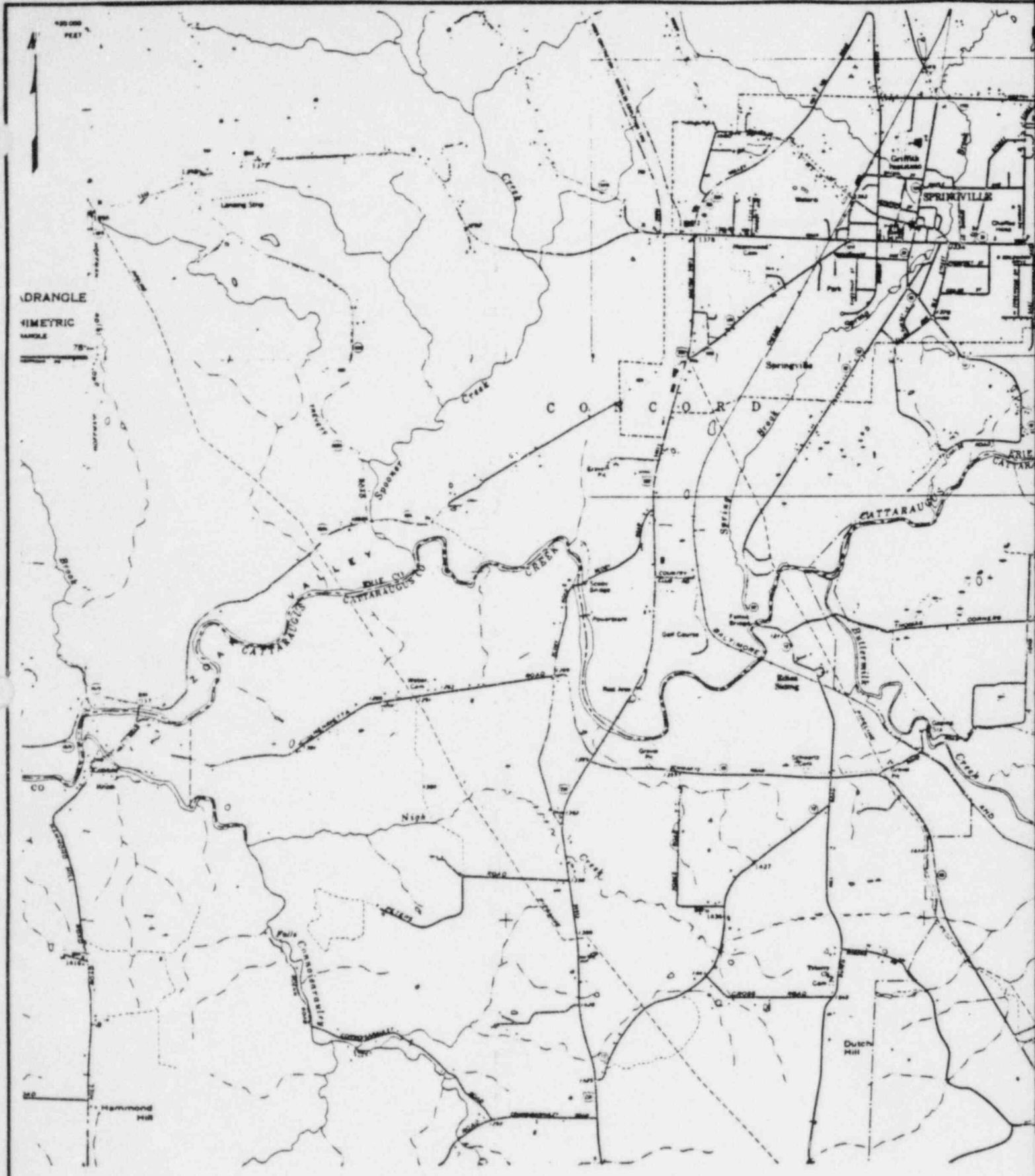
TABLE A.3.1-1

LOCATIONS AND POPULATIONS OF TOWNS AND VILLAGES
PARTIALLY OR TOTALLY WITHIN 16 KILOMETRES OF THE SITE

| Town/ Village* | Distance/Direction km | | Population 1970 | Population 1980 | Percent Change |
|---|---|---|---|---|---|
| Ashford | -- | -- | 1,577 | 1,922 | 21.9 |
| Concord | 4.8 | N | 7,573 | 8,171 | 7.9 |
| Springville | 5.6 | N | 4,350 | 4,285 | -1.5 |
| Sardinia | 6.4 | NNE | 2,505 | 2,792 | 11.5 |
| Yorkshire | 5.6 | NNE | 2,627 | 3,620 | 37.8 |
| Delevan | 14.4 | ENE | 994 | 1,113 | 12.0 |
| Machias | 6.4 | ESE | 1,749 | 2,058 | 17.7 |
| Franklinville | 12.5 | SSE | 2,847 | 3,102 | 9.0 |
| Ellicottville | 7.7 | S | 1,779 | 1,677 | -5.7 |
| Mansfield | 12.0 | SSW | 605 | 784 | 29.6 |
| East Otto | 4.8 | SW | 910 | 942 | 3.5 |
| Otto | 12.0 | WSW | 731 | 828 | 13.3 |
| Collins | 12.0 | WNW | 6,400 | 5,037 | -21.3 |
| North Collins | 14.4 | NW | 4,090 | 3,791 | -7.3 |
| TOTAL ALL TOWNS | | | 38,737 | 40,122 | 3.6 |

*Village population is included in the respective town.

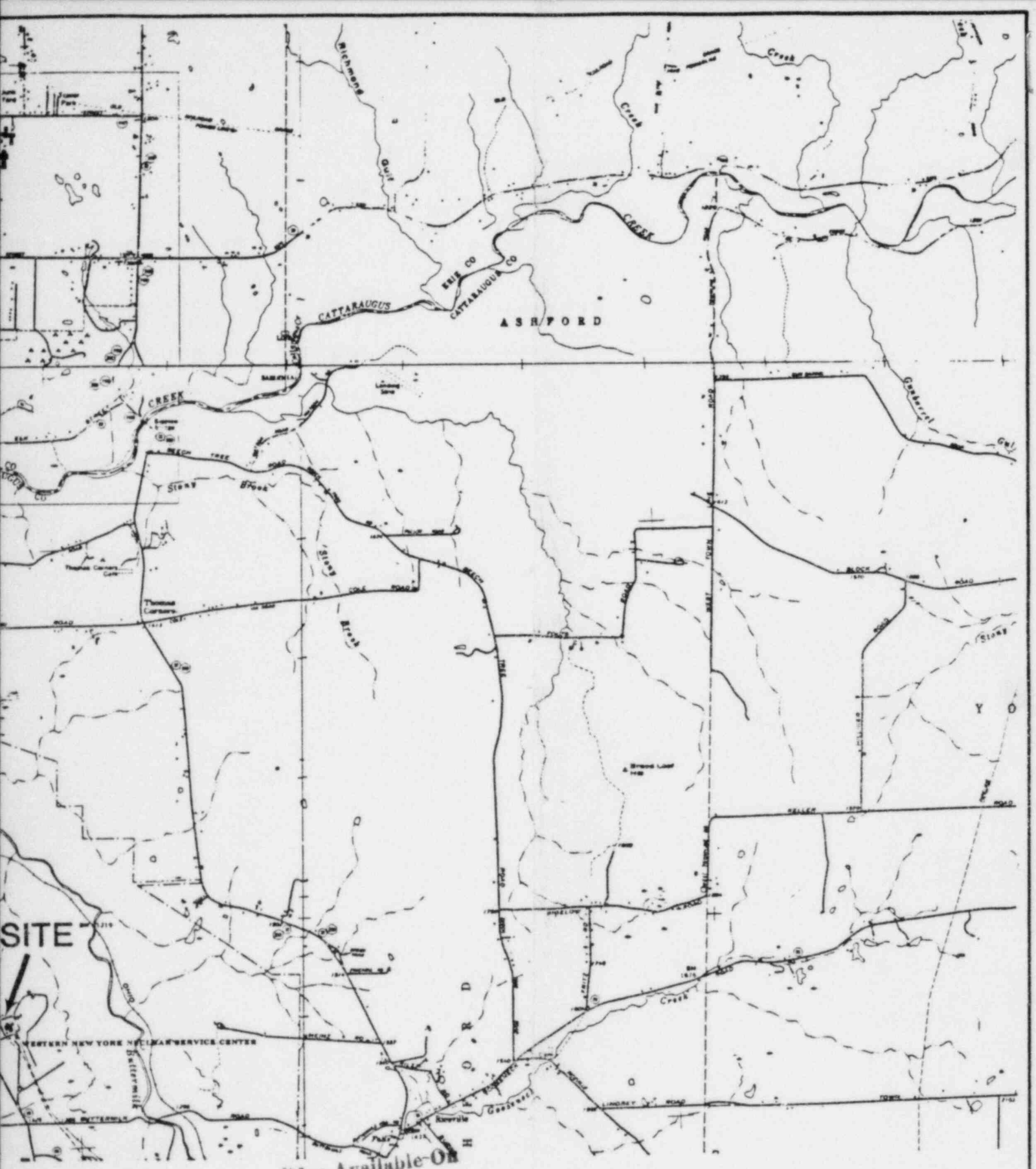
Source: U.S. Bureau of the Census, March 1981.




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1 .5

REFERENCE:
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
7.5 MINUTE SERIES PLANIMETRIC QUADRANGLES:
ASHFORD HOLLOW, SPRINGVILLE, COLLINS CENTER,
WEST VALLEY, AND SARDINIA.




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# SITE VICINITY MAP
## NORTHERN PORTION

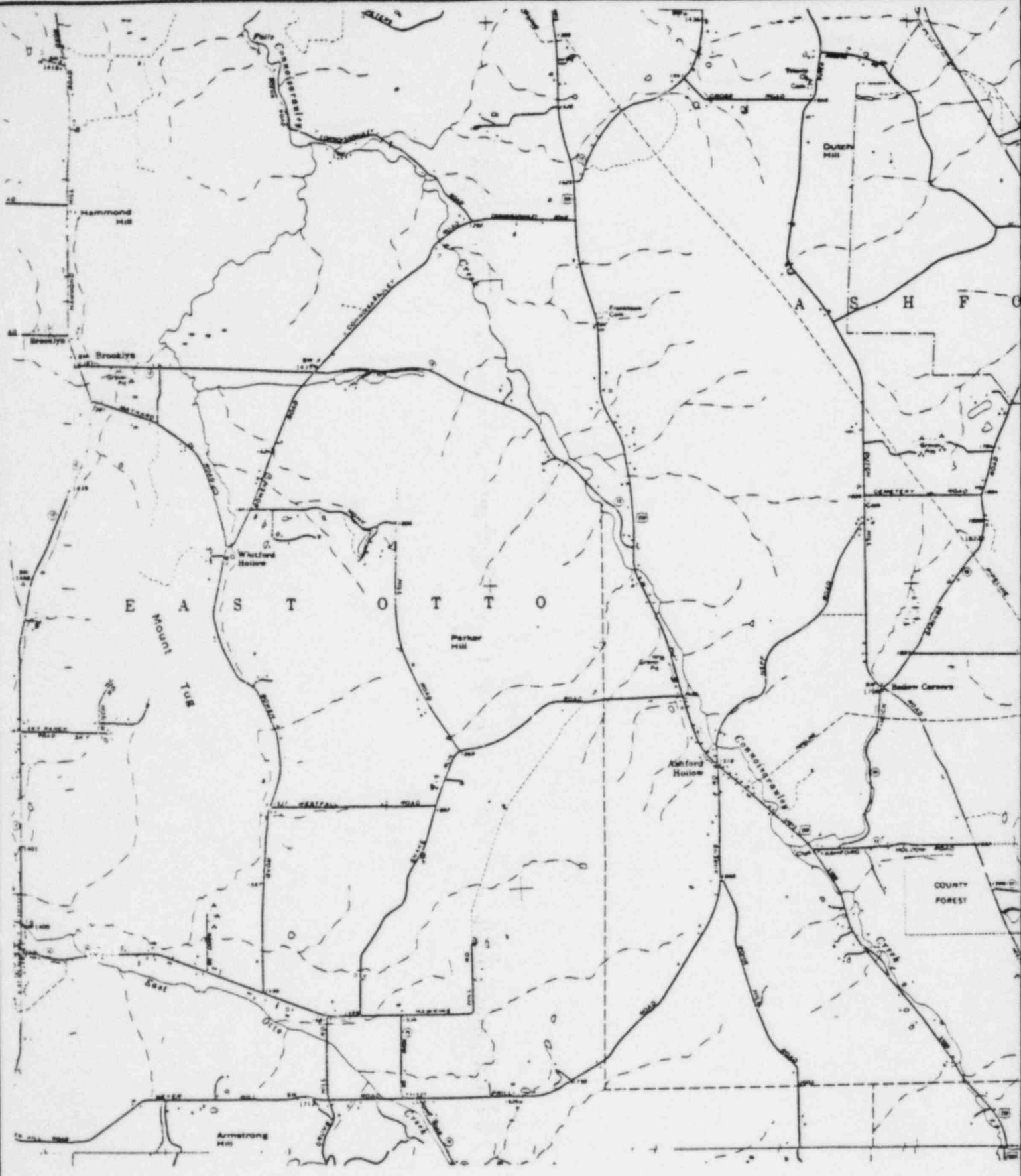
FIGURE A. 3.1-2

TABLE A.3.1-2

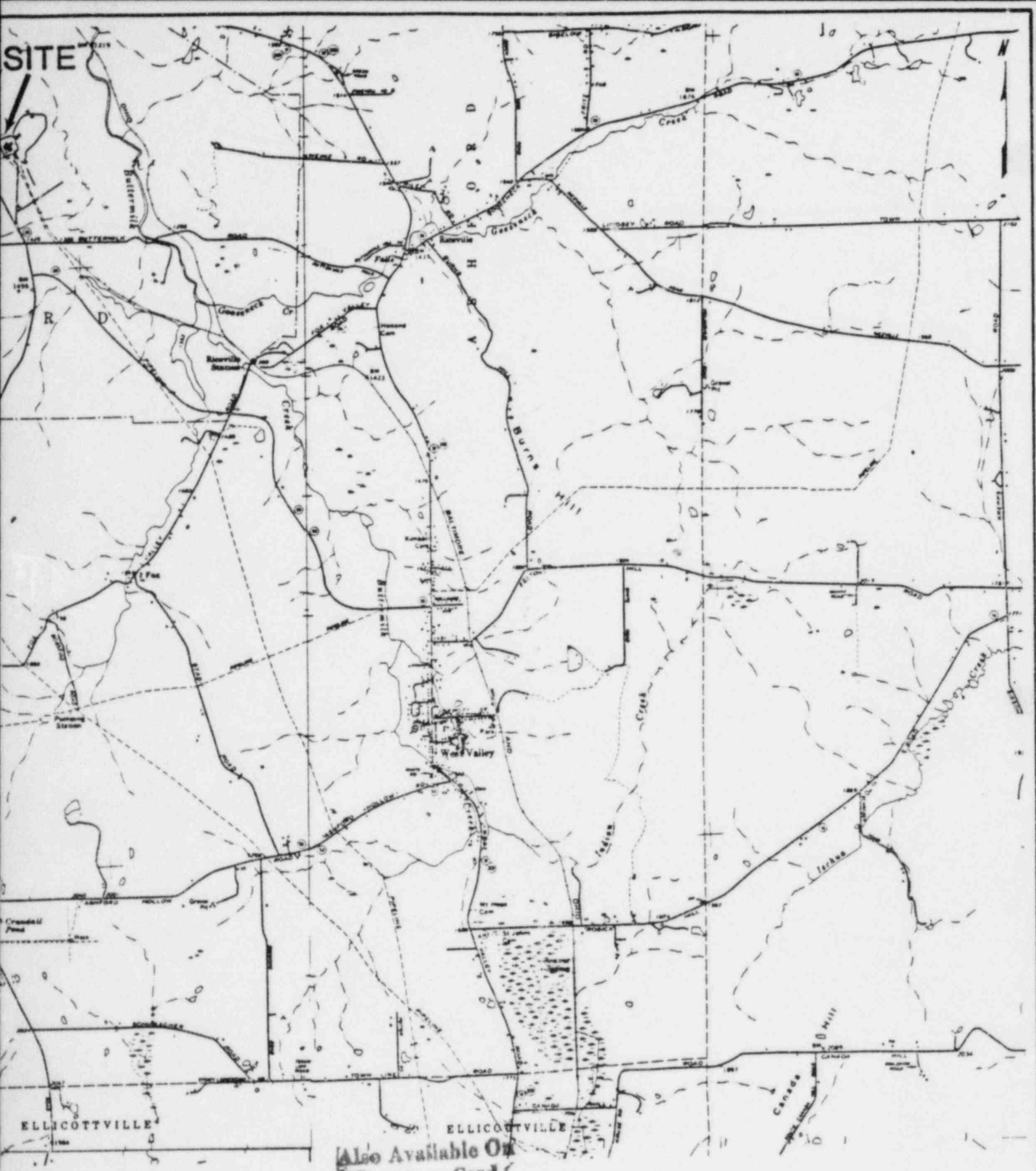
POPULATIONS OF COUNTIES IN THE 80 KILOMETRE SITE REGION
OF NEW YORK AND PENNSYLVANIA
(1970 and 1980)

| County | Population | | |
|---|---|---|---|
| | 1970 | 1980 | Percent Change |
| New York | 18,241,391 | 17,557,288 | -3.8 |
| Cattaraugus | 81,666 | 85,697 | 4.9 |
| Erie | 1,113,491 | 1,015,472 | -8.8 |
| Allegheny | 46,458 | 51,742 | 11.4 |
| Wyoming | 37,688 | 39,895 | 5.9 |
| Chautauqua | 147,305 | 146,925 | -0.3 |
| Livingston | 54,041 | 57,006 | 5.5 |
| Genesee | 58,722 | 59,400 | 1.2 |
| Niagara | 235,720 | 227,101 | -3.7 |
| Steuben | 99,546 | 99,135 | -0.4 |
| Pennsylvania | 11,800,766 | 11,866,728 | 0.6 |
| Warren | 47,682 | 47,449 | -0.5 |
| McKean | 51,915 | 50,635 | -2.5 |
| Potter | 16,395 | 17,726 | 8.1 |

Source: U.S. Bureau of the Census, March 1981.




REFERENCE:
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
7.5 MINUTE SERIES PLANIMETRIC QUADRANGLES:
ASHFORD HOLLOW, SPRINGVILL, COLLINS CENTER,
WEST VALLEY, AND SARDINIA.




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# SITE VICINITY MAP
## SOUTHERN PORTION

FIGURE A.3.1-3

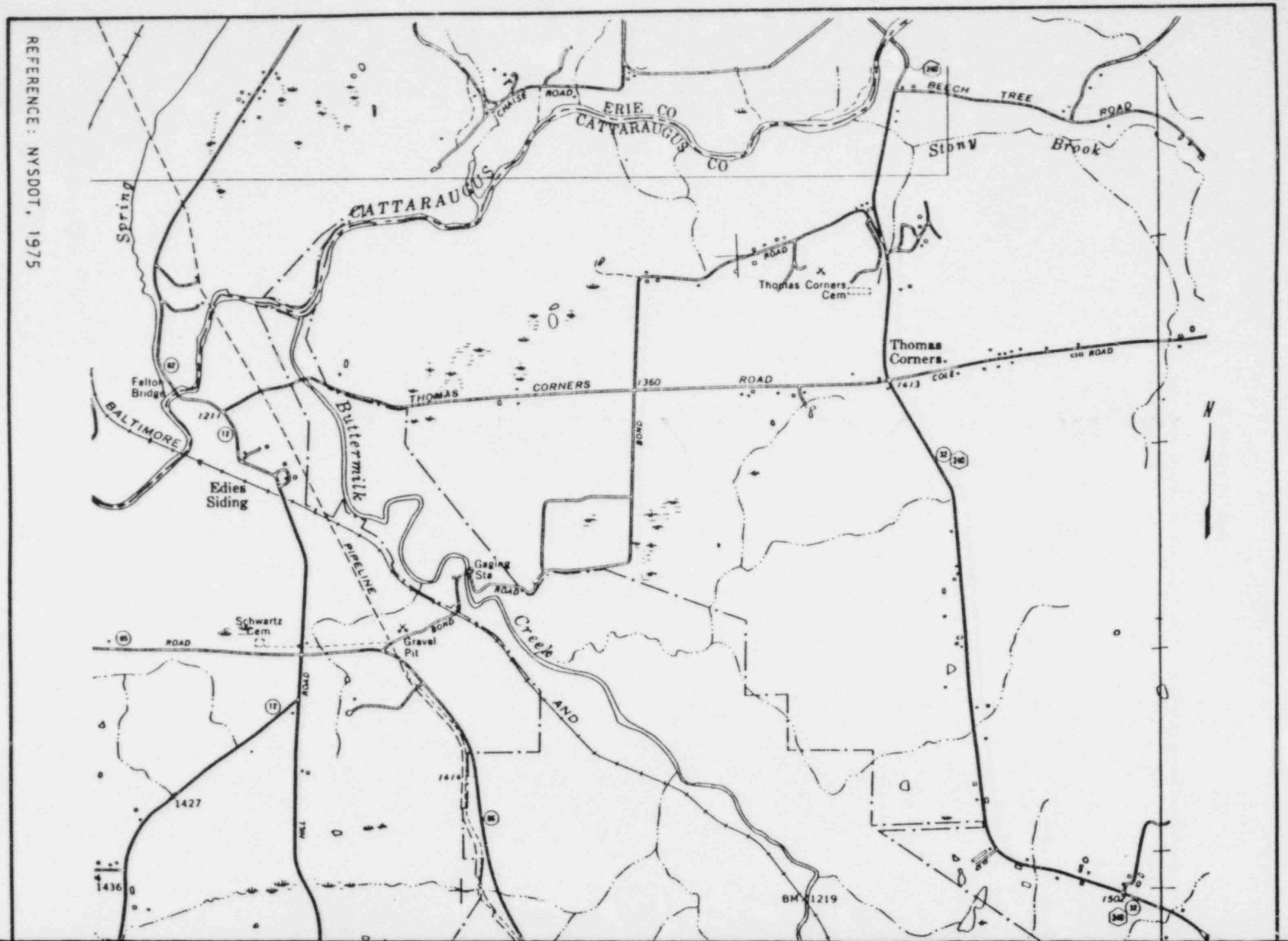
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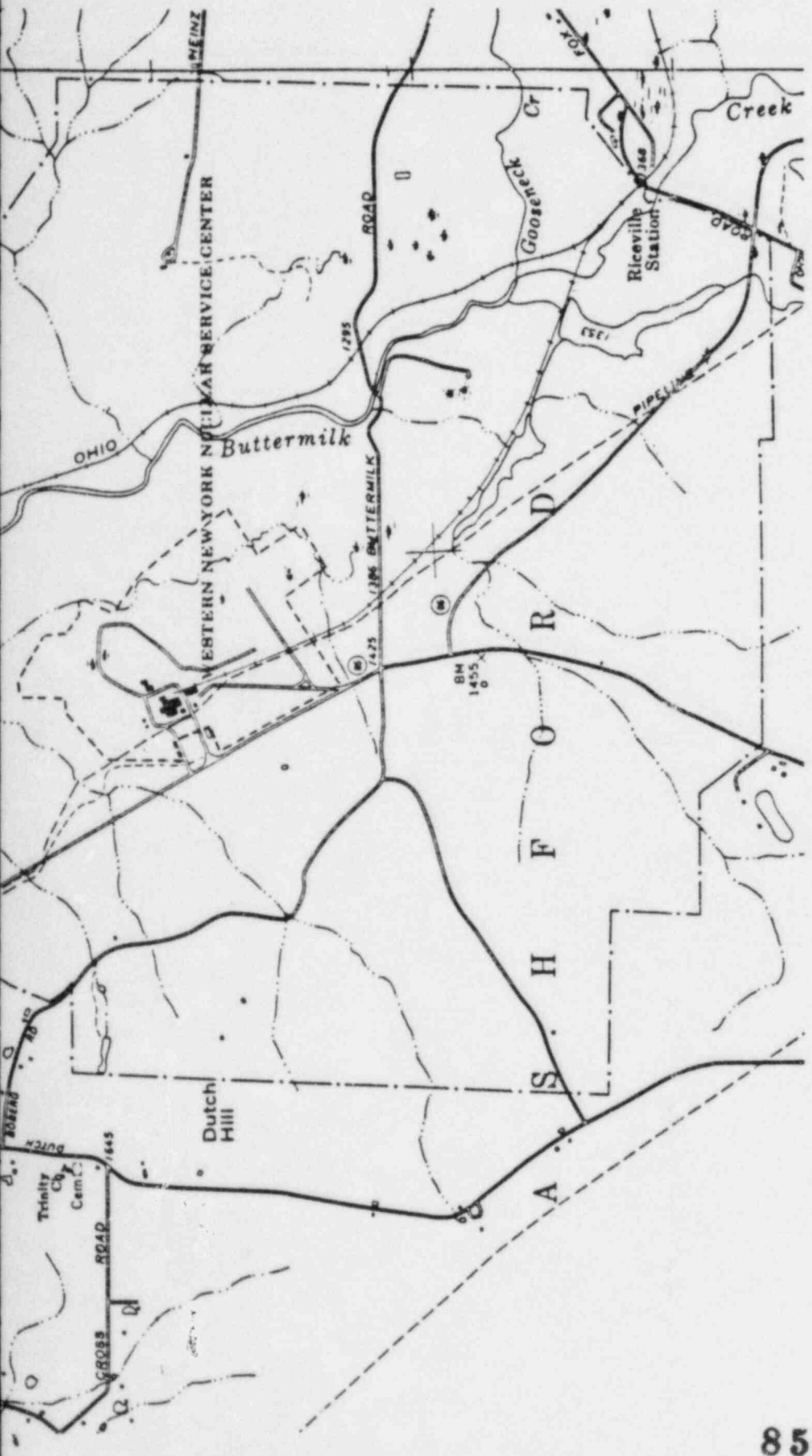
TABLE A.3.1-3

1980 POPULATION ESTIMATES BY SECTOR
WITHIN 16 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration Trend

| | Kilometres (Miles) | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | 0-1.6 (0-1) | 1.6-3.2 (1-2) | 3.2-4.8 (2-3) | 4.8-6.4 (3-4) | 6.4-8.0 (4-5) | 8.0-16 (5-10) | 0-16 (0-10) Total |
| N | 0 | 0 | 29 | 710 | 2,051 | 1,301 | 4,541 |
| NNE | 0 | 15 | 47 | 28 | 49 | 402 | 541 |
| NE | 0 | 13 | 3 | 48 | 31 | 831 | 926 |
| ENE | 0 | 24 | 8 | 74 | 19 | 1,987 | 2,022 |
| E | 0 | 39 | 100 | 64 | 85 | 1,040 | 1,328 |
| ESE | 0 | 8 | 58 | 31 | 24 | 1,290 | 1,411 |
| SE | 0 | 4 | 23 | 438 | 58 | 198 | 721 |
| SSE | 0 | 3 | 37 | 64 | 38 | 160 | 302 |
| S | 0 | 14 | 17 | 33 | 49 | 422 | 535 |
| SSW | 0 | 5 | 12 | 141 | 38 | 295 | 491 |
| SW | 0 | 7 | 25 | 28 | 40 | 440 | 540 |
| WSW | 0 | 10 | 23 | 27 | 57 | 294 | 411 |
| W | 0 | 27 | 57 | 39 | 16 | 259 | 398 |
| WNW | 7 | 34 | 19 | 23 | 14 | 348 | 445 |
| NW | 0 | 27 | 9 | 65 | 36 | 559 | 696 |
| NNW | 0 | 3 | 22 | 430 | 1,204 | 721 | 2,380 |
| Total | 7 | 233 | 489 | 2,243 | 4,259 | 10,457 | 17,688 |
| Cumulative Total | 7 | 240 | 729 | 2,972 | 7,231 | 17,688 | |

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REFERENCE: NYSDOT, 1975
ERIE CO
CATTARAUGUS CO
CATTARAUGUS
CHASE ROAD
BEECH TREE ROAD
Stony Brook
Spring
Thomas Corners Cem
Thomas Corners
COLE ROAD
Felton Bridge
BALTIMORE
THOMAS CORNERS ROAD
Buttermilk
Edies Siding
PIPELINE
Gaging Sta
Schwartz Cem
Gravel Pit
Creek
AND
1427
1436
BM 1219
N




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# SITE BOUNDARY AND EXCLUSION ZONE

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FIGURE A. 3.1-4

TABLE A.3.1-4

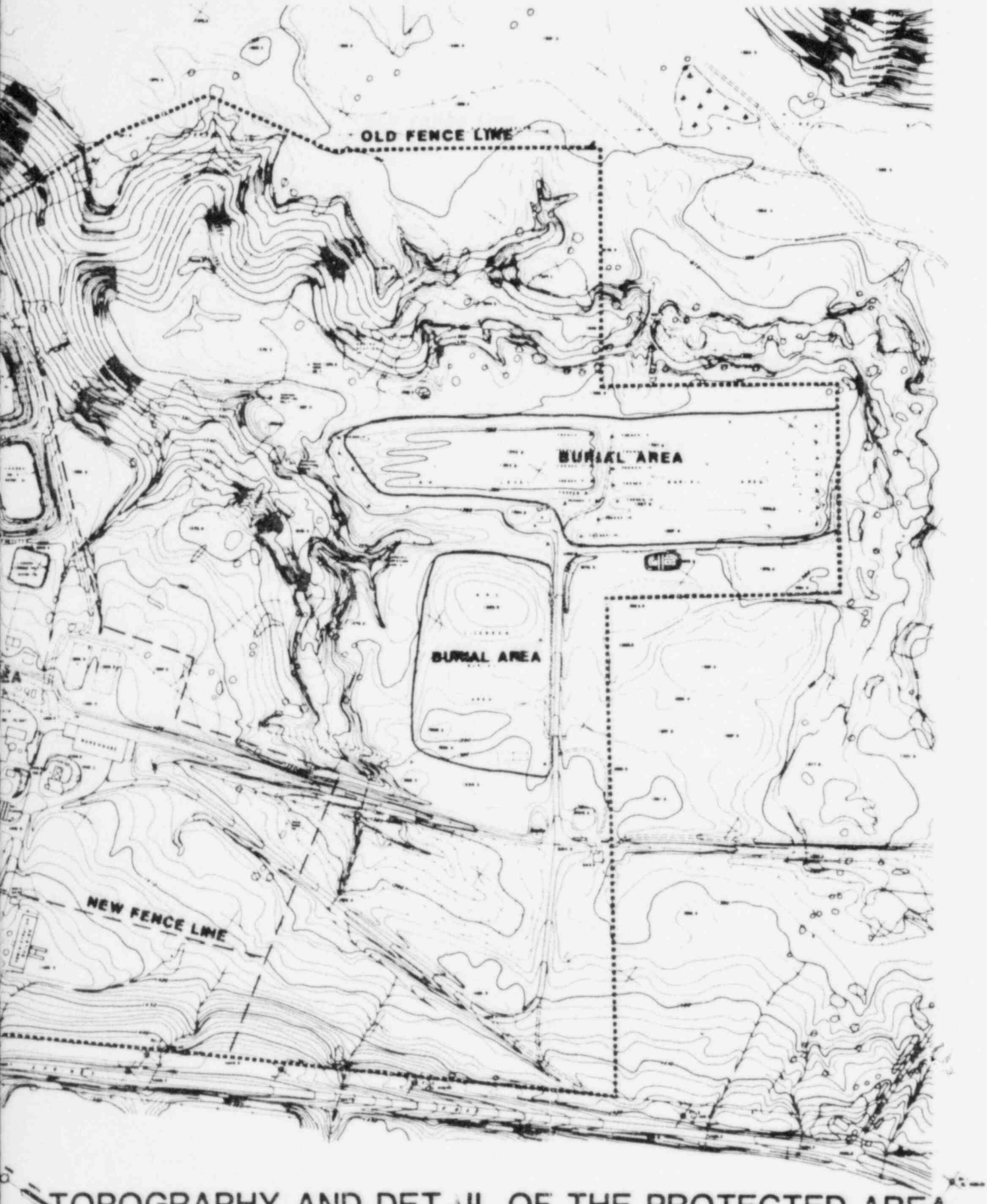
1990 POPULATION PROJECTIONS BY SECTOR
WITHIN 16 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration Trend

| | Kilometres (Miles) | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | 0-1.6 (0-1) | 1.6-3.2 (1-2) | 3.2-4.8 (2-3) | 4.8-6.4 (3-4) | 6.4-8.0 (4-5) | 8.0-16 (5-10) | 16 (10) Total |
| N | 0 | 0 | 29 | 672 | 2,369 | 1,486 | 4,556 |
| NNE | 0 | 15 | 46 | 27 | 54 | 432 | 574 |
| NE | 0 | 12 | 3 | 47 | 32 | 908 | 1,002 |
| ENE | 0 | 24 | 7 | 75 | 22 | 1,938 | 2,066 |
| E | 0 | 38 | 98 | 66 | 100 | 1,326 | 1,628 |
| ESE | 0 | 7 | 56 | 33 | 32 | 1,719 | 1,847 |
| SE | 0 | 4 | 22 | 429 | 56 | 239 | 750 |
| SSE | 0 | 3 | 36 | 62 | 37 | 167 | 305 |
| S | 0 | 14 | 17 | 32 | 47 | 424 | 534 |
| SSW | 0 | 5 | 12 | 138 | 37 | 277 | 469 |
| SW | 0 | 7 | 25 | 27 | 38 | 413 | 510 |
| WSW | 0 | 10 | 22 | 25 | 53 | 291 | 401 |
| W | 0 | 26 | 56 | 38 | 15 | 288 | 423 |
| WNW | 7 | 34 | 19 | 22 | 17 | 357 | 456 |
| NW | 0 | 26 | 11 | 76 | 43 | 645 | 801 |
| NNW | 0 | 3 | 23 | 408 | 1,099 | 845 | 2,378 |
| Total | 7 | 228 | 482 | 2,177 | 4,051 | 11,755 | 18,700 |
| Cumulative Total | 7 | 235 | 717 | 2,894 | 6,945 | 18,700 | |




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TOPOGRAPHY AND DETAIL OF THE PROTECTED AREA

FIGURE A 3 1-5

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TABLE A.3.1-5

2000 POPULATION PROJECTIONS BY SECTOR
WITHIN 16 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration Trend

| | Kilometres (Miles) | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | 0-1.6 (0-1) | 1.6-3.2 (1-2) | 3.2-4.8 (2-3) | 4.8-6.4 (3-4) | 6.4-8.0 (4-5) | 8.0-16 (5-10) | 16 (10) Total |
| N | 0 | 0 | 30 | 649 | 2,288 | 1,583 | 4,550 |
| NNE | 0 | 15 | 48 | 28 | 55 | 428 | 574 |
| NE | 0 | 13 | 3 | 49 | 37 | 967 | 1,069 |
| ENE | 0 | 25 | 8 | 84 | 27 | 2,285 | 2,429 |
| E | 0 | 41 | 103 | 75 | 124 | 1,296 | 1,639 |
| ESE | 0 | 8 | 59 | 35 | 36 | 1,426 | 1,564 |
| SE | 0 | 5 | 23 | 452 | 59 | 214 | 753 |
| SSE | 0 | 3 | 38 | 66 | 39 | 174 | 320 |
| S | 0 | 15 | 18 | 34 | 50 | 429 | 546 |
| SSW | 0 | 5 | 13 | 146 | 39 | 282 | 485 |
| SW | 0 | 7 | 26 | 28 | 38 | 422 | 521 |
| WSW | 0 | 10 | 23 | 25 | 54 | 300 | 412 |
| W | 0 | 28 | 59 | 39 | 15 | 277 | 418 |
| WNW | 7 | 35 | 20 | 23 | 18 | 338 | 441 |
| NW | 0 | 28 | 11 | 82 | 46 | 686 | 853 |
| NNW | 0 | 3 | 25 | 395 | 1,038 | 911 | 2,372 |
| Total | 7 | 241 | 507 | 2,210 | 3,963 | 12,018 | 18,946 |
| Cumulative Total | 7 | 248 | 755 | 2,965 | 6,928 | 18,946 | |

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TABLE A.3.1.-6

1980 POPULATION PROJECTIONS BY SECTOR
WITHIN 16-80 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration Trend

| | Kilometres (Miles) | | | | | |
|---|---|---|---|---|---|---|
| Sector | 16 (10) Total | 16-32 (10-20) | 32-48 (20-30) | 48-64 (30-40) | 64-80 (40-50) | 80 (50) Total |
| N | 4,541 | 17,312 | 58,936 | 164,115 | 79,047 | 323,951 |
| NNE | 541 | 5,814 | 7,884 | 14,611 | 29,676 | 58,526 |
| NE | 926 | 3,520 | 3,582 | 11,765 | 11,799 | 31,592 |
| ENE | 2,022 | 4,782 | 2,442 | 12,515 | 15,377 | 37,138 |
| E | 1,328 | 1,851 | 4,274 | 2,120 | 7,598 | 17,171 |
| ESE | 1,411 | 1,290 | 3,462 | 6,451 | 20,161 | 32,775 |
| SE | 721 | 3,022 | 5,925 | 5,789 | 5,789 | 5,742 |
| SSE | 302 | 963 | 27,222 | 9,478 | 7,989 | 45,954 |
| S | 535 | 3,328 | 8,430 | 27,006 | 4,280 | 38,579 |
| SSW | 491 | 2,584 | 4,908 | 2,120 | 18,999 | 29,102 |
| SW | 540 | 2,668 | 5,481 | 13,458 | 55,247 | 77,394 |
| WSW | 411 | 1,877 | 6,171 | 7,639 | 11,026 | 27,124 |
| W | 398 | 6,184 | 3,334 | 33,811 | 8,255 | 51,982 |
| WNW | 445 | 4,833 | 13,582 | 0 | 0 | 18,860 |
| NW | 696 | 9,151 | 21,185 | 983 | 22,090 | 54,105 |
| NNW | 2,380 | 14,547 | 173,055 | 407,341 | 158,810 | 783,133 |
| Total | 17,688 | 83,726 | 349,873 | 718,123 | 469,563 | 1,638,973 |
| Cumulative Total | 17,688 | 101,413 | 451,287 | 1,169,410 | 1,638,973 | |

TABLE A.3.1-7

1990 POPULATION PROJECTIONS BY SECTOR
WITHIN 16-80 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration Trend

| | Kilometres (Miles) | | | | | |
|---|---|---|---|---|---|---|
| Sector | 16 (10) Total | 16-32 (10-20) | 32-48 (20-30) | 48-64 (30-40) | 64-80 (40-50) | 80 (50) Total |
| N | 4,556 | 17,930 | 64,992 | 184,287 | 94,036 | 365,801 |
| NNE | 574 | 6,236 | 10,071 | 15,196 | 30,500 | 62,577 |
| NE | 1,002 | 3,742 | 4,300 | 11,712 | 13,609 | 34,365 |
| ENE | 2,066 | 4,895 | 2,413 | 12,959 | 16,014 | 38,347 |
| E | 1,628 | 1,682 | 5,028 | 2,170 | 7,834 | 18,342 |
| ESE | 1,847 | 1,235 | 4,079 | 7,249 | 21,747 | 36,157 |
| SE | 750 | 3,836 | 7,041 | 6,083 | 5,920 | 22,630 |
| SSE | 305 | 902 | 29,324 | 11,529 | 8,534 | 50,594 |
| S | 534 | 3,551 | 9,481 | 22,673 | 4,583 | 40,822 |
| SSW | 469 | 3,159 | 4,836 | 2,278 | 18,877 | 29,619 |
| SW | 510 | 2,791 | 6,372 | 13,917 | 57,614 | 81,204 |
| WSW | 401 | 2,029 | 6,327 | 8,619 | 13,152 | 30,528 |
| W | 423 | 6,857 | 3,554 | 34,193 | 7,787 | 52,814 |
| WNW | 456 | 4,977 | 13,471 | 0 | 0 | 18,904 |
| NW | 801 | 8,885 | 21,927 | 980 | 22,477 | 55,070 |
| NNW | 2,378 | 16,287 | 176,539 | 375,015 | 189,398 | 759,617 |
| Total | 18,700 | 87,994 | 369,755 | 708,880 | 512,082 | 1,697,391 |
| Cumulative Total | 18,700 | 106,694 | 476,449 | 1,185,309 | 1,697,391 | |

-COM005238:160H

TABLE A.3.1-8

2000 POPULATION PROJECTIONS BY SECTOR
WITHIN 16-80 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: 1970-1975 Migration

| | Kilometres (Miles) | | | | | |
|---|---|---|---|---|---|---|
| Sector | 16 (10) Total | 16-32 (10-20) | 32-48 (20-30) | 48-64 (30-40) | 64-80 (40-50) | 80 (50) Total |
| N | 4,550 | 21,040 | 75,611 | 223,854 | 117,576 | 442,631 |
| NNE | 574 | 6,585 | 11,781 | 16,093 | 31,071 | 66,104 |
| NE | 1,069 | 4,029 | 4,817 | 11,920 | 15,005 | 36,840 |
| ENE | 2,429 | 5,460 | 2,452 | 13,206 | 16,864 | 38,347 |
| E | 1,639 | 1,784 | 5,628 | 2,207 | 8,039 | 19,297 |
| ESE | 1,564 | 1,279 | 4,475 | 7,443 | 24,280 | 39,041 |
| SE | 753 | 2,844 | 7,884 | 6,218 | 6,268 | 23,041 |
| SSE | 320 | 929 | 30,615 | 12,946 | 9,099 | 53,909 |
| S | 546 | 3,756 | 10,145 | 22,814 | 4,687 | 41,948 |
| SSW | 485 | 3,411 | 4,659 | 2,418 | 18,496 | 29,469 |
| SW | 521 | 2,908 | 6,948 | 15,082 | 59,997 | 85,456 |
| WSW | 412 | 2,136 | 6,826 | 9,827 | 15,230 | 34,431 |
| W | 418 | 7,308 | 3,778 | 36,531 | 8,924 | 56,959 |
| WNW | 441 | 4,649 | 14,740 | 0 | 0 | 19,830 |
| NW | 853 | 9,157 | 25,398 | 985 | 22,832 | 55,070 |
| NNW | 2,372 | 19,221 | 177,701 | 333,236 | 197,580 | 730,110 |
| Total | 18,946 | 96,496 | 393,458 | 714,780 | 555,948 | 1,779,628 |
| Cumulative Total | 18,946 | 115,442 | 508,900 | 1,223,680 | 1,779,628 | |

-COM005238:160H

TABLE A.3.1-9

1990 POPULATION PROJECTIONS BY SECTOR
WITHIN 16 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: No Migration

| | Kilometres (Miles) | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | 0-1.6 (0-1) | 1.6-3.2 (1-2) | 3.2-4.8 (2-3) | 4.8-6.4 (3-4) | 6.4-8.0 (4-5) | 8.0-16 (5-10) | 16 (10) Total |
| N | 0 | 0 | 33 | 782 | 2,756 | 1,691 | 5,262 |
| NNE | 0 | 17 | 53 | 31 | 63 | 503 | 667 |
| NE | 0 | 14 | 3 | 54 | 38 | 1,057 | 1,166 |
| ENE | 0 | 28 | 9 | 88 | 25 | 2,256 | 2,406 |
| E | 0 | 45 | 114 | 77 | 117 | 1,542 | 1,895 |
| ESE | 0 | 9 | 66 | 38 | 37 | 2,000 | 2,150 |
| SE | 0 | 5 | 26 | 499 | 66 | 297 | 875 |
| SSE | 0 | 3 | 42 | 73 | 43 | 194 | 355 |
| S | 0 | 17 | 19 | 38 | 55 | 453 | 582 |
| SSW | 0 | 5 | 14 | 161 | 43 | 322 | 545 |
| SW | 0 | 8 | 29 | 31 | 44 | 480 | 592 |
| WSW | 0 | 11 | 25 | 29 | 62 | 339 | 466 |
| W | 0 | 31 | 65 | 44 | 17 | 329 | 486 |
| WNW | 8 | 39 | 22 | 26 | 20 | 416 | 531 |
| NW | 0 | 31 | 12 | 88 | 50 | 750 | 931 |
| NNW | 0 | 3 | 27 | 475 | 1,279 | 984 | 2,768 |
| Total | 8 | 266 | 559 | 2,534 | 4,715 | 13,595 | 21,677 |
| Cumulative Total | 8 | 274 | 833 | 3,367 | 8,082 | 21,677 | |

-COM005238:160H

TABLE A.3.1-10
2000 POPULATION PROJECTIONS BY SECTOR
WITHIN 16 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: No Migration

| Sector | Kilometres (Miles) 0-1.6 (0-1) | 1.6-3.2 (1-2) | 3.2-4.8 (2-3) | 4.8-6.4 (3-4) | 6.4-8.0 (4-5) | 8.0-16 (5-10) | 16 (10) Total |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 38 | 821 | 2,896 | 1,942 | 5,697 |
| NNE | 0 | 20 | 61 | 36 | 70 | 542 | 729 |
| NE | 0 | 17 | 4 | 62 | 47 | 1,224 | 1,354 |
| ENE | 0 | 32 | 101 | 106 | 35 | 2,891 | 3,074 |
| E | 0 | 51 | 131 | 95 | 157 | 1,641 | 2,075 |
| ESE | 0 | 10 | 75 | 45 | 46 | 1,804 | 1,980 |
| SE | 0 | 6 | 30 | 572 | 75 | 284 | 953 |
| SSE | 0 | 4 | 48 | 84 | 49 | 220 | 405 |
| S | 0 | 19 | 22 | 43 | 63 | 477 | 624 |
| SSW | 0 | 6 | 16 | 184 | 50 | 357 | 613 |
| SW | 0 | 10 | 33 | 35 | 49 | 534 | 661 |
| WSW | 0 | 13 | 29 | 32 | 68 | 380 | 522 |
| W | 0 | 35 | 74 | 50 | 19 | 341 | 519 |
| WNW | 7 | 45 | 26 | 30 | 23 | 427 | 558 |
| NW | 0 | 35 | 151 | 103 | 58 | 868 | 1,079 |
| NNW | 0 | 4 | 31 | 500 | 1,314 | 1,152 | 3,001 |
| Total | 7 | 307 | 643 | 2,798 | 5,019 | 15,070 | 23,844 |
| Cumulative Total | 7 | 314 | 957 | 3,755 | 8,774 | 23,844 | |

-COM005238:160H

TABLE A.3.1-11
1990 POPULATION PROJECTIONS BY SECTOR
WITHIN 16-80 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: No Migration

| | Kilometres (Miles) | | | | | |
|---|---|---|---|---|---|---|
| Sector | 16 (10) Total | 16-32 (10-20) | 32-48 (20-30) | 48-64 (30-40) | 64-80 (40-50) | 80 (50) Total |
| N | 5,262 | 20,862 | 75,621 | 214,426 | 109,415 | 425,586 |
| NNE | 667 | 7,256 | 11,718 | 17,681 | 35,488 | 72,810 |
| NE | 1,166 | 4,353 | 5,003 | 13,628 | 15,835 | 39,985 |
| ENE | 2,406 | 5,695 | 2,808 | 15,079 | 18,633 | 44,621 |
| E | 2,150 | 1,958 | 5,850 | 2,525 | 9,115 | 21,343 |
| ESE | 2,150 | 1,437 | 4,747 | 8,435 | 25,114 | 41,883 |
| SE | 875 | 3,299 | 8,193 | 7,071 | 6,570 | 26,008 |
| SSE | 355 | 1,050 | 34,119 | 12,868 | 8,975 | 57,367 |
| S | 582 | 4,106 | 10,970 | 23,912 | 4,819 | 44,389 |
| SSW | 545 | 3,650 | 5,565 | 2,438 | 19,851 | 32,049 |
| SW | 592 | 3,247 | 7,414 | 16,177 | 66,251 | 93,681 |
| WSW | 466 | 2,361 | 7,362 | 10,029 | 15,303 | 35,521 |
| W | 486 | 7,979 | 4,136 | 39,785 | 9,060 | 61,446 |
| WNW | 531 | 5,791 | 15,674 | 0 | 0 | 21,996 |
| NW | 931 | 10,338 | 25,513 | 980 | 22,477 | 60,239 |
| NNW | 2,768 | 18,951 | 205,412 | 432,334 | 217,306 | 876,771 |
| Total | 21,449 | 102,333 | 430,105 | 817,368 | 584,212 | 1,955,695 |
| Cumulative Total | 21,677 | 124,010 | 554,115 | 1,371,483 | 1,955,695 | |

TABLE A.3.1-12
2000 POPULATION PROJECTIONS BY SECTOR
WITHIN 16-80 KILOMETRES OF THE SITE
Fertility Assumption: 2.1 Children Per Woman
Migration Assumption: No Migration

| | Kilometres (Miles) | | | | | |
|---|---|---|---|---|---|---|
| Sector | 16 (10) Total | 16-32 (10-20) | 32-48 (20-30) | 48-64 (30-40) | 64-80 (40-50) | 80 (50) Total |
| N | 5,697 | 26,624 | 95,675 | 283,254 | 148,775 | 560,025 |
| NNE | 729 | 8,333 | 14,907 | 20,364 | 39,316 | 83,649 |
| NE | 1,354 | 5,098 | 6,095 | 15,083 | 18,986 | 46,616 |
| ENE | 3,074 | 6,909 | 3,103 | 16,712 | 21,339 | 51,135 |
| E | 2,075 | 2,257 | 7,121 | 2,793 | 10,173 | 24,419 |
| ESE | 1,980 | 1,619 | 5,663 | 9,419 | 30,407 | 49,088 |
| SE | 953 | 3,598 | 9,976 | 7,854 | 7,360 | 29,741 |
| SSE | 405 | 1,176 | 38,739 | 15,448 | 9,813 | 65,581 |
| S | 624 | 4,712 | 12,737 | 24,757 | 5,055 | 44,389 |
| SSW | 513 | 4,275 | 5,795 | 2,678 | 19,948 | 33,309 |
| SW | 661 | 3,680 | 8,792 | 19,055 | 74,562 | 106,750 |
| WSW | 522 | 2,703 | 8,637 | 12,435 | 19,272 | 43,569 |
| W | 519 | 8,082 | 4,760 | 46,224 | 9,267 | 86,872 |
| WNW | 558 | 5,883 | 18,652 | 0 | 0 | 25,093 |
| NW | 1,079 | 11,586 | 32,138 | 985 | 22,832 | 68,620 |
| NNW | 3,001 | 24,321 | 224,855 | 412,927 | 244,954 | 910,058 |
| Total | 23,844 | 120,806 | 497,665 | 892,256 | 682,059 | 2,214,360 |
| Cumulative Total | 23,844 | 144,650 | 642,315 | 1,532,301 | 2,214,360 | |

TABLE A.3.1-13

ESTIMATED PRODUCTION OF SELECTED AGRICULTURAL COMMODITIES
IN CATTARAUGUS COUNTY AND SITE VICINITY TOWNS 1980

| Commodity | Production | | | | |
|---|---|---|---|---|---|
| | Cattaraugus County | Ashford Township | East Otto Township | Yorkshire Township | Machias Township |
| Milk (1,000 kgs.) | 146,010* | 7,990 | 7,020 | 4,780 | 7,640 |
| Cull Cattle | 5,800 | 320 | 280 | 190 | 300 |
| Calves | 14,500 | 790 | 700 | 470 | 760 |
| Corn, Grain (hectares) | 3,300 | 180 | 160 | 110 | 170 |
| bushels | 762,600 | 41,710 | 36,680 | 24,940 | 39,880 |
| Corn, Silage (hectares) | 5,140 | 280 | 250 | 170 | 270 |
| bushels | 184,150 | 10,070 | 8,860 | 6,020 | 9,630 |
| Oats, Grain (hectares) | 2,300 | 130 | 110 | 80 | 120 |
| bushels | 324,900 | 17,770 | 15,628 | 10,620 | 17,000 |
| Hay Crops (hectares) | 28,880 | 1,580 | 1,390 | 940 | 1,510 |
| tons | 124,320 | 6,800 | 5,970 | 4,060 | 6,503 |
| Hogs and Pigs | 3,775 | 210 | 180 | 120 | 200 |

*Equivalent to 40,237,500 gallons

Source: New York State Crop Reporting Service, May 1981, April 1982, June 1982; Cattaraugus County Cooperative Extension Service (undated); Robert J. Ryan, July 17, 1982.

-COM005238:160H

TABLE A.3.1-14

USER POPULATION OF SCHOOLS AND HOSPITALS
IN THE SITE VICINITY

| Facility | Location | Population |
|---|---|---|
| Springville High School | 7.2 km north | 934 |
| Springville Midde School | 7.2 km north | 631 |
| Springville Elementary School | 7.4 km north | 736 |
| St. Aloysius Parochial School | 6.7 km north | 235 |
| West Valley Central School | 6.1 km southeast | 530 |
| Bertrand Chaffee Hospital | 6.9 km north | 55 |

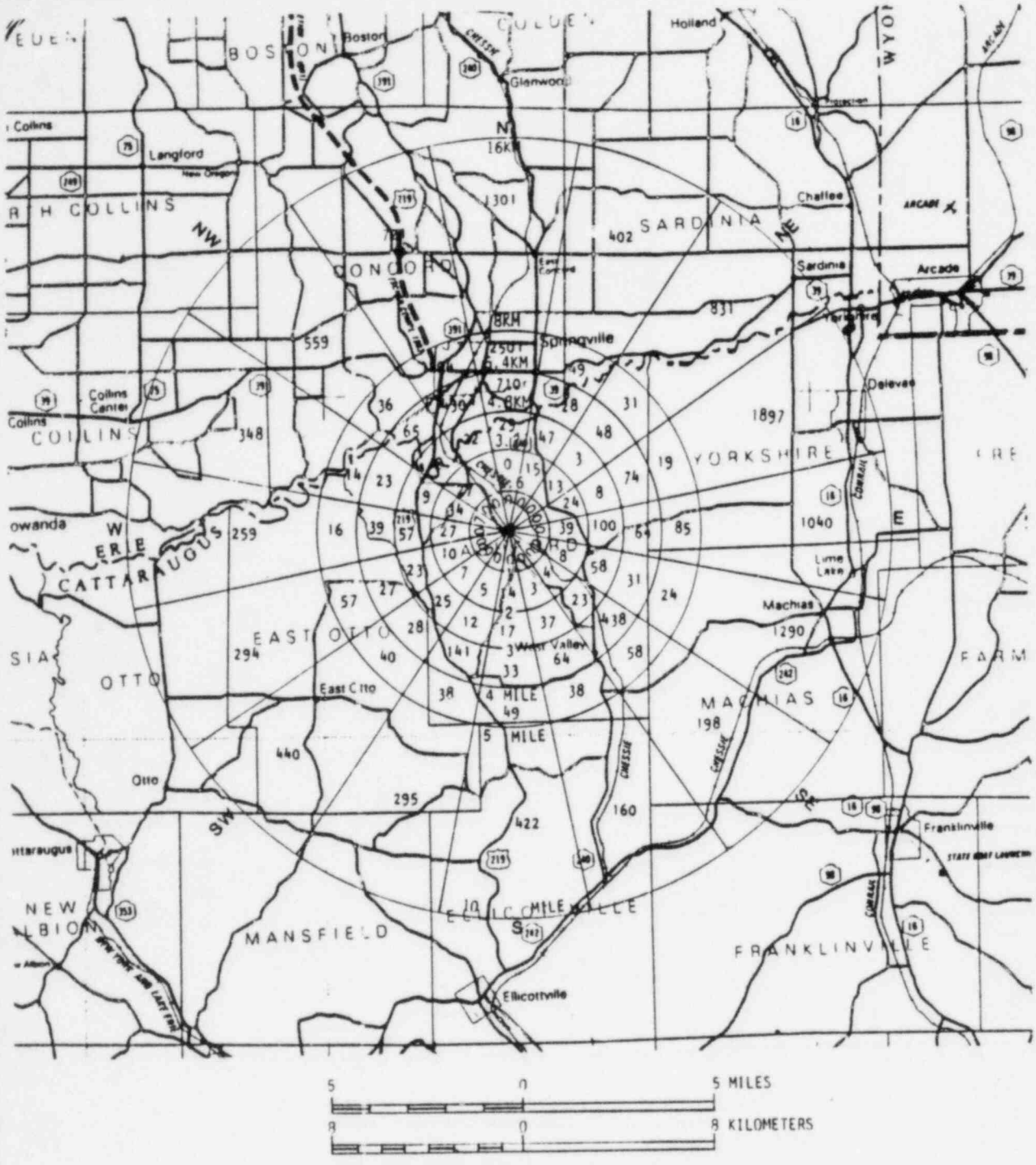
Source:

Hilde Rothfuss, Springville-Griffith Institute Central School District, Written Communication, July 28, 1982.

Sister Marion Rose, St. Aloysius School, Personal Communication, August 19, 1982.

Loretta Shuster, West Valley Central School, Personal Communication, August 19, 1982.

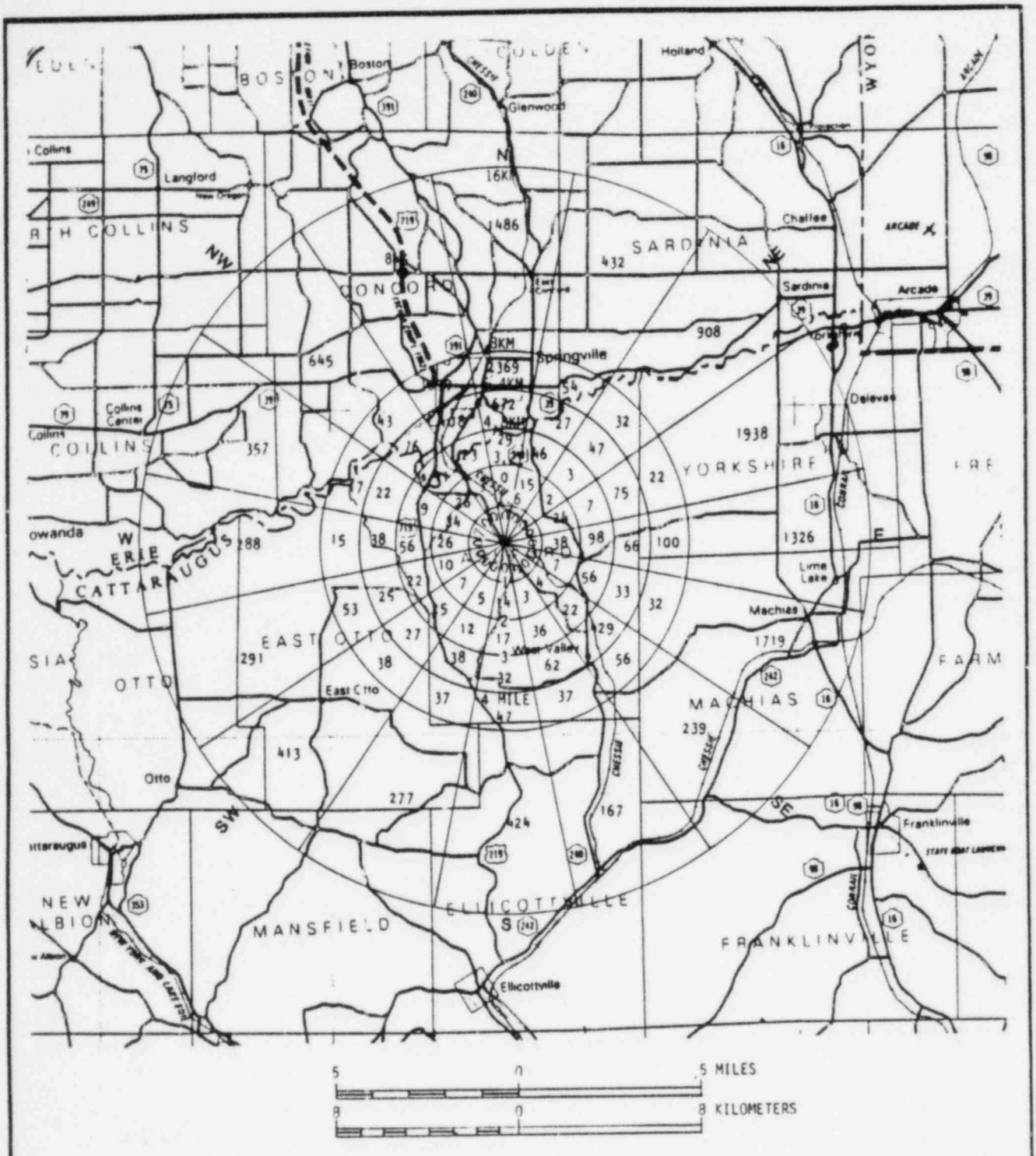
George Vasiliauskas, Bertrand Chaffee Hospital, Personal Communication, August 19, 1982.




## 1980 POPULATION ESTIMATES BY SECTOR

WITHIN 16 KILOMETERS (10 MILES) OF SITE

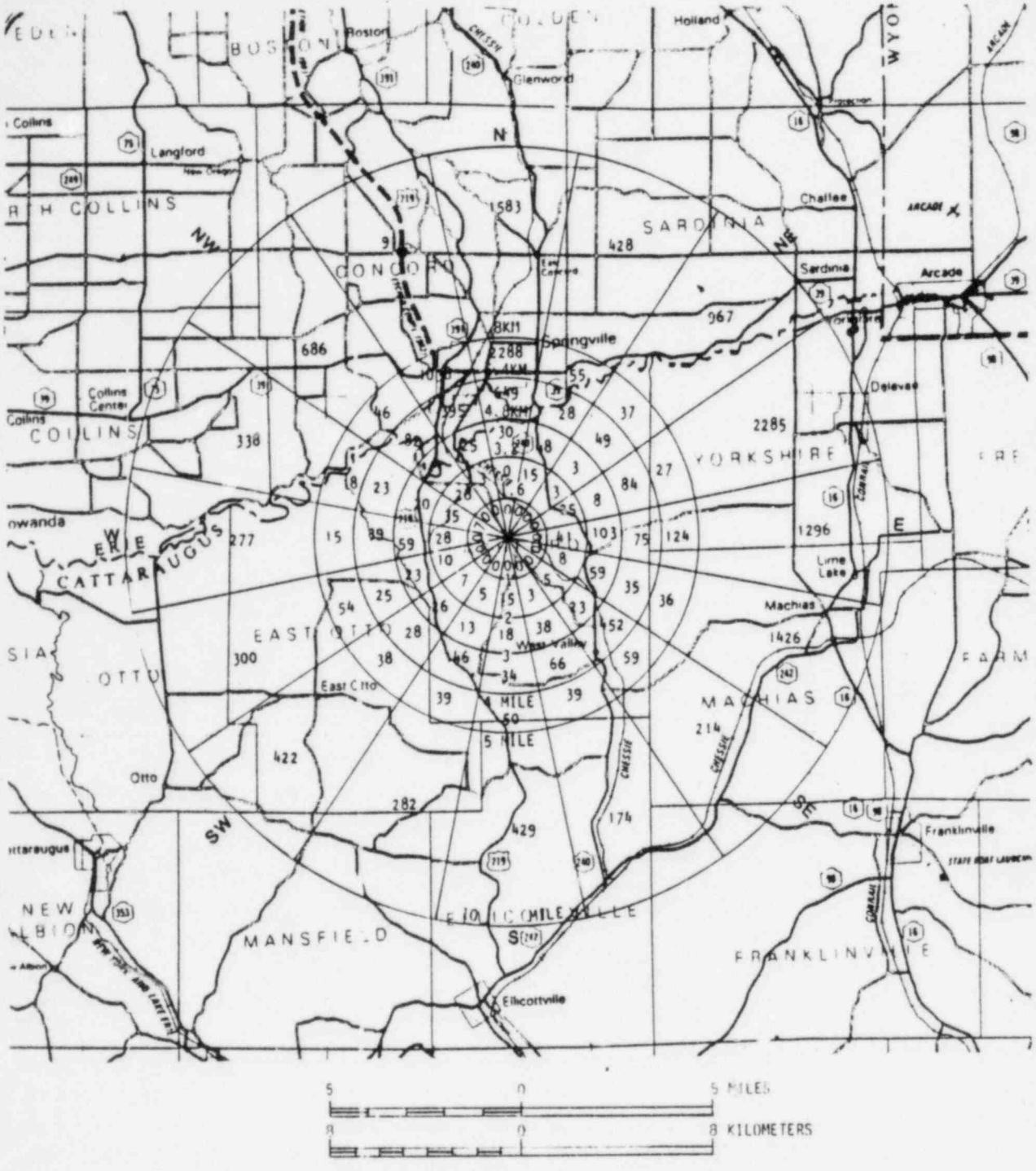
FIGURE A.3.1-6




## 1990 POPULATION PROJECTIONS BY SECTOR

WITHIN 16 KILOMETERS (10 MILES) OF SITE

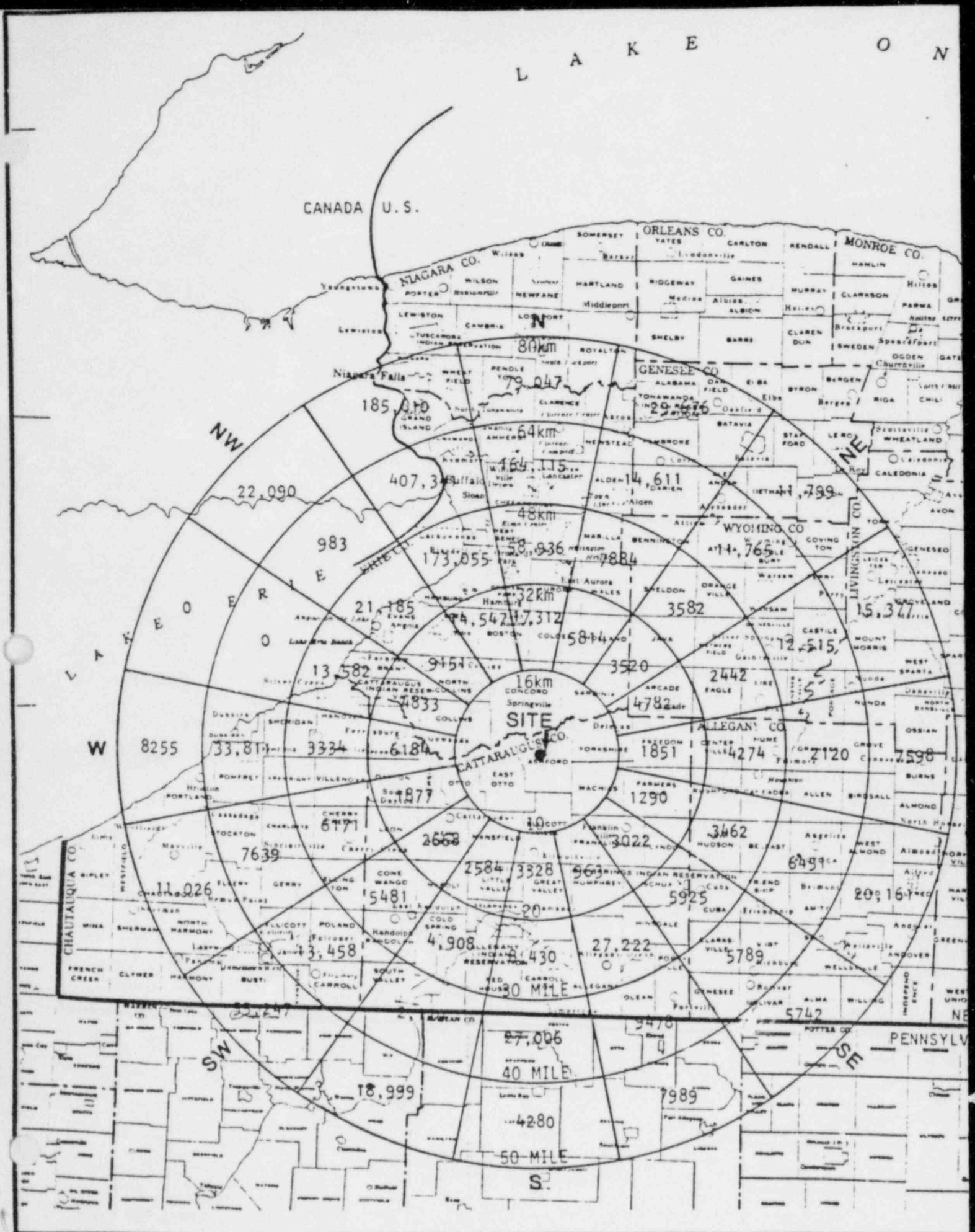
FIGURE A.3.1-7




## 2000 POPULATION PROJECTIONS BY SECTOR

WITHIN 16 KILOMETERS (10 MILES) OF SITE

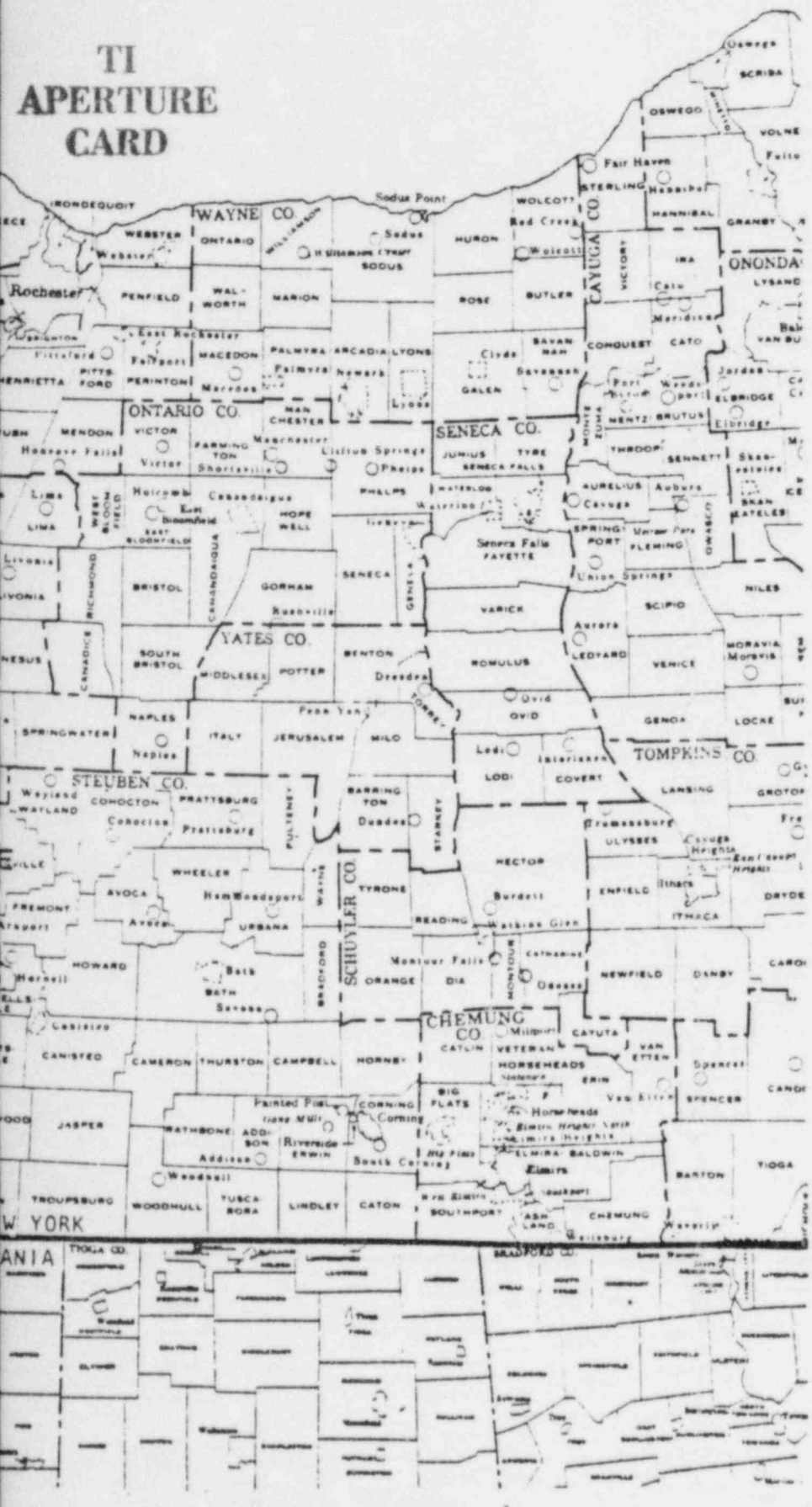
FIGURE A.3.1-8

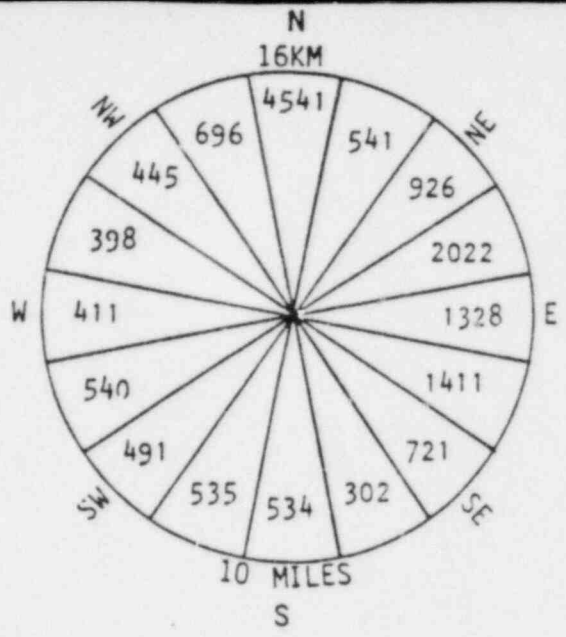

LAKE ONTARIO
CANADA U.S.
ORLEANS CO.
MONROE CO.
NIAGARA CO.
GENESEE CO.
WYOMING CO.
LIVINGSTON CO.
ALLEGANY CO.
CATTARAUGUS CO.
CHAUTAUQUA CO.
PENNSYLV
Niagara Falls
Buffalo
Springville
SITE
N
NE
E
SE
S
SW
W
NW
16km
32km
48km
64km
80km
30 MILE
40 MILE
50 MILE
185,010
79,047
29,576
407,371
164,115
14,611
11,799
22,090
983
173,055
58,936
7884
11,765
21,185
74,547
17,312
3582
15,347
13,582
9151
5814
12,515
4833
3520
2442
8255
33,811
3334
6184
4782
4274
2120
2598
1851
1877
1290
6171
2668
3022
3462
7639
2584
3328
963
6459
11,026
5481
5925
20,161
20
13,458
4,908
8,430
27,222
5789
5742
27,006
9478
18,999
7989
4280

T A R I O

Also Available On Aperture Card

TI APERTURE CARD




## 1980 POPULATION ESTIMATES BY SECTOR

WITHIN 16-80 KILOMETERS
(10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

- COUNTY
- MINOR CIVIL DIVISION
- INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION
- ○ INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

TYPE STYLES

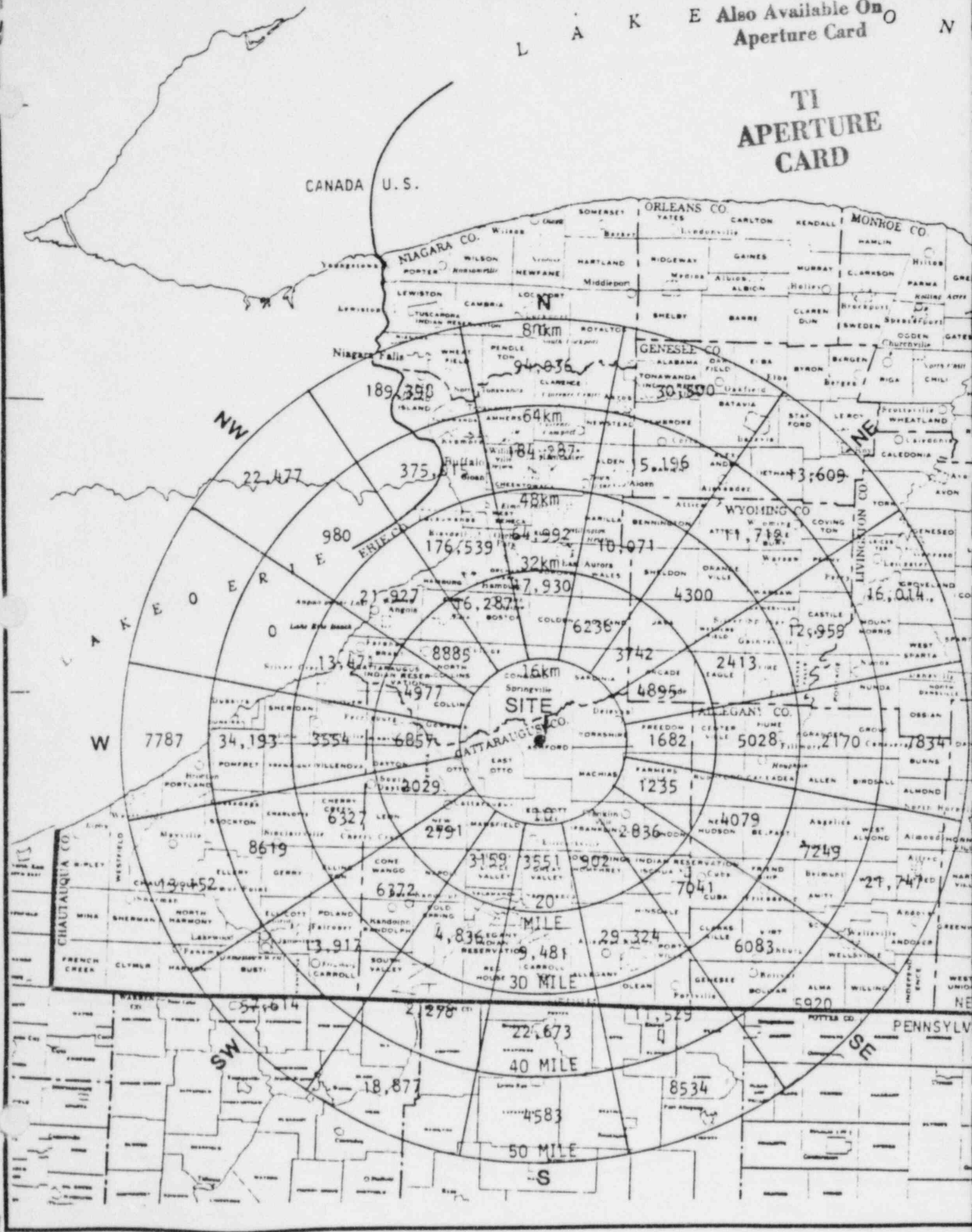
| | |
|---|---|
| WASHINGTON | COUNTY |
| WASHINGTON | MINOR CIVIL DIVISION |
| Washington | INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS |
| Washington | INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS |
| Washington | UNINCORPORATED PLACE |

MAP REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.

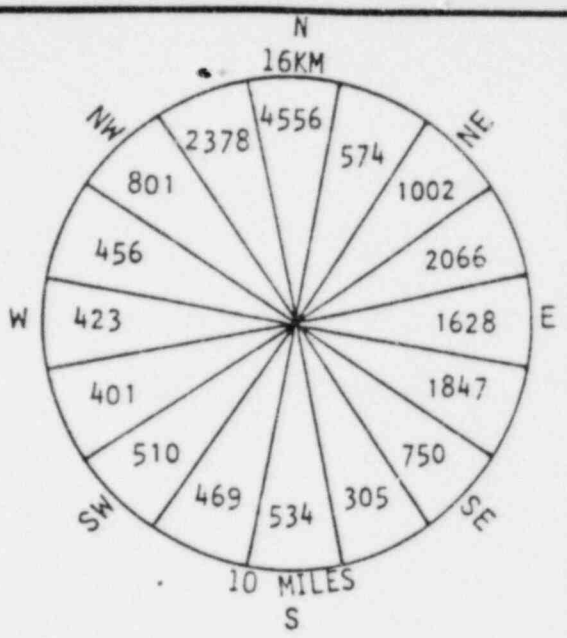
FIGURE A.3.1-9

8507030441-5

Also Available On
Aperture Card






## 1990 POPULATION PROJECTIONS BY SECTOR

WITHIN 16-80 KILOMETERS
(10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

- COUNTY
- MINOR CIVIL DIVISION
- INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION
- ○ INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

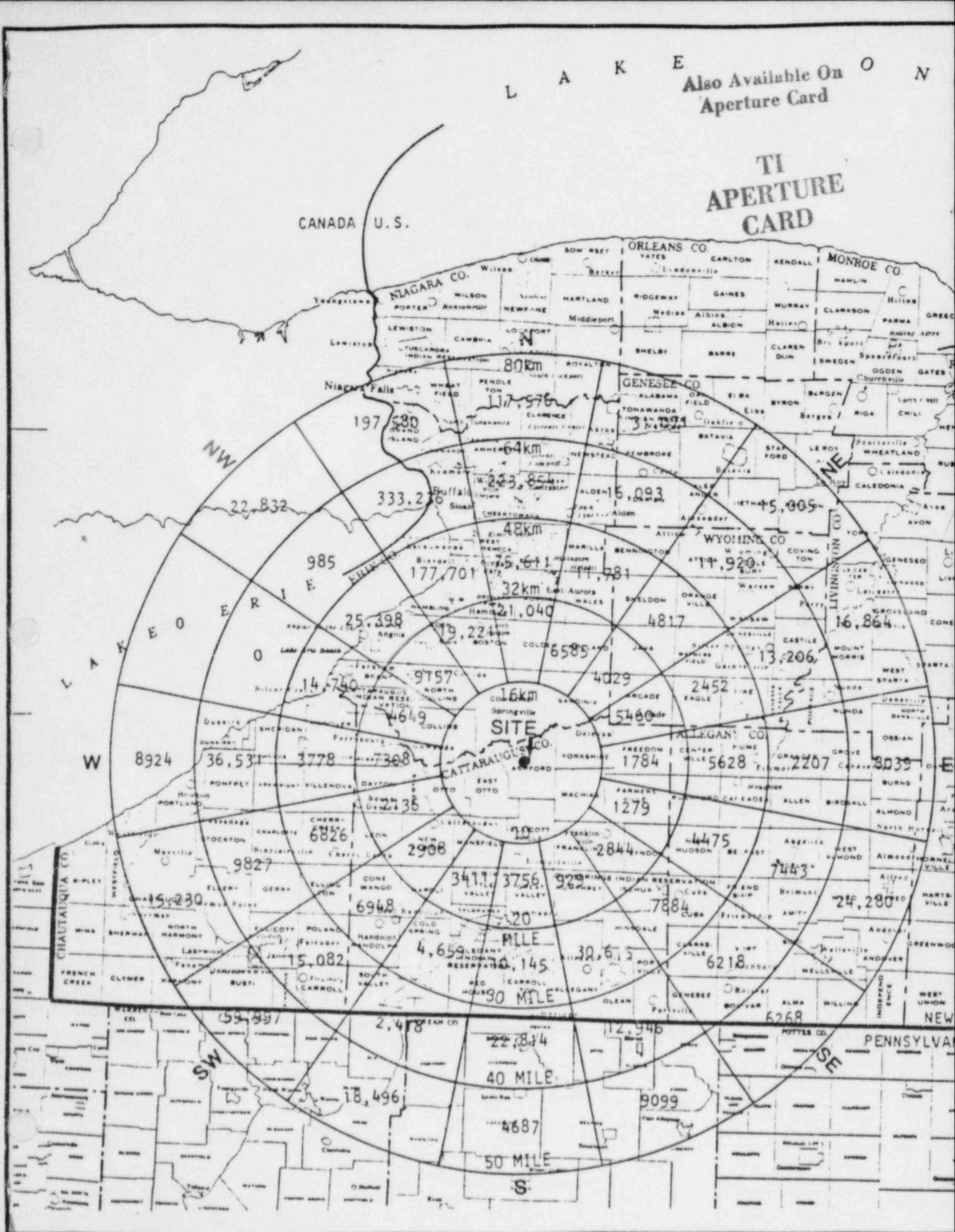
TYPE STYLES

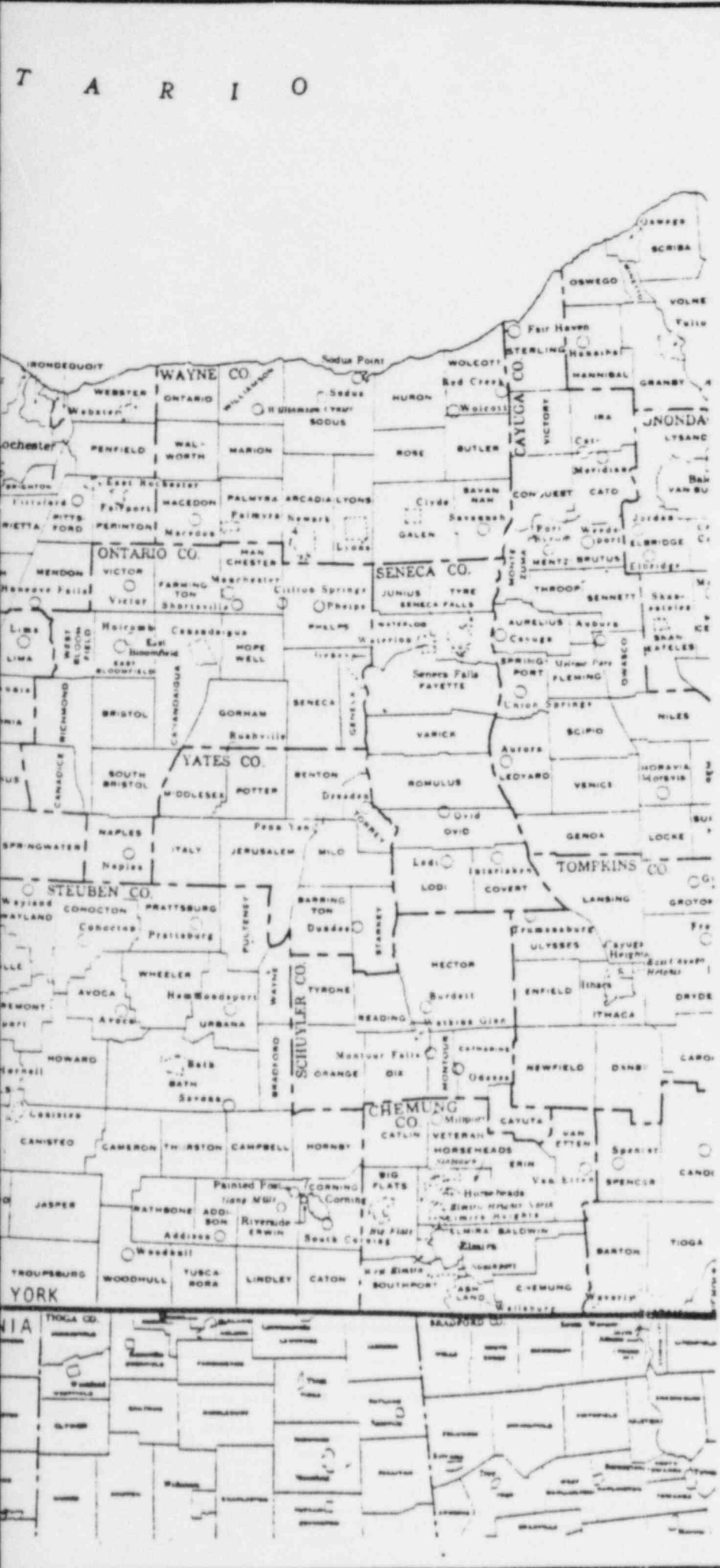
- WASHINGTON — COUNTY
- WASHINGTON — MINOR CIVIL DIVISION
- Washington — INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS
- Washington — INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS
- Washington — UNINCORPORATED PLACE

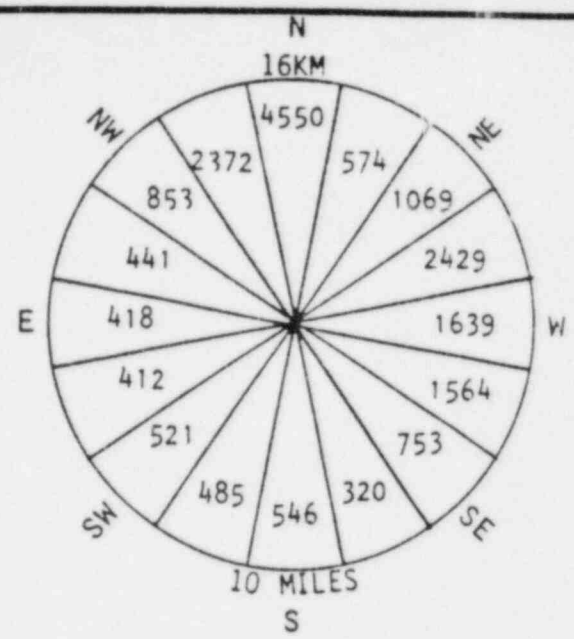
8507030441 -6

MAP
REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.

FIGURE A 3.1-10


Also Available On
Aperture Card
TI
APERTURE
CARD
LAKE ONTARIO
CANADA
U.S.
NIAGARA CO.
ORLEANS CO.
MONROE CO.
GENESEE CO.
WYOMING CO.
ALLEGANY CO.
CATTARAUGUS CO.
CHAUTAUQUA CO.
PENNSYLVANIA
Niagara Falls
Buffalo
Springville
SITE
16km
32km
48km
64km
80km
20 MILE
30 MILE
40 MILE
50 MILE
N
NE
E
SE
S
SW
W
NW
197,580
117,576
223,854
333,236
22,832
177,701
75,611
11,781
21,040
19,221
25,398
14,740
36,531
8924
985
16,093
15,005
11,920
4817
6585
4029
5460
2452
1784
5628
2207
1279
4475
7443
2844
7884
24,280
6218
6268
6826
2908
9827
15,230
6948
4,659
30,145
15,082
3778
7308
4649
9757
16,864
13,206
3039
3411
3756
922
18,496
9099
4687
22,814
12,946
2,418




## 2000 POPULATION PROJECTIONS BY SECTOR

WITHIN 16-80 KILOMETERS
(10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

- COUNTY
- MINOR CIVIL DIVISION
- INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION
- ○ INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

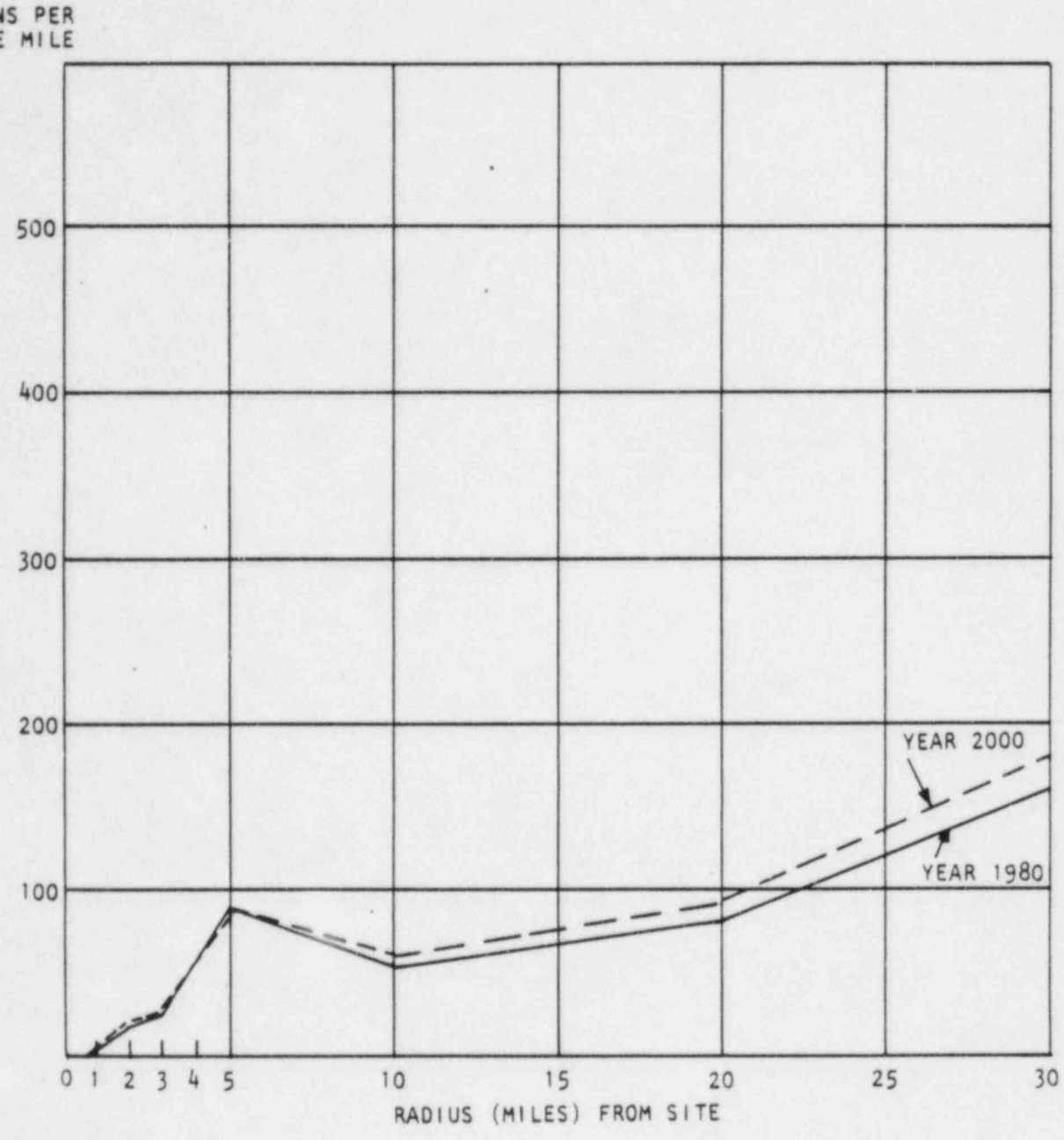
TYPE STYLES

- WASHINGTON — COUNTY
- WASHINGTON — MINOR CIVIL DIVISION
- Washington — INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS
- Washington — INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS
- Washington — UNINCORPORATED PLACE

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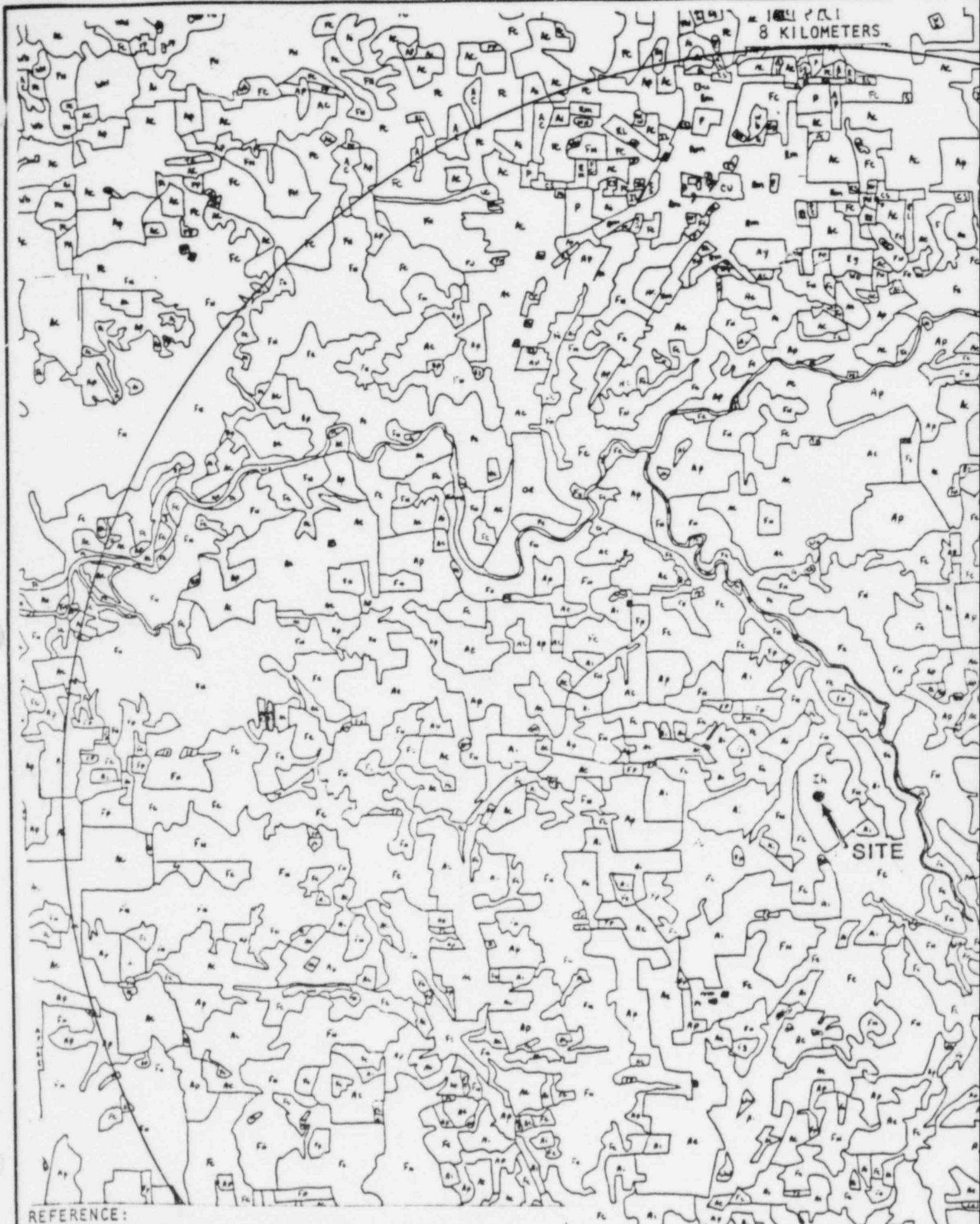
MAP
REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.

FIGURE A.3.1-11

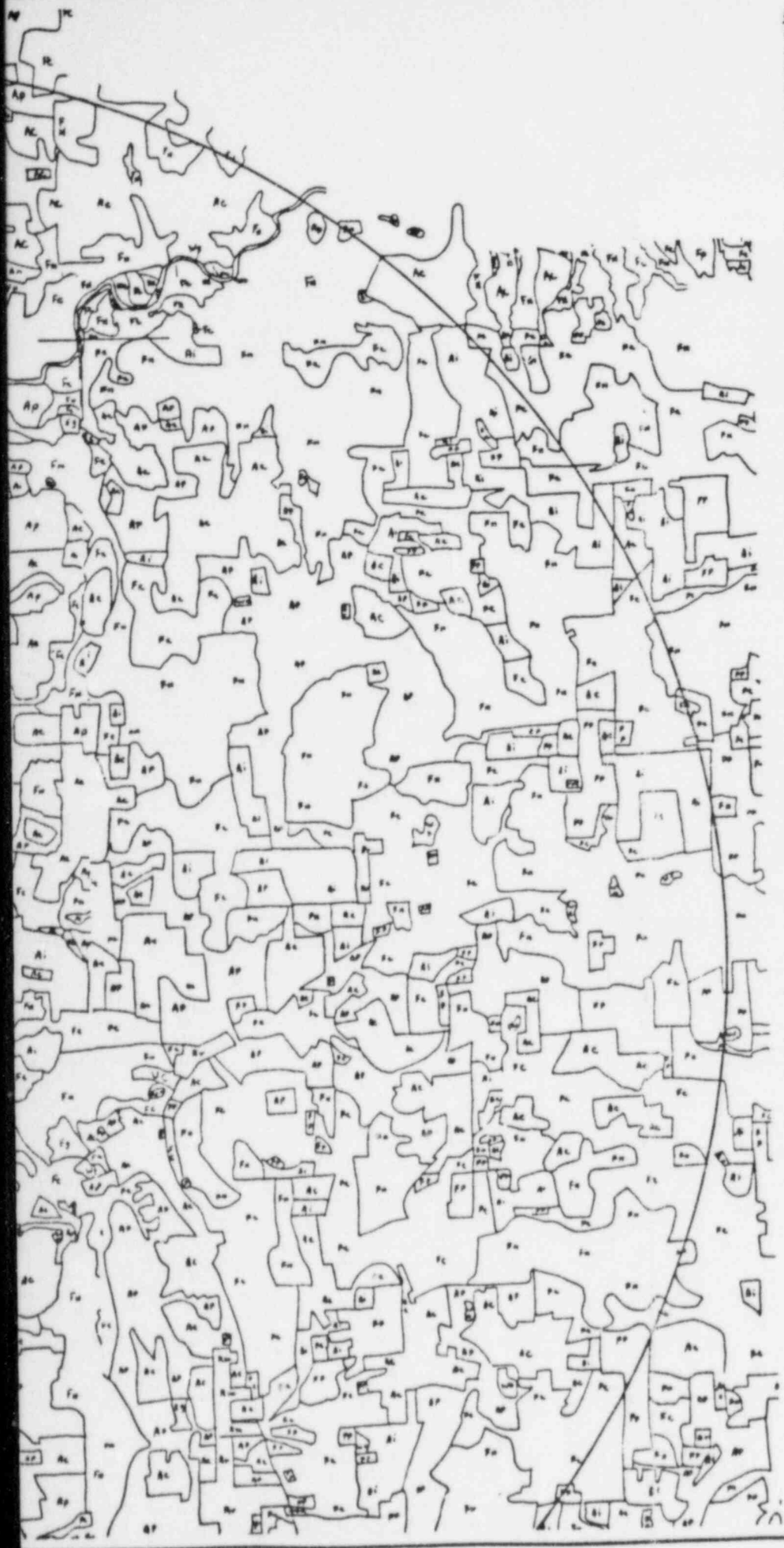



# POPULATION DENSITY WITHIN 48 KILOMETERS (30 MILES) OF SITE

FIGURE A.3.1-12




REFERENCE:
CORNELL UNIVERSITY, NEW YORK STATE LAND USE AND NATURAL RESOURCES INVENTORY, 1969; AND CATTARAUGUS COUNTY PLANNING BOARD, EXISTING LAND USE MAP, 1977.



ACTIVE
Ao ORCHARD
Av VINEYARD
Ah HORTICULTURE
At HIGH INTENSITY
Ac CROPLAND/CROPLAND PASTURE
Ap PERMANENT PASTURE

INACTIVE
Ai AGRICULTURE INACTIVE

FORESTLAND
Fc BRUSH COVER UP TO FULLY STOCKED POLES LESS THAN 30 FEET
Fn FOREST OVER 30 FEET
Fp PLANTATIONS, ANY SIZE

WATER
Wn NATURAL, ANY SIZE
Wc ARTIFICIAL, ONE ACRE
Ws STREAMS, RIVERS- 100 FEET

PUBLIC
P ALL CATEGORIES

RESIDENTIAL
Rm MEDIUM DENSITY, 50-100 FEET FRONTAGE
Rl LOW DENSITY, OVER 100 FEET FRONTAGE
Rs STRIP WITH MAX OF 1/3 INTERMIXTURE OF Cs COMMERCIAL

COMMERCIAL
Cu URBAN (DOWNTOWN)
Cc SHOPPING CENTER
Cs COMMERCIAL STRIP WITH MAX OF 1/3 INTERMIXTURE OF Rs OR DENSITY HOUSING

INDUSTRIAL
Il LIGHT MANUFACTURING
Ih HEAVY MANUFACTURING

EXTRACTIVE
Eg GRAVEL, SAND
Es STONE QUARRIES

OUTDOOR RECREATION
Or ALL CATEGORIES

Also Available On Aperture Card

TI APERTURE CARD

2000 0 2000 4000 6000 FEET

1 .5 0 1 KM

8507030441 - 8

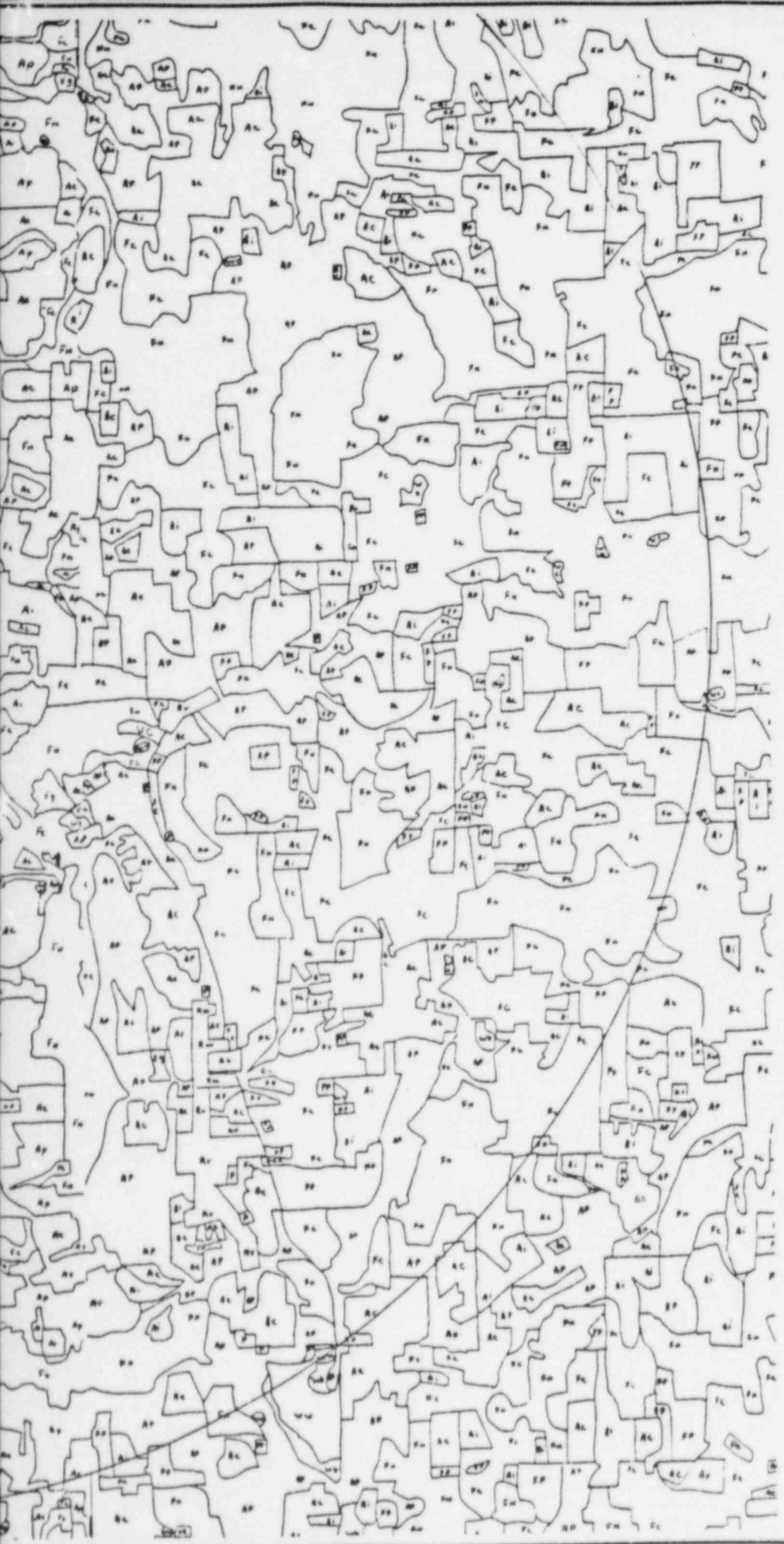
# SITE VICINITY LAND USE

## NORTHERN PORTION

FIGURE A 3.1-13




REFERENCE:
CORNELL UNIVERSITY, NEW YORK STATE LAND USE AND NATURAL RESOURCES INVENTORY, 1969; AND CATTARAUGUS COUNTY PLANNING BOARD, EXISTING LAND USE MAP, 1977.



ACTIVE
Ao ORCHARD
Av VINEYARD
Ah HORTICULTURE
At HIGH INTENSITY
Ac CROPLAND/CROPLAND PASTURE
Ap PERMANENT PASTURE

INACTIVE
Ai AGRICULTURE INACTIVE

FORESTLAND
Fc BRUSH COVER UP TO FULLY STOCKED POLES LESS THAN 30 FEET
Fn FOREST OVER 30 FEET
Fp PLANTATIONS, ANY SIZE

WATER
Wn NATURAL, ANY SIZE
Wc ARTIFICIAL, ONE ACRE
Ws STREAMS, RIVERS- 100 FEET

PUBLIC
P ALL CATEGORIES

RESIDENTIAL
Rm MEDIUM DENSITY, 50-100 FEET FRONTAGE
Rl LOW DENSITY, OVER 100 FEET FRONTAGE
Rs STRIP WITH MAX OF 1/3 INTERMIXTURE OF Cs COMMERCIAL

COMMERCIAL
Cu URBAN (DOWNTOWN)
Cc SHOPPING CENTER
Cs COMMERCIAL STRIP WITH MAX OF 1/3 INTERMIXTURE OF Rs OR DENSITY HOUSING

INDUSTRIAL
It LIGHT MANUFACTURING
Ih HEAVY MANUFACTURING

EXTRACTIVE
Eg GRAVEL, SAND
Es STONE QUARRIES

OUTDOOR RECREATION
Or ALL CATEGORIES

Also Available On Aperture Card

TI APERTURE CARD

2000 0 2000 4000 6000 FEET

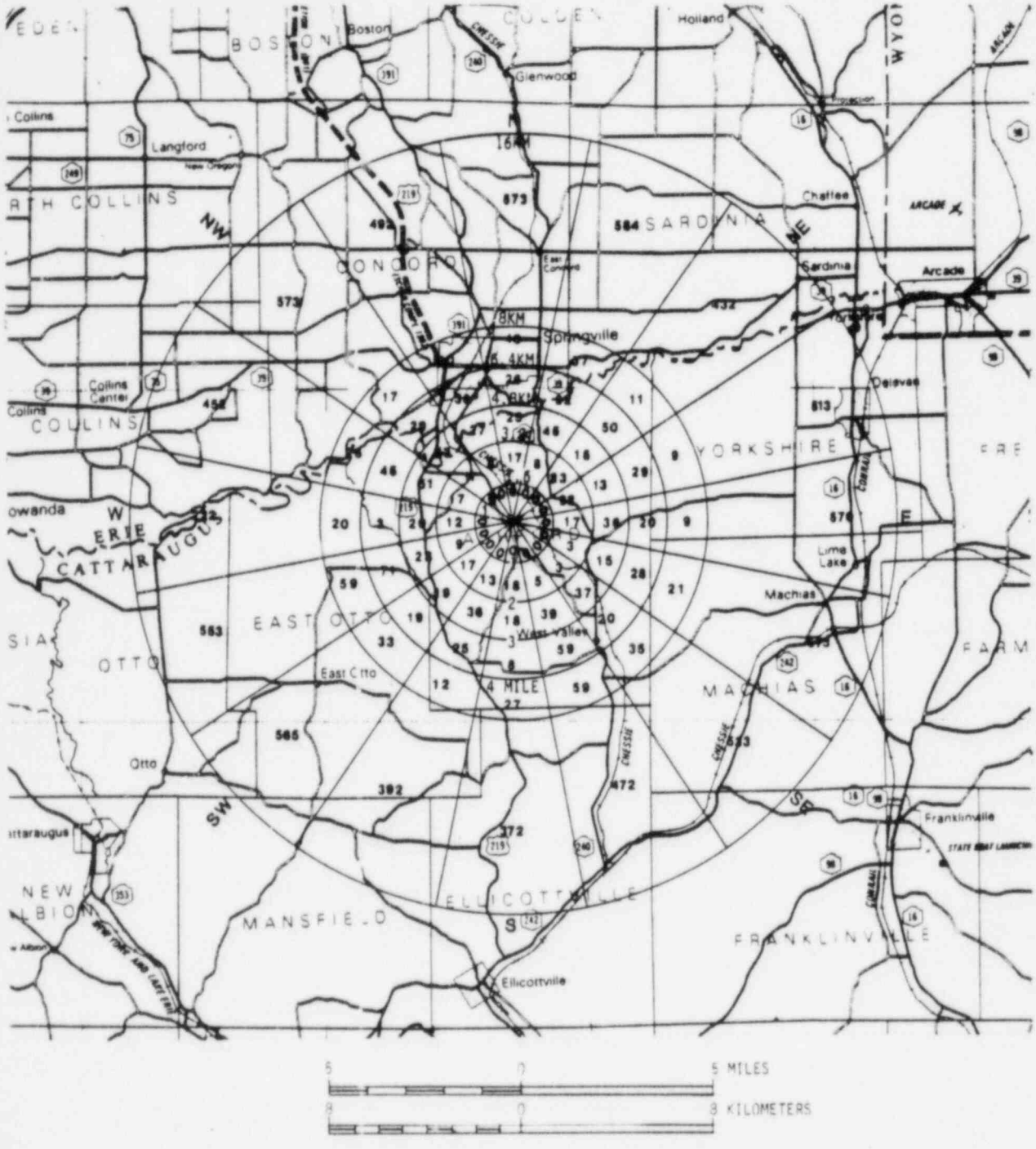
1 .5 0 1 KM

8507030441 -9

# SITE VICINITY LAND USE

## SOUTHERN PORTION

FIGURE A.3.1-14



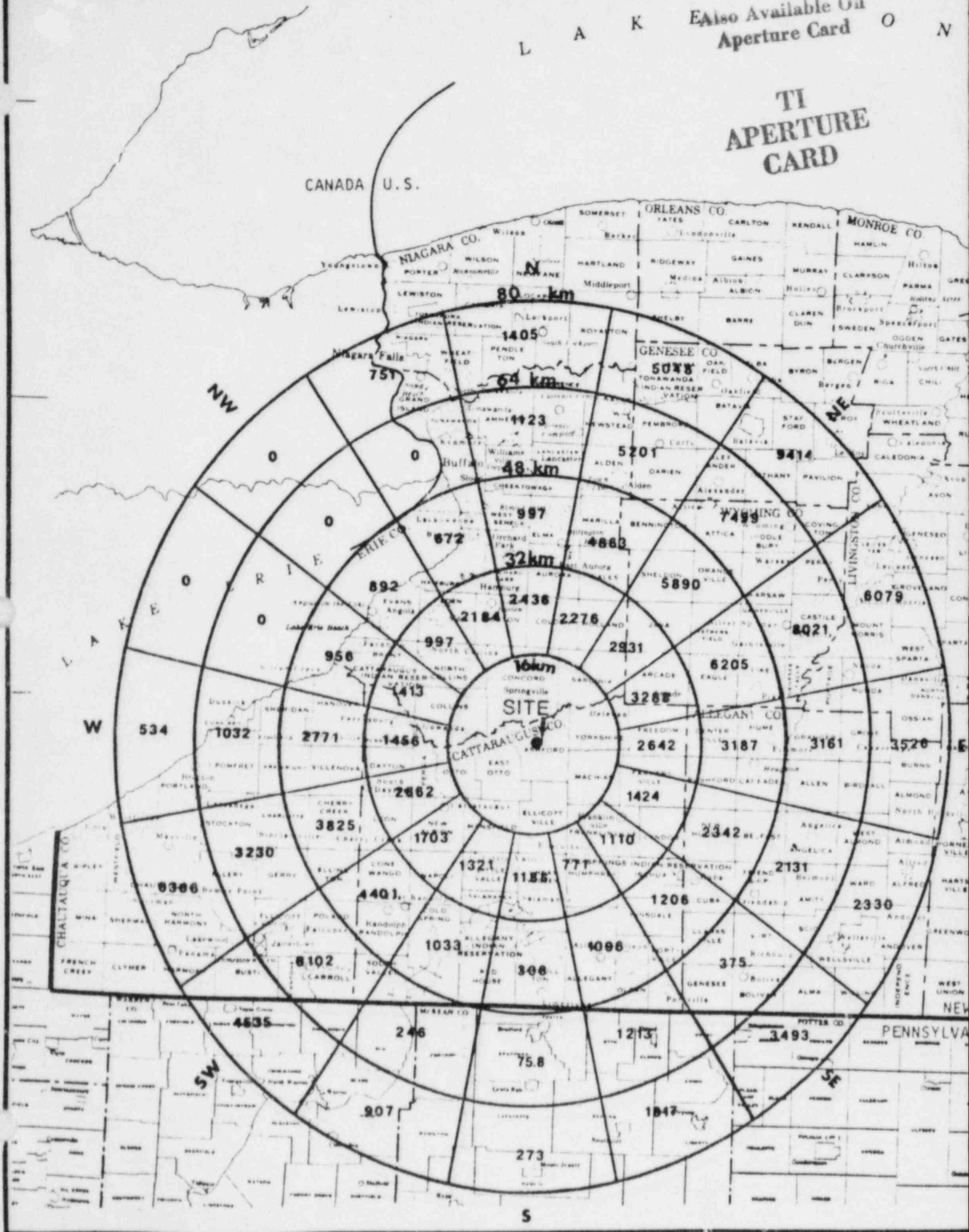

**NUMBER OF DAIRY COWS BY SECTOR**

**WITHIN 16 KILOMETERS (10 MILES) OF SITE**

FIGURE A 3.1-15

Also Available On
Aperture Card

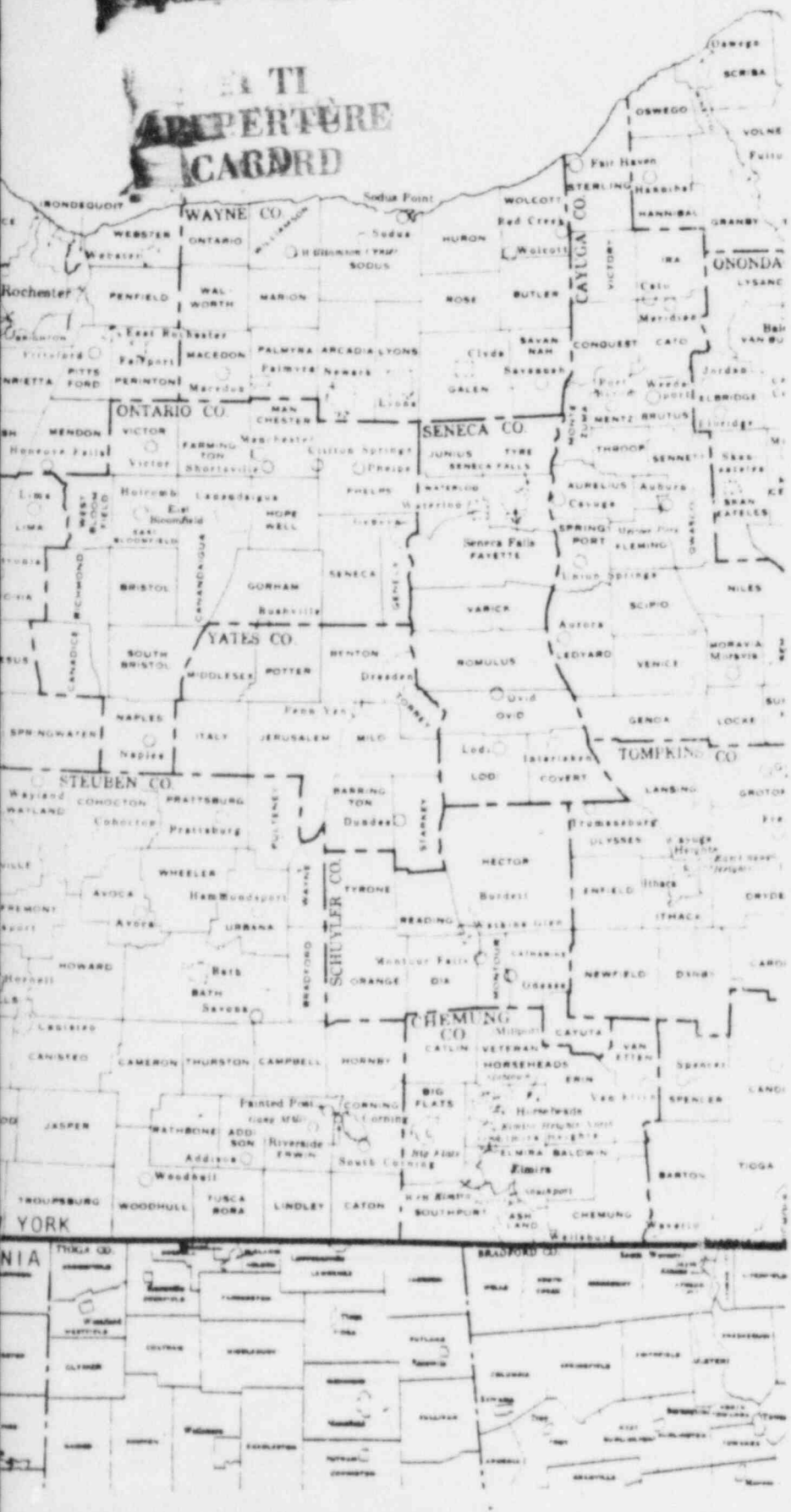
TI
APERTURE
CARD

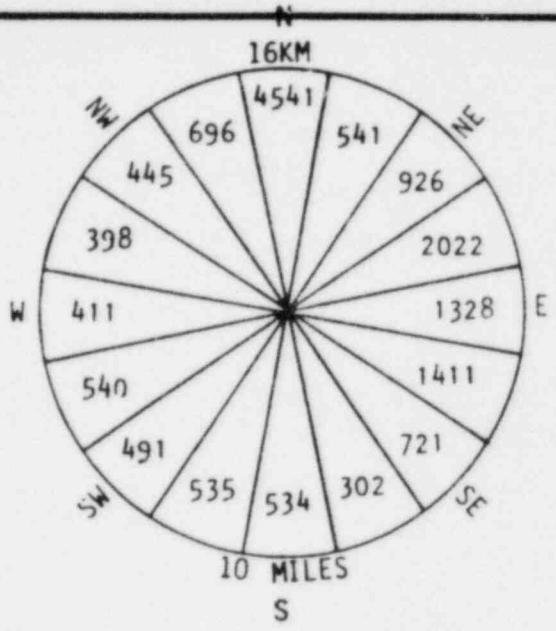


T A R I O

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BEST AVAILABLE APERTURE CARD




## NUMBER OF DAIRY COWS BY SECTOR

WITHIN 16-80 KILOMETERS
(10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

COUNTY

MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

TYPE STYLES

WASHINGTON COUNTY

WASHINGTON MINOR CIVIL DIVISION

Washington INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS

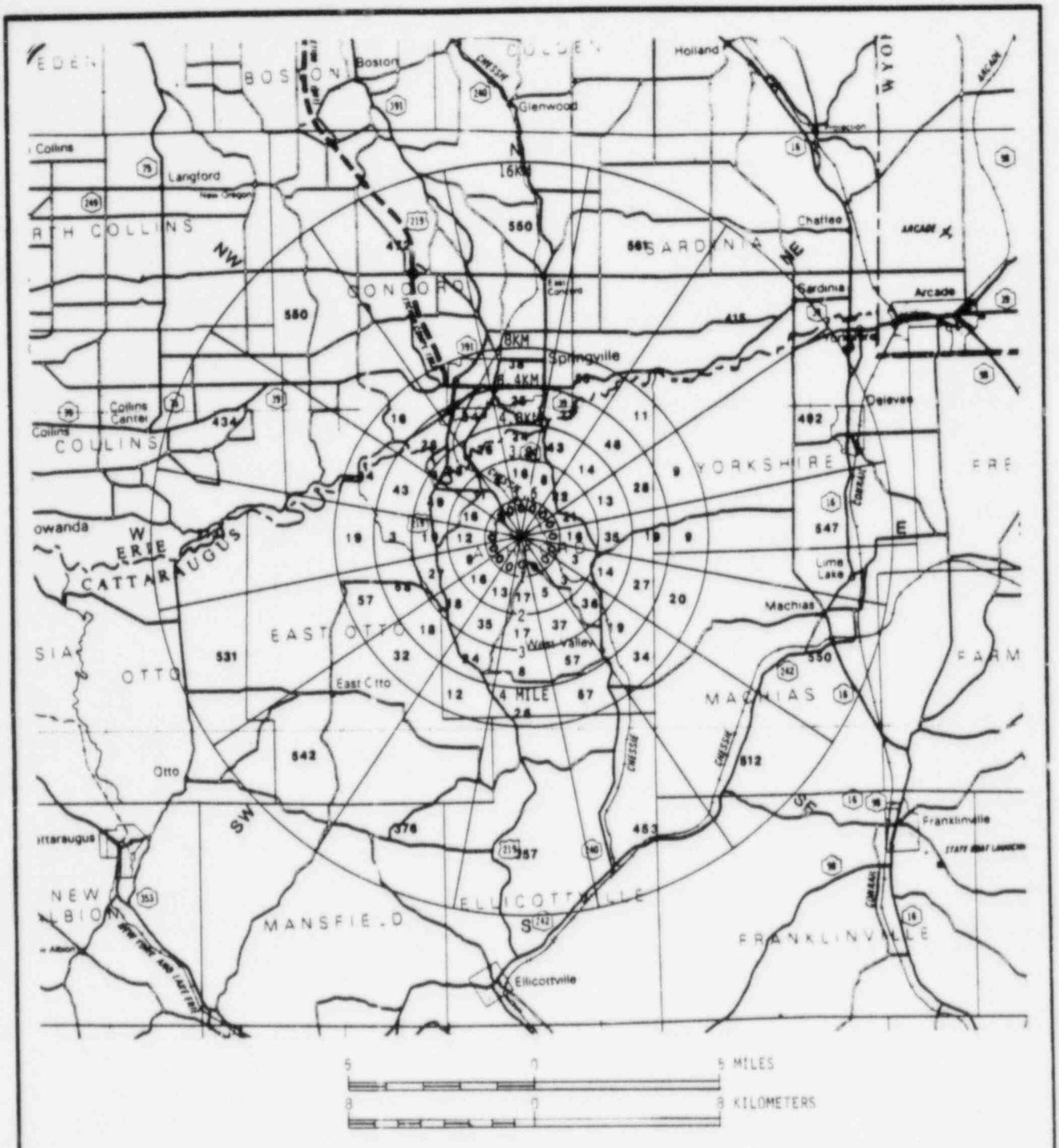
Washington INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS

Washington UNINCORPORATED PLACE

8507030441 – 10

FIGURE A 3.1-16

MAP REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.



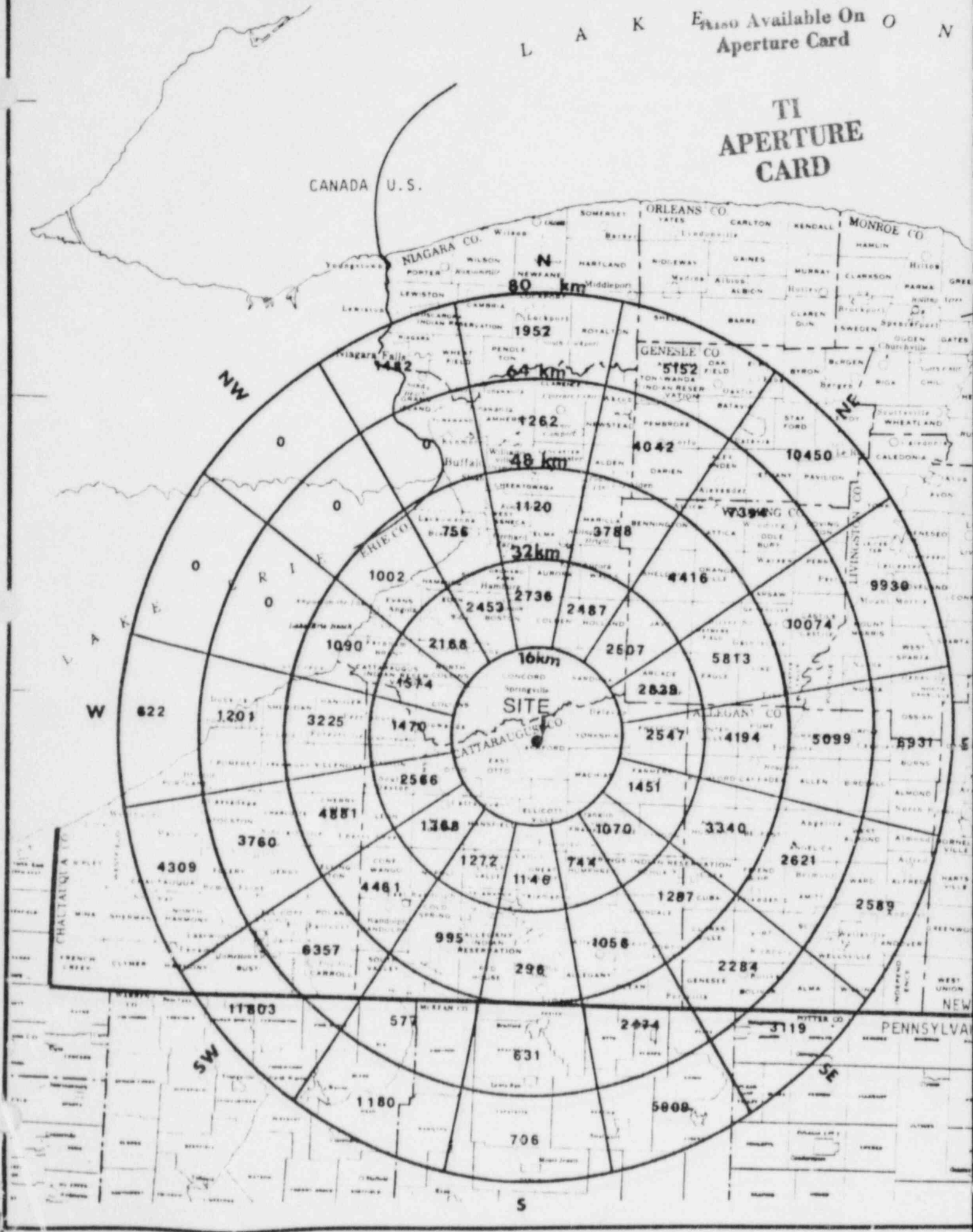

**NUMBER OF MEAT-PRODUCING ANIMALS BY SECTOR**

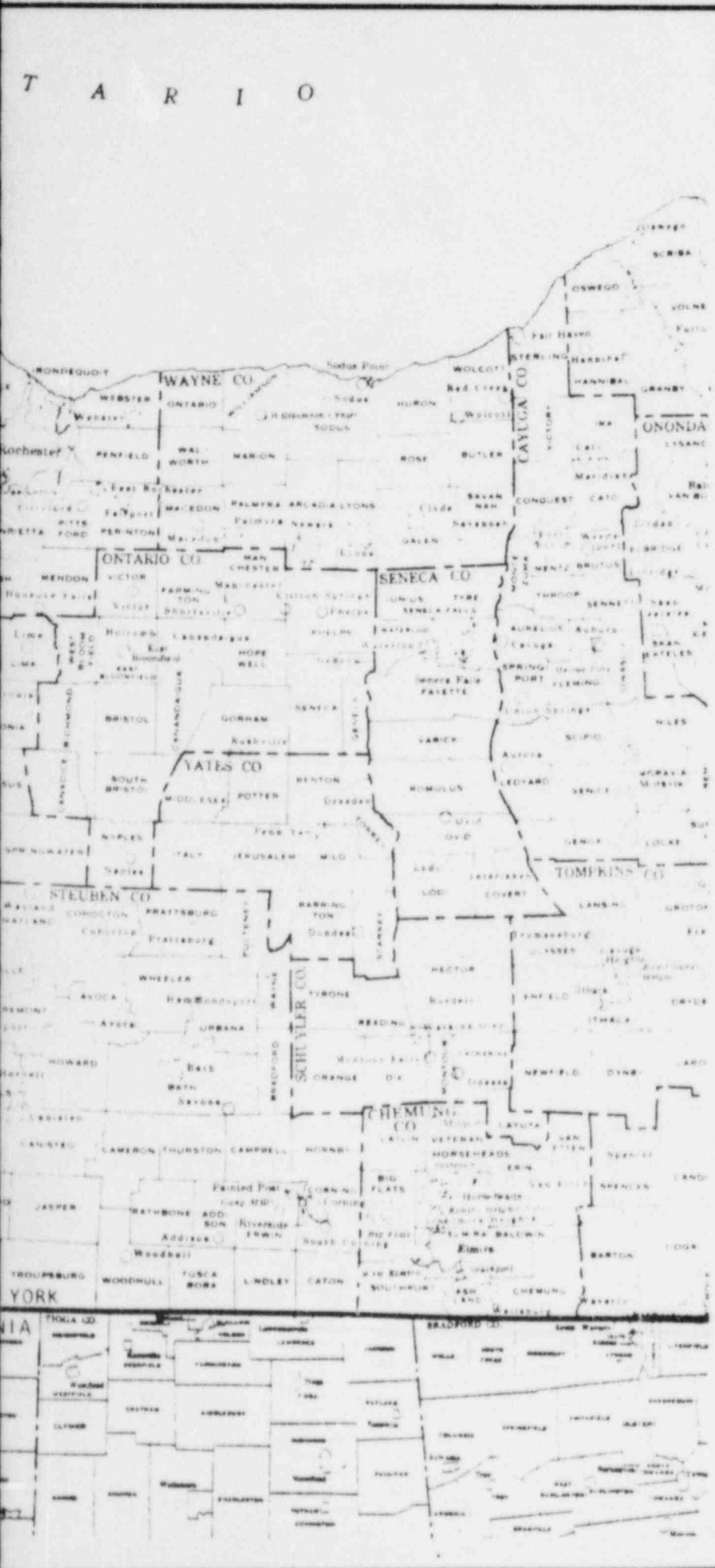
**WITHIN 16 KILOMETERS (10 MILES) OF SITE**

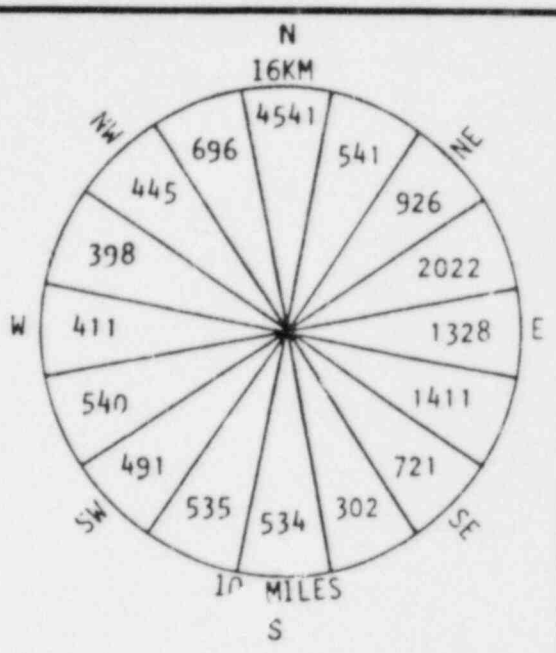
FIGURE A 3.1-17

Also Available On
Aperture Card

TI
APERTURE
CARD






## NUMBER OF MEAT-PRODUCING ANIMALS BY SECTOR

WITHIN 16-80 KILOMETERS
(10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

COUNTY

MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

TYPE STYLES

WASHINGTON COUNTY

WASHINGTON MINOR CIVIL DIVISION

Washington INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS

Washington INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS

UNINCORPORATED PLACE

FIGURE A 31-18

MAP
REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.

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TABLE A.3.1-15

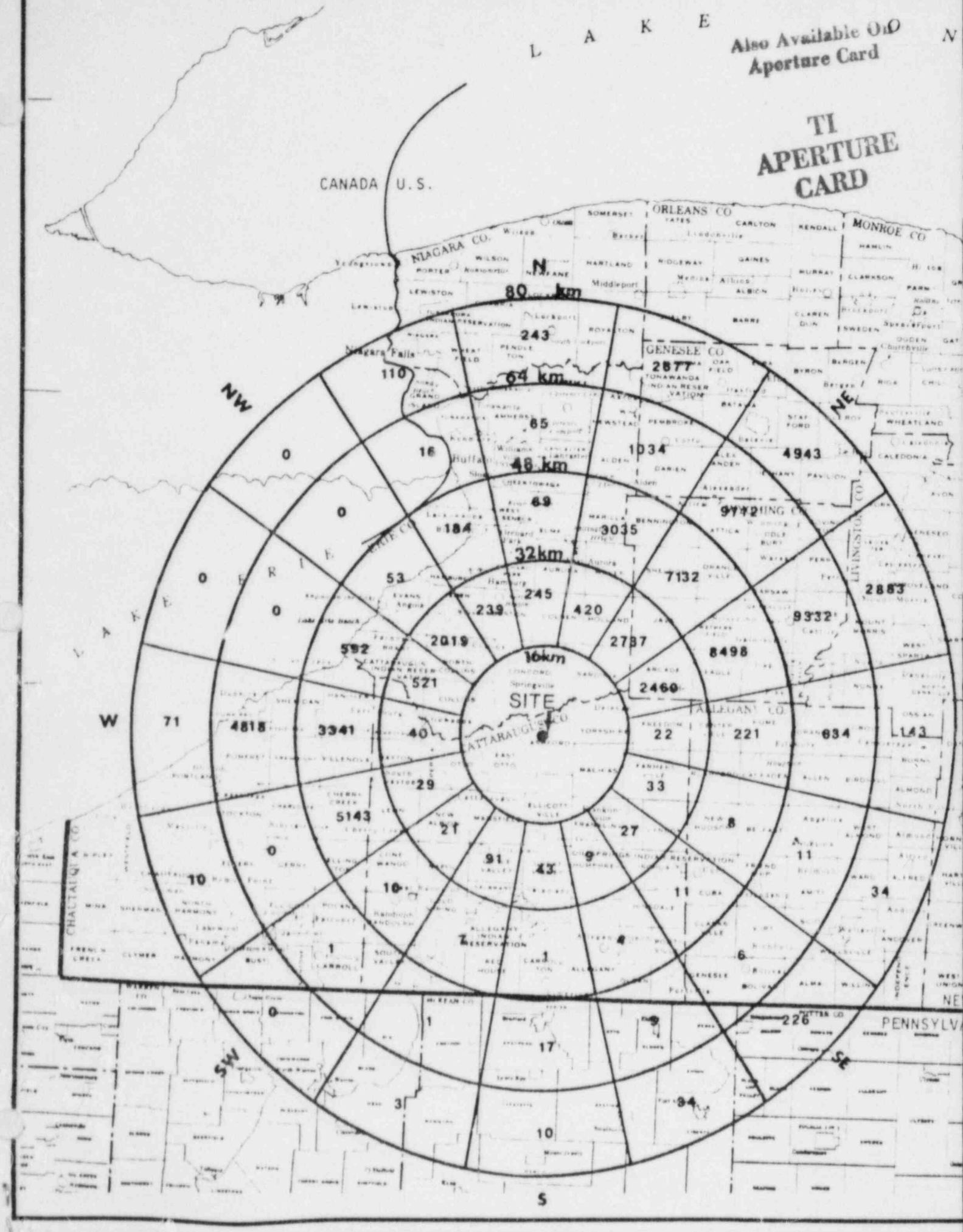
COMMERCIAL FISH LANDINGS FOR NEW YORK WATERS OF LAKE ERIE, 1980-1983

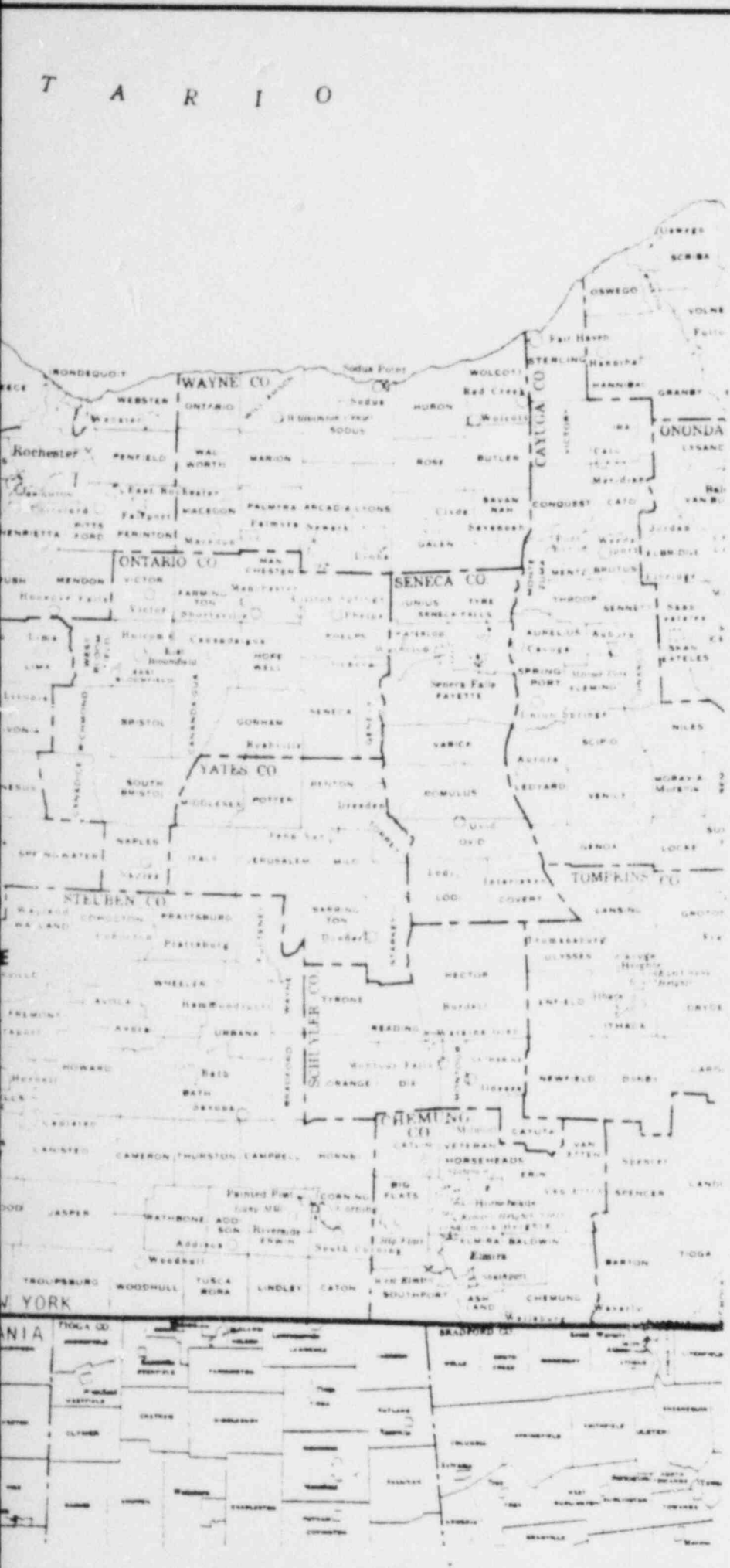
| | | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|
| Whitefish | kg. | 79 | 0 | 3 | 3 |
| Walleye | kg. | 25,032 | 18,804 | 27,5?1 | 28,749 |
| Smelt | kg. | 124 | 336 | 494 | 112 |
| Yellow Perch | kg. | 41,090 | 52,581 | 52,559 | 26,996 |
| Suckers | kg. | 3,045 | 3,753 | 8,026 | 6,615 |
| Catfish | kg. | 73 | 92 | 56 | 73 |
| Fresh Water Drum | kg. | 2,440 | 3,618 | 18,015 | 15,064 |
| Carp | kg. | 402 | 274 | 173 | 94 |
| White Bass | kg. | 2,92? | 9,183 | 20,857 | 8,844 |
| Misc. | kg. | 487 | 410 | 1,959 | 38,270 |
| White Perch | kg. | 0 | 0 | 0 | 1,864 |
| TOTAL | kg. | 75,693 | 89,051 | 129,618 | 126,684 |
| Number of Licenses | | 17 | 17 | 12 | 13 |

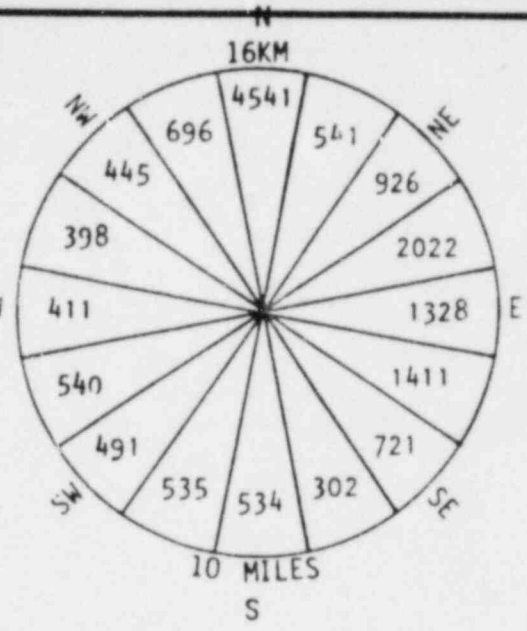
-COM005238:160H

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Aperture Card

TI
APERTURE
CARD






## AGRICULTURAL PRODUCE LAND AREA (ha)

WITHIN 16-80 KILOMETERS (10-50 MILES) OF THE SITE

10 0 10 20
MILES

16 0 16 32
KILOMETERS

SYMBOLS

COUNTY

MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE NOT A MINOR CIVIL DIVISION

INCORPORATED OR UNINCORPORATED PLACE WITH FEWER THAN 2,500 INHABITANTS

TYPE STYLES

WASHINGTON — COUNTY

WASHINGTON — MINOR CIVIL DIVISION

Washington — INCORPORATED PLACE WITH 50,000 OR MORE INHABITANTS

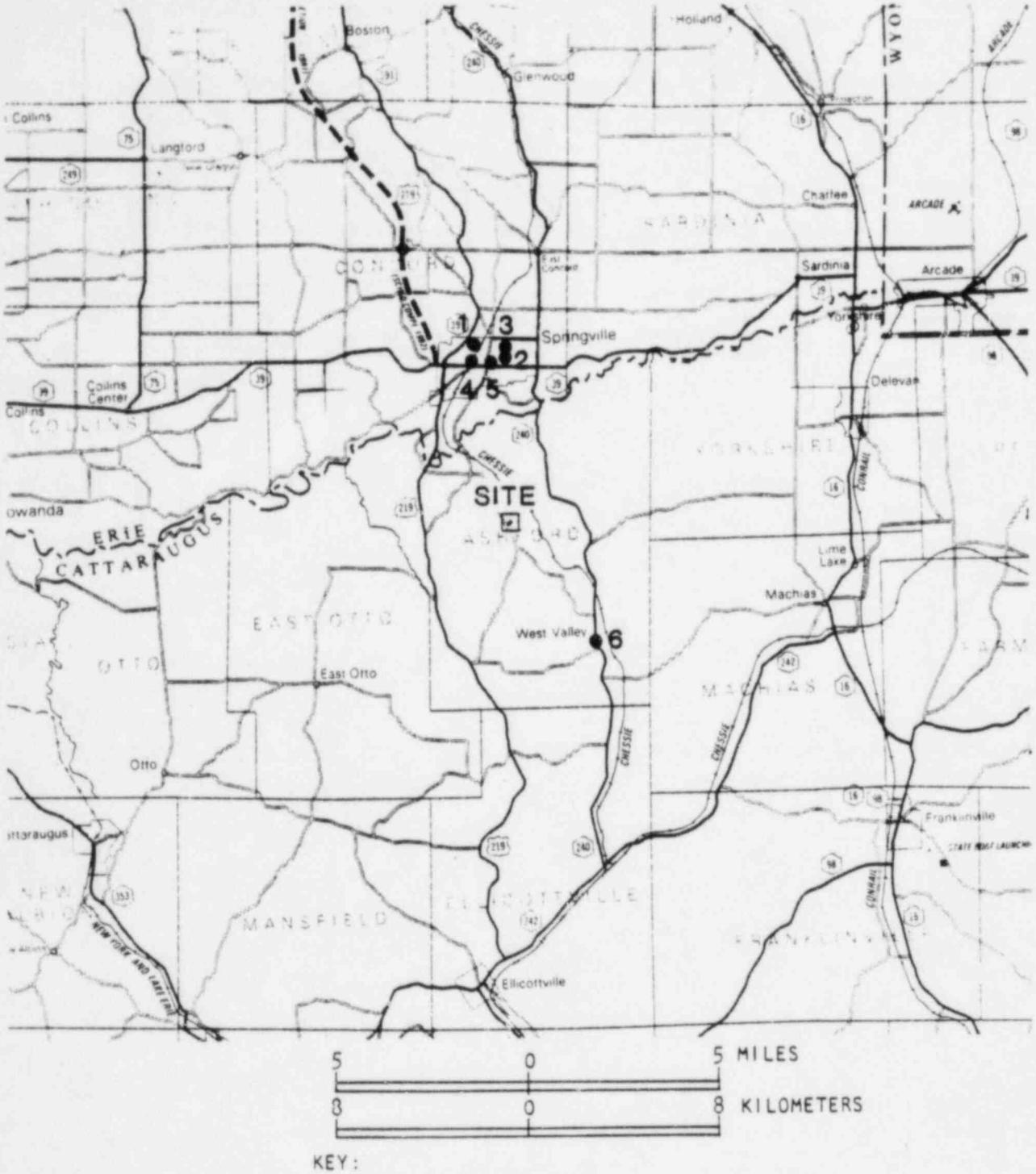
Washington — INCORPORATED PLACE WITH FEWER THAN 50,000 INHABITANTS

UNINCORPORATED PLACE

FIGURE A.3.1-20

MAP REFERENCE:
U.S. BUREAU OF THE CENSUS, 1970.

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KEY:

1 SPRINGVILLE HIGH SCHOOL
2 SPRINGVILLE MIDDLE SCHOOL
3 SPRINGVILLE ELEMENTARY SCHOOL
4 ST. ALOYSIUS PAROCHIAL SCHOOL
5 BERTRAND CHAFFEE HOSPITAL
6 WEST VALLEY CENTRAL SCHOOL

# INSTITUTIONS IN THE SITE VICINITY

FIGURE A 3 1-21

## A.3.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

### A.3.2.1 NUCLEAR FACILITIES

No nuclear facilities are within 80 km (50 miles) of the site.

### A.3.2.2 INDUSTRIES

The few industries in the site vicinity are primarily agricultural service oriented. Contacts with Cattaraugus County Planning and Chamber of Commerce, and a review of the County Industrial Directory (1981) do not indicate the presence of any industrial facilities that could be construed as hazardous.

A land use inventory of Cattaraugus County (County Planning Board and Cooperative Extension Service, 1981) identifies the number of individual commercial, professional, service, public and industrial land use sites in each village and hamlet. No significant industrial facilities are identified in the site vicinity. A similar land use inventory of Springville and Concord Township in Erie County, prepared for the Erie County Planning Department by the consulting firm Development, Analysis, Planning Associates, Ltd. (1982), does not indicate the presence of any significant industrial facilities in the site vicinity in Springville or the Town of Concord.

### A.3.2.3 MILITARY INSTALLATIONS

No military installations are located in the site vicinity.

### A.3.2.4 TRANSPORTATION FACILITIES

The primary methods of transportation in the site vicinity in Cattaraugus County and Erie County use the highway system shown in Figures A.3.1-2 and A.3.1-3.

In Cattaraugus County, all roads with the exception of those within the cities of Olean and Salamanca are considered rural roads. The basic New York State classification scheme for all roads and highways classifies rural roads into six categories - interstate, principal arterial, minor arterial, major collector, minor collector and local. The interstate category includes highways that are part of the national system of interstate and defense highways. None of these exist in the site vicinity.

The Cattaraugus County Highway Department maintains the 663 km of road in Cattaraugus County, which form the present county highway system. The New York State Department of Transportation also maintains approximately 423 km of road. The principal state highways crossing Cattaraugus County lie on essentially north-south and east-west corridors. The State Department of Transportation also maintains approximately 72 km of local roads on the Allegany, Cattaraugus and Oil Spring Indian Reservations. The remainder of the roads in Cattaraugus County are within the jurisdiction of the towns. Taken collectively, the towns maintain almost twice as much roadway as the state and the county combined. This 1,859 km of roadway is primarily classified local.

Arterial highways are connectors of major population and industrial centers. This category, primarily intra-county, would include many of the state highways and future state expressways. U.S. Route 219, located 4.2 km west of the site, is the only arterial road in the site vicinity.

Traffic volume along U.S. 219 ranges from a low average annual daily traffic volume (AADT) of 2,500 to a maximum of 4,400. The design hour volume is approximately 8 percent of the AADT. Seasonal holiday traffic is as much as 128 percent of the AADT. Approximately 18 percent of the traffic consists of trucks. This route operates at a level of service (LOS) B, which indicates a stable traffic flow, an operating speed of 80 km per hour, and reasonable driver freedom to maneuver (Cattaraugus County Planning Board, 1979).

Collectors are roads connecting smaller communities and industrial centers to the arterials. They frequently are intra-county in nature and serve short hauls and cross-county traffic. Three collectors are within approximately 2 km of the site. State Route 240 is 2 km northeast of the site. Dutch Hill Road is 1.8 km west of the site. North of the site, in the Town of Concord, the Dutch Hill Road/Mill Street surface deteriorates and driving conditions discourage use by heavy trucks and through traffic. Rock Springs Road, adjacent to the site on the west, is a collector which serves as the principal site access road. There are fewer than 10 residences on this road.

There are no major truck service areas, transportation terminals, or warehouses near the site.

The Baltimore and Ohio provides railroad service in a north-south direction, serving the central part of the County. This line is 1 km east of the site at its nearest point. The site is served by a siding from this line.

There are no airports in the site vicinity. The only major aviation facility in Cattaraugus County is the Olean Municipal Airport, located in the Town of Ischua. Regularly scheduled commercial air service was terminated at this airport in early 1972.

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## A.3.3 METEOROLOGY

### A.3.3.1 REGIONAL CLIMATOLOGY

#### A.3.3.1.1 General Description of Climate

West Valley, as represented by Buffalo, is located near the mean position of the polar front end; hence the weather is variable and changeable and characteristic of that latitude. The normal wide swings of seasonal temperature are moderated somewhat by the influences of Lakes Erie and Ontario. Continental polar and arctic air waves moving southeast from source regions in northwest Canada traverse the area. Passing over the lakes, they pick up heat and moisture which may lead to heavy snowfalls many centimetres in depth in a few hours along the shores of the lakes and on higher ground further inland.

The vigorous interplay of warm and cold air masses during winter and early spring months causes storms which may create strong winds in the range of 80 to 120 km per hour. Winters are vigorous and sometimes severe. Sub-zero temperatures are moderately frequent, with an all-time low of -35°C at Jamestown and -29°C at Buffalo. Summers are short and mild with brief hot spells that last for only one or two days. The growing season averages around 150 days with 45 to 51 centimetres of rainfall during the period and very infrequent droughts.

### A.3.3.2 LOCAL METEOROLOGY

#### A.3.3.2.1 Data Sources

The West Valley Demonstration Project lies approximately 50 km inland from the eastern end of Lake Erie. Off-site data for representation of the general

regional climate and the local meteorological conditions have been taken from the National Weather Service (NWS) observing stations at Buffalo, New York (on the eastern end of Lake Erie, 55 km north northwest of West Valley, at latitude 42.93° 56' N, longitude 78.73° W) and Jamestown, New York (63 km to the southwest, at latitude 42.1° N, longitude 79.25° W).

Buffalo has the most complete data record for the Western New York State region and has therefore been chosen as the major data source. But Buffalo's location on the eastern shore of Lake Erie modifies its climate and meteorology, producing a significant increase in annual snowfall. Jamestown is located at approximately the same distance inland as West Valley where lake effects are mitigated though they may still cause some increase in snowfall. Where available, data from the Jamestown station are used for comparison with data from Buffalo to provide a measure of possible lake effects.

Recording at the Buffalo NWS station began in 1870, but before 1929 the station's location was changed several times to various locations around the city. Since 1929, the Buffalo station has been located at the airport, though it has been moved several times, each time less than a kilometre. Between 1943 and 1960, it was maintained on a rooftop; in August 1960 it was moved to a ground-level position to meet aviation standards and has remained at that location ever since. Parameters such as extremes of temperature and wind speed and average wind speed probably have been affected by this change in the site's exposure.

The Jamestown station began recording in January, 1850. Its location changed a number of times and there are several gaps in the record until 1922, when it was located on the roof of the City Hall where it has remained ever since. The rooftop location probably leads to relatively higher recorded values for wind speeds than would be the case for a ground-level station.

More detailed data for analysis of long-term meteorological characteristics have been obtained from the records of the National Climatic Center.

A magnetic tape containing five years of data collected at Buffalo during the period 1973-1977 has been processed to provide the data for the joint frequency distribution of wind persistence tables and wind rises in Section A.3.3.2.2.1.

### A.3.3.2.2 Normal and Extreme Values

#### A.3.3.2.2.1 Wind Speed and Direction

Average annual wind speed at Buffalo is 19.8 km per hour (kph) and slightly less at West Valley because of the sheltering effect of the moderate terrain features. Table A.3.3-1 shows the average monthly wind speeds and the maximum recorded speeds and corresponding directions.

Highest winds occur in January and February from the west southwest to southwest with monthly averages of over 6 m/s. These wind speeds occur as a result of major winter cyclonic storms passing through the area. The highest recorded wind speed at Buffalo occurred from the southwest in January 1950 and was 41 m/s. The second highest recorded wind speed, also from the southwest, was 31 m/s. The summer winds are lighter; maximum speeds occur during passage of thunderstorms.

The seasonal and annual joint wind speed - wind directions frequency distribution based on 5 years' data from Buffalo are presented in Supplement A.3.3-A. The seasons in order are winter (December-February), spring (March-May), summer (June-August), and autumn (September-November).

On an annual basis, nearly 38 percent of all winds come from the southwest quarter and are the strongest winds. The most frequent wind speeds range between 3 and 7.5 metres per second, and account for nearly 64 percent of all winds in the 5-year period analyzed.

The frequency distributions for each of the seasonal periods are very similar to the annual distribution except that summer winds from the south are more strongly represented and speeds are lower.

Supplement A.3.3-A also contains the frequency distribution of wind direction persistence for the same annual seasonal periods between 1973 and 1977 for five degree sectors. The same data on wind speed and frequency are also shown in the form of wind roses in Figures A.3.3-1, -1a, -1b, -1c, -1d. The dominance of winds with a southwesterly component is clearly evident in each of the periods.

**A.3.3.2.2.2 Temperature**

The temperature and humidity ranges in the region are typical of the humid continental climatic type. Average summer maxima reach nearly 27°C at Buffalo on Lake Erie and are in the 30-32°C range inland at Jamestown and West Valley. In winter, the average maximum covers the range of -1° to 1°C across the region, with the higher temperatures away from the Lake. Minimum temperatures are from 16°C in the summer down to -29° to -32°C in the winter.

Temperature extremes are modest: the maximum recorded values at most localities are about 37° to 38°C. Minimum values range from -29° to -32°C; the more extreme values occur away from the lakes.

Average monthly temperatures and extremes for both Buffalo and Jamestown are shown in Tables A.3.3-2 and A.3.3-3.

#### A.3.3.2.2.3 Humidity

Relative humidity varies diurnally with temperature and changes with the absolute amount of water vapor present in the air. Buffalo has available relative humidity data taken at 0100, 0700, 1300, and 1900 hours local time since 1960. Table A.3.3-4 shows the normal diurnal range represented by monthly mean values for 0700 and 1300 hours. Values at West Valley probably do not differ from those at Buffalo by more than 2 or 3 percent since the region as a whole is generally humid.

Absolute humidity data is less readily available. In winter, values range between approximately 1.3 and 3.7 $g/m^2$ and in summer, between 4.1 and 14.7 $g/m^2$.

#### A.3.3.2.2.4 Precipitation

Precipitation in the region is bountiful and well distributed throughout the year with heavy snowfall in winter and early spring and plentiful rain in the remaining seasons.

Total water equivalent ranges from approximately 89 cm at low elevation to 114 cm on the hills inland. Snowfalls are typically in the range of 229 to 305 cm with the higher falls occurring near the lake and on the hills. Maximum rainfalls in 24 hours have been recorded at 11.4 to 12.7 cm, but the more normal 24-hour rainfall is between five and eight centimetres. Maximum daily snowfalls of around 63.5 cm have been recorded and falls of 25 to 38 cm are common.

Table A.3.3-5 shows monthly values for the average water equivalent and the maximum and minimum values for Buffalo. Precipitation is uniform on the average; all months receive more than five centimetres. The record shows no months without rain in 36 years. Late summer and autumn is the time of maximum falls. The maximum 24-hour rainfall recorded at Buffalo was 12.55 cm and occurred in September 1979. Maximum water equivalent falls by month are shown in Table A.3.3-6 for both Buffalo and Jamestown; the latter probably represents West Valley more closely.

The most striking example of the effect of Lake Erie occurs in winter when the cold continental air generated in Canada moves across the warmer lake, picks up warmth and moisture, and becomes increasingly unstable, leading to heavy snowfalls on the eastern shore of the lake and the hills further inland. Table A.3.3-7 shows maximum falls for both Buffalo and Jamestown.

### A.3.3.2.2.5 Other Climatic Variables

#### Sunshine

The normal annual number of hours of sunshine is approximately 2100 hours. In summer the daily value is approximately 9 hours and in winter the normal is 3-1/2 hours.

## Evaporation

Annual Class A pan evaporation at West Valley is approximately 91 cm per year. This is very close to the annual precipitation, while evaporation from lakes and reservoirs is less than 76 cm. The region as a whole has a net surplus of water on the average, but may experience some water stress in the middle to late part of the growing season when monthly evaporation rates rise above the precipitation.

## Thunderstorms and Tornadoes

The region averages thunderstorms 30 days each year; of these, approximately two-thirds occur in June, July, and August. Fifty percent of these storms are likely to occur between 1200 and 1800 hours local time. Tornadoes are infrequent and generally not particularly destructive. On the average, one tornado will occur in Western New York State each year, most likely in June. Jamestown was the location of the State's most severe tornado, which struck in 1945 and caused damage estimated at $5 million.

## Fog

Buffalo has a normal expectation of 10 days per year of dense fog; light fog occurs much more frequently. Away from the lake at West Valley, five to seven days of dense fog are more likely.

## A.3.3.3 ON-SITE METEOROLOGICAL PROGRAM

### A.3.3.3.1 Description of the Program

The measurement program for meteorological parameters at West Valley consists of:

[1] A primary location with measurement levels of 10 and 60 metres above ground, located on site;

[2] A hilltop location of the site, measuring wind parameters of 10 metres above the ground for the purpose of monitoring regional wind; and

[3] Five remote locations which measured wind parameters at ten metres above ground, monitoring local topographically-induced effects over the course of an annual cycle. These sites were dismantled in October 1984.

The Primary Monitoring Location - includes measurement of wind speed and wind direction at 10- and 60-metre heights, measurement of air temperature at 10 metres and measurement of temperature difference between the two heights. The standard deviation of the horizontal wind at both heights is calculated from 5-second interval samplings of the direction monitor. Data is recorded directly on a digital data acquisition system with backup on chart recorders. The data is automatically transmitted daily to the Chicago office of Dames and Moore for processing and storage.

The Regional Monitoring Location - measures wind speed and direction; the standard deviation of the horizontal wind direction is calculated in the same manner as for the primary location. The data are transmitted to the primary location and recorded in the same manner.

The Five Remote Monitoring Locations - Each location recorded wind speed and direction and standard deviation of the horizontal wind direction on a chart recorder contained in the monitor. The charts were collected every two weeks over the course of one year and were shipped to the Chicago office of Dames and Moore for editing and analysis.

Complete details of the monitoring system and data analysis procedures are contained in Project Technical Memoranda which are located in the Project files. The locations of these sites are shown on Figure A.3.3-2.

### A.3.3.3.2 Data from the On-Site Monitoring Program

The meteorological monitoring program was operated through a complete annual cycle covering the period October, 1983, through September, 1984. The data have been summarized in Wind Speed/Wind Direction frequency distribution tables for each of eight instrument locations. Stability class data calculated from temperature data from 10 and 60 metre heights at the primary (on-site) tower are compared by wind sector for both heights, and wind speed/wind direction data are broken out by stability class for these two instrument levels.

Wind roses have also been prepared and are shown in Figures A.3.3-3 through A.3.3-10. Several of these wind roses show topographical effects in their prevailing wind directions. The West Valley remote site has a very low

percentage of winds from the east and west and a high north-south occurrence, corresponding to local topography. By contrast, Riceville shows a 10 percent occurrence of easterly winds of less than six miles per hour. These are usually drainage winds moving down the valley slope to the east of the station.

### A.3.3.4 SHORT-TERM (ACCIDENT) DISPERSION

To calculate the maximum airborne radionuclide concentrations to which a member of the general public could be exposed as a result of an unplanned release, hourly relative dispersion factors (x/Q) at the nearest boundary for each of 16 wind sectors will be calculated using the PAVAN computer code. This code implements the guidance provided in Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants." The meteorological input for the PAVAN code (in the form of the joint frequency distribution of hourly average wind direction and wind speed by atmospheric stability class) are derived from data collected at the on-site meteorological tower from October, 1983, to September, 1984. At the on-site tower, wind speed and direction are measured at 10 and 60 metres from the base. The stability classes are determined from the temperature difference between the 10 and 60 metre elevations.

For Design Basis Accident (DBA) assessments, ground-level or elevated releases can be treated. The PAVAN code calculates the maximum x/Q at the site boundary. This dispersion factor is the largest of the 16 sector x/Q values that are exceeded during 0.5 percent of the time. It is assumed to apply during an accidental release and is used to calculate the dose to a "maximally exposed" person who remained at the site boundary for two hours during the accident. There is a 0.5 percent probability that meteorological conditions

during the accident might be so unfavorable that the "maximum" dose calculated by this method would be exceeded. The maximum x/Q thus calculated is 7.07 x $10^{-4}$ at 2,350 metres north of the plant for a ground release and 6.72 x $10^{-5}$ at 1700 metres northeast of the plant for an elevated release.

### A.3.3.5 LONG-TERM DISPERSION ESTIMATES

Estimates of annual average atmospheric transport and diffusion from ground and elevated releases at the West Valley Demonstration Project (WVDP) were developed using a variable trajectory Gaussian puff dispersion model formulation, as described in Subsection C.1.b of Regulatory Guide 1.111, Revision 1. Long-term average relative concentration (x/Q) and relative dry deposition (D/Q) values were computed for distances out to 80 km from the plant, based on hourly meteorological data from a 7-station monitoring network surrounding the WVDP, and from the 3 nearest National Weather Service (NWS) stations. The meteorological data set for the modeling study is described in Supplement A.3.3-C. Dames and Moore's WNDSRF3 wind field model was used to generate hourly site-specific 2-dimensional wind fields for input to the Dames and Moore EPM3 variable trajectory Gaussian puff dispersion model. These models are also discussed in Supplement A.3.3-C. These site-specific atmospheric dispersion models were used to generate relative dispersion factors (x/Q) for ground and elevated releases. These data are shown in Tables A.3.3-8 and A.3.3-9.

## REFERENCES FOR SECTION A.3.3

Pacific Northwest Laboratory (PNL), 1982. PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations, NURER/CR-2858, PNL-4413, November, 1982.

U.S. Nuclear Regulatory Commission, August 1979. Regulatory Guide 1.145, Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants.

TABLE A.3.3-1

BUFFALO NATIONAL WEATHER SERVICE STATION

WIND SPEEDS AND DIRECTIONS

(MPH)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Monthly Wind Speed | 14.5 | 14.0 | 13.7 | 13.0 | 11.7 | 11.2 | 10.5 | 10.0 | 10.6 | 11.4 | 12.9 | 13.5 | 12.3 |
| Prevailing Direction | WSW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | WSW | SW |
| Fastest Mile | 91 | 70 | 68 | 67 | 63 | 56 | 59 | 56 | 59 | 63 | 66 | 60 | |
| Direction | SW | SW | W | W | SW | NW | NW | SW | SW | SW | SW | S | |

TABLE A.3.3-2

MEAN AND EXTREME TEMPERATURES
(°F)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buffalo | | | | | | | | | | | | | |
| Mean Temperature | 23.7 | 24.4 | 32.1 | 44.9 | 55.1 | 65.7 | 70.1 | 68.4 | 61.6 | 51.5 | 39.8 | 27.9 | 47.1 |
| Maximum Temperature | 72 | 64 | 81 | 87 | 90 | 95 | 94 | 99 | 98 | 87 | 80 | 66 | |
| Minimum Temperature | -12 | -20 | -4 | 12 | 26 | 35 | 43 | 38 | 32 | 20 | 9 | -4 | |
| Jamestown | | | | | | | | | | | | | |
| Mean Temperature | 27.3 | 27.2 | 35.0 | 46.3 | 57.9 | 66.9 | 71.2 | 69.2 | 63.1 | 52.6 | 40.4 | 29.8 | |
| Maximum Temperature | 72 | 70 | 81 | 87 | 93 | 98 | 100 | 97 | 98 | 88 | 80 | 68 | |
| Minimum Temperature | -14 | -25 | -7 | 13 | 25 | 32 | 37 | 36 | 27 | 19 | 1 | -10 | |

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## TABLE A.3.3-3

## DAILY MAXIMUM AND MINIMUM TEMPERATURES (°F)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buffalo | | | | | | | | | | | | | |
| Daily Maximum | 29.8 | 31.0 | 39.0 | 53.3 | 64.3 | 75.1 | 79.5 | 77.6 | 70.8 | 60.2 | 46.1 | 33.6 | 55.0 |
| Daily Minimum | 17.6 | 17.7 | 25.2 | 36.4 | 49.9 | 56.3 | 60.7 | 59.1 | 52.3 | 42.7 | 33.5 | 22.2 | 39.1 |
| Jamestown | | | | | | | | | | | | | |
| Daily Maximum | 35.2 | 35.7 | 44.6 | 57.3 | 70.1 | 79.0 | 83.2 | 61.2 | 74.8 | 63.6 | 48.3 | 36.9 | 59.2 |
| Daily Minimum | 19.4 | 18.4 | 25.0 | 35.4 | 45.7 | 54.9 | 59.2 | 57.3 | 51.3 | 41.6 | 32.5 | 22.6 | 38.6 |

TABLE A.3.3-4

MONTHLY MEAN RELATIVE HUMIDITY
(PERCENT)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0700 Hours | 35.2 | 35.7 | 44.6 | 57.3 | 70.1 | 79.0 | 83.2 | 61.2 | 74.8 | 63.6 | 48.3 | 36.9 | 59.2 |
| 1300 Hours | 19.4 | 18.4 | 25.0 | 35.4 | 45.7 | 54.9 | 59.2 | 57.3 | 51.3 | 41.6 | 32.5 | 22.6 | 38.6 |

TABLE A.3.3-5

MONTHLY MEAN WATER EQUIVALENT PRECIPITATION (INCHES)
MONTHLY MAXIMUM AND MINIMUM VALUES (INCHES)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly Mean | 2.90 | 2.55 | 2.85 | 3.15 | 2.97 | 2.23 | 2.93 | 3.53 | 3.25 | 3.01 | 3.74 | 3.00 | 36.11 |
| Monthly Maximum | 6.47 | 5.80 | 5.59 | 5.90 | 6.39 | 6.06 | 6.43 | 10.67 | 8.99 | 9.13 | 6.37 | 5.02 | |
| Monthly Minimum | 1.07 | 0.81 | 1.20 | 1.27 | 1.21 | 0.11 | 0.99 | 1.10 | 0.77 | 0.30 | 1.44 | 0.69 | |

TABLE A.3.3-6

MONTHLY MAXIMUM WATER EQUIVALENT FALLS
(INCHES)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buffalo | 2.40 | 2.31 | 2.14 | 1.71 | 2.03 | 3.04 | 3.30 | 3.88 | 4.94 | 3.49 | 2.51 | 2.16 |
| Jamestown | 1.62 | 1.66 | 2.30 | 2.98 | 1.90 | 3.90 | 2.46 | 2.83 | 3.25 | 4.52 | 3.15 | 1.35 |

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TABLE A.3.3-7

MAXIMUM MONTHLY AND DAILY SNOWFALLS
(INCHES)

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buffalo | | | | | | | | | | | | | |
| Maximum Monthly Fall | 68.3 | 54.2 | 29.2 | 15.0 | 2.0 | 0.0 | 0.0 | 0.0 | T | 3.1 | 31.3 | 60.7 | 68.3 |
| Maximum Daily Fall | 25.3 | 14.5 | 15.8 | 6.8 | 2.0 | T | 0.0 | 0.0 | T | 2.5 | 19.9 | 24.3 | 25.3 |
| Jamestown | | | | | | | | | | | | | |
| Maximum Monthly Fall | 50.5 | 30.5 | 39.9 | 18.5 | 0.5 | T | 0.0 | 0.0 | 0.5 | 5.0 | 54.0 | 67.0 | 67.0 |
| Maximum Daily Fall | 18.0 | 17.0 | 23.0 | 10.0 | 0.5 | T | 0.0 | 0.0 | 0.5 | 5.0 | 12.5 | 14.5 | 23.0 |

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# TABLE A.3.3 - 8

## X/Q VALUES FOR ROUTINE GROUND RELEASE

WEST VALLEY NUCLEAR SERVICES, WEST VALLEY, NEW YORK
LONG-TERM RADIOLOGICAL IMPACT ASSESSMENT: GROUND RELEASE
METEOROLOGICAL DATA PERIOD: OCTOBER 1, 1983 TO SEPTEMBER 30, 1984

RESULTS FOR: YYMMDD HHMM
PERIOD BEGINNING DATE:831001, TIME: 100
TO PERIOD ENDING DATE:840930, TIME:2400

RECTANGULAR COORDINATES OF POLAR GRID ORIGIN: X= 692900.0 METERS, Y= 4702200.0 METERS.

| RECEPTOR AZIMUTH (DEGREES) | RECEPTOR RADIAL DISTANCE (METERS) 805.0 | 2414.0 | 4023.0 | 5633.0 | 7242.0 | 12070.0 | 24140.0 | 40234.0 | 56327.0 | 72420.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 22.50 | 1.64432E-06 | 4.55564E-07 | 1.66184E-07 | 1.01517E-07 | 6.77884E-08 | 3.52891E-08 | 3.40586E-09 | 1.00542E-09 | 1.07102E-09 | 4.89436E-10 |
| 45.00 | 1.56641E-06 | 3.30197E-07 | 1.34172E-07 | 4.73194E-08 | 3.59780E-08 | 2.21417E-08 | 5.09350E-09 | 1.70791E-09 | 1.69081E-09 | 9.70124E-10 |
| 67.50 | 1.01058E-06 | 1.97252E-07 | 9.42588E-08 | 5.81298E-08 | 3.79589E-08 | 1.42588E-08 | 4.70023E-09 | 1.70863E-09 | 1.73880E-09 | 1.00094E-09 |
| 90.00 | 1.09262E-06 | 1.82835E-07 | 6.67927E-08 | 3.73567E-08 | 2.40901E-08 | 8.93237E-09 | 2.77984E-09 | 1.41573E-09 | 1.88473E-09 | 1.14849E-09 |
| 112.50 | 1.78994E-06 | 2.74125E-07 | 1.11012E-07 | 5.38760E-08 | 3.54571E-08 | 1.28142E-08 | 3.20641E-09 | 1.18574E-09 | 1.76595E-09 | 1.12258E-09 |
| 135.00 | 2.15038E-06 | 2.94396E-07 | 1.14500E-07 | 6.48315E-08 | 4.33901E-08 | 1.65469E-08 | 3.96052E-09 | 1.37113E-09 | 1.86616E-09 | 1.30490E-09 |
| 157.50 | 1.44110E-06 | 2.02579E-07 | 7.62755E-08 | 4.02057E-08 | 2.65812E-08 | 1.08235E-08 | 2.93527E-09 | 1.04913E-09 | 1.64937E-09 | 8.86398E-10 |
| 180.00 | 8.98011E-07 | 1.26039E-07 | 4.46505E-08 | 2.10800E-08 | 1.25962E-08 | 4.28680E-09 | 1.03415E-09 | 3.53940E-10 | 4.66549E-10 | 5.45398E-10 |
| 202.50 | 5.82938E-07 | 9.09417E-08 | 3.23678E-08 | 1.65005E-08 | 1.04614E-08 | 3.68894E-09 | 8.73627E-10 | 3.80441E-10 | 7.41595E-10 | 4.34928E-10 |
| 225.00 | 6.20413E-07 | 7.22452E-08 | 2.39934E-08 | 1.50882E-08 | 1.07698E-08 | 3.43687E-09 | 8.53510E-10 | 3.15227E-10 | 7.20057E-10 | 5.13015E-10 |
| 247.50 | 4.08957E-07 | 6.32056E-08 | 1.82285E-08 | 1.01640E-08 | 8.59581E-09 | 2.33436E-09 | 7.21198E-10 | 3.22624E-10 | 5.78642E-10 | 4.33205E-10 |
| 270.00 | 8.34124E-07 | 9.51694E-08 | 2.16677E-08 | 9.40243E-09 | 5.93790E-09 | 2.40878E-09 | 9.84799E-10 | 4.35641E-10 | 4.90053E-10 | 3.45848E-10 |
| 292.50 | 1.28776E-06 | 1.80939E-07 | 3.03818E-08 | 2.59719E-09 | 1.63193E-09 | 6.26825E-09 | 1.25810E-09 | 3.77333E-10 | 4.77[illegible]4E-10 | 3.92251E-10 |
| 315.00 | 2.31598E-06 | 4.61826E-07 | 6.24797E-08 | 2.03700E-08 | 2.54686E-08 | 2.26095E-09 | 8.30861E-10 | 4.30455E-10 | 4.[illegible]71E-10 | 3.02797E-10 |
| 337.50 | 6.00362E-06 | 1.40566E-07 | 6.21634E-08 | 6.63543E-08 | 1.15632E-07 | 1.76978E-08 | 1.68011E-09 | 6.15352E-10 | 7.60912E-10 | 5.16590E-10 |
| 360.00 | 4.27125E-06 | 4.75757E-07 | 1.16690E-07 | 1.44426E-07 | 1.63061E-07 | 2.66190E-08 | 3.37986E-09 | 9.44245E-10 | 9.79275E-10 | 4.98107E-10 |

# TABLE A.3.3 - 9

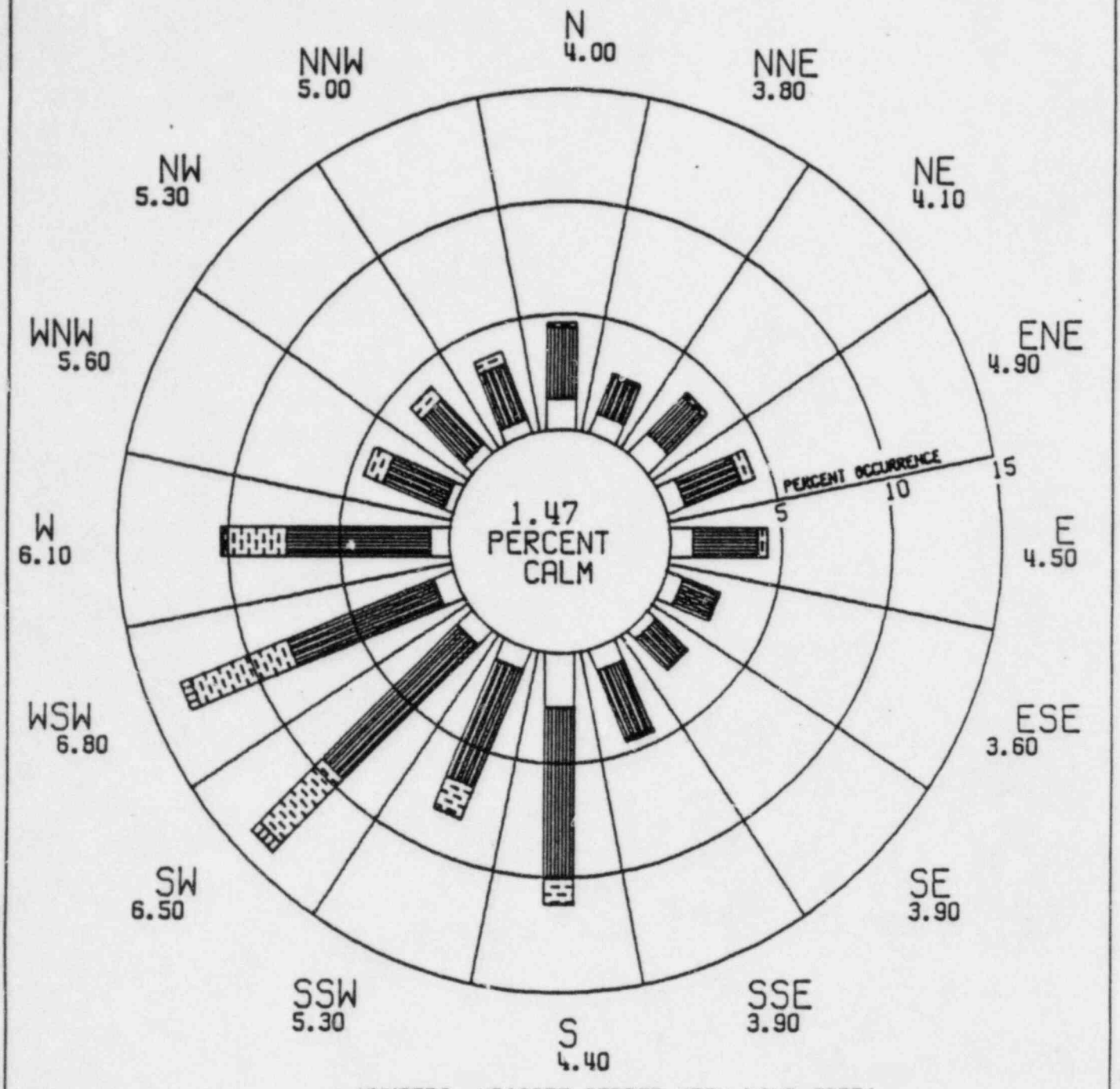
## X/Q VALUES FOR ROUTINE ELEVATED RELEASE

WEST VALLEY NUCLEAR SERVICES, WEST VALLEY, NEW YORK
LONG-TERM RADIOLOGICAL IMPACT ASSESSMENT: ELEVATED RELEASE
METEOROLOGICAL DATA PERIOD: OCTOBER 1, 1983 TO SEPTEMBER 30, 1984

RESULTS FOR: YYMMDD HHMM
PERIOD BEGINNING DATE:831001, TIME: 100
TO PERIOD ENDING DATE:840930, TIME:2400

RECTANGULAR COORDINATES OF POLAR GRID ORIGIN: X= 692900.0 METERS, Y= 4702200.0 METERS.

| RECEPTOR AZIMUTH (DEGREES) | RECEPTOR RADIAL DISTANCE (METERS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 805.0 | 2414.0 | 4023.0 | 5633.0 | 7242.0 | 12070.0 | 24140.0 | 40234.0 | 56327.0 | 72420.0 |
| 22.50 | 2.02416E-08 | 1.93936E-08 | 1.72210E-08 | 1.34912E-08 | 1.20170E-08 | 4.43343E-08 | 5.02300E-09 | 1.54200E-09 | 4.66679E-10 | 2.25540E-10 |
| 45.00 | 3.25187E-08 | 6.28082E-08 | 1.32191E-07 | 2.44441E-08 | 1.68344E-08 | 1.22992E-08 | 1.31197E-08 | 3.73175E-09 | 7.62408E-10 | 3.89659E-10 |
| 67.50 | 3.42855E-08 | 6.94581E-08 | 9.40678E-08 | 8.45441E-08 | 5.52987E-08 | 1.76386E-08 | 8.88299E-09 | 2.36241E-09 | 7.63461E-10 | 3.96656E-10 |
| 90.00 | 3.48094E-08 | 5.50870E-08 | 5.37927E-08 | 5.04765E-08 | 3.36123E-08 | 1.30863E-08 | 3.96711E-09 | 1.69612E-09 | 9.09068E-10 | 5.38685E-10 |
| 112.50 | 5.93936E-08 | 6.20651E-08 | 1.06356E-07 | 6.10075E-08 | 5.09316E-08 | 1.70443E-08 | 3.43913E-09 | 1.29261E-09 | 7.80346E-10 | 4.93087E-10 |
| 135.00 | 7.26163E-08 | 4.20942E-08 | 4.16769E-08 | 5.56745E-08 | 5.42665E-08 | 2.21988E-08 | 4.78107E-09 | 1.67453E-09 | 9.56557E-10 | 7.16724E-10 |
| 157.50 | 5.21367E-08 | 5.04154E-08 | 9.01721E-08 | 4.79790E-08 | 3.10507E-08 | 1.27633E-08 | 3.65858E-09 | 1.39235E-09 | 8.41724E-10 | 4.17164E-10 |
| 180.00 | 3.90295E-08 | 1.56936E-07 | 6.36421E-08 | 3.41481E-08 | 1.79095E-08 | 5.46839E-09 | 1.49509E-09 | 6.17677E-10 | 2.49661E-10 | 1.80339E-10 |
| 202.50 | 3.36508E-08 | 9.69468E-08 | 4.42338E-08 | 2.37874E-08 | 1.62491E-08 | 4.97200E-09 | 1.16554E-09 | 4.17297E-10 | 3.26463E-10 | 2.17867E-10 |
| 225.00 | 2.60220E-08 | 1.42672E-07 | 1.45403E-08 | 1.38970E-08 | 1.72462E-08 | 3.90207E-09 | 1.04904E-09 | 3.62789E-10 | 2.67344E-10 | 2.49012E-10 |
| 247.50 | 1.72524E-08 | 1.35143E-07 | 9.31379E-09 | 8.86101E-09 | 9.81254E-09 | 2.91434E-09 | 7.44792E-10 | 3.09624E-10 | 2.42050E-10 | 1.63484E-10 |
| 270.00 | 1.38976E-08 | 5.95015E-08 | 9.28389E-09 | 4.92763E-09 | 3.25826E-09 | 1.99053E-09 | 1.17354E-09 | 5.09524E-10 | 2.33294E-10 | 1.34791E-10 |
| 292.50 | 1.82690E-08 | 2.17990E-08 | 7.45750E-09 | 7.50383E-09 | 6.06720E-09 | 3.02399E-09 | 8.52397E-10 | 3.06939E-10 | 1.84965E-10 | 1.64367E-10 |
| 315.00 | 1.84112E-08 | 1.09852E-08 | 5.65960E-09 | 4.14112E-09 | 4.48262E-09 | 4.12131E-09 | 8.10527E-10 | 3.61054E-10 | 1.97646E-10 | 1.23069E-10 |
| 337.50 | 1.74931E-08 | 8.44696E-09 | 6.69558E-09 | 6.46389E-09 | 1.05258E-08 | 2.99186E-08 | 1.68992E-09 | 5.56843E-10 | 3.13688E-10 | 2.07107E-10 |
| 360.00 | 2.13821E-08 | 1.97053E-08 | 1.39587E-08 | 1.59614E-08 | 1.84509E-08 | 1.22515E-08 | 3.13466E-09 | 9.76986E-10 | 4.44199E-10 | 2.44763E-10 |




NUMBERS INDICATE SECTOR MEAN WIND SPEED

WIND SPEED RANGE

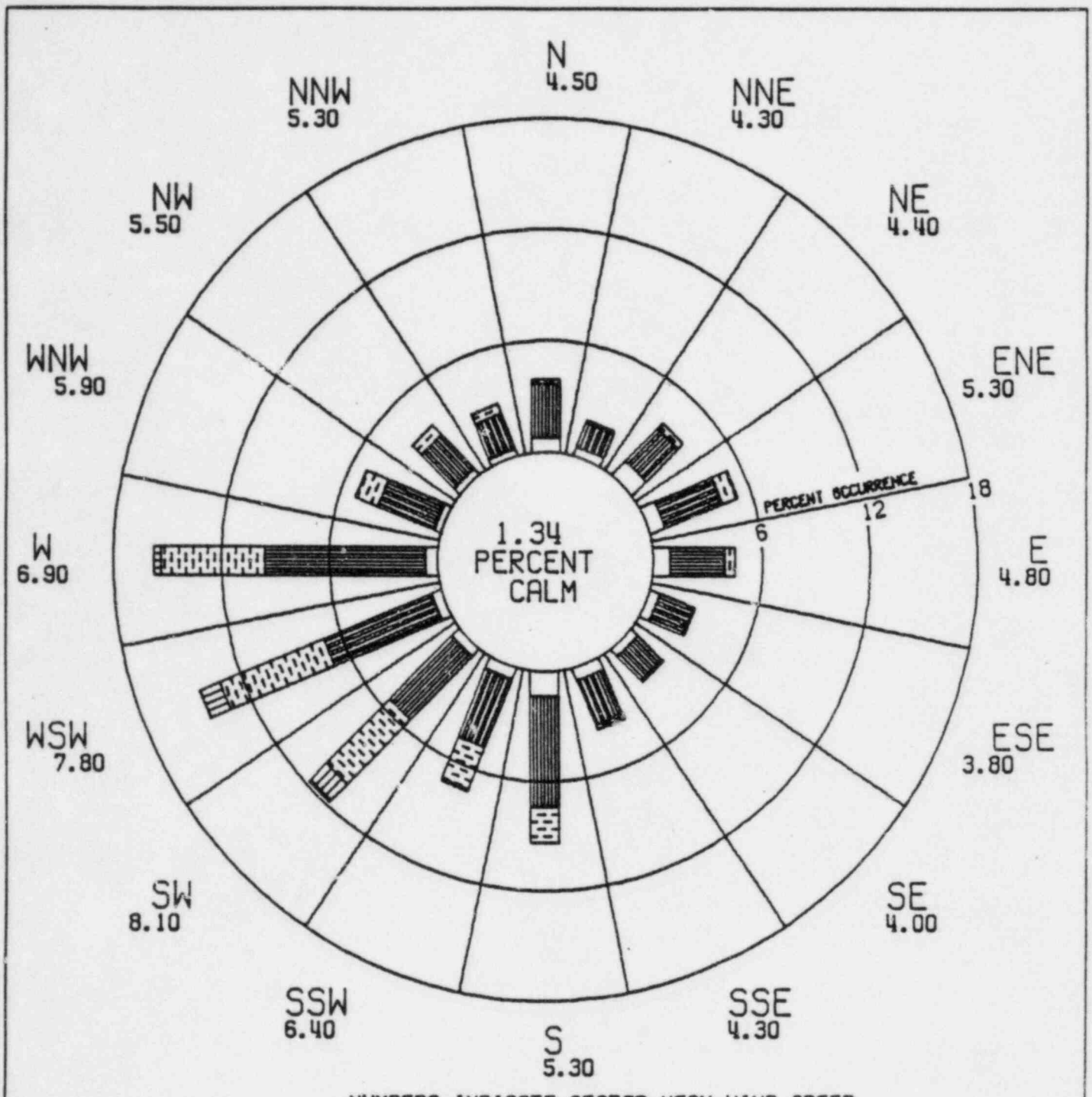
- 0.0-3.0 MPS
- 3.0-7.5
- 7.5-12.5
- 12.5-17.5
- >17.5

FIGURE A.3.3-1

METEOROLOGICAL MONITORING
BUFFALO SURFACE DATA
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION

JANUARY 1, 1973 - DECEMBER 31, 1977




NUMBERS INDICATE SECTOR MEAN WIND SPEED

WIND SPEED RANGE

- 0.0-3.0 MPS
- 3.0-7.5
- 7.5-12.5
- 12.5-17.5
- >17.5

FIGURE A.3.3-1a

METEOROLOGICAL MONITORING
BUFFALO SURFACE DATA
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
WINTER DATA (DECEMBER - FEBRUARY)
JANUARY 1, 1973 - DECEMBER 31, 1977

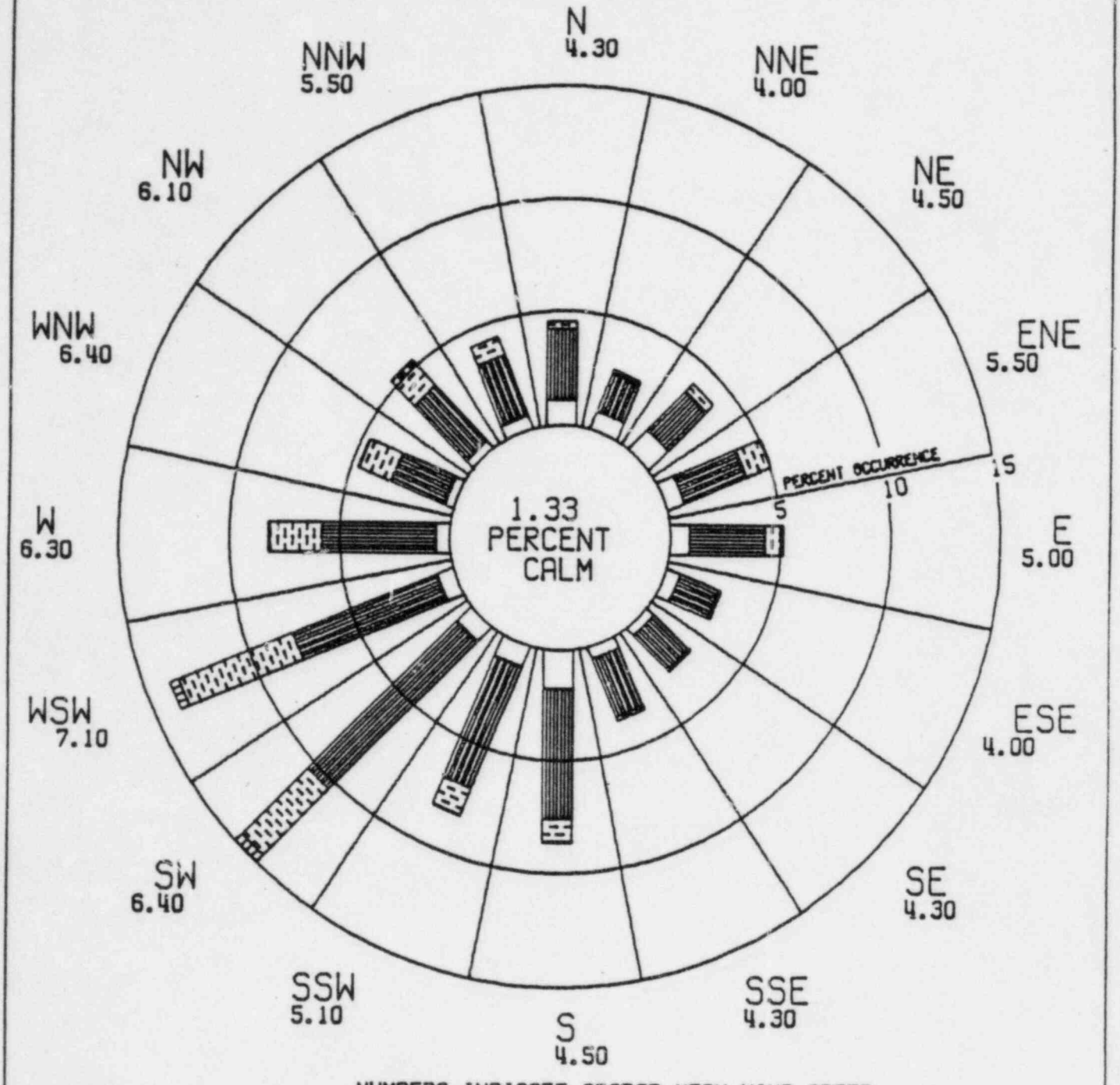
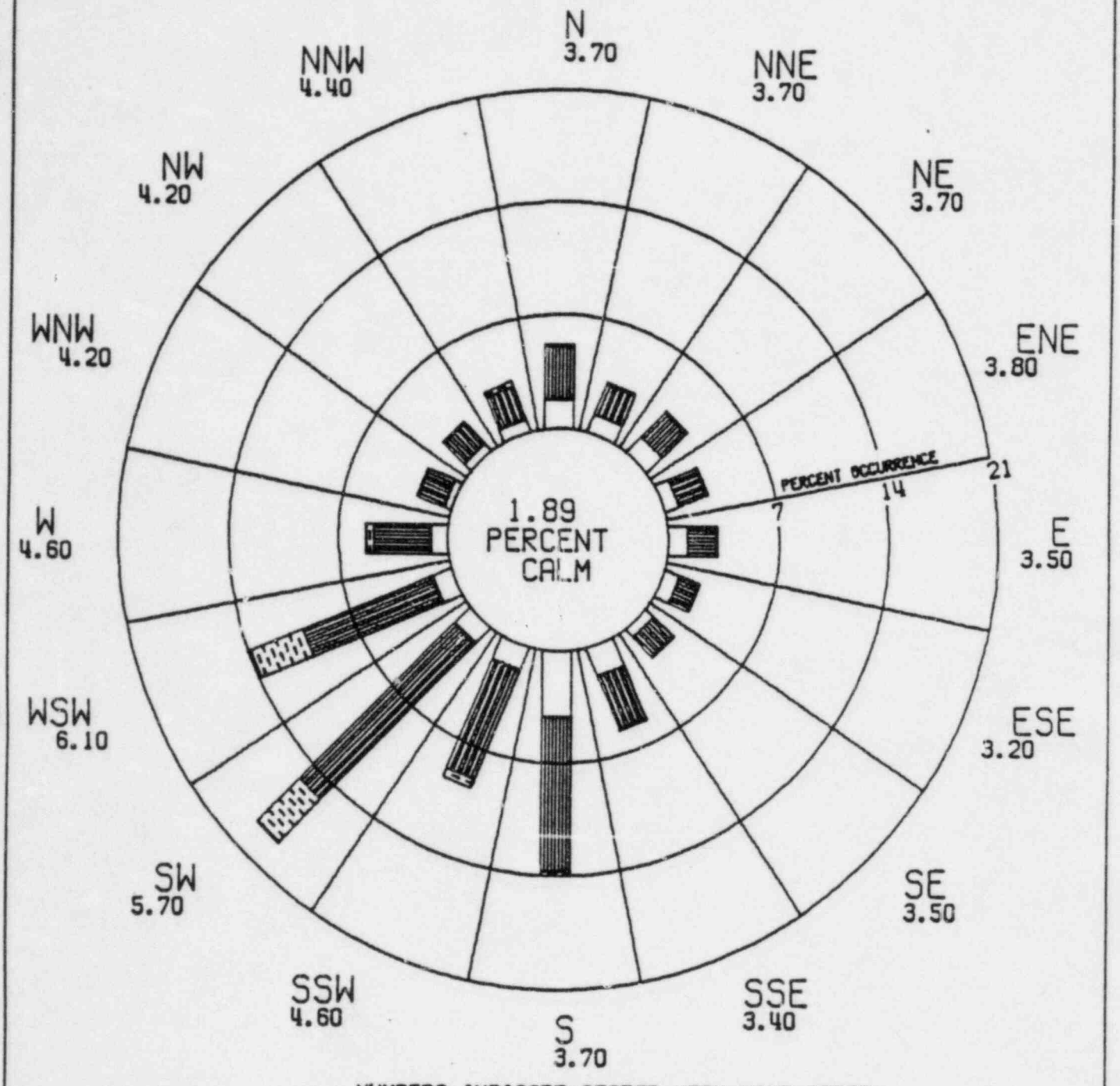



FIGURE A.3.3-1b

METEOROLOGICAL MONITORING
BUFFALO SURFACE DATA
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
SPRING DATA (MARCH - MAY)
MARCH 1, 1973 - MAY 31, 1977




NUMBERS INDICATE SECTOR MEAN WIND SPEED

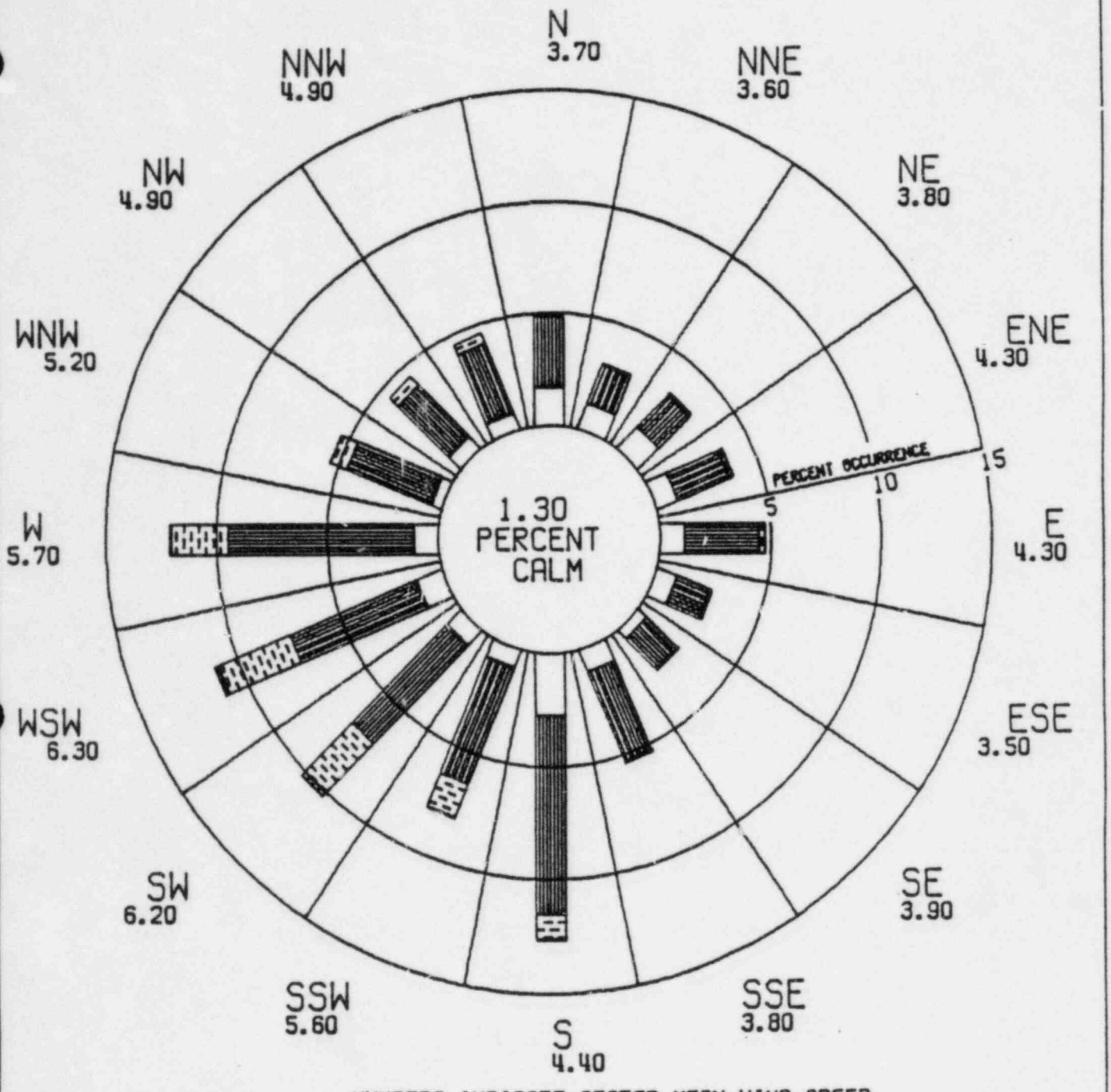
WIND SPEED RANGE

- 0.0-3.0 MPS
- 3.0-7.5
- 7.5-12.5
- 12.5-17.5
- >17.5

FIGURE A.3.3-1c

METEOROLOGICAL MONITORING
BUFFALO SURFACE DATA
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
SUMMER DATA (JUNE - AUGUST)
JUNE 1, 1973 - AUGUST 31, 1977




NUMBERS INDICATE SECTOR MEAN WIND SPEED

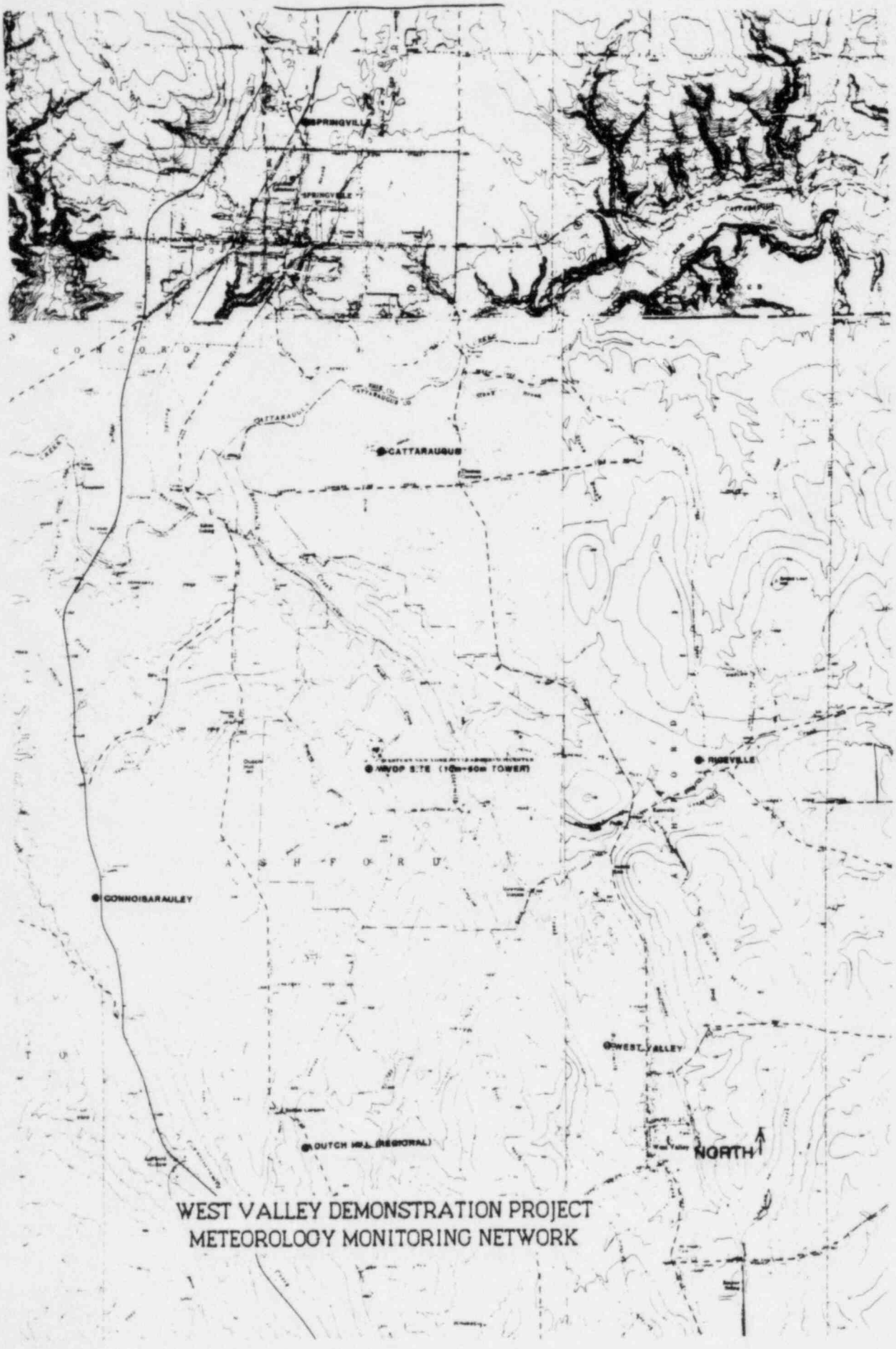
WIND SPEED RANGE

- 0.0-3.0 MPS
- 3.0-7.5
- 7.5-12.5
- 12.5-17.5
- >17.5

FIGURE A.3.3-1d

METEOROLOGICAL MONITORING
BUFFALO SURFACE DATA
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
FALL DATA (SEPTEMBER - NOVEMBER)
SEPTEMBER 1, 1973 - NOVEMBER 31, 1977




WEST VALLEY DEMONSTRATION PROJECT
METEOROLOGY MONITORING NETWORK

FIGURE A.3.3-2

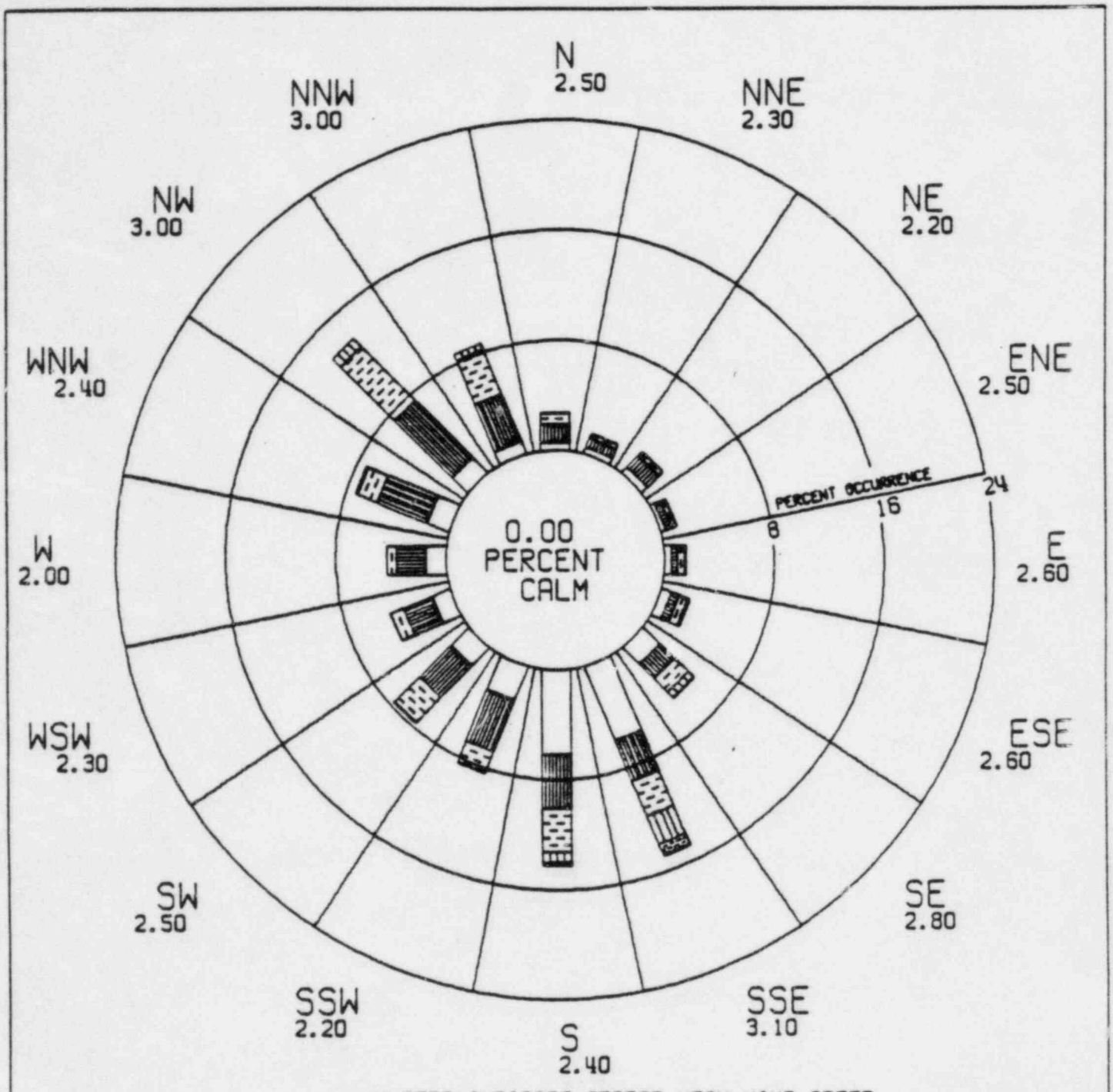



FIGURE A.3.3-3

METEOROLOGICAL MONITORING

WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
PRIMARY SITE 10-METERS
OCTOBER 1, 1983 - SEPTEMBER 30, 1984

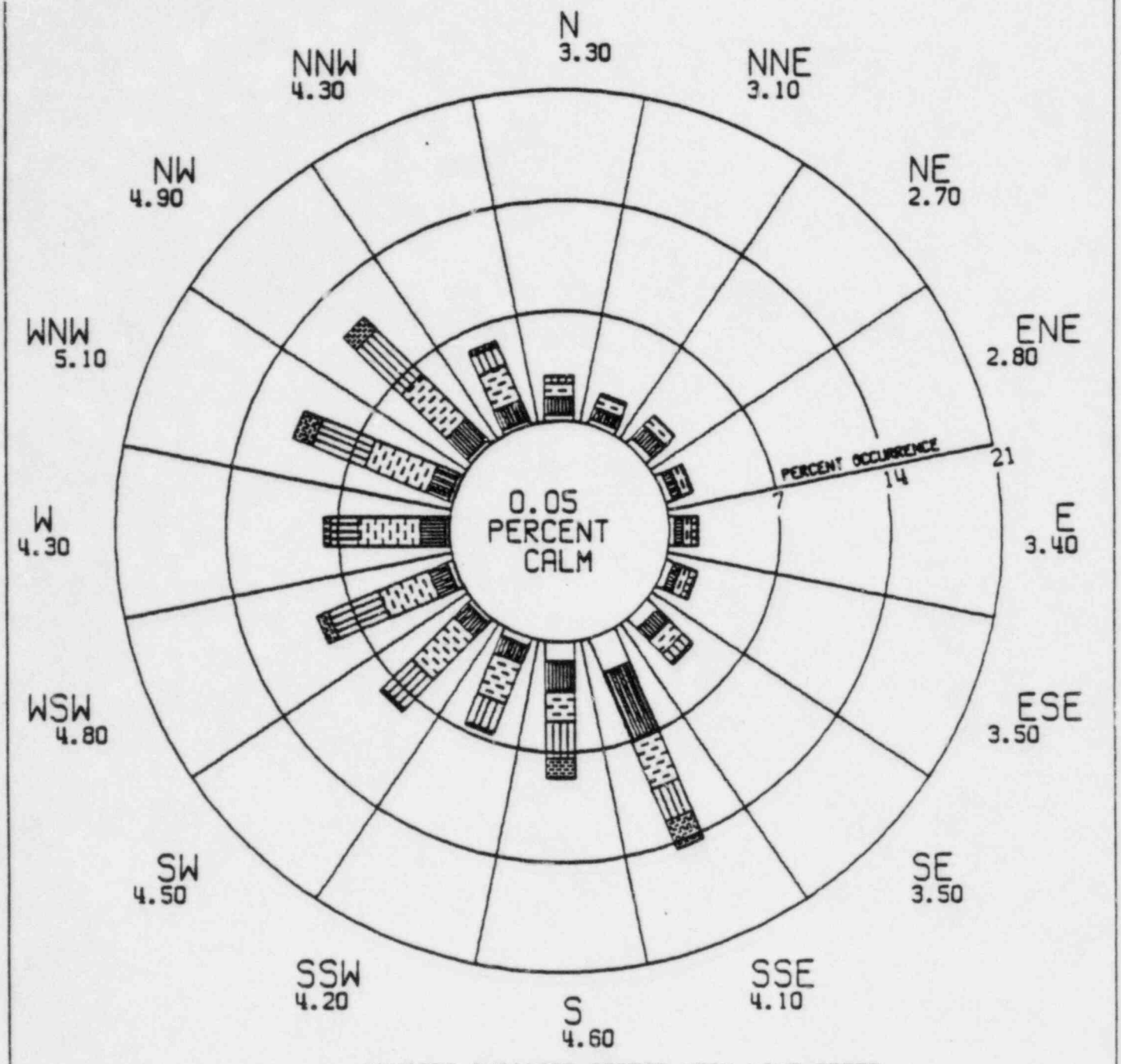



FIGURE A.3.3-4

METEOROLOGICAL MONITORING

WEST VALLEY NUCLEAR SERVICES

60-METER WIND FREQUENCY DISTRIBUTION

PRIMARY SITE 60-METERS

OCTOBER 1, 1983 - SEPTEMBER 30, 1984

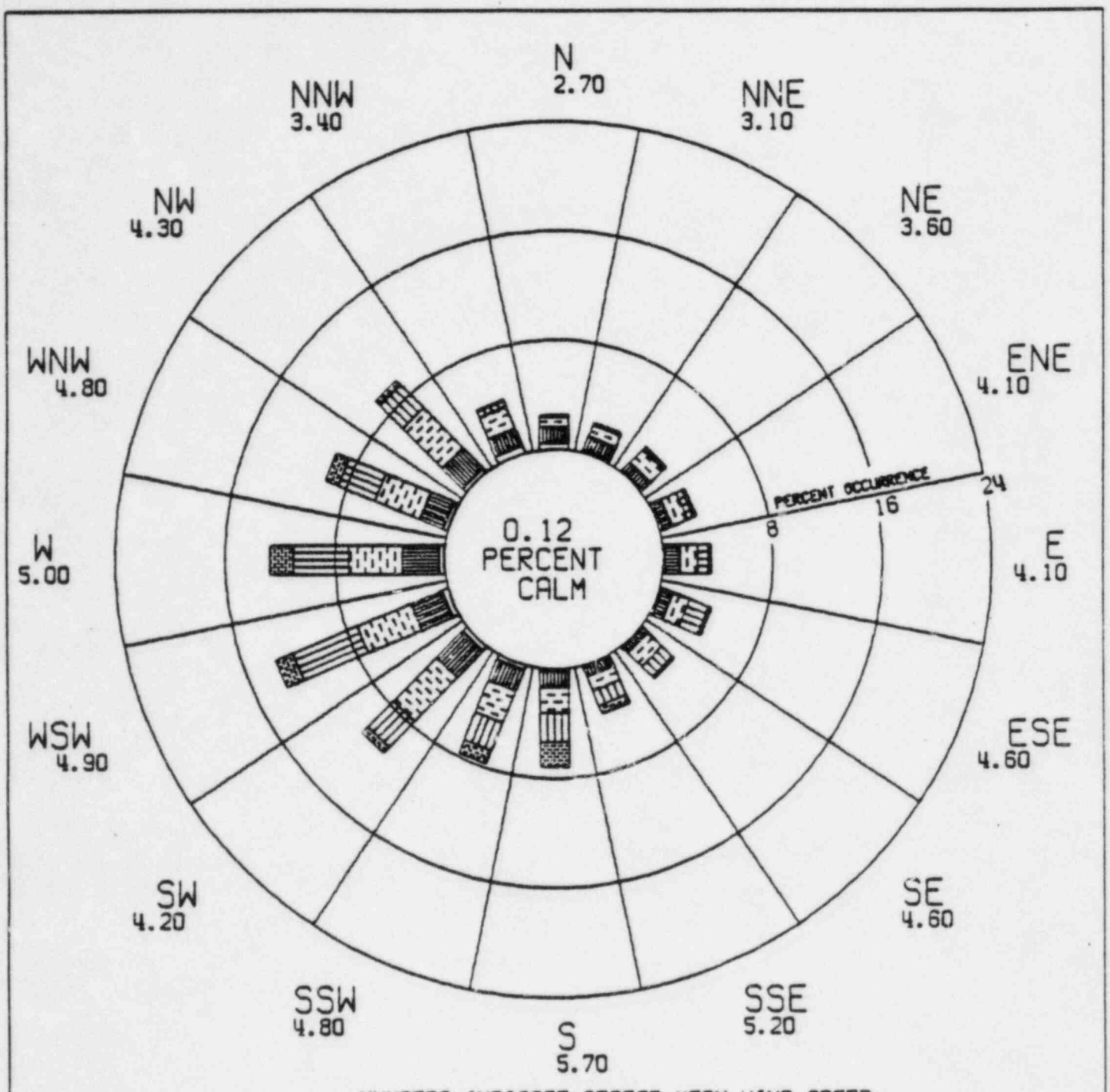



FIGURE A.3.3-5
METEOROLOGICAL MONITORING
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
REGIONAL SITE 10-METERS
OCTOBER 1, 1983 - SEPTEMBER 30, 1984

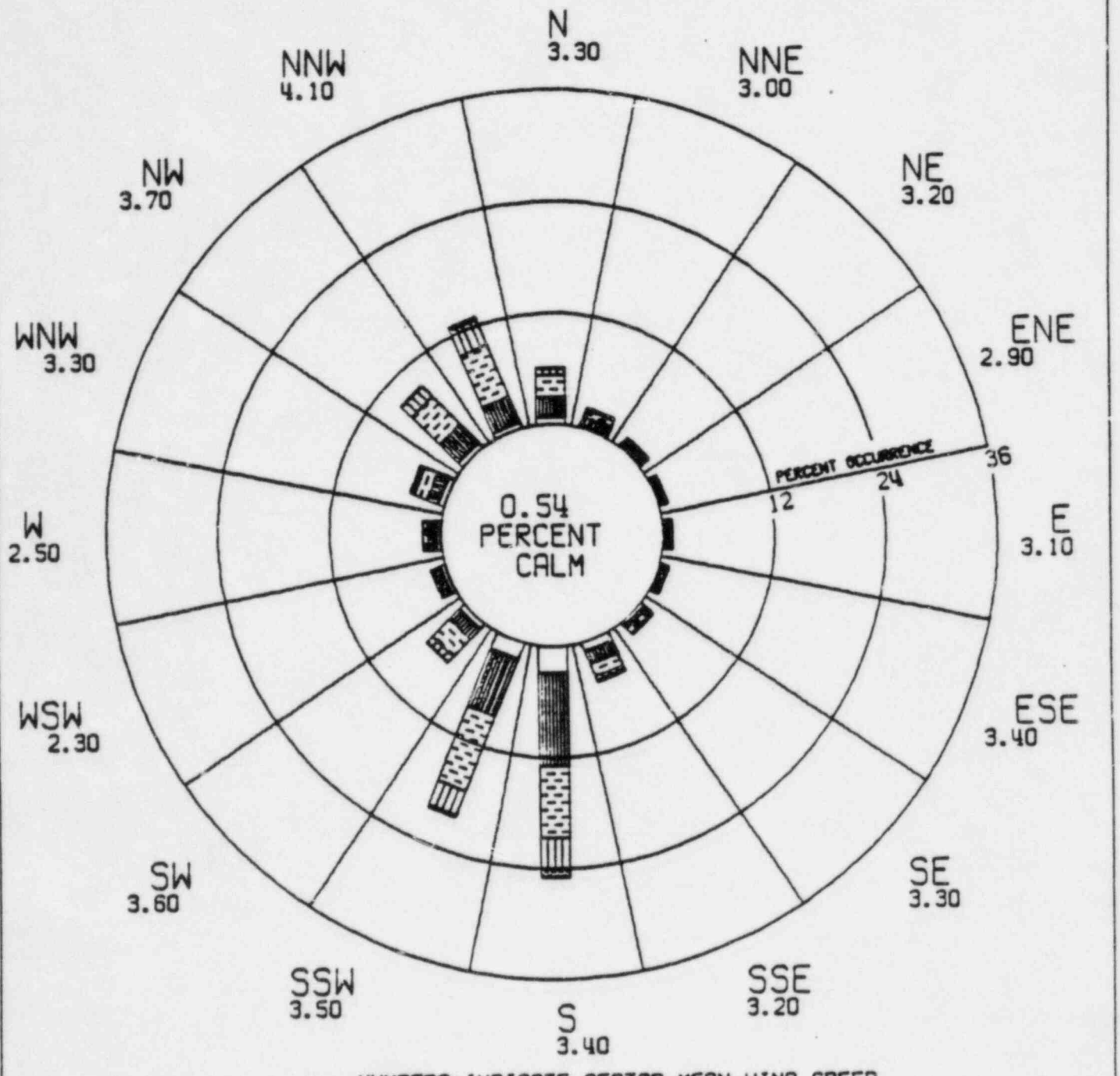



FIGURE A.3.3-6
METEOROLOGICAL MONITORING
WEST VALLEY NUCLEAR SERVICES

10-METER WIND FREQUENCY DISTRIBUTION
WEST VALLEY REMOTE SITE
OCTOBER 1, 1983 - SEPTEMBER 30, 1984

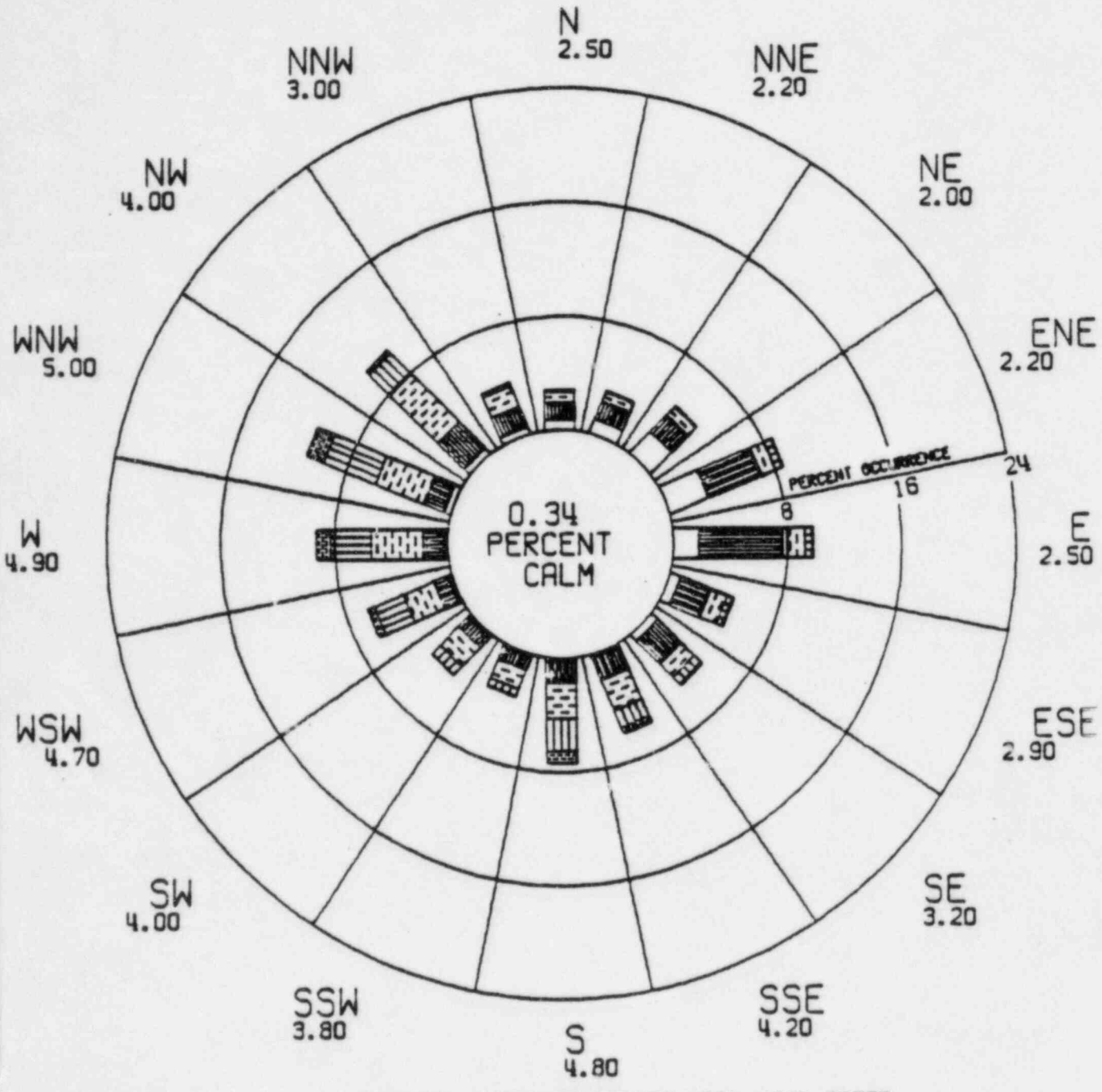



FIGURE A.3.3-7

METEOROLOGICAL MONITORING

WEST VALLEY NUCLEAR SERVICES

10-METER FREQUENCY DISTRIBUTION

RICEVILLE REMOTE SITE

OCTOBER 1, 1983 - SEPTEMBER 30, 1984

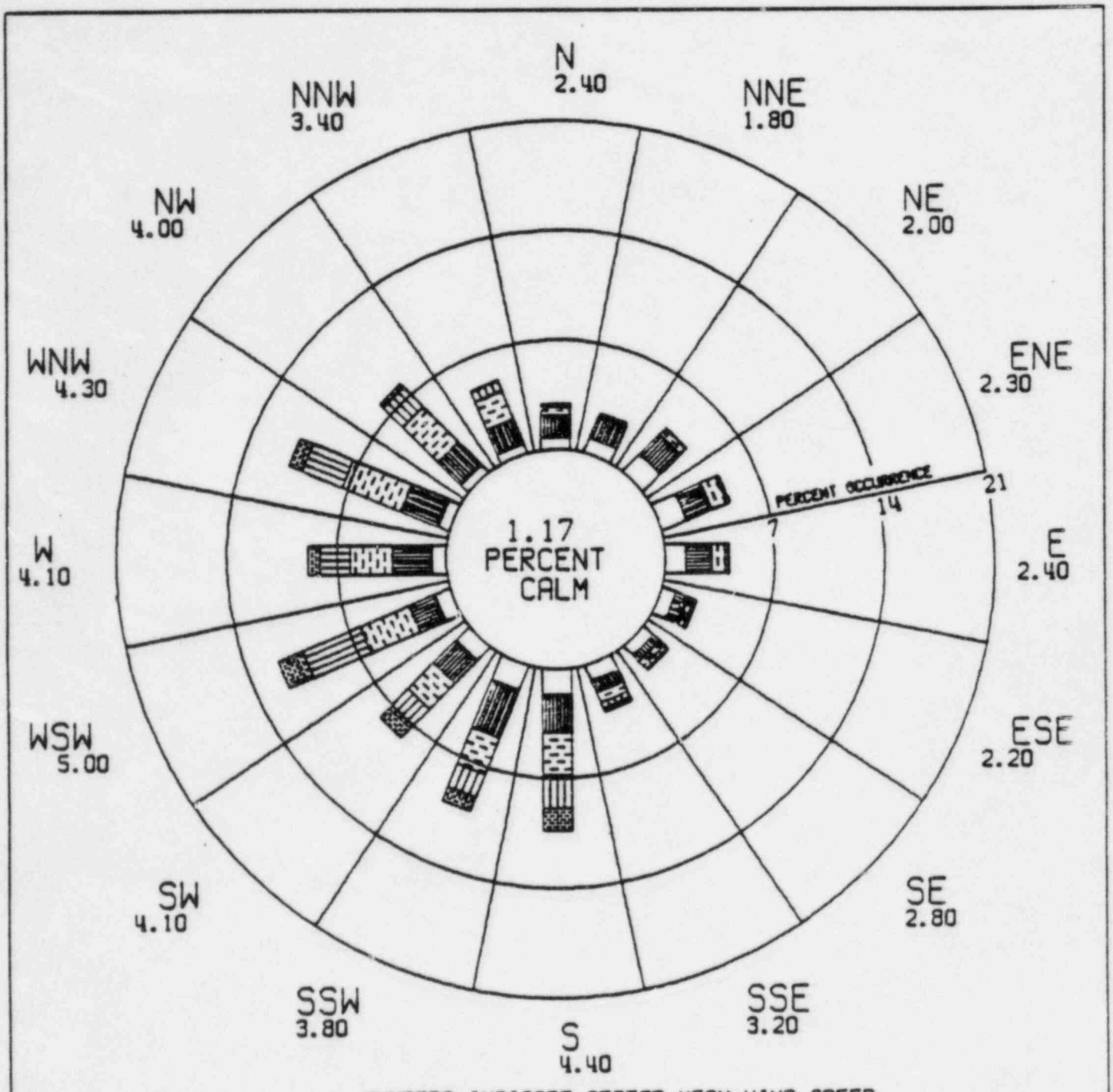
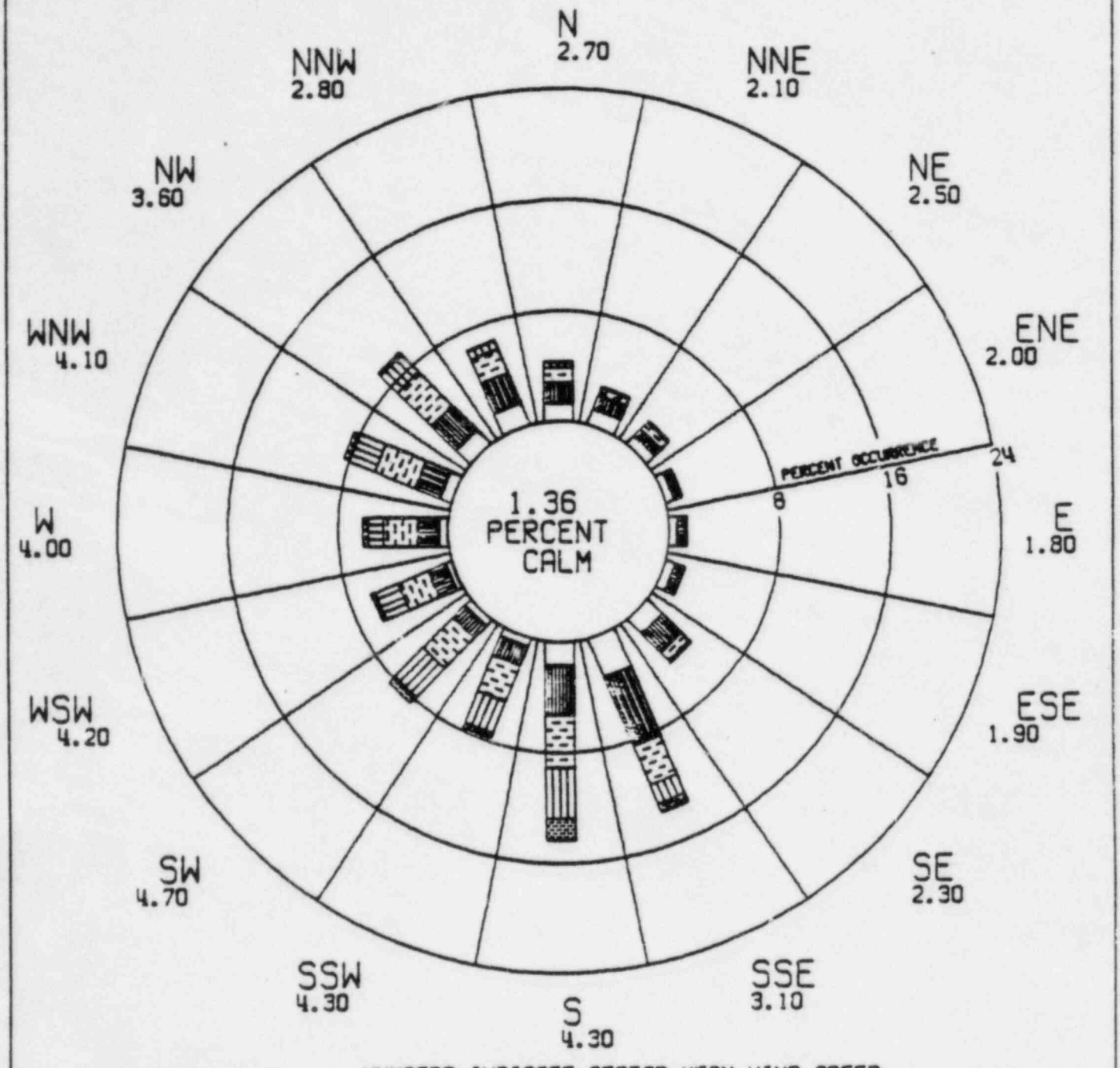



FIGURE A.3.3-8

METEOROLOGICAL MONITORING

WEST VALLEY NUCLEAR SERVICES

10-METER FREQUENCY DISTRIBUTION
CATTARAUGUS REMOTE SITE
OCTOBER 1, 1983 - SEPTEMBER 30, 1984




NUMBERS INDICATE SECTOR MEAN WIND SPEED

WIND SPEED RANGE

- 0.0-1.5 MPS
- 1.5-3.0
- 3.0-5.0
- 5.0-7.5
- › 7.5

FIGURE A.3.3-9
METEOROLOGICAL MONITORING
WEST VALLEY NUCLEAR SERVICES

10-METER FREQUENCY DISTRIBUTION
CONNOISARAULEY REMOTE SITE
OCTOBER 1, 1983 - SEPTEMBER 30, 1984

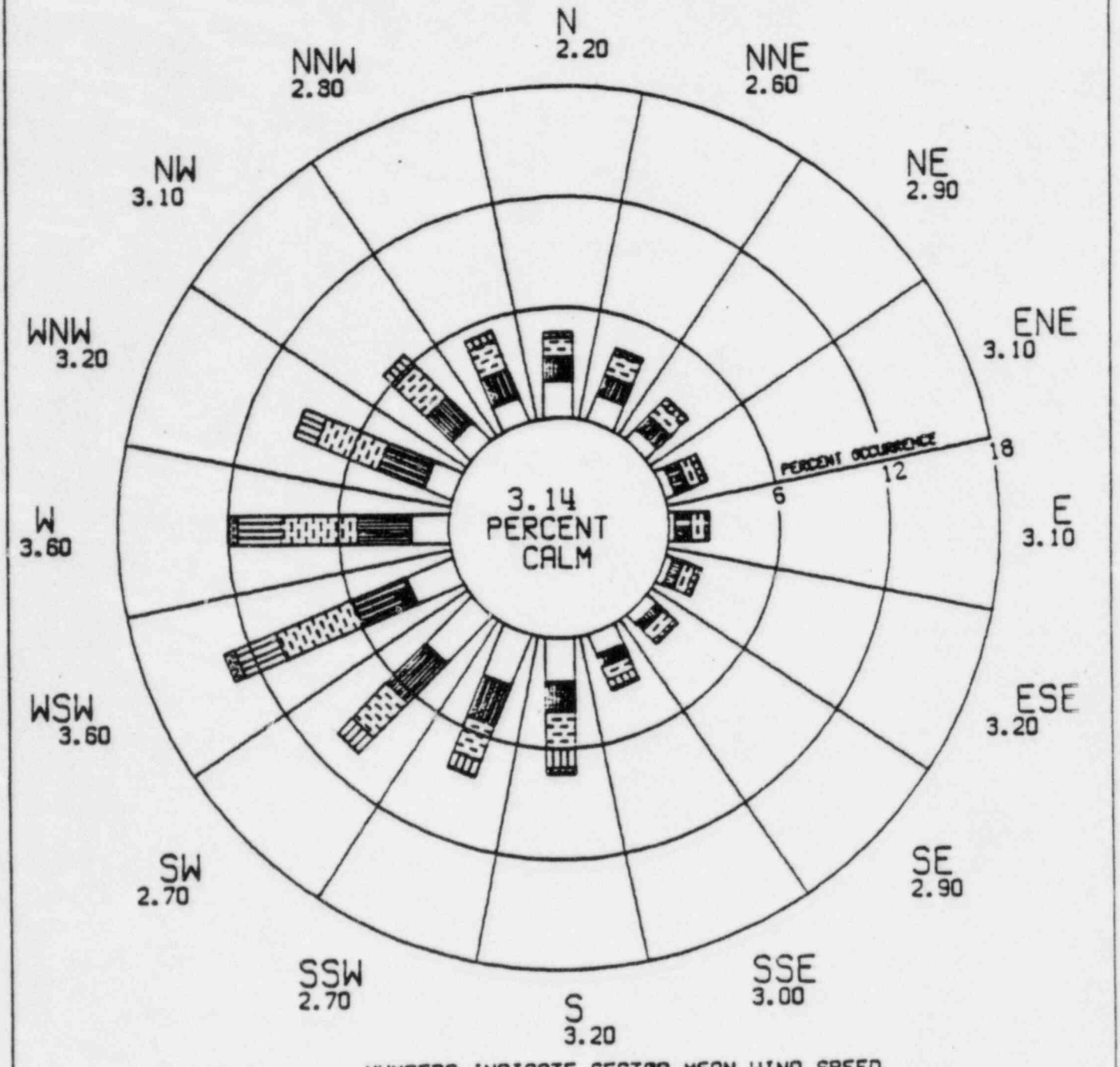



FIGURE A.3.3-10

METEOROLOGICAL MONITORING

WEST VALLEY NUCLEAR SERVICES

10-METER FREQUENCY DISTRIBUTION

SPRINGVILLE REMOTE SITE

OCTOBER 1, 1983 - SEPTEMBER 30, 1984

## A.3.4 SURFACE HYDROLOGY

### A.3.4.1 HYDROLOGIC DESCRIPTION

The WVDP and areas surrounding the site are drained by two creeks, Buttermilk and Cattaraugus Creeks as shown on Figure A.3.4-1

Buttermilk Creek flows through the site in a generally northwesterly direction from its origin south of the town of West Valley, New York and joins Cattaraugus Creek at the north end of the site some eight stream kilometres below the point of entry onto the site at Riceville Station. Buttermilk Creek has eroded a narrow, deep defile into the glacial deposits in the valley on which the site is situated. The Project facilities are located on a bench-like plateau at an elevation of about 431.3 m above sea level datum. The elevation of Buttermilk Creek at its entrance to the site is about 365.8 m and the creek falls to an elevation of slightly over 335.3 m at its confluence with Cattaraugus Creek. The total drainage area of Buttermilk Creek is estimated to be 48,215 ha. The U.S. Geological Survey maintained a gauging station on Buttermilk Creek from October 1961 to September 1968. The gauge was located at the Hays Hollow Road (Bond Road on USGS Ashford Hollow quadrangle map) bridge, two kilometres upstream from the mouth of the creek. The drainage area above the gauge is 46,500 ha. Pertinent flow data are summarized in Table A.3.4-1.

Cattaraugus Creek flows in a generally westerly direction from the site to Lake Erie some 63 km downstream. The total drainage area is estimated to 877,350 ha. Since 1939, the U.S. Geological Survey has maintained a gauging station on Cattaraugus Creek at Gowanda, New York, some 32 stream kilometres below the site. The drainage area above the gauging station is 683,000 ha.

The drainage area of Cattaraugus above the confluence of Buttermilk Creek is 344,600 ha; thus the average flow in Cattaraugus Creek past the site may be estimated to fifty percent* of the average flow rate at the gauging station.

Figure A.3.4-2 shows the comparative flows of Buttermilk and Cattaraugus Creeks for the year 1968 (the most recent year that USGS maintained gauges on both streams).

No public water supplies use Buttermilk or Cattaraugus Creeks as a source of potable water. The village of Springville operates a dam/hydroelectric generating station on Cattaraugus Creek approximately 4 km below the confluence of Buttermilk and Cattaraugus Creeks.

### A.3.4.1.1 Site And Facilities

Figures A.3.4-3 and A.3.4-4 show the drainage pattern of the site and adjacent areas. Figure A.3.4-3 also identifies the existing Project facilities, including the low-level waste treatment lagoons. No significant Project construction other than that indicated in this figure is currently envisioned.

The entire WNYNSC is shown in Figure A.3.4-4. This figure includes the two Project water supply reservoirs which were created by damming two small tributaries of Buttermilk Creek.

### A.3.4.1.2 Hydrosphere

The West Valley Site is underlain by at least two aquifers, neither of which are considered highly permeable. The upper aquifer consists of the saturated portion of the surficial gravel deposits ranging in thickness from about 1.5 m to 6.0 m. The second aquifer consists of a zone approximately 0.5 m thick of decomposed shale and rubble at the interface of the fill and bedrock.

---

*It is realized that flood level discharge is not directly proportional to the drainage areas. Therefore, this estimate could be low depending upon the locations of the storm center.

The upper aquifer is involved in the surface hydrologic cycle whereas the lower aquifer is isolated by a thick layer of glacial fill in the vicinity of the site. The approximate direction of groundwater flow in the surficial unit (based upon water level measurements) is easterly or northeasterly from the western boundary of the site. Most of the water in this unit drains into Frank's Creek, either directly or via one of its tributaries.

The groundwater hydrology of the site is discussed in Section A.3.5.

The surface water regime of the WVDP includes several small tributaries of Buttermilk Creek, the on-site low-level waste treatment lagoons and the two water supply reservoirs in addition to Buttermilk and Cattaraugus Creeks. The Buttermilk Creek tributaries include Frank's Creek, Quarry Creek, and Erdman Brook. The plateau on which the Project facilities are located is dissected by the steep walled valleys of these streams and surface run-off from the plateau is directly into these channels via drainage ditches and culverts.

The on-site low-level waste treatment facility includes four lagoons, the largest of which contains a controllable discharge pipe to Erdman Brook. Of these four lagoons, numbers 4 and 5 are very small feed and effluent holding basins, but Lagoon 2 can hold 12.2 million litres and Lagoon 3 can hold 13.4 million litres. (There used to be another basin, Lagoon 1, in this system. This basin was decommissioned in 1984.)

The two onsite reservoirs were created by damming branches of Buttermilk Creek to an elevation of 414.5 m MSL, impounding 824,100 $m^3$ of water at this elevation.

### A.3.4.2 FLOODS

#### A.3.4.2.1 Flood History

Because Buttermilk and Cattaraugus Creeks lie in deep valleys, little area is available for farming or housing; thus the effects of any flooding of the flood plain have been minimal and no history of floods in the area is

available. The data on water flows in Buttermilk Creek and Cattaraugus Creek (refer to Table A.3.4-1) included data on the maximum recorded flows. These flows correspond to maximum gauge heights of 4.3 m on Cattaraugus Creek and 2.6 m on Buttermilk. The levels would cause only local flooding on the flood plains well below the elevation of the nuclear site facility.

The Chief, Flood Plain Management Services, Buffalo District, Corps of Engineers, stated in a letter to Nuclear Fuel Services, quoted in the NFS, 1973 SAR:

> "We do not feel that the 100-year flood stage of Buttermilk Creed will affect your proposed plant as it is at least 120 feet above the creek. The drainage area of Buttermilk Creek, upstream of your plant, is too small to be able to provide enough water to raise the creek state the necessary 120 feet. In addition, before the creek stage could rise even 110 feet, it would spill over the divide on the west bank and flow down the valley of a tributary."

### A.3.4.2.2 Flood Design Considerations

Because the creek valleys can contain the floods without affecting the Project areas, flood design considerations need not be included in facility designs.

### A.3.4.2.3 Effects of Local Intense Precipitation

Probable maximum precipitation events (PMP) have been developed for the plant site, Buttermilk Creek, and the plant reservoirs based upon Hydrometeorological Report 33 and the following drainage basin areas:

| | | |
|---|---|---|
| Buttermilk Creek | 7903 | ha. |
| Plant Site | 606 | ha. |
| Plant Reservoirs | 1257 | ha. |

The PMPs are fully described in Supplement A.3.4-A. The resulting water levels in Buttermilk Creek for the PMP and the PMP increased by 50 percent were at least 50 metres below the plant elevation and could therefore not influence the plant area.

The plant site was evaluated in a similar manner. With the PMP increased by 50 percent, water levels in Frank's Creek reach a maximum elevation of 53 metres below plant grade.

when routed through the reservoirs, the PMP results in water elevations approximately 2.6 metres above the crest of the dams, resulting in dam failure. However, such a failure cannot flood the plant area due to the depth of the Buttermilk Creek valley below the dams.

The winter PMP (snow and liquid) for the WVDP was estimated in Nicholas and Eagan (1983) using 100-year snowpack depths from Syracuse, New York, and snowpack density conversion method of Bilello (1969), using a density of 0.25 with water equivalent snowpack depths of 44.5 and 36.8 cm for February and March, corresponding to snowloads of 444.3 $kg/m^3$ and 368.6 $kg/m^3$ respectively.

### A.3.4.3 PROBABLE MAXIMUM FLOOD

As indicated above, flooding of the plant area is not a possibility because of the deep valleys of Buttermilk and Cattaraugus Creeks. The various studies undertaken to verify and support this conclusion are detailed in Supplement A.3.4-A.

Although a probable maximum flood in buttermilk Creek and a catastrophic failure of the reservoir dams cannot flood the plant site, these events would probably affect the plant water supply system because the supply of water from the reservoir would be eliminated until repair could be made. No processes or facilities at the WVDP would represent a problem if the water supply was lost, however.

### A.3.4.4 POTENTIAL DAM FAILURES (SEISMICALLY INDUCED)

As identified in Supplement A.3.4-A, the on-site reservoirs cannot contain the PMP, resulting in dam failure. Furthermore, the dams creating the reservoirs were not designed to withstand a design basis earthquake, and can therefore be expected to fail if such an earthquake is experienced. However, it has also been demonstrated that the Buttermilk Creek valley is sufficiently large to accommodate the reservoir volumes and prevent flooding of the plant areas.

#### A.3.4.4.1 Reservoir, Pumphouse and Pipeline Descriptions

The plant water supply system (Figure A.3.4-5) consists of two interconnected lakes formed by earthen dams at the southeastern end of the site near Riceville Station. The railroad siding to the plant passes over a culvert in Buttermilk Creek and Dams 1 and 2 as it approaches the plant. The dams are constructed on compacted, impermeable soil meeting the specifications of the State of New York, Department of Public Works. The characteristics of the dams are shown in Table A.3.4-3

Sheet piling was driven to a depth of 10.7 m across a 18.3 m width of the old stream bed in the base of Dam 1 to prevent seepage through the base of the dam. Due to its lower height, piling was not installed under Dam 2.

The design elevation of the lake system is controlled by an overflow weir in the pumphouse in Lake 2 at an elevation of 412.4 mMSL. The total storage capacity at this level is 559,600 $m^3$ (refer to Figures A.3.4-6 through A.3.4-8 for the elevation-capacity curve for the reservoir). In order to provide additional surge capacity in the lakes to cushion the effects of sudden increases in run-off, a small 60 cm x 60 cm port was cut into the overflow weir at an invert elevation 411.7 mMSL, and the lake system is normally maintained at this level with a storage capacity of about 504,300 $m^3$. This port could be closed after the spring runoff to provide additional storage in the event that an extended dry period were anticipated.

An emergency spillway is installed in Lake 1 to provide flood relief for both lakes. The spillway elevation is 412.7 mMSL and the spillway is 53 m wide at the bottom with the sides graded to slopes of 1 on 1-1/2. Thus, the spillway width increases to a width of 59 m at the 414.5 mMSL elevation. The spillway discharges into Buttermilk Creek.

The drainage area of the lake system is about 1255 ha with about 810 ha draining to Lake 1 and 455 ha draining to Lake 2. The annual precipitation in the area is about 107 cm and with an assumed 51 cm of runoff, the average flow through the lake system is about 0.2 $m^3/s$ or some 12,100 litres per minute.

The pumphouse is equipped with two pumps discharging to Class-150, 20 cm cast iron pipeline buried 1.5 m below grade. Normally, one pump is in service and the other is in standby although both pumps can be operated simultaneously, if needed. The pipeline discharges to 1,800 $m^3$ storage tank at the processing plant and to the High Level Waste Storage Facility.

The pumphouse shown in Figure A.3.4-9 is located in Lake 2 about 18 m west of Dam 2 in about 9 m of water. A 4.3 m by 4.3 m square reinforced concrete caisson is mounted on a 0.9 m concrete slab which is itself supported by piling. The walls of the caisson are 38 cm thick and extend upward to the 414.5 m elevation with a 20 cm slab at the top which forms the floor of the pumphouse. A central well is located within the caisson to serve as an overflow to maintain the lake system at a constant elevation. The overflow drains through a 0.9 m diameter pipeline to the ravine below the dam. A flood gate at the bottom of the central well can be opened to increase the outflow when heavy runoff occurs. The capacity of the drain system is approximately 7.1 $m^3/s$ and is sufficient for all but the heaviest runoff situations. When this flow is exceeded, the lake level will rise to the 412.7 mMSL elevation and the excess flow will be discharged over the spillway from Lake 1.

The flooded gate is under automatic control and opens stepwise to the full open position with a rise in water elevation in the lake system. The automatic control has a manual override which permits the lowering of the lake level in anticipation of heavy runoff.

The concrete block pumphouse with a poured slab roof is mounted at the top of the caisson. Two electric driven pumps are mounted within the pumphouse with the pump intakes set about 6.1 m below lake level. The pumps are normally cycled automatically so as to divide the workload with one pump in service and the other in standby although both pumps can be operated simultaneously, if desired.

The pumps are manifolded into a single 20 cm Class-150 cast iron pipeline to the plant some 1525 m northwest of the pumphouse. The pipe complies with American Standards A-21.2, A-21.6, or A-21.8 as applicable and the mechanical joints (gasket and compression ring) comply with American Standard A-21.11. The pipeline is buried a minimum of 1.5 m below the surface.

### A.3.4.5 PROBABLE MAXIMUM SURGE AND SEICHE FLOODING

This section is not applicable to the West Valley Site.

### A.3.4.6 PROBABLE MAXIMUM TSUNAMI FLOODING

This section is not applicable to the West Valley Site.

### A.3.4.7 ICE FLOODING

Flooding caused by ice jams in Buttermilk Creek would not reach the plant site because prior to the water level increasing to the plant elevation, some 30 - 60 m above the creek, overflow across the eastern ridge line will occur. The low current velocities in the lake system, even under overflow conditions in the spillway, would probably be insufficient to cause an ice jam in the spillway. Even in the unlikely event of an ice jam in the spillway, the local topography will prevent the water level from rising to the level where flooding of the plant site would occur. The spillway elevation is 412.7 mMSL and the plant site elevation is about 431.3 mMSL.

### A.3.4.8 WATER CANALS AND RESERVOIRS

#### A.3.4.8.1 Canals

There are no canals at the WVDP; therefore, the section is not applicable.

#### A.3.4.8.2 Reservoirs

The design data for the WVDP reservoirs was presented in Section A.3.4.4.

### A.3.4.9 CHANNEL DIVERSIONS

Because the WVDP Project facilities and reservoirs are located in the headwater regions of the Buttermilk Creek watershed channel, diversions or rerouting should not be of significant magnitude to affect water flow through the site.

### A.3.4.10 FLOODING PROTECTION REQUIREMENTS

As described in the previous section, the stream valleys surrounding the WVDP Project facilities are sufficiently steep and large enough to accommodate the respective PMFs without flooding the plant site. Therefore, specific flood protection factors need not be factored into Project facilities and structures.

The project reservoirs may fail under peak PMF conditions thereby disrupting the plant water supply. In such an event, temporary measures such as trucking in water and shutting down some facilities can be implemented until the dams and reservoirs can be repaired.

There are no processes or facilities at the WVDP which would represent an immediate safety problem if the water supply was lost.

### A.3.4.11 LOW WATER STORAGE ANALYSIS

The water supply is not safety related. As noted in A.3.4.3, no processes or facilities at the WVDP would present a problem if the water supply was lost. Details on low water storage are therefore omitted from this report.

### A.3.4.12 ENVIRONMENTAL ACCEPTANCE OF EFFLUENTS

Project effluents discharged to surface waters must meet limits prescribed by the New York State Department of Environmental Conservation for nonradiological parameters in a State Pollution Discharge Elimination System (SPDES) Permit and US DOE requirements for radiological parameters per US DOE Order 5480.1.

Such discharges are monitored by the Project to ensure that all standards are being met. Radiological liquid wastes are processed through the lagoon system and low-level waste treatment facility prior to discharge. Such effluents can be retained on-site for up to several months to ensure that all parameters are within limits prior to release.

Analysis of accidental releases form the lagoons to Erdman Brook was performed in the WVDP existing facilities volume of the Project SAR. The impacts of such a release are estimated to be inconsequential as compared to natural background.

### A.3.4.13 CHEMICAL AND BIOLOGICAL COMPOSITION OF ADJACENT WATERCOURSES

An aquatic ecological survey of the WVDP environs is described in Supplement A.3.7-B. That section contains a description of the chemical biological composition of the waterways on and near the WVDP.

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TABLE A.3.4-1

BUTTERMILK AND CATTARAUGUS CREEK FLOW DATA

BUTTERMILK CREEK FLOW DATA AT HAYS HOLLOW ROAD

(Period 1961 - 1968)

| Flow Parameter | Flow ($m^3$/sec) |
|---|---|
| Average Discharge | 46.5 |
| Maximum Discharge Rate | 110.7 |
| Minimum Discharge Rate | 0.1 |

CATTARAUGUS CREEK FLOW DATA AT GOWANDA

(Period 1940 - 1972)

| Flow Parameter | Flow |
|---|---|
| Average Discharge | 20.1 |
| Maximum Discharge Rate | 979.2 |
| Minimum Discharge Rate | 1.5 |

**TABLE A.3.4-2**

**DAM PHYSICAL CHARACTERISTICS**

| | Dam 1 | Dam 2 |
|---|---|---|
| Upstream Slope | 1 Vertical In 2-1/2 Horizontal | 1 on 2-1/2 |
| Downstream Slope | 1 on 2 | 1 on 1-1/2 |
| Height | 22.9 mMSL | 15.2 mMSL |




**FIGURE A.3.4-1**

WATER COURSES WESTERN
NEW YORK
NUCLEAR SERVICE CENTER

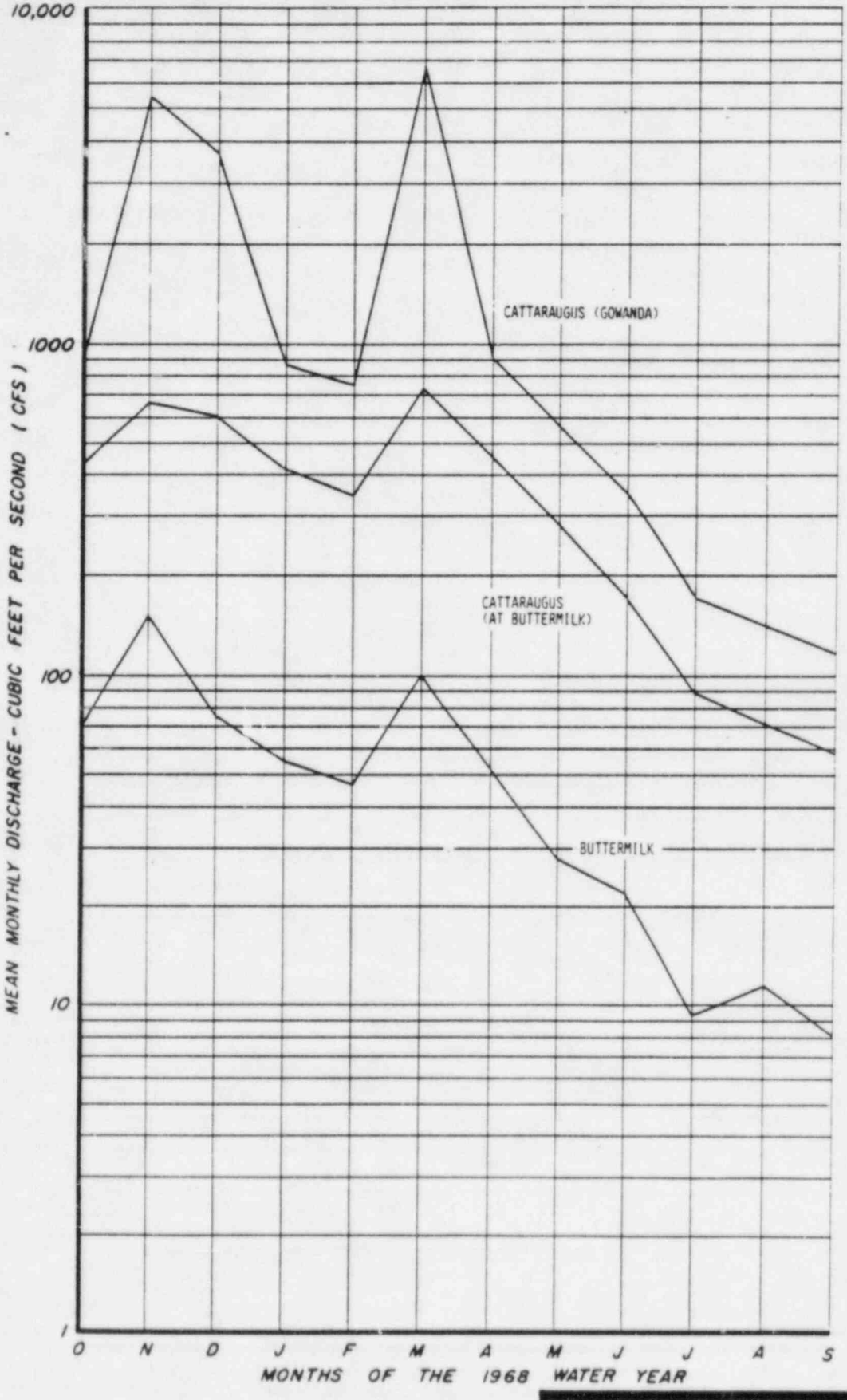


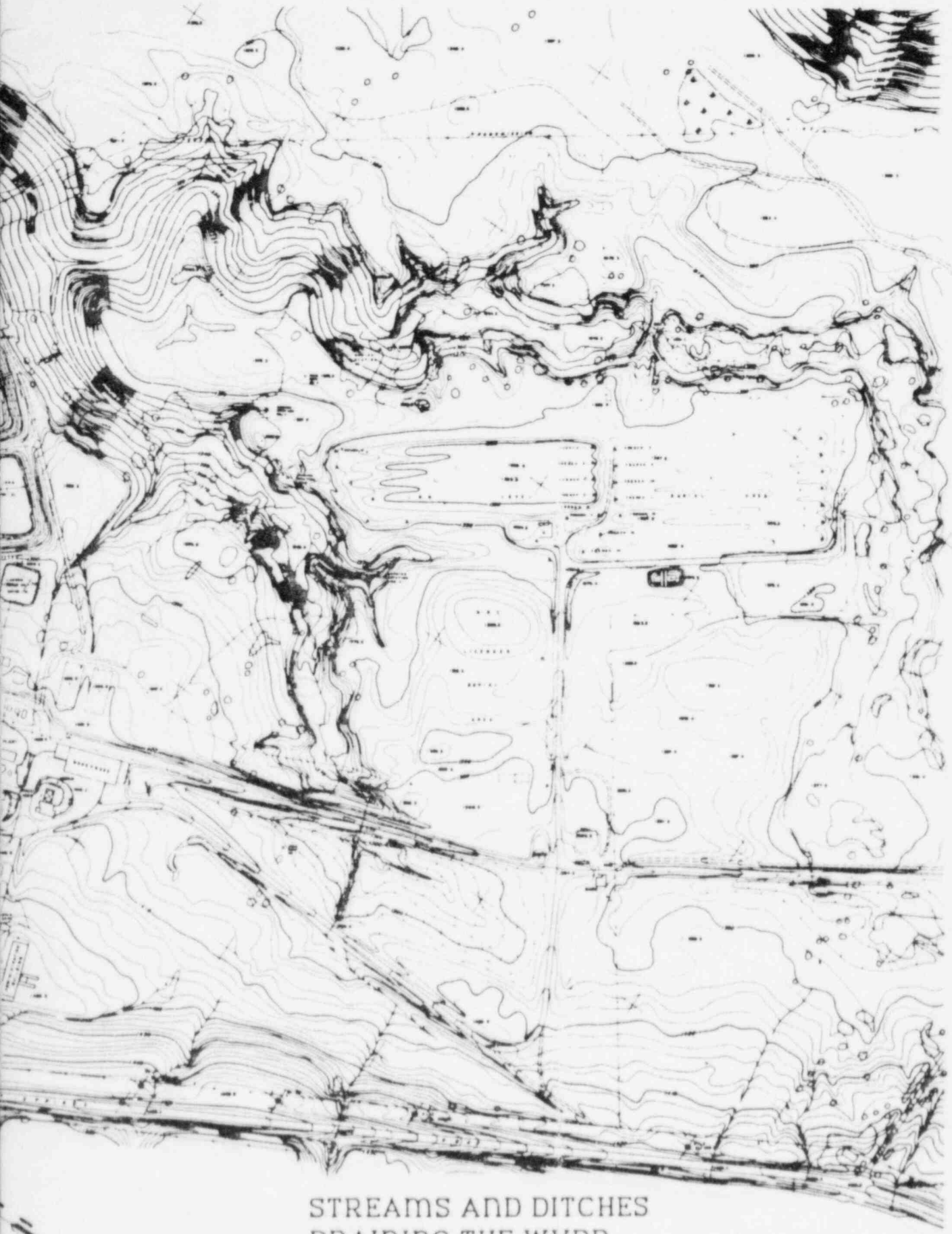

**FIGURE A.3.4-2**

COMPARATIVE FLOWS OF BUTTERMILK AND CATTARAUGUS CREEKS



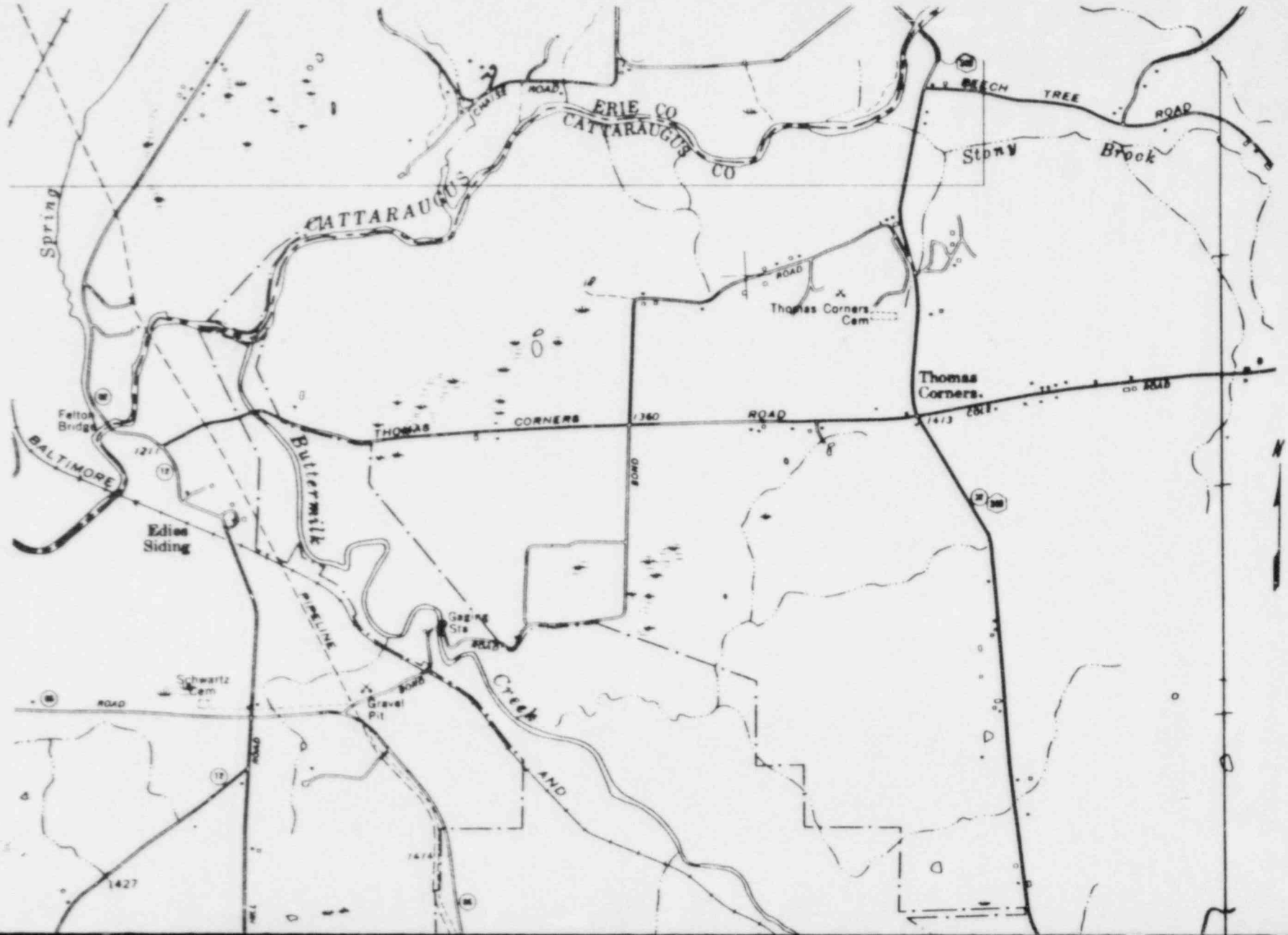

Also Available On
Aperture Card

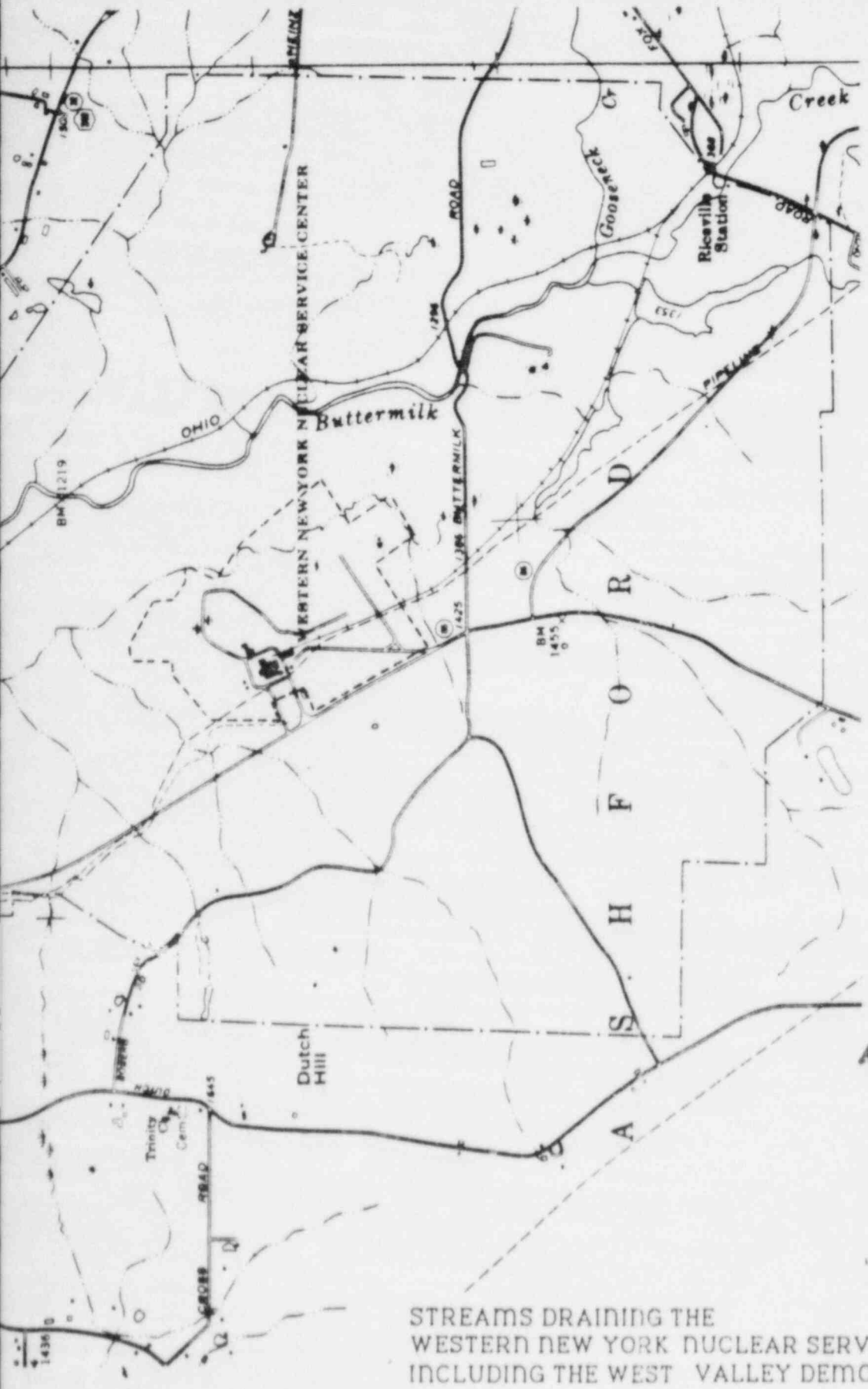
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STREAMS AND DITCHES
DRAINING THE WVDP
FACILITIES AREA

FIGURE A.3.4-3


ERIE CO
CATTARAUGUS CO
CATTARAUGUS
Spring
BEECH TREE ROAD
Stony Brook
Thomas Corners Cem
Thomas Corners
THOMAS CORNERS ROAD
Felton Bridge
BALTIMORE
Buttermilk
Edies Siding
PIPELINE
Gaging Sta
Schwartz Cem
Gravel Pit
Creek
AND
1427
1360
1413




Also Available On
Aperture Card

**TI APERTURE CARD**

STREAMS DRAINING THE
WESTERN NEW YORK NUCLEAR SERVICE CENTER
INCLUDING THE WEST VALLEY DEMONSTRATION PROJECT

FIGURE A.3.4-4

8507030441 

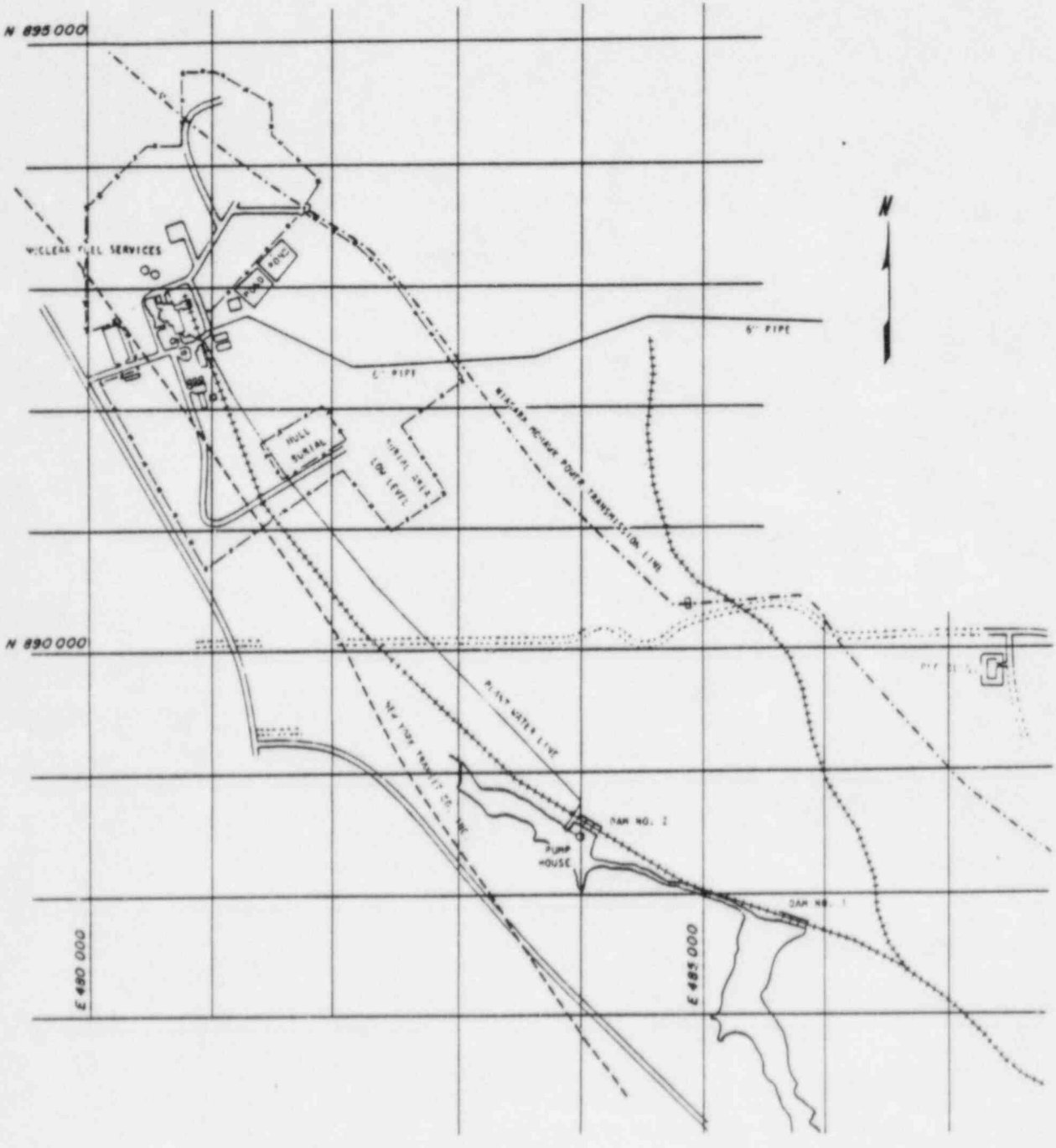



FIGURE A.3.4-5

LAKE WATER SUPPLY SYSTEM

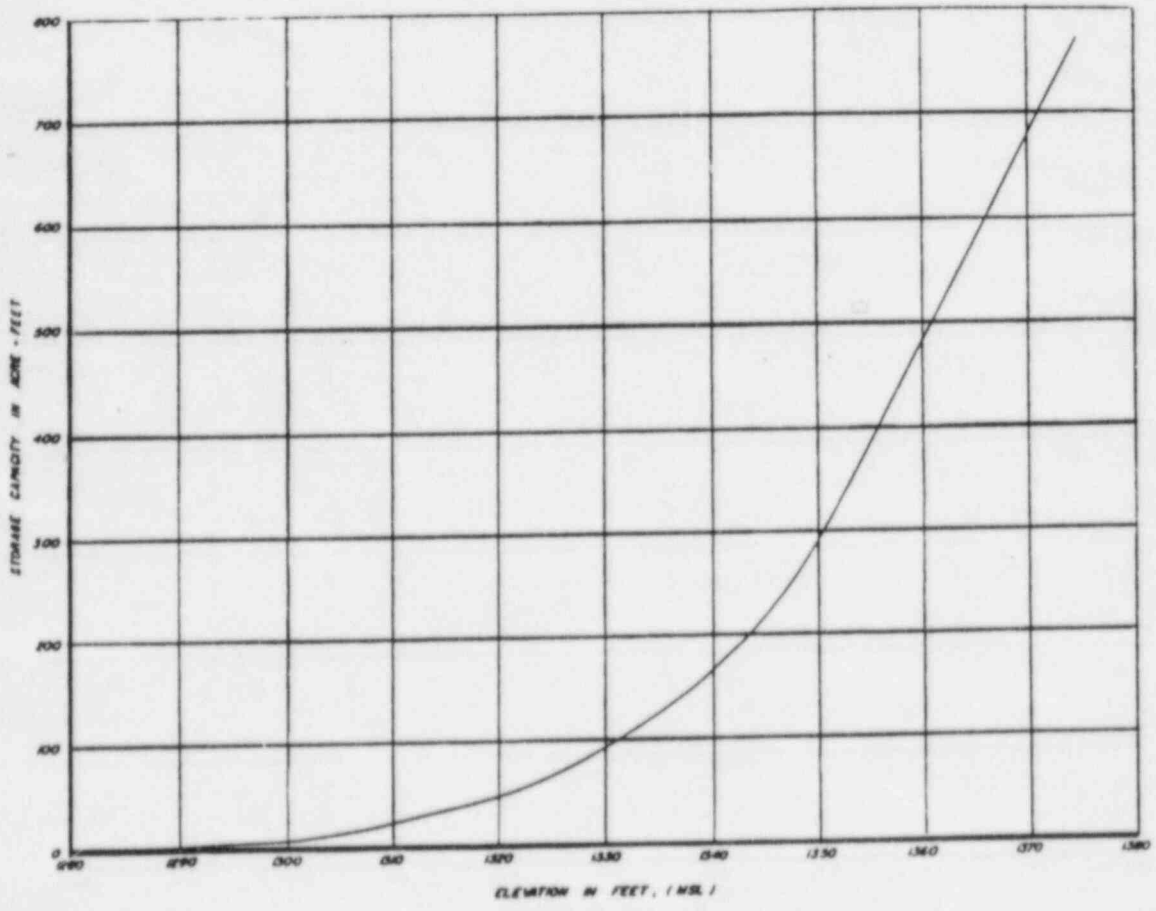



FIGURE A.3.4-6

STORAGE CAPACITY VS. ELEVATION CURVE FOR DAM 1 RESERVOIR

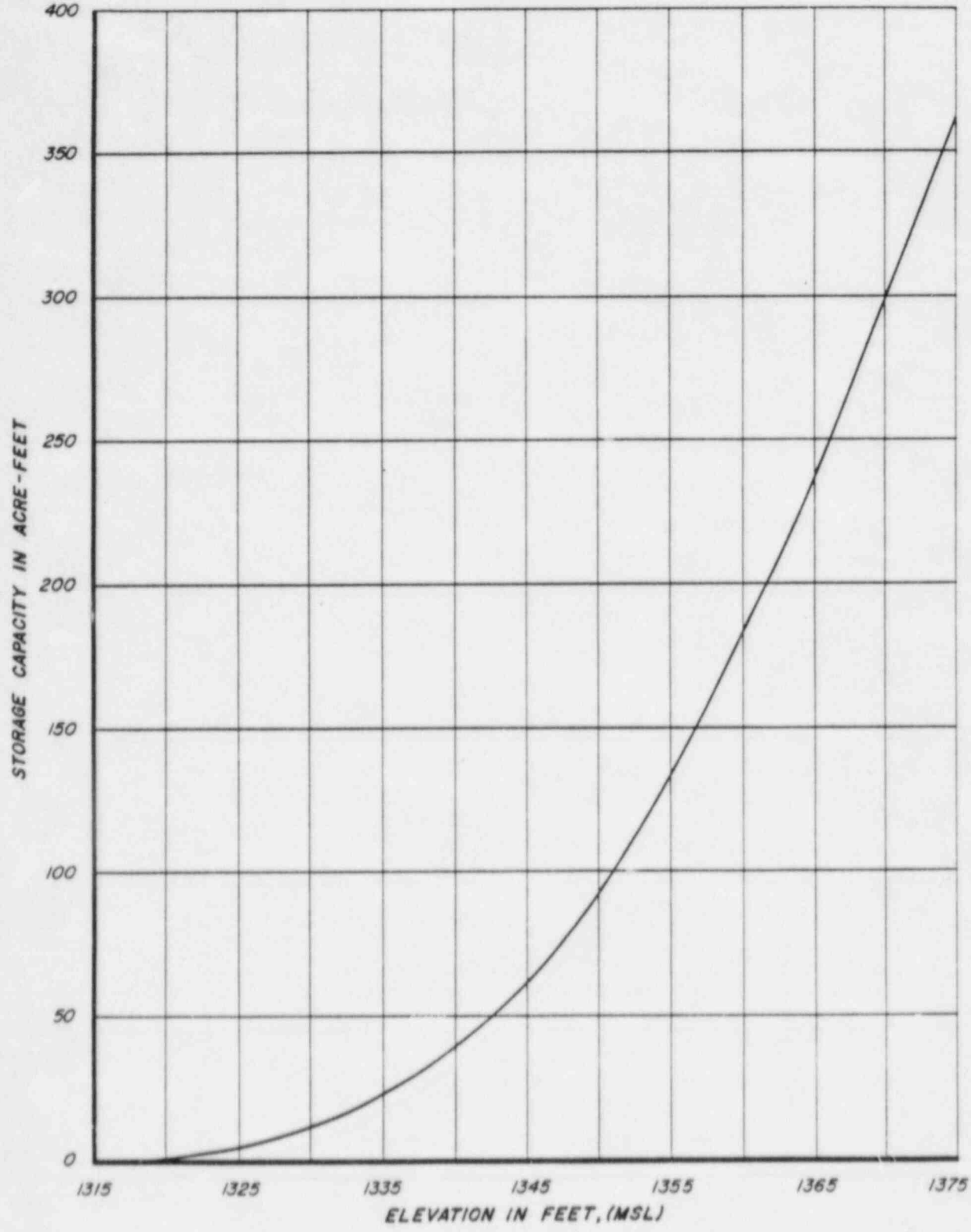



FIGURE A.3.4-7

STORAGE CAPACITY VS. ELEVATION CURVE FOR DAM 2 RESERVOIR

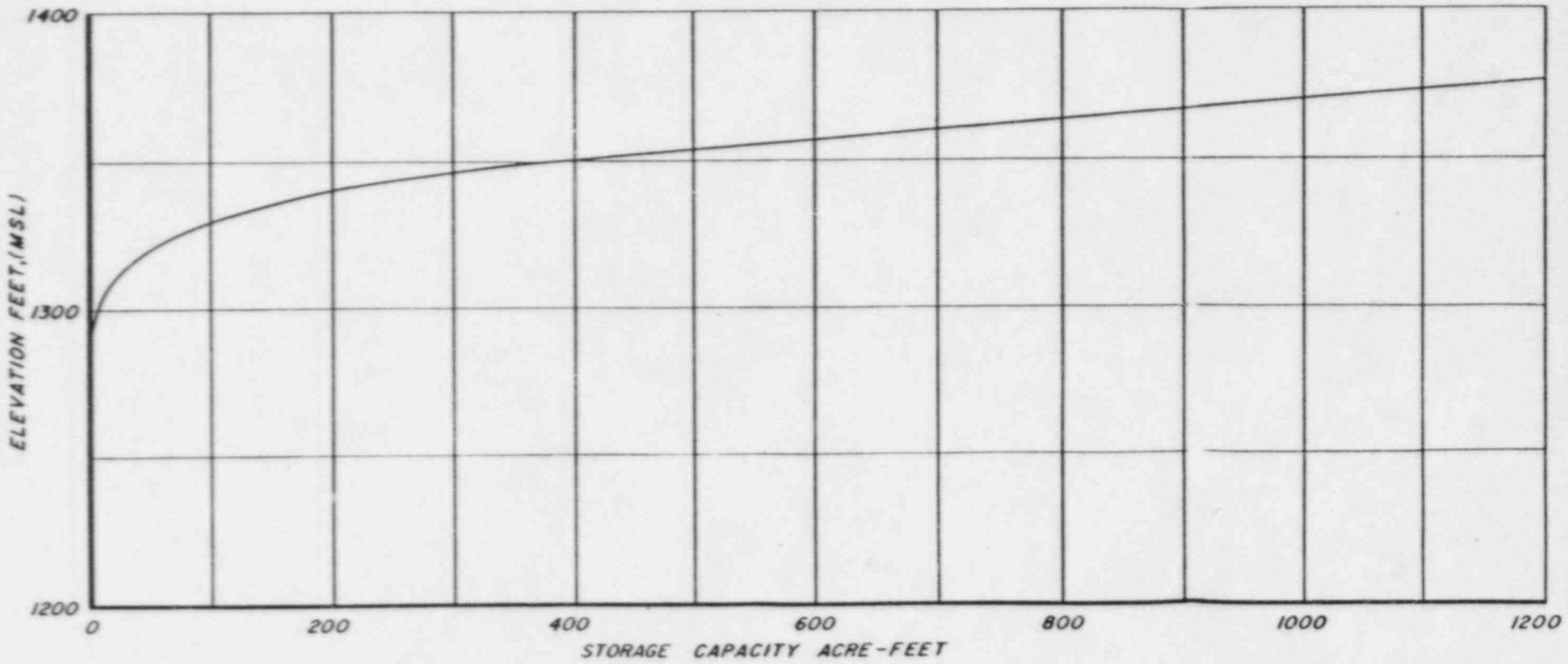



FIGURE A.3.4-8

STORAGE CAPACITY VS. ELEVATION CURVE FOR COMBINED DAMS 1 AND 2 RESERVOIRS

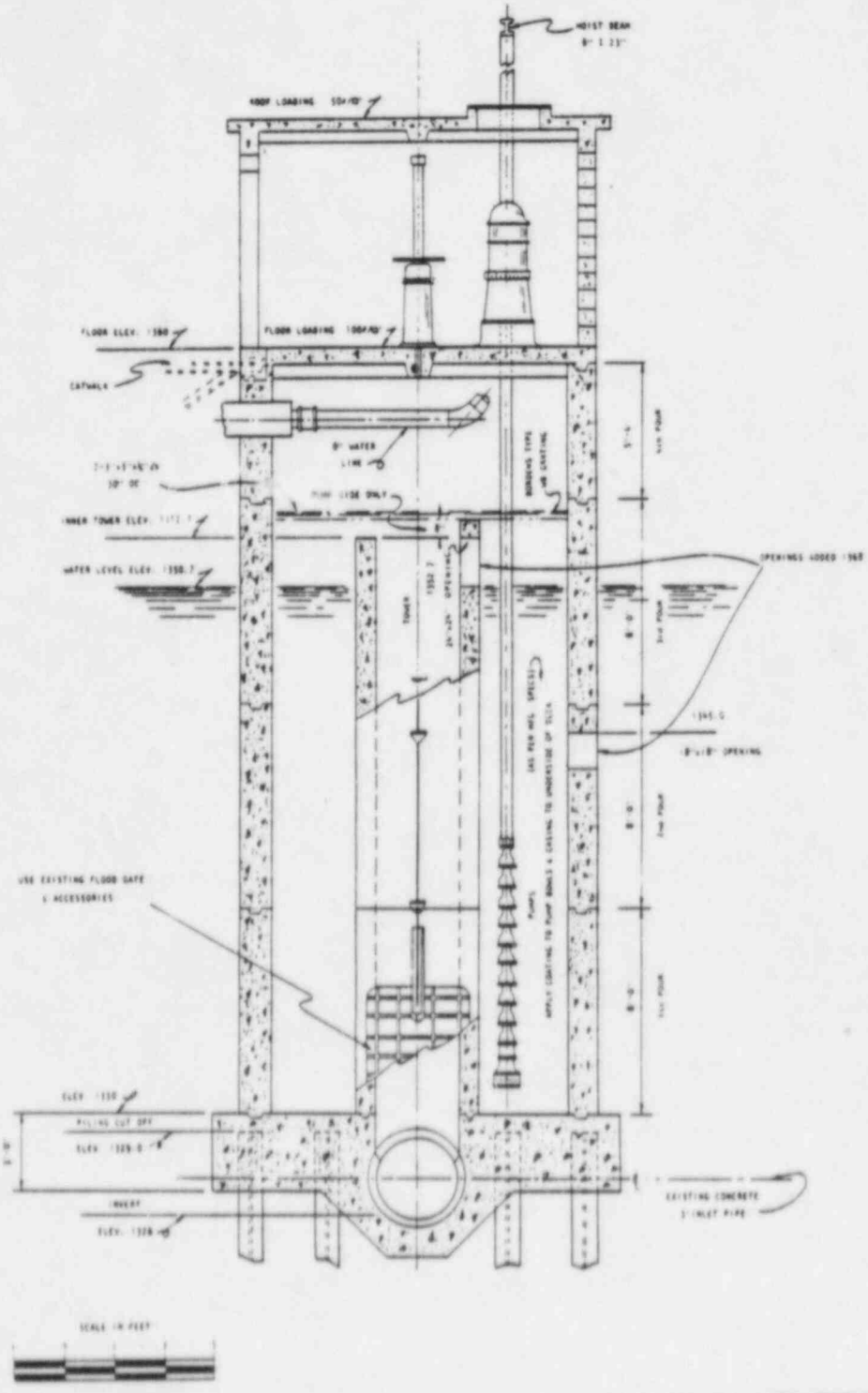



FIGURE A.3.4-9

LAKE PUMP HOUSE

## A.3.5 SUBSURFACE HYDROLOGY

### A.3.5.1 REGIONAL AND AREA CHARACTERISTICS

Four aquifers of interest underlie the WNYNSC. They are, from deepest to shallowest: (1) the weathered zone between the till and the competent bedrock; (2) a thin layer of fine silty sand beneath the uppermost till (Lacustrine Layer); (3) the silty Lavery till; and (4) the alluvial fan sands and gravels. These are discussed below.

#### A.3.5.1.1 Weathered Bedrock Zone

This zone is made up of a 0.5 metre thick layer of weathered and fractured shale resting on top of the consolidated bedrock at a depth of approximately 26 metres below the land surface in the vicinity of the NDA (US DOE, 1982). Bore hole data indicate that the uppermost layer of shale is usually fractured and weathered sufficiently to permit the passage of usable quantities of water.

This water-bearing zone is the largest and most reliable aquifer underlying the site. Water apparently enters the bedrock at higher elevations where the till cover is thin or absent and moves from the higher elevation downslope to points of discharge. None of the wells drilled at the WVDP that penetrate this unit have encountered water under artesian pressure. The production of a well drilled into this aquifer would be relatively low. Transmissivities of the aquifer are also low and have been estimated to be on the order of several litres per day (NFS, 1973). Most single home wells in the site area tap this zone as their primary water supply. Water samples taken from site wells tapping this water bearing zone in September 1982 (Dames and Moore, 1982) indicate a potable water of good quality. Laboratory analytical results of these samples are shown on Table A.3.5-1.

Little information is presently available on water in deeper formations. However, it is known from gas wells west and northwest of the site that two formations contain salt water at depths of 1,820 metres and 1,370 metres (NFS, 1973). Depths to water in this zone range between 27 and 37 metres below grade.

Flow directions, determined from the two deep wells on the site, indicate that groundwater flow follows surface topography and is towards the east at an average gradient of 0.005 m/m.

Plant operations do not withdraw water from this zone and there is no reason to believe that groundwater flow directions will change or reverse themselves. This zone is not recharged within the plant area and site operations are not likely to influence or limit its future use.

This unit does not outcrop within the controlled area of the plant. The nearest surface exposures are off plant property west of Rock Springs Road and to the northeast in the Buttermilk Creek stream channel.

#### A.3.5.1.2 Lacustrine Layer

A layered sequence of silt and clay locally grading upward into fine sand and silt up to six metres thick and capped with gravel has been encountered in several bore holes. This unit has been informally called the "lacustrine layer" and is the second water-bearing zone at the site.

This layer does not appear to occur uniformly throughout the WNYNSC subsurface (Albanese et al., 1983). In the vicinity of the burial ground it is typically found at depths of 20 to 25 metres below the land surface (Prudic and Randall, 1977) and is underlain by a sequence of glacial till deposits and bedrock (LaFleur, 1979).

This unit is only locally saturated and may be recharged by leakage from the overlying till (Prudic and Randall, 1977). Water level data in the lacustrine layer suggest groundwater moves laterally (under a gradient of 0.023 m/m) to the northeast towards Buttermilk Creek (Prudic and Randall, 1977; LaFleur, 1979).

This layer is not used as a source of water by anyone in the area. Plant operations do not withdraw water from this layer and there is no reason to believe that groundwater flow directions will change or reverse themselves.

As previously mentioned, this layer may be recharged by leakage from the overlying Lavery till. Because of its low yield and discontinuous nature, this layer has no future potential as a groundwater resource. The only plant operation which may influence it is leakage from the burial trenches. To date, no such leakage to the lacustrine layer has been confirmed.

This layer does not outcrop within the controlled area of the plant. Its nearest surface exposure is to the northeast in the stream channel of Buttermilk Creek. Groundwater discharges in the form of local seeps have been documented to be occurring in this stream channel (Prudic and Randall, 1977; LaFleur, 1979).

### A.3.5.1.3 Lavery Till

The Lavery till, which comprises most of the unconsolidated sedimentary column at the site, is a glacially derived green-gray, dense massive silty clay with some local, discontinuous, thin seams of sand and gravel.

The unit is not considered a true aquifer. Pore spaces in the till are very small. Hydraulic conductivities average 10E-8 centimetres/sec. (Nuclear Fuel Services, Co., Inc, 1973). The porosity of the material is approximately 0.3, and the effective porosity (specific yield) is estimated to be on the order of 0.06. The predominant direction of groundwater movement is vertical, and no large differences between horizontal and vertical hydraulic conductivities have been reported (Prudic and Randall, 1977; Albanese and others, 1983).

Because of its low yields and low permeability, the till is not suitable as a source of water by local users. At present, up to several litres of water per day are being withdrawn from the Lavery till from wells near the NDA. This is the only withdrawal of water from the till and will not greatly influence groundwater flow directions and gradients within the till.

Recent field data (WVNS, 1984) suggests that permeability may be several orders of magnitude higher in the upper portion (upper three metres) of the till. It is in this zone that a network of intersecting horizontal and vertical fractures occur in weathered till horizons. Fractures and root tubes whose surfaces are bordered by firm oxidized till were recognizable to depths of 3 to 4.5 metres in cores from several test holes. Some vertical fractures did extend downward into the unweathered till. Flow directions in these fractures are difficult to predict, but it has been assumed that they will generally follow surface topography.

As part of the continuing study of site geology, the United States Geological Survey and WVNS have installed a number of piezometers around the periphery of the NDA. The data from these piezometers reveal a downward pressure gradient which is compatible with the notion of one dimensional downward groundwater flow through the unweathered Lavery Till. Likewise, the piezometric contours are virtually horizontal which suggests little if any horizontal flow component. The till is recharged locally via precipitation and meltwaters. Potential effects of the plant on this till are limited to leakage from the existing burial ground.

### A.3.5.1.4 Alluvial Fan

This unit is comprised of gravels and silty sands with little to some silty clay (US DOE, 1982). This unit forms an elevated plain which is locally referred to as the North Plateau area. The fan is approximately three to five metres thick and rests directly on the Lavery till (LaFleur, 1979). The plant area and high-level waste tank complex are located in this unit. An isopach (Figure A.3.5.-1) of this unit (Albanese and others, 1983) indicates its areal extent and thickness. The fan pinches out several hundred feet north of the burial ground, southeast of the plant area.

This unit's groundwater is recharged by local precipitation and meltwaters. It yields water to small diameter monitoring wells at rates of $6.3 \times 10^{-5}$ - $31.5 \times 10^{-5}$ $m^3$/sec and is not used for any local water supply purposes.

This unit rests directly on the very impermeable Lavery till. Therefore, groundwaters in the alluvial fan material do not infiltrate into a regional groundwater table, but discharge locally along the fan's northern and eastern borders in the form of seeps and springs. Some discharge from this unit also supplies water to Erdman Brook.

Eighteen seepage faces surrounding the North Plateau have been identified and monitored, generally during rare flow periods (Albanese and others, 1983). The major seepage discharge point was the french drain system surrounding Lagoons 2 and 3 (as shown in Figure A.3.5-2). The highest concentration of seepage exists between the NP3 site and the french drain on the northeast side of the plateau.

Groundwater flow gradients within this fan range from 0.0026 m/m to 0.0033 with an average gradient of 0.00229 m/m. No water is withdrawn from this fan for plant operations and groundwater flow directions are not expected to reverse themselves under foreseeable conditions.

### A.3.5.1.5 Groundwater Users Survey

In September 1982, Dames and Moore conducted an extensive survey of groundwater users within a 3.2 km radius of the WVNSC. The results of this survey are presented in Table A.3.5-2. The locations of these wells are shown in Figure A.3.5-3.

This survey included a description of well specifications, well use, aquifer tapped, yield, etc. The majority of wells in the vicinity of the WVNSC are for domestic or farm use and tap the shale bedrock. Yields are relatively low ($12.6 \times 10^{-5}$ - $126.2 \times 10^{-5}$ $m^3$/sec) with depths ranging from 15-45 m. Several of these wells are used for monitoring purposes and none are within the zone of potential plant influence.

### A.3.5.2 SITE CHARACTERISTICS

Data on groundwater levels, flow, permeability, porosity and gradients reported in the published literature were reviewed and are summarized in Table A.3.5-3. All water used at the plant, both for processing and domestic use, originates from two artificial reservoirs. These reservoirs are formed by two earthen dams which were constructed to carry the plant railroad spur across two draws (NFS, 1974). The two lakes contain more than 555,525 $m^3$ of water, (NFS, 1973). Groundwater is not used at the plant for process or drinking water supplies. Figure A.3.5-4 identifies the groundwater recharge areas within the influence of the plant. These areas are:

1. The North Plateau alluvial fan, and
2. The Lavery till.

Both are recharged by precipitation and meltwaters. The alluvial fan, because of its higher permeability, is recharged much more readily than the Lavery till.

Because of the low permeabilities of the site sediments, impacts of dewatering during construction activities will be limited to areas immediately proximate to the excavation.

Water table contours are shown in Figure A.3.5.-5. This map indicates the predominant flow directions of the local groundwater regimes as is shown in Figure A.3.5-2. The locations of monitoring wells currently being sampled on a regular basis to evaluate possible outleakage from the plant are shown in Figure. A.3.5-6.

### A.3.5.3 CONTAMINANT TRANSPORT ANALYSIS

Models for contaminant transport associated with each facility are contained in Chapter 9 of the SAR module for each facility. The hydrologic input parameters are based on the data presented in this chapter augmented, as required, for site specific data. The codes listed below are used to perform the contaminant transport analysis. The choice of code(s) is based on the type of release and the subsurface conditions of and around the release area.

| Code | Reference | Description |
|---|---|---|
| FEMWATER-1 | Yeh, et al, 1980; Yeh, 1983 | Two dimensional finite element groundwater flow model. |
| LAYFLO | Gureghian and Junsen 1983 | One dimensional analytical radionuclide transport model with multilayer and decay chain capability. |
| AT123D | Yeh, 1981 | One, two or three dimensional analytical radionuclide transport model. |
| PRESTO-EPA | EPA, 1984 | Release, transport, and dose assessment model for low-level waste disposal facilities. |
| FEMWASTE-1 | Yeh, 19183 | Two dimensional finite element mass transport through porous media model. |

The source terms for the models are also presented in the appropriate SAR module.

Wherever possible the models are calibrated against existing environmental monitoring data. These data are contained in the environmental documentation for the Project. Pertinent segments of the monitoring data are summarized in the facility module of the SAR.

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TABLE A.3.5-1

WATER QUALITY RESULTS WEATHERED BEDROCK ZONE SAMPLES TAKEN 9/82

| Perimeter | Well No. CT272 | Well No. 76 USGS W-2 | EPA*** Standard |
|---|---|---|---|
| pH* | 8.2 | 8.8 | 6.5-8.5 |
| Specific Cond.** | 341 | 273 | |
| Sodium | 61 | 44 | 50 |
| Calcium | 14 | 60 | 150 |
| Magnesium | 3.0 | 11.0 | 125 |
| Sulfate | 5.0 | 2.5 | 25 |
| Chloride | 14.3 | 5.8 | 250 |

* Standard Units

** umhos/centimeters at 25 degrees centigrade

*** 40 CFR Part 265.91

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (1 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Reed, David | Thomas Corners Rd. | 1130 | D,A | Dug | 18" | 17 | 3' | Gravel | 4 | Sub | 6' Flowing | 9/82 | 100 cattle; alternative sources of water |
| 2 | Reed, David | Thomas Corners Rd. | 1300 | D,A | Spring | | | | | 4 | | | 9/82 | 100 cattle; alternative sources of water |
| 3 | Watson, Rich | Bond Rd. | 1295 | D,A | Spring | | | | | 3 | S.W. | Flowing | 9/82 | Supplies a small tree nursery |
| 4 | Waterstram | Thomas Corners Rd. | ~1330 | D,A | Dug | 36" | 12 | | Sand | 0 | Piston | | 9/82 | Used by Schichtel Nursery; a large tree farm |
| 5 | Waterstram | Thomas Corners Rd. | ~1330 | D | Auger | 4" | 10-12 | --- | Sand | 2 | Piston | | 9/82 | |
| 6 | Wulff, D. | Thomas Corners Rd. | 1330 | D | Well Point | 2" | 12 | 4' | Sand | 3 | Piston or Jet | | 9/82 | Never runs dry |
| 7 | Wolniewicz, C. | Bond Rd. | 1350 | D | Spring | cement block holding basin | | | | 5 | S.W. | Flowing | 9/82 | |
| 8 | Wolniewicz, C. | Bond Rd. | 1280 | D | Dug | 36" steel tube | 18 | | Sand | 2 | S.W. Jet | 1.0 | 9/82 | |
| 9 | Clark, R. | Bond Rd. | 1350 | D | Dug | 36" concrete tube | 15 | | Sand | 4 | S.W. Jet | 4.0 | 9/82 | Very quick recovery |
| 10 | Bond, F. | Bond Rd. | 1310 | D | Dug | 24" tile | 20 | | Sand | 5 | S.W. | 17.0 | 9/82 | |
| 11 | Bonds Meat Co. | Bond Rd. | 1280 | D,S,C | Spring | 30" x 7' deep fiberglass tank | | | | 5 | Sub.+ S.W. | 3.0 | 9/82 | Located 12' below edge of bank; 80 cattle. Board of Health chemical analysis, every 6 months |
| 12 | Fuller, Wilber | Bond Rd. + Rt 240 | 1310 | D,S | Dri | 6" | 150 | | Shale | 2 | Sub. | 20.25 | 9/82 | 7-15 cattle |
| 13 | Gilber, Alice | Rt. 240 | 1260 | D | Dri | 6" | 160 | 30' 5" | Shale | 2 | Sub | 17'7" | 9/82 | Test yield: 1 gpm |
| 14 | Wells, Richard | Rt. 240 | 1305 | U | Dug | 36" | 12-15 | | Gravel | 0 | --- | 5.0 | 9/82 | |
| 15 | Fuller, Wilbur Jr. | Rt. 240 | 1250 | D | Spring | | | | | | Gravity Fed | Flowing | 9/82 | In 7/73, spring was dry for two months |
| 16 | Miller, Alberta | Beech Tree Rd. | 1300 | D | Dri | 6" | 165 | 0 | Shale | 0 | Sub | 92.66 | 9/82 | |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (2 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | Fuller, Mag/John | Beech Tree Rd. | 1220 | D | Dri | | | | | 1 | | | 9/82 | |
| 18 | Fuller, Mag/John | Beech Tree Rd. | 1220 | U | Spring | | | | | | | | 9/82 | Used to supply cattle farm in the past |
| 19 | Fagnan, R. | Watson Rd. | 1310 | D | Dri | 6" | 170 | 8" at 118'--126 B.G. | Shale | 3 | Sub | | | Tested yield: 15 gpm at 110', 118'-126' B.G. is a screened interval |
| 20 | Odwarka, G. | Watson Rd. | | | Spring | | | | | | | | | Summer recreational use only not used for drinking water |
| 21 | Steiner, R. | Watson Rd. | 1190 | D | Spring | | | | | 5 | S.W. | | | Slow recovery in the summer |
| 22 | Bobseine, W. | Watson Rd. | 1200 | D | Spring | 1,000 gal. cement tank | | | | 3 | S.W. | | | Slow recovery in the summer |
| 23 | Fuller, Rich | Beech Tree Rd. | | D | Dri | 6" | 199 | -162 | Shale | 3 | Sub | 89.33' | 9/82 | |
| 24 | Fuller, Rich | Beech Tree Rd. | | U | Dri | 6" | 167 | | Shale | 0 | None | 84.66' | 9/82 | |
| 25 | Fuller, Rich | Beech Tree Rd. | | U | Dug | 36" | 13 | --- | Clay/Sand | 0 | None | 0 | 9/82 | |
| 26 | Martin, T. | Watson Rd. | 1280 | D,S | Dri | 6" | 200 | 3 | Shale | 4 | S.W. Jet | +0.5' | | 8 pigs, tested yield 1.5 very good recovery |
| 27 | Place, J. | Beech Tree Rd. | 1280 | D | Well Point | 2" | 13 | ø | Sand | 4 | S.W. | | | Tested yield; 3 gpm temporary; to be replaced by a drilled well |
| 28 | Place, Morris | Beech Tree Rd. | 1280 | D | Dug | 2' | 10-15 | | Sand | 3 | S.W. Jet | 0.5 | 9/82 | |
| 29 | Schweiker, T. | Beech Tree Rd. | 1374 | D | Spring | Stone Cistern | | | | 7 | Gravity Fed | | | 67 cattle, not a flowing spring |
| 30 | DeGrange, L. | Rt. 240 | 1430 | D | Dri | 6" | ~90 | | Shale | 5 | Sub | 26.0 | | Tested yield 8 gpm |
| 31 | DeGrange, L. | Rt. 240 | 1325 | C | Dug | | 9 | | S & G | 0 | Jet | ~5 | | Covered by garage floor |
| 32 | Thurtor, A. | Rt. 240 | 1250 | U | Dri | 6" | ~60 | ø | | 0 | Jet or Piston | | | Cap rusted on pipe; could not take reading. |
| 33 | Rogers, C. | Thomas Corners Rt. 240 | 1410 | D | Dri | 5" | 65 | | Shale | 3 | Sub | | | Does not want well opened |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (3 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | Buffam, G. | Thomas Corners | 1380 | D | Dri | 6" | 105 | 75 | Shale | 8 | | | | Tested yield, 4 gpm unable to measure s.w.l. well used by Newkirk, D., next door |
| 35 | Kean, George | Bond Rd. | 1345 | D | Dug | 24" steel tube | 12 | ♦ | Sand and Gravel | 4 | Piston or Rotary | | | Soft water, no supply problems |
| 36 | Emerson, R. | Thomas Corners | 1360 | D,A | Driven Well Point | 1 3/4" | 22 | 4 | Sand | 7 | Rotary | | | 12 cattle, cannot be pumped dry |
| 37 | Emerson, Ed | Thomas Corners Rd. | 1335 | D | Dug Tile Lined | 24" | 12 | | Sand | 2 | Sump | 4.0 assumed | 9/82 | Well tapped into a "spring" -never dries up, granular sand, little clay |
| 38 | Emerson, Ed | Thomas Corners Rd. | 1360 | U | Dug and Drilled | 3' | 40 | --- | Sand | 0 | | --- | --- | Not used-water "too hard" dries up in winter |
| 39 | Tucholski, J. | Emerson Rd. | 1330 | D | Dug | 24" steel tube | 12 | --- | Sand | 2 | | | | Site listed as swamps on quad |
| 40 | Somas, W. | Emerson Rd. | 1330 | D | Dug | 24" steel tube | 12 | --- | Sand | 2 | | | | Site listed as swamps on quad |
| 41 | Gephart, Wm. | Emerson Rd. | 1340 | D | Dug | 24" steel tube | 12 | --- | Sand | 2 | | | | Site listed as swamps on quad |
| 42 | Morgan, F. | Rt. 240 | | | | | | | | | | | | |
| 43 | Brooks, Wm. | Rt. 240 | 1413 | D | Dri | 6" | ~100 | ♦ | Shale | 3 | Sump | | | |
| 44 | Bond, F. | Cole Rd. | 1440 | D | Dri | 6" x 13' steel case | 90-105 | 77-92 | Shale | 2 | Jet | | | 11' of water in tube (F. Bond 9/82) 8 gpm recovery |
| 45 | Offorbeck, J. | Cole Rd. | 1465 | D | Dri | 6" | ~100 ±2 | ~80 | Shale | 6 | Jet | 20.75' | 9/82 | Tested yield estimate set at 400 gph (owner) |
| 46 | Stedman, J. | Cole Rd. | 1465 | D | Dri | 6" | 62 | | Shale | 1 | Jet | | | Silt accumulates in water water after a heavy rain |
| 47 | Kessler, A. | Cole Rd. | 1480 | D | Dri | 6" | | | Shale | 2 | Piston | | | |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply; U = unused.

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (4 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | Evens | Cole Rd. | 1460 | D | Drl | 6" | 60-65 | | Shale | 5 | Jet | 30.5 | 9/82 | Listed depth may be casing length, not well depth |
| 49 | Wilson, D. | Cole Rd. | 1460 | D | Drl | 6" | 60 | | Shale | 3 | Jet | | | |
| 50 | Kendall, R. | Cole Rd. | 1460 | D | Drl | 6" | 40 | | | 3 | Sump | | | |
| 51 | Belscher, K. | Cole Rd. | 1550 | D | Spring 4'x11'x7' Tile Cistern | | | | | 3 | Gravity fed flowing spring | | | |
| 51a | Rendell, W. | Cole Rd. | 1550 | D | Spring | | | | | 3 | | | | 51 cattle |
| 52 | Rendell, R. | Cole Rd. | 1530 | D | Spring Supplies Both Homes | | | | | 4 | gravity fed | | | |
| 52a | Rendell, K. | Cole Rd. | 1530 | D | Drl | | | | | 4 | | | | |
| 53 | Emerson, L. | Cole Rd. | 1480 | D | Drl | 6" | 30-40 | | Shale | 4 | Sub | | | Tested yield 4 or 5 gpm (1974) Owner: Yield is higher than 4-5 gpm |
| 54 | Codd, R. | Rt. 240 | 1460 | D | Drl | 6" | 100 | 65 | Shale | 2 | Sub | 41.0 | 9/82 | Tested yield: 18 gpm |
| 55 | Rogers, G. | Rt. 240 | 1460 | D | Drl | 6" | 32 | 12 | Shale | 5 | S.W. | | | Tested yield: 10 gpm |
| 56 | Boberg, D. | Rt. 240 | 1450 | D | Drl | 6" | ~40 | | | 5 | Sub | ~20 | 1978 | Tested yld: 13 gph (owner) |
| 57 | Codd, J. | Bond Rd. | 1325 | D | Dug | 24" | 12 | ♦ | Sand | 2 | | | | 200' E of house |
| 58 | Dobies, J. | Rt. 240 | 1440 | D | Drl | 6" | 80 | ♦ | Shale | 5 | Jet | 25 | 1952 | Tested yield: 75 gpm-well pumped all day with no drawdown |
| 59 | Heinen, F. | Rt. 240 | 1440 | D,S | Drl | 6" | 100 | 60 | Shale | 10 | Jet | 70' | 1969 | 3,000 chickens; owner; 24 hrs pumping at 25 gpm did not lower the W.L. |
| 60 | Smith, G. | Rt. 240 | 1490 | U | Drl | 6" | 73 | 8 | Shale | 0 | Sub | 50.5 | 11/61 | From LaScala, 1968 |
| 61 | Nelson, R. Pond No. 3 | Rt. 240 | 1500 | D,A,S | Spring | | | | | | | Gravity fed | | 60 cattle, never dried up |
| 61a | Wilson | Rt. 240 | | | | | | | | | | | | |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply; U = unused.

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (5 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | Croakman, H. | Rt. 240 | 1440 | D | Drl | 6" | 129 | ? | Shale | 8 | Jet | 27.33 | 9/82 | Fe-Ca rich |
| 63 | Nelson, R. | Rt. 240 | | D | Drl | 6" | 125 | | Shale | 7 | Jet | 25 | 1952 | |
| 64 | Zefers, D. | Rt. 240 | 1440 | D | Drl | 6" | 155 | | Shale | 3 | Sub | 20 | 1972 | Well used in past to supply 5,000 chickens, 60 cattle |
| 65 | Zefers, D. | Rt. 240 | 1450 | D | Drl | 6" | 160 | | Shale | 4 | S.W. | <20 | --- | |
| 66 | Wagner, R. | Rt. 240 | 1460 | D | Spring | | | | | 3 | Jet | | | |
| 67 | Zefers, M. | Rt. 240 | ~1500 | D | Drl | 6" | 130 | 120-130 | Shale | 2 | Sub | 0 | | *Will overflow if not pumped |
| 68 | Zimmerman | Rt. 240 | 1510 | D,S | Drl | 6" | 98 | ? | Shale | 4 | Sub | 12 | 1956 | 74 cattle; tested yield 12-14 gpm; would like water sampled |
| 69 | Kester, H. | Rt. 240 | 1490 | D | Drl | 6" | 165 | | Shale | 6 | Jet | --- | --- | Unable to sample |
| 70 | W.V. Conservation Club | Rt. 240 | | | | | | | | | | | | |
| 71 | Goggin, J. | Rt. 240 | 1500 | D | Drl | 6" | 173 | 43-53 | Shale | 3 | Sub | 17' 11" | 9/82 | |
| 72 | Zakulski, W. | Twitchell Rd. | 1520 | D | Drl | 6" | | | | | | | | |
| 73 | Steffennagen, P. | Rt. 240 + Green Rd. | 1510 | D,S | Drl | 6" | 105 | | Shale | 6 | Jet | * | | 28 cattle; tested yield 7 gpm; *excellent recovery-overnight the well will overflow if not pumped |
| 74 | Lara, I. | Rt. 240 | | | | | | | | | | | | |
| 75 | Schumacher, G. | Rt. 240 | 1535 | D | Drl | 6" | 92-96 | | Shale | 4 | Jet | 66 | Spring '73 | Can be pumped dry |
| 76 | Ebel, D. | Twitchell Rd. | 1570 | D,S | Spring | | | | | 3 | Gravity fed | flowing spring | | 9 cattle |
| 77 | Heary, T. | Heinz Rd. | 1570 | D | Drl | 6" | 92.4 | | Shale | 3 | Jet | 58.4 | 4/28/62 | 27 cattle, 3 pigs 1-LaScala, 1968 |
| 78 | Heary, T. | Heinz Rd. | 1540 | D | Spring | | | | | 3 | | 20.0 | 9/82 | 6 horses |
| 79 | Case | Rt. 240 | 1550 | D | Drl | 6" | 125 | | | | | | | |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

# TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (6 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | Day, K. (Fuller) | Rt. 240 | 1550 | D | Drl | 6" | 78 | | | 3 | | | | Well under porch, inaccessible. New owner has minimal knowledge of well |
| 81 | Heary, S. | Rt. 240 | | | | | | | | | | | | |
| 82 | Jones, H. | Rt. 240 | 1450 | D | Drl | 10" | 60 | | Shale | 4 | Sub | 32 | 9/82 | Tested yield: 4 gpm |
| 83 | Latona, J. J. | Rt. 240 | 1560 | | Drl | 8" | 90 | | | 2 | Piston or jet | 10.25 | 9/82 | |
| 84 | Flintjer, G. | Buttermilk Rd. | 1520 | D | Spring | | | | | 3 | S.W. | | | 300 gallon recovery in one day |
| 85 | Flintjer, G. | Buttermilk Rd. | 1420 | D | Drl | 8" | 110 | 70 | Shale | 2 | Sub | 60 | 1971 | Tested yield 16.66 gpm |
| 86 | Flintjer, G. | Buttermilk Rd. | 1520 | U | Spring | | | | | 0 | | | | |
| 87 | Spittler, F. | Fox Valley Rd. | 1415 | D,S | Drl | 6" | | | | 3 | S.W. | | | 25 cattle, uncooperative |
| 88 | Swartz, M. | Fox Valley Rd. | 1410 | D | Drl | 6" | | | | | | | | Uncooperative |
| 89 | Town of Ashford | Fox Valley Rd. | 1450 | T | Drl | 6" | 325 | | Shale | | Sub | | | |
| 90 | Widrig, W. | Fox Valley Rd. | 1450 | D,S | Drl | 6" | 300 | | Shale | 8 | Sub | 75.0 | Spring '82 | 60 cattle, sub. pump at 170' B.G. |
| 91 | Skinner, W. | Dutch Hill Rd. | 1890 | D | Spring | | | | | 2 | S.W. Jet | | | B.O.H. |
| 92 | Mullen | Rock Springs | 1840 | U | Dug | 48" wooden box | 6 | | Spring fed | | | | | |
| 93 | Mullen | Rock Springs | 1840 | D | Drl | 6" | ~100 | ~70 | Shale | 3 | Jet | 0 | 9/82 | At one time, fed 100 cows |
| 94 | Goll; Schumacher | Rock Springs | | U | Spring | | | | | | | | | |
| 95 | Hauri, D. | Rock Springs | | D,S | Spring | | | | | 4 | Jet | | | A good supply |
| 96 | Lee, Wm. | Dutch Hill | 1890 | D | Drl | 6" | ~90 | | Shale | 7 | Sub | 41.66' | 9/82 | |
| 97 | Lloyd | Dutch Hill | 1845 | D | Dug | 36" | 15 | | Silty Sand | 5 | S.W. | | | Cover over well difficult to move w/o disturbing construction of well |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (7 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 98 | Wilkosz, F. | Dutch Hill | 1840 | D,S | Drl | 6" | 100 | <60 | Shale | 7 | Jet | 25' 7" | 9/82 | 6 cattle |
| 99 | Myers, D. | Dutch Hill | | | | | | | | | | | | |
| 100 | Turner, B. | Dutch Hill | 1790 | D | Drl | 6" | 100 | 20 | | 4 | Jet | 6 (est.) | 9/82 | |
| 101 | Rachic, G. | Dutch Hill | 1800 | D | Dug | 24" | 5.3 | T | Till | | | 2.8 | 4/62 | Bedrock 5.3' B.G. according to LaScala |
| 102 | Rachic, G. | Dutch Hill | 1780 | D,S | Drl | 6" | 80 | 60-70 open | Shale | 3 | Jet | | | 6 cattle; cannot run dry |
| 103 | Serio, J. | Dutch Hill | 1780 | U | | | | | | | | | | |
| 104 | Guimento, J. | Dutch Hill | 1780 | D | | | | | | 3 | | | | Used by two tenants, one neighbor owner around Sundays only |
| 105 | Hughes, S. | Dutch Hill | 1710 | D,S | Drl | 8" | 76 | ϕ | Shale | 1 | Sub | | | 6 pigs - tested yield: 3 gpm. 6" column of water in well |
| 106 | Warzel, E. | Boberg Rd. | 1580 | D | Drl | 6" | 70 | | | 1 | | | | Unable to locate well in field 150' NE of house |
| 107 | Shimmel, H. | Boberg Rd. | 1580 | D | Drl | 6" | 83 | | | 5 | Jet | | | |
| 108 | Sarvar, R. | Boberg Rd. | ~1600 | D,S | Spring | Concrete vault 4'x4'x6' | | | | 2 | S.W. Jet | Overflows the pipe from the vault | | 5 cattle |
| 109 | Harshbarger | Boberg Rd. | 1550 | D | Drl | 6" | 86 | --- | --- | 2 | Sub | | | |
| 110 | Mumbach | Boberg Rd. | 1550 | D | Drl | 6" | 50 | --- | | 2 | | | | |
| 111 | Kramer, E. | Boberg Rd. | 1550 | D | Drl | 6" | 135 | | Shale | 4 | Sub | <10 | Summer 1980 | Tested yield: 26 gpm (∫) |
| 112 | Cobo, L. | Dutch Hill Rd. | 1560 | D,A,S | Drl | 6" | 60 | 40 | Shale | 1 | Jet | ~15 | 1982 | 100 cattle, tested yield: 33.3 gpm |
| 113 | Cobo, D. | Dutch Hill Rd. | 1560 | D | Drl | 6" | 40 | 25 | Shale | 3 | Jet | ~12 | 1982 | Can be pumped dry in 15 minutes |
| 114 | Phillips, G. | Dutch Hill Rd. | 1595 | D | Drl | 8" | 50 | | | 4 | Sub | 7.33 | 9/82 | Tied with church next door |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

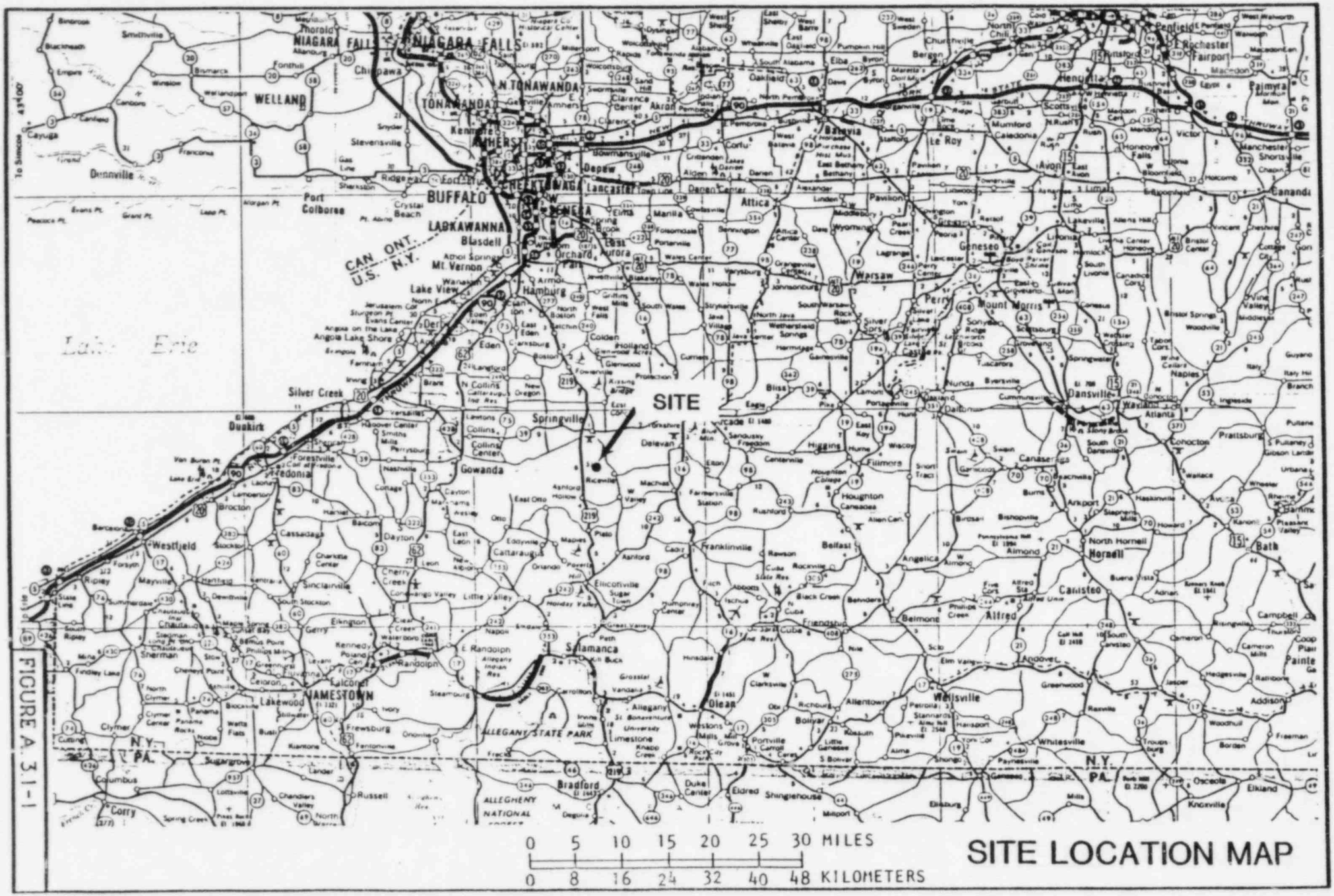
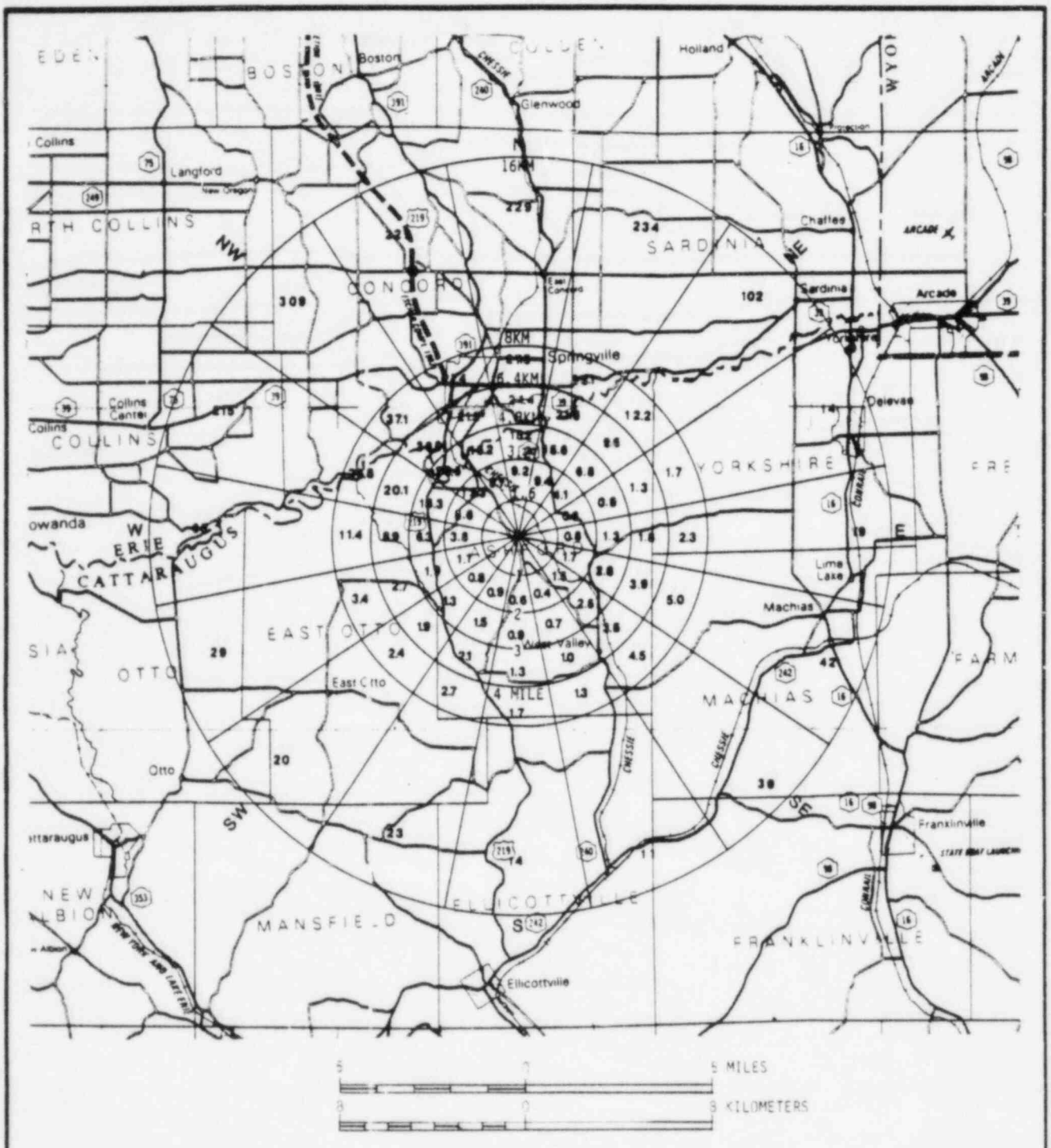



FIGURE A.3.1-1

# SITE LOCATION MAP




**AGRICULTURAL PRODUCE LAND AREA (ha) BY SECTOR**

**WITHIN 16 KILOMETERS (10 MILES) OF SITE**

FIGURE A 3 1-19

## TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (8 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | Hebdon, L. | Dutch Hill Rd. | 1640 | D,A | Drl | 6" | 72 | | Shale | 8 | Jet | 32 | 1955 | Hard water |
| 116 | Kern, E. (Penfield) | Cross Rd. | 1580 | D | Drl | 7" | 68 | | Shale | 3 | Sub | 20.5 | 9/82 | |
| 117 | Sarver, R. | Cross Rd. | 1600 | D | Drl | 6" | 48 | | | 2 | Jet | 34.0 | 1980 | |
| 118 | Barney, P. | Cross Rd. | 1570 | D | Drl | 6" | 30 | ♦ | S + G | 5 | S.W. | 3.0 | 1982 | |
| 119 | Batticci, E. | Cross Rd. | 1560 | D | Drl | 6" | 54 | 42 | Shale | 2 | Sub | 17 | 1980 | Tested yield: 5 gpm, soft water |
| 120 | Leichtheimer | Cross Rd. | 1540 | D | Drl | 6" | 50-60 | | Shale | 2 | Jet | 34.66 | 9/82 | Greyish coloration to water in summertime |
| 121 | Sabab, L. | Cross Rd. | 1480 | D | Drl | 6" | 30 | | | 2 | Piston | | | Shortage of supply during hot summers |
| 122 | Turner, R. | Rt. 12 | 1490 | D | Spring | 2,000 gal. tank | | | | 4 | S.W. Jet | Over-flows observed | 9/82 | Cannot pump tank dry |
| 123 | Lockhard, M. | Cross Rd. | 1450 | D | Drl | 6" | 88 | 18 | Shale | 7 | Jet | | | Tested yield: 80 gpm (owner). Could not remove cap |
| 124 | Lamphier, r. | Rt. 12 | 1440 | | | | | | | | | | | |
| 125 | Lamphier, J. | Rt. 12 | 1430 | D | Dug | 36" | 18-20 | | | 3 | Jet | | | Cemented over |
| 126 | Dick[illegible], J. | Rt. 12 | ~1450 | U* | Drl | 6" | | | | | | | | *Used only in summer |
| 127 | Vedder, L. | Rt. 12 | 1430 | D | Drl | 6" | 43 | | | 2 | Jet | ~10 | Spring/ 82 | Very good recovery; would like water sampled |
| 128 | Juras, W. | Forks Rd. | 1436 | D | Dug | | | | | 5 | Jet | | | Under a 6" thick concrete pad |
| 129 | Anderson, H. | Forks Rd. | 1430 | D,A | Drl | | ~80 | | | 2 | Jet | | | 5 cattle |
| 130 | Anderson, H. | Forks Rd. | 1430 | D | Dug | 4'x4' Concrete Lines | 30 | | Sand | 4 | S.W. | 6.0 | 9/82 | |
| 131 | Baker, R. | Forks Rd. | 1440 | D | Well Point | 2" | 8 | 4.0 | Sand | 5 | S.W. | | | Will dry up in autumn |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply; U = unused.

TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (9 of 10)

| Well Id No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 132 | Soboleski, R. | Rt. 12 | 1425 | D | Drl | 6" | 45 | | | 4 | Sub | -10 | 8/81 | |
| 133 | Hettrich, D. | Rt. 12 | 1450 | D | Drl | 6" | 30 | | Sand-Gravel | 7 | Jet | | | |
| 134 | Sion, J. | Rt. 12 | 1420 | D | Drl | 6" | 25 | | | 7 | S.W. Jet | 3.5 | 9/82 | |
| 135 | Dickson, R. | Rt. 12 | 1410 | D,S | Drl | 6" | <30 | 10 | "Clay" | 6 | Piston | 1.0 | 9/82 | 2 cattle |
| 136 | (West) O'Brien, W. | Dutch Hill Rd. | 1520 | D | Drl | 6" | 85 | 80 | (West) Shale | 3 | Sub | 24.33 | 8/82 | Tested yield est. by owner 15 gpm |
| 137 | (West) Meyers, J. | Dutch Hill Rd. | 1510 | D | Drl | 6" | 85 | 73 | (West) Shale | 4 | Sub | -20 | | 4 cattle; 10 gpm recovery |
| 138 | Fuller, A. | Rt. 12 + Dutch Hill Rd. | 1385 | D | Drl | 6" | 53 | | | 4 | Sub | 8-12 | | Owner estimate |
| 139 | Rambach, J. | Autumn View Trail | 1420 | D | Drl | 6" | 40 | | | 4 | Sub | 26 | 1980 | Poor recovery |
| 140 | Koch, M. | Schwartz Rd. | 1320 | D | Dug | 36" Ceramic Tile | 6 | | Sand + Gravel | 4 | | 0 | 8/82 | 8 horses; spring always flowing - that supplies the well |
| 141 | (West) Schroeder, D. | Schwartz Rd. | 1374 | D | Drl | 8" | 56 | | Sand | 2 | Centri-fugal | 7.66 | 8/82 | Would like water sampled |
| 142 | Kelley, H. | Schwartz Rd. | 1370 | D | Drl | 6" | 53' 5" | | Shale | 7 | Jet | 13 | 9/82 | |
| 143 | Herrick, M. | Schwartz Rd. | 1374 | D | Drl | 6" | 32 | | Shale | 2 | Piston | 7.75 | 8/82 | Tested yield (1 hr tort.) = 4-500 gph-owner |
| 144 | Schmauss, R. | Edies Rd. | 1370 | D | Drl | 6" | 100 | 15 | Shale | 4 | Sub | | | 9 cattle, tested yield = 8.33 gpm |
| 145 | Feuz, A. | Edies Rd. | 1380 | D | Drl | 6" | 70 | | | 4 | Sub | 35 | 1981 | Tested yield = 2 gpm, drillers log 0-45 S+G; 45-90 clay 90-bedrock, well filled in back to 70' |
| 146 | Feuz, W. | Edies Rd. | 1320-30 | S | Well Point | 2" | -21 | | Sand, Gravel | 0 | | | | 5 cattle; tested yield = 2 gpm-buried under barn floor |
| 147 | Feuz, W. | Edies Rd. | 1320-30 | D | Drl | 6" | 116-140 | | Shale | 2 | Sub | | | Tested yield = 12 gpm. Unable to measure S.W.L. |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

TABLE A.3.5-2: LOCAL WATER WELL INVENTORY FORM (10 of 10)

| Well No. | Owner | Location and Address | Approx. Land Surface Elev. (ft) | Well Use* | Well and Type | Well Diameter | Total Depth (ft) | Interval Screened or Interval (ft) | Probable Aquifer Tapped | No. of People Served | Type of Pump | Static Water Level (ft) | Date of Measurement | Comments: Water Quality, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | Felton, F. | Edies Rd. | 1285 | D | Dug | 36" wood encased | 21 | | Sand (clear) | 4 | Jet | -2-3' | | Previously used for dairy farm |
| 149 | Hess, L. | Schwartz Rd. | 1360 | D | Drl | 6" | 100+ | | | 4 | Sub | | | 8 cattle |
| 150 | Hess, L. | Schwartz Rd. | 1360 | U | Dug | 6" | 40 | | | | | | | |
| 151 | Preston, J. | Rock Springs Rd. | 1460 | D | Dug | 48" Stone Lined | 4 | --- | | 2 | S.W. | 2.0 | 9/82 | |

*D = domestic; S = stock; C = commercial; I = industrial; A = agricultural; P = public supply
U = unused.

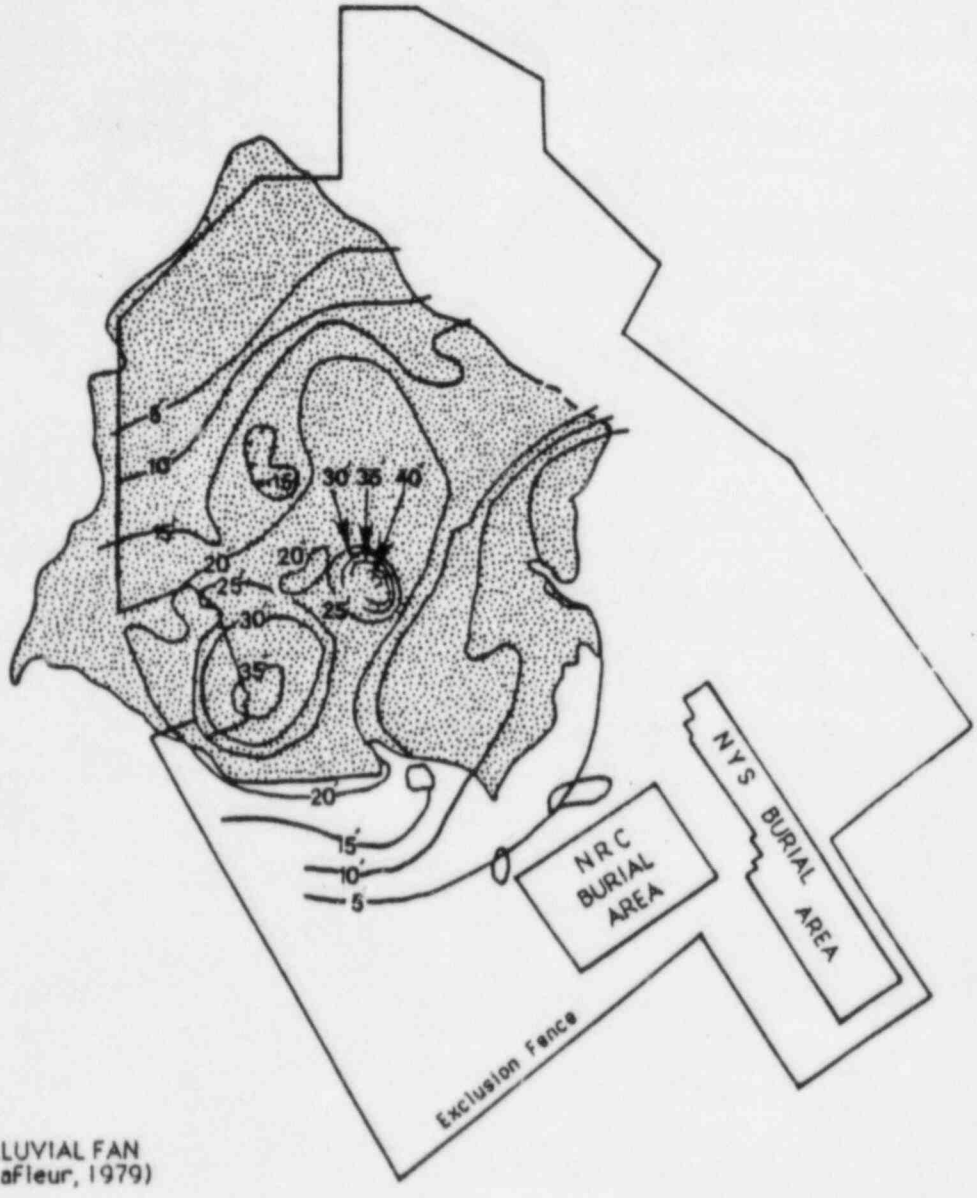
TABLE A.3.5-3

SUMMARY OF AQUIFER CHARACTERISTICS FOR THE LAVERY TILL

(See Sources Listed for Additional Data)

| Parameter | Representative Values (Source) |
|---|---|
| Porosity (percent) | 32.4 (Fickes and Others, 1979)<br>31.4 (David and Fakundiny, 1972) |
| Density ($lbs/ft^3$) | 113.4 (dry) (Dames and Moore, 1975)<br>110.0 (dry) (Dames and Moore, 1976) |
| Hydraulic Conductivity (cm/sec) | 2.5 E-7 (Vertical) (Dames and Moore, 1975)<br>5.3 E-8 (Vertical) (Dames and Moore, 1976)<br>2.5 E-7 (Horizontal)<br>9.4 E-8 (Vertical) (Davis and Fakundiny, 1977)<br>1.9 E-7 (Horizontal)<br>5.0 E-8 (Vertical) (Dana and Others, 1979)<br>6.2 E-8 (Vertical) (Prudic, 1982)<br>3.8 E-8 (Horizontal) |
| Water Quality (pCi/ml) | <3.4 gross alpha (Albanese and Others, 1982)<br><5 gross beta<br><0.02 gross alpha (Dana and Others, 1979)<br>0.211 gross beta |
| Water Table Elevations (ft below grade) | 1 - 6 WVNS On-Site Records for Monitoring Wells<br>5 - 9<br>1 - 4<br>3 - 10 SAR, 1973, Off-Site Well Measurements |

ISOPACH MAP OF THE HOLOCENE ALLUVIAL FAN
DEPOSIT ON THE NORTH PLATEAU
SHOWING AREAL EXTENT AND THICKNESS.



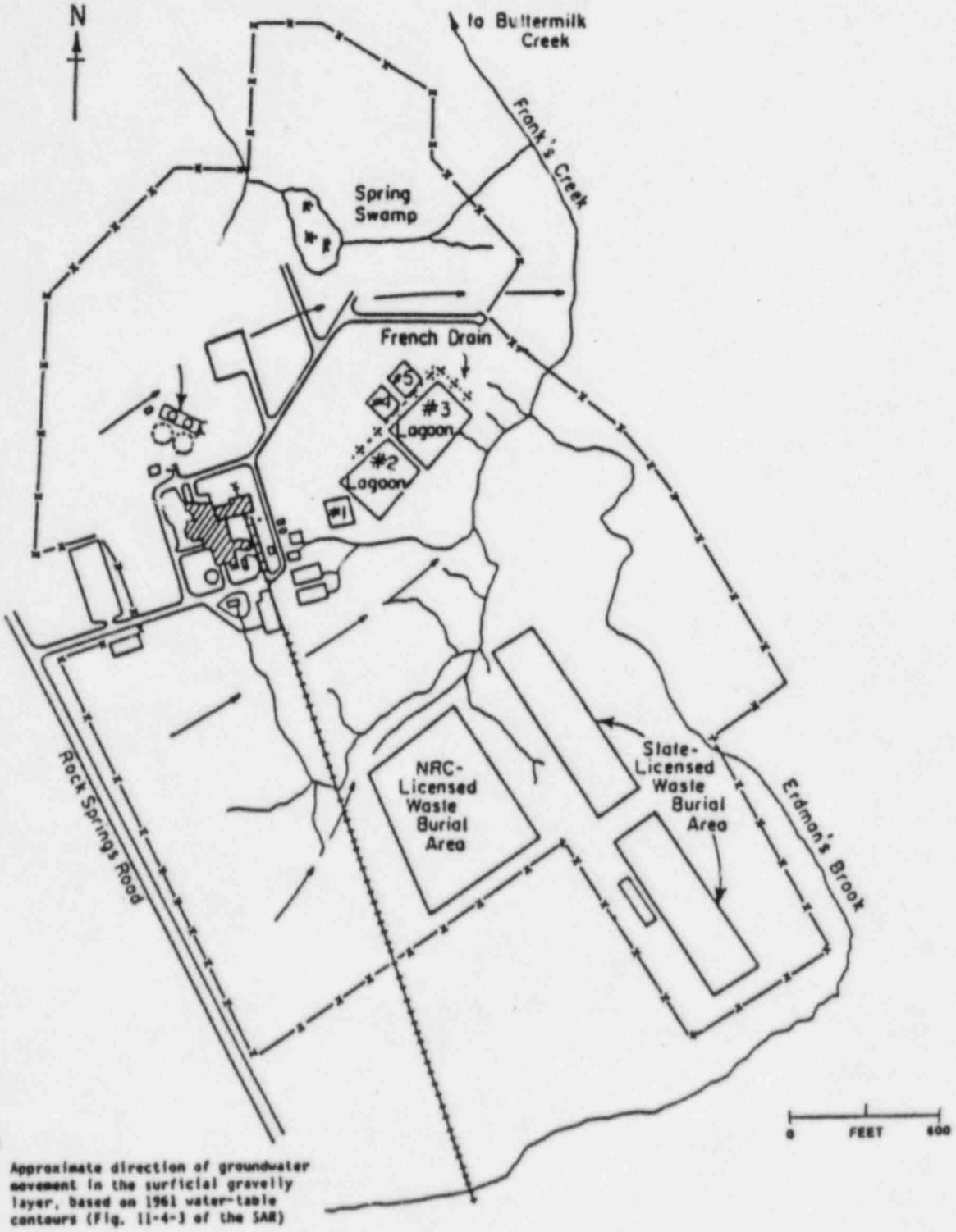

HOLOCENE ALLUVIAL FAN
(from LaFleur, 1979)

ISOPACHS INDICATING DEPTH TO BOTTOM
OF HOLOCENE ALLUVIAL FAN (in feet)

0' 500' 1000'
0 100 200 300 m

Reference Albanese and others, 1981

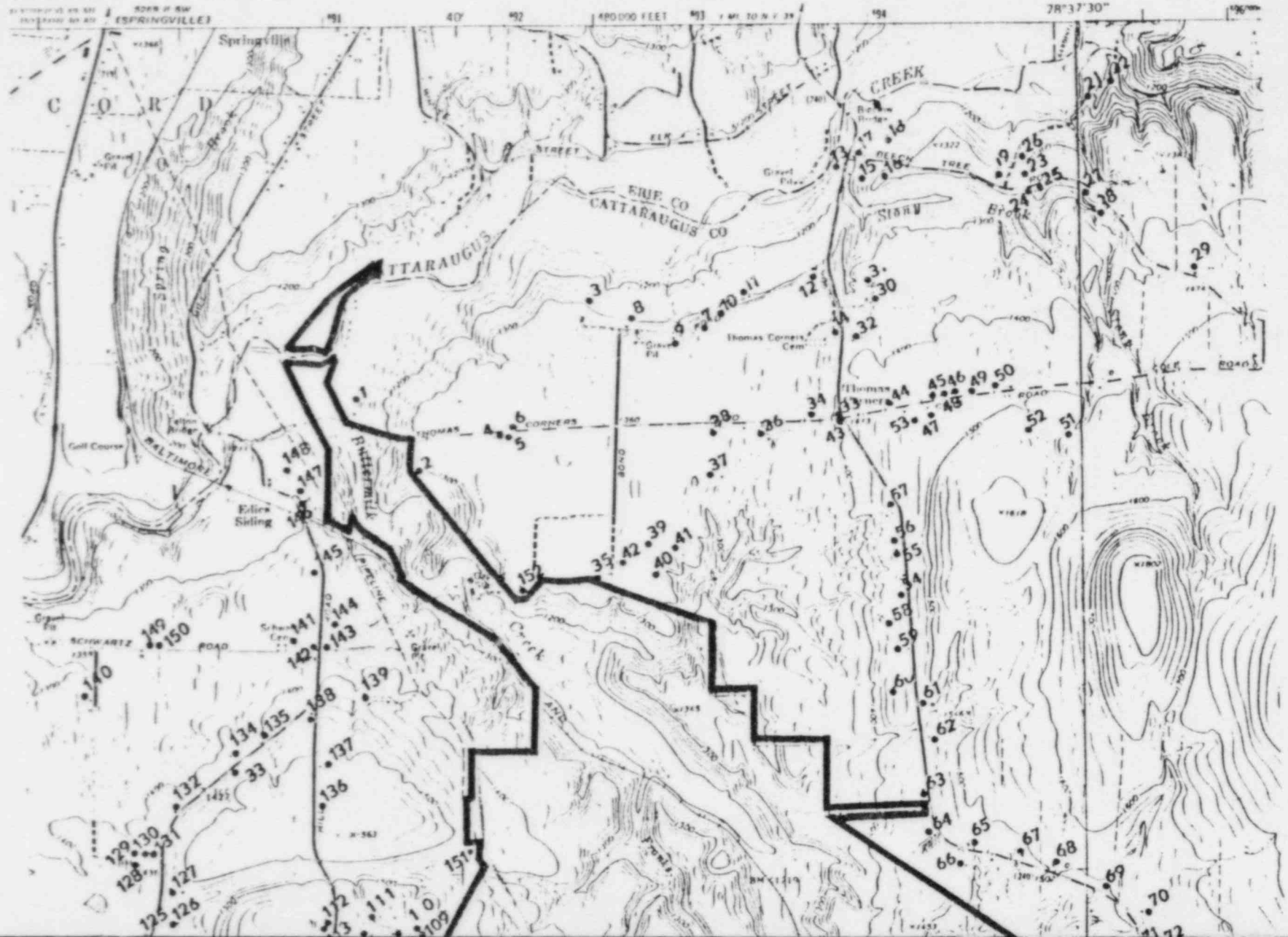
FIGURE A. 3.5-1

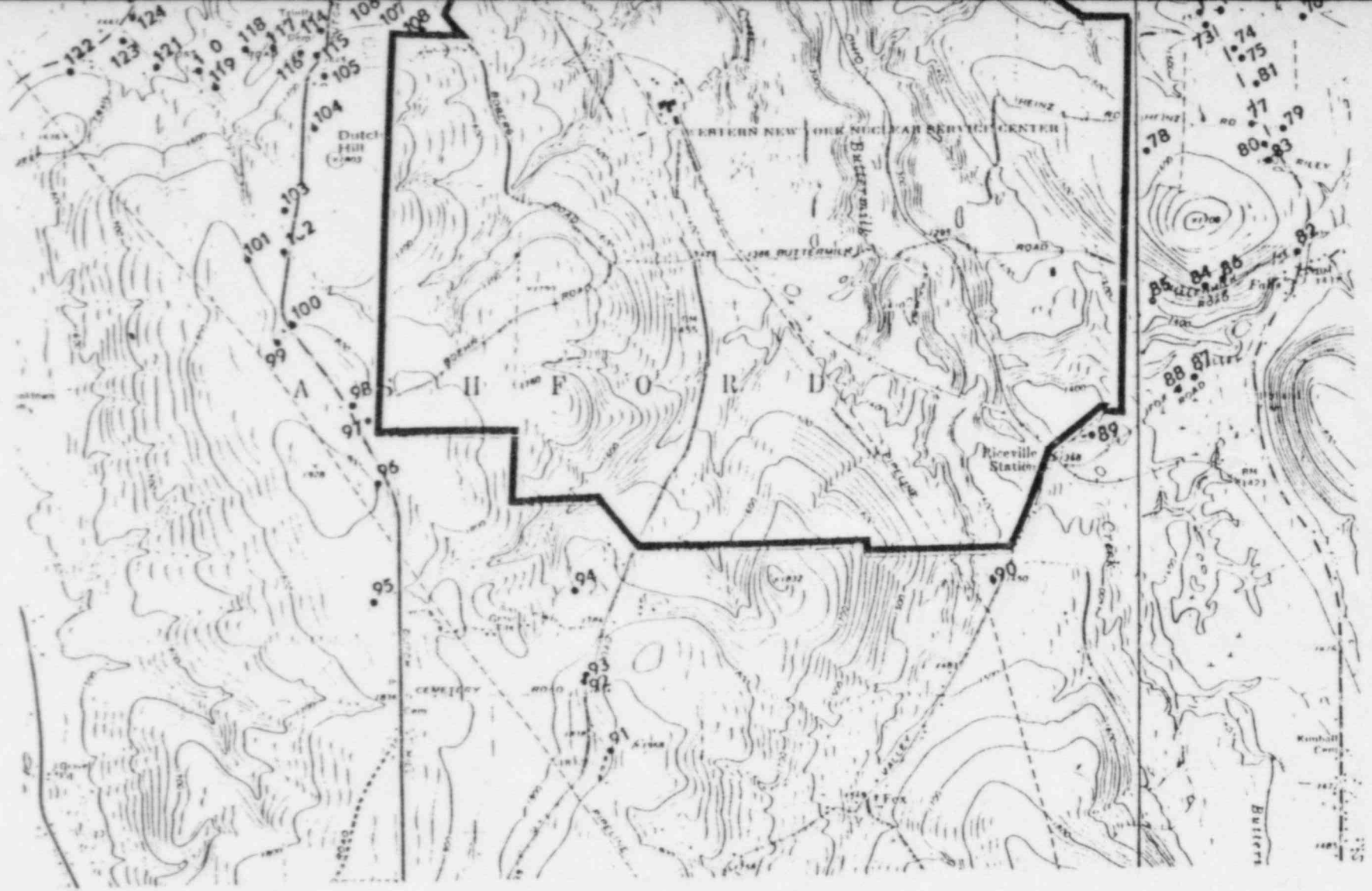



GROUNDWATER FLOW DIRECTIONS
IN NORTH PLATEAU ALLUVIAL FAN

FIGURE A 3.5-2

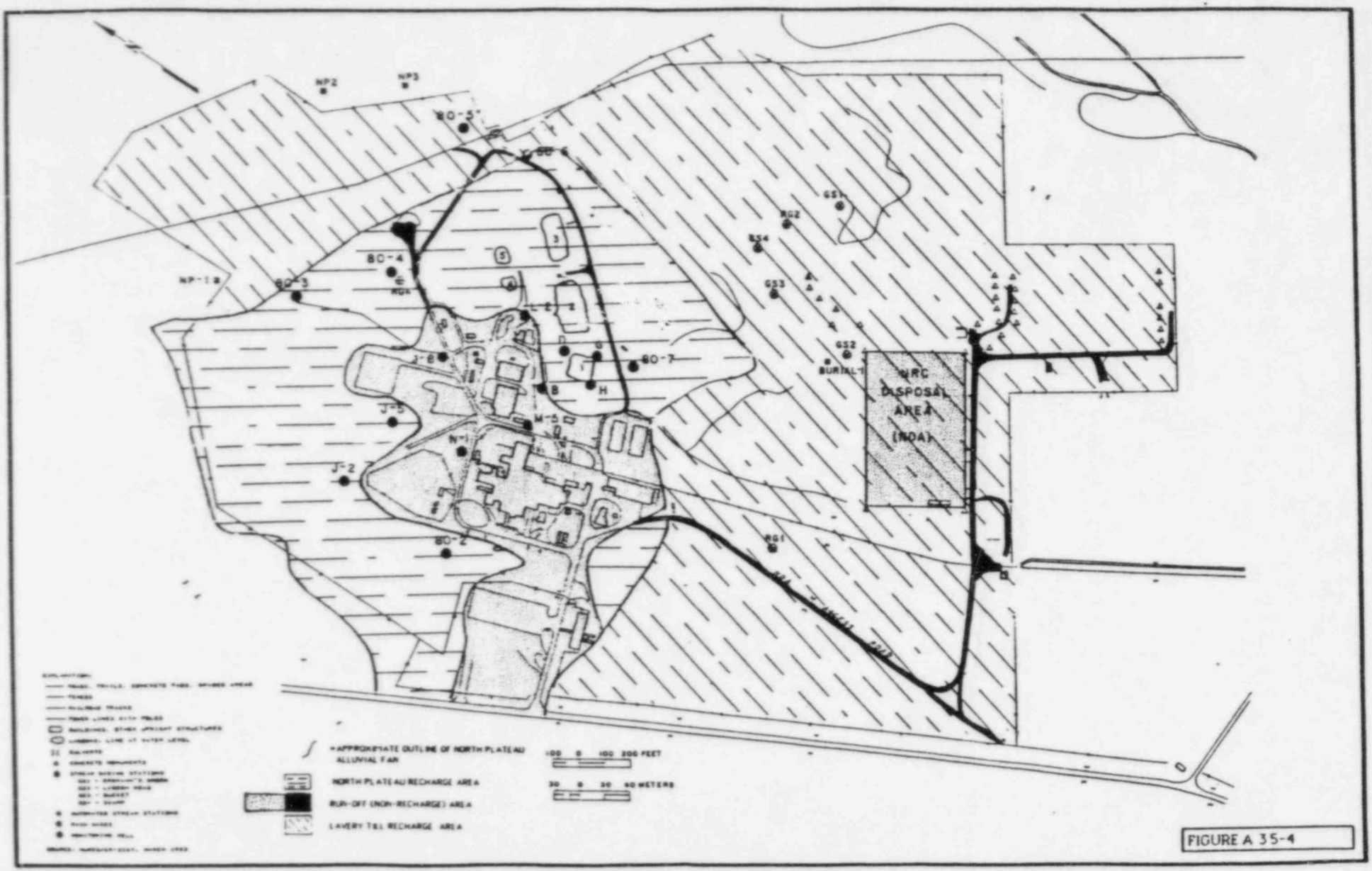
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS



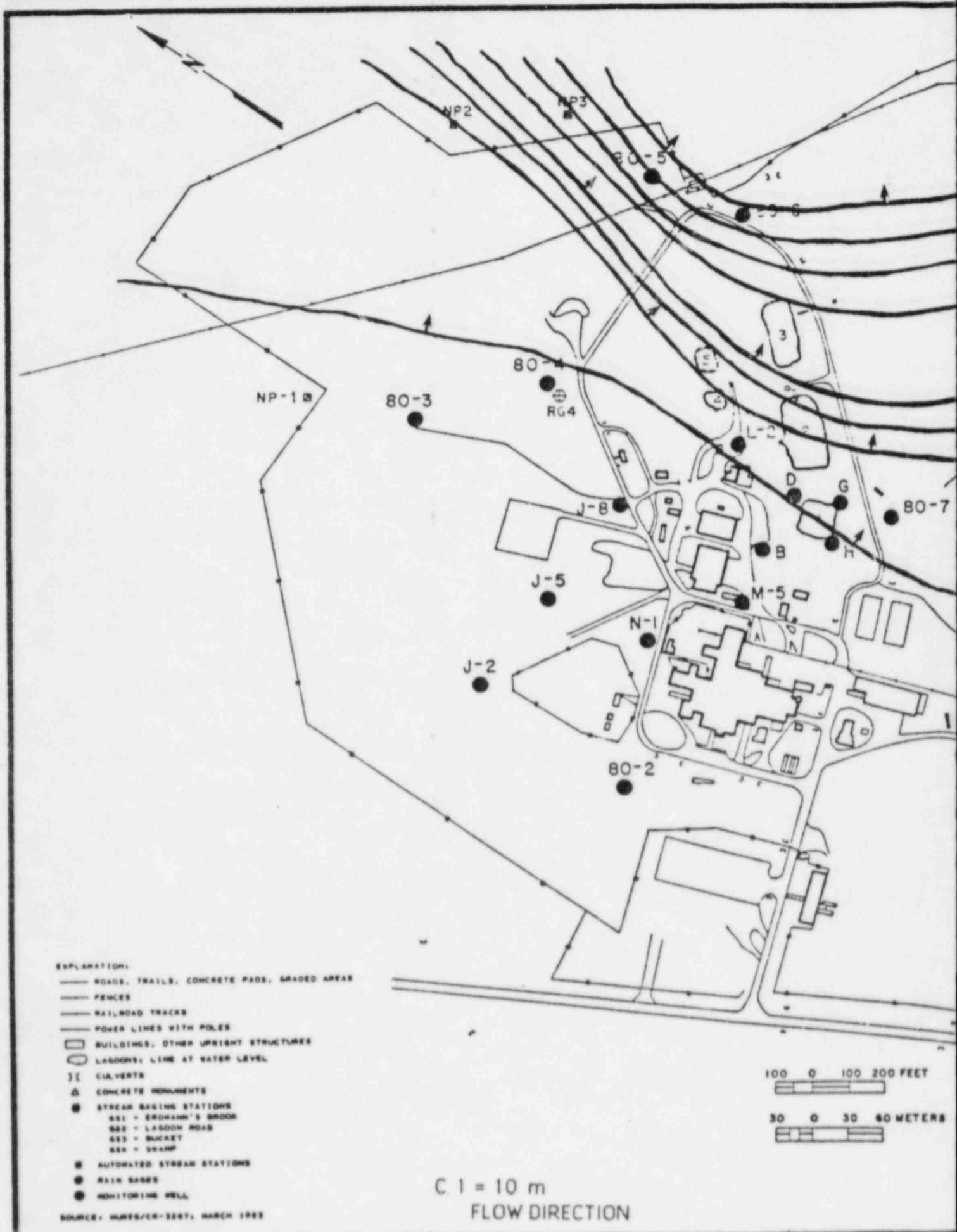


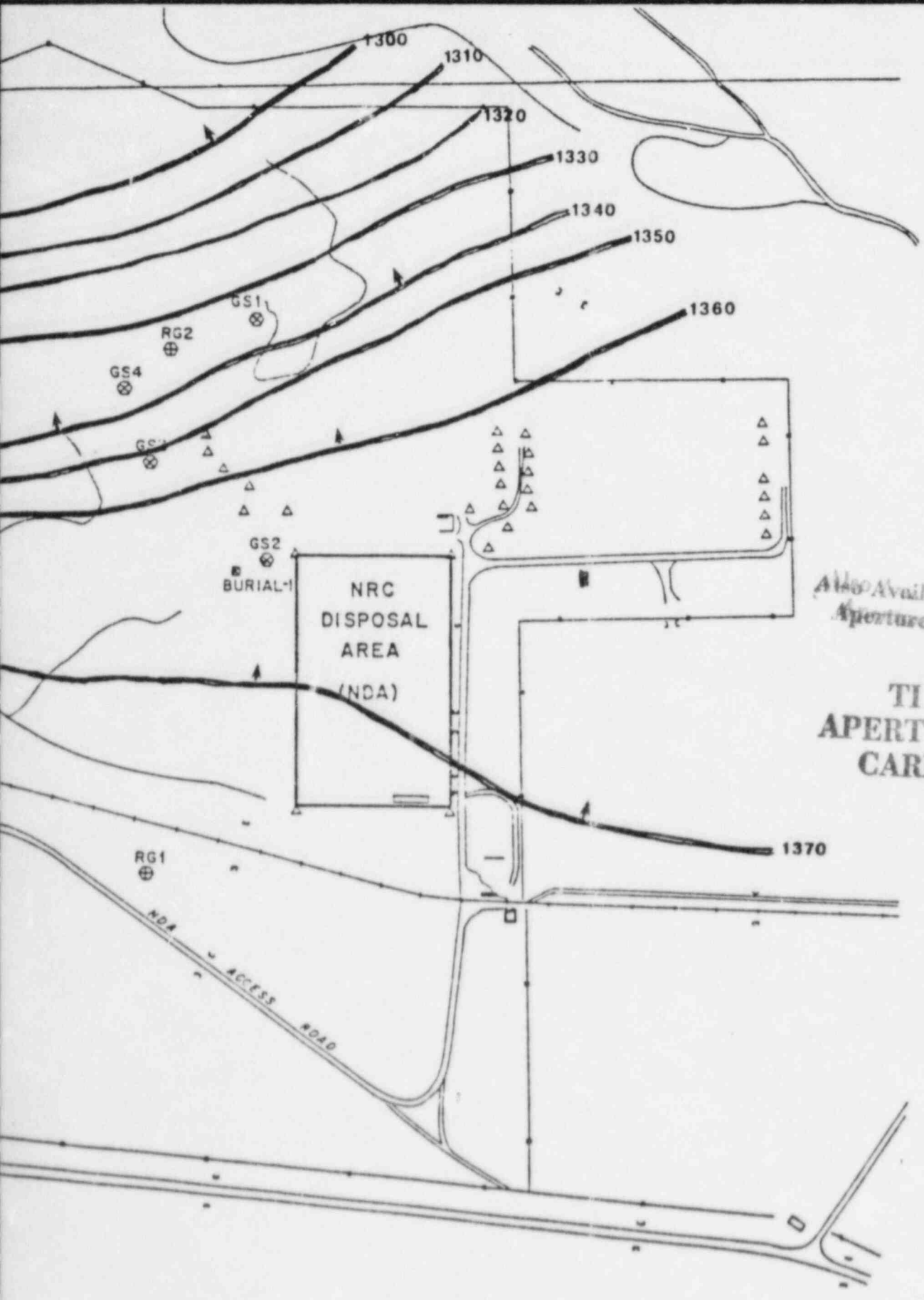

LOCATION OF OFFSITE
SURVEYED WELLS

FIGURE A 35-3




Groundwater Recharge Areas


N
NP2
NP3
80-5
80-4
RG4
NP-1
80-3
L-6
D
G
80-7
J-8
B
H
J-5
M-5
N-1
J-2
80-2
EXPLANATION:
ROADS, TRAILS, CONCRETE PADS, GRADED AREAS
FENCES
RAILROAD TRACKS
POWER LINES WITH POLES
BUILDINGS, OTHER UPRIGHT STRUCTURES
LAGOONS; LINE AT WATER LEVEL
CULVERTS
CONCRETE MONUMENTS
STREAM GAGING STATIONS
681 = ERDMANN'S BROOK
682 = LAGOON ROAD
683 = BUCKET
684 = SWAMP
AUTOMATED STREAM STATIONS
RAIN GAGES
MONITORING WELL
SOURCE: HUMES/CH-3207; MARCH 1983
100 0 100 200 FEET
30 0 30 60 METERS
C I = 10 m
FLOW DIRECTION



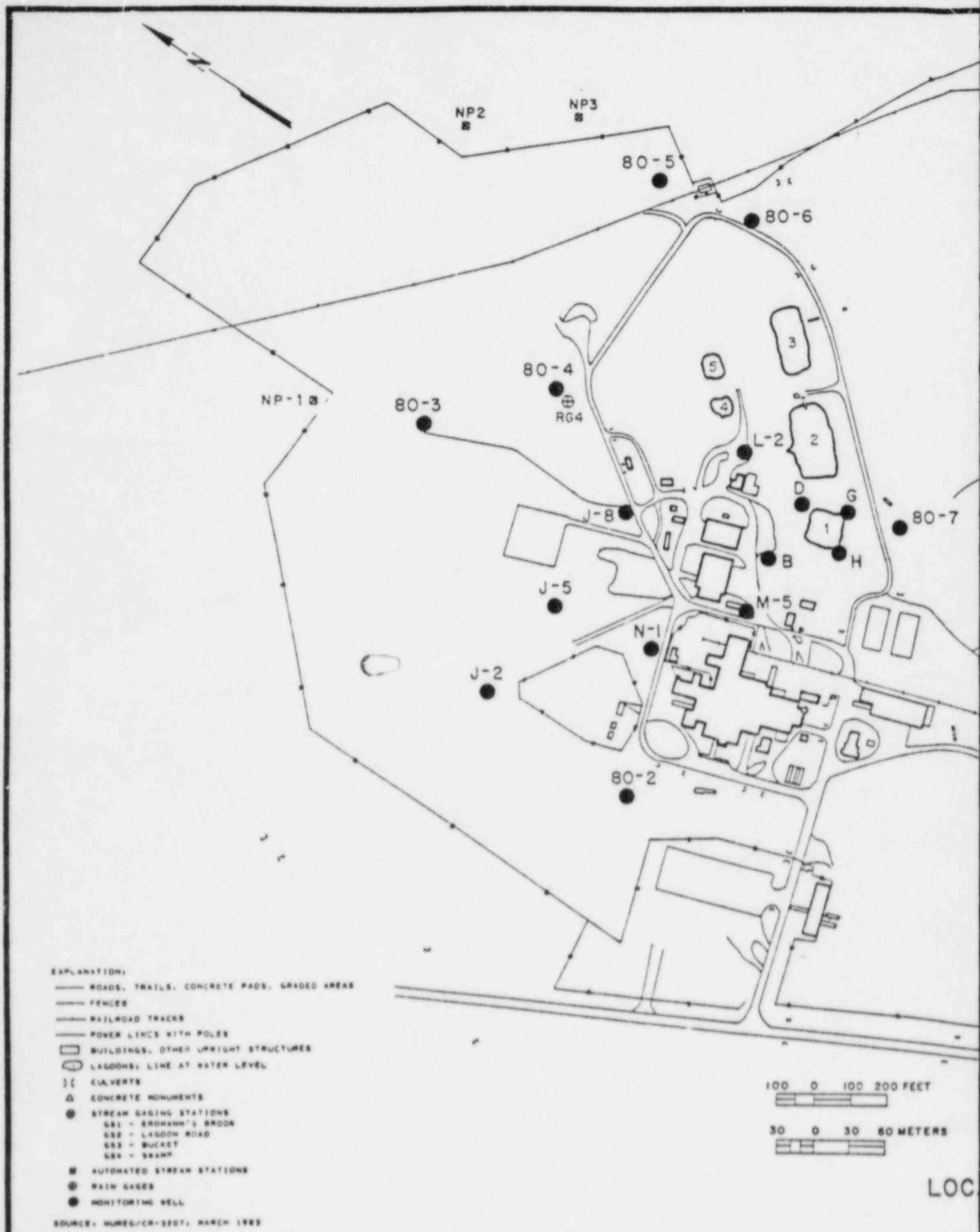

Also Available On
Aperture Card

TI
APERTURE
CARD

- GROUNDWATER CONTOUR MAP AND FLOW DIRECTION FOR UPPER LAVERY TILL

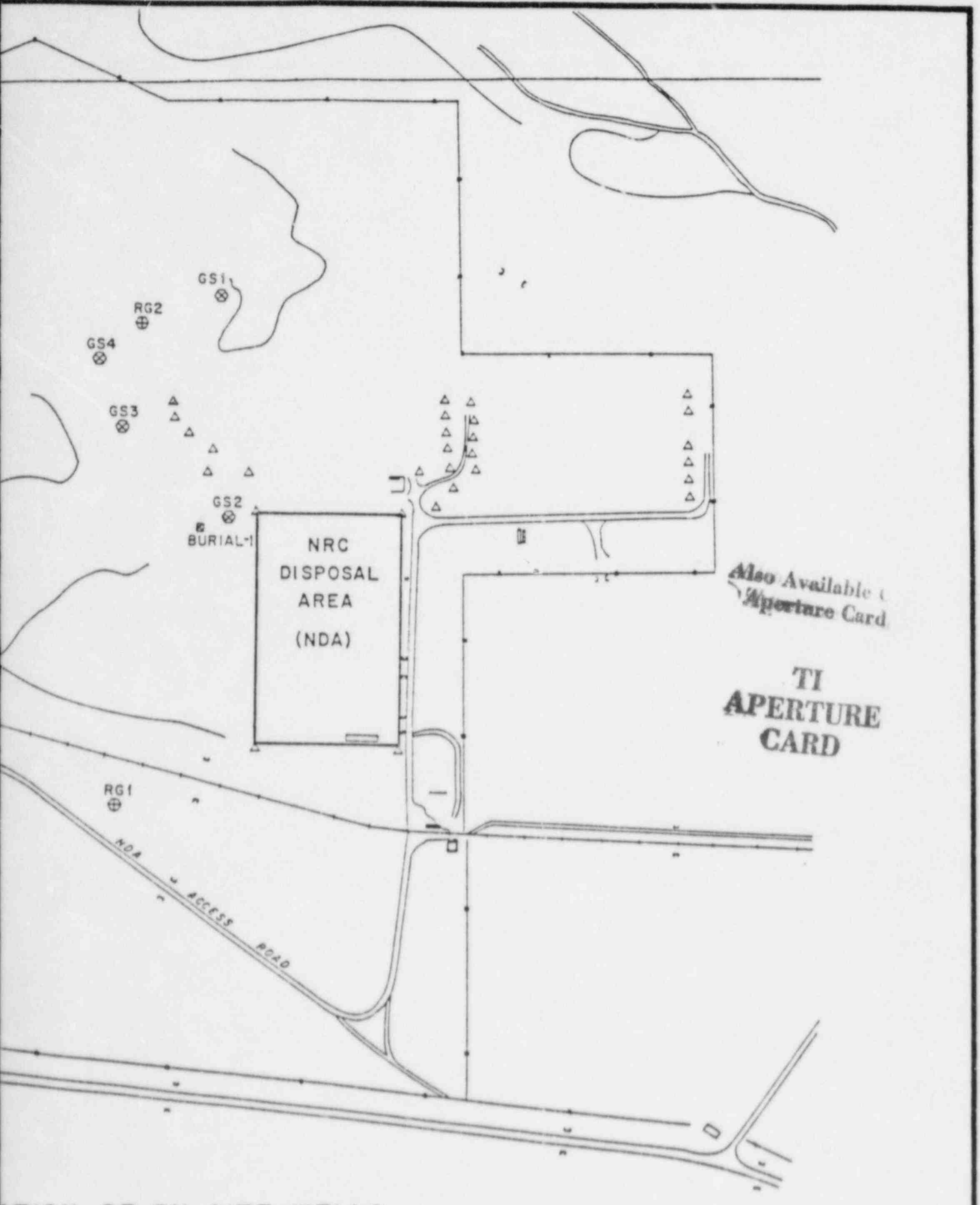
FIGURE A 35-5

8507030441 - 1/c




SOURCE: NUREG/CR-3207, MARCH 1983

LOC




Also Available on
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APERTURE
CARD

ATION OF ON-SITE WELLS
REGULARLY SAMPLED BY E.& O.S.

FIGURE A.3.5-6

8507030441 ~17

## A.3.6 GEOLOGY AND SEISMOLOGY

### A.3.6.1 BASIC GEOLOGIC AND SEISMIC INFORMATION

The WVDP site is located within the glaciated Allegheny Plateau section of the Appalachian Plateau Province (Fenneman, 1938). The province is made up of a maturely dissected plateau with surficial bedrock units of Devonian shales and sandstones. The plateau has been subjected to the erosional actions of repeated glaciations, resulting in the accumulation of various glacial deposits (till, outwash and lacustrine deposits). Glacial scour deepened many valleys which were later filled with sequences of glacial deposits up to 153 metres thick (LaFleur, 1979). WVNS rests on one such glacially deepened and filled valley. Section A.3.6.1.1 and Supplement A.3.6-A contain additional discussion of regional and site geology and geologic history.

WVNS is in a region which has experienced a moderate amount of relatively minor seismic activity. The only significant (MMI > VII) earthquake activity in Western New York has occurred in the vicinity of Attica on the Clarendon-Linden Fault (50 km to the northeast). Several small shocks in the Buffalo-Hamilton area are probably due to glacial rebound effects (i.e., local stress concentrations as a triggering mechanism for earthquakes, causing minor crustal readjustments). The greatest level of ground motion experienced at the site in historical time (WVDP, 1984) would probably not be greater than intensity IV.

The West Valley site has undergone intense geologic investigation and characterization since the early 1960s. As of May 1984, over 100 publications have dealt with almost every aspect of the site geology, seismology, and hydrogeology. These data can be summarized under three categories as follows:

[1] Borings - Site boring data were collected for subsurface characterization studies, foundation investigations, and monitor well installation.

As of May 1984, approximately 200 logs of borings inside the fenced area are available for review. Hollow stem auger techniques were used to make most borings, but several deeper site monitoring wells were installed using conventional rotary drilling methods. Representative graphic boring logs for different site areas are presented in Supplement A.3.6-B. The major agencies involved in these boring activities included NYGS, Dames and Moore, USGS, US NRC, NFS, and WVDP.

[2] Geophysical surveys - Two geophysical surveys have been conducted at the WNYNSC.

The first one was reported in 1973 in the NFS SAR. This survey was a shallow reflection type and included the running of 12 survey lines across various areas of the site. The second survey was conducted in December 1983. It employed electromagnetics, resistivity and magnetrometry, and was conducted in and around the US NRC-Licensed Disposal Area. Results of this survey are described in the Dames and Moore report of March 5, 1984.

[3] Trenching - Several trench studies have been carried out by the NYS Geological Survey. These consisted of the trenching of tills in various locations around the burial ground and a detailed description and interpretation of till structural and sedimentary features. Results of these trench studies can be found in Dana and others (1979 and 1980).

### A.3.6.1.1 Summary of Regional and Site Geology

The subsections which follow provide summary descriptions of regional and site geology; Supplement A.3.6-A contains detailed information on these topics.

#### A.3.6.1.1.1 Physiography

The site is located on the Glaciated Allegheny Plateau section of the Appalachian Plateau Province. This section is bounded on the north by the Erie Ontario Lowlands, on the east by the Tughill Upland, on the south by unglaciated portions of the Appalachian Plateau, and on the west by the Interior Lowlands.

The Plateau has been subjected to the erosional and depositional actions of repeated glaciations resulting in accumulation of various glacial deposits over the area. Ongoing fluvial and mass wasting processes are currently altering the existing landscape.

Buttermilk Creek and its tributaries drain the site. Buttermilk Creek is a tributary of Cattaraugus Creek which flows generally to the west and empties into Lake Erie near Silver Creek, New York.

#### A.3.6.1.1.2 Geologic History

The bedrock underlying the surficial deposits was deposited during the Precambrian and early to mid-Paleozoic Eras. The later stages of the Paleozoic Era (Mississippean, Pennsylvanian, and Permian) are not recorded in the sedimentary rocks of the region. Five or more Pleistocene glacial ice sheets advanced over the region depositing a thick sequence of tills and lacustrine sediments and producing the present topographic surface of the site.

### A.3.6.1.1.3 Stratigraphy

Precambrian crystalline rocks comprise the basement rocks of the region. The basement is overlain by approximately 2,300 metres of Paleozoic strata. The sequence includes predominantly shales, siltstones, sandstones, and carbonates, and some evaporites. Bedrock in the area is nearly flat and relatively undeformed. The average dip is 6-8 m/km to the south. The overburden material consists of glacial deposits which have filled a preglacial valley that had been eroded into the bedrock. The thickness of the glacial deposits at the site ranges from 1.5 metres or less to 168 metres toward the center of the valley.

### A.3.6.1.1.4 Structure

No fold or fault of any consequence is recognized within the general site area. The closest major structural feature is the St. Lawrence Rift Valley System located about 480 km to the northeast. The north-south trending Clarendon-Linden Structure located 50 km northeast of the site is the only significant structural feature in the region.

### A.3.6.1.1.5 Subsurface Hydrology

A complete discussion of site condition and the regional hydrogeology is presented in Sections A.3.5.1 and A.3.5.2 respectively.

### A.3.6.1.1.6 Engineering Geology Considerations

The area within 8 kilometres of the site has been carefully examined during a geologic field investigation for physical evidence of behavior of substrate and overlying surficial materials during prior earthquakes. Aerial photographs of the site and surrounding area at distances from the site ranging from approximately 8 to 65 kilometres have also been examined. Neither field reconnaissance nor examination of aerial photos revealed any geomorphic features indicative of recent seismic activity.

Section A.3.6.4.1 discusses additional considerations such as identification and evaluation of deformational zones (i.e., shears, joints, fractures, and folds), description and evaluation of zones of alteration, irregular weathering profiles or structural weakness, unrelieved residual stresses in bedrock, description of unstable rock or soil, and evaluation of human activities such as the withdrawal or addition of subsurface fluids and/or mineral extractions at the site.

### A.3.6.2 VIBRATORY GROUND MOTION

Characteristics relating to the general seismicity of the site and surrounding region are presented in this section in order to develop seismic criteria and guidelines. A description and the results of the site investigations and laboratory testing are provided in Section 3.6.4.

A summary description of the regional and site geologic framework is provided in Section 3.6.1.1 and detailed discussions are contained in Supplement A.3.6-A.

#### A.3.6.2.1 Underlying Tectonic Structures

No features, natural or otherwise, would result in conditions conducive to a significant geological event at the site. Tectonic structures are detailed in Supplements A.3.6-A and A.3.6-B.

#### A.3.6.2.2 Behavior During Prior Earthquakes

Little information is available concerning the seismic excitation and behavior of the surficial geologic materials and substrate underlying the site during prior earthquakes. No evidence of seismically induced ground failure (such as liquefaction, slumping, or fissuring) has been found on or near the site during intensive geologic exploration programs. These findings are consistent with the reported and estimated intensities from historic earthquakes in the

site region which were felt at the site (Modified Mercalli Intensity $\leq$ IV or V; refer to Section A.3.6.2.4). Such low intensities are typically associated with accelerations less than 0.05 g (Coulter, et al, 1973; Krinitisky and Chang, 1977) and would not be expected to produce observable physical effects in the materials encountered at the site.

### A.3.6.2.3 Engineering Properties of Materials Underlying the Site

The engineering properties of subsurface materials are discussed in Section A.3.6.4.2.

### A.3.6.2.4 Earthquake History

Several extensive reviews of seismicity within the WVDP site region have been conducted. These studies have been performed both in association with the project and for nearby critical facilities by a variety of federal and state agencies as well as private consultants and university researchers. In addition, Dames and Moore (1973, 1983) previously evaluated earthquakes within the site area. This subsection summarizes the results of all these various studies.

There have been 118 earthquakes within the site region (323 km radius) with epicentral intensities of V to VII on the Modified Mercalli Scale. Distribution of these earthquakes is shown on Figure A.3.6-1. Dates, locations, intensities and magnitudes (where available) for these events are listed on Table A.3.6-1. Events 323-484 km from the site, used in the probabilistic study (Section A.3.6.2.8), are also listed.

Based on the assumption that Modified Mercalli Intensity (MM) II is the limit of perceptible (i.e., felt) ground shaking, all of the earthquakes listed in Table A.3.6-1 with epicentral distances of less than 210 km could have been felt or expected to have been felt at the WVDP site. Based on the published Eastern U.S. attenuation curve (Figure A.3.6-2), this estimate indicates that

six intensity V earthquakes could have been felt at the site since approximately 1840. Similar reasoning suggests that all nine intensity VI events reported within 322 km of the site could have been felt at the site. Both intensity V and VI events that could have been felt at the site are indicated on Table A.3.6-1.

The published attenuation relationships (Figure A.3.6-2) also suggest that all of the eight intensity VII events within 484 km of the WVDP site could have been felt there, and that two of them (1871, 424 km; and 1954, 288 km) could have been felt as intensity III at the site. These eight intensity VII earthquakes are also noted on Table A.3.6-1.

The only historic earthquakes within or near the site region known to have produced intensities higher than III at the site were the August 12, 1929 Attica, and September 5, 1944 Cornwall-Massena shocks. Both earthquakes produced an estimated intensity IV at the site; each is discussed below, along with other relevant shocks.

The Cornwall-Massena shock occurred on September 5, 1944 (MMI VIII) at 12:39 a.m., Eastern War Time. The epicenter was about 420 km east-northeast of the site at approximately 45.0°N, 74.7°W, about midway between Cornwall, Ontario, and Massena, New York. The shock was felt in an area of about 453,250 sq km (175,000 sq mi) in the United States. The earthquake was recently (1983) evaluated by the Niagara Mohawk Power Corporation.

The damage loss resulting from the earthquake amounted to about two million dollars. At Massena, the shock destroyed or damaged 90 percent of the chimneys. Masonry, plumbing, and house foundations were also damaged and windows were broken. Many structures were rendered unsafe for occupancy until repaired. A large number of wells in St. Lawrence County, N.Y. went dry; water levels were affected in streams and wells as far away as Westchester County and Long Island, N.Y. Fourteen aftershocks were noted by November 1. The strongest (September 9 at 7:25 p.m.) was nearly equal to the intensity of

the main shock. It is significant that structures founded on rock or compact till soils in the epicentral areas did not sustain any appreciable damage. Structures in the epicentral area founded on outwash sand, silts, and clays suffered the greatest damage. Deposits at the WVDP site would have undergone intensities no greater than IV (Figure A.3.6-3).

The Attica earthquake of August 12, 1929, occurred at 6:25 a.m., EST about 48 km northeast of the site. The epicenter was at about 42.9° N, 78.4° W. The total affected area was about 129,500 sq km (50,000 sq miles) including parts of Canada. The shock was felt most strongly in the eastern part of the city of Attica and the region lying immediately to the east (Figure A.3.6-4). In the region immediately to the south, there was less effect on structures, but changes in groundwater conditions were noted. The shock was accompanied by sounds compared to thunder. It was reported that 251 house chimneys collapsed in Attica but recent investigations indicate that many of these occurrances probably consisted of bricks falling from the top of still-standing chimneys. Walls were cracked and instances of fallen plaster were common. Objects were thrown from shelves, monuments in cemeteries toppled, and a number of wells went dry. (The degree of damage to structures generally could be related to the type of design and construction. For example, three churches and a school within one square block area experienced different degrees of damage. The Methodist Church, considered to be of poor design, was badly damaged; the Presbyterian Church, a simpler structure, was less damaged; the Baptist Church, a still simpler structure, was scarcely damaged at all. The Attica High School, a new three-story building considered to be of good construction, had damage limited to minor plaster cracking. Damage to portions of the Westinghouse factory southeast of the city was greatest in the east-west wing of the T-shaped brick building, due to the collapse of a brick chimney.) Based on a review of damage effects, Dames and Moore (1974) assigned an MMI of VII and a magnitude of 5.2 to this event.

Shocks smaller than the preceding Attica event have been reported fairly frequently in the Attica area (December 1929, 1939, and 1955; July and August 1965; January 1966; and June 1967). The largest of these were the two most recent, each reported as being MMI VI in the epicentral area. These shocks probably resulted in intensities of III or less at the site. The shock of January 1, 1966 (MMI VI) occurred at 8:24 a.m. EST with two similar foreshocks reported at 5:30 a.m. and 6:30 a.m. The shock was accompanied by thunderous sounds and was felt by many.

A few chimneys were damaged slightly, cellar walls and foundations cracked, bricks tumbled from houses, and plaster fell at the state prison. The shocks were felt over approximately 9,065 sq km of Western New York, Northwestern Pennsylvania, and Southern Ontario, Canada. The shock was most strongly felt at Varysburg. The shock of June 13, 1967 (MMI VI) occurred at 2:09 p.m. EST and was accompanied by loud noises compared to a sonic boom. The shock was felt over an area of about 7,770 sq km (3,000 sq miles) in Western New York. Slight damage to plaster and ceilings was sustained at Attica and Alabama, N.Y., where the shock was felt by many. Some chimneys were cracked at Attica.

The Buffalo-Lockport (N.Y.) earthquake of October 23, 1857, occurred at 3:15 p.m. EST. The epicenter was about 43.2° N, 78.6° W, and the shock affected a total area of about 46,620 sq km. The epicenter intensity of VI was felt in an area about 120 km long, from north-northeast to south-southwest, and about 97 km east-west. It was felt at Hamilton, Petersborough, and Port Hope, Ontario; Rochester, New York; Warren, Pennsylvania, and was also reported to have been felt at Dayton, Ohio. In Buffalo, a man seated on a chair was thrown to the ground, walls vibrated and surged, bells rang, and crocks fell from shelves. At Lockport, rumbling noises were heard for a full minute. The shock was felt by many, but caused no serious damage (Niagara Power Corporation, 1983).

In addition to the 1857 shock, several smaller events were experienced in the Buffalo-Hamilton, Ontario area in 1879, 1944, 1946, and 1962. The 1962 shock is typical. It occurred at 1:37 p.m. EST. The epicenter was located near Niagara Falls, N.Y. The shock was accompanied by a loud noise and was felt by many. Beds and chairs were displaced, houses shook, and dishes rattled. The shock was a maximum of MMI V and was felt over a relatively small area.

Effects at the WVDP site from the large, distant shocks of record, such as the Charleston, South Carolina, event of 1886, the New Madrid, Missouri, event(s) of 1811-1812, and the more significant (MMI IX-X) events in the upper St. Lawrence Valley would have been minimal. Using empirical relationships (Coulter et al, 1973) to correlate MMI with acceleration and considering the effects of attenuation, it is conservatively concluded that accelerations resulting from any historical events in the entire region have been no more than 0.05 g at the site.

Surficial geologic materials underlying the site are essentially identical to those in the areas of highest intensity for the Attica and Buffalo area earthquakes. The only significant difference between the WVDP site and the aforementioned epicentral areas is the thickness of the Paleozoic section overlying the granitic basement. In the site area, the basement is at an elevation of 4,570 to 4,590 m while in the Attica and Buffalo areas it varies from 3,200 to 3,660 m in elevation. Figure A.3.6-5 shows the depth to basement in the site region together with historic earthquake epicenters and major geologic structures. No observable differences in radiation of energy from the Attica or Buffalo area earthquakes are attributable to this change in depth to basement.

### A.3.6.2.5 Correlation of Epicenter with Geologic Structures

Within the site region (323 km), only one tectonic structure has been confirmed as seismically active: the Clarendon-Linden structure (Figure A.3.6-5). Earthquakes in the Attica, New York, area have been

associated with this structure by several studies (e.g., NMPC, 1983; Dames and Moore, 1973, 1974, 1983; and Van Tyne, 1975). Other earthquakes within the site region have not been definitely associated with known geologic structures and are thus considered to be associated with tectonic provinces. The Clarendon-Linden structure is discussed in Sections A.3.6.2.6 and A.3.6.2.7; tectonic provinces are identified below and discussed in Supplement A.3.6-C.

### A.3.6.2.5.1 Tectonic Provinces of the Site Region

Several recent investigations have defined various tectonic provinces as potential seismic source zones. Hadley and Devine (1974) defined seismotectonic provinces based on their interpretation of regional tectonic structure and seismicity. Similar interpretations have been presented by NYSEG (1979) and Niagara Mohawk Power Company (NMPC, 1983) for the proposed NYSEG New Haven Nuclear Plant and the Nine Mile Point Nuclear Station. Additional seismic zones have been proposed by the USGS (Algermisen and others, 1976) and various other studies. A recent study (Dames and Moore, 1983) of seismic exposure at the WVDP provides a review and evaluation of these various tectonic provinces and includes digitized models of the various interpretations. This review and analysis is summarized in Supplement A.3.6-C.

### A.3.6.2.6 Identification of Active Faults

The Clarendon-Linden structure has been associated by several investigations with seismicity near Attica, New York (Section A.3.6.2.5). The Attica earthquake of 1929 (MMI-VII; RFI-VIII) was centered near a structurally complex portion of the Clarendon-Linden structure (Section A.3.6.2.4; Figure A.3.6-5). A permanent array of seismic stations, operated by the Lamont-Doherty Geological Observatory of Columbia University, has been monitoring the earthquake activity in the Attica area since early 1971 and is designed to accurately locate events in the Buffalo-Attica region. A number of small (magnitudes generally less than 3.0) naturally occurring events have

been reported (Fletcher and Sykes, 1977; Sbar and Sykes, 1973). A swarm of microseismic events also occurred during the summer and fall of 1971. The swarm was related in time and space to the injection of water under high pressure into a brine well (Van Tyne, 1975) and was elongated along the strike of the Clarendon-Linden structure. This strongly suggests that the fluid injection triggered the release of tectonic strain energy accumulated on the fault. Much of the natural and induced activity occurs within the triangular fault-bounded block formed by the main Clarendon-Linden structure and its bifurcated limbs (Dames and Moore, 1974) in the Attica-Dale area.

Focal mechanism solutions of two Attica earthquakes that occurred in 1966 ($m_b$ = 4.6) and 1967 ($m_b$ = 4.4) (Hermann, 1978), and a composite focal mechanism solution of earthquake swarms near Attica (Fletcher and Sykes, 1977) indicate a combination of right lateral strike-slip and reverse faulting on a plane parallel to the northerly trend of the Clarendon-Linden system (Fletcher and Sykes, 1977). Hermann computed the focal depths of the 1966 and 1967 Attica events as occurring in the upper 2 to 3 km of the crust. The events analyzed by Fletcher and Sykes occur at depths of less than 1 km and were thought to be related to hydraulic mining of salt deposits at a depth of 500 m.

There has been no known surface movement along the structure as a result of earthquakes, but basement-rooted faulting and the localized seismicity indicate that the Clarendon-Linden structure is active in the normal geologic sense. Lacking surface offset, the structure cannot be considered "capable" in the strict sense of the 10 CFR 100 Appendix A definition. However, available evidence indicates that the structure is certainly "capable" of generating earthquakes. Consequently, this analysis makes the conservative assumption that the Clarendon-Linden structure is capable, and should be considered for evaluation of the MCE for the WVDP.

### A.3.6.2.7 Description of Capable Faults

The Clarendon-Linden structure extends approximately 89 km north-south from Lake Ontario to near Bliss, NY 37 km east-northeast of the WVDP site.

The Clarendon-Linden structure was initially described (Chadwick, 1920) as a normal essentially north-south trending fault extending from the Niagara escarpment near Clarendon, New York on the north to Linden, New York on the south, a distance of some 40 km. Chadwick found surficial displacement of the Onondaga and Niagara escarpments with the western side displaced farther north relative to the eastern side. In the vicinity of Linden he determined that the formations to the west were at a much lower elevation than the same formations on the east. Thus, Chadwick concluded that the feature was a fault with the downthrown side on the west. After further study, Chadwick (1932) redefined the feature as a monocline at the Linden end (south) and a fault at the Clarendon end (north). He subsequently termed the entire structure the Clarendon-Linden Displacement.

Further documentation and compilation of more recent data concerning the structure were evaluated and presented in Safety Analysis Reports. Most of this work has been conducted in close association with the NYGS. In particular, the ongoing work of Mr. Arthur Van Tyne of the Wellsville Office of the NYGS provided the basic data for a series of studies undertaken by Dames and Moore.

This later interpretation of the Clarendon-Linden structure represented a synthesis of data from published and unpublished reports and geologic field reconnaissance as well as interpretations of aerial photographs, gravity and magnetic surveys and the seismology of Northwestern New York. Figure A.3.6-6 reproduced from the 1973 NFS SAR, shows the results of this interpretation. Dames and Moore (1974) presented a detailed discussion of this work.

### A.3.6.2.7.1 Current Interpretation of the Structure

Fisher and McWhorter (1976) discuss the subsequent interpretation of the Clarendon-Linden zone as follows:

> "In April, 1975, the New York State Geological Survey released an open file report, authored by A. M. Van Tyne, which again cast a new interpretation for the Clarendon-Linden structure. A reexamination of old well data and the addition of new data consisting of identified formation tops from new well records developed a structural model consisting of a series of horst and graben structures between parallel high angle reverse faults. The northwesterly trending branch from Warsaw to Attica (and beyond) was eliminated (Figure A.3.6-7). A possible southwestward trending fault (traceable about six miles to the southwest of Attica) bifurcating from the westernmost fault of the main Clarendon-Linden structure near Batavia was tentatively identified (Van Tyne, 1975).
>
> Seismic reflection profiling by an exploration group across the main north-south segment of the Clarendon-Linden structure between Batavia and Hermitage supports the idea of a series of en echelon faults, high angle, up on the east, but does not indicate a through-going single fault. Offsets of up to 100 feet in the deeper horizons (Trenton and Black River) are clear, but somewhat anomalous for the shallower horizons (Onondaga) where a flexure or simple nosing has been interrupted.
>
> What structure, fault, flexure or other feature causes the clustering of events in the Attica area? Van Tyne (1975) indicates that he no longer considers the northwest branch (Warsaw Trend) of faulting to exist, but he bases his position solely on rather spotty stratigraphic control from deep wells. However, Revetta (1970) described gravity or magnetic anomalies which indicate a basement trend in that orientation. Isoseismal data for the 1966 and 1967 Attica earthquakes (by MM VI) show a distinct distortion along a NNW-SSE direction (US CGS 1966, 1967).

At present there is certainly no positive proof of the existence of such a northwesterly trend. However, until all the evidence (geologic, seismologic, and stratigraphic) is amassed, the northwesterly trend and/or the triangular fault block which it produces cannot be dismissed lightly.

It has been clearly shown that the Clarendon-Linden Structure is complex. Earthquakes occur in close association with this structure. Although there has been no known surface movement along the Clarendon-Linden structure as a result of earthquakes, the existence of basement-rooted faulting suggests that the structure is active in the normal geologic sense, as a locus for strain release. As New York State is in an area of the Northeast United States that shows the existence of a strong east-west to northeast trending horizontal compressive stress in the shallow crust (Voigt, 1969), it would seem logical that strain release in the form of minor to moderate earthquake activity could take place in certain favorable areas."

**A.3.6.2.7.2 Relation to Regional Tectonics**

Three contemporary stress provinces (Figure A.3.6-8) have been defined for the site region (Zoback and Zoback, 1980) based on evaluation of available local mechanisms and in situ stress determinations. These include:

1) Central Lowland - Canadian Shield; &, NE-SW, horizontal;
2) Appalachians - &, WNW to EW, near horizontal; and
3) Atlantic Coastal Plain - &, NW to SE to WNW to ESE, horizontal.

All are defined in terms of maximum horizontal compressive stress (&). As shown on Figure A.3.6-8, the Clarendon-Linden Structure lies within the Central Lowlands-Canadian Shield stress province. Given the NE-SW compressive stress, one would expect movement on the generally north striking Clarendon-Linden Structure which would show a major component of right slip. Focal mechanisms of the 1966 and 1967 earthquakes near Attica (Figure A.3.6-9) show either approximately N-S right slip, with a component of down to the east

thrusting, or E-W left slip. Because of the elongation of the hypocentral areas of fluid injection induced earthquakes during 1971 parallel to the N-S Clarendon-Linden Structure, the right slip solutions appear to represent the actual fault plane.

Although these focal mechanisms (Figure A.3.6-9) are consistent with the movement expected, given the regional stress field and observed subsurface offset of the Clarendon-Linden Structure, it is not clear how they relate to ongoing vertical glacial rebound. Review of precision survey lines (Dames and Moore, 1978) indicates that the site area is tilting southwards at about 2 mm/year (Figure A.3.6-10). Given the pattern of tilting shown, an up-to-the-east, largely normal motion on the Clarendon-Linden Structure would be expected if it is a result of glacial rebound. Based on available data, it appears that deviatoric stress from rebound must be small in relation to the NE-SW horizontal compressive stress.

### A.3.6.2.8 Maximum Earthquake

Three maximum earthquakes have been considered for the WVDP:

a) maximum earthquake associated with a tectonic structure (the Clarendon-Linden Structure);
b) the maximum event within the site tectonic province not associated with a specific structure; and
c) the maximum event exterior to the site tectonic province.

#### A.3.6.2.8.1 Clarendon-Linden Structure Maximum Earthquake

The 1929 Attica earthquake was the maximum historic earthquake associated with the Clarendon-Linden Structure. This quake had an intensity of MM VII (Rossi Forel VIII) as discussed in Section A.3.6.2.4 and a magnitude estimated as $m_b$ 5.2 (Dames and Moore, 1974).

Two basically different approaches have been used to estimate the maximum earthquake for the Clarendon-Linden Structure. The first is to assume that a maximum earthquake would be one intensity (approximately one-half magnitude) higher than the maximum historic earthquake. The approach used in the original analyses for the site (Dames and Moore, 1970, 1971) was to assume the maximum historic event was the maximum event to be considered during design life of the NFS facility. At that time the Attica earthquake was considered to be an intensity MMI VII-VIII. This event was projected to the nearest approach of the Clarendon-Linden Structure, about 37 km from the site. Using then-current attenuation relationships, Dames and Moore (1971) estimated that such an event would produce approximately 0.12 g peak horizontal acceleration. This was recommended as the SSE acceleration in the NFS Safety Analysis Report (1973).

Subsequent study has shown that the 1929 Attica event was more likely an intensity VII earthquake with a magnitude of 5.2, as noted above. If the maximum earthquake is assumed (as is often done) to be one intensity higher than the maximum historic earthquake, then the maximum earthquake for the Clarendon-Linden Structure would be an intensity VIII with a magnitude of approximately $m_b$ 5.7 to 5.8.

Attenuation of the intensity VII Attica earthquake was about 1-1/2 intensity units (minimum) over 40 km (Figure A.3.6-2). In the direction of the site, it was even higher: approximately 2-1/2 intensity units, over 140 km, near the epicenter. Such high attenuation is typical of shallow earthquakes in the mesoseismal area. If the minimum attenuation for the 1929 Attica earthquake is used (Figure A.3.6-2) an epicentral intensity of VIII on the Clarendon-Linden Structure would be attenuated to an intensity of VI-VIII at the site 37 km distant. This intensity corresponds to a peak horizontal acceleration of approximately 0.12 g for average foundation conditions (Coulter et al, 1973). This value is in agreement with an estimate of 0.1 g

sustained maximum horizontal acceleration (three cycles) based on attenuation of an $m_b$ = 5.75 at a distance of 47 km using Nuttli's (1979) relationship for the Eastern United States. Other appropriate attenuation relationships suggest similar accelerations (Housner, 1965, 0.13 g; Schnabel and Seed, 1973, 0.13 g; Algermissen and Perkins, 1976, 0.10 g).

The second approach used to estimate the maximum earthquake for the Clarendon-Linden Structure was probabilistic in nature (Dames and Moore, 1983). This analysis was part of the regional probabilistic analysis discussed in the subsection below.

**A.3.6.2.8.2 Tectonic Province Maximum Earthquake**

A probabilistic assessment of the seismic ground motion hazard was performed for the WVDP at West Valley, New York. As much available information as possible regarding possible seismic source zone models was utilized, including the published works of others and suggestions of US DOE, US NRC and the NYS GS.

The results of this assessment confirm that only the most active zone closest to the site contributed to the seismic hazard. Supplement A.3.6-D describes the hazard model adopted for this study, the basic assumptions regarding the validity of the treating the input to tne model, the subjective weighting system used for the various seismic source zone models, the parameters used to describe seismicity for each seismogenic zone, and the methods used to estimate mean values and to quantify uncertainty.

**A.3.6.2.9 Safe Shutdown Earthquake**

Supplement A.3.6-E details the methods Dames and Moore used to estimate ground motion and the results of that analysis. Based on this analysis, the adoption of a range of annual exceedance probabilities of $3 \times 10^{-2}$ to $3 \times 10^{-3}$ for the WVDP is adopted as conservatively representative of the seismic hazard at

the site and comparable to current analyses for a typical Eastern United States nuclear power plant. This would translate into ground motion levels of less than 0.07 g, even at the 84 percent fractile (+1), a level of ground motion less than the 0.12 g design level acceleration adopted herein for the existing West Valley facilities. The adopted acceleration is equivalent to that from an intensity VIII on the Clarendon-Linden Structure, 50 km from the site.

**A.3.6.2.9.1 Response Spectra SSE**

Response spectra for use in structural design are shown in Figure A.3.6-11 Safe Shutdown Earthquake. Dames and Moore constructed the response spectra based upon the smoothed average response spectra developed by Dr. G. W. Housner and presented in TID-7024. The average response spectra were developed using both components of the strong motion records of four earthquakes: El Centro, CA, 1934; El Centro, CA, 1940; Olympia, WA, 1949; and Taft, CA, 1952. These strong motion records were obtained at overburden sites and are thus considered appropriate for the reprocessing plant site.

For frequencies lower than about 0.3 Hertz, the spectra were prepared utilizing data suggested by Dr. N. M. Newmark (1967).

An amplification factor of 3-1/2 over the base maximum horizontal accelerations was used in the frequency range of from 2 to 10 Hertz. The spectra are presented over a range of frequencies corresponding to the natural periods of various structural elements. The sectors represent the maximum amplitude of motion in the various elements of the structure for typical degrees of structured damping.

### A.3.6.2.10 Operating Basis Earthquake

The Operating Basis Earthquake indicates the level of ground motion to which the structures, components and systems might realistically be subjected during their life. Major structures will be designed to respond elastically with no loss of function to this level of earthquake ground motion. This level of ground motion is normally assumed to be one half of the corresponding ground motions for the safe shutdown earthquake. Since the probable maximum intensity earthquake experienced at the site during historic times was no greater than Intensity IV, the maximum horizontal acceleration at foundation level was probably less than five percent gravity. Therefore, criteria for the Operating Basis Earthquake of six percent of gravity horizontal and four percent of gravity vertical are highly conservative.

#### A.3.6.2.10.1 Response Spectra OBE

Figure A.3.6-12 shows response spectra developed for the OBE by scaling the SSE spectra to 0.06 g.

### A.3.6.3 SURFACE FAULTING

Both geologic and geophysical investigations have revealed no faults at the site. Summary information concerning faulting on a regional and site basis is presented in Section A.3.6.1.1.4; detailed information is contained in Supplement A.3.6-A.

### A.3.6.3.1 Geologic Conditions of the Site

Details of the stratigraphy, structure, and geologic history of the site are presented in Supplement A.3.6-A. Lithologic, stratigraphic, and structural geologic conditions at the WVDP site and surrounding areas are also discussed in the same supplement.

### A.3.6.3.2 Evidence of Fault Offset

Detailed geologic mapping and subsurface investigations conducted for the WVDP show that no surface or near surface faulting is present at or near the site. (Refer to the Site Structure portion of Supplement A.3.6-A for a discussion of these glacial "pop-up" features in the site region. Compression buckles or pop-up features are present in the site region. The nearest such feature is located approximately 60 km northwest of the site, near Buffalo.)

### A.3.6.3.3 Identification of Capable Faults

No faults have been identified within 8 km of the site. The nearest documented faulting is that associated with the Clarendon-Linden Structure, about 37 km east of the site. Refer to Sections A.3.6.2.5 and A.3.6.2.6.

### A.3.6.3.4 Earthquakes Associated with Capable Faults

No faults have been identified within 8 km of the site, and no historic earthquakes have been reported within 24 km of the site. Further details on regional faulting and earthquakes can be found in Sections A.3.6.3.3 and A.3.6.2.4.

### A.3.6.3.5 Correlation of Epicenters with Capable Faults

Not applicable because of lack of capable faulting as defined in Appendix A of 10 CFR 50.

### A.3.6.3.6 Description of Capable Faults

Not applicable.

### A.3.6.3.7 Zones Requiring Detailed Faulting Investigation

No zone requiring detailed faulting investigation has been identified.

### A.3.6.3.8 Results of Faulting Investigation

Not applicable.

## A.3.6.4 STABILITY OF SUBSURFACE MATERIALS

This section describes the subsurface conditions and engineering properties of the soils supporting the site facilities. Site geologic conditions are described in detail in Supplement A.3.6-A and summarized in A.3.6.4.1.

A number of subsurface investigations and studies have been performed at the reprocessing plant site since 1963 when 22 borings were drilled for the then-proposed spent fuel processing plant for Nuclear Fuel Services, Inc. (Dames and Moore, 1963). Additional investigations related to the fuel reprocessing facility were performed and reported in Dames and Moore 1970a, 1971a, 1975a. Investigations for a proposed Iodine Recovery Building and for a high-level waste facility were reported in Dames and Moore 1970b and 1971b. An investigation regarding the existing facilities and the proposed high-level waste facilities was reported on October 22, 1975 Ref. 0102 (Dames and Moore, 1975). One other investigation for a proposed Component Test Stand was reported March 18, 1983. Borings were drilled and laboratory tests performed for all except the studies reported in References 0093 and 0095. These investigations and studies were performed by and/or under the direction of Dames and Moore principal geotechnical consultants.

The information and data developed for these investigations and studies have been reviewed and form the basis for the discussion and conclusions reached in assessing the stability of subsurface materials at this site. The description of the soil and rock strata underlying the site supported by log of borings and test data is presented in Section A.3.6.4.2. Subsequent sections discuss the engineering design parameters, dynamic characteristics, excavations and backfill, groundwater conditions, and responses to dynamic loadings.

### A.3.6.4.1 Geologic Features

Potential for Subsidence Landslides

Subsidence is the sudden sinking or gradual downward settlement of the earth's surface with little or no horizontal motion (Bates and Jackson, 1980). Subsidence is typically caused when subterranean earth material such as limestone and dolomite are removed. The lack of support for the overlying sediments may then lead to collapse and formation of circular depressions at the land surface (i.e. sinkholes). This process is not likely to occur at the WVDP site. The shallowest lithology subject to subterranean removal by groundwater dissolution is the Onondaga Limestone. This limestone is present at depths of greater than 610 metres below the present land surface, well below the typical depths for sinkhole formation (Sweeting, 1973).

Zones of known active landsliding within the site area are shown in Figure A.3.6-10 and discussed in Supplement A.3.6-A.

The consolidated rocks underlying the site and environs are principally persistent limestone or sandstone beds at great depth. The unconsolidated materials that blanket the area are till, bedded lake deposits, and discontinuous sand and gravel deposits, all the result of glacial action during the Pleistocene time.

Neither the bedrock nor the surficial deposits are considered to be regional aquifers nor do they exhibit characteristics that suggest that they contain economic mineral deposits. The shale bedrock has poor primary permeability characteristics and produces only small quantities of water from joints and fractures. These openings die out or close with depth. The glacial deposits are erratic and discontinuous and would therefore not be used for large scale water withdrawal.

Based on the available data, the potential for subsidence as a result of fluid withdrawal is considered to be extremely slight.

Within the regional setting of the WVDP site, the Paleozoic rock strata are essentially undeformed. No fold or fault of any consequence is recognized within the general site area; therefore regional warping should not affect the site.

Deformational Zones

A study of shears, joints and fractures has been performed based on a photogrammetric study. No joints or fractures were found in the area where plate structures were located (Figure A.3.6-13).

Weathered Till/Bedrock

The only identified weathered soil on site occurs as an oxidized zone approximately 2-3 metres thick within the upper portion of the Lavery Till. A network of intersecting horizontal and vertical fractures occurs within this zone, as discussed in Supplement A.3.6-A. Within the bedrock, an 0.5 metre thick layer of weathered and fractured shale rests on top of the consolidation bedrock at a stratum of 26 metres below the land surface in the vicinity of the NDA (US DOE, 1982). This zone is considered significant because it functions as an aquifer (refer to discussion in Section A.3.5.1).

In Situ Stress

In situ stress measurements have been made in recent years in several areas in the Eastern United States. In Western New York State, two measurements were made near Niagara Falls and Rochester; both indicated the maximum in situ compressive stress was on the order of 6,900 kPa. Although similar determination was not made at the site, it was estimated that the in situ stress in the bedrock at the site would be on the same order of magnitude. Based on the available data and site geology information, we believe that the unrelieved residual stress at the site is small and will not affect the plant structure.

Soil/Rock Stability

A complete description of the soils in the building areas is presented in Section A.3.6.4.2. The soils are not subject to liquefaction under stresses developed by the Design Basis Earthquake (refer to Section A.3.6.4.8).

**A.3.6.4.2 Properties of Underlying Materials**

**A.3.6.4.2.1 Laboratory Testing**

The results of the laboratory testing performed in connection with the various investigations undertaken at the site have been reviewed. Summaries of all tests are provided below. The locations of the borings referenced in this section are illustrated on the plot plans (Figures 3.6-14 through A.3.6-16). The logs of the borings are presented in Supplement A.3.6-8.

### A.3.6.4.2.2 Index Properties

#### Moisture and Density

Moisture and density are routinely measured for all samples subjected to laboratory tests. In addition, determinations were made for selected samples not otherwise tested for purposes of correlating parameters. All tests were run in accordance with ASTM test designation D2216. The results of these tests are shown on Table A.3.6-2.

#### Atterberg Limit Determinations

Representative soil samples were tested to evaluate their plasticity characteristics in accordance with ASTM test designations D423 and D424 for liquid and plastic limits, respectively. The results of these tests were used primarily for classification and correlation purposes. The Atterberg Limit determinations are presented in Table A.3.6-2.

Of the 22 tests performed, 18 resulted in a classification of the finer fraction (passing the Number 40 score) as CL (inorganic clay of low to medium plasticity). The remaining four tests resulted in classifications of CL-ML including a greater silt content. These classifications are consistent with the visual classifications made in the field.

#### Specific Gravity

Tests to determine specific gravity of solids were performed on ten representative samples in accordance with ASTM test designation D-854. The results of these tests are presented on Table A.3.6-2. Values obtained range from 2.65 to 2.75. For six of the ten samples values ranged from 2.70 to 2.72.

## Particle Size Analyses

Particle size analyses were performed on representative samples of the soils at the site in accordance with the ASTM test designation D-422-63. The results are presented in Supplement A.3.6-F. The results indicate that the soils are generally a poorly graded mixture of gravel, sand, silt, and clay.

## Strength Tests

### Direct Shear Tests

Direct shear tests were performed on eight representative samples using the method described on Figure A.3.6-17. The results of the tests are presented on Table A.3.6-3 and indicate dense soils and high angles of internal friction where gravels predominate.

### Unconfined Compression Tests

Four unconfined compression tests were run on representative samples of the unweathered clay soils found at 6 to 14 metres below the surface and one test on a silty soil encountered near the surface (1.5 m) as described on Figure A.3.6-18. The results are presented on Table A.3.6-4. The results correllate well with density in that both values indicate the tills are stiff to very stiff materials.

### Triaxial Compression Tests

The results of fourteen triaxial compression tests performed on representative samples of clayey soils (CL) with occasional gravel are presented in Table A.3.6-4.

## Consolidation Tests

Consolidation tests were performed on six representative samples of the clayey soils found in the plant area. The method used to perform the test is described on Figure A.3.6-19. Samples were selected from various depths below the surface to provide a profile of the compressibility characteristics. The results are presented in Supplement A.3.6-G. An evaluation of the data indicates that preconsolidation pressures resulting from glacier loading are in excess of 479 kPa.

## Hydraulic Conductivity Tests

The vertical hydraulic conductivity of representative undisturbed samples of foundation soils at the site was determined by constant head and falling head tests. In addition, constant head tests were performed on samples prepared in the laboratory by compacting these samples at about optimum moisture content determined from compaction tests.

The results of the laboratory tests are summarized on Table A.3.6-5.

In addition to the above tests from the project area of the site, the US and New York State Geological Surveys have performed a number of laboratory and in situ hydraulic conductivity tests in the vicinity of the New York State Licensed Low-Level Waste Disposal Area. The results of these tests are summarized in Prudic (1982) and confirm the permeabilities shown on Table A.3.6-8. Using various data analysis techniques, Prudic estimated the hydraulic conductivity to range from $2 \times 10^{-8}$ to $7 \times 10^{-8}$ cm/sec. Prudic also found the oxidized portion of the till (upper 2-3 m) to have a hydraulic conductivity up to several orders of magnitude higher than the underlying unoxidized till.

### A.3.6.4.3 Plot Plan

The locations of 47 of the 55 borings drilled for the various geotechnical studies are shown on the Plot Plan, Figures A.3.6-14 through A.3.6-16. The eight remaining borings are not within the sections depicted on the three figures; however, these borings and the associated test data were considered in developing soil parameters and foundation recommendations. Three subsurface sections have been developed for the plant area (Figures A.3.6-20 through A.3.6-22). The locations of these sections are illustrated on Figure A.3.6-14.

The site is located in an area subjected to several glacial advances. Deposits of material, laid down by the glacier, fill a shale bedrock valley which runs generally parallel to Buttermilk Creek. The geologic history of the site is discussed in some detail in Supplement A.3.6-A. In general, the subsurface soil conditions consist of: [1] an upper stratum of dense glacial drift extending to a depth of about 6 m consisting of rock fragments with varying amounts of silt, clay, sand, and gravel; [2] a stratum of stiff silty clay with a heterogeneous mixture of sand and gravel which extends to a depth of about 18.3 m; and [3] a stratum of dense silty sand. Bedrock was encountered in several borings at a depth ranging from 18.3 m to 24.4 m in the building area. As one progresses eastward the rock surface dips eastward toward Buttermilk Creek to depths in excess of 60.9 m.

The bedrock known as the Machias Shale-Siltstone formation consists of a gray shale with thin bands of light blue-gray dolomitic limestone found at shallow depths within the shale. Horizontal bedding plane fractures and high angle joints were observed in some instances.

### A.3.6.4.4 Soil and Rock Characteristics

#### A.3.6.4.4.1 Static Soil Characteristics

The foundation soil for the nuclear reprocessing plant is a dense, compact, stable impervious material. It will maintain a satisfactory condition when subjected to design static loading during the economic life of the plant. Following are the data upon which this conclusion is based.

**General**

The average field moisture content is 18 percent. The average specific gravity is 2.70. The overall liquid limit is 28, the plastic limit is 17 and the plasticity index is 11. The in situ dry density generally ranges from 110 pcf to 2.03 g/cc with extremes of and 1.27, 2.18 g/cc. The estimated field relative density is between 40 percent and 100 percent. The Unified Soil Classification for most of the material is "CL." The static groundwater table is recorded at a depth of about 23 metres. (Intermittent perched water may be encountered at shallower depth because of the underlying impervious clayey stratum.)

**Strength**

The laboratory static shear strength of clayey soil ranges from 35.9 kPa to 213.2 kPa. Based on the isotropically consolidated undrained test results, an undrained strength envelope was developed (Figure A.3.6-24). The field standard penetration tests ranged from seven to refusal with most between 20 and 60. The relative density of the cohesionless soil on the north plateau area was evaluated by means of these standard penetration tests. The results of the standard penetration tests plotted against relative density as a function of overburden depth are presented on Figure A.3.6-23. Based on the correlation between relative density and standard penetration resistance

developed by Gibbs and Holtz (1957), the relative density for the upper layer of gravelly soils varied from 45 to 90 percent but generally was greater than 70 percent. For the lower layer of gravelly soil, the relative density is on the order of 90 percent or more.

The material thus can be considered as stiff to hard with occasional medium stiff layers. The dynamic test data also indicate the material has very high dynamic strength.

## Compressibility

Determined from consolidation tests, the compression ratio of the clayey soil is about 0.07 except at the surface of the dam site where it is 0.21. The compression (i.e., estimated from the empirical formula) ranges from 0.05 to 0.16. Therefore the compressibility of the underlying clayey soil can be considered small and most of the settlement results from applied structural loads occurring within one year following construction.

## Hydraulic Conductivity

The in situ hydraulic conductivity of the clayey material is $1.37 \times 10^{-8}$ cm/sec. The average hydraulic conductivity is $3.9 \times 10^{-8}$ cm/sec when the same material is compacted at optimum moisture content. This material can therefore be considered as being relatively impervious.

### A.3.6.4.4.2 Dynamic Soil Characteristics

A seismic survey conducted by the NYGS in 1963 has revealed that the overburden compressional wave velocities ranged from 1,646 metres per second to 1,920 metres per second. The lower velocities were measured in the deeper portion of the valley while the higher velocities were measured toward the flanks where the site is located. No shear wave information is available.

Laboratory resonant column tests were performed on the samples of foundation materials to evaluate the dynamic parameters which are important in analyzing the soil structure interaction. A sample of the soil was subjected to a steady state torti:nal, sinusoidal forcing function. The frequency of the applied force was varied until the resonant frequency of the soil system was obtained. From these data the velocity of shear wave propagation and the modulus of rigidity (shear modulus) were computed using an empirical value for the elasticity and the vertical spring constant and vertical subgrade modulus were estimated. The following soil parameters are recommended for the foundation soil:

B = Footing or mat width (m)
L = Footing or mat length (m)

[1] Silty gravel:

| | |
|---|---|
| Modulus of Elasticity | $E = 2.87 \times 10^5$ kPa |
| Modulus of Rigidity (shear modulus) | $G = 9.58 \times 10^4$ kPa |
| Vertical Spring Constant | $ky = 2.4 \times 10^8 (BL)^{0.5}$ n/m |
| Vertical Subgrade Modulus | $Sy = \frac{2.4 \times 10^5}{(BL)^{0.5}}$ kPa/m |
| Poisson's Ratio | $\mu = 0.4$ |

[2] Clayey Till:

| | |
|---|---|
| Modulus of Elasticity | $E = 1.1 \times 10^6$ psf (1,460 kg/cm$^2$) |
| Modulus of Rigidity (shear modulus) | $G = 4 \times 10^6$ psf (485 kg/cm$^2$) |
| Vertical Spring Constant | $kg = 2.9$ to $4.3 \times 10^8 (BL)^{0.5}$ N/m |
| Vertical Subgrade Modulus | $Sy = \frac{1.9 \times 10^5}{(BL)^{0.5}}$ kPa/m |
| Poisson's Ratio | $\mu = 0.45$ |

### A.3.6.4.5 Excavations and Backfill

Plan and profile drawings of the excavation and backfill requirements for Project facilities are presented in the appropriate facility modules. Excavation and backfill requirements for existing facilities are not known since as-built records were not maintained.

Structural fill and backfill for Project facilities are constructed of an equal blend of New York State Department of Transportation Number 1 and Number 2 crushed stone. Sand pipe bedding consists of clean concrete sand meeting the following gradation:

| Sieve Size | Percent Passing |
|---|---|
| 0.953 cm (3/8 in) | 100 |
| No. 4 | 95 - 100 |
| No. 8 | 80 - 100 |
| No. 16 | 50 - 85 |

Under general backfill requirements, the contractor must remove all debris from the area to be filled. When placed, backfill must be free of debris and frozen soil. Fill is placed in level layers not exceeding eight inches and is computed to 95 percent of optimum density obtained by the modified AASHO method. In situ density is verified by field testing.

### A.3.6.4.6 Groundwater Conditions

A general discussion of groundwater conditions in and around the plant site is presented in Section A.3.5.2. The recorded water levels in site-wide monitoring wells range from near the surface to more than 6 metres below it. The monitoring data reveal that the upper layer (gravel or unoxidized till) can act as perched aquifer.

Facility specific design water level for lateral earth pressure and hydrostatic uplift analyses are determined based upon the above conditions.

### A.3.6.4.7 Response of Soil and Rock to Dynamic Loading

Because each of the various Project facilities has a different stratigraphic column, a generic free field analysis is not feasible. For those facilities which require seismic design by other than Uniform Building Code Procedures, an appropriate geomechanical model is used to analyze the response of soil and rock to dynamic loading. These analyses are presented in the appropriate SAR modules.

### A.3.6.4.8 Liquefaction Potential

Liquefaction occurs in loose, uniformly graded, saturated granular soils of generally alluvial origin. Earthquake shaking induces increased fluid pressures in the pore water of the soils, reducing the supporting capacity of the soils.

The foundation materials beneath the Project site are of glacial origin, either a heterogeneous drift or a fine-grained lacustrine sediment. The glacial lake deposits are generally cohesive and develop their strength from molecular attraction, not intergranular friction. The materials on site have been described as stable and insensitive; consequently, they are not subject to liquefaction. The surface glacial drift and the lower glacial till overlying bedrock are primarily cohesionless but they are well-graded, coarse-grained, and very dense; therefore, they are not considered liquefaction-susceptible material.

All backfilling around building excavations is performed with crushed stone, which is not a liquefaction-prone material.

### A.3.6.4.9 Earthquake Design Basis

The earthquake design basis used to determine the response of soil and rock to dynamic loading are presented in Sections A.3.6.2.9 and -10 and Supplement A.3.6-D.

### A.3.6.4.10 Static Analyses

Static analyses are performed on a facility specific basis. The methods used are presented in the appropriate SAR module.

### A.3.6.4.11 Criteria and Design Methods

The criteria and design methods used are facility specific and are presented in the appropriate SAR modules.

### A.3.6.4.12 Techniques to Improve Subsurface Conditions

No subsurface improvements are required for the construction of Project facilities.

## A.3.6.5 SLOPE STABILITY

Other than temporary excavations, no slopes are contemplated for Project constructed facilities. Temporary excavations are the responsibility of the contractor and Project specifications require the contractor to conform to the applicable federal and state construction safety regulations.

## REFERENCES FOR SECTION A.3.6


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_____, ASTM D 424, Standard Test for Plastic Limit and Plasticity Index of Soils.

_____, ASTM D 854, Standard Test for Specific Gravity of Soils.

_____, ASTM D 422-63, Standard Method for Particle-Size Analysis of Soils.

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TABLE A.3.6-1 (1 of 3)

HISTORICAL SEISMICITY WITHIN

480 km (300 mi) OF SITE

(Only events with MM intensity $\geq$ V are listed. Events shown with zero magnitude do not have an independently-determined magnitude.)

| DATE | | LONG. | LAT. | $I_e$ | $m_b$ | DISTANCE (km) |
|---|---|---|---|---|---|---|
| 1737 | 1219 | 74.00 | 40.80 | 7.0+ | 0.0 | 449.1 |
| 1776 | 0 0 | 81.90 | 39.60 | 6.0 | 4.7 | 422.3 |
| 1783 | 1130 | 74.50 | 41.00 | 6.0 | 0.0 | 401.7 |
| 1840 | 116 | 75.00 | 43.00 | 6.0+ | 0.0 | 321.5 |
| 1840 | 910 | 79.90 | 43.20 | 5.0+ | 0.0 | 113.7 |
| 1840 | 1111 | 75.20 | 39.80 | -7.0+ | 0.0 | 433.1 |
| 1847 | 929 | 74.00 | 40.50 | 5.0+ | 0.0 | 464.9 |
| 1848 | 9 9 | 74.00 | 40.40 | 5.0 | 0.0 | 470.6 |
| 1853 | 312 | 75.50 | 43.70 | 6.0+ | 0.0 | 302.3 |
| 1853 | 313 | 79.40 | 43.10 | 5.0+ | 0.0 | 74.9 |
| 1853 | 5 2 | 79.50 | 38.50 | 5.0 | 0.0 | 458.9 |
| 1855 | 1 3 | 77.50 | 39.20 | 5.0 | 0.0 | 392.8 |
| 1855 | 2 7 | 74.00 | 42.00 | 6.0 | 0.0 | 407.7 |
| 1857 | 1023 | 78.60 | 43.20 | 6.0+ | 0.0 | 68.7 o |
| 1861 | 713 | 75.40 | 45.40 | 7.0+ | 0.0 | 421.6 |
| 1867 | 1218 | 75.20 | 44.70 | 6.0 | 0.0 | 381.2 |
| 1871 | 10 9 | 75.50 | 39.70 | +7.0+ | 0.0 | 424.4 |
| 1873 | 425 | 74.20 | 44.80 | 5.0 | 0.0 | 456.3 |
| 1873 | 7 6 | 79.50 | 43.00 | 6.0+ | 0.0 | 73.6 |
| 1874 | 1211 | 73.80 | 40.90 | 5.0 | 0.0 | 459.5 |
| 1877 | 910 | 74.90 | 40.30 | 5.0 | 0.0 | 414.7 |
| 1877 | 1218 | 76.80 | 45.70 | 5.0 | 0.0 | 382.7 |
| 1878 | 10 4 | 74.00 | 41.50 | 5.0 | 0.0 | 420.4 |
| 1879 | 326 | 75.50 | 39.20 | 5.0 | 0.0 | 467.9 |
| 1879 | 326 | 75.50 | 39.20 | 5.0 | 0.0 | 467.9 |
| 1884 | 531 | 75.50 | 40.60 | 5.0 | 0.0 | 354.6 |
| 1884 | 810 | 74.00 | 40.60 | 7.0+ | 0.0 | 459.4 |
| 1885 | 1 3 | 77.50 | 39.20 | 5.0 | 0.0 | 392.8 |
| 1886 | 5 3 | 82.10 | 39.50 | 5.0 | 3.6 | 441.5 |
| 1889 | 3 8 | 76.00 | 40.00 | 5.0 | 0.0 | 371.9 |
| 1893 | 3 9 | 74.00 | 40.60 | 5.0 | 0.0 | 459.4 |
| 1895 | 9 1 | 74.80 | 40.70 | 6.0 | 0.0 | 396.0 |
| 1900 | 4 9 | 81.90 | 41.40 | 6.0+ | 4.7 | 291.9 |
| 1901 | 517 | 82.50 | 39.30 | 5.0 | 4.2 | 479.9 |
| 1903 | 1225 | 75.50 | 44.70 | 5.0 | 0.0 | 361.7 |
| 1906 | 627 | 81.60 | 41.40 | 5.0 | 4.2 | 269.8 |
| 1908 | 531 | 75.50 | 40.60 | 6.0 | 0.0 | 354.6 |
| 1908 | 616 | 74.80 | 45.10 | 5.0 | 0.0 | 435.2 |

TABLE A.3.6-1 (2 of 3)

HISTORICAL SEISMICITY WITHIN

480 km (300 mi) OF SITE

| DATE | LONG. | LAT. | $I_e$ | $m_b$ | DISTANCE (km) |
|---|---|---|---|---|---|
| 1909 4 2 | 78.00 | 39.40 | 5.0 | 0.0 | 361.5 |
| 1912 527 | 79.70 | 43.20 | 5.0← | 0.0 | 100.6 |
| 1913 429 | 75.30 | 44.90 | 6.0 | 4.4 | 388.8 |
| 1916 1 5 | 73.70 | 43.70 | 5.0 | 0.0 | 444.5 |
| 1916 2 2 | 74.00 | 42.90 | 5.0 | 0.0 | 403.6 |
| 1916 2 3 | 74.00 | 43.00 | 5.0 | 0.0 | 404.7 |
| 1916 11 2 | 73.70 | 43.30 | 5.0 | 0.0 | 434.4 |
| 1917 522 | 75.60 | 45.10 | 5.0 | 0.0 | 385.9 |
| 1918 410 | 78.40 | 38.70 | 5.0 | 0.0 | 434.2 |
| 1918 410 | 78.40 | 38.70 | 6.0 | 0.0 | 434.2 |
| 1919 9 6 | 78.20 | 38.80 | 6.0 | 0.0 | 424.8 |
| 1919 9 6 | 78.20 | 38.80 | 5.0 | 0.0 | 424.8 |
| 1921 126 | 75.00 | 40.00 | 5.0 | 0.0 | 429.8 |
| 1922 12 8 | 75.10 | 44.40 | 5.0 | 0.0 | 368.9 |
| 1923 1231 | 78.00 | 39.20 | 5.0 | 0.0 | 383.3 |
| 1924 715 | 76.50 | 45.70 | 5.0 | 0.0 | 394.4 |
| 1926 126 | 75.00 | 40.00 | 5.0 | 0.0 | 429.8 |
| 1926 512 | 73.90 | 40.90 | 5.0 | 0.0 | 451.9 |
| 1926 11 5 | 82.10 | 39.10 | -7.0← | 4.0 | 476.9 |
| 1927 129 | 81.20 | 40.90 | 5.0 | 0.0 | 275.8 |
| 1927 6 1 | 74.00 | 40.30 | -7.0← | 0.0 | 476.4 |
| 1928 318 | 74.30 | 44.50 | 6.0 | 4.1 | 432.1 |
| 1928 9 9 | 82.00 | 41.50 | 5.0 | 4.2 | 294.6 |
| 1929 812 | 78.40 | 42.91 | 7.0 | 5.2 | 48.0 ○ |
| 1929 12 2 | 78.30 | 42.80 | 5.0← | 0.0 | 47.4 |
| 1931 420 | 73.79 | 43.47 | -7.0← | 4.7 | 430.8 |
| 1931 610 | 84.00 | 41.30 | 5.0 | 4.2 | 459.0 |
| 1932 121 | 81.50 | 41.10 | 5.0 | 4.2 | 280.9 |
| 1933 125 | 74.70 | 40.20 | 5.0 | 0.0 | 434.8 |
| 1934 415 | 73.80 | 44.70 | 6.0 | 4.5 | 479.5 |
| 1934 1029 | 80.20 | 42.00 | 5.0← | 0.0 | 134.9 |
| 1935 11 1 | 79.05 | 46.87 | 7.0← | 6.2 | 474.4 |
| 1938 715 | 78.43 | 40.68 | 6.0← | 3.3 | 215.4 ○ |
| 1938 823 | 74.34 | 40.10 | 5.0 | 3.9 | 465.5 |
| 1938 1118 | 75.30 | 44.80 | 5.0 | 0.0 | 381.7 |
| 1939 1115 | 75.05 | 39.58 | 5.0 | 4.0 | 459.5 |
| 1939 1126 | 76.60 | 39.50 | 5.0 | 0.0 | 390.4 |
| 1944 1 8 | 75.50 | 39.80 | 5.0 | 0.0 | 416.0 |
| 1944 9 5 | 74.72 | 44.96 | 8.0 | 5.8 | 430.7 |
| 1949 1016 | 74.90 | 45.49 | 5.0 | 4.0 | 457.9 |
| 1951 9 3 | 73.86 | 41.36 | 5.0 | 3.8 | 436.3 |
| 1952 620 | 82.02 | 39.64 | 6.0 | 4.1 | 425.2 |
| 1952 825 | 74.50 | 43.00 | 5.0 | 0.0 | 363.1 |
| 1952 10 8 | 74.00 | 41.70 | 5.0 | 0.0 | 414.5 |
| 1953 327 | 73.50 | 41.10 | 5.0 | 0.0 | 474.3 |

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TABLE A.3.6-1 (3 of 3)

HISTORICAL SEISMICITY WITHIN

480 km (300 mi) OF SITE

| DATE | LONG. | LAT. | $I_e$ | $m_b$ | DISTANCE (km) |
|---|---|---|---|---|---|
| 1954 1 7 | 76.00 | 40.30 | 6.0 | 0.0 | 346.7 |
| 1954 221 | 75.90 | 41.20 | +7.0← | 0.0 | 288.5 |
| 1955 121 | 73.70 | 43.00 | 5.0 | 0.0 | 429.7 |
| 1955 526 | 81.70 | 41.50 | 5.0 | 3.8 | 272.0 |
| 1955 629 | 81.70 | 41.50 | 5.0 | 3.8 | 272.0 |
| 1955 816 | 78.30 | 42.90 | 5.0 | 0.0 | 53.5 o |
| * | | | | | |
| 1957 323 | 74.80 | 40.60 | 6.0 | 4.8 | 402.0 |
| 1958 5 1 | 81.70 | 41.50 | 5.0 | 4.0 | 272.0 |
| 1961 222 | 83.40 | 41.20 | 5.0 | 4.2 | 415.6 |
| 1961 420 | 74.80 | 45.00 | 5.0 | 2.0 | 428.2 |
| 1961 915 | 75.50 | 40.80 | 5.0 | 0.0 | 341.2 |
| 1961 1227 | 74.80 | 40.50 | 5.0 | 0.0 | 408.3 |
| 1962 327 | 79.30 | 43.00 | 5.0← | 3.0 | 61.0 |
| 1964 1 8 | 77.53 | 46.41 | 5.0 | 4.3 | 436.1 |
| 1964 329 | 74.90 | 44.90 | 5.0 | 0.0 | 414.7 |
| 1964 512 | 76.41 | 40.30 | 6.0← | 3.2 | 324.5 |
| 1964 1117 | 73.70 | 41.20 | 5.0 | 0.0 | 454.8 |
| 1966 1 1 | 78.25 | 42.84 | 6.0← | 4.6 | 53.2 o |
| 1967 4 8 | 82.53 | 39.65 | 5.0 | 3.5 | 452.7 |
| 1967 613 | 78.23 | 42.84 | 6.0 | 4.4 | 54.7 o |
| 1967 1122 | 73.80 | 41.20 | 5.0 | 0.0 | 446.9 |
| 1968 1210 | 74.82 | 39.92 | 5.0 | 3.0 | 446.9 |
| 1971 523 | 74.47 | 43.87 | 5.0 | 4.1 | 389.3 |
| 1972 211 | 75.60 | 39.70 | 5.0 | 0.0 | 419.0 |
| 1972 12 8 | 76.24 | 40.14 | 5.0 | 3.5 | 347.3 |
| 1973 228 | 75.44 | 39.77 | 5.0 | 3.8 | 421.9 |
| 1974 6 7 | 73.94 | 41.63 | 6.0 | 2.9 | 421.3 |
| 1974 1020 | 81.61 | 39.06 | 5.0 | 3.8 | 458.1 |
| 1976 311 | 74.40 | 41.00 | 5.0 | 2.4 | 409.3 |
| 1976 413 | 74.00 | 40.80 | 6.0 | 3.1 | 449.1 |
| 1977 210 | 75.50 | 39.80 | 6.0 | 2.0 | 416.0 |
| 1977 3 9 | 83.50 | 41.00 | 5.0 | 0.0 | 432.1 |
| 1978 716 | 76.34 | 39.93 | 5.0 | 3.0 | 361.0 |
| 1978 10 6 | 76.10 | 40.10 | 6.0 | 3.0 | 358.1 |
| 1980 820 | 83.10 | 42.10 | 5.0 | 3.3 | 364.6 |

Notes: ← Could have been felt at site

o Associated with Clarendon-Linden Structure

TABLE A.3.6-2 (page 1 of 14)

SUMMARY OF INDEX PROPERTIES TESTS

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.305/1 | ML | 24 | | | | | 1.59 | 0090,1963 |
| | 2 | 1.829/6 | GP | 7 | | | | | 1.96 | " |
| | 3 | 3.353/11 | CL | 18 | | | | | 1.81 | " |
| | 4 | 4.877/16 | CL | 17 | | | | | 1.84 | " |
| | 5 | 6.401/21 | CL | 17 | | | | | 1.81 | " |
| | 6 | 7.925/26 | CL | 17 | | | | | 1.84 | " |
| | 7 | 10.363/34 | CL | 8 | | | | | 1.98 | " |
| | 8 | 12.497/41 | CL | 13 | | | | | 1.77 | " |
| | 9 | 14.021/46 | CL | 18 | | | | | 1.73 | " |
| | 10 | 15.545/51 | CL | 22 | | | | | 1.59 | " |
| | 11 | 17.069/56 | CL | 18 | | | | | 1.79 | " |
| | 12 | 18.593/61 | CL | 18 | | | | | 1.85 | " |
| 2 | 1 | 0.305/1 | GP | 14 | | | | | 1.79 | " |
| | 2 | 1.829/6 | GP | 10 | | | | | 1.88 | " |
| | 3 | 3.353/11 | CL | 16 | | | | | 1.88 | " |
| | 4 | 4.877/16 | CL | 19 | | | | | 1.77 | " |
| | 5 | 6.401/21 | CL | 18 | | | | | 1.77 | " |

Depth in m - Depth in ft x 00.3048

Dry Density in g/cc = Dry Density in pcf x 0.0157

Table A.3.6-2 (page 2 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 7.925/26 | CL | 21 | | | | | 1.73 | 0090,1963 |
| | 7 | 9.449/31 | CL | 19 | | | | | 1.77 | " |
| | 8 | 10.973/36 | CL | 19 | | | | | 1.77 | " |
| | 9 | 12.497/41 | CL | 16 | | | | | 1.82 | " |
| | 10 | 14.021/46 | CL | 15 | | | | | 1.90 | " |
| | 11 | 15.545/51 | CL | 17 | | | | | 1.84 | " |
| | 12 | 17.069/56 | CL | 19 | | | | | 1.77 | " |
| | 13 | 18.593/61 | CL | 20 | | | | | 1.74 | " |
| | 14 | 20.117/66 | CL | 15 | | | | | 1.92 | " |
| | 15 | 21.641/71 | CL | 14 | | | | | 1.90 | " |
| | 16 | 23.165/76 | CL | 15. | | | | | 1.95 | " |
| 3 | 1 | 0.305/1 | GM | 12 | | | | | 1.98 | " |
| | 2 | 1.829/6 | CL | 16 | | | | | 1.87 | " |
| | 3 | 3.353/11 | CL | 17 | | | | | 1.90 | " |
| | 4 | 4.877/16 | CL | 19 | | | | | 1.77 | " |
| | 5 | 6.401/21 | CL | 20 | | | | | 1.76 | " |
| | 6 | 7.925/26 | CL | 21 | | | | | 1.76 | " |
| 4 | 1 | 0.305/1 | GM | 11 | | | | | 1.98 | " |
| | 2 | 1.829/6 | GM | 10 | | | | | 1.92 | " |
| | 3 | 3.353/11 | CL | 17 | | | | | 1.82 | " |

Table A.3.6-2 (page 3 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 4.877/16 | CL | 21 | | | | | 1.71 | " |
| | 5 | 6.401/21 | CL | 19 | | | | | 1.76 | " |
| | 6 | 7.925/26 | CL | 21 | | | | | 1.70 | " |
| 5 | 1 | 0.305/1 | GM | 34 | | | | | 1.46 | 0090,1963 |
| | 2 | 1.829/6 | GM | 13 | | | | | 1.95 | " |
| | 3 | 3.353/11 | CL | 14 | | | | | 1.93 | " |
| | 4 | 4.877/16 | CL | 20 | | | | | 1.71 | " |
| | 5 | 6.401/21 | CL | 20 | | | | | 1.71 | " |
| | 6 | 7.925/26 | CL | 19 | | | | | 1.79 | " |
| | 7 | 9.449/31 | GP | 13 | | | | | 1.88 | " |
| | 8 | 10.973/36 | CL | 26 | | | | | 1.55 | " |
| | 9 | 12.497/41 | CL | 20 | | | | | 1.63 | " |
| 6 | 1 | 0.305/1 | GM | 13 | | | | | 1.85 | " |
| | 2 | 1.829/6 | CL | 8 | | | | | 2.07 | " |
| | 3 | 3.353/11 | CL | 15 | | | | | 1.92 | " |
| | 4 | 4.877/16 | CL | 21 | | | | | 1.70 | " |
| | 5 | 6.401/21 | CL | 21 | 29 | 16 | 13 | | 1.71 | " |
| | 6 | 7.925/26 | CL | 25 | | | | | 1.63 | " |
| | 7 | 9.449/31 | CL | 22 | | | | | 1.71 | " |
| | 8 | 10.973/36 | CL | 21 | | | | | 1.73 | " |
| | 9 | 12.497/41 | CL | 14 | | | | | 1.87 | " |

Table A.3.6-2 (page 4 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 7 | 9.449/31 | CL | 31 | 32 | 18 | 14 | | 1.46 | " |
| | 8 | 10.973/36 | CL | 20 | | | | | 1.74 | " |
| | 9 | 12.497/41 | CL | 20 | | | | | 1.73 | " |
| | 10 | 14.021/46 | CL | 16 | | | | | 1.82 | " |
| | 11 | 15.545/51 | CL | 11 | | | | | 2.04 | 0090,1963 |
| | 12 | 17.069/56 | CL | 17 | | | | | 1.82 | " |
| | 13 | 18.593/61 | CL | 16 | | | | | 1.79 | " |
| | 14 | 20.117/66 | CL | 14 | | | | | 1.93 | " |
| | 15 | 21.641/71 | CL | 12 | | | | | 1.99 | " |
| | 16 | 26.213/86 | GM | 8 | | | | | 2.03 | " |
| | 17 | 29.261/96 | SM | 5 | | | | | 1.79 | " |
| | 18 | 32.309/106 | ML | 21 | | | | | 1.63 | " |
| | 19 | 35.357/116 | ML | 25 | | | | | 1.60 | " |
| | 20 | 39.929/131 | ML | 19 | | | | | 1.71 | " |
| | 21 | 46.025/151 | ML | 22 | | | | | 1.66 | " |
| | 22 | 49.073/161 | ML | 16 | | | | | 1.79 | " |
| 8 | 1 | 0.305/1 | GM | 11 | | | | | 1.81 | " |
| | 2 | 1.829/6 | GM | 15 | | | | | 1.96 | " |
| | 3 | 3.353/11 | CL | 12 | | | | | 1.99 | " |
| | 4 | 4.877/16 | CL | 20 | | | | | 1.77 | " |
| | 5 | 6.401/21 | CL | 18 | | | | | 1.82 | " |

Table A.3.6-2 (page 5 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 7.925/26 | CL | 25 | | | | | 1.59 | " |
| | 7 | 9.449/31 | CL | 27 | | | | | 1.55 | " |
| | 8 | 10.973/36 | CL | 20 | | | | | 1.76 | " |
| | 9 | 12.497/41 | CL | 18 | | | | | 1.81 | " |
| 9 | 1 | 0.305/1 | GM | 22 | | | | | 1.71 | 0090,1963 |
| | 2 | 1.829/6 | GM | 12 | | | | | 2.06 | " |
| | 3 | 3.962/13 | CL | 13 | | | | | 1.99 | " |
| | 4 | 5.486/18 | CL | 18 | | | | | 1.77 | " |
| | 5 | 7.315/24 | CL | 19 | | | | | 1.76 | " |
| 12 | 1 | 0.305/1 | PT-CL | 25 | | | | | 1.26 | " |
| | 2 | 1.829/6 | GM | 13 | | | | | 1.98 | " |
| | 3 | 3.353/11 | GM | 8 | | | | | 2.18 | " |
| | 4 | 4.877/16 | GM | 9 | | | | | 1.90 | " |
| | 5 | 6.401/21 | GM | 8 | | | | | 2.03 | " |
| | 6 | 7.925/26 | CL | 13 | | | | | 1.93 | " |
| | 7 | 9.449/31 | CL | 20 | | | | | 1.71 | " |
| | 8 | 10.973/36 | CL | 17 | | | | | 1.79 | " |
| | 9 | 12.497/41 | CL | 14 | | | | | 1.92 | " |
| | 10 | 14.021/46 | CL | 21 | | | | | 1.74 | " |
| | 11 | 15.545/51 | CL | 20 | | | | | 1.70 | " |

Table A.3.6-2 (page 6 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 12 | 17.069/56 | CL | 18 | | | | | 1.88 | " |
| | 13 | 18.593/61 | CL | 18 | | | | | 1.74 | " |
| | 14 | 20.117/66 | CL | 16 | | | | | 1.88 | " |
| | 15 | 21.641/71 | CL | 21 | | | | | 1.71 | " |
| | 16 | 23.165/76 | CL | 11 | | | | | 2.15 | " |
| | 17 | 24.689/81 | CL | 12 | | | | | 1.99 | " |
| 15 | 1 | 0.305/1 | ML | 21 | | | | | 1.51 | 0090,1963 |
| | 2 | 0.914/3 | ML | 17 | | | | | 1.79 | " |
| | 3 | 2.134/7 | CL | 19 | | | | | 1.77 | " |
| | 4 | 2.743/9 | CL | 20 | | | | | 1.74 | " |
| | 5 | 3.353/11 | CL | 18 | | | | | 1.79 | " |
| | 6 | 4.877/16 | CL | 19 | | | | | 1.74 | " |
| | 7 | 6.401/21 | CL | 21 | | | | | 1.76 | " |
| | 8 | 7.925/26 | CL | 18 | | | | | 1.77 | " |
| 16 | 1 | 0.305/1 | ML | 21 | | | | | 1.37 | " |
| | 2 | 1.829/6 | GM-ML | 9 | | | | | 1.84 | " |
| | 3 | 3.353/11 | GM-ML | 12 | | | | | 1.92 | " |
| | 4 | 4.877/16 | GM-ML | 11 | | | | | 2.06 | " |
| | 5 | 6.401/21 | GM-ML | 9 | | | | | 2.12 | " |
| | 6 | 7.925/26 | GM-ML | 10 | | | | | 1.98 | " |
| | 7 | 9.449/31 | GM-ML | 11 | | | | | 1.98 | " |

Table A.3.6-2 (page 7 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 10.973/36 | GM-ML | 12 | | | | | 2.06 | " |
| | 9 | 12.497/41 | CL | 17 | | | | | 1.73 | " |
| | 10 | 14.021/46 | CL | 26 | | | | | 1.63 | " |
| | 11 | 15.545/51 | CL | 18 | | | | | 1.82 | " |
| | 12 | 17.069/56 | CL | 19 | | | | | 1.59 | " |
| | 13 | 18.593/61 | CL | 13 | | | | | 1.96 | " |
| 17 | 1 | 0.305/1 | ML | 19 | | | | | 1.71 | 0090,1963 |
| | 2 | 1.829/6 | GM-ML | 9 | | | | | 2.01 | " |
| | 3 | 3.353/11 | GM-ML | 10 | | | | | 1.84 | " |
| | 4 | 4.877/16 | GM-ML | 12 | | | | | 1.98 | " |
| | 5 | 6.401/21 | CL | 25 | 32 | 23 | 9 | | 1.59 | " |
| | 6 | 7.925/26 | GM-ML | 5 | | | | | 2.06 | " |
| | 7 | 9.449/31 | CL | 18 | | | | | 1.77 | " |
| | 8 | 10.973/36 | CL | 17 | | | | | 1.74 | " |
| | 9 | 12.497/41 | CL | 19 | | | | | 1.71 | " |
| 18 | 1 | 0.305/1 | ML | 32 | | | | | 1.27 | " |
| | 2 | 1.829/6 | GM-ML | 11 | | | | | 1.95 | " |
| | 3 | 3.353/11 | GM-ML | 10 | | | | | 2.07 | " |
| | 4 | - | - | - | | | | | | " |
| | 5 | 6.401/21 | GM-ML | 20 | | | | | 1.73 | " |
| | 6 | 7.925/26 | CL | 32 | | | | | 1.48 | " |

Table A.3.6-2 (page 8 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 9.449/31 | CL | 28 | | | | | 1.48 | " |
| | 8 | 10.973/36 | CL | 32 | | | | | 1.40 | " |
| | 9 | 12.497/41 | CL | 19 | | | | | 1.73 | " |
| | 10 | 14.021/46 | CL | 16 | | | | | 1.90 | " |
| | 11 | - | - | - | | | | | | " |
| | 12 | 17.069/56 | CL | 14 | | | | | 1.96 | " |
| | 13 | 18.593/61 | CL | 17 | | | | | 1.79 | " |
| | 14 | 20.117/66 | GM-ML | 9 | | | | | 2.03 | " |
| 19 | 1 | 0.305/1 | ML | 30 | | | | | 1.18 | 0090,1963 |
| | 2 | 1.829/16 | GM-ML | 9 | | | | | 2.07 | " |
| | 3 | 3.353/11 | GM-ML | 8 | | | | | 2.10 | " |
| | 4 | 4.877/16 | CL | 23 | | | | | 1.68 | " |
| | 5 | 6.401/21 | CL | 18 | | | | | 1.71 | " |
| | 6 | 7.925/26 | CL | 16 | | | | | 1.84 | " |
| | 7 | 9.449/31 | CL | 27 | | | | | 1.51 | " |
| | 8 | 10.973/36 | CL | 9 | | | | | 2.07 | " |
| | 9 | 12.497/41 | CL | 12 | | | | | 2.03 | " |
| | 10 | 14.021/46 | GM-ML | 11 | | | | | 1.99 | " |
| | 11 | 15.545/51 | GM-ML | 15 | | | | | 1.96 | " |

Table A.3.6-2 (page 9 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 1 | 0.305/1 | GM-ML | 20 | | | | | 1.37 | " |
| | 2 | 1.829/6 | GM-ML | 17 | | | | | 1.62 | " |
| | 3 | 3.353/11 | GM-ML | 10 | | | | | 2.04 | " |
| | 4 | 4.877/16 | GM-ML | 12 | | | | | 1.88 | " |
| | 5 | 7.010/23 | SP | 22 | | | | | 1.74 | " |
| | 6 | 7.925/26 | CL | 18 | | | | | 1.79 | " |
| | 7 | 9.449/31 | CL | 21 | | | | | 1.73 | " |
| | 8 | 10.973/36 | CL | 22 | | | | | 1.59 | " |
| | 9 | 12.497/41 | CL | 17 | | | | | 1.87 | " |
| | 10 | 14.021/46 | CL | 13 | | | | | 1.98 | " |
| | 11 | 15.545/51 | CL | 13 | | | | | 1.99 | " |
| | 12 | 17.069/56 | CL | 13 | | | | | 1.98 | " |
| | 13 | 18.593/61 | GM-ML | 10 | | | | | 1.98 | 0090,1963 |
| | 14 | 20.117/66 | GM-ML | 10 | | | | | 2.04 | " |
| | 15 | 21.641/71 | GM-ML | 10 | | | | | 1.88 | " |
| | 16 | 23.165/76 | GM-ML | 8 | | | | | 2.07 | " |
| | 17 | 24.689/81 | GM-ML | 6 | | | | | 2.014 | " |

Table A.3.6-2 (page 10 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 1 | 0.305/1 | GM | 25 | | | | | 1.33 | " |
| | 2 | 3.353/11 | GM-ML | 7 | | | | | 2.06 | " |
| | 3 | 3.353/11 | GM-ML | 15 | | | | | 1.85 | " |
| | 4 | 6.401/21 | CL | 18 | | | | | 1.68 | " |
| | 5 | 7.925/26 | CL | 24 | | | | | 1.66 | " |
| | 7 | 10.973/36 | CL | 21 | | | | | 1.65 | " |
| | 8 | 12.497/41 | CL | 26 | | | | | 1.63 | " |
| | 9 | 14.021/46 | CL | 14 | | | | | 1.92 | " |
| | 10 | 15.545/51 | CL | 13 | | | | | 2.04 | " |
| | 11 | 17.069/56 | CL | 14 | | | | | 1.88 | " |
| | 12 | 18.593/61 | GP-ML | 8 | | | | | 2.04 | " |
| | 13 | 21.641/71 | GP-ML | 9 | | | | | 1.88 | " |
| | 1 | 0.305/1 | GM | 8 | | | | | 1.62 | " |
| | 2 | 1.829/6 | GM-ML | 10 | | | | | 1.84 | " |
| | 3 | 3.353/11 | GM-ML | 10 | | | | | 1.96 | " |
| | 4 | 4.877/16 | GM-ML | 11 | | | | | 2.20 | " |
| | 5 | 6.401/21 | GM-ML | 11 | | | | | 1.98 | " |
| | 6 | 7.925/26 | CL | 17 | | | | | 1.77 | 0090 1963 |
| | 7 | 9.449/31 | CL | 19 | | | | | 1.87 | " |
| | 8 | 10.973/36 | CL | 30 | | | | | 1.52 | " |
| | 9 | 12.497/41 | CL | 17 | | | | | 1.82 | " |

Table A.3.6-2 (page 11 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 14.021/46 | CL | 21 | | | | | 1.66 | " |
| | 11 | 15.545/51 | CL | 20 | | | | | 1.65 | " |
| | 12 | 17.069/56 | CL | 15 | | | | | 1.93 | " |
| | 13 | 20.117/66 | CL | 15 | | | | | 2.07 | " |
| 23 | 1 | 0.305/1 | GM-ML | 21 | | | | | 1.29 | " |
| | 2 | 1.829/6 | GM-ML | 13 | | | | | 1.88 | " |
| | 3 | 3.353/11 | CL | 21 | | | | | 1.70 | " |
| | 4 | 4.877/16 | CL | 20 | | | | | 1.71 | " |
| | 5 | 6.401/21 | CL | 22 | | | | | 1.66 | " |
| | 6 | 7.925/26 | CL | 16 | | | | | 1.71 | " |
| | 7 | 9.449/31 | CL | 23 | | | | | 1.63 | " |
| | 8 | 10.973/36 | CL | 20 | | | | | 1.70 | " |
| | 9 | 12.497/41 | CL | 24 | | | | | 1.66 | " |
| | 10 | 14.021/46 | CL | 14 | | | | | 1.55 | " |
| | 12 | 17.069/56 | CL | 14 | | | | | 1.85 | " |
| | 13 | 20.117/66 | CL | 13 | | | | | 1.95 | " |
| | 14 | 23.165/76 | GM-ML | 9 | | | | | 2.01 | " |
| 24 | 1 | 0.305/1 | GM-ML | 10 | | | | | 1.59 | 0090,1963 |
| | 2 | 1.829/6 | GM-ML | 13 | | | | | 1.92 | " |
| | 3 | 3.353/11 | GM-ML | 11 | | | | | 1.99 | " |
| | 4 | 4.877/16 | CL | 18 | | | | | 1.79 | " |

Table A.3.6-2 (page 12 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 6.401/21 | SP | 10 | | | | | 1.93 | " |
| | 6 | 7.925/26 | CL | 17 | | | | | 1.82 | " |
| | 7 | 9.449/31 | CL | 13 | | | | | 1.96 | " |
| | 8 | 10.973/36 | CL | 23 | | | | | 1.66 | " |
| | 9 | 12.497/41 | CL | 12 | | | | | 1.96 | " |
| 25 | 1 | 0.305/1 | GM | 13 | | | | | 1.49 | " |
| | 2 | 1.829/6 | GM-ML | 13 | | | | | 1.87 | " |
| | 3 | 3.353/11 | GM-ML | 14 | | | | | 1.88 | " |
| | 4 | 4.877/16 | GM-ML | 12 | | | | | 1.79 | " |
| | 5 | 6.401/21 | SC | 18 | | | | | 1.66 | " |
| | 6 | 7.925/26 | CL | 23 | | | | | 1.71 | " |
| | 7 | 9.449/31 | CL | 25 | | | | | 1.57 | " |
| | 8 | 10.973/36 | CL | 16 | | | | | 1.85 | " |
| | 9 | 12.497/41 | CL | 22 | | | | | 1.55 | " |
| | 10 | 14.021/46 | CL | 15 | | | | | 1.92 | " |
| | 11 | 17.069/56 | GM-ML | 9 | | | | | 2.01 | " |
| | 12 | 20.117/66 | GM-ML | 7 | | | | | 1.93 | " |
| | 29 | 2.438/8 | | | 33 | 19 | 14 | | | 0098,1971 |
| | 30 | 6.401/21 | | | 26 | 14 | 12 | | | " |
| | 30 | 9.144/30 | | | 50 | 26 | 24 | | | " |
| | 31 | 12.497/41 | | | 25 | 15 | 10 | | | " |

Table A.3.6-2 (page 13 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| B-3 | 10 | 20.726/68 | CL | 22.8 | - | - | - | - | 1.65 | 0101,1975 |
| | 8 | 14.630/48 | CL | 13.7 | - | - | - | - | 1.95 | " |
| | 4 | 7.010/23 | CL | 21.5 | - | - | - | - | 1.73 | " |
| B-7 | 7 | 7.620/25 | CL | 13.4 | 26 | 16 | 10 | - | - | " |
| | 5 | 4.572/15 | CL | 23.4 | 33 | 19 | 14 | - | - | " |
| | 4 | 3.048/10 | CL | 23.3 | - | - | - | - | 1.57 | " |
| | 2 | 0.610/2 | CL-ML | 16.8 | 33 | 20 | 13 | - | - | " |
| B-2 | 14 | 24.384/80 | CL | 21.7 | 30 | 19 | 11 | 2.70 | - | " |
| | 10 | 12.192/40 | CL | 12.2 | 24 | 14 | 10 | 2.71 | - | " |
| | 5 | 6.096/20 | CL | 13.0 | 31 | 17 | 114 | 2.70 | - | " |
| 33 | 1 | 1.524/5 | - | - | - | - | - | 2.65 | - | 0102,1975 |
| | 3 | 4.724/15.5 | CL | 19.3 | 35.4 | 19.4 | 16.0 | - | - | " |
| | 9 | 13.868/45.5 | - | - | - | - | - | 2.72 | - | " |
| | 11A or B | 17.069/56 | CL | 12.1 | 22.9 | 13.2 | 9.7 | - | - | " |
| 34 | 9 | 14.021/46 | CL | 10.3 | 23.1 | 13.8 | 9.3 | 2.74 | - | " |
| | 13 | 19.964/65.5 | CL | 5.6 | 23.6 | 13.3 | 10.3 | 2.75 | - | " |
| 36 | 12 | 18.440/60.5 | CL-ML | 17.7 | 22.7 | 15.3 | 7.4 | - | | " |

Table A.3.6-2 (page 14 of 14)

| Boring No. | Sample No. | Depth (m/ft) | Soil Type | Natural Moisture Content Percent | Liquid Limit Percent | Plastic Limit Percent | Plasticity Index Percent | Specific Gravity of Solids | Dry Density (g/cc) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 38 | 2 | 3.200/10.5 | - | - | - | - | - | 2.69 | - | " |
| 39 | 8 | 12.497/41 | CL | 12.1 | 22.6 | 13.8 | 8.8 | - | | 0102,1975 |
| | 9 | 15.545/51 | CL | 11.6 | 24.5 | 14.4 | 10.1 | - | - | " |
| 40 | 19 | 30.632/100.5 | CL-ML | 22.2 | 24.5 | 17.9 | 6.6 | 2.71 | - | " |
| | 23 | 36.576/120.0 | - | - | - | - | - | 2.70 | - | " |
| 42 | 7 | 10.820/35.5 | CL | 11.7 | 23.2 | 14.4 | 8.8 | - | - | " |
| 43 | 3 | 4.724/15.5 | CL | 24.2 | 33.5 | 15.0 | 18.5 | - | - | " |
| 26 | - | 14.021/46 | CL | 12.1 | 22 | 14 | 8 | - | - | 0097,1970 |
| 27 | - | 11.582/38 | CL-ML | 12.9 | 22 | 15 | 7 | - | - | " |

TABLE A.3.6-3

Results of Direct Shear Tests

| Boring No. | Sample No. | Depth (m/ft) | Normal Pressure (kPa) | Shear Strength (kPa) | Water Content Percent | Dry Density (g/cc) | Soil Classification | Reference |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1.829/6 | 24 | 38 | 7 | 1.96 | GP | 0090, 1963 |
| 2 | 2 | 1.829/6 | 24 | 57 | 10 | 1.88 | GP | 0090, 1963 |
| 17 | 4 | 4.877/16 | 66 | 130 | 12 | 1.98 | GM/ML | 0090, 1963 |
| 17 | 8 | 10.973/36 | 130 | 144 | 17 | 1.74 | CL/GP | 0090, 1963 |
| 20 | 4 | 4.877/16 | 83 | 148 | 12 | 1.88 | GM/ML | 0090, 1963 |
| 20 | 8 | 10.973/36 | 150 | 76 | 22 | 1.59 | CL | 0090, 1963 |
| 22 | 3 | 3.353/11 | 63 | 160 | 10 | 1.96 | GM/ML | 0090, 1963 |
| 23 | 3 | 3.353/11 | 54 | 55 | 21 | 1.70 | GM/CL | 0090, 1963 |

TABLE A.3.6-4 (1 of 2)

Results of Unconfined and Triaxial Compression Tests

| Boring No. | Sample No. | Depth (m/ft) | Cell (or Consolidation) Pressure (kPa) | Maximum Shear Strength (kPa) | Water Content Percent | Dry Density (g/cc) | Soil Classification | Remarks | Reference |
|---|---|---|---|---|---|---|---|---|---|
| B-2 | 3 | 3.353/11 | 95.8 | 139.1 | 19.8 | 1.73 | CL | (1) | 0101, 1975 |
| B-2 | 5 | 6.096/20 | 143.7 | 139.2 | 13.0 | 1.98 | CL | (1) | 0101, 1975 |
| B-2 | 9 | 12.192/40 | 191.6 | 236.8 | 12.9 | 1.97 | CL | (2) | 0101, 1975 |
| B-2 | 14 | 24.384/80 | 287.4 | 246.7 | 22.0 | 1.67 | ML | (1) | 0101, 1975 |
| B-1 | 4 | 6.096/20 | 431.1 | 184.9 | -- | -- | CL | (2) | 0101, 1975 |
| B-1 | 5 | 7.620/25 | 143.7 | 145.9 | -- | -- | CL | (2) | 0101, 1975 |
| B-1 | 3 | 3.048/10 | 574.8 | 282.6 | 20.0 | 1.71 | CL | (2) | 0101, 1975 |
| B-1 | 4 | 6.096/20 | 287.4 | 184.1 | -- | -- | CL | (2) | 0101, 1975 |
| B-1 | 7 | 12.192/40 | 191.6 | 204.5 | 16.3 | 1.84 | CL | (2) | 0101, 1975 |
| B-7 | 6 | 7.620/25 | 103.5 | 78.1 | 25.4 | 1.56 | CL | (1) | 0101, 1975 |
| B-7 | 10 | 15.240/50 | 172.4 | 115.7 | -- | -- | CL | (1) | 0101, 1975 |
| B-7 | 12 | 18.288/60 | 227.5 | 163.2 | 29.8 | 1.48 | CL | (1) | 0101, 1975 |

(1) From Unconsolidated Undrained (UU) Test

(2) From Isotropically Consolidated Undrained (CIU) Tests

TABLE A.3.6-4 (2 of 2)

Results of Unconfined and Triaxial Compression Tests

| Boring No. | Sample No. | Depth (m/ft) | Cell (or Consolidation) Pressure (kPa) | Maximum Shear Strength (kPa) | Water Content Percent | Dry Density (g/cc) | Soil Classification | Remarks | Reference |
|---|---|---|---|---|---|---|---|---|---|
| 26 | 5 | 10.668/35 | 0 | 124.5 | 23.3 | 1.54 | CL | (3) | 0097, 1970Y |
| 26 | 6 | 18.716/45 | 0 | 213.2 | 12.1 | 1.99 | CL | (3) | 0097, 1970Y |
| 27 | 5 | 9.144/30 | 0 | 201.2 | 13.5 | 1.88 | CL | (3) | 0097, 1970Y |
| 30 | 6 | 6.096/20 | 0 | 67.1 | 21.5 | 1.71 | CL | (3) | 0098 Y |
| 30 | 7 | 7.620/25 | 413.9 | 178.8 | 20.8 | 1.70 | CL | (1) | 0098 Y |
| 31 | 2 | 1.524/05 | 0 | 117.4 | 13.4 | 1.84 | ML | (3) | 0098 Y |
| 31 | 8 | 9.144/30 | 413.9 | 124.5 | 26.6 | 1.55 | CL | (1) | 0098 Y |

(3) Unconfined Compression Test

TABLE A.3.6-5 (1 of 3)

Summary of Hydraulic Conductivity Results

| Boring No. | Sample No. | Depth (m/ft) | Soil Type (Unified) | Head (kPa) | Effective Confining Pressure (kPa) | Water Content Percent | Dry Density (g/cc) | Hydraulic Conductivity (cm/sec) | Reference |
|---|---|---|---|---|---|---|---|---|---|
| 2 (U.D.) | 9 | 12.192/40 | CL | 227.5 | 191.7 | 12.2 | 1.97 | $1.37 \times 10^{-8}$ | 0101 |
| Block Sample* | - | - | CL | 27.6 | 103.4 | 11.6 | 1.73 | $4.9 \times 10^{-8}$ | 0101 |
| | - | - | CL | 27.6 | 172.4 | 11.6 | 1.73 | $3.8 \times 10^{-8}$ | 0101 |
| | - | - | CL | 27.6 | 310.3 | 11.6 | 1.73 | $3.0 \times 10^{-8}$ | 0101 |
| T.P.-7* | - | - | GM-ML | 13.8 | 103.4 | 9.5 | 1.86 | $7.6 \times 10^{-7}$ | 0101 |
| | - | - | GM-ML | 13.8 | 172.4 | 9.5 | 1.86 | $7.0 \times 10^{-7}$ | 0101 |
| | - | - | GM-ML | 13.8 | 310.3 | 9.5 | 1.86 | $4.2 \times 10^{-7}$ | 0101 |
| 83-1-E | - | 3.048/10 | CL | ** | N/A | 19.8 | 1.73 | $4.27 \times 10^{-8}$ | Dames and Moore 1983 (b) |
| 83-1-E | - | 13.594/44.6 | CL | ** | N/A | 20.5 | 1.85 | $3.01 \times 10^{-8}$ | " |
| 83-2-E | - | 6.096/20 | ML | ** | N/A | 11.7 | 1.99 | $1.94 \times 10^{-8}$ | " |

*Tests were run on samples prepared in laboratory by compacting these samples as optimum moisture content.

**Falling head test

TABLE A.3.6-5 (2 of 3)

Summary of Hydraulic Conductivity Results

| Boring No. | Sample No. | Depth (m/ft) | Soil Type (Unified) | Head (kPa) | Effective Confining Pressure (kPa) | Water Content Percent | Dry Density (g/cc) | Hydraulic Conductivity (cm/sec) | Reference |
|---|---|---|---|---|---|---|---|---|---|
| 83-2-E | - | 12.314/40.4 | ML | ** | N/A | 19.9 | 1.82 | $2.00 \times 10^{-8}$ | " |
| 83-2-E | - | 15.240/50 | ML | ** | N/A | 27.2 | 1.56 | $3.13 \times 10^{-8}$ | " |
| 83-2-E | - | 21.336/70 | CL | ** | N/A | 23.0 | 1.71 | $2.89 \times 10^{-8}$ | " |
| 83-3-E | - | 3.048/10 | CL | ** | N/A | 15.5 | 1.89 | $3.12 \times 10^{-8}$ | " |
| 83-3-E | - | 6.096/20 | CL | ** | N/A | 13.5 | 1.95 | $1.47 \times 10^{-8}$ | " |
| 83-3-E | - | 9.144/30 | ML | ** | N/A | 13.5 | 1.94 | $1.58 \times 10^{-8}$ | " |
| 83-3-E | - | 12.466/40.9 | ML | ** | N/A | 21.4 | 1.68 | $3.96 \times 10^{-8}$ | " |
| 83-3-E | - | 15.240/50 | SM-SC | ** | N/A | 11.8 | 2.26 | $4.42 \times 10^{-8}$ | " |
| 83-3-E | - | 18.288/60 | ML | ** | N/A | 36.0 | 1.36 | $3.81 \times 10^{-8}$ | " |
| 82-1-D | - | 15.240/50 | CL | ** | N/A | 16.3 | 1.87 | $5.04 \times 10^{-8}$ | Dames and Moore 1983 (a) |
| 82-1-D | - | 18.288/60 | CL | ** | N/A | 11.8 | 2.09 | $8.03 \times 10^{-8}$ | " |
| 82-1-D | - | 21.306/69.9 | CL/GC | ** | N/A | 13.7 | 2.05 | $3.80 \times 10^{-8}$ | " |

*Test were run on samples prepared in laboratory by compacting these samples at optimum moisture content.

**Falling head test

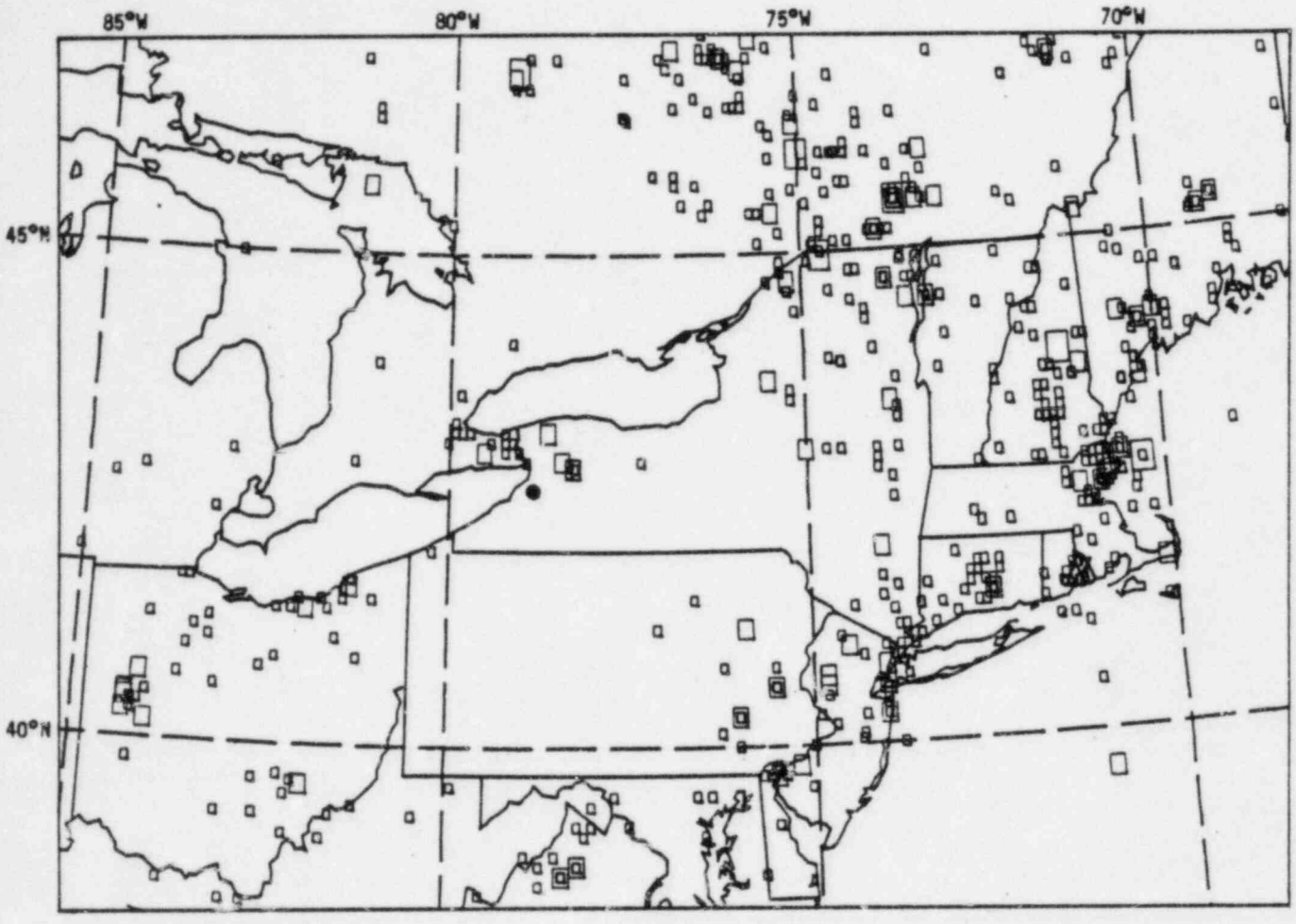
TABLE A.3.6-5 (3 of 3)

Summary of Hydraulic Conductivity Results

| Boring No. | Sample No. | Depth (m/ft) | Soil Type (Unified) | Head (kPa) | Effective Confining Pressure (kPa) | Water Content Percent | Dry Density (g/cc) | Hydraulic Conductivity (cm/sec) | Reference |
|---|---|---|---|---|---|---|---|---|---|
| 82-1-D | - | 24.293/79.7 | CL/ML | ** | N/A/ | 15.0 | 1.79 | $7.27 \times 10^{-8}$ | Dames and Moore 1983 (a) |
| 82-3-D | - | 16.124/52.9 | CL | ** | N/A | 12.8 | 1.95 | $7.91 \times 10^{-8}$ | " |
| 82-3-D | - | 18.288/60 | CL | ** | N/A | 11.7 | 2.03 | $5.67 \times 1^{-8}$ | " |
| 82-3-D | - | 24.994/82 | CL/ML | ** | N/A | 25.4 | 1.60 | $1.26 \times 10^{-8}$ | " |

*Test were run on samples prepared in laboratory by compacting these samples at optimum moisture content.

**Falling head test.



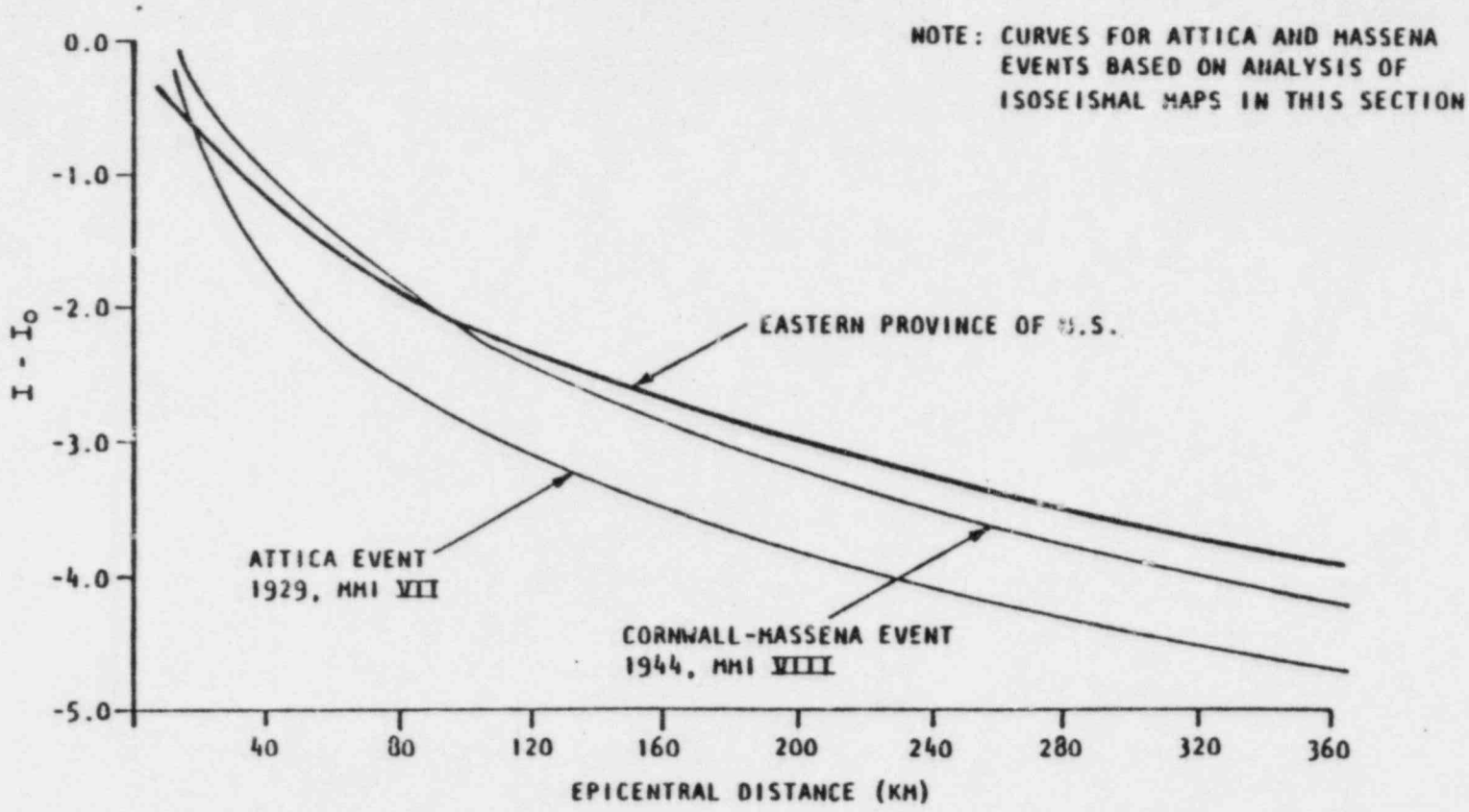

LEGEND:

MAGNITUDE

- $3.5 \leq m_b < 4.5$
- $4.5 \leq m_b < 5.5$
- $5.5 \leq m_b$

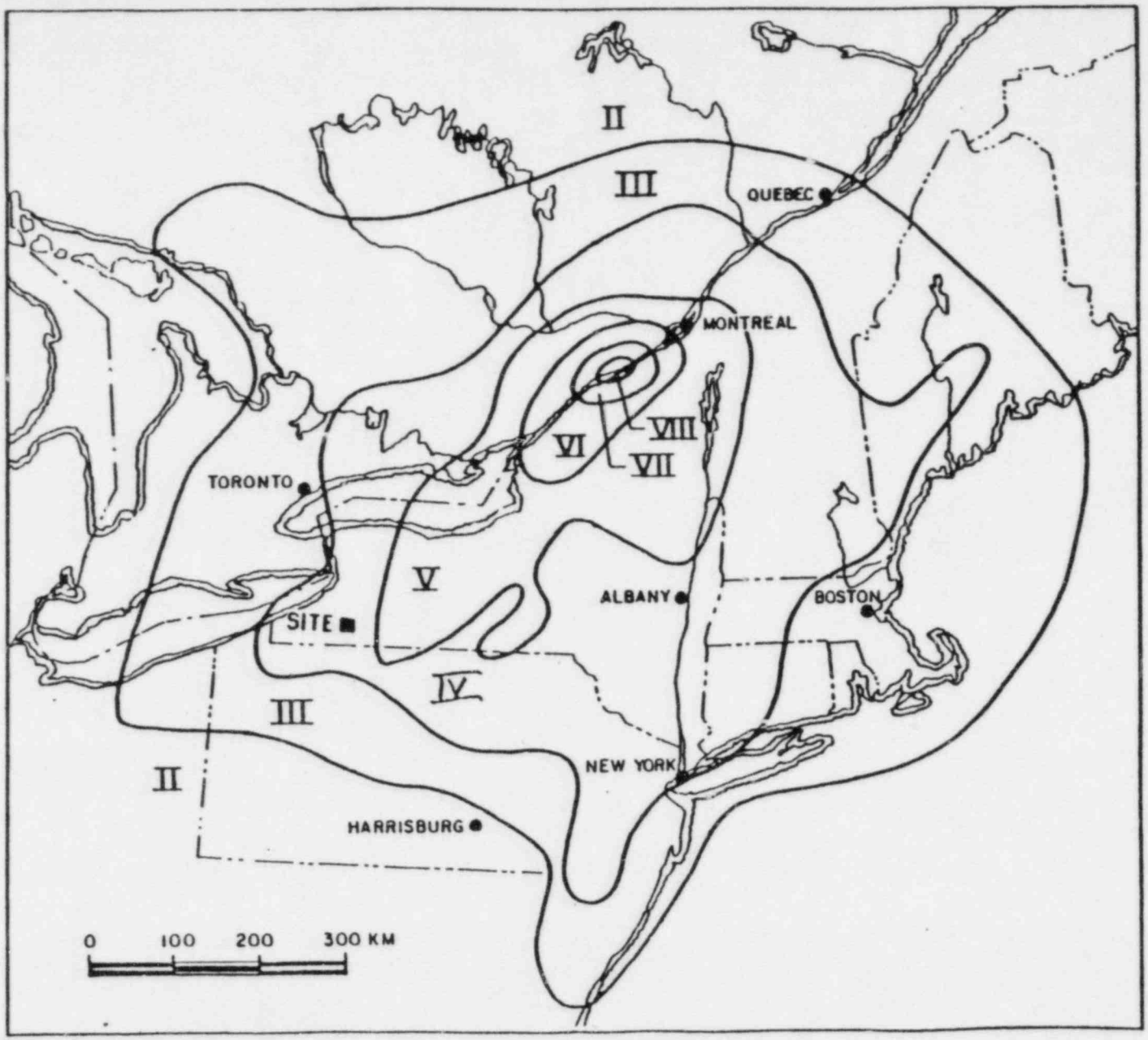
# SEISMICITY IN THE WEST VALLEY AREA

FIGURE A.3.6-1



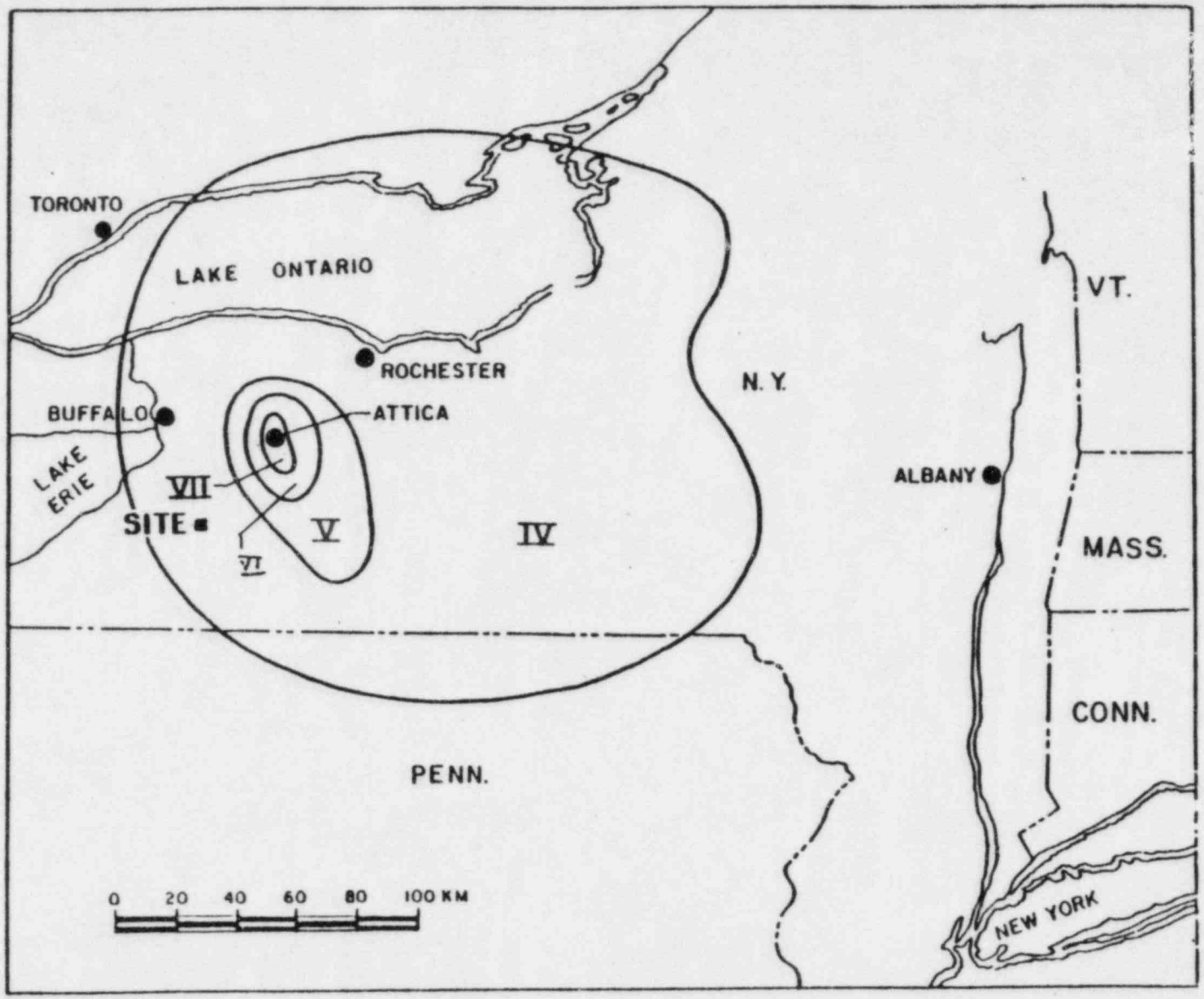

COMPARISON OF GENERAL EASTERN UNITED STATES ATTENTUATION WITH ACTUAL EXPERIENCE IN SITE REGION

FIGURE A.3.6-2



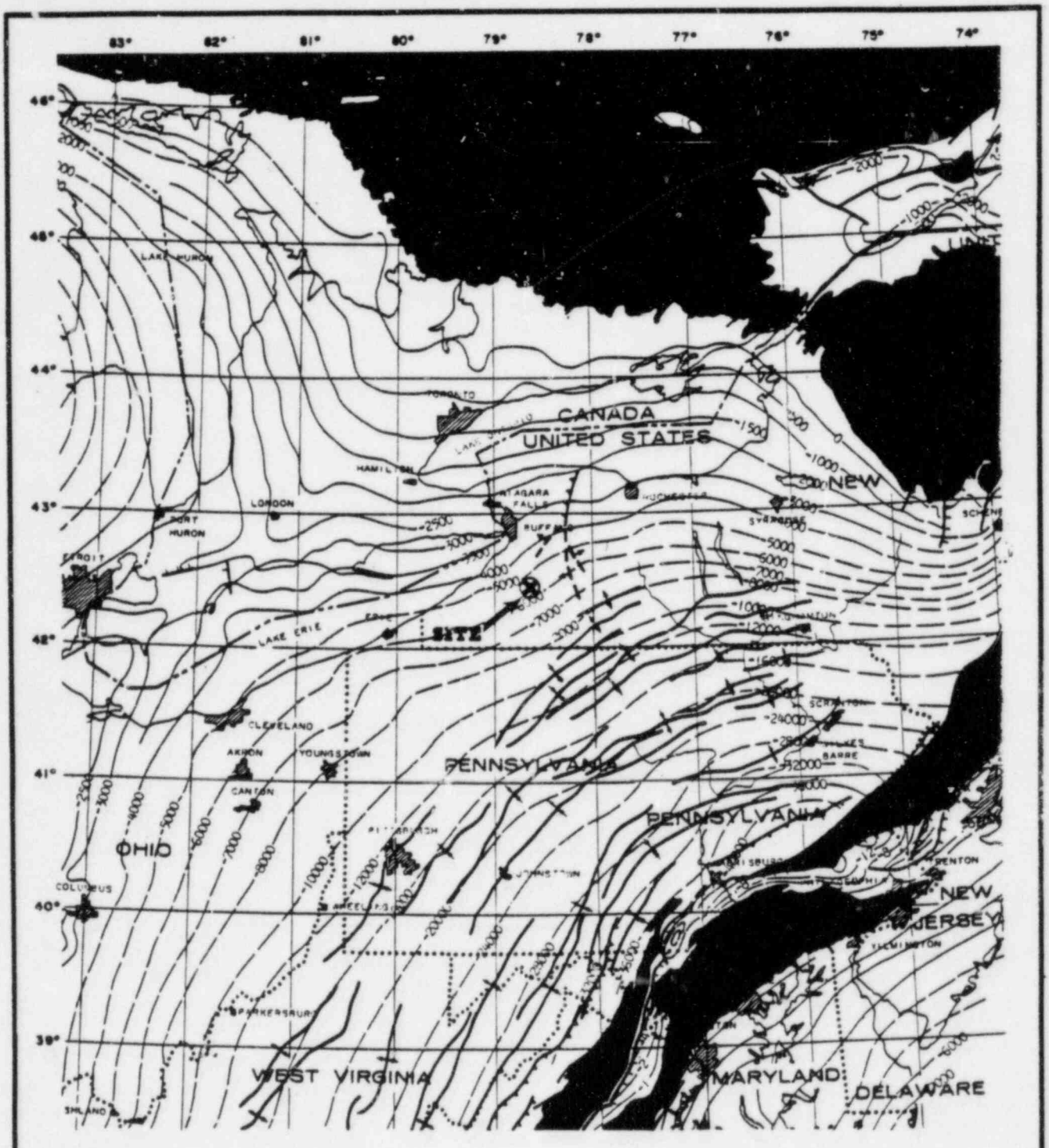

ISOSEISMAL MAP OF THE CORNWALL-MASSENA
EARTHQUAKE SEPT. 5, 1944, MMI VIII

FIGURE A.3.6-3




ISOSEISMAL MAP OF THE ATTICA
EARTHQUAKE OF AUG. 12, 1929, MMI VII

FIGURE A.3.6-4




# REGIONAL TECTONIC MAP

STATUTE MILES

50 25 0 50 100

KEY:

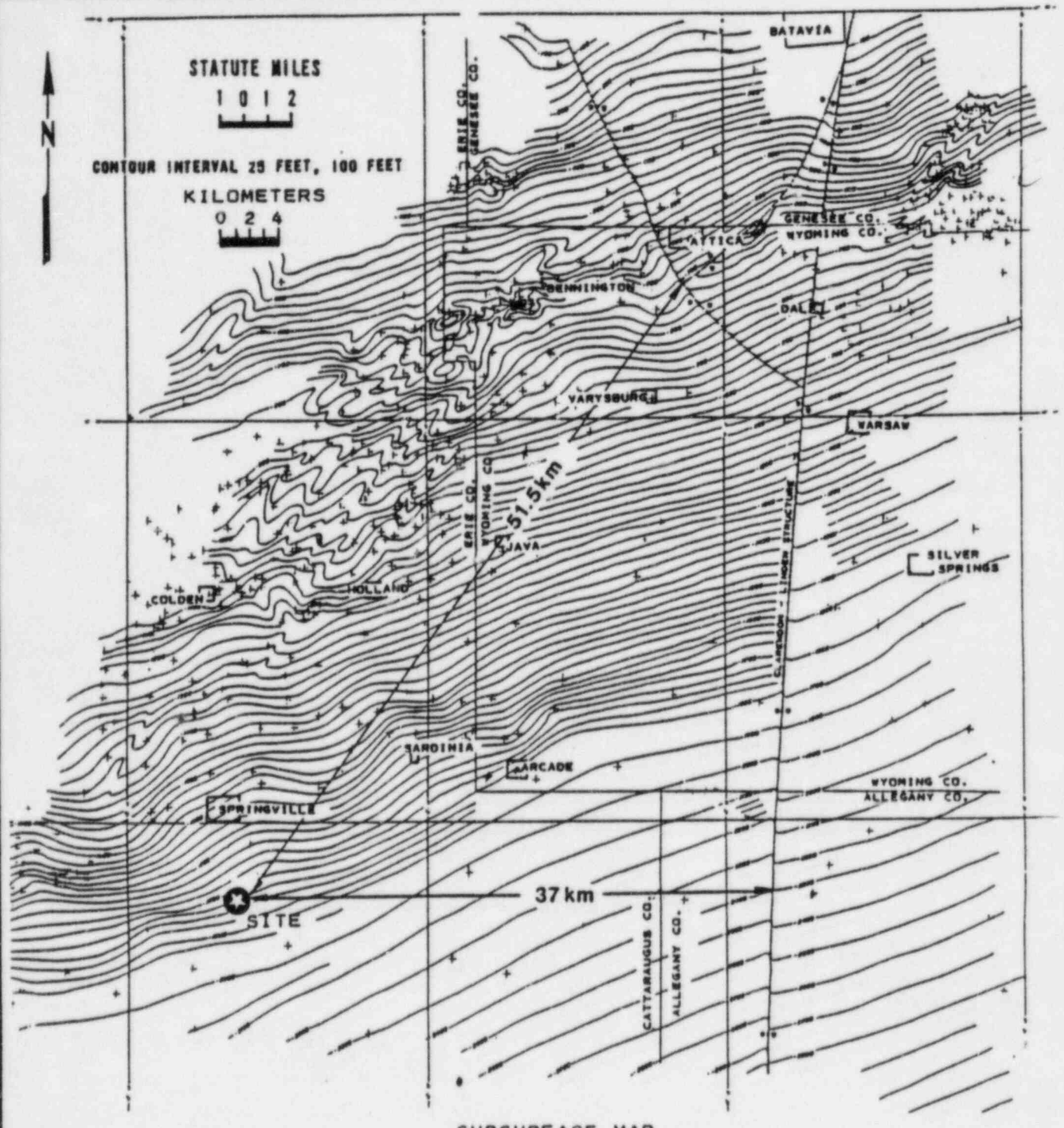
- CONTOURS OF BASEMENT ROCK SURFACE
- BASEMENT ROCK OUTCROP
- SYNCLINAL AXIS
- ANTICLINAL AXIS
- NORMAL FAULT
- THRUST FAULT
- UNDIFFERENTIATED FAULT
- MONOCLINAL FLEXURE

REFERENCE:

THIS MAP WAS PREPARED FROM A PORTION OF THE U.S.G.S. "IFR WALL PLANNING CHART, EAST AND WEST, 1968."

MAJOR TECTONIC FEATURES WERE TAKEN FROM A PORTION OF THE "TECTONIC MAP OF THE UNITED STATES" BY U.S.G.S. AND A.A.P.G., 1962. (SEE TEXT FOR SEISMOLOGY REFERENCES)

FIGURE A.3.6-5




SUBSURFACE MAP
SHOWING STRUCTURE CONTOURS ON THE MEDINA FORMATION

MAP PREPARED BY ARTHUR M. VAN TYNE,
GEOLOGIST, N.Y.S. GEOLOGICAL SURVEY
WELLSVILLE, N.Y., JULY & AUGUST, 1971.
BASED ON FIELD-CHECKED, CORRECTED EXPLOR-
ATORY WELL LOG DATA, PUBLISHED AN UNPUBLISHED.

THE BASE FOR THIS MAP WAS PREPARED FROM
PORTIONS OF THE FOLLOWING U.S.G.S. 15
MINUTE QUADRANGLE MAPS: ATTICA 1949,
ARCADE 1953, BATAVIA 1960, PORTAGE 1953
DEPEW 1948, SPRINGVILLE 1953, ELLICOTTVILLE
1939, & FRANKLINVILLE 1938.
SOURCE: NYS, 1975

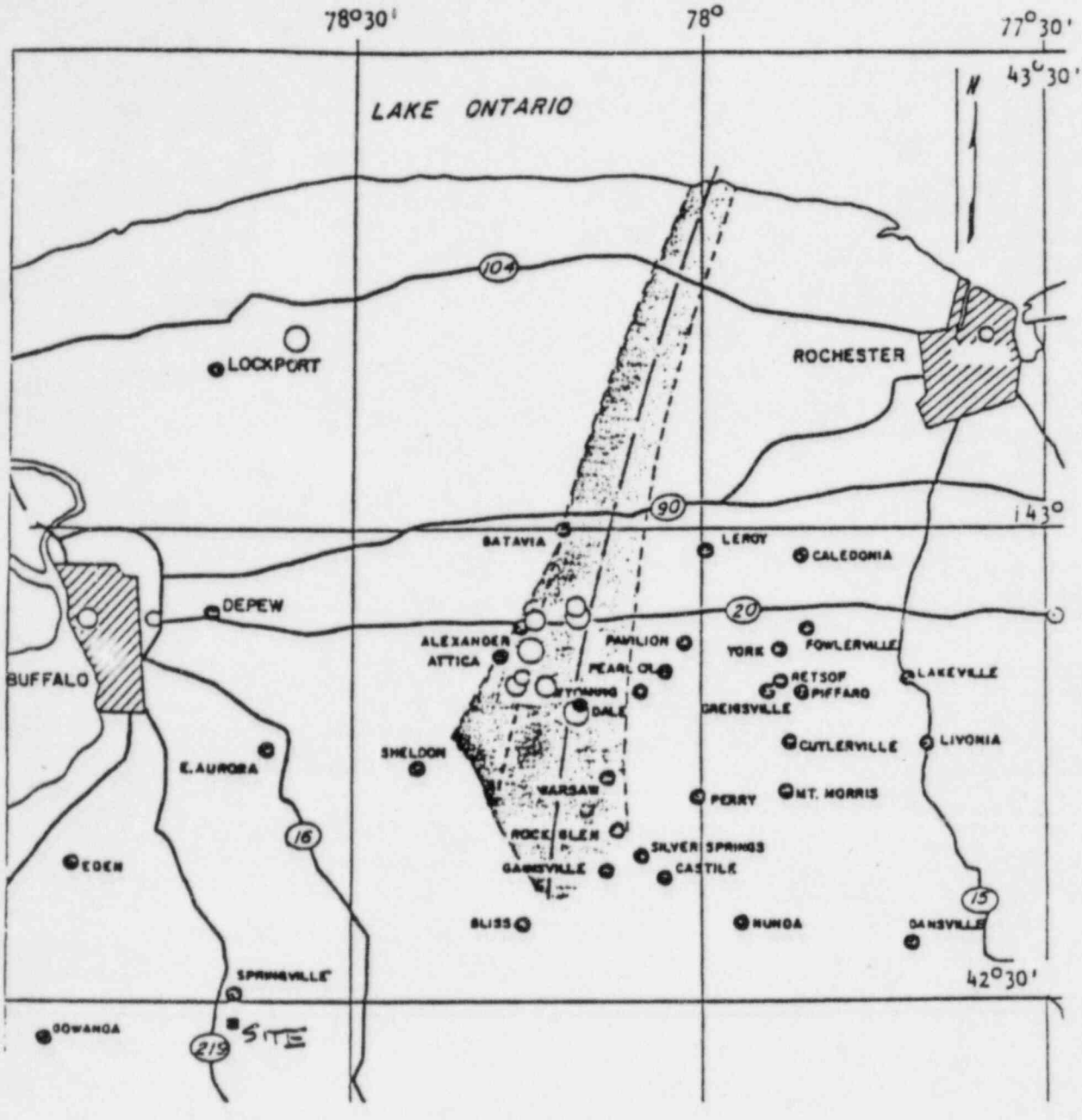
LEGEND:

—1500— CONTOUR LINE SHOWING DEPTH BELOW SEA LEVEL TO TOP OF MEDINA

\+ WELL LOCATION

---------- FAULT

FIGURE A.3.6-6




CLARENDON-LINDEN FAULT AND
ASSOCIATED EARTHQUAKES, 1975 INTERPRETATION

KEY:

CLARENDON -LINDEN FAULT AND
POSTULATED RELATED STRUCTURE*

INTENSITY

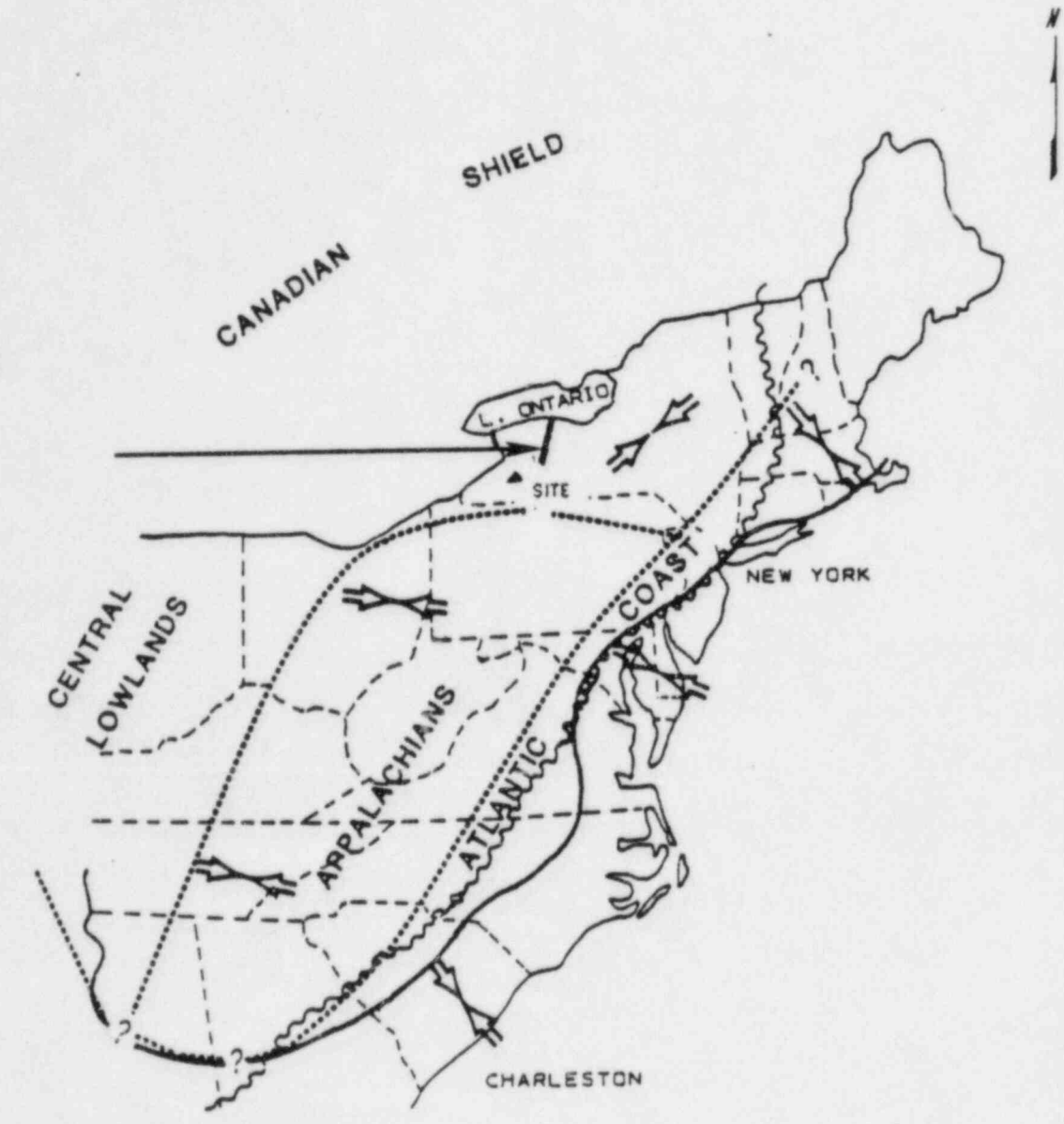
- 8-6
- 5-3
- 2-0

SCALE IN MILES

0 10

*VAN TYNE-N.Y. GEOLOGICAL SURVEY OPEN FILE REPORT APRIL /75

FIGURE A.3.6-7




SOURCE:
Reference: Zoback and Zoback, 1980

FIGURE A.3.6-8

STRESS PROVINCES

SCALE 1:5,000,000
1 INCH EQUALS APPROXIMATELY 80 MILES

25 0 25 50 75 100 MILES

25 0 25 50 75 100 KILOMETERS

LEGEND:

GEOLOGIC BOUNDARY

TECTONIC PROVINCE BOUNDARY
DASHED WHERE CONCEALED BY
YOUNGER DEPOSITS

MAJOR ANTICLINE OR ANTICLINORIUM

MAJOR SYNCLINE OR SYNCLINORIUM

ARCH SHOWING APPROXIMATE LOCATION
OF AXIS

DOME

HIGH-ANGLE FAULT
KNOWN; ARROWS SHOW RELATIVE
MOVEMENT. DASHED WHERE
APPROXIMATELY LOCATED OR COVERED
BY YOUNGER DEPOSITS

LOW-ANGLE FAULT
SAWTEETH ON UPPER PLATE. DASHED
WHERE COVERED BY YOUNGER
DEPOSITS

NOTE: BLACK QUADRANTS OF FOCAL MECHANISM
SOLUTIONS INDICATE COMPRESSION,
BLANK QUADRANTS INDICATE DILATATION.


REFERENCES:

HADLEY, J.B.; DEVINE, J.F. SEISMOTECTONIC MAP OF THE EASTERN UNITED STATES. USGS; MF-620; 1974.

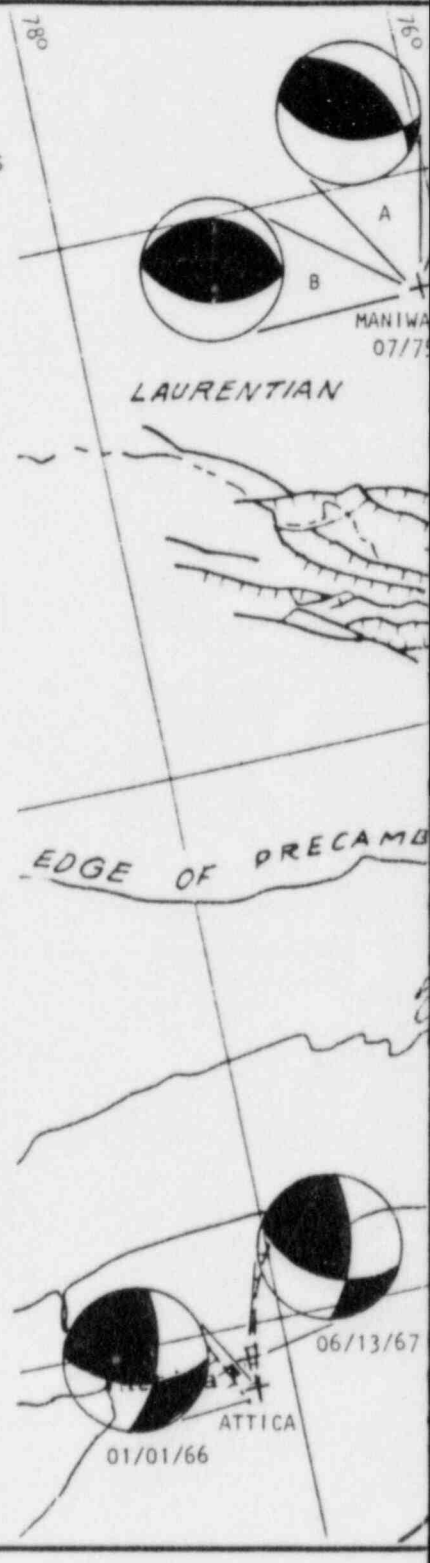
AGGARWAL, Y.P.; SYKES, L.R. EARTHQUAKE HAZARD STUDIES IN THE NORTHEASTERN UNITED STATES. USGS; OPEN FILE REPORT 81-943, 1981.

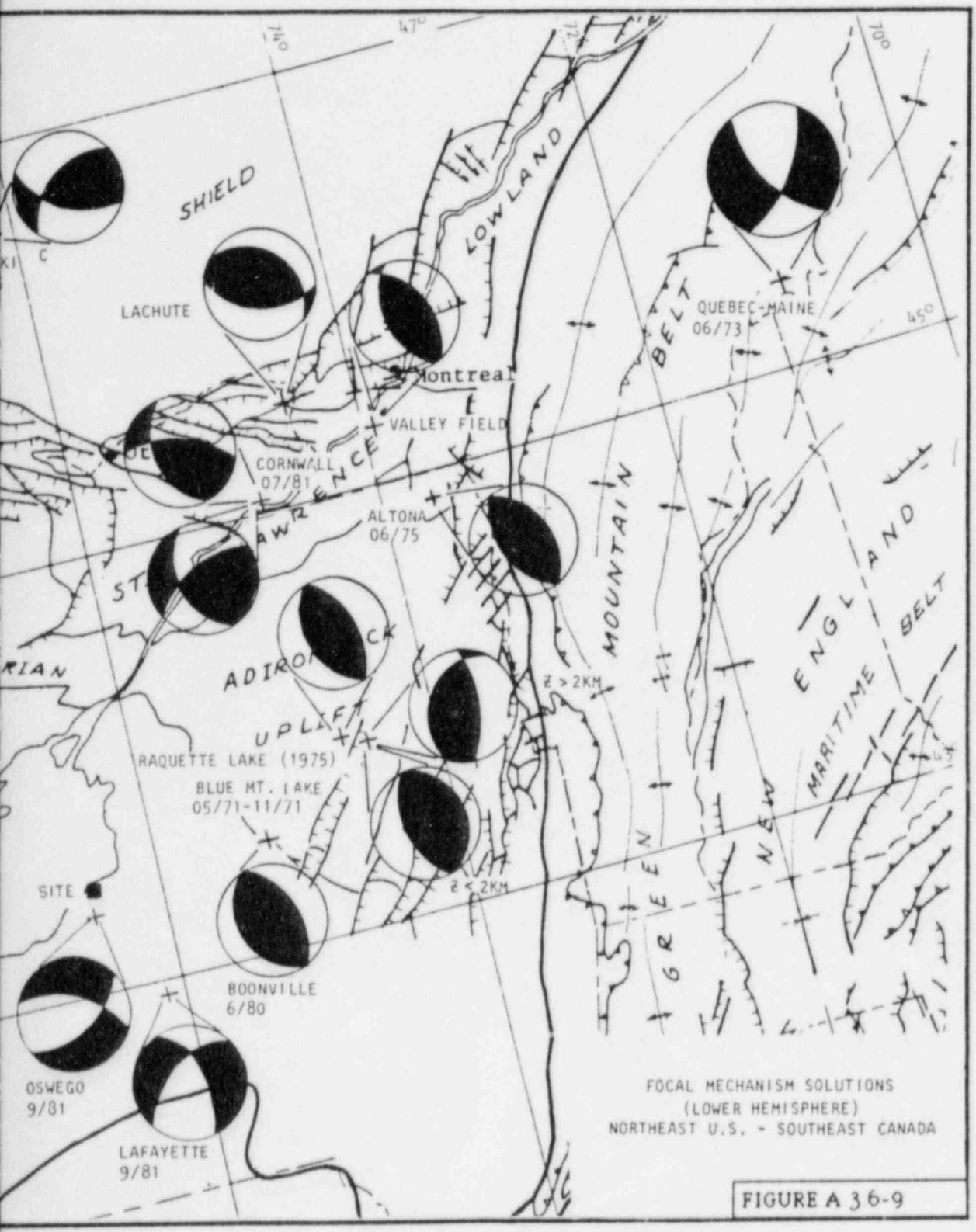
HORNER, R.B.; ET AL. FOCAL PARAMETERS OF THE JULY 12, 1975 MANIWAKI QUEBEC EARTHQUAKE - AN EXAMPLE OF INTRAPLATE SEISMICITY IN EASTERN CANADA, BULL. SEIS. SOC. AMER., 68(3): 619-640, 1978.

SCHLESINGER-MILLER, E.A.; ET AL. RECENT EARTHQUAKES NEAR CORNWALL ONTARIO. (ABSTR) PROC. SEIS. SOC. AMER. 53RD ANN. MTG. EASTERN SECTION; 1981.

SBAR, M.L. (ET AL) THE ADIRONDACK, N.Y., EARTHQUAKE SWARM OF 1971 AND TECTONIC IMPLICATIONS. BULL. SEIS. SOC. AMER. (62) 1303-1317, 1972.

HERMAN, R.B. A SEISMOLOGICAL STUDY OF TWO ATTICA, NEW YORK EARTHQUAKES. BULL. SEIS. SOC. AMER. 1978, 68(3), P 641-651.




FOCAL MECHANISM SOLUTIONS
(LOWER HEMISPHERE)
NORTHEAST U.S. - SOUTHEAST CANADA

FIGURE A 36-9

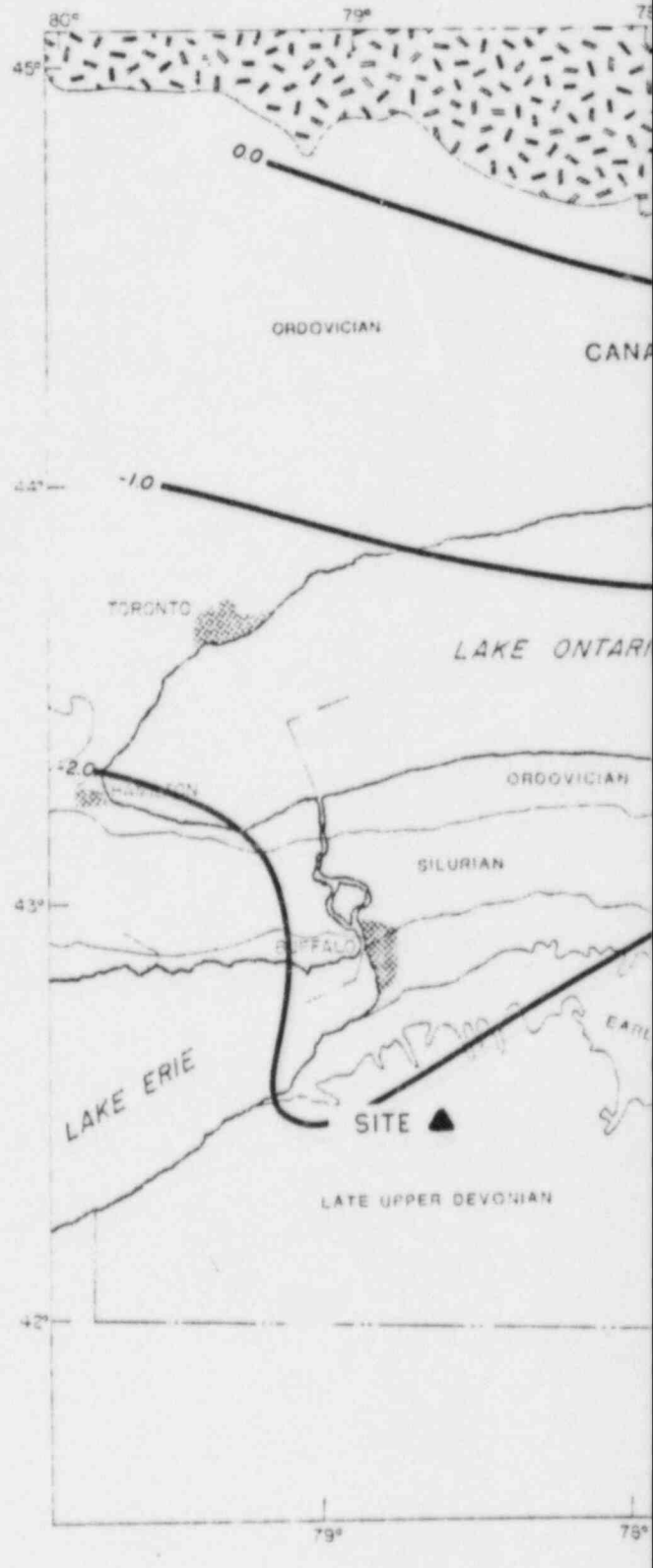
Also Available On
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CARD

8507030441 - 18

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CARD




SYNTHESIZED FROM ALL
AVAILABLE DATA

10 0 10 20 30 40
SCALE IN MILES

10 0 10 20 30 40 50 60 70
SCALE IN KILOMETERS

1.0 CONTOURS ARE IN MM/YR

LEGEND:

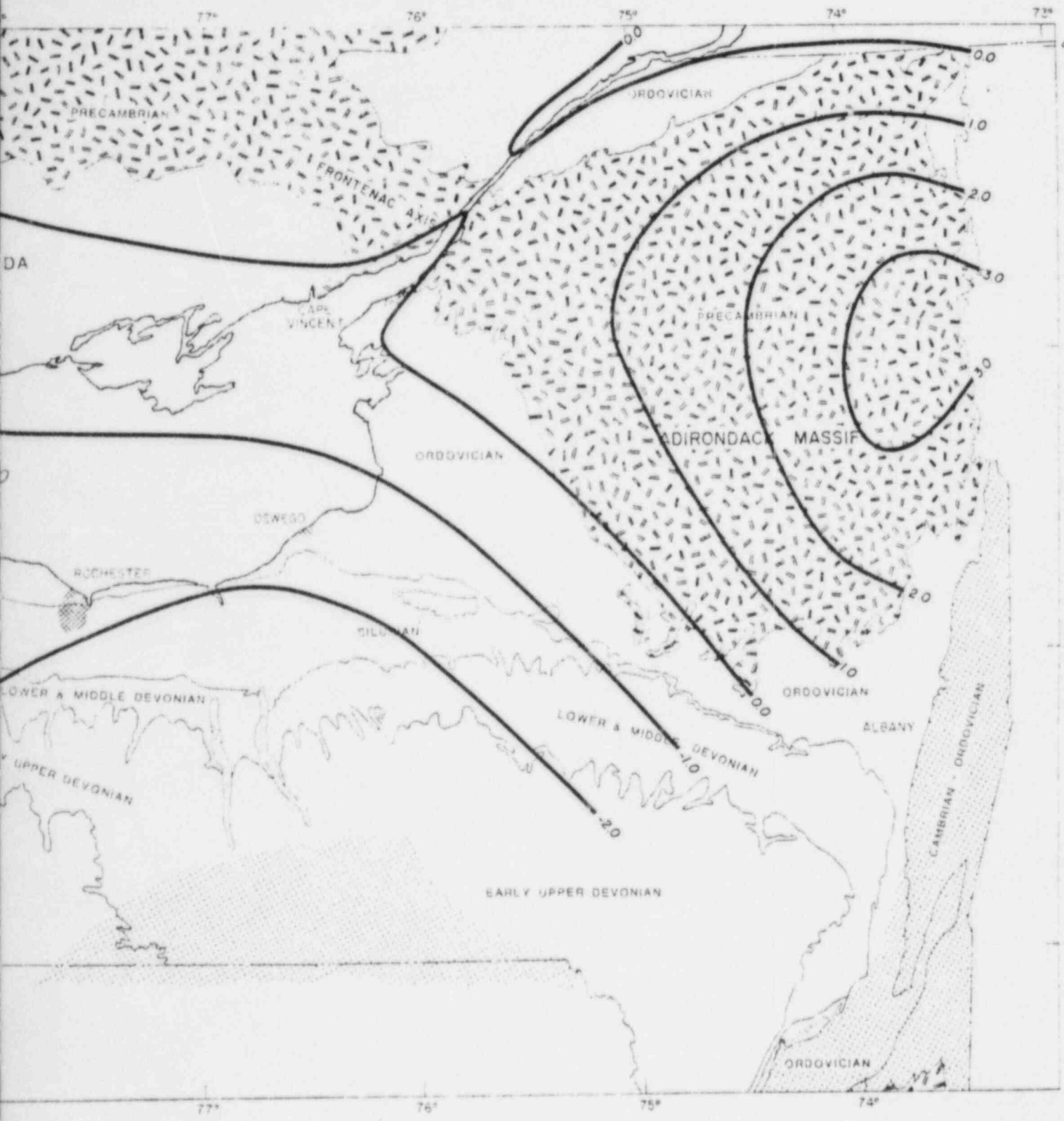
FOLDED AND FAULTED PALEOZOIC SEDIMENTS

PRECAMBRIAN BASEMENT

REFERENCES:

BROUGHTON, J.G. et al., 1966, GEOLOGY OF NEW YORK - A SHORT ACCOUNT
EDUCATIONAL LEAFLET No.20 NEW YORK STATE MUSEUM AND SCIENCE SERVICE

GEOLOGICAL SURVEY OF CANADA (1969) GEOLOGICAL MAP OF CANADA No. 1250 A




INTERPRETATION OF VERTICAL CRUSTAL VELOCITY FOR LAKE ONTARIO REGION RELATIVE TO CAPE VINCENT, N.Y.

FIGURE A.3.6-10

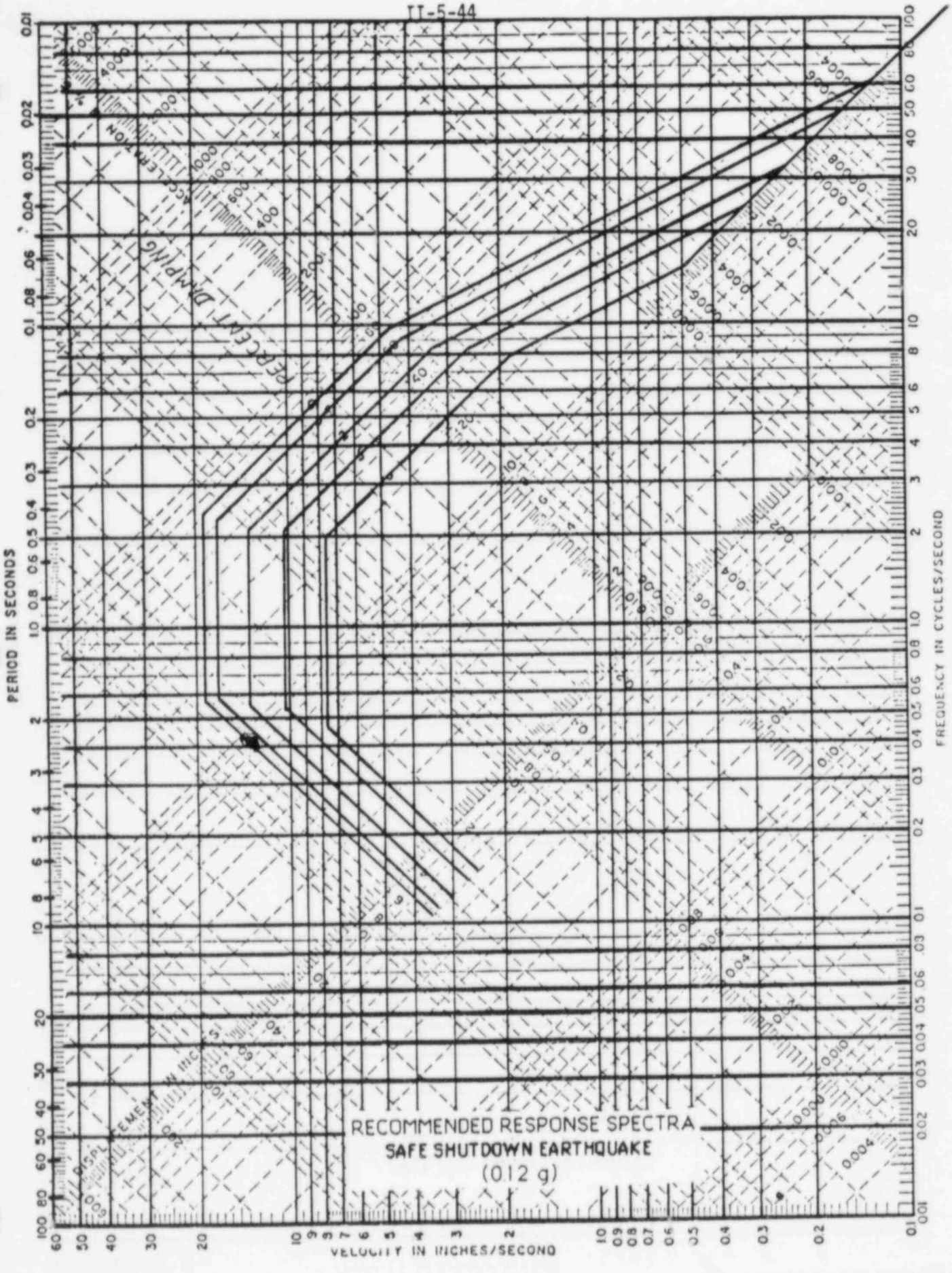



FIGURE A.3.6-11

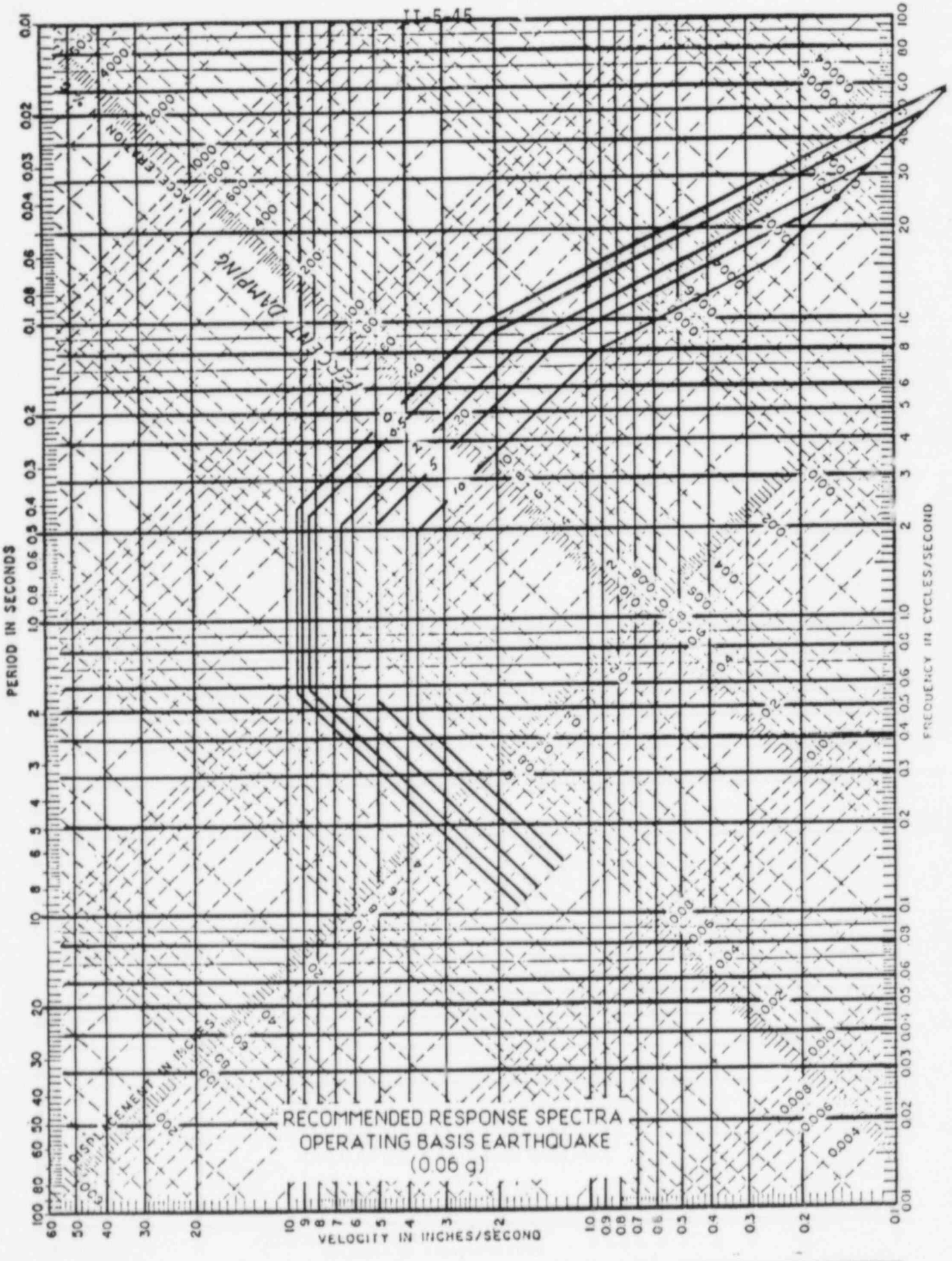
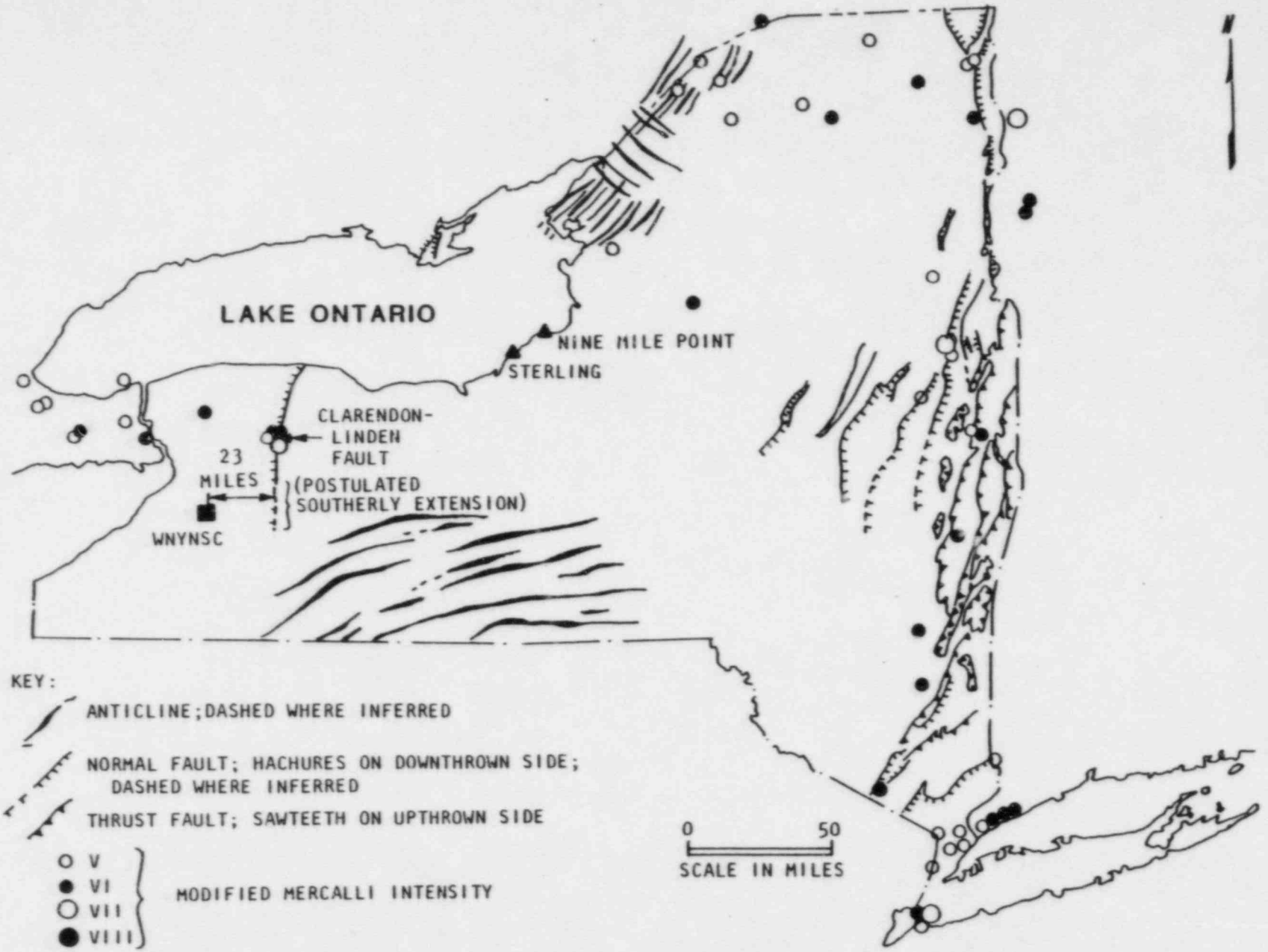
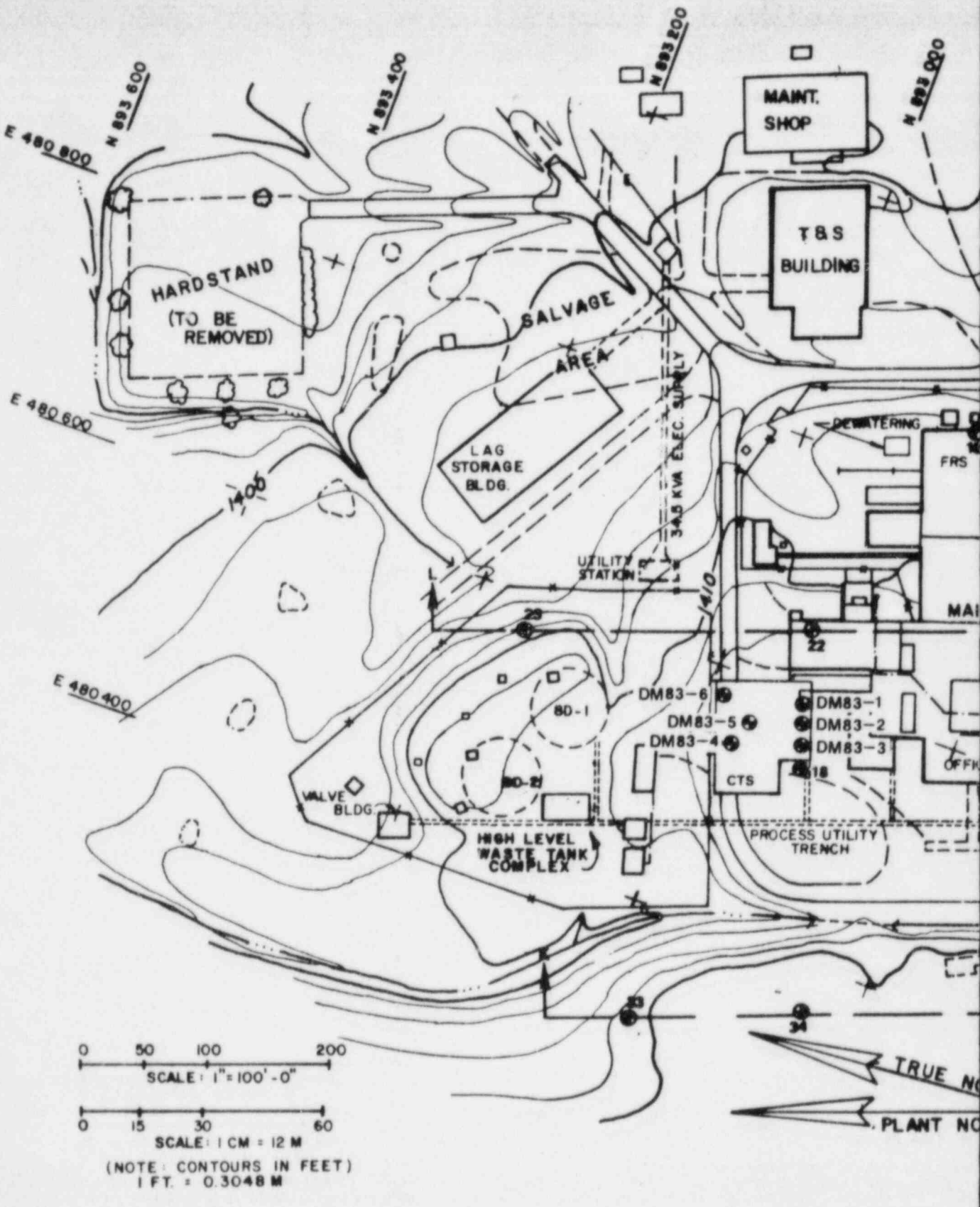


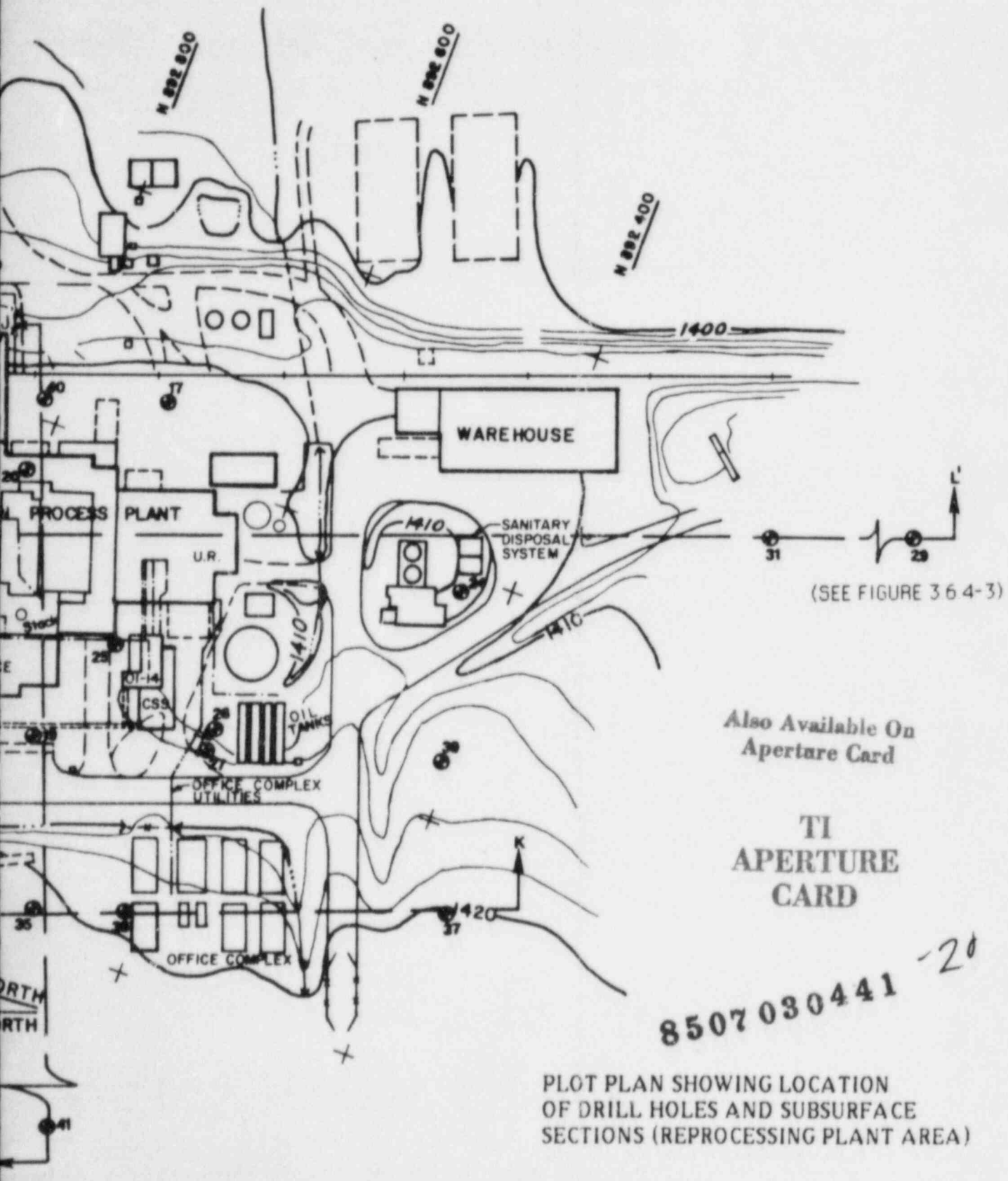

FIGURE A.3.6-12




GENERALIZED SEISMO-TECTONIC MAP
OF NEW YORK
SHOWING HISTORICAL SEISMICITY

FIGURE A.3.6-13


N 893 600
N 893 400
N 893 200
N 893 000
E 480 800
E 480 600
E 480 400
MAINT. SHOP
T & S BUILDING
HARDSTAND
(TO BE REMOVED)
SALVAGE AREA
LAG STORAGE BLDG.
345 KVA ELEC. SUPPLY
DEWATERING
FRS
UTILITY STATION
1405
1410
80-1
80-2
DM83-6
DM83-5
DM83-4
DM83-1
DM83-2
DM83-3
CTS
VALVE BLDG.
HIGH LEVEL WASTE TANK COMPLEX
PROCESS UTILITY TRENCH
TRUE NO
PLANT NO
0 50 100 200
SCALE: 1"=100'-0"
0 15 30 60
SCALE: 1 CM = 12 M
(NOTE: CONTOURS IN FEET)
1 FT. = 0.3048 M



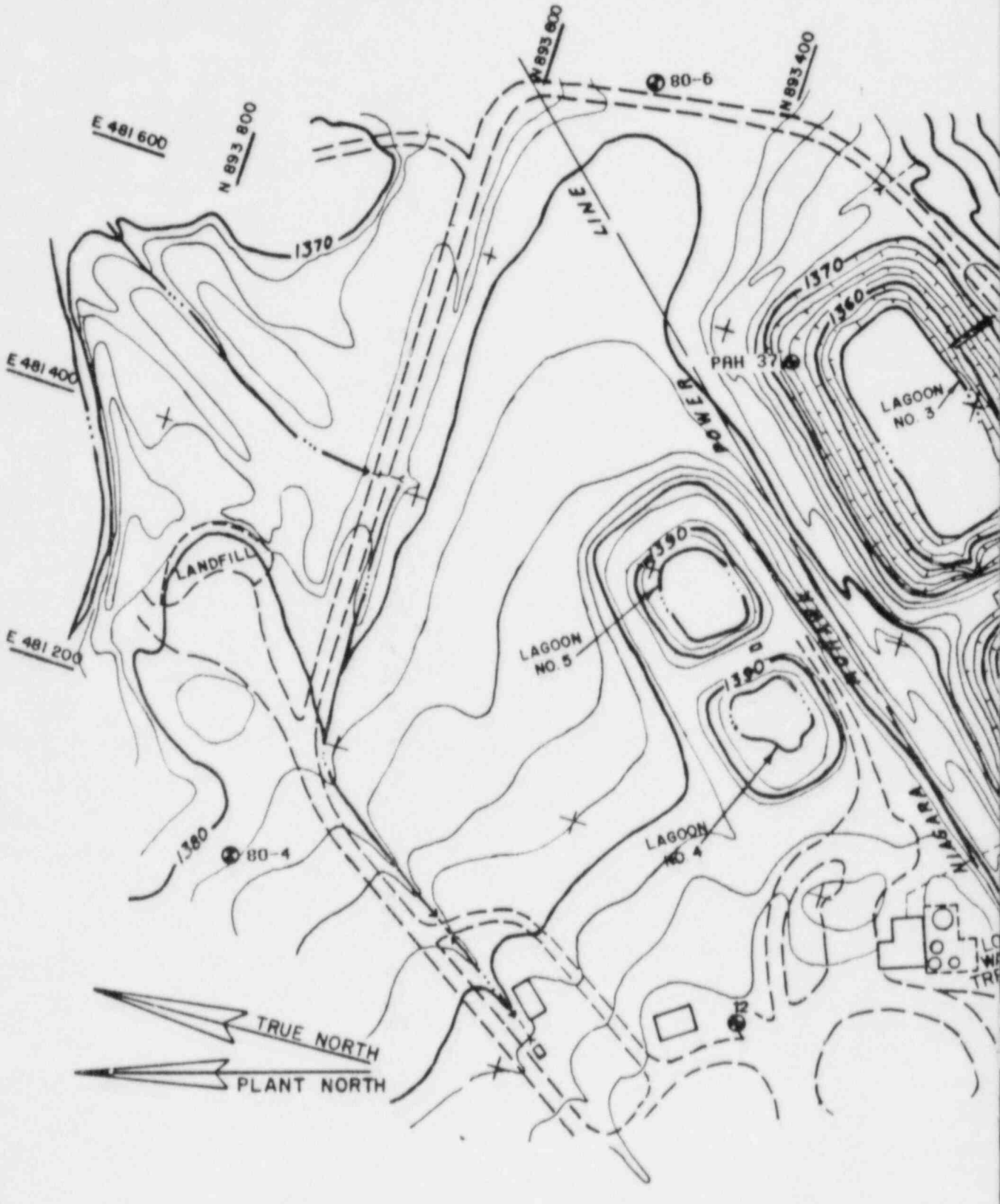

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PLOT PLAN SHOWING LOCATION
OF DRILL HOLES AND SUBSURFACE
SECTIONS (REPROCESSING PLANT AREA)

FIGURE A 3.6-14


E 481 600
N 893 800
N 893 600
N 893 400
80-6
1370
E 481 400
LINE
POWER
PAH 37
1370
1360
LAGOON NO. 3
LANDFILL
E 481 200
1390
LAGOON NO. 5
1390
NIAGARA
1380
80-4
LAGOON NO. 4
TRUE NORTH
PLANT NORTH



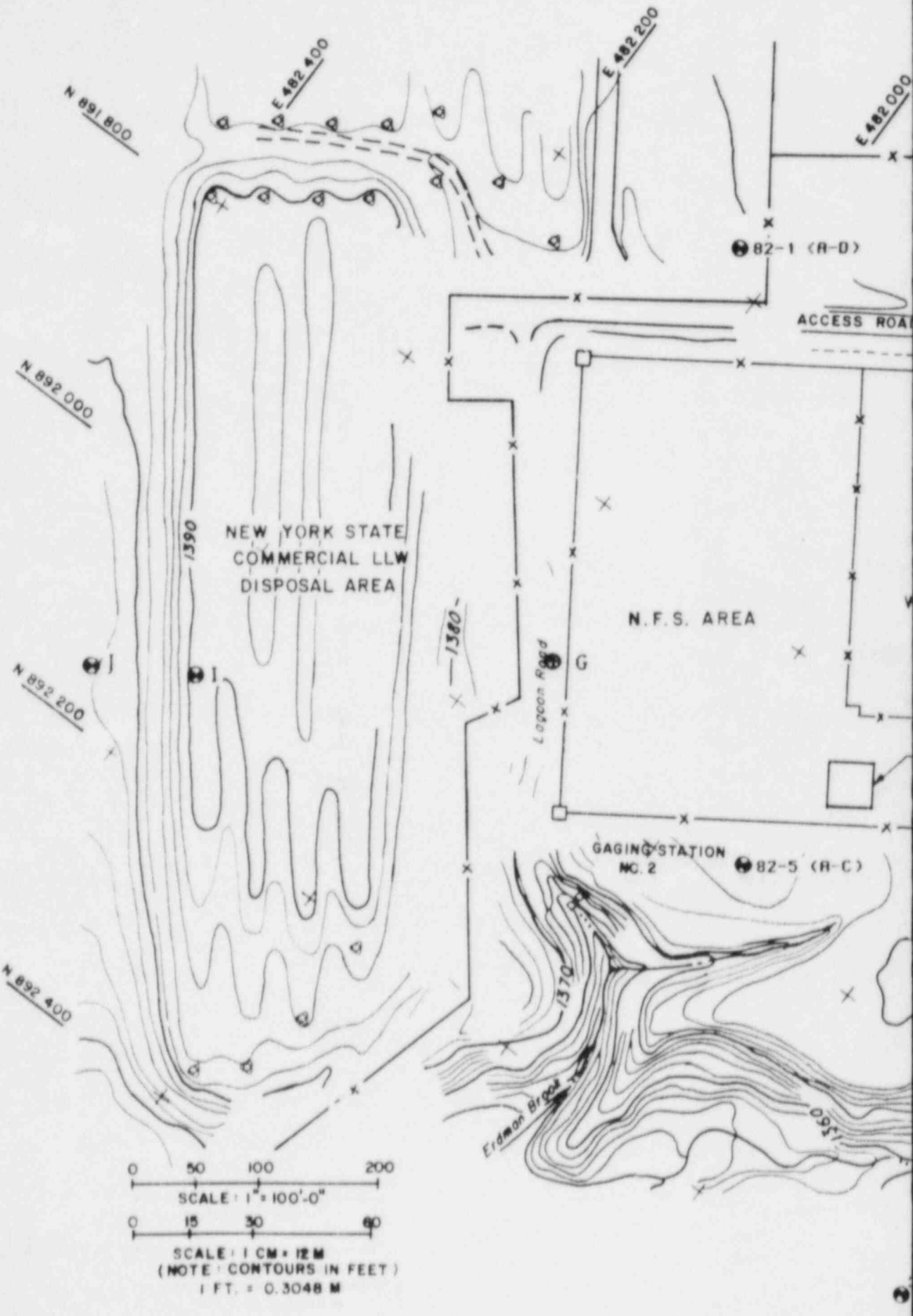

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PLOT PLAN SHOWING LOCATIONS
OF DRILL HOLES (LOW-LEVEL WASTE
TREATMENT FACILITY AREA)

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FIGURE A.3.6-15


E 482 400
E 482 200
E 482 000
N 891 800
82-1 (A-D)
ACCESS ROAD
N 892 000
NEW YORK STATE
COMMERCIAL LLW
DISPOSAL AREA
1390
1380
N.F.S. AREA
G
I
I
N 892 200
Lodge Road
GAGING STATION
NO. 2
82-5 (A-C)
1370
N 892 400
Erdman Brook
0 50 100 200
SCALE: 1" = 100'-0"
0 15 30 60
SCALE: 1 CM = 12 M
(NOTE: CONTOURS IN FEET)
1 FT. = 0.3048 M




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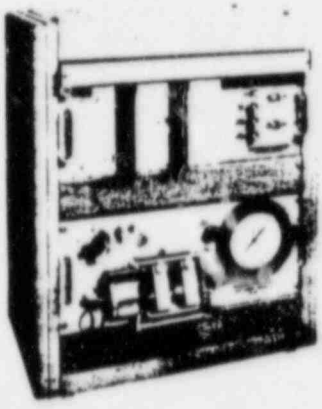
PLOT PLAN SHOWING LOCATIONS
OF DRILL HOLES
(SOLID WASTE DISPOSAL AREA)

8507030441-22

FIGURE A.3.6-16

## METHOD OF PERFORMING DIRECT SHEAR AND FRICTION TESTS

DIRECT SHEAR TESTS ARE PERFORMED TO DETERMINE THE SHEARING STRENGTHS OF SOILS. FRICTION TESTS ARE PERFORMED TO DETERMINE THE FRICTIONAL RESISTANCES BETWEEN SOILS AND VARIOUS OTHER MATERIALS SUCH AS WOOD, STEEL, OR CONCRETE. THE TESTS ARE PERFORMED IN THE LABORATORY TO SIMULATE ANTICIPATED FIELD CONDITIONS.



DIRECT SHEAR APPARATUS WITH ELECTRONIC RECORDER

EACH SAMPLE IS TESTED WITHIN THREE BRASS RINGS, TWO AND ONE-HALF INCHES IN DIAMETER AND ONE INCH IN LENGTH. UNDISTURBED SAMPLES OF IN-PLACE SOILS ARE TESTED IN RINGS TAKEN FROM THE SAMPLING DEVICE IN WHICH THE SAMPLES WERE OBTAINED. LOOSE SAMPLES OF SOILS TO BE USED IN CONSTRUCTING EARTH FILLS ARE COMPACTED IN RINGS TO PREDETERMINED CONDITIONS AND TESTED.

### DIRECT SHEAR TESTS

A THREE-INCH LENGTH OF THE SAMPLE IS TESTED IN DIRECT DOUBLE SHEAR. A CONSTANT PRESSURE, APPROPRIATE TO THE CONDITIONS OF THE PROBLEM FOR WHICH THE TEST IS BEING PERFORMED, IS APPLIED NORMAL TO THE ENDS OF THE SAMPLE THROUGH POROUS STONES. A SHEARING FAILURE OF THE SAMPLE IS CAUSED BY MOVING THE CENTER RING IN A DIRECTION PERPENDICULAR TO THE AXIS OF THE SAMPLE. TRANSVERSE MOVEMENT OF THE OUTER RINGS IS PREVENTED.

THE SHEARING FAILURE MAY BE ACCOMPLISHED BY APPLYING TO THE CENTER RING EITHER A CONSTANT RATE OF LOAD, A CONSTANT RATE OF DEFLECTION, OR INCREMENTS OF LOAD OR DEFLECTION. IN EACH CASE, THE SHEARING LOAD AND THE DEFLECTIONS IN BOTH THE AXIAL AND TRANSVERSE DIRECTIONS ARE RECORDED AND PLOTTED. THE SHEARING STRENGTH OF THE SOIL IS DETERMINED FROM THE RESULTING LOAD-DEFLECTION CURVES.

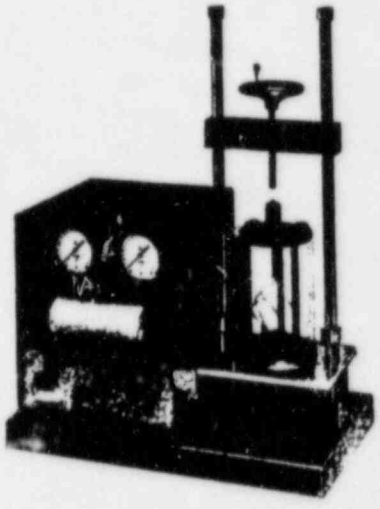
### FRICTION TESTS

IN ORDER TO DETERMINE THE FRICTIONAL RESISTANCE BETWEEN SOIL AND THE SURFACES OF VARIOUS MATERIALS, THE CENTER RING OF SOIL IN THE DIRECT SHEAR TEST IS REPLACED BY A DISK OF THE MATERIAL TO BE TESTED. THE TEST IS THEN PERFORMED IN THE SAME MANNER AS THE DIRECT SHEAR TEST BY FORCING THE DISK OF MATERIAL FROM THE SOIL SURFACES.

FIGURE A.3.6-17

## METHODS OF PERFORMING UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS

THE SHEARING STRENGTHS OF SOILS ARE DETERMINED FROM THE RESULTS OF UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS. IN TRIAXIAL COMPRESSION TESTS THE TEST METHOD AND THE MAGNITUDE OF THE CONFINING PRESSURE ARE CHOSEN TO SIMULATE ANTICIPATED FIELD CONDITIONS.



TRIAXIAL COMPRESSION TEST UNIT

UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS ARE PERFORMED ON UNDISTURBED OR REMOLDED SAMPLES OF SOIL APPROXIMATELY SIX INCHES IN LENGTH AND TWO AND ONE-HALF INCHES IN DIAMETER. THE TESTS ARE RUN EITHER STRAIN-CONTROLLED OR STRESS-CONTROLLED. IN A STRAIN-CONTROLLED TEST THE SAMPLE IS SUBJECTED TO A CONSTANT RATE OF DEFLECTION AND THE RESULTING STRESSES ARE RECORDED. IN A STRESS-CONTROLLED TEST THE SAMPLE IS SUBJECTED TO EQUAL INCREMENTS OF LOAD WITH EACH INCREMENT BEING MAINTAINED UNTIL AN EQUILIBRIUM CONDITION WITH RESPECT TO STRAIN IS ACHIEVED.

YIELD, PEAK, OR ULTIMATE STRESSES ARE DETERMINED FROM THE STRESS-STRAIN PLOT FOR EACH SAMPLE AND THE PRINCIPAL STRESSES ARE EVALUATED. THE PRINCIPAL STRESSES ARE PLOTTED ON A MOHR'S CIRCLE DIAGRAM TO DETERMINE THE SHEARING STRENGTH OF THE SOIL TYPE BEING TESTED.

UNCONFINED COMPRESSION TESTS CAN BE PERFORMED ONLY ON SAMPLES WITH SUFFICIENT COHESION SO THAT THE SOIL WILL STAND AS AN UNSUPPORTED CYLINDER. THESE TESTS MAY BE RUN AT NATURAL MOISTURE CONTENT OR ON ARTIFICIALLY SATURATED SOILS.

IN A TRIAXIAL COMPRESSION TEST THE SAMPLE IS ENCASED IN A RUBBER MEMBRANE, PLACED IN A TEST CHAMBER, AND SUBJECTED TO A CONFINING PRESSURE THROUGHOUT THE DURATION OF THE TEST. NORMALLY, THIS CONFINING PRESSURE IS MAINTAINED AT A CONSTANT LEVEL, ALTHOUGH FOR SPECIAL TESTS IT MAY BE VARIED IN RELATION TO THE MEASURED STRESSES. TRIAXIAL COMPRESSION TESTS MAY BE RUN ON SOILS AT FIELD MOISTURE CONTENT OR ON ARTIFICIALLY SATURATED SAMPLES. THE TESTS ARE PERFORMED IN ONE OF THE FOLLOWING WAYS:

UNCONSOLIDATED-UNDRAINED: THE CONFINING PRESSURE IS IMPOSED ON THE SAMPLE AT THE START OF THE TEST. NO DRAINAGE IS PERMITTED AND THE STRESSES WHICH ARE MEASURED REPRESENT THE SUM OF THE INTERGRANULAR STRESSES AND PORE WATER PRESSURES.

CONSOLIDATED-UNDRAINED: THE SAMPLE IS ALLOWED TO CONSOLIDATE FULLY UNDER THE APPLIED CONFINING PRESSURE PRIOR TO THE START OF THE TEST. THE VOLUME CHANGE IS DETERMINED BY MEASURING THE WATER AND/OR AIR EXPELLED DURING CONSOLIDATION. NO DRAINAGE IS PERMITTED DURING THE TEST AND THE STRESSES WHICH ARE MEASURED ARE THE SAME AS FOR THE UNCONSOLIDATED-UNDRAINED TEST.

DRAINED: THE INTERGRANULAR STRESSES IN A SAMPLE MAY BE MEASURED BY PERFORMING A DRAINED, OR SLOW, TEST. IN THIS TEST THE SAMPLE IS FULLY SATURATED AND CONSOLIDATED PRIOR TO THE START OF THE TEST. DURING THE TEST, DRAINAGE IS PERMITTED AND THE TEST IS PERFORMED AT A SLOW ENOUGH RATE TO PREVENT THE BUILDUP OF PORE WATER PRESSURES. THE RESULTING STRESSES WHICH ARE MEASURED REPRESENT ONLY THE INTERGRANULAR STRESSES. THESE TESTS ARE USUALLY PERFORMED ON SAMPLES OF GENERALLY NON-COHESIVE SOILS, ALTHOUGH THE TEST PROCEDURE IS APPLICABLE TO COHESIVE SOILS IF A SUFFICIENTLY SLOW TEST RATE IS USED.

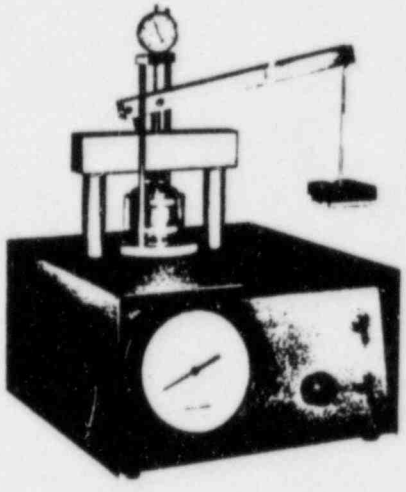
AN ALTERNATE MEANS OF OBTAINING THE DATA RESULTING FROM THE DRAINED TEST IS TO PERFORM AN UNDRAINED TEST IN WHICH SPECIAL EQUIPMENT IS USED TO MEASURE THE PORE WATER PRESSURES. THE DIFFERENCES BETWEEN THE TOTAL STRESSES AND THE PORE WATER PRESSURES MEASURED ARE THE INTERGRANULAR STRESSES.

FIGURE A.3.6-18

## METHOD OF PERFORMING CONSOLIDATION TESTS

CONSOLIDATION TESTS ARE PERFORMED TO EVALUATE THE VOLUME CHANGES OF SOILS SUBJECTED TO INCREASED LOADS. TIME-CONSOLIDATION AND PRESSURE-CONSOLIDATION CURVES MAY BE PLOTTED FROM THE DATA OBTAINED IN THE TESTS. ENGINEERING ANALYSES BASED ON THESE CURVES PERMIT ESTIMATES TO BE MADE OF THE PROBABLE MAGNITUDE AND RATE OF SETTLEMENT OF THE TESTED SOILS UNDER APPLIED LOADS.

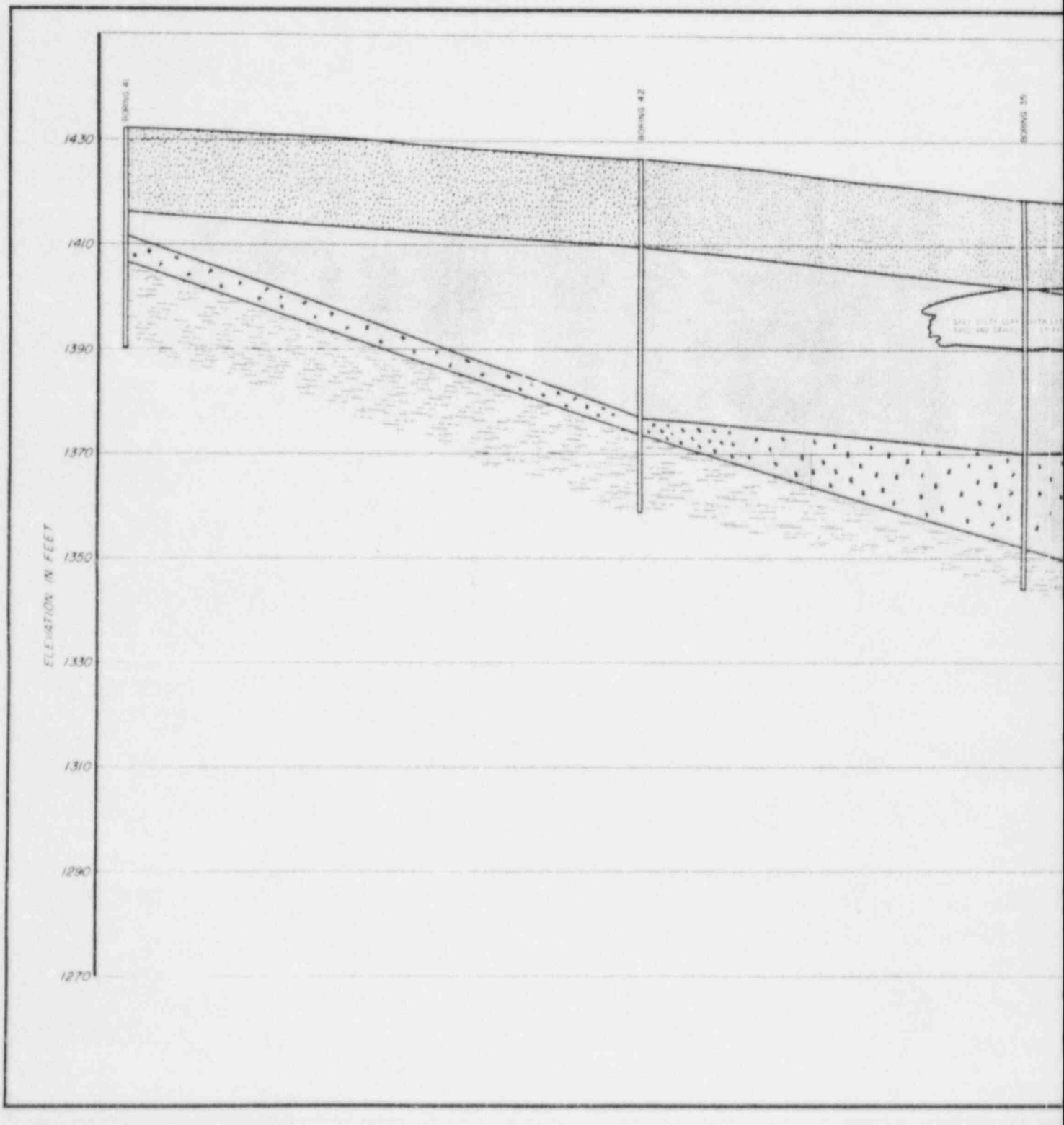
EACH SAMPLE IS TESTED WITHIN BRASS RINGS TWO AND ONE-HALF INCHES IN DIAMETER AND ONE INCH IN LENGTH. UNDISTURBED SAMPLES OF IN-PLACE SOILS ARE TESTED IN RINGS TAKEN FROM THE SAMPLING DEVICE IN WHICH THE SAMPLES WERE OBTAINED. LOOSE SAMPLES OF SOILS TO BE USED IN CONSTRUCTING EARTH FILLS ARE COMPACTED IN RINGS TO PREDETERMINED CONDITIONS AND TESTED.

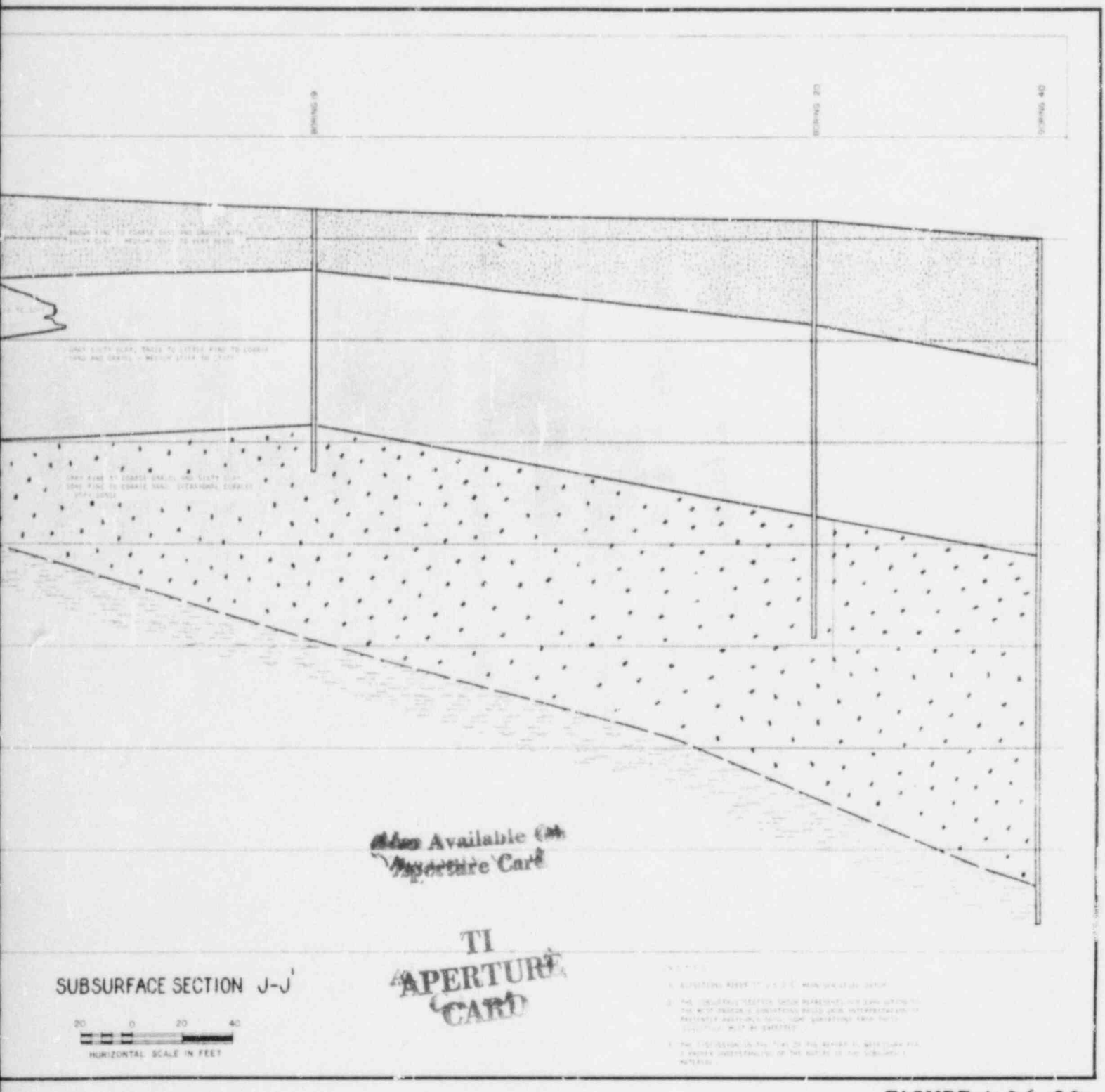


DEAD LOAD-PNEUMATIC CONSOLIDOMETER

IN TESTING, THE SAMPLE IS RIGIDLY CONFINED LATERALLY BY THE BRASS RING. AXIAL LOADS ARE TRANSMITTED TO THE ENDS OF THE SAMPLE BY POROUS DISKS. THE DISKS ALLOW DRAINAGE OF THE LOADED SAMPLE. THE AXIAL COMPRESSION OR EXPANSION OF THE SAMPLE IS MEASURED BY A MICROMETER DIAL INDICATOR AT APPROPRIATE TIME INTERVALS AFTER EACH LOAD INCREMENT IS APPLIED. EACH LOAD IS ORDINARILY TWICE THE PRECEDING LOAD. THE INCREMENTS ARE SELECTED TO OBTAIN CONSOLIDATION DATA REPRESENTING THE FIELD LOADING CONDITIONS FOR WHICH THE TEST IS BEING PERFORMED. EACH LOAD INCREMENT IS ALLOWED TO ACT OVER AN INTERVAL OF TIME DEPENDENT ON THE TYPE AND EXTENT OF THE SOIL IN THE FIELD.

FIGURE A.3.6-19


BORING 41
BORING 42
BORING 35
1430
1410
1390
1370
1350
1330
1310
1290
1270
ELEVATION IN FEET




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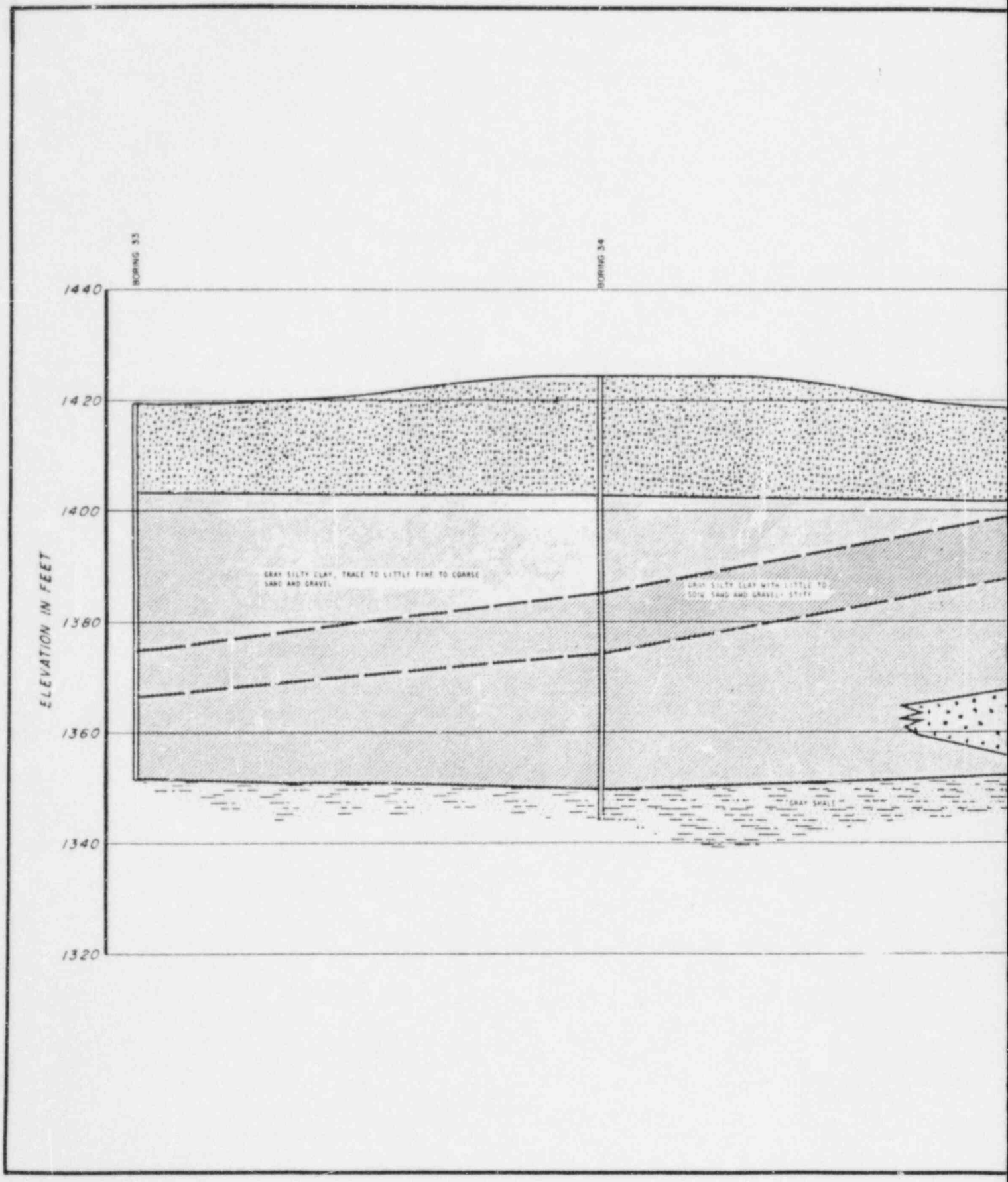
SUBSURFACE SECTION J-J'

20 0 20 40
HORIZONTAL SCALE IN FEET

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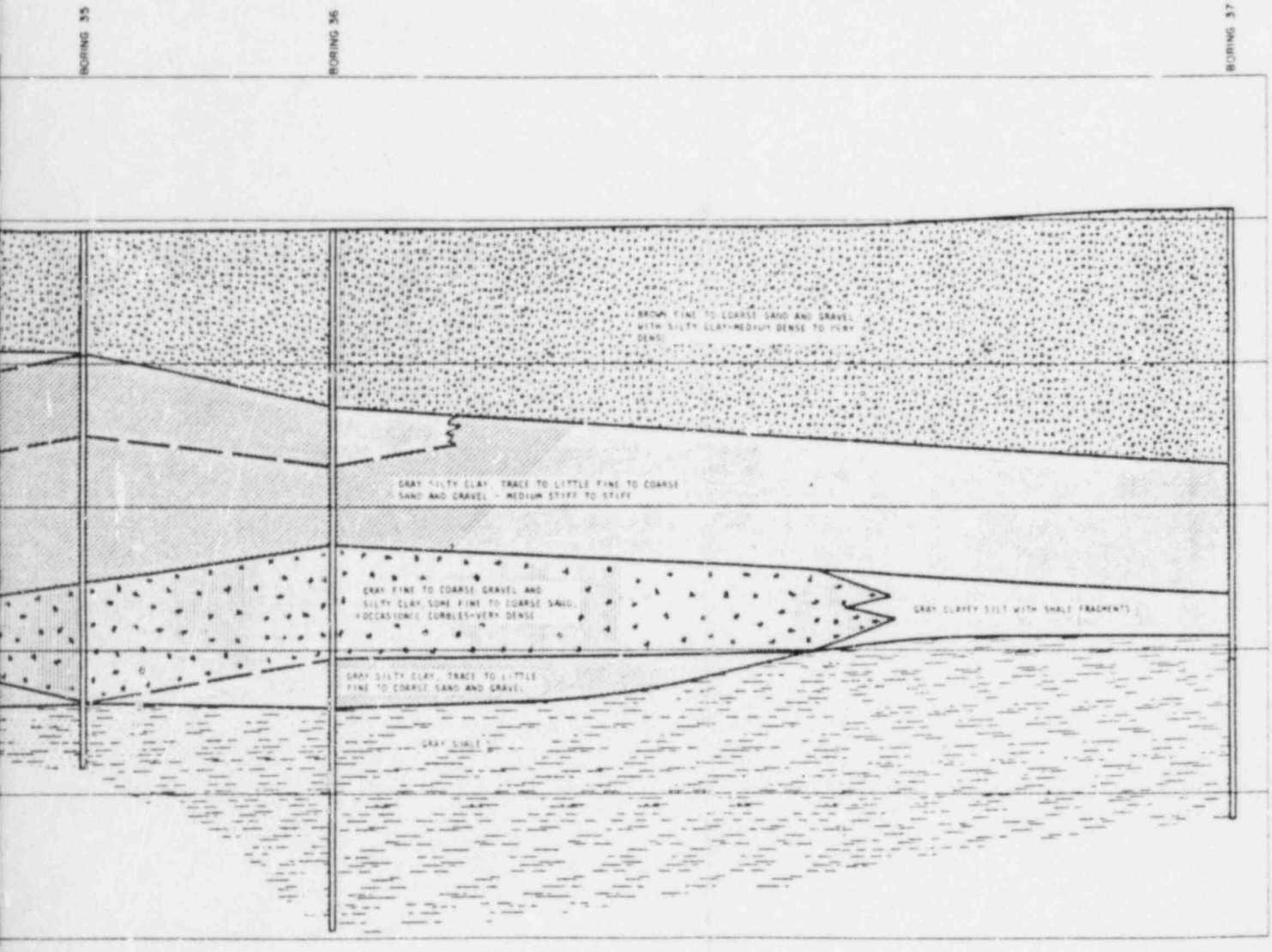
FIGURE A.36-20

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BORING 33
BORING 34
1440
1420
1400
1380
1360
1340
1320
ELEVATION IN FEET
GRAY SILTY CLAY, TRACE TO LITTLE FINE TO COARSE SAND AND GRAVEL
GRAY SILTY CLAY WITH LITTLE TO SOME SAND AND GRAVEL; STIFF
GRAY SHALE

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SUBSURFACE SECTION K-K'

20 0 20 40

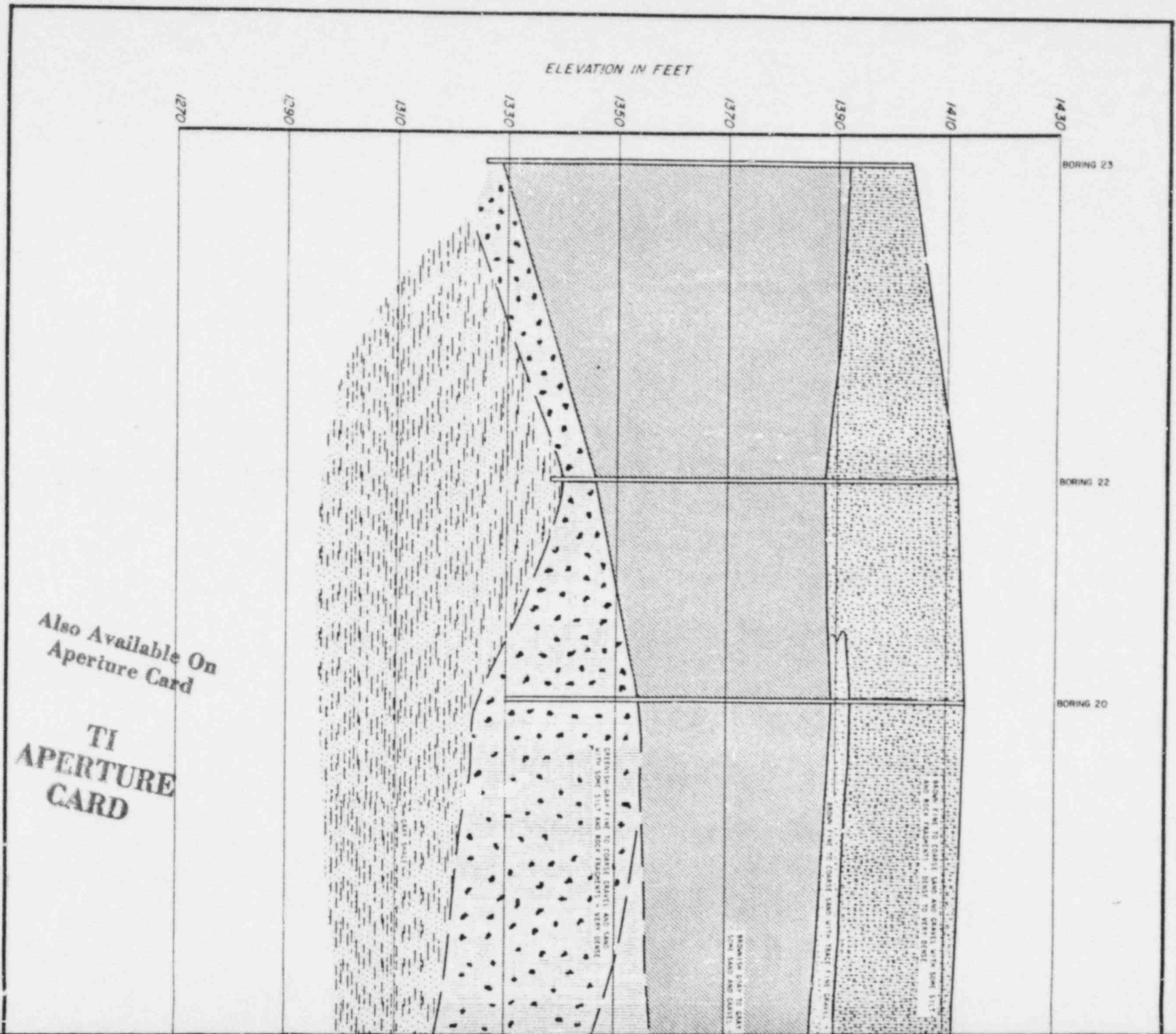
HORIZONTAL SCALE IN FEET

NOTES:

1. ELEVATIONS REFER TO U.S.G.S. MEAN SEA LEVEL DATUM.
2. THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.
3. THE DISCUSSION IN THE TEXT OF THE REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.

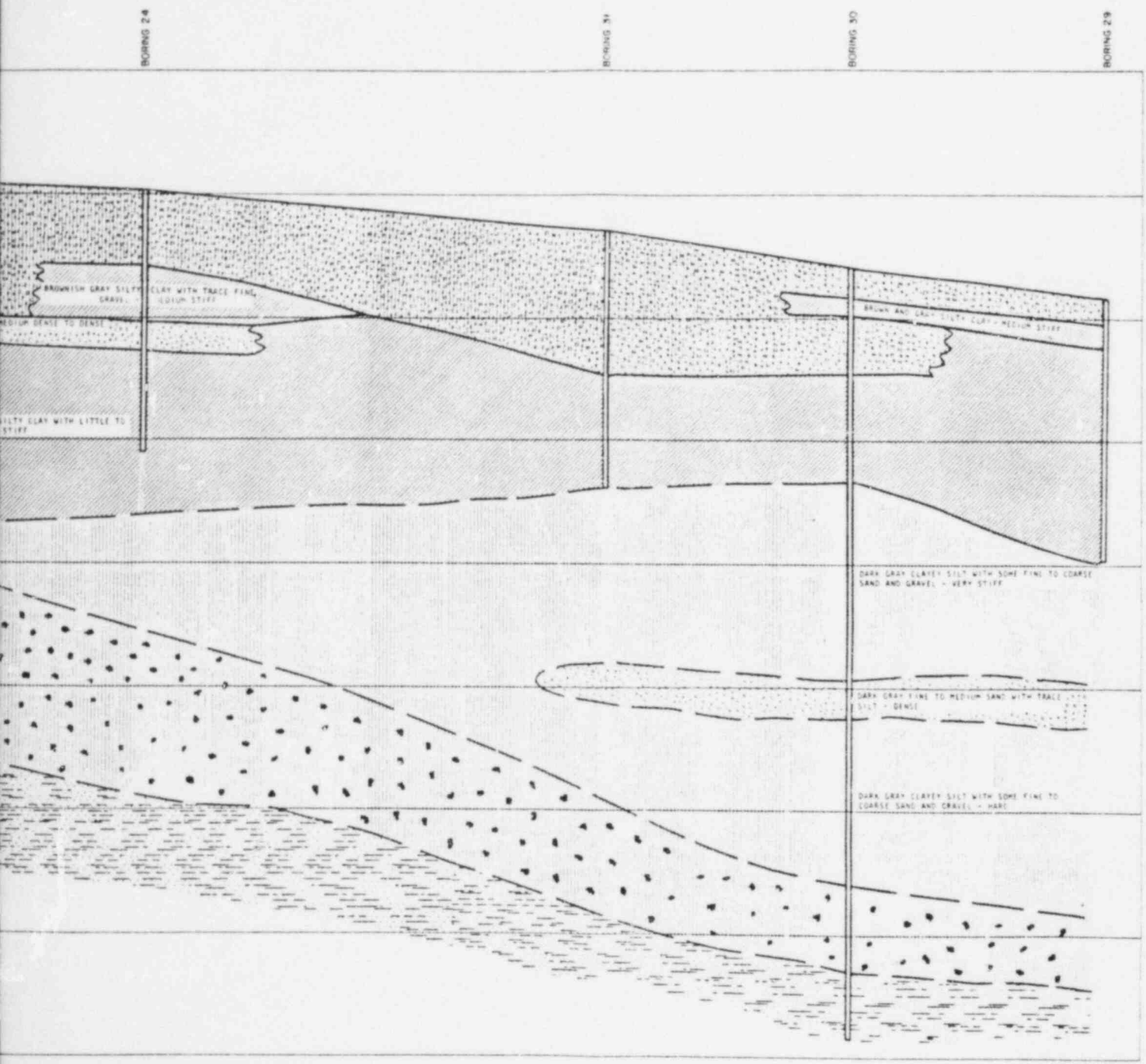
FIGURE A 36-21

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SUBSURFACE SECTION L-L'

40 0 40 80

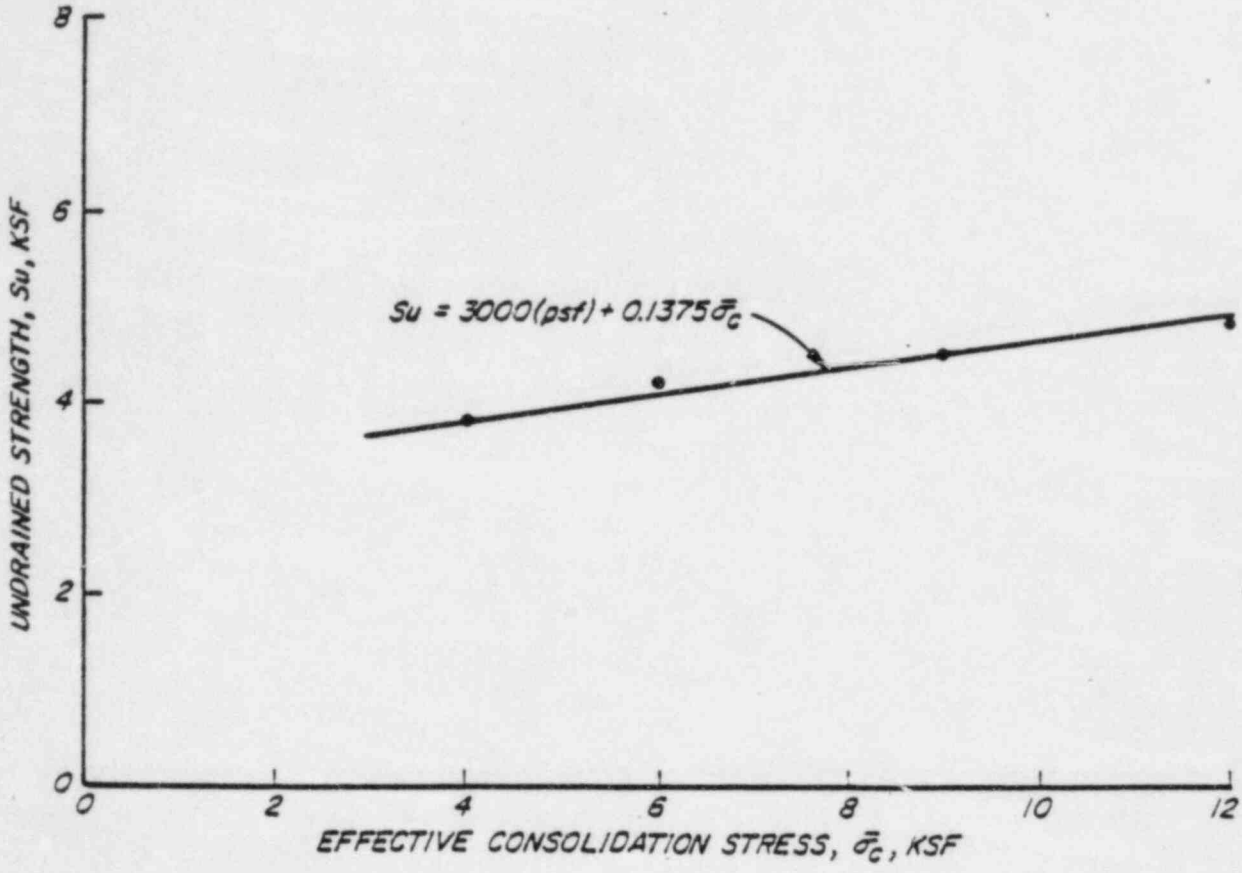
HORIZONTAL SCALE IN FEET

NOTES:

1. ELEVATIONS REFER TO U.S.G.S. MEAN SEA LEVEL DATUM.
2. THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.
3. THIS DISCUSSION IN THE TEXT OF THE REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.

FIGURE A.3.6-22

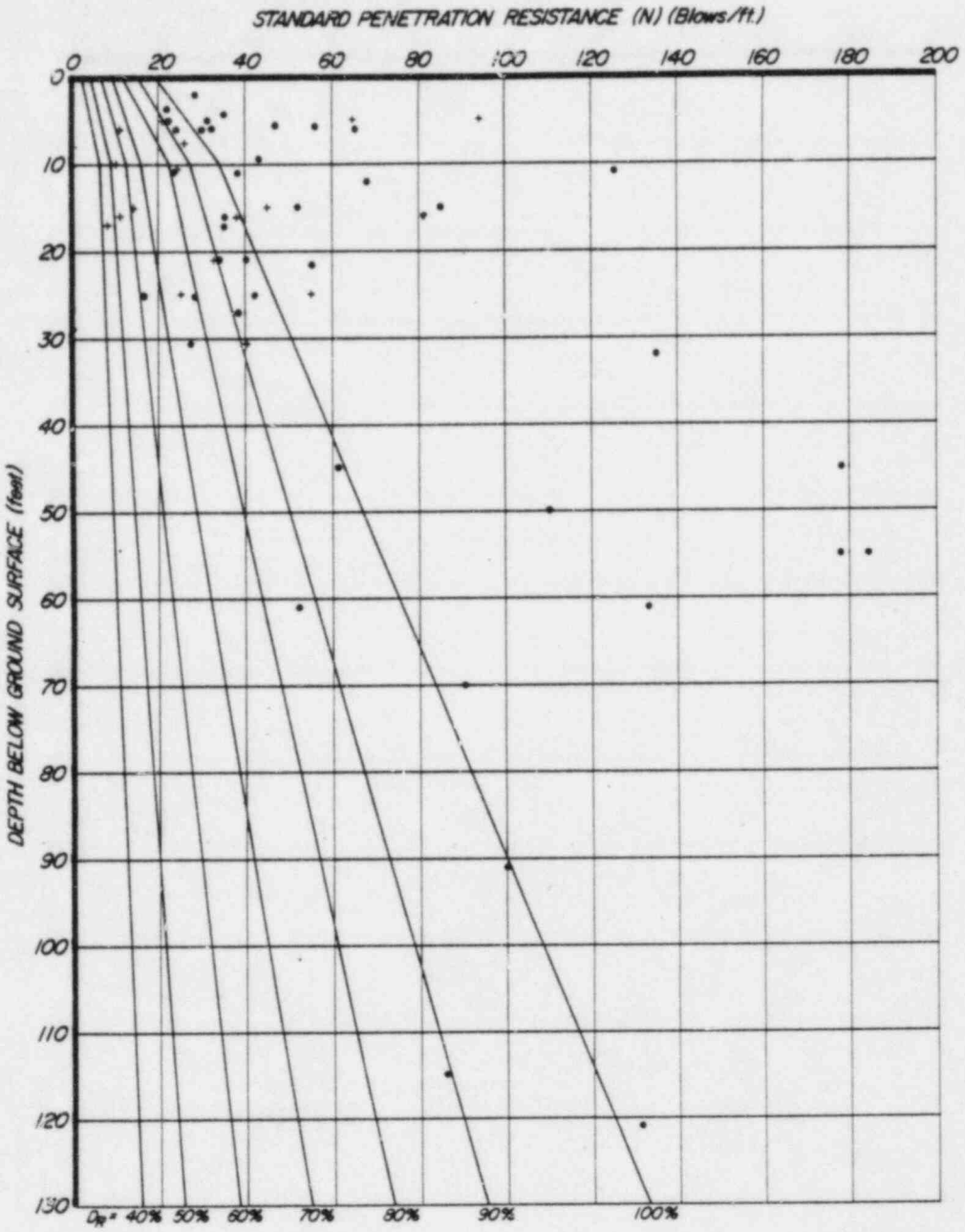
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# CONFINING STRESS VERSUS UNDRAINED SHEAR STRENGTH

## CIU TESTS - CL SOILS

FIGURE A.3.6-23




# CORRELATION BETWEEN RELATIVE DENSITY AND STANDARD PENETRATION RESISTANCE

NOTES:

1. THE GROUND WATER LEVEL WAS ASSUMED TO BE AT A DEPTH OF 10 FEET BELOW THE GROUND SURFACE.
2. THE SATURATED UNIT WEIGHT ($\gamma_{sat}$) OF THE SOIL WAS TAKEN TO BE 132 P.C.F. THE BUOYANT UNIT WEIGHT ($\gamma_w$) OF THE SOIL WAS TAKEN TO BE 70 P.C.F.
3. THE GIBBS AND HOLTZ CORRELATION BETWEEN RELATIVE DENSITY AND STANDARD PENETRATION RESISTANCE IS DISCUSSED IN "RESEARCH ON DETERMINING THE DENSITY OF SAND BY SPOON PENETRATION POTENTIAL", PROC. 4TH INTER. CONF. ON SOIL MECHANICS AND FOUNDATION ENGINEERING, VOL. 1, 1957.

KEY:

- • DATA FROM BORINGS DRILLED FOR THIS INVESTIGATION (BORINGS B-33 THROUGH B-43)
- + DATA FROM PREVIOUS BORINGS DRILLED (BORINGS B-1 THROUGH B-32)-SEE APPENDIX TO SAR ENTITLED GEOLOGY AND FOUNDATION ENGINEERING
- —— GIBBS AND HOLTZ (1957)
- $D_R$ INDICATES RELATIVE DENSITY IN PERCENT

FIGURE A.3.6-24

## A.3.7 ECOLOGICAL CHARACTERIZATION OF WESTERN NEW YORK NUCLEAR SERVICES CENTER

### INTRODUCTION AND PURPOSE

The Western New York Nuclear Service Center (Center) is located in the town of Ashford, Cattaraugus County, New York, about 48 km south of Buffalo. The Center is comprised of 1,335 ha divided into two zones: a 100 ha protected area and a 1,235 ha exclusion or buffer zone (see Figure A.3.7-1). Most of the protected area has been cleared for existing facilities, although wooded tracts are found along on-site streams. The buffer area of the site consists of a mixture of previously cleared agricultural areas, which are now in various stages of succession, and forestland. The site has a rolling and irregular topography and is intersected by several streams. The stream banks are somewhat steeper along Buttermilk Creek within the buffer zone than those found within the protected area. The generally acidic and poorly drained soils of the site influence the occurrence, distribution and relative abundance of the plant species and their associated fauna. No human occupation has been allowed within the approximate 1,335 ha site since 1961.

The purpose of the ecological studies undertaken by the West Valley Nuclear Services, Safety and Environmental Assessment group (S/EA) is to characterize the site sufficiently to conduct an assessment of the ecological impacts resulting from the performance of the West Valley Demonstration Project (WVDP). The Safety and Environmental Assessment group used the data collected during previous studies of the Center in combination with seasonal data collected from an annual cycle (August 1982 - May 1983) to characterize the important terrestrial and aquatic ecosystem components of both the protected and the exclusion zones of the site.

The biological studies conducted by S/EA updates the information already available for the Center which was used in the development of the Environmental Impact Statement published by the U.S. Department of Energy in June 1982. Vegetation, mammals, birds, reptiles and amphibians were investigated since they were studied in past surveys. Insect studies were not currently conducted because they were not included in previous studies and because the current field sampling procedures are qualitative in nature and will not permit meaningful analysis of the insect populations. Detailed quantitative sampling of insects is not considered appropriate to the present level of effort of the ecological investigations.

Standard biological sampling procedures were used during the 1982-83 surveys. Field investigations were undertaken during the summer, fall, winter and spring to obtain seasonal data. Such seasonal studies are necessary to fully characterize the site because a single study would not permit observation of certain wildlife such as spring and fall migratory birds or plant species which can only be accurately identified during the spring when the flowers are present.

The results of the recent field investigations, review of available publications, and consultation with noted authorities of the area are summarized in Section A.3.7.1 (Terrestrial Ecology) and Section A.3.7.2 (Aquatic Ecology). Supplement A.3.7-A provides detailed discussion of the terrestrial ecology of the site and Supplement A.3.7-B provides detailed discussion of the site's aquatic ecology. Supplement A.3.7-C lists all publications reviewed and authorities contacted. Supplement A.3.7-D lists common and scientific (Latin) names of all species presented in this report in alphabetical order of the common names.

## A.3.7.1 TERRESTRIAL ECOLOGY

### A.3.7.1.1 Summary

The Center lies within the northern hardwood forest region, and its forests are characterized by the dominance of sugar maple, beech, and hemlock. At present, the site is about equally divided between forestland and open land. Plant communities found on-site have been categorized into five cover types: mixed hardwood forest, pine-spruce community, successional creek bank communities, late oldfield successional areas, and fields-meadows. The plant communities found on-site are typical to this area of Western New York. The undisturbed nature of the Center has allowed for succession of the field communities whereas many off-site areas are retained in agriculture. The forest communities that will eventually develop are not unique to the region. Based on the current field studies, no obvious signs of stress to the vegetation were apparent.

Several small wetland areas are found on-site; however, due to their size (less than 12 ha each), none are regulated by the State of New York. Forested wetlands occur in isolated areas where groundwater seepages are found; persistent emergent wetlands occur at the headwaters of on-site ponds and reservoirs; and a shrub-scrub wetland is found at the headwaters of the easternmost reservoir. Similar-sized and larger wetland areas are found within a 16 km radius (as noted by Andrle, pers. comm. 1982).

Based on current and past field studies, and review with the State Botanist, Dr. Richard Mitchell (pers. comm. 1982), no State or Federally protected plants are known or expected to be found at the Center.

According to the New York Department of Environmental Conservation (NYSDEC), no species of wildlife that are recognized as being endangered or threatened or that are unique to the area are known or expected to occur at the Center (Moore, pers. comm. 1982). Fauna found at the site are typical of those of Western New York (Moore, pers. comm. 1982).

The Center is not on a normal migratory flyway nor is it used as a normal resting area for migratory waterfowl (Nuclear Fuel Services, Inc., 1973a). However, several such areas do exist nearby, including Lime Lake (five miles east), Farmersville Pond and Marsh (10 miles east), and Cuba Lake and Marsh (20 miles southeast) (Andrle, pers. comm. 1982). Canada geese were observed for several days during early spring migration on two exposed ponds on a private farm adjacent to the Center, but no individuals were seen on the on-site reservoirs. Common game species found on the site and in the region include whitetail deer, Eastern cottontail, red fox, ruffled grouse, turkey, and others. The entire Center is recognized as a concentrated wintering ground for deer, but other such areas are also noted with Cattaraugus and Allegany Counties (Moore, pers. comm. 1982).

Moore (pers. comm. 1982) also notes a potentially stressful situation that may occur on-site as a result of an overpopulation of whitetail deer, especially within the fenced-in protected area. Contamination of on-site deer has also been documented. Studies reported by the US EPA in 1974 indicated the deer taken from the Center had slightly elevated levels of cesium-134, cesium-137, and zinc-65; strontium-90 levels did not differ significantly from deer taken from off-site locations. This report also indicated that the deer accumulate radionuclides while grazing on-site. Based on this information, the maximum whole-body dose commitment to an individual from ingestion of venison in 1970 was estimated to have been 14 millirem (US EPA, 1974).

Supplement A.3.7-A provides a detailed discussion of the terrestrial ecology of the site.

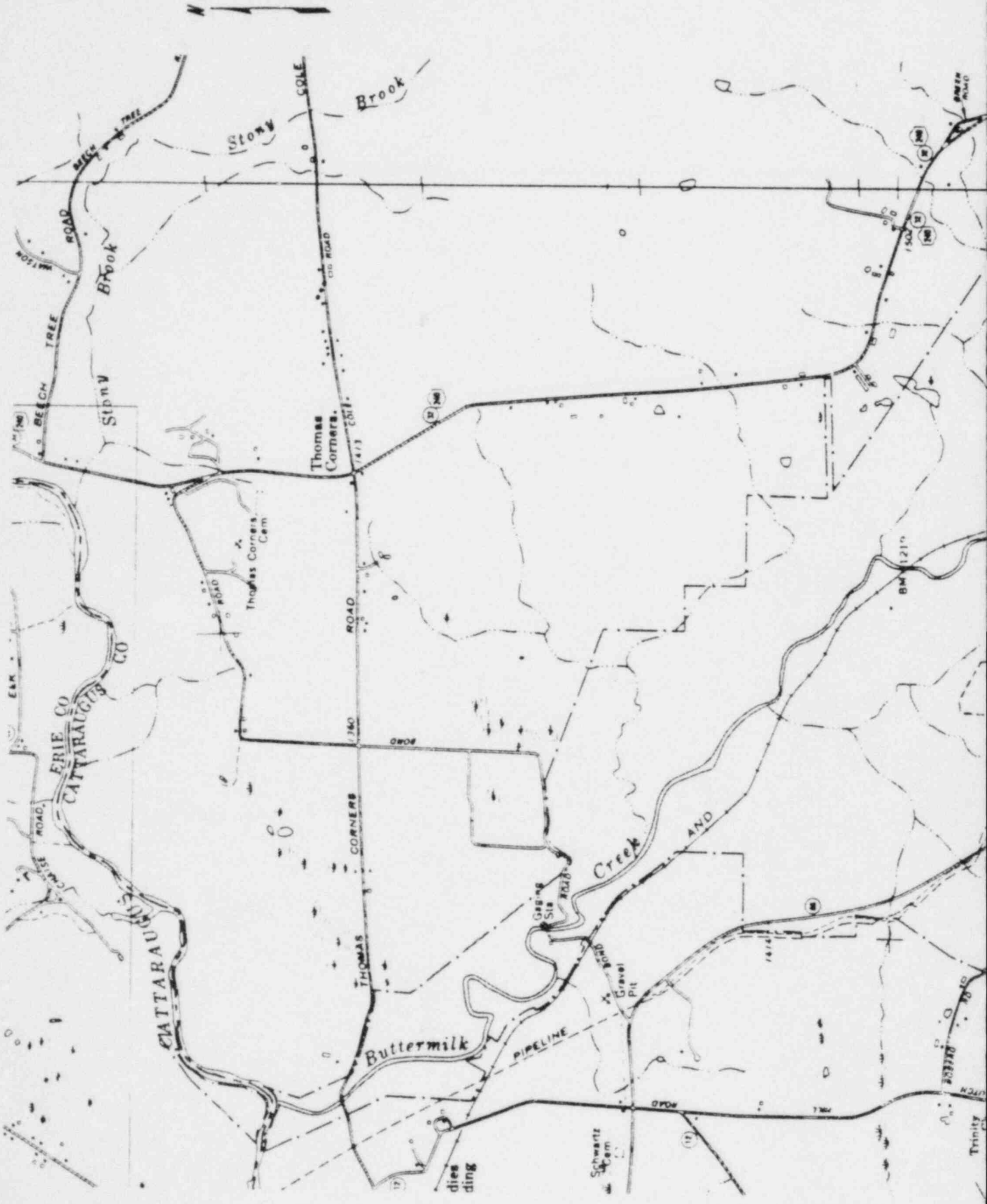
## A.3.7.2 AQUATIC ECOLOGY

### A.3.7.2.1 Summary

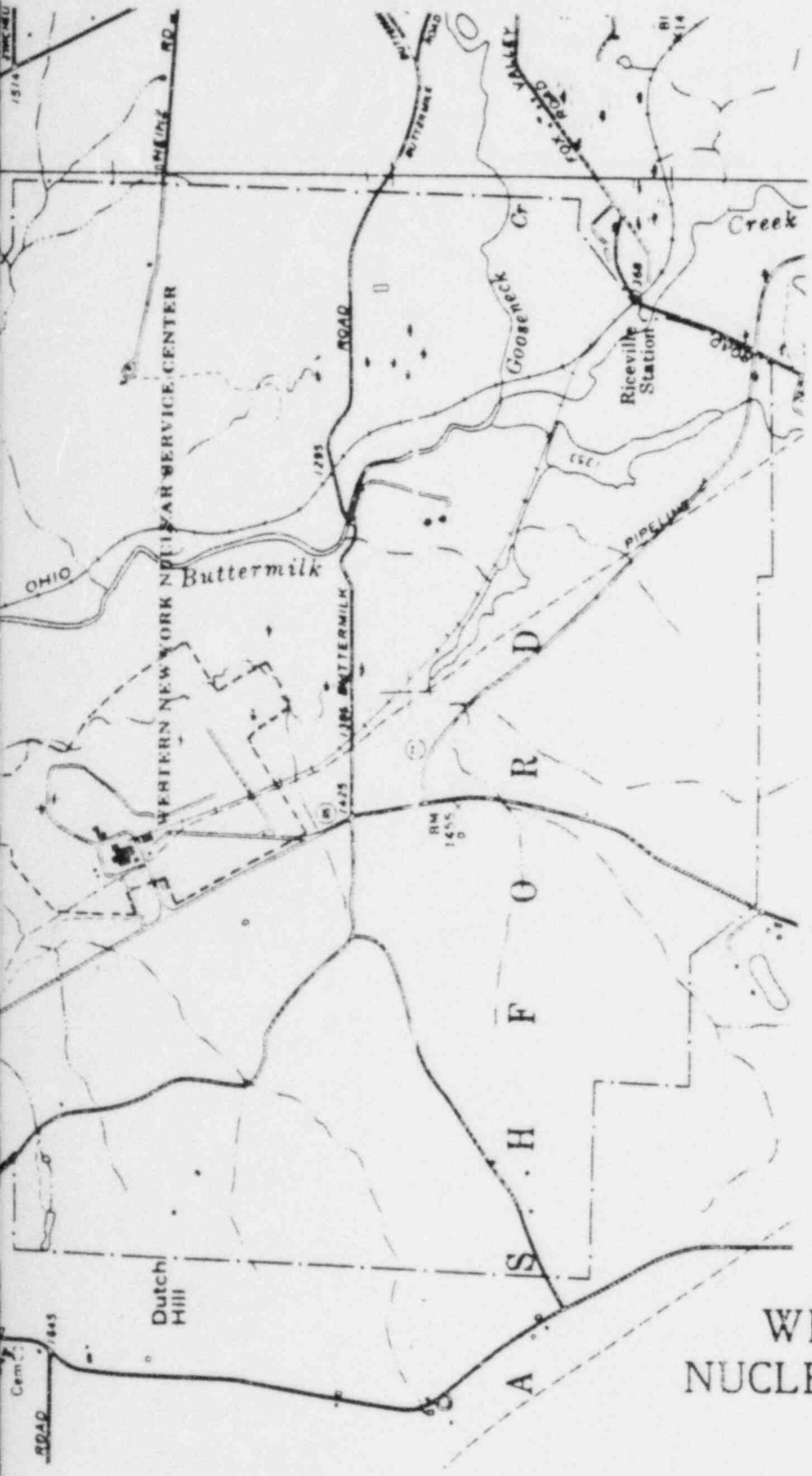
The aquatic environment at the Center consists of several creeks and two small reservoirs. The creeks originating on or flowing through the site are of particular interest to the WVDP because they receive effluent discharges from a nonoperating nuclear fuels reprocessing facility and/or runoff from areas of surface contamination near two radioactive waste burial areas. The aquatic data may also be useful in performing pathway-to-man analyses of radionuclide transport through the environment, based on an earlier report of Kelleher (1969) that indicates that the aquatic pathway at the Center is a more critical pathway than either the atmospheric or terrestrial pathways. Erdman Brook, Frank's Creek, Quarry Creek, Buttermilk Creek, and Cattaraugus Creek were sampled during August 1982 and May 1983.

The field sampling, literature survey, and interviews with local experts disclosed no indication that any threatened or endangered aquatic flora or fauna exist in the reservoirs, ponds, or streams on the Center or in its vicinity.

Supplement A.3.7-B presents physical descriptions of the streams and habitats which form the aquatic environment at the Center and detailed discussions of the flora and fauna found in them.




REFERENCE: NYSDOT, 1975




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# WESTERN NEW YORK NUCLEAR SERVICES CENTER SITE LOCATION

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FIGURE A.3.7-1

## A.4.0 PRINCIPAL DESIGN CRITERIA

Principal design criteria at the WVDP will vary among specific components, systems, and facilities depending upon the safety classification assigned to the unit under design. (The safety classification system is described in detail in Section A.4.4, Classification of Structures, Components and Systems.) Because of this, much of the specific, detailed design criteria are deferred to the SAR module for each system associated with the Project.

Included in this chapter are the magnitudes of design basis natural phenomena which will be applied as dictated by the safety classification.

## A.4.1 PURPOSE OF THE FACILITY

The West Valley facility is a nonoperating nuclear fuel chemical reprocessing plant which is at present being modified to house a liquid high-level radioactive waste vitrification system and ancillary waste treatment and management systems. Modifications include removing the reprocessing equipment and decontaminating the process cells to a level where workers can enter the cells to work for extended periods of time without respiratory protection. Throughout the presolidification decontamination work, necessary support systems such as the atmospheric protection system and low-level waste treatment facility will remain in operation. Fuel assemblies stored in the Fuel Storage Pool are at present being returned to the utility companies which own them.

### A.4.1.1 PLANT FEED

The feed for the vitrification and waste treatment systems will be discussed in the respective SAR modules.

### A.4.1.2 PLANT PRODUCTS AND BY-PRODUCTS

The products and by-products of the various vitrification and waste treatment facilities will be discussed in the respective SAR modules.

### A.4.1.3 FACILITY FUNCTIONS

The functions of the various Project facilities are developed early in the design process in facility-specific Functional and Operational Requirements (F and ORs) for each component, system, or facility. These requirements will be discussed in detail in individual SAR modules.

## A.4.2 STRUCTURAL AND MECHANICAL SAFETY CRITERIA

### A.4.2.1 WIND LOADINGS

The design basis fastest-mile wind is 90 mph (144 kph). This value corresponds to a return frequency of 1,000 years as derived from a Fisher-Tippett type I analysis performed by several different authors (Simiu, 1979; Fujita, 1981; MacDonald, 1981, Nicholas and Eagan 1983). The peak gust associated with this wind speed is estimated to be on the order of 184 kph (115 mph). These values will be used to determine the appropriate wind applied forces on a structure as dictated by the safety class for that structure.

### A.4.2.2 TORNADO LOADINGS

The design basis tornado for the WVDP is based upon the work of Fujita (1981) and MacDonald (1981). The characteristics of this tornado are:

| | |
|---|---|
| maximum wind speed | 260 kph (160 mph) |
| rotational speed | 180 kph (110 mph) |
| translational speed | 80 kph (50 mph) |
| radius of maximum rotational wind | 46 m (150 ft) |
| total pressure drop | 2.4 kPa (0.35 psi) |
| rate of pressure drop | 1.0 kPa (0.15 psi) |

The determination of the forces generated by this tornado upon a specific structure will be contained in the SAR module for that specific facility if required by the corresponding safety class.

### A.4.2.3 FLOOD DESIGN

As explained in Section A.3.4, Surface Hydrology, the site is situated in an area which will not be affected by flooding of either Buttermilk or Cattaraugus Creeks and no special considerations therefore need to be taken to design against a flood. The usual practices in grading the site to handle local runoff during heavy rains have adequately protected the Project facilities from water incursions from this source and will continue to do so.

### A.4.2.4 MISSILE PROTECTION

Missile barriers will be provided for those facilities determined by safety class to require such protection. The spectrum of missiles generated by the design basis tornado were identified by MacDonald (1981) and are summarized as follows:

| Missile | Weight | Cross-Sectional Area | Velocity* | Maximum Height |
|---|---|---|---|---|
| Timber Plank | | | | |
| 10 cm x 0.3 m x 3.7 m | 63 kg | 269.4 $cm^2$ | 144 kph | 60.9 m |
| 8 cm diameter pipe | | | | |
| 3 m long | 34.4 kg | 14.39 $cm^2$** | 104 kph | 30.5 m |

* Vertical velocities are taken as 2/3 the horizontal missile velocity. Horizontal and vertical velocities should not be combined vectorially.

** Value represents metal area.

### A.4.2.5 SEISMIC DESIGN

The design basis earthquake for the WVDP has a horizontal acceleration of 0.1 g and a vertical acceleration of 0.067 g (i.e. 2/3 of the horizontal component). The basis for selection of this earthquake is presented in Section A.3.6 of this SAR. The design implications of this earthquake will be presented in the individual SAR modules as required by the safety class.

### A.4.2.6 SNOW LOADING

Estimation of snowload on roofs of safety-related structures is based on frequency analysis of snowpack on the ground combined with a local winter probable maximum precipitation (PMP) (snow and liquid), which is assumed to occur in the form of snow. The assumption of PMP to occur in the form of snow is conservative since not all of the winter precipitation at the site occurs in the form of snow. Combining the antecedent snowpack and the PMP in the form of snow produces a more conservative estimate of snowpack load.

The analyses performed for the Sterling Nuclear Generating Station provides a very good estimate of the combined snow and PMP loading to be expected for the West Valley site because snow and winter rainfall records from Syracuse, New York with 26 years of record were used in the analysis.

The 100-year snowpack depths at Syracuse, New York for the months of February and March are 177.8 and 147.3 cm, respectively. The snowpack density is determined from analyses of historical snowpack data and from the method of Bilello (1969). Bases on these analyses, a density of 0.25 is selected. The resulting snowpack equivalent water depths are 44.4 and 36.8 cm for February and March and correspond to snowloads of 440 and 370 $kg/m^2$, respectively.

### A.4.2.7 PROCESS AND EQUIPMENT DERIVED LOADS

The parameters used to establish process and equipment loads for the original facility are not specified in the historical record of the site. In applying the Uniform Building Code to the original design, it must be assumed that reasonably conservative values were factored in. This assumption is borne out by the fact that the systems were constructed, operated for approximately five years, and shut down without evidence of unusual or unexpected load stresses.

Decontamination activities will result in removal of process equipment, which will in turn result in a reduction of equipment loads. Design of vitrification process and support equipment will consider acceptable loading for the decontaminated cells. The specific details of these designs will be included in the SAR module for the specific system.

### A.4.2.8 COMBINED LOAD CRITERIA

The combined load design basis used for the original facility is not available. However, as with other load design criteria, it must be assumed that reasonably conservative values were factored into the original design.

Combined load criteria for new systems and facilities will be developed in the specific SAR modules.

### A.4.2.9 SUBSURFACE HYDROSTATIC LOADINGS

The subsurface hydrostatic loading criteria used in the original design is not available in the site historical record. However, in a subsequent safety analysis for expansion of the reprocessing facility, a value of 1922 $kg/m^3$ equivalent fluid force was used for foundations of similar design (NFS SAR Vol. I, 1973). This value will be applied to future safety-related construction at the WVDP.

## A.4.3 SAFETY PROTECTION SYSTEMS

### A.4.3.1 GENERAL

The WNYNSC was sited at West Valley because the area is suitable in several ways for nuclear materials handling and disposal. The population density around the site is low, yet access to the site via road and rail is good. The rolling terrain and high elevation provide good atmospheric dispersion, and the soil materials, geology, and hydrology at the site are ideal for near surface disposal of low-level wastes. These site features are "passive" safety features, but special care must be exercised in design and operation of systems to ensure that these features are not compromised. The facility was designed, constructed and operated as a spent nuclear fuels reprocessing plant. As such, it was designed to accommodate specific systems, processes, and related equipment in certain areas. In decontaminating these areas and preparing them to house new systems, reviews will have to be made to ensure that original design bases will not be violated.

### A.4.3.2 PROTECTION BY MULTIPLE CONFINEMENT BARRIERS AND SYSTEMS

#### A.4.3.2.1 Confinement Barriers and Systems

The design criteria and the operating rules of the WVDP have been set up so that the plant will conform to the rules and regulations specified in US DOE Order 5480.1.

The Project has separate radiological control and safety programs aimed at reducing exposures and accidents of all types. It maintains programs designed to increase the safety morale of all of its personnel, both in normal industrial safety and in radiation safety, by providing training and orientation to promote radiological and industrial safety awareness.

The radiological control program is designed to protect the plant personnel from:

[1] external radiation,
[2] inhalation, and
[3] ingestion.

All three have been taken into consideration in the original design of the plant. They also dictate the conditions under which the plant is currently operated. The subsequent paragraphs discuss each of these areas in detail to demonstrate that the plant as designed and operated is in accordance with the provisions of US DOE Order 5480.1.

**A.4.3.2.1.1 Protection from External Radiation**

For the worker, the primary protection from penetrating radiation is to interpose sufficient shielding between him and the radioactivity at all times. The shielding has been designed so that when the most active unit which could be in any particular section of the plant is present, the radiation level on contact in a normal access area outside the shielding would be 1 mR/hr. In many cases, the point of contact is not readily accessible to personnel and the percentage of the time that the shielding wall is subjected to the maximum activity level is small. The shielding design has been based on a "design" fuel having the following irradiation history:

| | |
|---|---|
| Burnup | 30,000 MWD/T |
| Specific Power | 35 MW/T |
| Cooling Time | 150 Days |

The actual exposures outside the cells are much lower because no reprocessing operations are being done.

Fuel is shipped from the plant in shielded casks whose design has been carefully checked to ensure that adequate protection is available. Before the cask is loaded, it is placed under sufficient water so that, as a fuel element is loaded, there will be at least 11 feet of water over the top of the longest type of fuel element. Movement of the elements in the storage pool and their storage is also conducted under at least this much water.

The mechanical operations in the PMC and GPC are carried out remotely behind concrete shielding. Transfers between the PMC and the CPC are handled remotely. All operations in the CPC can be done remotely.

In order to maintain the background levels in the plant at design levels, it is necessary not only to have adequate shielding, but also to maintain strict controls to prevent leakage or spillage. This is done in three ways: (1) the activity is kept behind the shielding--activity is not withdrawn from shielded areas without approved Special Instruction Procedures and appropriate radiological controls over the operations; (2) careful and continual radiation surveys are performed to detect areas in which activity may have been inadvertently introduced; and (3) such areas are promptly cleaned up and at the same time the cause of the event is determined and corrected.

Both routine and major maintenance work can be expected to contribute somewhat to the whole body radiation of the plant personnel. It is the policy at the WVDP to permit maintenance work only under such conditions that no worker will be exposed in excess of the administrative limits defined in the Radiological Controls Manual, which in all cases are less than the US DOE 5480.1 limits. The maintenance procedures (described in detail in Project SOPs and SIPs) are designed to mimimize the exposure of the personnel. Maintenance work that has to be done in radiation areas is controlled by a radiation work permit system as described in the Radiological Control Manual. In attacking any maintenance

job, the area is carefully surveyed, and the amount of time that may be permitted a worker in the area is calculated. Work in the radiation field is done under closely supervised conditions. Accurate time is kept from outside the field. Recording meters as well as thermoluminescent dosimeters (TLDs) are worn during the operation, and a log of the exposure is kept. This is added to each worker's permanent radiation record.

Workers at the WVDP are trained to maintain their exposures "to as low as reasonably achievable" during normal operation of the plant. Workers' exposures are regularly monitored and recorded quarterly, and more frequently if job assignments so dictate. In no case during normal operations will a worker's exposure be allowed to exceed the quarterly or annual administrative exposure limits of 1,250 mrem and 3 rem, respectively.

**A.4.3.2.1.2 Protection from Inhalation of Radioactive Materials**

The primary protection of the workers from inhalation lies in keeping the activity inside the process equipment. As a second line of defense, all of the equipment is contained in cells maintained by a separate ventilation system at a pressure negative to the working areas. These ventilation systems are described in detail in Volume II, Section B.5. As third line of defense, masks and supply-air equipment are available. Under all normal operating conditions no process activity is expected to escape past the first two barriers and into the operating areas.

A system of fixed air samplers backed up by a program of air monitoring with portable air monitors will assure that the air in the working area does indeed remain free of activity. This monitoring program is described in Volume II, Section B.8.4.3. The monitors have audible and visual alarms set to activate at the lowest practical level so that remedial action may be taken before any consideration of evacuation is necessary.

An ample supply of respiratory protective equipment will be available for use during emergency conditions and during maintenance and decontamination work inside cells. The industrial safety program will include frequent training sessions and drills for all personnel in the use of this equipment so that the equipment will be used properly.

### A.4.3.2.1.3 Protection From Ingestion of Radioactive Materials

The problem of ingestion of radioactivity can be controlled by developing good safety consciousness and habits of personal hygiene within the workers and providing them with adequate protective clothing, devices, and monitors to facilitate the execution of the program.

Coveralls and other protective clothing are available to all personnel working in the plant areas. Anticontamination clothing is issued to workers who enter contaminated areas and must be worn therein. This clothing shall not be worn outside the radiological control areas. It is laundered at the plant and returned to service or discarded to solid waste, depending on monitoring before and after laundering. An ample supply of specialized protective clothing such as surgical, heavy rubber, and cotton gloves, caps, boots, and tape (for taping gloves to Anti-C's, for instance) is also maintained.

Eating and smoking are controlled throughout the Process Building. Eating will be done only in nonradiologically controlled areas, where protective clothing may not be worn. This area is be checked frequently by the Radiation-Safety survey. Smoking is done only in designated areas.

Upon leaving a posted controlled area, workers are required to perform a whole body "frisk" survey for contamination. At the conclusion of each shift, each individual who works in the plant areas is required to change clothes, and frisk before leaving the premises. "Frisker" survey instruments are located throughout the plant at exits from controlled areas. Additionally, all personnel exiting the site must pass through a portal monitor.

### A.4.3.3 PROTECTION BY EQUIPMENT AND INSTRUMENT SELECTION

The safety aspects and protection provided by system equipment and instrument selection will be presented in the individual SAR modules.

### A.4.3.4 NUCLEAR CRITICALITY SAFETY

A criticality safety program prevents the accumulation of fissile and fertile material in quantities and configurations that could result in an unplanned nuclear excursion (criticality). The maximum allowable quantities of fissile and fertile material for storage, handling, processing and shipping are determined by performing criticality safety evaluations to establish a margin of safety for all normal and credible accident conditions. The criteria used in performing criticality safety evaluations are published in US DOE Order 5480.1, Chapter V and US DOE-ID Order 5480.1, Chapter V. In general, they require that the fissile and fertile material be stored, handled, processed, and shipped so that a criticality is not credible even after an accident which resulted in an increase in reactivity has occurred. To ensure adequate margins of safety, plant equipment will be designed so that the effective neutron multiplication factor ($k_{eff}$) does not exceed 0.95 (at the 95 percent confidence level) for the most reactive credible accident configuration.

As a result of the decontamination efforts by NFS between 1972 and the present (Riethmiller 1981), the plant is estimated to have only contamination level quantities of fissile and fertile material. Preliminary estimates of alpha contamination in the plant are as low as 127 curies (Duckworth 1976). Consequently, the criticality safety of the existing plant configuration is facilitated by the estimation and assignment of an obviously subcritical quantity fissile or fertile material to process areas and equipment. These material estimates will be revised and kept current as results of sampling activities become available.

Criticality safety evaluations were performed for the upgraded radiochemistry laboratory in anticipation of the accumulation of numerous samples of unknown fissile and fertile material content. Process areas in which fissile and fertile material are suspected were evaluated for criticality safety to ensure safe sample collection and waste disposal. These evaluations are presented in Volume II, Section B.6.

Criticality analyses will also be factored into design of new systems to assure that criticality will be prevented by maintaining the $K_{eff}$ below 0.95 at all times. These analyses will be presented in the appropriate SAR modules.

### A.4.3.5 RADIOLOGICAL PROTECTION

Administrative and design controls provide radiological protection. Administrative controls are discussed in Section A.8 of this SAR; design controls will be presented in the individual facility SAR modules.

### A.4.3.6 FIRE AND EXPLOSION PROTECTION

Design criteria for fire and explosion protection will be developed in individual SAR modules. The administrative controls to prevent fires and explosions are presented in the WVNS Industrial Hygiene and Safety Manual.

### A.4.3.7 FUEL AND RADIOACTIVE WASTE HANDLING AND STORAGE

The safety design criteria for radioactive waste storage will be described in the SAR modules for Vitrified HLW Storage, the Cement Solidification System, and LLW/TRU Waste Storage Building.

### A.4.3.8 INDUSTRIAL AND CHEMICAL SAFETY

The administrative controls for industrial and chemical safety are presented in the WVNS Industrial Hygiene and Safety Manual. The specific implementation of these controls and related design requirements will be presented in the individual SAR modules.

## A.4.4 CLASSIFICATION OF STRUCTURES, COMPONENTS, AND SYSTEMS

### A.4.4.1 HAZARD CLASSIFICATION SYSTEM

The purpose of the WVDP Hazard Classification System is to establish the level of review to which a particular Project facility will be subjected. The System establishes a hierarchy of Hazard Classes, criteria, and management review levels. This System has been adapted from US DOE-ID Order ID-5481.1 and is summarized on Table A.4.4.1.

Since the purpose of the Hazard Classification System is to establish the level of review of the Safety Analysis for a particular Project facility or activity, a Hazard Class is assigned to a stand-alone facility or activity (such as those listed in Table A.4.4.2) in its entirety, rather than to its individual subsystems or tasks. This is not to say, however, that a particular subsystem or task may not be the cause for a major Project facility being assigned a given Hazard Classification. In much the same way as an entire length of chain might be given a strength rating based on its weakest link, a major Project facility in its entirety would be classified based on its most hazardous subsystem or operation. It will be noted that this rationale differs from that applied to safety classifications (as explained in subsequent sections) where individual pieces of a subsystem (perhaps down to a single valve) may be assigned a safety classification different than the remainder of the subsystem, and an overall safety classification for a major Project facility is likely to be inappropriate if not meaningless.

The line of logic shown at the lower left of Figure A.4.4-1 illustrates the steps involved in establishing the Hazard Classification.

The Hazard Classification Procedure may be undertaken in advance of the preparation of the safety analysis (if one is required), or concurrent with it. However, the US DOE's approval of the WVNS Hazard Classification must precede the WVNS approval of the action if it is a Low Hazard (and the safety analysis is limited to WVNS Safety Committee review), and must precede or be concurrent with the delivery of the safety analysis to US DOE if the hazard is classified as Moderate or High. If the activity under review is complex or is expected to be classified as Moderate or High, it would be prudent to initiate the Hazard Classification process as early in the development of an action as is possible and in advance of the safety analysis.

### A.4.4.2 SAFETY CLASSIFICATION SYSTEM

The WVDP Safety Classification System is used to determine the importance of facility components, systems, and structures for ensuring the safety of workers and the general public during all phases of the Project. The Safety and Hazard Classification systems are complementary in that design of engineered safety systems can take place only after the level of hazard (i.e., with no engineered barriers) is known. The relationship of engineering design standards to safety classes is explained in the next section.

The WVDP Safety Classification System consists of four safety classes. Three safety classes are listed in decreasing order of importance to safety: Safety Class A, Safety Class B, and Safety Class C; Class N, the fourth class, is not important to safety in comparison to Safety Classes A, B, and C. These four classes are defined in Table A.4.4-3.

The Safety Classification System is to be applied to all structures, systems, and components of the Project. In addition to providing adequate reliability to ensure that the criteria listed in Table A.4.4-1 are met, WVDP facilities should be designed to:

- safely shut down the affected facility following a postulated severe accident;

- prevent nuclear criticality throughout the facility operational period; and

- provide sufficient radiation shielding for on-site personnel to meet US DOE and WVNS requirements.

To assure that structures, systems, and components have been designed to meet the requirements of their safety classification, appropriate quality standards will also be assigned to each design effort as well as the follow-on procurement, fabrication, inspection, and testing. Apart from safety considerations, other factors such as process requirements, maintainability, and cost considerations may dictate that certain structures, systems, and components meet higher design standards.

The procedure for determining the safety classification of structures, systems, and components starts once the conceptual design has been developed as shown in Figure A.4.4-1. To determine whether a structure, system, or component is required to control radiation doses (on-site or off-site) or other hazards to acceptable levels, the consequences of its failure to perform its designed function is analyzed. "Best estimate" calculations, specifically modified by a rational compounding of allowances for uncertainties, are used to determine the most severe consequences. The facility is assumed to be operating at its limiting condition consistent with the operation, controls and limits imposed by the physical constraints of the system itself. The dose analysis is performed using methods that reasonably account for the actual plant and site characteristics and that include similarly conservative dose-reducing features of the plant and site.

As shown in Figure A.4.4-2, the consequences are compared to the requirements of the three radiological safety classes in order of decreasing importance to safety. A higher degree of safety must be applied to a facility that has a greater consequence (i.e., higher radiation dose) should it fail. Following the procedures in Figures A.4.4-1 and A.4.4-2, the Safety Classification for each major structure, component or system is determined. In situations where a single component performs two or more functions and could be assigned to more than one safety class, it is assigned to the more limiting class. Various sections of structures, systems, and components can be assigned to different safety classes provided that these sections are separated by interface boundaries such that failure of one section will not influence the remaining sections.

### A.4.4.3 RELATIONSHIP OF DESIGN STANDARDS TO SAFETY CLASSES

Once the safety class of an item has been determined, its design requirements and quality levels for this item can be specified. Existing technology and standard engineering procedures will be used as much as possible. Thus, existing nuclear and commercial industry codes and standards can be used to guide the design, construction, and operation of the various structures, systems, and components associated with the Project. These are given at the end of this section. General considerations associated with design requirements are given in the following paragraphs.

Structures

Generally, Class N structures will be designed in accordance with State building codes. These structures are not explicitly designed to withstand severe seismic events, tornadoes, or other severe natural phenomena, except as implied by the State building codes. Radiological safety class structures (A, B, or C) shall be designed to accommodate a more specific spectrum of

potential natural phenomena or abnormal processing incidents. Safety class structures will be designed to assure the continued effectiveness of their essential safety functions following the occurrences of a design-basis event (e.g., earthquake, tornado, or malfunction).

Systems

In addition to the major process systems, systems that will be analyzed for safety classification include:

- Instrumentation and control systems,
- Electrical systems,
- Fire protection systems,
- Monitoring systems,
- Off-gas treatment systems, and
- Heating, ventilation, and air-conditioning systems.

These systems will be classified as belonging to safety class A, B, or C if required to meet the criteria listed in Table A.4.4-3. The design requirements are, in general, specified in existing codes and standards.

Components

Safety class components at a nuclear facility must be designed to withstand a variety of postulated accidents. If necessary, safety class components will be designed to perform their safety function in the post-accident environment. Mechanical and fluid system components such as vessels, piping, pumps, agitators, and valves are classified based on their functional requirements from a safety viewpoint.

For some components, the post-accident environment may be entirely different from the normal operating environment. The temperature, pressure, humidity, radiation, and chemical environment that is needed for the design of safety class components shall be based on the most severe postulated accident appropriate to the particular component. Single failure analyses will be used except where it is reasonable to expect a common mode failure, a common cause failure, or an induced mode failure.

Mechanical and fluid system components will be designed to Class N standards if they are not required for controlling: (1) on-site radiation exposure, (2) off-site radiation doses, or (3) criticality safety. Such components will be designed to appropriate industrial codes and standards and subjected to industrial quality assurance practices.

The minimum codes and standards which will be used for the safety classes are given in Table A.4.4-4. They will be used to specify design requirements for the final confinement after evaluating the safety functions and the classification of structure, systems, and components which are to be designed for HLW vitrification and other Project activities. In general, the recommended codes and standards for Safety Class A requirements are those used at nuclear power plants and other facilities that process radioactive materials with a potential for very large releases of radioactivity (e.g. nuclear fuel reprocessing plants). In general, Safety Class B requirements, are those used in typical industrial situations. Safety Class C requirements are similar to Safety Class B requirements, although somewhat less restrictive. Requirements for Class N components are commercial and/or manufacturer's standards.

### A.4.4.4 QUALITY LEVEL CLASSIFICATION

The Quality Assurance Level Classification System is used to implement the WVNS Quality Assurance Program which is described in detail in Chapter A.12. This system is applied to structure, systems, and components during the design, procurement, construction/fabrication, and operation in a manner which is consistent with their importance to safety and desired reliability. Four Quality Level designations, identified by alphabetic designations A, B, C and N, are provided. The degree of review, application, and control of applicable criteria will be commensurate with their importance to safety and desired reliability.

The specification of safety level designates those aspects of the system, subsystem, structure, or component that are important to safety (e.g., maintenance of pressure boundary, continuous operation in spite of imposed disruption, availability to function on demand, etc.). The quality level designation applies to all aspects of a system, subsystem, structure, or component relevant to safety. Those portions of a system, subsystem, structure or component which are necessary to meet the required safety class shall be evaluated to determine the corresponding quality level.

The Quality Level Classification is outlined in Table A.4.4-5.

### A.4.4.5 SERVICE CLASSIFICATION SYSTEM

A higher Quality Level may be required based on a degree of operational reliability. Separate Service Classification criteria are developed based on lost time and cost of radiation exposure for repair or replacement; these considerations may in certain instances be controlling factors. Service class shall be independent of both safety and quality level and shall be designated on the basis of functional reliability to meet the service requirements.

The Service Classification is outlined in Table A.4.4-6.

The composite relationship among Safety, Service and Quality Level Classes is presented in Figure A.4.4-3.

Some items are not expected to fit logically into any category, and in those cases, judgement (usually conservative) will be used to assign a Quality Level.

To assure that initial system classifications and related codes and standards are properly assigned and documented in the Design Criteria, the Radiation and Safety Committee Chairman will review and sign Design Criteria documents. When design and/or field changes to a particular system are made, an additional review step is required to assure that the system safety classification (and thus the safety margin) is not changed. To further assure that system changes do not impact the approved margin of safety, the Radiation and Safety Committee Chairman is a permanent member of the Configuration Control Board. Appropriate changes to policy and procedure guidance affecting these areas will be made. Engineering Department personnel who are responsible for preparation of Design Criteria documents will also be trained in the process for safety classification of systems.

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WVDP-011, Industrial Hygiene and Safety Manual.

TABLE A.4.4-1 (1 of 3)

WEST VALLEY DEMONSTRATION PROJECT HAZARD CLASSIFICATION SYSTEM[a]

| Hazard Class | Criteria[b] | Highest[c] Review Level |
|---|---|---|
| Routine | o Construction related work activities in uncontrolled/ uncontaminated areas<br>o Operations having only hazards of a type and magnitude routinely encountered and/or accepted by the public<br>o Activities conducted by others at the WVDP where:<br>- There is no direct WVNS operational or financial involvement<br>- The other operating organization has adequate in-house safety expertise<br>- The perceived accidents are not of a major nature, i.e., fatalities, gross overexposures, etc. | Cognizant WVNS Manager |

Notes: a) Adapted from U. S. Department of Energy, Idaho Operations Office Order ID-5481.1, "Safety Analysis and Review System for DOE-ID Managed Activities", dated 8/21/81.
b) These criteria are to be applied in the absence of (i.e., without taking credit for) engineered barriers or mitigative features.
c) Highest review level with respect to safety only. May require higher review for other reasons.

TABLE A.4.4-1 (2 of 3)

WEST VALLEY DEMONSTRATION PROJECT HAZARD CLASSIFICATION SYSTEM[a]

| Hazard Class | Criteria[b] | Highest[c] Review Level |
|---|---|---|
| Low | o Not a routine hazard, but meets <u>all</u> the following criteria:<br>- Could result in personnel injury to not more than five people within the plant area or on-site.<br>- The potential for personnel radiation exposure does not exceed 3 rem/yr.<br>- Has no potential for a nuclear criticality.<br>- Could not result in exposures to toxic or carcinogenic materials in excess of 1.0 threshold limit values (TLV).<br>- Maximum property loss due to plausible accidents is less than $250,000.<br>- Could not result in any risk of exposure to the public off-site. | WVNS Safety Committee |
| Moderate | o Any activity which could result in <u>any</u> of the following:<br>- Serious injuries to more than five personnel and/or one or more fatalities on-site. | DOE-ID |

TABLE 4.4-1 (3 of 3)

WEST VALLEY DEMONSTRATION PROJECT HAZARD CLASSIFICATION SYSTEM[a]

| Hazard Class | Criteria[b] | Highest[c] Review Level |
|---|---|---|
| Moderate (con't) | - One or more off-site serious injuries.<br>- On-site and off-site exposures to radiation exceeding the limits provided in DOE Order 5480.1A, Chapter XI, "Requirements for Radiation Protection."<br>- An unplanned nuclear criticality.<br>- On-site and off-site radiological environmental effluents exceeding the limits provided in DOE Order 5480.1A, Chapter XI.<br>- Off-site non-radiological effluents exceeding TLV's of 1.0 or other recognized national method of evaluating chemical concentration.<br>- More than $250,000 damage for plausible accidents. | |
| High | o Any activity which could result in one or more off-site fatalities due to abnormal operations or accidents. | DOE-HQ |

TABLE A.4.4-2

MAJOR PROJECT FACILITIES AND ACTIVITIES REQUIRING SAFETY ANALYSIS

- Existing Plant and Operations
- Component Test Stand/ Vitrification Facility
- Supernatant Treatment System
- Sludge Mobilization System
- Vitrified High-Level Waste Storage
- Cement Solidification System
- Liquid Waste Treatment System Upgrades
- Size Reduction System
- Lag Storage Facility
- Disposal Area Operations
- Final Decontamination, Decommissioning and Waste Shipment

TABLE A.4.4-3

WEST VALLEY DEMONSTRATION PROJECT SAFETY CLASSIFICATION SYSTEM

Criteria

Safety Class A -

Structures, systems, and components whose failure to function as designed could cause an off-site effective dose equivalent in excess of 25 rem.

Safety Class B -

Structures, systems, and components whose failure to function could cause an off-site effective dose equivalent in excess of 0.5 rem.

Safety Class C -

Structures, systems, and components whose failure to function could cause an on-site effective dose equivalent in excess of 3 rem.

Class N -

Structures, systems, and components which are not important to safety (specifically, radiological safety as defined above).

NOTE: Effective dose equivalents will be calculated by following the recommendations of the International Commission on Radiological Protection (ICRP, 1977)

TABLE A.4.4-4

MINIMUM QUALITY LEVELS, CODES AND STANDARDS FOR STRUCTURES, SYSTEMS, AND COMPONENTS

| Classification | Quality Level | Structures | Process Equipment | | | | | Control and Electrical |
|---|---|---|---|---|---|---|---|---|
| | | | Vessels/Vents | Pumps | Valves | Piping | Heat Exchangers | |
| Safety Class A | A | ACI 349; ASME Sec. III Division 1 Subsection NF | ASME Sec. III Division 1 | ASME Sec. III Division 1 | ASME Sec. III Division 1 | ASME Sec. III Division 1 | ASME Sec. III Division 1; TEMA "R" | IEEE Class IE |
| Safety Class B | B | ACI 318 | ASME Sec VIII Division 1 | ASME Sec VIII Division 1 | ANSI B16.5; ANSI B31.3 | ANSI B31.3 | ASME Sec VIII Division 1; TEMA "R" | ISA Standards; NEC (designed to fail on preferred mode) |
| Safety Class C | C | NYS Building Code | ASME Sec VIII Division 1 (or API 620 and API 2000 for large, low pressure tanks) | API-610 (or manufacturer's standard) | ANSI B16.5; ANSI B31.3 | ANSI B31.3 | ASME Sec VIII Division 1; TEMA "C" | ISA Standards; NEC |
| Class N | N | NYS Building Codes | Manufacturer's Standard | Manufacturer's Standard | Manufacturer's Standard | Manufacturer's Standard | Manufacturer's Standard | ISA Standards; NEC |

## TABLE A.4.4-5

## WVDP QUALITY LEVELS

Quality Level A: This category requires the implementation of a formalized quality assurance program which conforms to the requirements of ANSI-ASME-NQA-1 by WVNS and any subtier supplier. Specific requirements of the activities related to one or more of the eighteen criteria of NQA-1 may be performed by WVNS rather than by the supplier.

Suppliers of items or services assigned as Quality Level A must invoke on their lower tier suppliers Quality Assurance Program requirements appropriate to the activities to be performed by the lower-tier supplier.

Quality Level B: This category requires the implementation of a quality assurance program which conforms to the requirements of NQA-1 by WVNS and any subtier supplier. The formalization of a supplier quality assurance program may be limited to specific criteria which impose quality assurance and its administration requirements such as inspection, test control, special processes, and documentation of compliance with design and procurement documents as provided by the supplier.

Quality Level C: This category requires the implementation of a quality assurance program in accordance with selected criteria of NQA-1 by WVNS and any subtier suppliers but does not require the formalization of a quality assurance program related to any specific criterion. This is applicable when the acceptability of the system, structure, or components can be determined by inspection or tests performed by WVNS or its suppliers.

Quality Level N: This category is for systems, subsystems, structures, and components which are not important to radiological safety and are excluded from WVNS Quality Assurance group activities specifically based on NQA-1. Specific Quality requirements will be specified by the Cognizant Engineer and/or the procurement group in conforming with conventional commercial practice.

## TABLE A.4.4-6

## WVDP SERVICE CLASSIFICATION SYSTEM

Service Class I: Structure, systems, subsystems, and components whose failure could cause:

1. A loss of process operating capability for an unacceptable period of greater than six months due to difficulties encountered in repair or replacement; or

2. High radiation exposures greater than 5 rem/yr to personnel required to perform operation, repair, or replacement.

Service Class II: Structure, systems, subsystems, and components whose failure could cause:

1. A loss or delay in process operating capability for one to six months due to difficulties encountered in repair or replacement; or

2. High radiation exposures between 1 rem/yr to 5 rem/yr to personnel required to perform operation, repair, or replacement.

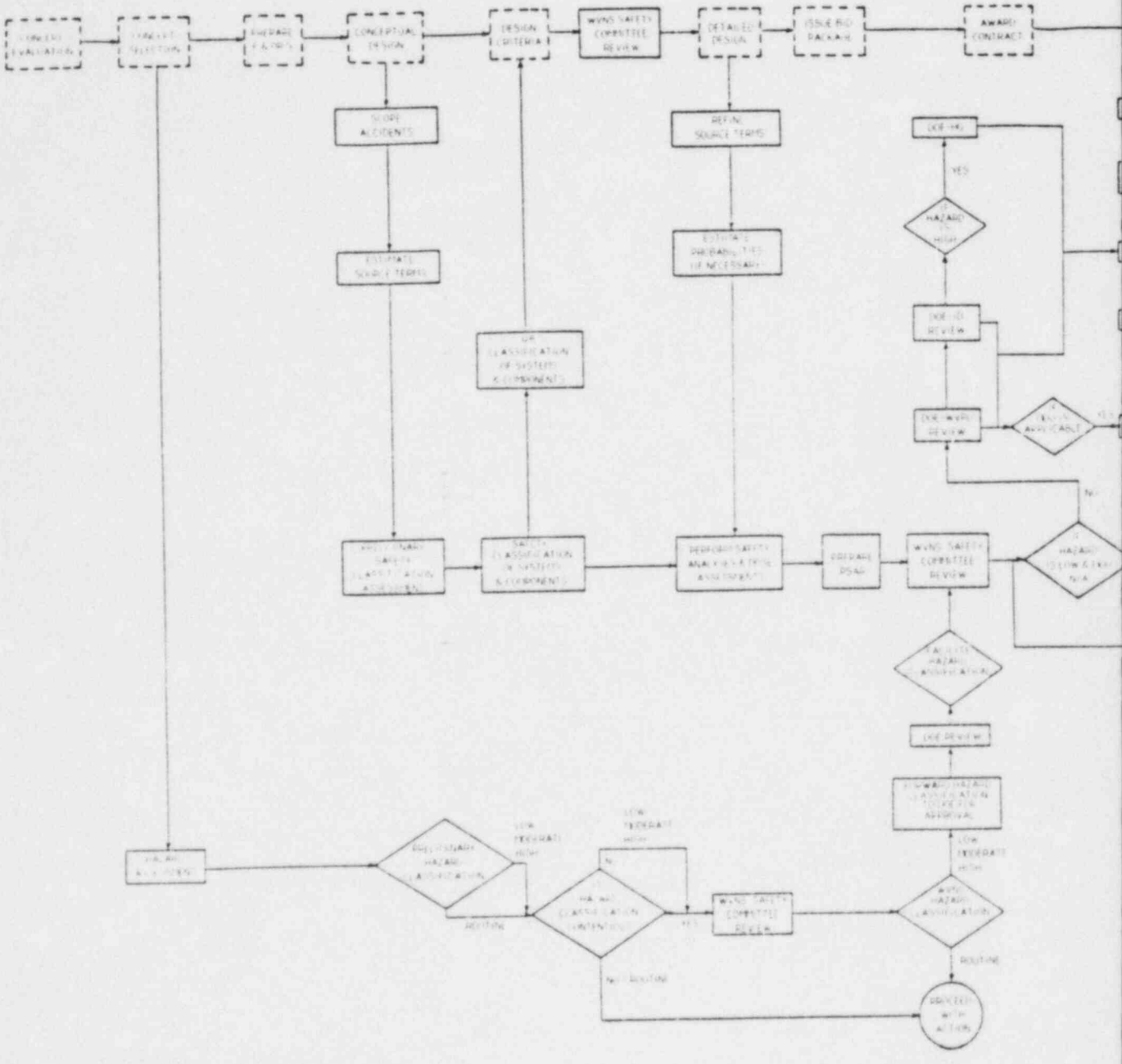
Service Class III: Structures, systems, subsystems, and components whose failure could not be readily detected and corrected in a time period that would cause:

1. A loss or delay in process operating capability for one to four weeks due to difficulties in repair or replacement; or

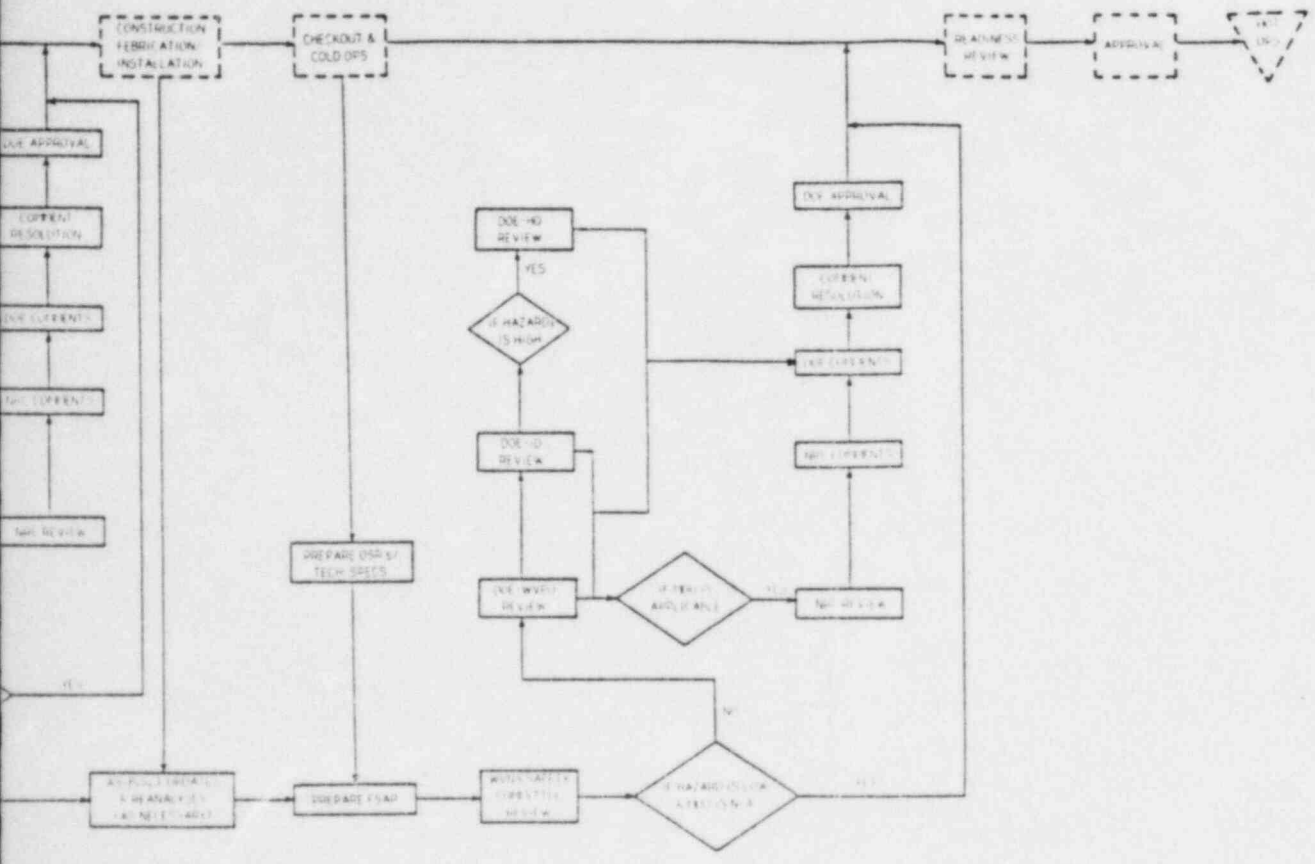
2. High radiation exposures between ALARA to 1 rem/yr to personnel required to perform operation, repair, or replacement.

Service Class IV: Structures, systems, subsystems, and components which by nature are reliable and compatible with their required availability based on a history of proven industrial reliability and acceptance.

WEST VALLEY DEMONS
SAFETY PROG



STRATION PROJECT
RAM LOGIC

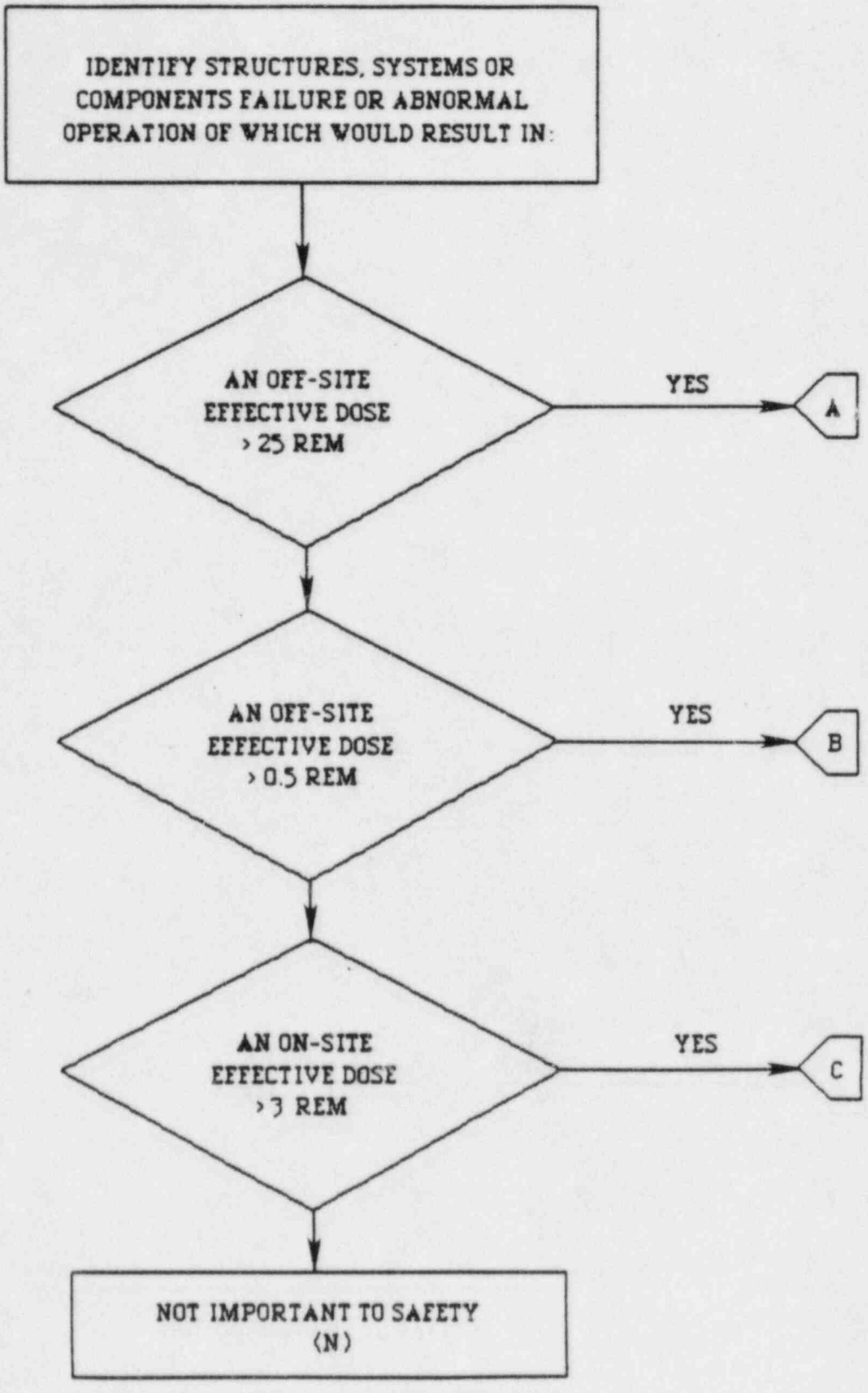



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FIGURE A.4.4-1




PROCEDURE FOR DETERMINING THE SAFETY CLASSIFICATION OF WVDP STRUCTURES, SYSTEMS OR COMPONENTS

FIGURE A.4.4-2

SAFETY CLASS

SERVICE CLASS

| | | | | |
|---|---|---|---|---|
| I | A | B | C | D |
| II | A | A | A | A |
| III | A | B | B | B |
| IV | A | B | C | C |
| V | A | B | C | N |

DESIGNATION INSIDE MATRIX IS QUALITY LEVEL

FIGURE A.4.4-3

MATRIX SHOWING RELATIONSHIP OF
SAFETY LEVEL, QUALITY LEVEL AND SERVICE CLASS

## A.7.0 WASTE CONFINEMENT AND MANAGEMENT

## A.7.1 WASTE MANAGEMENT CRITERIA

Wastes generated at the WVDP are either treated and released to the environment (liquid effluents and airborne stack releases) disposed of on-site (solid low-level radioactive wastes), or disposed of off-site in a commercial sanitary landfill (noncontaminated, nonhazardous solid wastes). The Project does not generate nonradioactive hazardous wastes in its present mode of operation.

In the sections that follow, The Project Waste Management Program is described in detail, from waste stream characterization at the point of generation, through treatment to final disposition in the WVNS Waste Management Plan.

The following basic criteria will be factored into each Project facility or activity involving waste generation and handling, or treatment:

- Minimize all waste generation as much as possible;
- Provide as much flexibility as possible in designed facilities to accommodate future uncertainties (e.g., liquid and solid waste volumes, storage, process equipment, etc.);
- Segregate uncontaminated from contaminated waste as early as possible to minimize additional storage, disposal, and transportation requirements;
- Minimize occupational exposures;
- Protect the worker, public health, and the environment; and
- Conform to applicable DOE orders and guidance from other regulations provided by DOT, EPA, NRC, and New York State.

A detailed analysis of Project radioactive waste disposal will be presented in an Environmental Assessment and a separate module of the SAR.

## A.7.2 RADIOLOGICAL WASTES

Estimates of volumes of low-level waste (LLW) that will be generated by the West Valley Demonstration Project (WVDP) were prepared for use as a source term in environmental documentation supporting the disposal of WVDP LLW. These estimates are summarized here. The wastes are expected to meet the waste form requirements of 10 CFR 61.55 and 56. The waste streams were divided into six categories to represent the operations performed at the project.

### LLW Volume Estimates

Table A.7.2-1 shows the radionuclide distribution assigned to waste packages based upon detection of the Cs-137 gamma emission. These values are calculated for 1 curie of Cs-137 and can be scaled according to the actual amount detected. Tables A.7.2-2 to A.7.2-7 present volume estimates and other information of LLW that were generated previously or will be generated by existing systems, the Radwaste Treatment System, presolidification decontamination, vitrification, and post solidification decontamination and decommissioning. A total of 19,900 $m^3$ (703,000 $ft^3$) of LLW will be disposed by the end of the project.

The volume estimates of trash, equipment, and rubble from presolidification decontamination (Table 7.2-5), vitrification (Table 7.2-6), and post solidification D/D (Table 7.2-7) as well as post solidification D/D liquid and wet solid wastes were derived from information in the WVDP FEIS. This was compiled when the upper limit for LLW was 10 nCi TRU activity per gram of waste. With the increase of the limit to 100 nCi TRU activity per gram, as much as 20 percent of what was once considered TRU waste may become LLW with TRU activity between 10 and 100 nCi/g. In Tables A.7.2-5 to A.7.2-7 this is listed as Class C waste with a TRU content of 55 nCi/g (the midpoint between 10 and 100 nCi/g).

For the post solidification D/D estimates (Table A.7.2-6), the dismantlement option was used because this option would generate more waste volume and more waste types than entombment would.

The curie estimates of low-level waste are based on gamma dose rates at the surface of the disposal package. This dose rate is converted to curies of cesium-137 and ratioed across the distribution of radionuclides in the HLW tank 8D-2, which is presented in Table A.7.2-1, normalized to 1 curie of Cs-137.

## Previously Buried Waste

Table A.7.2-2 was compiled by reviewing the WVDP Radioactive Waste Disposal Records for locations WVDP No. 1 to No. 7 and WVDP Caisson No. 1; the dates of hole closure ranged from March 27, 1982 to November 3, 1983.

## Trash

The volume estimate for trash waste generated by existing systems operations after 10/01/83 was obtained by considering that 540 $m^3$ (19,000 $ft^3$) of trash is generated each year (see WVDP Long-Term Radioactive Waste Management Plan, Table 2-3). It is expected that this waste stream will continue in significant quantities until the end of vitrification, June 29, 1990, at which time plant operations and maintenance activities will become less dominant as the trash volumes from post vitrification D/D activities become larger. Because there is some uncertainty on the annual generation rate and the duration, a contingency of 50 percent is added, giving a final disposal volume of 1,800 $m^3$ (64,000 $ft^3$) as listed in Table 7.2-3.

## Miscellaneous Dry Solids

Table A.7.2-2 indicates that a large amount of miscellaneous waste ("other" waste in Table A.7.2-2) has been disposed previously. This includes such items as soil, plywood, railroad ties, concrete, etc. and amounts to about 560 $m^3$ (20,000 $ft^3$) per year while existing systems are operating. The volume estimate reported in Table A.7.2-3, 5,700 $m^3$ (200,000 $ft^3$), was obtained by using the same assumptions and contingency as that used for trash from existing systems operations. The radiation and activity estimates were obtained by averaging those from previously buried waste.

## Equipment, Fuel Storage Racks, and Rubble

In the analysis of the activity on the equipment, fuel storage racks, and rubble wastes in Tables A.7.2-5 to A.7.2-7, it was assumed that the wastes were packaged in 1.9 m X 1.2 m X 1.3 m steel boxes with a mass of 5,900 kg (13,000 lbs). This may not be the case in actual practice, because a stable waste form may be required. If analysis of the metallic and concrete components indicates that they will provide stability to the disposal area for at least 300 years, then no additional packaging will be required. Otherwise, the equipment and rubble will be packaged in high integrity containers.

## Liquids and Wet Solids

For many of the activities reported for the liquid and wet solid wastes only the major radionuclides, Cs-137 and Sr-90, are included. Minor amounts of other radionuclides are also expected to be present, but present information is insufficient to quantify their activities.

It is planned to treat all liquid wastes, except possibly for the miscellaneous liquids generated during presolidification decontamination, in the Radwaste Treatment System (RTS). The information listed in Tables A.7.2-4 and A.7.2-6 was derived from data that is being used as input for system design (Saha, 1984). Post solidification D/D liquid waste information was obtained from the WVDP FEIS.

Wet solids from the Low Level Waste Treatment Facility (LLWTF) are sludge and resin. The average annual generation rate of the sludge from 1973 to 1982 was 375 drums. The Liquid Waste Treatment Subsystem of the RTS is expected to begin operating on June 30, 1987, and at that time it is planned to shut the LLWTF down. Because the sludge generation rate has varied, (as low as 228 drums and as high as 548 drums) and the sludge will be solidified in cement during future operations, a 25 percent contingency was added. The value of 360 $m^3$ reported in Table A.7.2-3 therefore represents 1,750 drums.

The LLWTF has two ion-exchange columns, each containing 1.8 $m^3$ (65 $ft^3$) of resin. It is assumed that one column requires replacement each year. In the future it is planned to immobilize the resin in cement at approximately 50 volume percent waste loading. Each year 3.6 $m^3$ of resin will require disposal, giving a total of 14 $m^3$ (490 $ft^3$) of resin waste for disposal before the LLWTF is shut down.

The last fuel is expected to be removed from the Fuel Receiving and Storage (FRS) pool by September 30, 1985 at which time it can be shut down. The FRS generates 2 $m^3$ (71 $ft^3$) per year of filter precoat and 13 $m^3$ (460 $ft^3$) per year of resin. Future packaging improvements may reduce the disposal volume, but such improvements will not be considered here to maintain conservatism. From October 1, 1983 to FRS shutdown, 4 $m^3$ of precoat and 26 $m^3$ (920 $ft^3$) of resin are expected to be generated. Because the date of FRS shut down is uncertain, a 50 percent contingency was added for Table A.7.2-3.

## Radiological Effluents

All Project discharges to the environment are routinely monitored to assure that radionuclide concentrations are below DOE limits as prescribed in DOE Order 5480.1. These data are tabulated and checked to identify trends of increasing activity early enough to identify and mitigate the causes prior to exceeding the limits.

The wet solids in the secondary waste streams from the RTS and vitrification will be immobilized in cement to produce stable waste forms. They will be treated in the RTS, and the information listed in Tables A.7.2-4 and A.7.2-6 was derived from data used as input for RTS design.

## REFERENCES

"Final Environmental Impact Statement, Long-Term Management of Liquid High-Level Radioactive Wastes stored at the Western New York Nuclear Service Center, West Valley," DOE/EIS-0081, U. S. Department of Energy, Washington, DC, June 1982, Table B.16.

"Final Environmental Impact Statement on, 10 CFR 61 'Licensing Requirements for Land Disposal of Radioactive Waste,'" NUREG-0945, Vol. 1, U. S. Nuclear Regulatory Commission, Washington, DC, November 1982, Table 3.1.

D. C. Grant, "West Valley Low-Level Waste Treatment Facility Analysis-Final Report" 82-8E4-WESTV-R4, Westinghouse R/D Center, Pittsburgh, PA, September 27, 1982, Table 5-1.

Memorandum, G. E. Riethmiller to P. Burn, "Low-Level Waste Treatment Operation Summary," January 28, 1983.

"Radwaste Incinerator System Technical Information," Westinghouse Water Reactors Divisions, Pittsburgh, PA, February 1983.

T. H. Smith, "Risk and Safety Analyses for Disposal of Alpha-Contaminated Waste in INEL," Proceedings of the Alpha-Contaminated Workshop, Gaithersburg, Maryland, Aug. 10-13, 1982, CONF-820845, Oak Ridge National Laboratory, Oak Ridge, TN, December 1982, p. 395.

Volker W. Schneider and Friedrich W. Ledebrink, "Cementation of TRU Waste by a New Process, Properties of the Products," Proceedings of the Second International Symposium on Ceramics in Nuclear Waste Management, American Ceramic Society, Chicago, IL, April 24-27, 1983.

Technical Advisory No. 3 of Purchase Order No. 0017, A. K Saha to S. Weisberg, "RTS Design," January 3, 1984.

"WVDP Long-Term Radioactive Waste Management Plan," WVDP-019, Rev. 1, West Valley Demonstration Project, West Valley, NY, July 1983, Table 2-3.

"WVDP Radioactive Waste Disposal Records," WVDP No. 1 to WVDP No. 7, WVDP Caisson No. 1, March 27, 1982 to November 3, 1983.

TABLE A.7.2-1

RADIONUCLIDE CONTENT OF WASTE PACKAGES BASED ON DETECTING 1 Ci OF Cs-137

| Isotope | Activity |
|---|---|
| H-3 | $1.5 \times 10^{-8}$ |
| C-14 | $1.7 \times 10^{-8}$ |
| Ni-63 | $1.2 \times 10^{-7}$ |
| Se-79 | $4.7 \times 10^{-6}$ |
| Sr-90 | $9.6 \times 10^{-1}$ |
| Y-90 | $9.6 \times 10^{-1}$ |
| Zr-93 | $2.8 \times 10^{-5}$ |
| Nb-93m | $2.8 \times 10^{-5}$ |
| Tc-99 | $1.0 \times 10^{-4}$ |
| Ru-106 | $4.4 \times 10^{-4}$ |
| Rh-106 | $4.4 \times 10^{-4}$ |
| Pd-107 | $6.4 \times 10^{-8}$ |
| Cd-113 | $4.4 \times 10^{-17}$ |
| Sb-125 | $1.9 \times 10^{-3}$ |
| Te-125m | $4.2 \times 10^{-4}$ |
| Sn-126 | $5.0 \times 10^{-6}$ |
| Sb-126m | $3.4 \times 10^{-7}$ |
| Sb-126 | $3.4 \times 10^{-7}$ |
| I-129 | $2.6 \times 10^{-11}$ |
| Cs-134 | $8.3 \times 10^{-4}$ |
| Cs-135 | $1.4 \times 10^{-5}$ |
| Cs-137 | $1.0 \times 10^{0}$ |
| Ba-137m | $9.4 \times 10^{-1}$ |
| Pm-147 | $1.4 \times 10^{-1}$ |
| Sm-151 | $2.5 \times 10^{-2}$ |
| Eu-152 | $6.6 \times 10^{-5}$ |
| Eu-154 | $2.5 \times 10^{-2}$ |
| Eu-155 | $5.6 \times 10^{-3}$ |
| Np-237 | $1.4 \times 10^{-6}$ |
| Np-239 | $2.9 \times 10^{-5}$ |
| Pu-238 | $1.1 \times 10^{-3}$ |
| Pu-239 | $2.0 \times 10^{-4}$ |
| Pu-240 | $1.5 \times 10^{-4}$ |
| Pu-241 | $1.4 \times 10^{-2}$ |
| Pu-242 | $2.1 \times 10^{-7}$ |
| Am-241 | $1.5 \times 10^{-3}$ |
| Am-242 | $2.6 \times 10^{-5}$ |
| Am-243 | $2.9 \times 10^{-5}$ |
| Cm-242 | $2.6 \times 10^{-5}$ |
| Cm-243 | $4.2 \times 10^{-6}$ |
| Cm-244 | $1.3 \times 10^{-3}$ |
| Cm-245 | $2.1 \times 10^{-7}$ |
| Cm-246 | $2.5 \times 10^{-8}$ |

TABLE A.7.2-2

SUMMARY OF PREVIOUSLY BURIED WASTE

| WASTE TYPE | VOLUME $m^3$ ($ft^3$) | ACTIVITY Total Ci |
|---|---|---|
| General Plant Waste | 800 (28,000) | 22* |
| LLWTF Sludge | 130 (4,600) | 0.70* |
| FRS Resin and Precoat | 32 (1,100) | Cs-137:430 Sr-90:40 |
| Other (Soil, Wood, metal, etc.) | 940 (34,000) | 1.3* |

* Multiply values by those in Table A.7.2-1.

TABLE A.7.2-3

WASTE FROM EXISTING SYSTEMS OPERATIONS (FROM 10/01/83)

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-Ci/$m^3$ | Container |
|---|---|---|---|---|---|---|
| Trash | Cloth, paper, plastic, etc. | A | 1,800 (64,000) | 1 | $9.6 \times 10^{-4}$ times Table A.7.2-1 | 1.9 m x 1.2 M X 1.3 m (L x W x H) steel box |
| Miscellaneous Dry Solids | Soil, wood, railroad ties, concrete, etc. | A | 5,700 (200,000) | 2 | $1.4 \times 10^{-3}$ | - |
| Wet Solid | LLWTF Sludge: Bell Tile Clay Polyelectrolyte, Sulfates, and Nitrates | A | 360 (13,000) | 1 | $5.3 \times 10^{-3}$ times Table A.7.2-1 | 208 litre drum |
| | LLWTF Resin: Duolite Cs-100 | A | 14 (490) | 1 | $4.3 \times 10^{-3}$ times Table A.7.2-1 | 208 litre drum |
| | FRS filter precoat: Super Cell Hy-Flo (diatomaceous earth) and Zeolan-100 | B | 6 (210) | 7 rem/h | Cs-137:1.8 Sr-90:0.2 | high integrity container |
| | FRS resin: Diamond Shamrock ARC | B | 39 (1,400) | 8 rem/hr | Cs-137:16 Sr-80:1.5 | high integrity container |

TABLE A.7.2-4

SECONDARY WASTE STREAMS FROM THE RADWASTE TREATMENT SYSTEM

(to end of vitrification, 6/30/90)

| Waste Type | Physical/Chemical Description Before Treatment | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-Ci/$m^3$ | Container |
|---|---|---|---|---|---|---|
| Liquid | Eluate and regenerate from polishers. 0.4 weight percent $NaNO_3$ and 1.13 weight percent $HNO_3$ | B | 25 (880) | - | Cs-137:2.4<br>Sr-90:0.27 | 208 litre drum |
| Wet Solid | Spent resin slurry | B | 6 (220) | - | Cs-137:0.47<br>Sr-90:0.052 | 208 litre drum |
| | 5 weight percent filter backwash slurry | B | 25 (880 $ft^3$) | | Cs-137:2.5<br>Sr-90:0.28 | 208 litre drum |

TABLE A.7.2-5

PRESOLIDIFICATION DECONTAMINATION WASTES

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-$Ci/m^3$ | Container |
|---|---|---|---|---|---|---|
| Trash | Cloth paper plastic, etc. | A | 51 (1,800) | 10 | 0.02 times Table A.7.2-1 | 1.9 m x 1.2 m x 1.3 m steel box |
| | | B | 15 (530) | 50 | 0.12 times Table A.7.2-1 | high integrity container |
| | | C | 33 (1,200) | 10 | 0.02 times Table A.7.2-1, except TRU. TRU is 55 nCi/g | high integrity container |
| Equipment and hardware | Predominantly steel and stainless steel | B | 1,100 (39,000) | 500 | 2.5 times Table A.7.2-1 | unknown |
| | | C | 110 (3,900) | 10 rem/h | 36 times Table A.7.2-1 | unknown |
| | | C | 80 (2,800) | 500 | 2.5 times Table A.7.2-1 except TRU. TRU is 55 nCi/g | unknown |
| Liquid Solidified in Cement | 6.5 weight percent salt before treatment* | C | 92 (3,200) | - | total: 36 due to Pu-238 to 241, Am-241, U-235 and 238, Sr-90, Cs-137, Tc-99 | 208 litre drum |

* Miscellaneous liquid wastes from presolidification decontamination may be TRU waste. It is included in this LLW analysis, because data refinement may classify it as LLW. Volume and activity estimates were derived from discussions with various groups within West Valley Nuclear Services Co., Inc.

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TABLE A.7.2-6 (1 of 2)

SECONDARY WASTE STREAMS FROM VITRIFICATION

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-Ci/$m^3$ | Container |
|---|---|---|---|---|---|---|
| Trash | Cloth paper plastic, etc. | A | 140 (4,900) | 10 | 0.02 times Table A.7.2-1 | 1.9 m x 1.2 m x 1.3 m steel box |
| | | B | 42 (1,500) | 50 | 0.12 times Table A.7.2-1 | high integrity container |
| | | C | 93 (3,300) | 10 | 0.02 times Table A.7.2-1, except TRU. TRU is 55 nCi/g | high integrity container |
| Failed equipment | Predominately stainless steel and Inconel | B | 38 (1,300) | 500 | 2.5 times Table A.7.2-1 | unknown |
| | | C | 4 (140) | 10 rem/h | 36 times Table A.7.2-1 | unknown |
| | | C | 3 (110) | 500 | 2.5 times Table A.7.2-1 except TRU. TRU is 55 nCi/g | unknown |

TABLE A.7.2-6 (2 of 2)

SECONDARY WASTE STREAMS FROM VITRIFICATION

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-Ci/$m^3$ | Container |
|---|---|---|---|---|---|---|
| Liquid Solidified in Cement | Decontaminated supernatant. See Table A.7.2-7 | A | 2,100 (74,000) | - | | 208 litre drums |
| | Sludge wash solution, similar to supernatant, but 2 weight percent salt | C | 130 (4,600) | - | | 208 litre drums |
| | Submerged bed scrubber conden- 3 M $HNO_3$ with $NaNO_3$ content equivalent to 20 weight percent | C | 790 (28,000) | - | Cs-137:50 Sr-90:0.5 | 208 litre drums drums |
| | Melter feed concentrator overheads | C | 11 (390) | - | Cs-137:1100 Sr-90:879 | 208 litre drums |
| | Fractionator condensate. 0.27 M $HNO_3$ or 1.66 wt. percent $HNO_3$ with $NaNO_3$ content equivalent to 2.24 weight percent | A | 2 (81) | - | Cs-137:4.4 x $10^{-2}$ remainder; 4.8 x $10^{-4}$ (Sr-90, Cs-134 and 135, Pu 238...) | 208 litre drums |
| Wet Solid Immobilized in Cement | Spent zeolite slurry. 14.2 weight percent hydrated zeolite | B | 590 (21,000) | - | Cs-137:2.7 remainder:2.9 x $10^{-3}$ (Sr-90, Cs-134 and 135, Pu 238...) | 208 litre drums |

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TABLE A.7.2-7 (1 of 2)

POST SOLIDIFICATION D/D WASTES

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-Ci/$m^3$ | Container |
|---|---|---|---|---|---|---|
| Trash steel | Cloth, paper, plastic, etc. | A | 100 ( 3,500) | 10 | 0.02 times Table A.7.2-1 | 1.9 m x 1.2 m x 1.3 m box |
| | | B | 31 (1,100) | 50 | 0.12 times Table A.7.2-1 | high integrity container |
| | | C | 69 (2,400) | 10 | 0.02 times Table A.7.2-1 except TRU. TRU is 55 nCi/g | high integrity container |
| Equipment and Hardware | Predominately steel, stainless steel and Inconel | B | 1,100 (39,000) | 500 | 2.5 times Table A.7.2-1 | unknown |
| | | C | 110 (3,900) | 10 rem/h | 36 times Table A.7.2-1 | unknown |
| | | C | 180 (6,400) | 500 | 2.5 times Table A.7.2-1 except TRU TRU is 55 nCi/g | unknown |
| Fuel storage racks | Aluminum Alloy | B | 620 (22,000) | 10 | 0.05 times Table A.7.2-1 | unknown |
| | | B | 62 (2,200) | 50 | 0.25 times Table A.7.2-1 | unknown |

TABLE A.7.2-7 (2 of 2)

POST SOLIDIFICATION D/D WASTES

| Waste Type | Physical/Chemical Description | Class | Volume $m^3$ ($ft^3$) | Average Surface Radiation-mrem/h | Activity-$Ci/m^3$ | Container |
|---|---|---|---|---|---|---|
| Rubble | Predominately concrete | A | 810 (29,000) | 1 | $5 \times 10^{-3}$ times Table A.7.2-1 | unknown |
| | | B | 81 (2,900) | 10 | 0.05 times Table A.7.2-1 | unknown |
| | | C | 65 (2,300) | 1 | $5 \times 10^{-3}$ times Table A.7.2-1 except TRU. TRU is 55 nCi/g | unknown |
| Liquid Solidified in Cement | Spent decontamination solutions and secondary streams from the RTS | C | 600 (21,000) | 6 rem/h | 43 times Table A.7.2-1 | 208 litre drum |
| | | C | 60 (2,100) | 15 rem/h | 120 times Table A.7.2-1 | 208 litre drum |
| | | C | 44 (1,600) | 6 rem/h | 43 times Table A.7.2-1, except TRU. TRU is 55 nCi/g | 208 litre drum |
| Wet Solids Immobilized in Cement | Resins and other slurries | C | 700 (25,000) | 20 rem/hr | 140 times Table A.7.2-1 | 208 litre drum |

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## A.7.3 NONRADIOLOGICAL WASTES

Nonradiological wastes at the WVDP include combustible solid waste (office trash, packing materials, etc.) and noncombustible solid wastes such as construction and demolition debris. In the past these wastes were disposed of in an on-site landfill (designated as the "Cold Dump") located approximately 100 metres north of the Low-Level Waste Treatment Facility. At present, the Project sends its noncontaminated solid wastes off-site to a licensed sanitary landfill.

Nonradiological wastes generated by various systems will be discussed in the respective SAR module.

## A.7.4 OFF-GAS TREATMENT AND VENTILATION

The Off-Gas Treatment and Ventilation Systems for the existing facility are described and discussed in Volume II, Section B.5. Ventilation for future systems, whether as a modification of existing ventilation or new Ventilation Off-Gas Systems, will be discussed in the specific SAR modules.

## A.7.5 LIQUID WASTE TREATMENT AND RETENTION

The existing liquid Low-Level Treatment System is described in Volume II, Section B.5. Future systems for treating high-level waste supernatant and liquid low-level wastes will be the subject of other SAR modules.

## A.7.6 LIQUID WASTE SOLIDIFICATION

The WVDP has selected cement as the waste form for liquid low-level wastes. A Cement Solidification System (CSS) is presently being designed and will be the subject of a separate SAR module.

## A.7.7 SOLID WASTES

Project generated solid wastes, described briefly in Sections A.7.2 and A.7.3 are at present packaged for storage in the LLW Lag Storage Building until disposal in the on-site NRC licensed Low-Level Waste Disposal Area (NDA) if they are radioactive. Noncontaminated and nonhazardous wastes are disposed of off-site in a licensed sanitary landfill.

The LLW Lag Storage Facility is operated in accordance with a separate SAR module and the NDA will be assessed in a future SAR module.

TRU waste will be stored on-site until it can be shipped to a TRU waste disposal facility. The Project will not dispose of TRU waste on-site.

## A.8.0 RADIATION PROTECTION

## A.8.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)

### A.8.1.1 POLICY CONSIDERATIONS

A formally documented program directed toward maintaining personnel radiation doses "as low as reasonably achievable" (ALARA) is in place for the WVDP. Guidance provided in DOE/EV/1830-T5, "A Guide to Reducing Radiation Exposures to As Low As Reasonably Achievable," on recommended practices and policy has been implemented in the ALARA program. This program is required by management policy, coordinated by the Radiological and Decommissioning Operations (R/DO) Manager and implemented by line management. In essence, the program establishes annual radiation exposure reduction goals and management commitments to facility modification, changes in operating practice, etc., which assist in meeting the goals. Progress toward meeting the goals is reported #o management monthly and an annual summary report presents the accomplishments for the previous year and establishes goals and corresponding activities for the following year. The formal ALARA program and its implementation is the subject of annual Radiation Safety Committee review.

### A.8.1.2 DESIGN CONSIDERATIONS

The responsibility for ALARA policy implementation into the design of the high level waste (HLW) solidification and support facilities lies with the WVNS Engineering Manager.

Periodic design reviews are held in which ALARA principles (discussed below) are considered and incorporated into design documents, i.e., design bases and drawings.

### A.8.1.2.1 General Design Considerations for Maintaining Exposures ALARA

General design considerations and methods employed to maintain radiation doses ALARA are as follows:

- Minimize the necessity for personnel to spend time in radiation areas and the amount of time spent there;

- Minimize radiation and airborne activity levels in routinely occupied areas of the solidification and support facilities and in the vicinity of equipment expected to require the attention of personnel;

- Maintain whole body radiation doses of personnel in continuously occupied areas below 500 mrem per year per person; and

- Maintain whole body radiation doses of personnel involved in maintenance activities below 1 rem per year per person.

Both equipment and facility designs are considered in maintaining doses ALARA during operation (including normal operation, maintenance and repairs, in-service inspection, and calibrations).

### A.8.1.2.2 Equipment Design Considerations for ALARA

Equipment design considerations to minimize the necessity for personnel to spend time in radiation areas and the amount of time spent there include:

(1) Incorporating design features and constructing equipment, components, and materials to reduce the need for repair or preventive maintenance;

(2) Providing maintenance and repair convenience (including easy disassembly and the use of modular components) so that repairs can be made in areas with a lower radiation level;

(3) Remotely or mechanically operating, repairing, servicing, monitoring, and inspecting equipment where practicable;

(4) Providing redundant equipment or components to reduce the need for immediate repair or maintenance where radiation or airborne radioactivity levels may be high; and

(5) Providing override features on remote handling equipment in radiation areas.

**A.8.1.2.3 Facility Layout Design Considerations for ALARA**

Facility design considerations to minimize the amount of time personnel spend in radiation areas include:

(1) Locating equipment and instruments that require routine maintenance, calibration, operation, or inspection in easily accessible areas in order to minimize the amount of time needed to perform those operations;

(2) Separating radioactive or potentially radioactive equipment from nonradioactive equipment;

(3) Providing for the transportation of equipment components requiring service to areas with a lower radiation level;

(4) Separating radiation sources from occupied areas (e.g., designing so that pipes and ducts containing potentially radioactive fluids do not pass through normally occupied areas);

(5) Providing adequate shielding between radiation sources and access and service areas;

(6) Providing central control panels to permit remote operation of all essential instrumentation and controls from the lowest radiation zone practicable;

(7) Providing means for controlling contamination and airborne radioactivity by proper design of the ventilation system (i.e., designing air flow rate, velocity, and flow patterns for maximum confinement efficiency); and

(8) Designing surfaces subject to possible contamination so that they are free of crevices and sharp edges and coating them to facilitate decontamination.

### A.8.1.3 Operational Considerations

In accordance with the operating contractor's policy and consistent with the recommendations of DOE/EV/1830-T5, the radiation exposure to plant personnel is kept ALARA by the facility design, continued review of operations and training, and the functioning of the radiological control organization. In addition to planning, training, and monitoring all activities related to radiation exposure of personnel, some of the ALARA techniques used to reduce exposures are:

(1) Work is performed outside radiation areas to the extent practicable.

(2) Entry and exit points are located in areas where dose rates are as low as practicable.

(3) Shielding is utilized whenever possible. Temporary shielding is also used for operations near radiation sources.

(4) Work is preplanned when it involves whole-body exposure to high levels of radiation or contamination. This ensures expeditious performance in a safe manner and with minimum personnel.

(5) When required, protective clothing and respiratory equipment are worn for radiological protection and selected to minim.ze the discomfort of workers so that efficiency is maintained and less time is spent in radiation areas.

(6) Workers entering radiation areas where significant doses could be received wear self-reading dosimeters so that they can determine their accumulated exposure at any time while on the job.

(7) Areas with potential for significant loose contamination of airborne radioactivity are isolated by air locks and/or airflow control to minimize inhalation exposure and the potential for the spread of contamination.

## A.8.2 RADIATION SOURCES

The radiation sources will vary from system to system and will be addressed individually in each specific SAR module.

## A.8.3 RADIATION PROTECTION DESIGN FEATURES

Specific radiation protection design features will be described and discussed in the individual SAR modules.

## A.8.4 OCCUPATIONAL DOSE ASSESSMENT

The on-site (occupational) dose assessment for a given system or operation will be presented in the individual SAR modules. In the actual operation of each system, an ALARA budget is predetermined for annual exposures resulting from routing operation and maintenance of that system. The budget is based upon WVNS administrative exposure limits and is monitored monthly to assure that excessive exposures are not being accrued. In the event that the budget is being exceeded, the operation is flagged for additional management attention.

## A.8.5 HEALTH PHYSICS PROGRAM

### A.8.5.1 ORGANIZATION

Implementation of the health physics program is an operating line management responsibility. Development of the health physics program is the responsibility of the Radiological and Decommissioning Operations Manager and the Radiation and Safety Manager. They are also responsible for the development of policies and procedures relative to the independent safety review program. This program requires the formation of ad hoc committees to conduct objective reviews of significant modifications to programs or facilities. The organizational structure and duties of the staff which provide health physics program management are described below and shown in Figure A.8.5-1.

#### A.8.5.1.1 Radiological and Decommissioning Operations

WVDP management has provided a staff of radiological and nuclear safety professionals to implement those health physics policies which are related to specific organizational duties. In general terms, the health physics-related responsibilities of the Radiological and Decommissioning Operations organization are to:

- Establish, interpret, and implement the health physics program and policy requirements;
- Adopt and interpret applicable codes, standards, and guides;
- Provide health physics services for employes;

- Provide training support and support an emergency response capability;
- Support line organizations with regard to health physics matters;
- Determine the need for operational health physics research;
- Collect, evaluate, and disseminate health physics related information; and
- Support hazard and risk assessment and systems safety programs.

In addition to those staff members directly committed to WVDP, support is available, if necessary, from other Occupational Safeguards organizations within the Westinghouse Nuclear Energy Systems and operating divisions of Westinghouse Electric Corporation.

Figure A.8.5-1 depicts the R/DO management organization at WVDP starting with the initial decontamination and decommissioning operations through solidification and final decontamination and decommissioning. The functions and responsibilities of the health physics-related organizations are discussed in the following paragraphs.

## Manager, Radiological and Decommissioning Operations

The Manager, Radiological and Decommissioning Operations, is responsible for all activities concerning radiation protection of employees. He is responsible for developing training programs to instruct workers in performing their jobs safely. He reports to the President of WVNS and has the full authority to cease operations in the event that operating conditions are not in compliance with operational radiological safety controls or approved operating procedures. This authority is also delegated to the Manager of Radiation and Safety (R/S) and his staff.

## Manager, Radiation and Safety

The Manager, Radiation and Safety, through the R/S Technicians, is responsible for maintaining radiological safety of the plant by regularly evaluating and assessing surface contamination, radiation levels, and airborne radioactivity concentrations in work areas with respect to approved limits. A major responsibility of this organization is to assist operating management in developing programs and plans to maintain radiation exposures as low as reasonably achievable. Cost effectiveness of these programs is a consideration in their development. The Manager, Radiation and Safety, is responsible for ensuring that a personnel dosimetry program is in place to determine radiation exposures of employes and visitors who are authorized to receive occupational radiation exposure and that records of such exposures are properly maintained and reported. He is also responsible for ensuring proper calibration and maintenance of the radiological control instrumentation used in normal or emergency operations. He has the authority to remove from the list of employes authorized to receive occupational radiation exposure those who: (1) have either exceeded the established administrative radiation exposure limits, or (2) have not demonstrated their continuing understanding of the Project's radiological safety-related operating procedures or the need for compliance with them. He is responsible for review of facility and process design, operating procedures, design and process changes and for providing engineering support to operational groups which prepare those procedures. He and delegated staff have both the authority and responsibility to cease operations in the event that they are not proceeding in accordance with established operating procedures and safety controls or involve an unreviewed operation which presents a safety risk. He maintains the Radiological Controls Manual which implements the policies contained in the Policies and Procedures. The Manager, Radiation and Safety, through the Criticality Safety Engineer, is also responsible for reviewing facility

operations which involve fissile material storage, processing, handling and shipping, and for developing and implementing a control and monitoring program to prevent accumulating unsafe quantities of nuclear materials. He is responsible for ensuring that criticality monitoring instrumentation, nuclear accident dosimeters and an effective and well documented analysis program and review system are in place. In compliance with WVNS policy, these systems will meet or exceed the DOE requirements for nuclear criticality safety of nonreactor nuclear facilities described in DOE Order 5480.1, Chapter V.

He is responsible for maintaining an effective thermoluminescent dosimetry laboratory, dosimetry processing equipment, and an effective record system for processing personnel dosimeters. He is also responsible for establishing programs which ensure the safety of fissile and radioactive material shipping. The Manager, Radiation and Safety reports to the Manager, Radiological and Decommissioning Operations.

Reporting to the Manager, Radiation and Safety are Radiological Control Supervisors. The Radiological Control Technicians who provide routine monitoring and surveillance functions report to these supervisors. Safety professionals and management within the R/DO Department are on call to provide shift technical support if needed. The Radiological Control Shift Supervisor is a field representative of the R/DO Department. He is responsible for ensuring that the facility radiation and contamination surveys are completed as scheduled and that they are properly documented. Additionally, he is responsible for proper surveillance of work being conducted on radioactive systems and posting controlled areas.

### A.8.5.1.2 Facility Operations

The R/DO organization provides support to Facility Operations in the area of training and emergency planning. R/DO assists the Training Department in developing training programs, qualification standards and questionnaires for use in radiation worker training, use of containment devices, fissile material handler training, radiation orientation for nonoccupationally exposed workers and training in the use of respiratory protective devices. These programs are presented by either OS or the Training Department; in both cases, the training records are maintained in a central file by the Training Department. Specific training policies and requirements are discussed under Section A.10.3.

The Plant Operations Manager is responsible for maintaining the Emergency Plan and implementing the requirements of the applicable DOE Orders. R/DO supports Plant Operations in safety and in providing a radiological emergency response capability.

### A.8.5.1.3 Safety Committees

WVNS company policy and procedures require the establishment of an independent safety review program. This program requires the formation of a safety committee whose function is to provide an independent review of significant modifications to programs and facilities to assure that:

- Health physics matters are comprehensively addressed;
- Risks have been identified and that they are acceptably low with respect to the benefits gained; and

o Management authorization of operations is documented.

The Safety Committee is staffed by standing and ad hoc members who are independent of the organization being reviewed. The Standing Committee is appointed by the Project Manager. The ad hoc committee members are appointed by the Standing Committee Chairperson. The ad hoc committee members are independent of the organization being reviewed. The Safety Committee reports to the Project Manager through the Safety Committee Chairperson.

**A.8.5.2 EQUIPMENT, INSTRUMENTATION, AND FACILITIES**

The instrumentation used by the radiological control personnel can be divided into four categories:

(1) Fixed radiation counting instruments (laboratory type);

(2) Portable radiation detection instruments;

(3) Area radiation monitoring instruments; and

(4) Airborne radioactivity sampling and monitoring instruments.

Instruments are repaired and calibrated by instrument maintenance and calibration personnel in the Radiation and Safety group. In some cases, specialized instruments may be returned to the manufacturers for repair and calibration.

### A.8.5.2.1 Radiation Counting Instruments

Fixed radiation counting instruments are located in the Process Building and are used primarily for analyzing air, water, and smear samples taken in and around the WVDP facilities. The Environmental Laboratory (in the administration area) is also equipped with radiation counting instruments for counting environmental samples. The instruments selected for use in the laboratories possess sensitivities to detect levels required by the operating technical specifications and good operating practices.

These instruments are periodically calibrated with standard sources traceable to NBS or other recognized standards laboratories. The standards are counted in the various geometries that are normally used to count actual samples. Instrument background and response to calibrated check sources is determined each operating day to verify that the instrument background and calibration have not changed.

The types of instruments on the second floor are low background, gas flow proportional counters that consist of an anticoincidence guard detector with lead shield, automatic sample changer, and electronics to permit simultaneous counting of alpha and beta radiations. The counters are used for low-level alpha and beta determinations of air, smear and water samples.

The instruments located on the third floor of the Process Building are operated by the Analytical Chemistry group within the R/DO organization. The instrumentation consists of:

(1) Sodium iodide (NaI), germanium lithium (GeLi), and hyperpure germanium (HPGe) detectors for gamma and X-ray spectroscopy;

(2) Surface barrier-type semiconductor detectors for alpha spectroscopy;

(3) Low energy photon spectroscopy (LEPS) detector for high resolution of X-rays and low energy gamma rays; and

(4) Microprocessor-based multichannel analyzers, a line printer, an X-Y plotter, and associated electronics and software that can be interfaced with all of the above detectors for spectrum display and analysis and data printout.

Samples are prepared for counting in the radiochemical laboratory. Sample preparation for counting may include solidification, chemical separation, and loading samples into appropriate containers.

A.8.5.2.2 Portable Radiation Detection Instruments

The portable radiation detection instruments are used to perform radiation and contamination surveys in the field. Portable instruments include those capable of detecting alpha, beta, gamma, and neutron radiation. Instruments are selected based on ruggedness, accuracy, reliability, and ease of service. These instruments cover the entire spectrum of radiation measurements expected to be required during normal operations and accident conditions.

Portable instruments are normally calibrated semiannually in the Calibration Room using the calibrator. Prior to use, these instruments are checked for response with a source containing a known amount of radioactivity.

#### A.8.5.2.2.1 Alpha Detection Instruments

Portable alpha detection instruments used at WVDP are scintillation detectors.

These detectors have at least 20 percent efficiency and are intended for field use in making surface and personnel contamination surveys. The geometry of the detectors makes them suitable for use in both smear and total contamination surveys. In addition to the detectors, the ratemeters are also provided with portable scalers. By using the portable scalers, it is possible to conduct contamination surveys in the field, thus reducing the burden on the counting laboratory instruments. The minimum detectable activity of these instruments is less than the facility operational contamination limits.

#### A.8.5.2.2.2 Beta Detection Instruments

A variety of beta detectors and suitable ratemeters for both surface and personnel contamination control are used at WVDP. In general, these detectors are thin window G-M tubes. In addition to the ratemeters, portable shielded caves and scalers are provided for counting smear samples in the field. The scalers perform essentially the same function as those described in the previous section. The thin window G-M tubes have an efficiency of about 40 percent of $2\pi$ for strontium-yttrium beta particles. These instruments are capable of detecting activities below the operating limits for surface contamination. As purchased, the detectors have about 1-2 percent efficiency for Cs-137 gamma rays.

### A.8.5.2.2.3 Gamma Detection Instruments

Shielded G-M tubes, scintillation detectors, and ionization chambers are used for gamma surveys. The shielding that covers the active area of the detector is sufficient to filter out beta radiation, thus allowing discrimination between penetrating and nonpenetrating radiation. Both directional and nondirectional detectors are provided. When coupled with a rate meter, these detectors are used for both field contamination and direct radiation surveys. Low, medium and high range instruments are available as follows:

(1) Low range instruments are normally used for background monitoring outside of areas where radioactive materials are handled. They use either scintillation or high pressure ionization chambers as detectors. The range of detection is of at least 0 to 5 mR/h.

(2) Medium range instruments are hand-held survey instruments used for general area radiation surveys. They have a range of at least 0 to 50,000 mR/h and use either ionization chambers or scintillation detectors.

(3) High range instruments fitted with telescoping probes are available for monitoring high level radiation sources. In general, they have probes that can be extended over 10 feet to reduce exposure to the technician making the measurement. These instruments are either G-M tubes or solid state detectors not subject to saturation at high fluxes and have ranges from 0.1 mR/h to at least 1000 R/h.

(4) Neutron detection instruments are portable instruments available for neutron surveys incorporating tissue-equivalent, polyethylene-cadmium shielded, $BF_3$-type detectors. These instruments are calibrated to read directly in mrem per hour.

Neutron-sensitive nuclear accident dosimeters (NADs) are portable cylinders containing a variety of foils and materials necessary for determining neutron energy spectra in the event of a criticality; they are available and placed in specified work areas.

### A.8.5.2.3. Airborne Contamination Sampling and Monitoring Equipment

Sampling for airborne contamination is accomplished using both fixed and portable devices. The fixed instrumentation consists of low volume air samplers mounted on the walls near breathing zone heights throughout the plant. The plant vacuum system draws air through fixed filter papers in these samplers continuously at a flow rate of approximately 28 litres per minute.

Portable instrumentation used for airborne contamination sampling consists of continuous air monitors (CAMs) and hand-held high volume air samplers. The CAMs are located near the workers' operational areas and provide representative samples of the concentrations to which personnel are exposed. They continuously collect and measure airborne particulates by pumping air through a fixed filter in close proximity to an integral beta-gamma or alpha detector. Flow rate may be adjusted to the desired level, and pulse height discriminators and background subtraction features available on some of the models lessen the sensitivity of the detectors to short-lived radon and thoron daughter interference. Meters, strip chart recorders, audible alarms, and alarm lights provide a clear, permanent record and unambiguous indication of alarm conditions. Ranges are switched automatically. Each monitoring system has a minimum detectable concentration of 10 MPC hours which is 25% of the 7-day limit established in 10 CFR 20.

Portable high volume air samplers operate with much higher flow rates than the CAMs or the fixed plant air samplers. They operate on battery power or line voltage. Air is drawn through a fixed filter paper; interchangeable filter holders of varying sizes are used in conjunction with filters of matching sizes and varying materials depending on the particular application.

Flow rate measuring devices are recalibrated semiannually using WVDP-owned flow rate calibration equipment. The flow calibrator is itself calibrated annually by an independent vendor certified by NBS. CAM detectors are calibrated regularly and post-maintenance or post-repair calibration is performed using NBS traceable calibration standards.

### A.8.5.2.4. Personnel Monitoring Instruments and Service

Personnel monitoring instruments are used to measure the radiation dose received by personnel and to detect external and internal contamination.

Personnel monitoring for external contamination is performed using the survey instruments previously discussed. These "friskers" are placed near all exits to the controlled area and personnel are responsible for conducting whole body surveys each time they exit the controlled area. In addition, when special operations are conducted, contamination surveys of personnel handling special materials are performed by a qualified radiological control technician.

Portal monitors are located at each exit from the site for follow-up checks; all persons entering or exiting the protected area pass through this device.

Personnel monitoring for external dose utilizes thermoluminescent dosimeters (TLDs). Card-mounted lithium fluoride (LiF) TLDs are used. Li-7 enriched chips are provided for beta and gamma monitoring. TLDs are processed singly in a manually operated TLD reader. The TLD reader is calibrated both electronically and with chips exposed to known doses from NBS traceable sources prior to processing TLDs. The TLD badge issued to those workers whose TLDs are read monthly (see Section A.8.5.3.6) also contains a combination of foils with varying neutron capture characteristics. In the event of a criticality, neutron spectra and dose could be obtained from these foils.

In addition to the TLD badge, ionization chamber direct-reading pocket dosimeters are issued to those workers on the monthly badge processing schedule. The direct reading dosimeters and TLDs are worn continuously by these employees while they are in controlled areas. In some special cases, digital electronic alarming integrating dosimeters are used in addition to the standard-issue dosimetry.

A whole body counting facility for internal dose assessment is located in the dosimetry laboratory. In-vivo measurements are made using a sodium iodide detector placed over the lungs and interfaced to a microprocessor-based multichannel analyzer. Bioassay samples are shipped to a vendor facility for analysis. Containers for urine samples and fecal samples are available at the site.

### A.8.5.2.5 Instrument Storage, Calibration, and Maintenance Facilities

Portable radiation detection instruments are stored in the Radiological Control Shift Office. A locker containing a selection of portable instruments designated for use in emergencies as well as a selection of instruments and contamination control equipment in a second case are stored in this area.

The Project maintains an instrument calibration facility. In addition to other equipment, this facility possesses a retractable shielded Cs-137 source capable of producing radiation fields greater than 500 R/hr inside a small portion of the shielded calibration cavity; the corresponding external dose rate is 0.1 mR/hr at 1 metre.

Instrument maintenance is also performed in the Calibration Room. Out-of-service instruments are tagged accordingly and stored in the Calibration Room while awaiting calibration/service.

### A.8.5.2.6 Health Physics and Radioactive Analysis Facilities

The Radiological Control Shift Office as well as the offices of the Manager, Radiation and Safety and his engineering staff are located in the offices of the Process Building. Laboratory facilities are available in the Analytical Chemistry Laboratory, the Radiochemical Laboratory, and the Counting Room located on the third floor.

### A.8.5.2.7 Radiological Control Equipment and Clothing and Associated Facilities

Personal protective equipment and clothing are supplied on an as-needed basis to protect personnel from contamination. Protective equipment to be provided includes:

- Body protection - lab coats, coveralls, plastic suits, body cooling suits and/or supplied air as appropriate;
- Head protection - cloth and plastic hoods;
- Hand protection - disposable gloves, surgeon's gloves, rubber gloves, leather gloves, and glove liners; and
- Foot protection - plastic shoe covers, rubber overshoes, and boots.

Protective clothing is stored at the change room or control points in the Process Building for normal facility entry. Protective clothing is removed when personnel exit a controlled surface contamination area; clothing designated for use in contaminated areas is not permitted to be worn elsewhere in the facility. Used protective clothing is stored in plastic hampers at the change point.

Contamination control equipment is used to prevent or limit the spread of radioactive contamination and to assist in its removal. The equipment includes such items as:

- Polyethylene sheeting;
- Disposable absorbent towels;
- Plastic bags of assorted sizes;
- Clothbacked tape;
- Radiation and contamination signs;
- Barricade posts with magenta and yellow-colored rope;
- Air locks and tents for manned entry/exit and work in highly contaminated areas. The air locks/tents are fabricated by a vendor according to WVNS specifications as needed for decontamination and decommissioning activities; and
- Custom glove boxes, also designed on an as-needed basis, for entry/exit of remotely-controlled equipment into/out of highly contaminated areas.

This equipment is stored in closets at control points, and in or near other areas where it is usually used.

### A.8.5.2.8 Respiratory Protection Equipment and Associated Facilities

A variety of types of respiratory protection equipment for decontamination and decommissioning activities, maintenance, and emergency use is available at WVDP. Both high efficiency filtered and forced air devices are used.

Only equipment approved for use by the National Institute of Occupational Safety and Health is allowed at WVDP. The equipment available for use is as follows:

a. Particulate Removing Respirators

Particulate removing respirators protect personnel against inhalation of nonvolatile airborne particles in the form of dust, spray, and mist. They usually consist of one or two particulate-removing cartridges connected to a full facepiece.

b. Chemical Cartridge Respirators

Chemical cartridge respirators usually consist of one or two cartridges containing granular absorbants or catalysts attached to a full facepiece. These respirators protect against low concentrations of vapors or gases such as acid gases, ammonia, and solvent vapors.

The respiratory fit and test equipment is located in the Test and Storage Building. The equipment consists of a sealed fit and test booth interfaced with a DOP generator and associated sampling lines for measuring DOP concentrations inside and outside the mask. The equipment is sensitive enough to verify protection factors up to 100,000 for individual wearers.

c. Airline Respirators

A source of compressed air (compressor or pressurized tank) supplies respirable air through a hose to the wearer of an airline respirator. The airline respirator is used for a wide variety of airborne contaminants, and for higher concentrations of gases and vapors.

d. Self-Contained Breathing Apparatus

A self-contained breathing apparatus is a respirator that employs a supply of air carried by the wearer to provide him with a respirable atmosphere. Self-contained breathing apparatus offers respiratory protection against toxic vapors, gases, particulates and combinations thereof up to a protection factor of 10,000, and against any degree of oxygen deficiency.

Sanitized and tested respiratory protective devices are stored at the work location or change room/control point in sealed plastic bags. Used respirators are collected for processing at the exit of the contaminated area.

### A.8.5.2.9 Equipment and Personnel Decontamination Facilities

If required, contaminated tools and equipment are decontaminated in the MSM Shop. Any water and detergents used in the decontamination process is routed to the low-level waste treatment facility.

Anticontamination clothing is decontaminated in the WVDP laundry facility. Respirators are decontaminated, sanitized, refurbished (if necessary), and tested at the laundry. After passing all tests (per ANSI 788.2-1980, "Practices for Respiratory Protection"), respirators are bagged and tagged ready for use and stored in the laundry facility or near the work area.

One personnel decontamination facility is available onsite. The decon facility is located in the Process Building. It contains a stainless steel pen with shower attachments and two sinks and is equipped with the appropriate personnel decontamination chemicals and detergents. All drains are directed to the low-level waste treatment facility.

In addition to these exclusive-use facilities, showers and eyewash stations are placed at various locations throughout the process building.

### A.8.5.3 Radiological Control Procedures

#### A.8.5.3.1 Radiation and Contamination Surveys

Radiological Control technicians perform routine radiation and contamination surveys of all accessible areas of the facility. Survey areas and frequencies are determined in accordance with radiological control procedures and manuals, and are based upon the probability of contamination and changes in radiation level and upon personnel occupancy. These surveys consist of radiation measurements and/or smears as appropriate for the specific area. The records of the survey results are retained by Radiation and Safety and are reviewed periodically so that trends indicating problem areas are identified as early as possible. Direct radiation surveys are performed using portable instruments in accordance with the following criteria:

- Appropriate radiation surveys are performed periodically to control radiation doses during solidification and decontamination and decommissioning activities.

- Routine gamma surveys are performed at frequencies specified by the Radiation Control Manual.

- Gamma surveys are performed in spaces surrounding radiation areas subsequent to movement of radioactive equipment or material. The boundaries are adjusted as necessary.

- Boundaries of radiation areas established for a specific short-term purpose are surveyed each work day when activities are performed during which radiological conditions may change.

- Radiation and Safety establishes and maintains a routine schedule for surface contamination surveys. This survey schedule defines the area to be surveyed and the frequency of the survey. In general, areas with a higher potential for contamination are surveyed more frequently than the areas with a lower contamination potential. In addition, sufficient surveys are taken during work involving radioactive material handling to ensure that contamination control is maintained.

Two types of contamination surveys are made: surveys performed with portable instruments and smear surveys analyzed with laboratory instruments. For any item to be removed from the controlled area, portable instruments are used to determine the amount of fixed plus removable contamination deposited on the surface. The probe is placed in close proximity to the surface being surveyed, and the total amount of radioactivity detected by the instrument is averaged over the active area of the probe. These probe surveys are followed by smear surveys made by wiping a 100 $cm^2$ area with swipes and analyzing the materials on the paper in the laboratory to determine the amount of gross alpha and beta activity wiped from the potentially contaminated surface.

In some cases, (e.g., operational surveillance), it may be necessary to count swipe surveys in the field with a portable instrument. When smears are counted with a portable instrument, the smear is, in general, taken over a larger area to improve the count rate and provide greater assurance of positive identification in higher backgrounds.

Results of smear surveys are compared with the maximum allowable surface contamination level permitted in clean (noncontaminated) areas. Limits for removable contamination for accessible surfaces within clean areas are specified in the Radiation Control Manual.

The survey methods discussed above are capable of detecting activities well below the applicable limits. Based on the results of these surveys, areas are posted and controlled in accordance with the criteria discussed in Section A.8.5.3.3.

### A.8.5.3.2 Procedures for Ensuring that Occupational Doses are ALARA

The objective of the radiological and safety program is to ensure that the exposure of employes to radiation and radioactive materials is within the guidelines of 10 CFR, Part 20 and that such exposures are kept as low as reasonably achievable (ALARA). These objectives are met by ensuring that:

- Personnel receive a level of radiation protection training appropriate to their assignments;

- Appropriate access control techniques and protective clothing are used to limit the spread of external contamination;

- A respiratory protection program is in place, and respiratory protective equipment is used where required;

- Radiation areas are segregated and appropriately posted to limit radiation exposure;

- Instruments and equipment are properly calibrated so that accurate radiation, contamination, and airborne activity surveys can be performed;

- Appropriate personnel dosimetry devices are supplied, and a radiation exposure record system is maintained;

- An internal dose assessment program (whole body counting and/or bioassay) is in place; and

- All work in radiation areas and surface or airborne contamination areas is preplanned and reviewed from an ALARA standpoint.

### A.8.5.3.3 Access Control

Access to portions of the facility is controlled in accordance with 10 CFR, Part 20. Personnel entering the controlled areas of the plant must know the radiological control procedures, must receive documented training in this area as specified in Section A.8.5.3.5, or must be escorted continuously by someone who has received this training. With the exception of large groups of escorted visitors, all personnel entering a radiologically controlled area will wear record dosimeters (Section A.8.5.2.4). Groups of escorted visitors will be provided with sufficient record dosimetry devices to assure an accurate assessment of their maximum dose. High Radiation Areas, Surface Contamination Areas, Airborne Radioactivity Areas, and Restricted Access Areas (see below) at WVDP are accessed through an administrative system of radiation work permits (RWPs) and, if necessary, locks are placed on the entrances to prevent inadvertent or intentional entry; keys to these areas are kept and issued by the Facilities Operations Department. The RWP specifies the controls necessary for the planned entry, such as protective clothing, stay times, respiratory protection, and supplemental dosimetry. The necessity for these controls may be based exclusively on radiation level, a combination of surface contamination and radiation level, the concentration of airborne contamination, or the potential for occurrence of any of these conditions. Access and stay time are rigidly controlled for High Radiation Areas. If conditions are of a nature that manned entry is not warranted, remote

techniques are used. The exposure and contamination controls to be specified depend on the nature of the work performed in the areas. A stay time or maximum allowable dose for each entry is determined by Radiation and Safety and noted on the RWP. In addition to TLD badges, entering personnel may be accompanied by a member of Radiation and Safety who continuously monitors the dose rate in the work area.

There are six area posting classifications as defined in the following sections: Radiation Area, Surface Contamination Area, Airborne Radioactivity Area, High Radiation Area, Radioactive Materials Area, and Restricted Access Area. Posting may include any combination of classifications needed to correctly characterize the area.

## Radiation Area

A Radiation Area is an area accessible to personnel where there are radiation fields of such levels that an individual could receive in any 1 hour a whole body equivalent dose in between 2.5 mrem and 100 mrem.

Each Radiation Area is posted with a sign meeting the standards of 10 CFR, Part 20, including the trefoil radiation symboi and the words CAUTION-RADIATION AREA DOSIMETRY REQUIRED.

## Surface Contamination Area

A Surface Contamination Area is an area accessible to personnel in which the limits for surface contamination are:

Removable alpha: $<50$ and $\leq 500$ dpm /100 $cm^2$
Removable beta: $<500$ and $\leq 50{,}000$ dpm/100 $cm^2$

Each Surface Contamination Area is posted with signs meeting applicable standards, including the trefoil radiation symbol and the words CAUTION-SURFACE CONTAMINATION AREA.

## Airborne Radioactivity Area

Areas accessible to personnel are posted as Airborne Radioactivity Areas if airborne radioactivity exists or is likely to exist in concentrations greater than those specified in 10 CFR, Part 20, Appendix B, Table 1, or in concentrations which, if averaged over a normal work week, would exceed 25 percent of the specified concentrations (i.e., producing an integrated exposure of 10 MPC hours).

Each Airborne Radioactivity Area is posted with signs meeting applicable standards, including the trefoil radiation symbol and the words CAUTION-AIRBORNE RADIOACTIVITY AREA.

## High Radiation Area

A high radiation area is an area accessible to personnel and in which there are radiation fields of such levels that an individual could receive in any 1 hour a whole body equivalent dose in excess of 100 mrem. Each High Radiation Area is posted with signs meeting applicable standards, and the words CAUTION-HIGH RADIATION AREA.

## Radioactive Materials Area

A Radioactive Materials Area is an area or enclosure in which radioactive material is present but is contained or is in a form such that no protective clothing is required. Each Radioactive Materials Area is posted with signs meeting applicable standards. These signs include the radiation symbol and the words CAUTION-RADIOACTIVE MATERIALS.

## Restricted Access Area

Restricted Access Areas are identified as requiring special safety precautions for entry. If removable contamination exceeds 500 dpm alpha per 100 $cm^2$ and/or 50,000 dpm beta per 100 $cm^2$, the area must be posted as a Restricted Access Area. Restricted Access Areas are designated by signs with the following words in yellow over a magenta background: CAUTION-RESTRICTED ACCESS AREA-APPROVAL REQUIRED FOR ENTRY - CONTACT RADIATION AND SAFETY. Access to these areas is controlled by ropes, locks, or alarms, based on the hazard potential. As a minimum, entry into a Restricted Access Area requires a completed and approved RWP specifying all protective measures. In most cases, standby personnel consisting of a representative from the group making the entry and a representative of Radiological and Safety are required. Standby requirements are stipulated on the RWP.

### A.8.5.3.4. Sealed Source and Radioisotope Control

As a general rule, no sealed sources may be purchased without the approval of Radiation and Safety and an approved purchase specification. The control program for the purchase of radioisotopes is essentially the same as that for sealed sources.

Upon receipt, sealed sources will be leak tested and placed on the sealed source inventory list. Leaking sources will not be accepted and arrangements are made for their safe return to the manufacturer. In addition to the receipt leak test, sealed sources are leak tested semiannually. Source disposal is controlled as to disposition and requires removal from the source inventory list. The source inventory list also indicates transfer of sources between organizations. When not in actual use, sealed sources are maintained in secured storage. Sealed sources are inventoried semiannually.

For irradiation sources such as high-range calibration facilities or radiography equipment, the design of the facility or system shall meet ANSI N543-1974, as-built engineering drawings of the facility will be maintained current, user training and certification is required and an operational survey program will be developed for the system or facility. Initial startup and any modifications to the safety interlock system requires Safety Committee review and approval. Records of facility operations, maintenance and calibration are maintained in an auditable manner. The sealed source program meets the requirements of 10 CFR Part 34.

### A.8.5.3.5 Radiation Protection Training

Radiological protection training is conducted at WVDP to ensure that each worker understands: (1) the general and specific radiological aspects of his assignment, (2) his responsibility to his co-workers and the public for safe handling of radioactive materials, and (3) his responsibility for minimizing his own dose. As a general statement of policy, WVNS provides a level of training commensurate with an individual's work assignment and responsibilities. In addition to completion of routine employe training programs, Radiation Control Technicians are required to demonstrate their proficiency in performing to a minimum standard in qualification

examinations. The training standards for Radiation and Safety (R/S) programs are maintained in the separate R/S qualification standards. Personnel who are not capable of demonstrating acceptable performance to a documented standard for a given operation are not permitted to perform that operation except under the direct, continuous control of a qualified employe. Employes who have qualified but whose actions on the job indicate a lack of knowledge in operational health physics are immediately disqualified and retrained. The general process of radiological protection training is discussed in the following paragraphs. The training programs meet the intent of DOE 5480, 1A Chapter V, "Safety of Nuclear Facilities."

## All Employe - Indoctrination

All new employees are required to attend a general orientation program, all employes not involved in radioactive work are required to receive basic radiological training which is repeated annually and ensures that personnel understand the posting of radiologically controlled areas and the identification of radioactive materials. The instruction also explains the impact of WVDP on the radiation environment of personnel employed outside radiation areas and outside the WVDP facility. Additional instruction is provided on the recognition of emergency signals and the response of employes who have no formally designated responsibility during an emergency.

## Radiation Workers

Before being authorized to work with radioactive materials (or to enter any radiologically controlled area unescorted), a worker is required to complete a formal course in radiation worker training and pass a written and practical examination. Consideration of radiation exposure and contamination control are prominent in this training. The principal areas covered in training on radiation exposure control are:

- Limits for whole body penetrating radiation and units of radiation dose;
- Use of "stay times";
- The seriousness of violations;
- Procedures and methods of minimizing exposure, such as working at a distance from a source, reducing time in a radiation area, and shielding;
- Potential sources of radiation associated with work performed by an individual's trade;
- Proper use of dosimetry equipment and personnel monitoring devices;
- Proper posting and labelling;
- Exposure records;
- Biological risks of radiation exposures;

- Procedures and methods for control of contamination;

- Proper methods of personnel survey; and

- Use of protective clothing and "step-off" procedures.

In addition to passing the written and practical examination, completion of the training course requires satisfactory performance during basic types of simulated work operations and use of this training in all situations in radiologically controlled areas. To supplement this training, selected incident/accident reports are also discussed to familiarize the worker with how things can go wrong while on the job. To continue as a radiation worker, an employe must requalify for his assignment at least every year and follow the training information during all work activities. On-the-job training is also conducted in the specific job skills for radiation work within each trade. For complex jobs, this is followed by special training for specific operations as required using mock-ups outside radiation areas.

## Fissile Material Handlers

Those employes who, in addition to working in radiologically controlled areas, are responsible for fissile material handling or control receive additional training in nuclear safety and the mass control system where implemented as a means of criticality control. The course satisfies the requirements of DOE 5480.1, Chapter V. Qualification as a fissile material handler is by written examination. Under no circumstances will personnel be allowed to handle or control fissile material without completing the formal qualification program. Supervisors in facilities where radioactive and fissile materials are handled receive training similar to that described above.

## Radiological and Nuclear Safety Technicians

Radiological Control Technicians are required to complete an extensive course in radiological controls, to demonstrate their practical abilities, and to pass comprehensive written, practical, and oral examinations. The first-line Radiological Control Supervisor is required to have at least sufficient training to allow him to evaluate initial symptoms of unusual radiological control situations, state immediate corrective action required, state what additional measurements are required, perform a final analysis of the measurements to identify the specific problem, and demonstrate the ability to implement the required actions. At least every 3 years, radiological control personnel requalify through written and oral examinations similar to those used for their initial qualification.

## Respiratory Protection Training

In addition to radiation worker training, all personnel who may be required to wear respiratory protection devices are required to attend a training program on their use during normal and emergency operations. They are fitted for the devices they are required to wear and are given a special medical examination to ensure that they are capable of wearing the devices. Respiratory protection training meets or exceeds the requirements of Regulatory Guide 8.15 and ANSI Z88.2-1980.

### A.8.5.3.6 Personnel Monitoring Program

Personnel at WVDP are monitored for both internal and external dose. The monitoring equipment used is discussed in Section A.8.5.2.4.

## Monitoring External Radiation Dose

A routine external dose monitoring program at WVDP measures the radiation dose received by personnel. The basic monitoring device is the TLD.

The dosimeter is a card containing two TLD chips. As explained below, some of the cards also house neutron activation foils. The two TLD chips are enriched in lithium-7 and are used to monitor penetrating and nonpenetrating radiation doses. Dosimetry badges are permanently issued only to those employes who have been trained and qualified to enter areas where radioactive materials are handled. These employes are called radiation workers.

WVDP badges two types of radiation workers; they are distinguished by the employe's potential exposure. Those with a lesser potential are placed on a quarterly TLD-processing schedule, and their dosimeters do not contain neutron activation foils. Exployes with a greater potential for exposure are placed on a monthly TLD-processing schedule, and their dosimeters do contain neutron activation foils. In addition, workers on the monthly processing schedule are issued a self-reading pocket ionization chamber to be worn along with the TLD badge.

Personnel dosimetry is issued only to radiation workers who meet the following qualifications:

- Whole body count and/or bioassay baseline completed;
- Inclusion on the periodic whole body count and/or bioassay roster;
- Medical baseline examination, including respirator physical if required;

- Inclusion on periodic medical examination roster;
- Satisfactory completion of radiation worker training course (Section A.8.5.3.5);
- Completion of respirator training course, if required;
- Successfully fitted with an approved respiratory protective device, if required;
- Completion of facility indoctrination;
- Completion of required special training;
- No precluding physical limitations or radiological restrictions; and
- NRC Form 4 or equivalent on file with or requested by Radiation and Safety.

Badges may be issued to visitors who have a valid need to enter these areas. A visitor is defined as any WVDP employe who is not qualified as a radiation worker or any person not permanently assigned to the WVDP facility who is not qualified as a radiation worker. Visitors are escorted by a qualified radiation worker at all times and are issued a visitor's dosimeter for a period not exceeding one week. A visitor is not permitted to exceed 50 mrem during a visit without prior written approval by his organization's radiation safety officer.

Persons not permanently assigned to the WVDP facility may be qualified as radiation workers, at which time the visitor requirements are no longer applicable.

Radiation workers at WVDP are monitored for external dose in accordance with 10 CFR Part 20. In cases where a limited portion of the body (e.g., head, arms) is exposed to the source of radiation, supplemental dosimeters are placed at the point of the highest anticipated dose rate to monitor the localized exposure.

## Internal Dose Assessment

Internal doses are assessed by direct counting (in vivo) and by bioassay analysis techniques. The bioassay program is subcontracted with provisions for emergency assessments. The monitoring program is capable of detecting internal depositions of transuranic elements, fission products, and activation products. In vivo counters are used to measure the gamma rays from radionuclides present inside the body. This whole body counter, as described in Section A.8.5.2.4, is sensitive to the relatively high energy gamma rays emitted by fission and activation products and in general can detect an internal deposition of any gamma emitting Radionuclide at a level much lower than 1 percent of the maximum permissible body burden (the typical MDA for Cs-137 is 4 μCi). The counter is most sensitive to energies greater than 60 keV, making it unsuitable for detection of the lower energy gamma and X-rays associated with plutonium decay. However, if the ratio of americium-241 to plutonium is known, it is possible to determine the lung burden of Am-241 using its 60 keV gamma and calculate the quantity of plutonium deposited in the lung.

Bioassay analysis is used to monitor for strontium-90 and as an additional analysis for plutonium. Urinalysis is the normal method used in the bioassay program. Urine samples are collected to obtain the equivalent of a 24-hour sample. The minimum detectable amount (MDA) of radionuclides in the urine is calculated based on the statistics of the analysis. Typical MDAs are 2 disintegrations per minute (dpm) for Sr-90 and 0.05 dpm for plutonium.

The routine internal exposure monitoring program is designed to detect deposition of both actinide and fission products. Employes on the monthly TDL-processing schedule are required to submit a urine sample annually. All radiation workers permanently assigned to WVDP are required to undergo a whole body count annually. Radiation workers not permanently assigned to WVNS are required to have whole body counts at the start and termination of the work, and may also be required to submit urine samples initially and upon termination if WVDP determines the need.

Additional internal dose assessment may be required if personnel are exposed during an accident in which radioactive contamination is released and:

- Personnel receive skin contamination above the shoulders;
- Detectable radioactivity is deposited in a person's nostrils or mouth;
- The concentration of airborne radioactivity in an area is determined to exceed the maximum permissible concentration (without respiratory protection); or
- A worker has a potentially contaminated wound.

The extent of post-accident dose evaluations is determined in each case by the Radiation and Safety Manager and may include urine sampling, fecal analysis, blood sample analysis, nose swipes, and lung or whole body counting.

## Dosimetry Records

Dosimetry processing at WVDP is performed by the R/S Dosimetry Section; however, the DOE-ID RESL office is the official records office for WVDP dosimetry records. The record includes:

- Any preemployment occupational exposure history;
- External and internal exposure occupationally received, including that received at other installations, during employment at WVDP;
- Special dose evaluations; and
- Reports of unusual exposure (i.e., overexposure or incidents with the potential for internal deposition) and the results of any follow-up investigations.

Duplicate records are also maintained by WVDP, but RESL is the legal repository for all WVDP dosimetry records.

A statement of exposure records is provided to employes:

- At least annually;

- Within 24 hours to any employe exceeding the external exposure limits of 10 CFR 20 following determination of this exposure; and

- Within 30 days of receiving a written request. (The requests are forwarded to RESL.)

In addition to the above records, the readings from ionization chambers are retained for at least one year by Radiation and Safety to allow the reconstruction or verification of exposures and for use in comparing pocket dosimeter/TLD data.

The dosimetry program record system is maintained in accordance with Regulatory Guide 8.5 and is modeled and matched to the program maintained at RESL.

### A.8.5.3.7 Airborne Radioactivity Monitoring Program

The function of the airborne radioactivity monitoring program is to comply with 10 CFR 20.103 and to verify that the survey program described in Section A.8.5.3.1 is detecting contamination control problem areas. The equipment used for air sampling and monitoring is described in Section A.8.5.2.3.

Fixed filters from the low volume air samplers located throughout the process building are collected and analyzed weekly for gross alpha and gross beta activity. If the amount of radioactivity on the filter paper indicates that the work area MPC has been exceeded during the sampling period, the sample is tested to determine the isotopic content (tests may include alpha, beta, and/or gamma spectroscopy and/or radiochemical analysis techniques). This data is used in performing follow-up assessments of internal dose.

Fixed filters on the CAM units are changed daily or more frequently if required by dust loading. These filters are analyzed with the same methods used for low volume air sample filters.

High volume air samplers are available for rapid measurement of airborne activity. These short term samples are taken:

- If the installed CAM in a work area is inoperative and radioactive work is being performed;
- When opening a radioactive system to the atmosphere for maintenance;
- Before entering tanks or voids containing potentially radioactive piping; or
- Where a proposed operation could potentially release airborne radioactivity.

Records of the above airborne radioactivity surveys are maintained indefinitely.

### A.8.5.3.8 Criticality Safety Program

The Radiological and Decommissioning Operations Criticality Safety Program is implemented by the Radiation Control Manual under the authority of the Manager, Radiation and Safety.

## Criticality Safety Control

The Radiation and Safety organization implements controls to assure that there is no criticality following any two unlikely and independent credible events involving fissile materials. All factors affecting the potential for nuclear criticality will be considered in criticality safety analyses. These include:

- Mass of fissile material;
- Source geometry;
- Moderation; and
- Reflection.

Requirements for criticality analyses, verification, and internal review procedures, and documentation of analyses are presented in detail in the criticality safety procedures contained in the Radiological Control Manual.

In any area where criticality is credible, Radiation and Safety will ensure inclusion of criticality safety requirements in all procedures, design documents, etc.

## Nuclear Safety Training

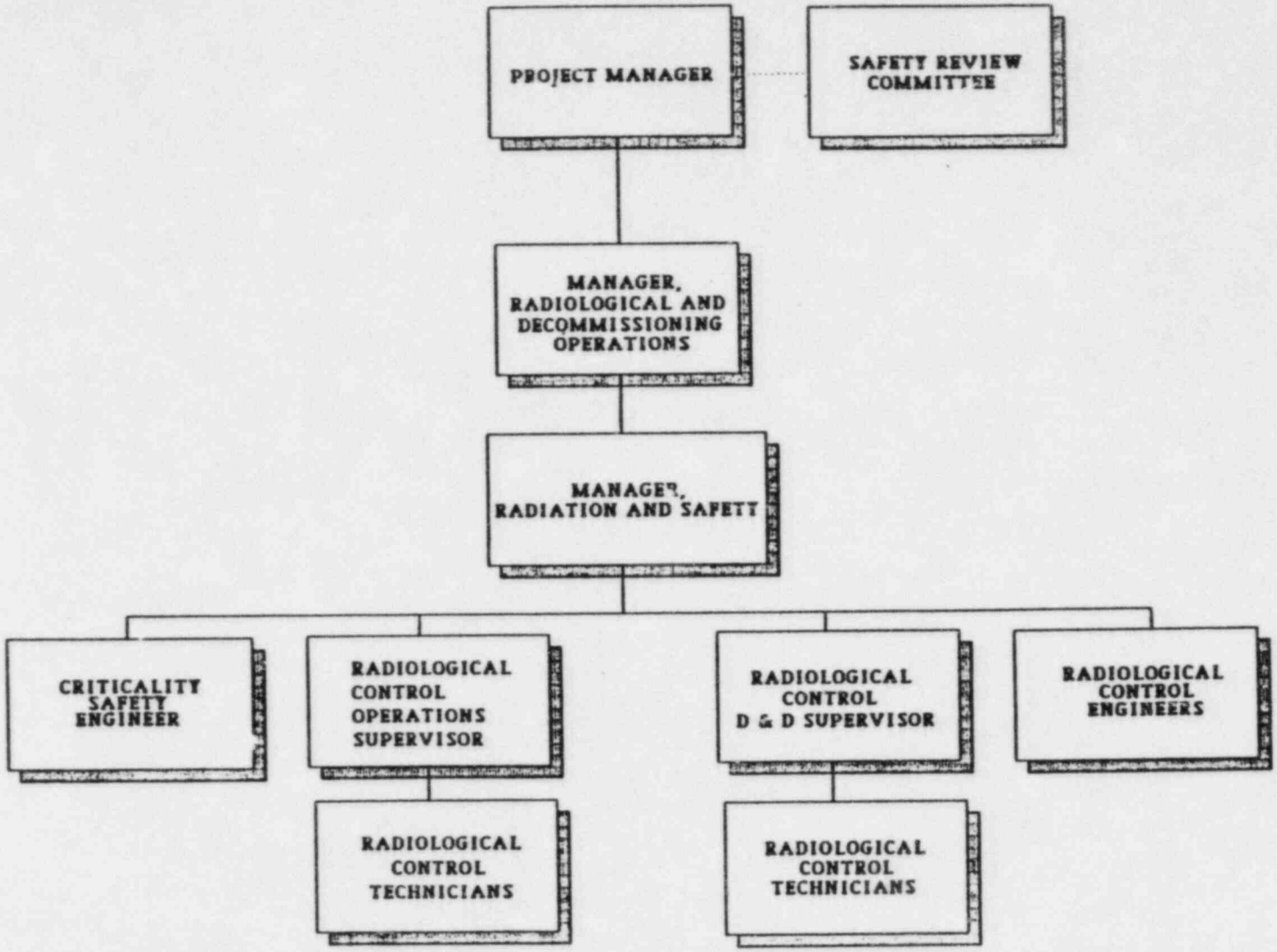
Personnel receive nuclear safety training commensurate with their responsibilities as required by the Radiological Control Manual. The training program is briefly described in Section A.8.5.3.5.

## Criticality Alarms and Dosimeters

Criticality alarms and criticality dosimeters are placed as required in DOE Order 5480.1, Chapter V. The criticality alarms are described in Section A.8.5.2.1; criticality dosimeters are described in Section A.8.5.2.2.

## Abnormal Conditions

In the event of an abnormal condition (one which may violate a mass or geometry control), no action will be taken except at the direction of the Manager, Radiation and Safety or his delegated representative. Following resolution of an abnormal condition, corrective action taken and the preventative action to preclude recurrence of the event will be documented as specified in the Radiological Controls Manual.




WVDP RADIOLOGICAL AND DECOMMISSIONING OPERATIONS ORGANIZATION AS IT RELATES TO HEALTH PHYSICS

FIGURE A.8.5.1

## A.8.6 OFF-SITE DOSE ASSESSMENT

### A.8.6.1 ENVIRONMENTAL MONITORING PROGRAM

The environmental monitoring network was retained essentially unchanged immediately after the transfer of operational responsibility from Nuclear Fuels Services (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. 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 Tables A.8.6-1 and A.8.6-2.

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.

#### A.8.6.1.1 Radiological Monitoring

This section addresses the monitoring of air, water, and biological media for radioactive contamination.

### A.8.6.1.1.1 Radioactivity in Air

Airborne particulate radioactivity is sampled continuously by three air samplers at the locations shown in Figure A.8.6.1. Each air sampler, mounted on a 4-metre high tower, maintains an average air flow of about 40 lpm (1.5 $ft^3$/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. These measured activities are compared to the most limiting concentration guides listed in DOE Order 5480.1 for releases to uncontrolled areas. Results of the analyses of perimeter air sample filters for 1983 are presented in Table A.8.6.3.

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 $2 \times 10^{-14}$ µCi/ml in Albany, New York. 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 during 1983, based on the 52 weekly filter measurements, are shown in Table A.8.6-4. The results of analyses for specific radionuclides in the four 1983 quarterly composites of stack effluent samples are also listed in Table A.8.6.4. These measured concentrations of airborne radioactivity sampled through the in-stack probe are well within the concentration guides for airborne radioactive materials released to unrestricted areas.

### A.8.6.1.1.2 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 A.8.6.1). This Cattaraugus Creek sampler continuously removes a small volume of water from the creek (approximately 400 ml/hr); a stream gage-level chart recorder provides a means of flowweighting 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 A.8.6.3). On the average, however, 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 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 since the last part of 1983 (see Table A.8.6.3).

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.

Nonradiological water quality measurements are also taken at the Franks Creek location; these data are discussed in Section A.8.6.1.2.

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 A.8.6-2 and A.8.6-3) and into Erdman Brook. There were two batch releases from Lagoon 3 in 1983 which totaled about 29 million litres. 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 A.8.6-6. 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.

### A.8.6.1.1.3 Radioactivity in the Food Chain

Samples of fish and game animals are collected during periods of time when they would normally be taken for consumption by sportsmen. Milk from cows grazing near the site is also collected and analyzed during the second and third calendar quarters. The results of these analyses for 1983 are presented in Table A.8.6-7.

Fish samples are taken semiannually above the Springville dam from the portion of Cattaraugus Creek which receives WNYNSC drainage. Nine fish are collected from this section of stream during each period. The Sr-90 content in flesh and skeleton and gamma emitting isotopes in flesh are determined for each specimen. Although several fish are also taken from waters that could not have been influenced by site runoff and analyzed in a similar manner, this control (natural background) sample is not truly representative of either the age or species collected in Cattaraugus Creek. However, these control data are included 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, although the Sr-90 content in the skeleton has remained at the same average level during recent years. The statistical treatment of the fish data presented in Table A.8.6-7 is specified by the site reporting requirements.

A single deer is 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 in 1983 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.

Although the dairy cattle sampled in 1983 reside adjacent to the site and receive the maximum exposure possible to any dairy herd, the concentration of Sr-90 in milk from this herd was below the detection limit of 0.4 pCi/l. 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. Iodine-129 and gamma emitting isotopes also were not detectable.

Radionuclides present in the human food chain are assessed to determine their contribution to the radiation exposure of the public. Although in many cases the concentrations of specific radionuclides are below the analytical detection limit, for purposes of the dose assessment they will be considered present at the minimum detectable concentration.

#### A.8.6.1.1.4 Direct Environmental Radiation

A commercial dosimetry service measured ambient penetrating radiation in 1982 and the first half of 1983. The monthly badges contained high-sensitivity $CaSO_4$:Tm thermoluminescent dosimetry (TLD) material packaged such that energy correction could be factored into the final results. In anticipation of the discontinuation of the commercial dosimetry services after June of 1983, an alternative dosimetry system was established in April 1983 to provide continuous monitoring around the site perimeter (Figure A.8.6.1). The results (total exposure for each calendar quarter) for each type of TLD in each quarter of use are summarized in Table A.8.6-8.

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 so that one-quarter of overlap data was available for the two systems, and the two types of dosimeters were placed at the same locations. Several aspects of the new system are notable in comparing the $CaSO_4$:Tm and the LiF results. The $CaSO_4$: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 appear 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 A.8.6-8 for comparison with the perimeter stations. Differences due to seasonal variations in snow cover were not evaluated for this short measurement period, but they may be a significant factor in long-term evaluation.

### A.8.6.1.2 Nonradiological Monitoring

Nonradiological emissions and plant effluents are controlled and permitted under the New York State and US EPA 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 A.8.6-3.

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 because 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 nonradiological 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 also reported 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 A.8.6-9.

### A.8.6.2 ANALYSIS OF MULTIPLE CONTRIBUTION

This section is not applicable to the WVDP because there are no nearby nuclear facilities either operating or planned during the duration of the Project. (The adjacent New York State licensed commercial LLW Burial ground is maintained in a shut-down status by NYSERDA. However, per the cooperative agreement between DOE and NYSERDA, the effluents from this facility are treated and discharged by the Project.)

## A.8.6.3 ESTIMATED EXPOSURES

### A.8.6.3.1 Source Term Estimation

Source terms for each system or facility will be developed through the application of accepted analytical methods, extrapolation of available relevant measurement data, and, to the extent necessary, from engineering judgment. A complete description of the source term resulting from a given accident scenario or operational activity will be presented in each SAR module.

Except for criticality accidents which would generate new fission products, the radioactive material that is available at the WVDP site and which could contribute to the source term for a given scenario is fairly well characterized. Radionuclides of interest are those currently present in the forms of sludge and supernatant in storage tank of 8D-2 and 8D-4 and the contaminated portions of the existing facility. Additional analytical work is underway to characterize even more accurately the contents of these tanks and the cells and facilities used in reprocessing.

The results of this characterization work will be used for the safety analysis of WVDP operations. In order to perform an efficient radiological assessment, each radionuclide will be screened for its contribution to the total impact. Each radionuclide will be ranked by the product of the quantity of radioactivity (Ci) at the time of intake or exposure and the effective dose equivalent factor (rem/Ci) appropriate to the intake pathway. The radionuclides included in dose calculations will be those which contribute more than 0.1 percent of the total effective dose equivalent.

An important factor to be considered in estimating source terms is the release fraction. This is the fraction of total radioactive material in process which is released from primary confinement in dispersible form. Estimates of release fractions under accident conditions at WVDP will be based on results from recent experiments conducted at PNL and elsewhere. In the absence of experimental data, best estimate values from the literature or based on engineering judgement (e.g. see DiNunno, et al., 1962; NRC, 1977; and Elder, 1984) will be supplemented by identified factors of conservatism.

If radionuclides are released from the primary confinement, their concentration may be reduced by natural or engineered means. Inside a facility the released material may plate out on walls or deposit on the floor. Engineered safety systems such as filters and scrubbers can remove a substantial amount of the material. The removal or decontamination factors for each air cleaning system will be based on actual performance testing data, or on values recommended by the manufacturer. Removal factors under accident conditions will be based on case-by-case studies of each release scenario. Best estimate values will be used along with identified estimates of uncertainties.

### A.8.6.3.2 Environmental Pathways

The pathways by which radioactive effluents may be dispersed into the off-site environment and eventually expose members of the general public to radiation may be broadly categorized as airborne or liquid. Both of these major pathways may lead to direct external exposure since gamma and energetic beta emitters will be among the released radionuclides in most cases. External exposure can result from immersion in an airborne cloud of radioactive particulates or in contaminated waters, or from radioactivity deposited on land, vegetation, sediments, and stream banks. The more significant exposures

from both the air and water pathways are likely to result from internally deposited radionuclides. Inhalation of airborne radioactive particulates is an important cause of lung irradiation and irradiation of other tissues and organs following translocation from the lung. Ingestion of radionuclides also results in internal radiation exposure. Some ingestion pathways are quite direct, such as drinking contaminated water. Others are more complex, such as the transfer of radioiodine deposited from air or irrigation water on forage to cows, to milk, to humans. The pathways to be analyzed for routine releases from the WVDP (by the AIRDOS-EPA and LADTAP-II codes, see Section A.8.6.3.4) are illustrated in Figure A.8.6-4.

For short-term accidental releases to the atmosphere, only inhalation and direct radiation from cloud immersion will be of significance and therefore be considered when estimating the dose to the maximally exposed individual. This will be done by using the models and codes described in Section A.8.6.3.4. Even accidental releases to the hydrosphere of short duration would result in dispersion over an extended time and would be modeled in most cases as a chronic release, also using the LADTAP-II code. If an accident scenario is identified which leads to a credible release of short duration directly to surface water, an analyses of the pathways will be done using the LPGS code or by hand calculations.

### A.8.6.3.3 Radiological Parameters

In general, the methods and terminology most recently recommended by the International Commission on Radiological Protection (ICRP) will be adopted for use in WVDP safety analyses (ICRP 1977, 1979, 1980). While recent ICRP recommendations have not yet been adopted formally by DOE, NRC, or EPA, all of these agencies are circulating draft documents which will implement the ICRP approach. The scientific community meanwhile has largely accepted ICRP recommendations.

For hazard and safety classification, the parameter of primary interest is the "dose" to the maximally exposed individual. In the context of Project safety analysis, "dose" is understood to mean the 50-year dose equivalent commitment expressed in units of rem or millirem (mrem). Effective dose equivalent commitments (i.e., whole body equivalent doses) will be calculated according to the ICRP formula (ICRP, 1977) and based on the "reference man" (ICRP, 1974). No attempt will be made to estimate dose as a function of the age or sex of the maximally exposed individual.

The maximally exposed individual will be assumed to be at the point on the Western New York Nuclear Service Center perimeter where the largest effective dose equivalent would be received during an accident, unless the duration of the accidental release is longer than two hours. In the latter case, the assumptions to be made will be appropriate for the predicted duration and the probability of evacuation. The meteorological parameters assumed to exist during an accidental release of two hours' duration or less will be those which have only a 0.5 percent probability of causing a larger dose. Less severe conditions will be assumed to exist during more protracted releases. For frequent or continuous operational releases, the maximum exposure (dose) will be estimated for the closest actual residences.

### A.8.6.3.4 Analytical Tools

This section briefly describes the computer codes to be used for the analysis of radiological impacts from the WVDP during both normal and abnormal events. The principal environmental pathways considered include:

- Atmospheric dispersion,
- Surface water, and
- Subsurface or groundwater.

In addition, computer codes are available to estimate the radiological impacts which result from the transportation of radioactive wastes by truck or train.

### A.8.6.3.4.1 Atmospheric Dispersion Codes

Because the ridges and hills in the vicinity of the WVDP frequently channel the winds, strong systematic deviations from straight-line air flow are to be expected. To realistically account for the terrain effects on wind flow, a fine-grid, two-dimensional wind field is currently under development. The wind field data will then be input to a variable-trajectory Gaussian puff dispersion code for calculating the radionuclide concentrations from both routine and accidental releases. The assumption underlying the code is that a number of discrete puffs are serially released from the source to simulate a continuous plume. Each puff is assumed to have a Gaussian concentration distribution in three dimensions.

Puffs expand in size as they move downwind from the source in response to spatial and temporal wind and stability conditions. They are tracked until they leave the grid region. Each puff is transported independently by the nonuniform wind field. Concentration and deposition are computed at each location in the receptor grid. The results of this computation will produce realistic site-specific $\chi/Q$ and $D/Q$ values for input to the AIRDOS-EPA code. Although the AIRDOS-EPA code also includes a routine for dispersion computation, it will not be used because it is not designed for use in areas with uneven terrain. The meteorological dispersion models are discussed more thoroughly in Section A.3.3.

Radionuclide concentrations in meat, milk, and fresh produce consumed by man are estimated by coupling the output of the atmospheric transport model described above with the dosimetry models of AIRDOS-EPA. These models implement the U.S.NRC Regulatory Guide 1.109 recommendations for terrestrial food chains. Internal dose conversion factors input to the code are those derived using ICRP-30 methodology (ICRP 1979, 1980). The external dose conversion factors are those given by Kocher (1981).

The computer code PAVAN was selected to provide atmospheric dispersion conditions for assessments of the consequences of accidental release from the WVDP. The computer code implements the guidance provided in Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants." The code uses joint frequency distributions of wind direction and wind speed by atmospheric stability class to calculate relative air concentration ($\chi/Q$) values as a function of direction and distance. Calculations of $\chi/Q$ can be made for ground-level or elevated releases and are based on a Gaussian plume model. A straight-line trajectory is assumed between the point of release and all distances for which $\chi/Q$ values are calculated.

The code can account for variation in the location of release points, additional plume dispersion due to building wakes, plume meander under low wind speed conditions, and curved trajectories. It computes an effective plume height using the physical release height adjusted by the terrain features of the receptor location. To calculate the concentration to which the maximally exposed off-site person is exposed, hourly relative dispersion factors ($\chi/Q$'s) will be calculated at the distance of the nearest boundary.

For each of 16 sectors, a cumulative probability distribution of $\chi/Q$'s will be constructed. The $\chi/Q$ value that is exceeded during 0.5 percent of the total number of hours in the meteorological data set is the "unfavorable" dispersion factor for that sector. The sector having the highest unfavorable dispersion factor defines the wind direction assumed to occur during the release and the unfavorable dispersion factor in this sector is used to calculate the dose to the maximally exposed off-site person, provided this is consistent with other assumptions in the accident scenario being analyzed.

**A.8.6.3.4.2 Liquid Pathway Codes**

The radiological impact of liquid effluents released to surface water will be estimated using the LADTAP-II code for routine releases and the LPGS code for accidental releases. The LADTAP-II code, a revision of the original LADTAP, implements the radiological exposure models of NRC Regulatory Guide 1.109. Radiological impacts from potable water, aquatic foods, shoreline deposits, swimming, boating, and irrigation are calculated in terms of dose to the maximally exposed individual and the general population. Dose conversion factors, based on ICRP Publication 30, have been incorporated into the WVDP version of the LADTAP-II code.

The LPGS computer code was selected to predict the radiological impacts resulting from accidental releases of radionuclides to wells, streams, and lakes. The code is designed to calculate radiation dose to the maximally exposed individual as well as to the regional population. The exposure modes considered are drinking water, aquatic food, and recreational activities such

as swimming and boating. One of the important features of the code is that radiation dose as a function of time can be estimated for either direct releases to surface water or indirect release from another water body. Accidents such as spills or underground leaks followed by eventual releases to surface water can be analyzed appropriately. Dose conversion factors from ICRP-30 also have been incorporated into this code.

The simulation of subsurface migration requires two analyses. The first involves the prediction of subsurface flow patterns, i.e., the magnitude and direction of groundwater flow lines in the saturated and unsaturated zones. These patterns can change as a result of fluctuations in hydrometeorologic conditions. The second analysis involves the estimation of radionuclide transport parallel and perpendicular to these flow lines. This analysis must consider radioactive decay, daughter product ingrowth, soil attenuation, and molecular diffusion/advective dispersion.

Two computer codes will be available to predict groundwater flow patterns. The choice of codes will depend on the hydrogeologic complexity of the subsurface conditions. For simple cases (i.e. single layer geology, slug sources, and one dimensional flow), a hand calculation based on Darcy's law will be used. For more complex situations, the FEMWATER-1 code (Yeh, et al., 1980; Yeh, 1983) will be used. It is envisioned that the safety analyses in the plant area and at the NDA will require the use of FEMWATER-1. FEMWATER-1 is a two dimensional finite element Galerkin model. The code solves the water mass continuity equation which governs the pressure head distribution to the user-specified boundary conditions. The flow field is then computed by Darcy's law.

Two codes alsc will be available for the analysis of radionuclide transport. The choice will be a determined by the source term and hydrogeologic conditions. LAYFLO, which is a one-dimensional analytical model with decay chain capabilities, will be used for cases when daughter product ingrowth is a significant factor and/or hydrogeologic conditions are relatively simple. FEMWASTE-1, which is a two-dimensional finite element model for the transport of dissolved constituents through porous media, will be used when hydrogeologic conditions are complex. Since FEMWASTE-1 does not have a decay chain capability, it may be necessary to use both codes to solve some problems.

In order to get useful initial estimates of the dispersion, advection, and absorption characteristics of a specific site, the computer code AT123D (Analytical Transient One-Two-Three- Dimensional Code)may be used as an alternative to the numerical codes. The AT123D code is a generalized analytical code developed for estimating the transport of wastes in an aquifer system.

To analyze the long-term radiological impact from the LLW burial ground, the methodology employed in PRESTO-EPA code will be used. PRESTO-EPA (Prediction of Radiation Effects from Shallow Trench Operations) is a computer code developed to evaluate possible health effects from shallow land burial of low-level radioactive wastes. The model is intended to assess radionuclide transport, ensuing exposure, and health impact to a static local population for up to 1000 years following the end of burial operations. Pathways and processes of transport from the trench to an individual or population include: vertical subsurface flow, groundwater transport, chemical exchange, overland flow, erosion, surface water dilution, resuspension, atmospheric transport, deposition, inhalation, and ingestion of contaminated beef, milk,

crops, and water. Off-site population and individual doses may be calculated as well as doses to the intruder and farmer. The code consists of simple algorithms which are evaluated annually; therefore, the code iterates over the period of analysis. Input to the code includes mostly annual average values of the parameters except for rainfall for which hourly data is required to estimate infiltration through the trench cap. The code is completed and documentation is to be published shortly by EPA.

### A.8.6.3.4.3 Transportation Impacts

The solidified high-level waste and TRU waste containers will be stored on-site until an appropriate repository site becomes available. Transportation of these waste containers will be necessary when the repository site is identified. It may also be necessary to evaluate off-site disposal alternatives for low-level Project waste . To evaluate the consequences of transporting waste to a burial site, the computer code RADTRAN-II, developed by Sandia National Laboratory, will be used.

## A.8.6.4 LIQUID RELEASES

Liquid releases from each system or facility will be addressed in the individual SAR modules. The existing liquid effluents from the Project are identified in Tables A.8.6-1, -5, -6, and -9, and are discussed further in Volume II, the Existing Plant and Operations module of the SAR.

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TABLE A.8.6-1 (1 of 4)

EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM

| Monitoring Point | Reason for Monitoring | Sampling Type | Sampling Frequency | Analyses |
|---|---|---|---|---|
| Airborne | | | | |
| 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<br><br>Quarterly composites: filters analyzed for Sr-90, Ru-106, Cs-134/137. Charcoal analyzed for I-129 |
| Liquid | | | | |
| 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 |

[a]Isokinetic sampling with probe placed at the 80-foot level within the stack.

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TABLE A.8.6-1 (2 of 4)

EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM

| Monitoring Point | Reason for Monitoring | Sampling Type | Sampling Frequency | Analyses |
|---|---|---|---|---|
| 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<br><br>Quarterly weighted composite of daily samples: U isotopic, Pu isotopic |
| 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 | 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 |

* Samples to be split (shared with NYSDOH).

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TABLE A.8.6-1 (3 of 4)

EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM

| Monitoring Point | Reason for Monitoring | Sampling Type | Sampling Frequency | Analyses |
|---|---|---|---|---|
| 3 Hull Burial Ditch | Drains NRC disposal area | Grab | Weekly | Gross beta and H-3 |
| 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 |
| 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<br><br>Monthly composite: gross alpha, beta, H-3, and Sr-90 |

[b] Utility 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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TABLE A.8.6-1 (4 of 4)

EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING PROGRAM

| Monitoring Point | Reason for Monitoring | Sampling Type | Sampling Frequency | Analyses |
|---|---|---|---|---|
| 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 |
| On-Site Wells | | | | |
| NFS wells B, D, G, H, L-2, M-5, J-2, J-5, J-8, US GS wells 80-2, 80-3, 80-4, 80-5, 80-6, 80-7, 82-1, 82-2, 82-3, 82-4, 82-5 | | Grab | Semiannual | H-3, gross alpha, beta |

TABLE A.8.6-2 (1 of 4)

OFF-SITE RADIOLOGICAL MONITORING PROGRAM

| Media | Number of Samples and Locations | Sampling and Collection Frequency | Type and Frequency of Analysis |
|---|---|---|---|
| Direct Radiation (TLD)* | (16) at each of 16 previous NFS locations | Quarterly | Quarterly gamma dose |
| | (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) | | |
| Surface water | (1) Cattaraugus Creek at Felton Bridge location | Continuous sampler operation with weekly collection | Weekly for gross alpha, beta, and H-3; monthly composite for gamma isotopic and Sr-90 |
| | (1) Cattaraugus Creek upstream of Buttermilk Creek confluence at Bigelow Bridge | Monthly grab | Gross alpha, beta, and H-3 on collection |

* Samples to be split (shared with NYSDOH).

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TABLE A.8.6-2 (2 of 4)

OFF-SITE RADIOLOGICAL MONITORING PROGRAM

| Media | Number of Samples and Locations | Sampling and Collection Frequency | Type and Frequency of Analysis |
|---|---|---|---|
| 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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TABLE A.8.6-2 (3 of 4)

OFF-SITE RADIOLOGICAL MONITORING PROGRAM

| Media | Number of Samples and Locations | Sampling and Collection Frequency | Type and Frequency of Analysis |
|---|---|---|---|
| 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)* | Semiannually | Isotopic gamma and Sr-90 |
| | (1) Buttermilk Creek, near Thomas Corners Road | | |
| | (1) Cattaraugus Creek, near Felton Bridge | | |
| | (1) Behind Springville dam impoundment* | | |
| Fish | (1) Cattaraugus Creek, downstream of the Buttermilk Creek confluence | Semiannually* | Isotopic gamma and Sr-90 in edible portions |
| | (1) Control sample from nearby stream not affected by the WVNS | | |

* Samples to be split (shared with NYSDOH).

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TABLE A.8.6-2 (4 of 4)

OFF-SITE RADIOLOGICAL MONITORING PROGRAM

| Media | Number of Samples and Locations | Sampling and Collection Frequency | Type and Frequency of Analysis |
|---|---|---|---|
| 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).

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TABLE A.8.6-3

MEASURED CONCENTRATIONS OF AIRBORNE PARTICULATE RADIOACTIVITY COLLECTED BY PERIMETER AIR SAMPLERS
($\mu$Ci/ml)

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

* Numbers in parenthesis refer to locations of TLD direct radiation dosimeters identified in Figure A.8.6-1.

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

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TABLE A.8.6-4

MEASURED CONCENTRATIONS OF PARTICULATE
RADIOACTIVITY IN PLANT VENTILATION STACK EFFLUENT
($\mu$Ci/ml)

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

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

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

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

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

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TABLE A.8.6-5 (1 of 2)

MEASURED CONCENTRATIONS OF RADIOACTIVITY IN SURFACE WATER (μCi/ml) AND SEDIMENT

Cattaraugus Creek

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

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TABLE A.8.6-5 (2 of 2)
MEASURED CONCENTRATIONS OF RADIOACTIVITY IN SURFACE WATER (μCi/ml) AND SEDIMENT

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

| Month 1983 | Buttermilk Creek at Fox Valley Road Sampler (above plant) Gross α X $10^{-10}$ | Gross β X $10^{-8}$ | Tritium X $10^{-6}$ | Radioactivity in Sediment (μCi/gm) Buttermilk Creek Silt at Thomas Corners Road Sampler Quarter 1983 | Gross α X $10^{-5}$ | Gross β X $10^{-5}$ |
|---|---|---|---|---|---|---|
| July | 4.32±3.97 | 0.23±0.12 | 0.62±0.21 | First | 0.7±0.2 | 3.4±0.4 |
| August | 6.41±62 | 0.26±0.13 | 0.38±0.20 | Second | 0.5±0.4 | 2.5±1.0 |
| September | <2.37 | 0.24±0.09 | 0.48±0.20 | Third | 0.9±0.4 | 2.9±1.0 |
| October | 5.63±3.72 | 0.30±0.09 | <0.20 | Fourth | 1.4±0.6 | 4.1±1.0 |
| November | <2.60 | 0.71±0.12 | 0.83±0.20 | | | |
| December | 3.50±3.04 | 0.55±0.11 | 0.32±0.19 | | | |

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TABLE A.8.6-6

RADIOACTIVITY DISCHARGED FROM THE LLWT SYSTEM THROUGH LAGOON 3 IN 1983

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

TABLE A.8.6-7

MEASURED CONCENTRATIONS OF RADIOACTIVITY IN MILK, DEER AND FISH

Milk - 1983

| | Concentration (μCi/ml) | | | |
|---|---|---|---|---|
| | Sr-90 | I-129 | Cs-134 | Cs-137 |
| NE Farm 2nd Qtr 1983 | <4 E-10 | <7.1 E-9 | <1.48 E-8 | <1.54 E-8 |
| NE Farm 3rd Qtr 1983 | <4 E-10 | <8.3 E-9 | <1.10 E-8 | <7.74 E-9 |

Deer - 1983

| | Concentration (μCi/kg) | | | |
|---|---|---|---|---|
| | Sr-89 | Sr-90 | Cs-134 | Cs-137 |
| Flesh | -- | 3.61±0.71 E-6 | <4.45 E-5 | 2.94±2.10 E-5 |
| Skeleton | <1.72 E-3 | 1.24±0.17 E-3 | -- | -- |

Cattaraugus Creek Fish - 2nd Quarter 1983

| | Concentration (μCi/kg) | | | |
|---|---|---|---|---|
| | Flesh | | | Skeleton |
| | Sr-90 | Cs-134 | Cs-137 | Sr-90 |
| Median | 8.95E-5 | 9.51E-4 | 9.66E-4 | 8.1E-4 |
| Average Geometric Deviation | 1.7 | 1.35 | 1.36 | 1.45 |
| Maximum | 1.12±0.37E-4 | <1.32E-3 | <1.19E-3 | 1.15±0.27E-3 |
| Minimum | <3.92E-5 | <6.26E-4 | <6.55E-4 | 3.29±1.55E-4 |

Cattaraugus Creek Fish - 3rd Quarter 1983

| | Concentration (μCi/kg) | | | |
|---|---|---|---|---|
| | Flesh | | | Skeleton |
| | Sr-90 | Cs-134 | Cs-137 | Sr-90 |
| Median | 6.5E-5 | 3.63E-4 | 2.12E-4 | 7.3E-4 |
| Average Geometric Deviation | 1.5 | 1.2 | 1.4 | 1.3 |
| Maximum | 1.18±0.21E-4 | <4.06E-4 | <3.10±1.46E-4 | 8.30±1.14E-4 |
| Minimum | 2.28±0.94E-5 | <2.66E-4 | <1.46E-4 | 3.76±0.52E-4 |

Background Fish - 3rd Quarter 1983

| | Concentration (μCi/kg) | | | |
|---|---|---|---|---|
| | Flesh | | | Skeleton |
| | Sr-90 | Cs-134 | Cs-137 | 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±0.26E-4 | <2.16E-4 | <2.16E-4 | 1.05±0.12E-3 |
| Minimum | 1.09±0.13E-4 | <1.01E-4 | <1.18E-4 | 9.26±1.0?E-4 |

TABLE A.8.6-8

DIRECT ENVIRONMENTAL RADIATION EXPOSURES (mR)
January through December 1983

| TLD Location+ | $CaSO_4$ 1st Qtr | $CaSO_4$ 2nd Qtr | LiF 2nd Qtr | LiF 3rd Qtr | LiF 4th Qtr | Quarterly Average LiF** |
|---|---|---|---|---|---|---|
| 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 | 61±0 |
| 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 A.8.6-1 for location of numbered TLD stations.

* Background location added July 1983.

**Using individual chip readings over three quarters.

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TABLE A.8.6-9 (1 of 4)

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 | --- | --- | --- | --- | --- | 650±580 | --- | 0 |

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TABLE A.8.6-9 (2 of 4)

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tritium (No Limit, pCi/l) | --- | --- | --- | --- | 1.52±0.03E5 | --- | --- | --- | --- | --- | 1.36±0.03E5 | --- | 0 |
| Isotopic Gamma (No Limit, pCi/l) | | | | | | | --- | --- | --- | --- | | | 0 |
| Co-60 | --- | --- | --- | --- | 63.71±3.6 | --- | --- | --- | --- | --- | 122±17 | --- | 0 |
| Cs-134 | --- | --- | --- | --- | 20.4±7 | --- | --- | --- | --- | --- | 11.1±9.8 | --- | |
| Cs-137 | --- | --- | --- | --- | 938±26 | --- | --- | --- | --- | --- | 940±29 | --- | |
| 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 |
| Tritum (No Limit, pCi/l) | --- | --- | --- | --- | 1.16±0.02E6 | --- | --- | --- | --- | --- | --- | --- | 0 |
| Isotopic Gamma (No Limit, pCi/l) | --- | --- | --- | --- | <MDL | --- | --- | --- | --- | --- | --- | --- | 0 |
| Strontium - 90 (No Limit, pCi/l) | --- | --- | --- | --- | 5450±580 | --- | --- | --- | --- | --- | --- | --- | 0 |
| Iodine - 129 (No Limit, pCi/l) | --- | --- | --- | --- | <3.8 | --- | --- | --- | --- | --- | --- | --- | 0 |

TABLE A.8.6-9 (3 of 4)

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) | 645 | --- | --- | --- | --- | --- | 49±8 | --- | --- | --- | --- | --- | 0 |
| Iodine 129 (No Limit, pCi/l) | <0.12 | --- | --- | --- | --- | --- | N/A | --- | --- | --- | --- | --- | 0 |

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TABLE A.8.6-9 (4 of 4)

MEASURED CONCENTRATIONS AT SPDES DISCHARGE POINTS

SPDES 005 UTILITY DITCH

| Parameter (limit, units) | Months, 1983 January | February | March | April | May | June | July | August | September | October | November | December | Non-Compliance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

SPDES OUTFALL 006 - ERDMAN BROOK

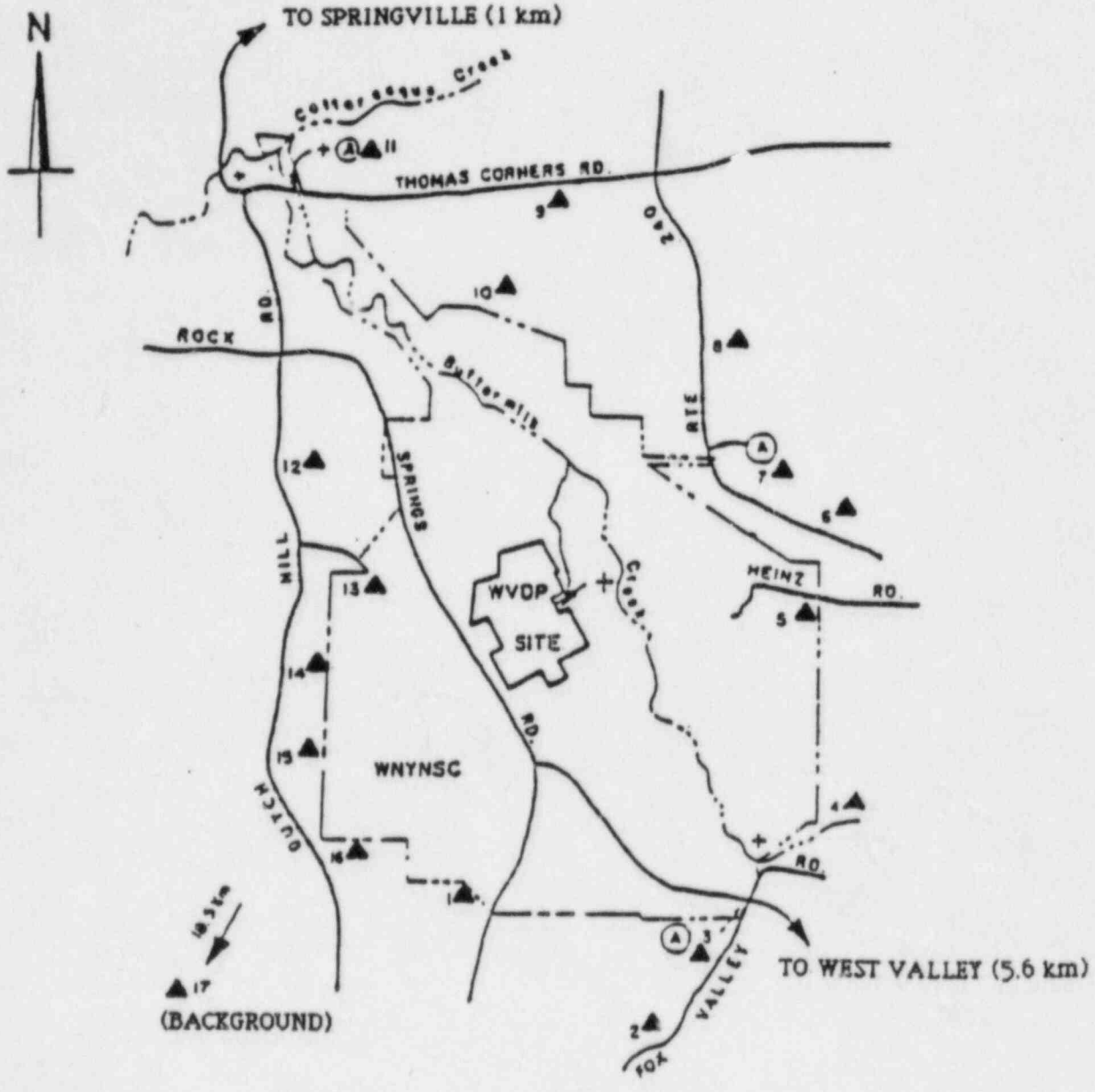
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Iron (1.0 mg/l) | 0.09<br>0.12 | 0.55<br>1.6 | 1.1<br>1.6 | 1.2<br>1.4 | 0.73<br>0.79 | 2.1<br>0.78 | <0.4<br><0.2 | <0.5<br>0.7 | 2.0<br>4.0 | 0.5<br>0.7 | <0.2<br>1.4 | <0.2<br>1.3 | 10 |
| Ammonia (2.0 mg/l) | <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

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# LOCATIONS OF ENVIRONMENTAL MONITORING STATIONS



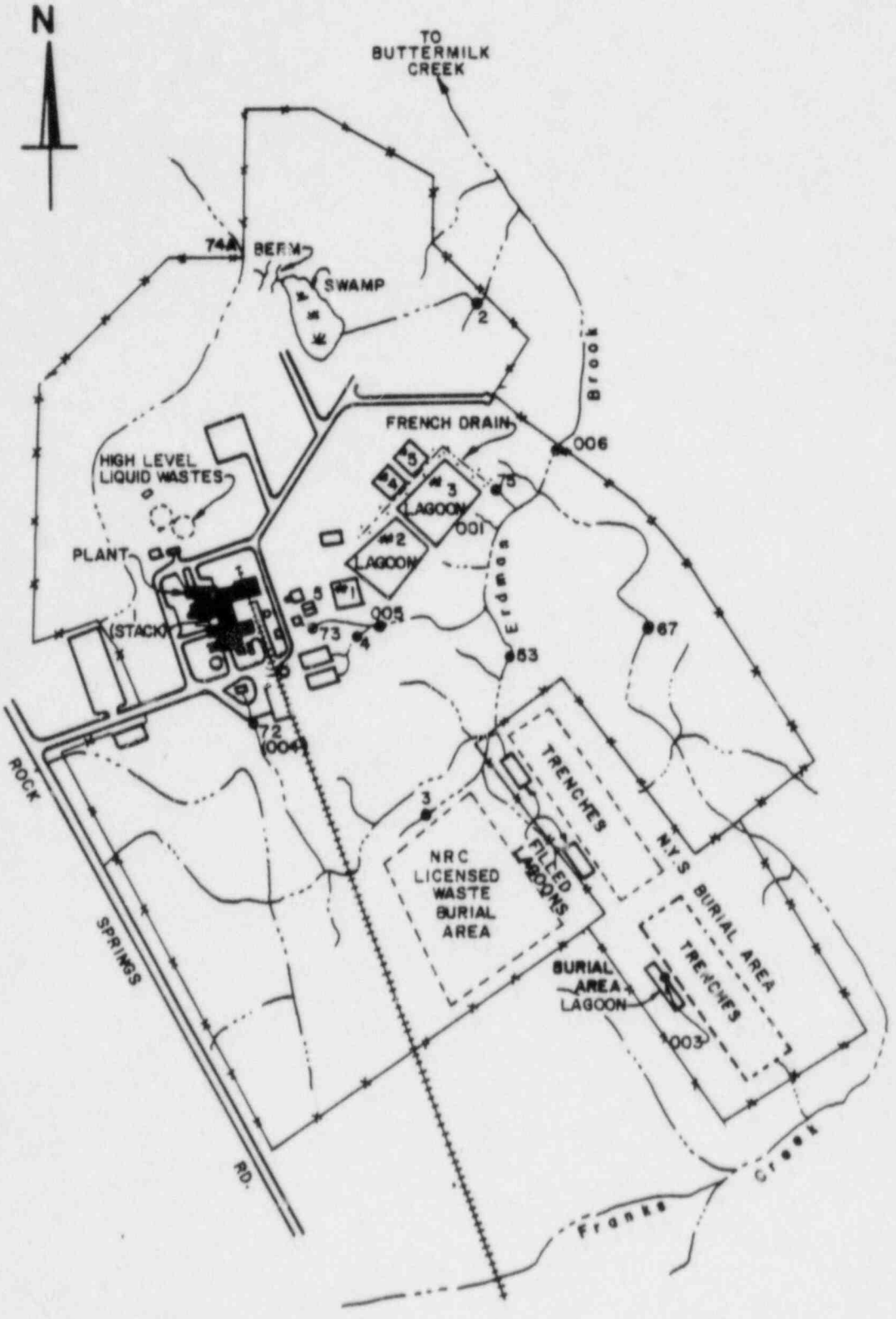

LEGEND

- (A) - AIR SAMPLER
- \+ - CREEK SAMPLER
- ▲ - (NUMBERED) PERIMETER RADIATION DOSIMETERS
- ——— WNYNSC BOUNDARY
- ——— PROJECT SITE BOUNDARY

SCALE - KILOMETERS

0 1 2

FIGURE A. 8.6-1




- LOCATIONS OF EFFLUENT AND ON-SITE RADIOLOGICAL MONITORING STATIONS



FIGURE A 8.6-2

LOCATIONS OF SPDES MONITORING POINTS ONSITE

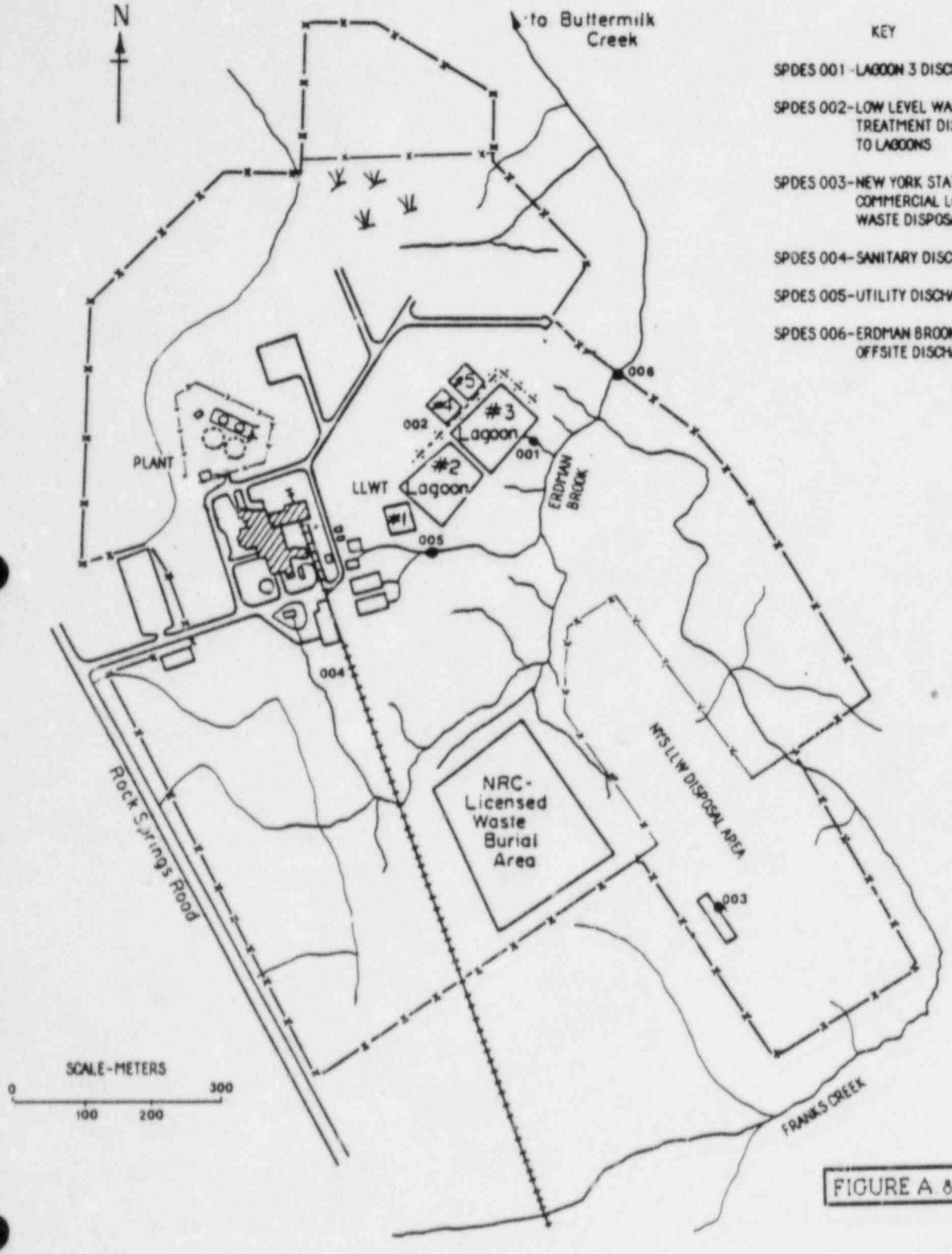



FIGURE A 8 6-3

# COMPARTMENT MODEL OF PATHWAYS

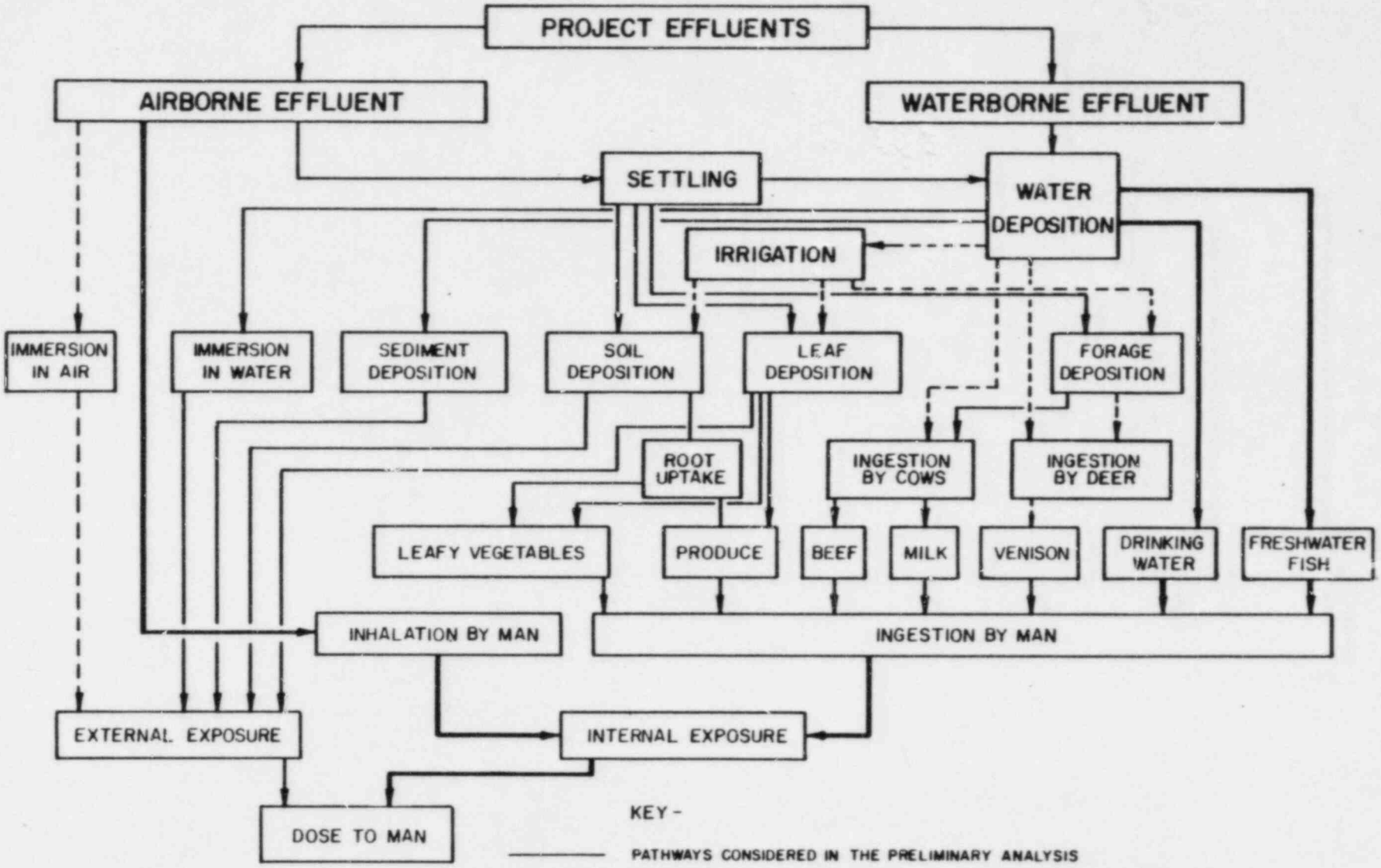



FIGURE A 8.6-4

## A.10.0 CONDUCT OF OPERATIONS

## A.10.1 ORGANIZATIONAL STRUCTURE

### A.10.1.1 CORPORATE ORGANIZATION

#### A.10.1.1.1 Project Organization

Public Law 96-368 authorizes the Department of Energy to carry out a high-level liquid nuclear waste management demonstration project at the Western New York Nuclear Service Center in West Valley, New York. The law directs the Secretary of Energy to "...solidify, in a form suitable for transportation and disposal, the high-level radioactive waste at the Center by vitrification or by such other technology which the Secretary determines to be the most effective for solidification."

West Valley Nuclear Services Company (a wholly owned subsidiary of Westinghouse Electric Co.), a prime contractor to the Department of Energy at the West Valley Demonstration Project, is responsible for site and facility operation, solidification of the existing high-level radioactive waste, decontamination and decommissioning of the facility, and program and project management (Figure A.10.1-1).

#### A.10.1.1.2 WVNS In-House Organization

WVNS is organized to ensure successful completion of the West Valley Demonstration Project. Project Management systems exist to assure Project compliance with applicable Federal and State requirements. The WVNS Policies and Procedures Manual documents these management systems in a manner which provides adequate review and interaction by appropriate WVNS personnel. The following is a brief description of departmental responsibilities for design, construction, review, and Quality Assurance activities.

Facilities - Direct daily operations of the facility including plant maintenance, nuclear materials accountability and plant services engineering. Provide support for decontamination and decommissioning, waste characterization, and solidification engineering activities.

Radiological and Decommissioning Operations - Responsible for Health and Safety plan implementation, radiological controls, and decontamination at the Process Building. Provide Project-wide support in the areas of radiation protection, analytical chemistry, and radiochemistry.

Project Control - Develop and maintain top-level project management systems including an integrated cost and schedule control system and Contract Master Schedule. Issue progress and activity reports and maintain project records system.

Quality Assurance - Maintain the Project Quality Assurance Program, which assures compliance with all required contract documents. Review engineering documents and implement inspection programs relative to operational activities.

Engineering - Responsible for all engineering and technical activities from conception through design of new plant and process systems, HLW solidification, TRU and LLW treatment, storage and transportation.

Construction - Responsible for all construction activities, developing plans and schedules for plant construction. Integrate construction activities with engineering and facilities activities.

Additionally, (Westinghouse) corporate assistance is provided on an as-needed basis when specialized expertise and services are required. Projects requiring significant time and assistance are contracted out to other Westinghouse entities or other contractors. A Corporate Review Board consisting of top level Corporate Management and selected experts in Project related fields convenes approximately three times a year to review status and direction of Project to ensure that appropriate corporate resources are available to Project.

### A.10.1.1.3 Interrelationships with Contractors and Suppliers

All contacts with subcontractors and suppliers are made through the Purchasing and Contracts Department. For technical subcontracts, technical contacts are assigned within the appropriate department at WVNS. The Purchasing Policies and Procedures Manual and the WVNS Policies and Procedures Manual contain specific directions for establishing an interface with subcontractors and suppliers in accordance with DOE Directives and Federal Procurement Regulations.

## A.10.1.2 OPERATING ORGANIZATION

### A.10.1.2.1 WVNS Organization

Figure A.10.1-2 details the complete WVNS organization showing flow of responsibilities, the titles of each position, and the total number of personnel. To assure safe operation, a Radiation and Safety Committee has been appointed by the WVNS President to review planned work activities.

The WVNS Radiation and Safety Committee is chaired by an individual whose management function is independent of facility design and operation and is staffed by members who are independent of the functions under review to the maximum extent practicable. These members are appointed by the WVNS President. In accordance with DOE Directive 5481.1, all operational activities and facilities that present a risk higher than the level routinely accepted by the public will be analyzed and reviewed on a level commensurate with the perceived risk. The WVNS Radiation and Safety Committee is responsible for reviewing appropriate programs, procedures, designs, and operations to ensure that health and safety risks have been identified. They are also responsible for performing facility appraisals annually and arranging for an independent review at least once every three years. Hazardous activities will not be conducted without prior approval of the Radiation and Safety Committee.

### A.10.1.2.2 Personnel Functions, Responsibilities, and Authorities

The following is a brief description of key personnel responsibilities. See Figure A.10.1-2 for personnel currently assigned to these positions. The flow of responsibility is determined by the WVNS President. If no one has been assigned by the president, and in the event of the president's absence or incapacitation, the following flow of responsibility is to be used:

[1] Technical Director,
[2] Facilities Manager, and
[3] Project Control Manager.

The WVNS Emergency Plan (see Section A.10.5) contains a complete description of the flow of responsibility in the event of an emergency.

Project Manager - Responsible for satisfactory completion of the WVDP work scope. Control all Project activities, including technical, construction, operations, financial, and administrative activities.

Technical Director - Provides overall technical direction to the Project through engineering, construction, and Safety and Environmental Assessment. Responsible for the environmental monitoring program to assess the impact of plant operations on public health and safety. Responsible for environmental compliance.

Facilities Manager - Responsible for day-to-day operation of the WVDP facilities including plant services engineering, plant maintenance, and nuclear material accountability. Responsible for the development and implementation of the Project Emergency Response Plan, including conduct of required emergency drills.

Engineering Manager - Responsible for all Engineering activities associated with conceptual through detailed design, HLW solidification and storage, TRU and LLW treatment and storage, transportation and ancillary systems.

Construction Management Manager - Responsible for all construction management activities associated with the WVDP work scope. Develops overall construction plant schedule. Ensures proper design and construction integration. Supports the preparation of construction packages. Supervises and surveys all construction activity. Monitors the constructor's performance for progress and trends. Takes appropriate action with contractors to ensure schedule, budget, specification compliance, and to resolve problems. Coordinates and expedites work among contractors.

Project Control Manager - Direct development and implementation of the Cost and Schedule Control System which satisfies DOE criteria for work authorization, cost and schedule control, variance analysis, etc. Develops schedules and assures schedule hierarchy consistency. Conducts manpower planning and maintains the total Project Cost Estimate. Establishes and implements a system for correspondence and commitment control, document control, and record storage for Project participants.

Quality Assurance Manager - Responsible for all quality assurance and quality control activities associated with WVDP work scope. Develops quality assurance policies and procedures for project design, procurement, component testing, construction and assembly, acceptance testing, and operations. Performs quality assurance surveillances and audits of Project activities to ensure compliance with quality assurance policies and procedures.

Radiological and Decommissioning Operations Manager - Develops and implements a DOE-approved Environmental Safety and Health Plan to minimize impact of operations on public and employee health and safety. Reviews initial decontamination and rehabilitation plans and operating procedures to ensure adequate protection is established with respect to radiation and contamination control, nuclear safety, and industrial safety. Responsible for radiological and industrial safety surveillance programs. Responsible for developing new safety manuals or revising existing safety manuals as necessary. Responsible for maintaining an effective personnel dosimetry program and analytical chemistry services.

Controller - Establish and implement WVDP accounting policies and procedures; auditing and overview of accounting functions. Responsible for the implementation, maintenance, and operation of the project computer and word processing systems.

Public Information - Responsible for ensuring that the general public is kept informed about Project information. Responsible for interactions with the media. Coordinates, prepares, and releases all Project-approved information.

Personnel Relations - Administer benefits, pension, and salary plans for WVNS personnel. Coordinates hiring and training of new employees.

Administrative Services Manager - Responsible for the administration of the site security program, office equipment systems, warehouse activities, and purchasing and contracts activities.

### A.10.1.3 PERSONNEL QUALIFICATION REQUIREMENTS

#### A.10.1.3.1 Minimum Qualification Requirements

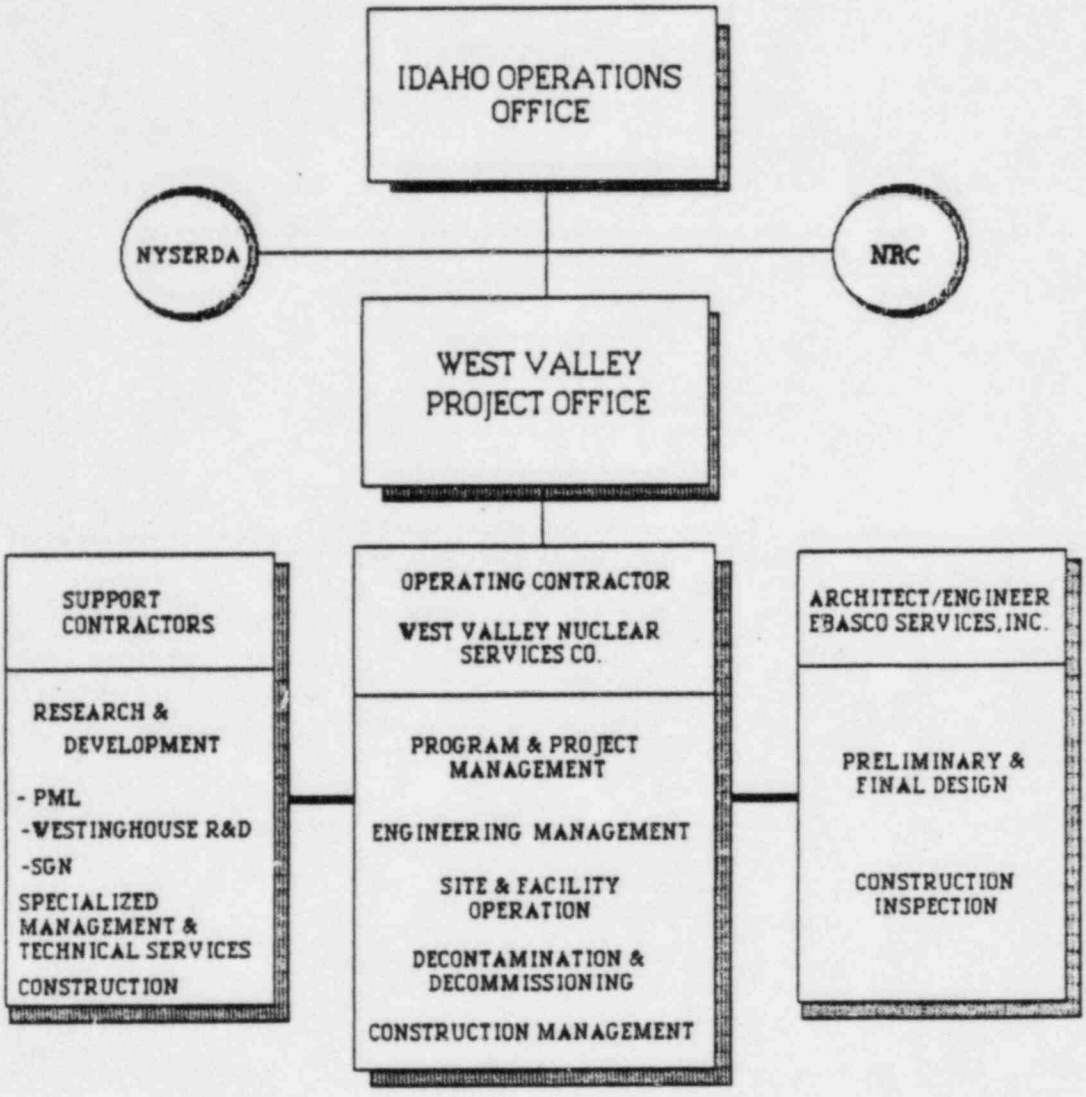
Minimum qualification requirements for personnel working at the WVDP are previous industrial experience and an ability and understanding in math and science. Personnel are further trained by the WVNS training department for specific job responsibilities. The training courses must be completed successfully before any individual can begin working in his assigned area. All subcontractors are required to successfully complete WVNS training which applies to them while they are working on-site before they can begin work.

#### A.10.1.3.2 Qualification of Plant Personnel

All key subject personnel are highly qualified individuals with extensive management experience in nuclear projects across the entire spectrum of the nuclear industry. Resumes of these personnel were included in the proposal submitted to DOE for the WVDP. Resumes for other Project personnel are kept on file in the WVNS Personnel Relations department.

### A.10.1.4 LIAISON WITH OUTSIDE ORGANIZATIONS

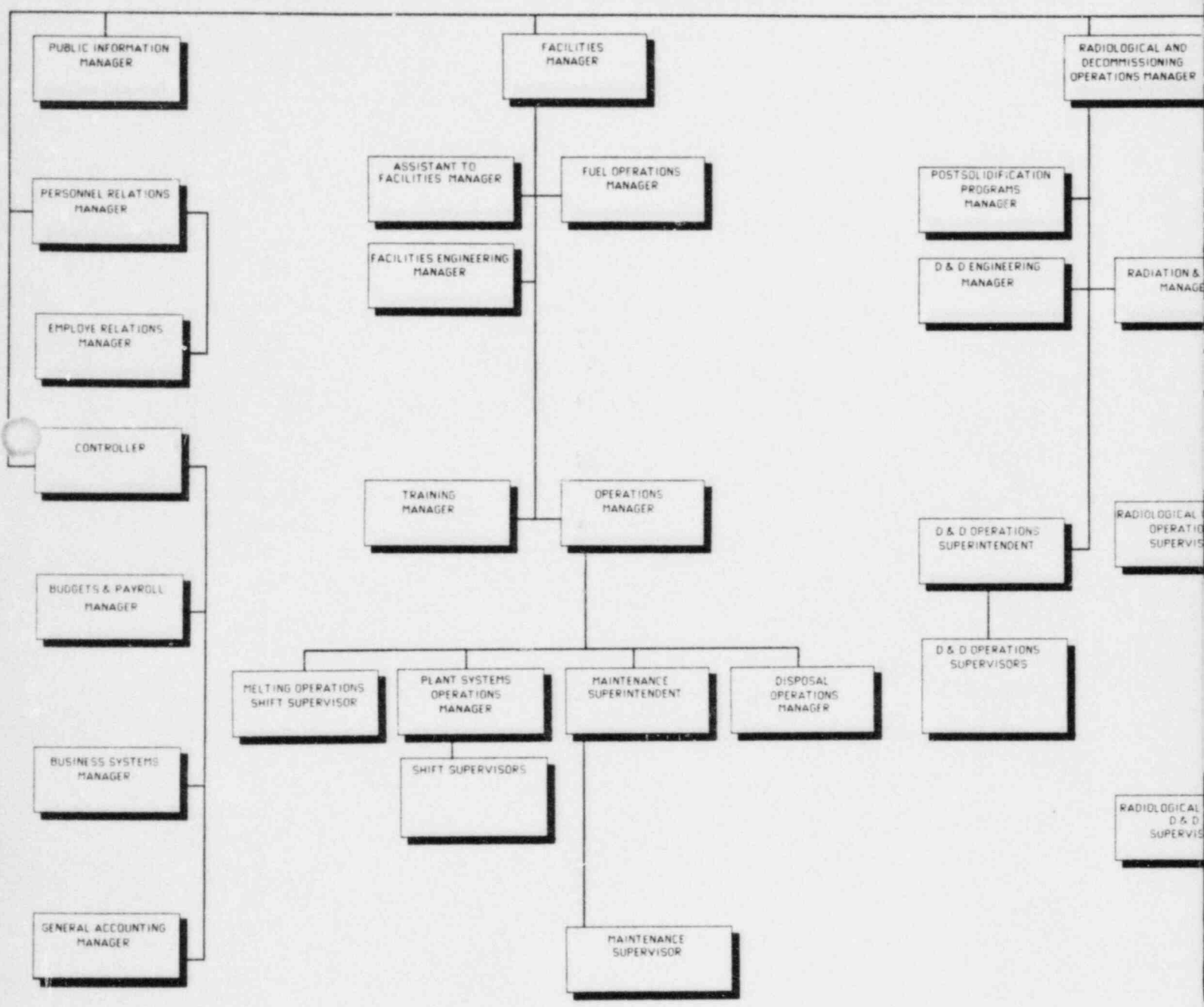
The various organizations associated with the WVDP and their interrelationships were illustrated in Figure A.1.4-1. All government agencies deal directly with the DOE-WV Project Office in a manner controlled by cooperative agreements or Memoranda of Understanding. All subcontractors deal with the WVDP through the WVNS Purchasing and Contracts department and WVNS technical liaison.



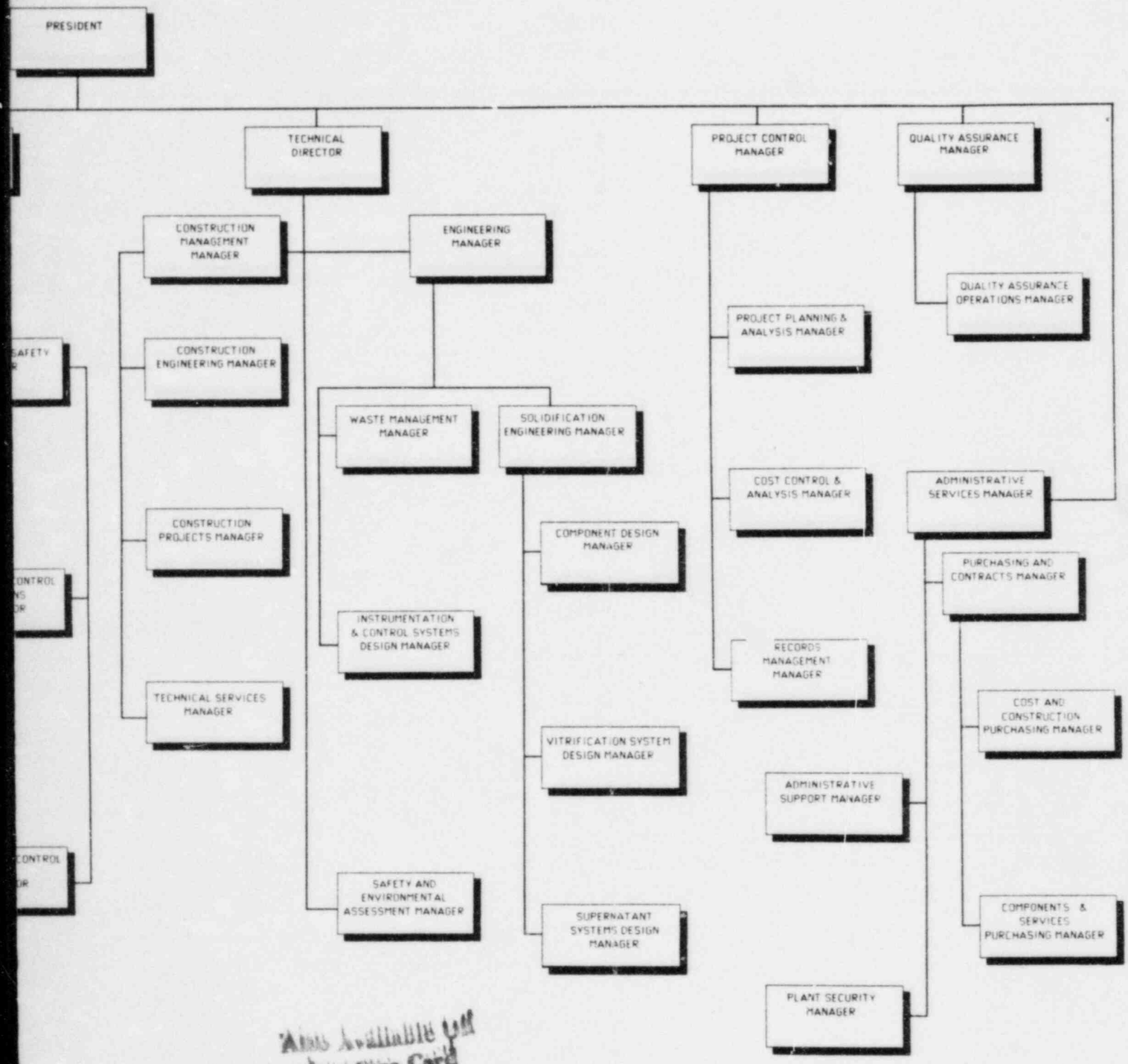

WVDP ORGANIZATION

FIGURE A.10.1-1

# WEST VALLEY
# ORGA



# NUCLEAR SERVICES COMPANY
# NIZATION CHART




Aperture Card

TI APERTURE CARD

FIGURE A 10.1-2

8507030441 -28

## A.10.2 PREOPERATIONAL TESTING

### A.10.2.1 ADMINISTRATIVE PROCEDURES FOR CONDUCTING THE TEST PROGRAM

Several administrative procedures are applicable to the planning, operation, and acceptance of test programs at the WVDP.

Quality Method and Procedure (QMP) 10-1 "Inspection and Test Planning" describes the contents and format for inspection and test plans to ensure that purchased items and services conform to the approved drawings and specifications.

QMP 11-1 "Test Control at WVNS" identifies responsibility for developing and approving test requirements and acceptance criteria as well as the content for the testing procedure. It also identifies the data review requirements and the necessary data to be entered into the test record.

A third manner in which tests are conducted is the Temporary Operating Procedure (TOP). The TOP is a facility procedure which is discussed further in Section A.10.4.1.

In simple cases, any of the above procedures may be used to develop preoperational testing requirements. However, complex programs or systems will be the subject of detailed preoperational test plans. Such testing program plans will develop criteria for operational readiness and will document the results of the preoperational testing program.

## A.10.3 TRAINING PROGRAMS

### A.10.3.1 PERSONNEL STAFFING AND TRAINING

Training at the West Valley Demonstration Project is a formally organized and continuing program of employe indoctrination and training to ensure that WVDP Personnel receive a level of training consistent with work assignment and responsibilities.

The WVDP maintains several separate training programs:

- o for operating systems supervisors and system operators;
- o for decontamination supervisors and operators;
- o for fissile material handlers;
- o for radiation and nuclear safety technicians;
- o for maintenance and custodial personnel;
- o for the general employe; and
- o for other plant contractor and visitor personnel in safety-related topical areas.

Emphasis is placed on formal qualification in radiation protection for workers who may be occupationally exposed to radiation. Specific training requirements for personnel involved in various operations are discussed in the following subsections.

All WVDP training programs meet the intent of DOE Order 5480.1A Chapter V. The programs are evaluated and upgraded by management observations and appraisal of on-the-job performance of individuals and of operating crews and teams. These evaluations also include the evaluation of response to written and oral examinations and the identification of deficient areas that may require retraining/retesting.

The total qualification training programs for the various departments discussed below consists of: (a) formal classroom training, (b) plant orientation, (c) on-the-job training, (d) proficiency testing, (e) comprehensive oral and/or written examinations, and (f) continuing training.

### A.10.3.1.1 General Training

All new employes are required to attend a general orientation program which consists of a scope and purpose of the project, a combined safety and security orientation, emergency signal response orientation, and an introduction into the project organizational responsibilities and management. All new Engineering personnel receive an orientation into the engineering procedures which govern their work at the project.

In addition, all employes receive an indoctrination in the policies pertaining to radiation exposure control for the fertile female.

All visitors/subcontractors to the WVDP receive a visitor/subcontractor orientation prior to proceeding into the protected area. The orientation consists of a combined security, basic radiological safety, and emergency signal response orientation.

Without further mandatory training these personnel are strictly forbidden from working with or handling radioactive materials. Additionally, they are not permitted to enter any controlled area without direct control of a qualified radiation worker.

Each year, all WVDP nonradiation workers receive refresher training in the topics discussed above and in the emergency signal response.

### A.10.3.1.2 Radiation Worker Training

Before being authorized to work with or handle radioactive materials (or enter any controlled area unescorted), all personnel at the WVDP are required to complete a formal course in Radiation Worker Training. The course consists of formal classroom training and practical training followed by a comprehensive written examination in which candidates are required to pass all areas with a grade of 80 percent or better in each area. Candidates are tested in writing in these areas:

- fundamental atomic theory;
- biological effects of radiation exposure;
- radiation exposure control of the unborn child;
- decontamination and waste minimization;
- external radiation exposure control;
- internal radiation exposure control;
- radiation warning signs; and
- employer/employe responsibilities.

Annual requalification is required for all radiation workers. In addition, all radiation workers, whether or not they have access to areas where fissile materials are handled, receive nuclear criticality safety training in these topics:

- nuclear theory;
- criticality and criticality characteristics;
- criticality control; and
- emergency response.

### A.10.3.1.3 Radiation and Nuclear Safety Personnel Training

Training requirements for Radiological Controls Technicians, Calibration Technicians, Dosimetry Technicians, In-vivo Counting Technicians, and other certified positions in Radiation and Nuclear Safety are discussed in Section A.8.5, "Health Physics Program."

### A.10.3.1.4 Plant Operators Training

For staffing and training, all plant operations at WVDP are currently divided into these areas (a) plant systems, (b) Decontamination and Decommissioning operations (D and D), (c) fuel handling. These operations areas and the scope of training within each can be revised as the scope of operations change.

To operate in one or more of the above areas, an operator must be trained and certified. Certification in any one of the areas requires all of the following:

1. Review of the capabilities of the candidate by upper management and assignment to a specific training program.

2. Completion of all of the checklist items of the applicable qualification guide.

3. A recommendation for examination by the appropriate supervisors.

4. Completion of a comprehensive written examination with a grade of at least 80 percent for each process or operation within the areas for which the operator is to be certified.

5. Completion of a plant walk-through examination, including hands-on testing, demonstration and discussion of the operator's responsibilities in existing plant operations. (Plant systems and senior plant systems operators only.)

6. Concurrence by an Oral Examination Committee consisting of senior members of Operations, Training and Radiation and Nuclear Safety. (Senior D and D, senior systems, and senior fuel handling operators only.)

7. Concurrence by the appropriate Department Manager.

### A.10.3.1.5 Maintenance Craftsmen/Custodial Personnel

The Maintenance Section has separate proficiency/progression schedules for craft training of maintenance personnel and custodial personnel. In addition, maintenance personnel are required to participate in selected portions of the operator training programs that concern radiation safety, nuclear safety, and production processes.

### A.10.3.1.6 Fissile Material Handler Training

The DOE Order 5480.1A, Chapter V requires that fissile material handlers be trained appropriately for the work to be performed. All personnel authorized or required to handle fissile material are trained and certified in accordance with those requirements. This training is included in the specific qualification program in the manner consistent with the specific qualification program.

### A.10.3.1.7 Safety Training

Ongoing safety awareness and selected safety equipment training topics are conducted by the Industrial Safety Group of the WVDP. In addition, training programs are developed and conducted as new equipment is identified as requiring specific safety training. Only those individuals who have received the training and demonstrated the ability (by written test or otherwise) to operate the equipment are allowed to do so.

### A.10.3.2 RETRAINING PROGRAM

All nonradiation workers receive annual refresher training on safety and security topics, emergency signal response, and project organizational responsibilities.

All visitors are required to participate annually in the combined security, basic radiological safety, and emergency signal response orientation.

All radiation workers are required to participate annually in the radiation worker training program and satisfactorily demonstrate knowledge of the program by a written examination score of 80 percent or greater.

All plant systems, D and D, and fuel handling operators are required to participate in an annual requalification program consisting of required reading (procedures and unusual occurrence reports) and satisfactory completion of a comprehensive written requalification exam and annual walk-through and oral exam, if applicable.

Verification of training for all certified positions by a senior cognizant manager is conducted every two years.

### A.10.3.3 ADMINISTRATION AND RECORDS

Before releasing it for use, the Training Department reviews all training material for content to assure that it satisfies established training criteria, objectives and content. It is then reviewed for technical accuracy and approved by the cognizant functional manager.

The Training department is responsible for maintenance of a course file for all approved training material and a central documentation file for employe/subcontractor records supporting implementation of the overall training program. The file also contains the information used to schedule refresher or upgrading training for all WVDP personnel.

## A.10.4 NORMAL OPERATIONS

### A.10.4.1 FACILITY PROCEDURE

#### A.10.4.1.1 Preparation and Format

WVNS Procedures are developed in accordance with Procedure WV-100 "Policy and Procedure Preparation and Format." This Procedure identifies the various types of procedures, their format and content, and the review and approval cycle. A list of all WVNS Policy and Procedures titles and designator numbers is presented in Table A.10.4-1.

#### A.10.4.1.2 Operating Procedures

Separate and apart from WVNS Policy and Procedure are the Facility Operating Procedures. These Procedures provide detailed step-by-step descriptions of specific operations and routines for testing, maintenance, decontamination, and other special activities. Facility Procedures are of three basic types: Standard Operating Procedures (SOPs), Special Instruction Procedures (SIPs), and Temporary Operating Procedures (TOPs). Format and content for these various procedures are presented in SOP 002, "Guidelines for the Preparation of Facilities Work Instruction Documents and Technical Specifications." A listing of all WVNS SOPS is presented in Table A.10.4-2.

#### A.10.4.1.3 Safety Review

Of special concern for the facility procedures described in the previous section is the safety associated with the procedure in question. To ensure that operations, especially those dealing with radioactive or hazardous materials or those performed in a hazardous environment, include the appropriate safety precautions, WVNS has implemented a Safety Review Program. This Program establishes a Safety Committee which reviews proposed actions of a hazardous nature to ensure that appropriate safety precautions

are in place. Safety Committee approval must be obtained before any hazardous operation is performed. The Safety Review Program is developed in WVNS Procedure WV-906.

### A.10.4.2 PLANT RECORDS

The WVNS Records Management System is outlined in WVNS Procedure WV-730 "Records Management and Storage." The Procedure identifies the various types of records (nonpermanent, permanent, and lifetime), the storage and retention requirements for each type, and the responsibilities of various organizations in operating the Records Management System. The Records Management System has been developed to comply with the requirements of DOE Orders 1300.1 "Micrographic Management"; DOE 1324.2 "Records Disposition"; and NQA-1-1979 "Quality Assurance Program Requirements for Nuclear Power Plants."

TABLE A.10.4-1 (1 of 4)

## WVNS POLICIES AND PROCEDURES

| ADMINISTRATION | | LATEST ISSUE DATE |
|---|---|---|
| WV-100 Rev. 1 | WVNS Policy and Procedure Guidance | 12/12/83 |
| WV-102 Rev. 1 | Forms Control | 06/11/84 |
| WV-103 Rev. 1 | Document Control and Controlled Distribution | 01/27/84 |
| WV-104 Rev. 1 | Document Review Approval and Release | 02/28/84 |
| WV-105 Rev. 1 | Attendance at Society Meetings and Foreign Travel | 12/12/83 |
| WV-107 Rev 2 | Correspondence Control | 10/07/83 |
| WV-114 Rev 1 | Purchasing Manual | 05/31/83 |
| WV-120 Rev. 1 | Quality Assurance Program | 07/12/83 |
| WV-132 Rev. 1 | Management of Government Property | 02/28/84 |
| WV-160 Rev. 2 | Release of Technical Reports, Papers and Journal Articles | 01/27/84 |
| WV-161 Rev. 3 | Responses to Public Information Requests | 07/19/84 |
| WV-162 | Protection of Westinghouse Proprietary Information | 05/21/82 |
| WV-163 Rev. 1 | WVNS Patent Disclosures | 06/11/84 |
| WV-164 Rev. 1 | Engineering Permanent Record Books | 04/04/84 |
| WV-180 | Commitment Control | 04/20/82 |
| WV-181 Rev. 1 | Baselining of Documents | 02/28/84 |
| WV-182 Rev. 1 | CWBS Maintenance | 10/07/83 |
| WV-183 Rev. 1 | Work Definition and Authorization | 08/31/83 |
| WV-184 Rev. 1 | Cost Account Planning and Budgeting | 08/31/83 |
| WV-185 Rev. 1 | Data Accumulation | 10/07/83 |
| WV-186 Rev. 1 | Variance Analysis | 08/31/83 |
| WV-187 Rev. 1 | Estimate at Completion | 08/31/83 |
| WV-188 Rev. 1 | Performance Reporting | 08/31/83 |
| WV-189 Rev. 1 | Budget Baseline Change Control | 08/31/83 |
| WV-190 Rev. 1 | Schedule Control | 06/11/84 |
| WV-191 | Schedule Status Report | 08/31/83 |
| WV-195 Rev. 1 | Configuration Control | 02/28/84 |
| WV-220 Rev. 1 | Review of Training Materials Produced | 05/14/84 |
| WV-221 | DOE Directives Administration | 12/12/83 |

TABLE A.10.4-1 (2 of 4)

WVNS POLICIES AND PROCEDURES

| ADMINISTRATION | | LATEST ISSUE DATE |
|---|---|---|
| **ENGINEERING** | | |
| WV-305 Rev. 1 | Preparation of Drawings | 02/28/84 |
| WV-306 | Preparation of Equipment Specifications | 02/28/84 |
| WV-307 Rev. 1 | Interface Control Documentation | 02/28/84 |
| WV-360 Rev. 2 | Design Review Procedure | 02/28/84 |
| WV-361 Rev. 1 | Control of Technical Information to Subcontractor | 02/28/84 |
| WV-362 Rev. 1 | Functional and Operating Requirements Preparation | 02/28/84 |
| WV-363 | Design Criteria Documents | 02/28/84 |
| WV-364 | Process Narrative Documents | 04/04/84 |
| WV-365 | Preparation of Technical Specifications | 04/04/84 |
| WV-366 | Technical Manual Preparation | |
| **PERSONNEL RELATIONS** | | |
| WV-538 Rev. 2 | Personnel Training and Indoctrination | 08/26/83 |
| WV-542 Rev. 2 | Personnel Control - Irregular Hours | 05/14/84 |
| WV-543 Rev. 1 | Employee Gate Control - Regular Hours | 05/14/84 |
| WV-544 Rev. 2 | Visitor Control | 05/14/84 |
| **PURCHASING AND TRAFFIC** | | |
| WV-602 | Approval Requests | 05/07/83 |
| WV-620 Rev. 2 | Purchase Requisitions and Changes | 06/28/84 |
| WV-640 | Purchase and Control of Hand-Type Calculators and Other Small Portable Equipment | 12/15/82 |
| WV-650 Rev. 1 | Shipping Procedure | 01/31/83 |
| WV-652 | Receipt of Material and Government Furnished Equipment | 12/15/82 |
| WV-654 Rev. 1 | Receiving Purchased Services | 05/14/84 |
| WV-655 | Vehicle Control | 05/02/83 |
| WV-660 | Procedure for Shipping Hazardous Materials | 06/07/83 |
| WV-680 | Construction Labor Services | 08/09/82 |

TABLE A.10.4-1 (3 of 4)

## WVNS POLICIES AND PROCEDURES

| | | LATEST ISSUE DATE |
|---|---|---|
| **ADMINISTRATION** | | |
| WV-685 Rev. 1 | Acquisition of Computer Equipment, Software and Services | 05/14/84 |
| WV-686 Rev. 1 | Acquisition and Control of Photographic and Video Equipment | 05/14/84 |
| WV-687 | Property Pass | 04/04/84 |
| SERVICES | | |
| WV-710 Rev. 1 | Library Services | 08/15/83 |
| WV-730 Rev. 1 | Records Management and Storage | 07/25/83 |
| WV-742 | Business Systems Services | 01/14/83 |
| WV-743 Rev. 1 | Word Processing Services | 03/22/83 |
| WV-754 | Stationery and Office Supplier, Warehouse Withdrawals | 12/15/82 |
| WV-755 | Changes to Warehouse Inventory Levels | 02/28/84 |
| WV-757 Rev. 1 | Telecommunications: Telephone Equipment | 04/04/84 |
| WV-758 Rev. 1 | Computer Security/Protection for Unclassified Computer Systems | 05/14/84 |
| WV-759 | Storeroom Withdrawals/Warehouse Procedures | 12/15/82 |
| WV-760 | Computer Software Sharing | 12/12/83 |
| WV-761 | Cost Recovery for Sharing Excess Data Processing Capacity | 10/07/83 |
| ACCOUNTING | | |
| WV-810 | Direct Labor Records - Salary | 12/15/82 |
| WV-811 | Direct Labor Records - Hourly | 12/15/82 |
| WV-812 | Salaried Nonexempt Employe Time Reporting White Time Card | 12/15/82 |
| WV-830 Rev. 1 | Travel Advances, Reservations and Expense Reporting | 10/26/83 |
| WV-835 | Signature Authority for Accounting Documents | 03/22/83 |
| WV-860 | Membership in Professional Societies | 03/22/83 |

TABLE A.10.4-1 (4 of 4)

WVNS POLICIES AND PROCEDURES

| ADMINISTRATION | | LATEST ISSUE DATE |
|---|---|---|
| **SAFETY** | | |
| WV-900 Rev. 1 | Industrial Hygiene and Safety | 07/12/83 |
| WV-905 Rev. 1 | Radiation and Criticality Safety | 07/12/83 |
| WV-906 Rev. 3 | Safety Review Program | 05/14/84 |
| WV-980 Rev. 1 | Environmental and Pollution Control | 07/12/83 |
| WV-981 Rev. 1 | Safety Shoe Program | 07/12/83 |
| WV-982 | Safety Eyeglasses Program | 08/09/82 |
| WV-983 | Assigning Dosimetry Badges to Radiation Workers and Visitors | 09/24/82 |
| WV-984 | Alara Program | 02/08/83 |
| WV-985 Rev. 1 | Motor Vehicle Safety Program | 05/14/84 |
| WV-986 | Environmental Review Program | 02/07/84 |

TABLE A.10.4-2 (Page 1 of 6)

## LIST OF PROJECT STANDARD OPERATING PROCEDURES

### LOW-LEVEL WASTE TREATMENT

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 02-1 | 13 | LLWT Cold Chemical Makeup | October 1981 |
| 02-2 | 8 | Ion Exchange Bed Operation | November 1983 |
| 02-3 | 9 | Process Control Procedures for LLWT Plant | July 1983 |
| 02-4 | 5 | Operation of the Anthracite Filter | April 1981 |
| 02-5 | 11 | Centrifuge and Drumming Station Operation | September 1983 |
| 02-6 | 10 | Operations of Flocculator-Clairfier | September 1983 |

### SOLID WASTE HANDLING AND STORAGE

| | | | |
|---|---|---|---|
| 9-1 | 12 | Scrap Removal and Burial | May 1981 |
| 9-2 | 11 | Solid Radioactive Waste Disposal | May 30, 1984 |
| 9-4 | 0 | Waste Burial Lagoon Pumpout Procedure | March 1981 |
| 9-5 | 0 | Operation of the Radioactive Waste Compactor | June 1983 |
| 9-7 | 0 | Labeling/Color Coding of Low-Level Waste Containers | May 1984 |

### COMMON FACILITIES

| | | | |
|---|---|---|---|
| 15-1 | 20 | Management of Plant Liquid Releases | October 1981 |
| 15-3 | 9 | Operation of Process Building Supply Fan | October1981 |
| 15-4 | 12 | Sampling "B" and "C"-Type Operations | September 1981 |

TABLE A.10.4-2 (Page 2 of 6)

LIST OF PROJECT STANDARD OPERATING PROCEDURES

LOW-LEVEL WASTE TREATMENT (CONTINUED)

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 15-6 | 12 | Jetting Sumps | May 1981 |
| 15-8 | 12 | Operation of Ventilation Washer | February 1982 |
| 15-9 | 9 | Process Building and FRS Exhaust Fans | February 1982 |
| 15-11 | 7 | Sampling of Stack Cases | July 1981 |
| 15-12 | 12 | Laundry Operations | September 1981 |
| 15-13 | 9 | Interceptor Operations | July 1981 |
| 15-14 | 10 | Work in Contaminated Areas | July 1984 |
| 15-20 | 7 | Operation of Head-End Ventilation System | October 1981 |
| 15-21 | 9 | Head-End Ventilation Filter Change | January 1983 |
| 15-22 | 4 | Use of the Decontamination Building | November 1983 |
| 15-25 | 4 | Absolute Filter Change in Alpha Laboratory | May 1981 |
| 15-27 | 1 | Inventorying Nuclear Material in Nuclear Material Control Areas | January 1983 |
| 15-28 | 3 | Testing Final Filters | February 1984 |
| 15-29 | 0 | Load Testing Nonmechanized Rigging Components | April 1983 |
| 15-30 | 0 | Control and Installation of Tamper-Indicating Devices | December 1982 |

TABLE A.10.4-2 (Page 3 of 6)

## LIST OF PROJECT STANDARD OPERATING PROCEDURES

### LOW-LEVEL WASTE TREATMENT (CONTINUED)

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 15-31 | 0 | Cleaning Respirator Equipment | May 1983 |
| 15-32 | 0 | Supplied Air Respirator Protection | May 1983 |
| 15-33 | 2 | Transfer of Samples From Waste Tank Farm to Analytical Cells | June 1983 |

### FUEL RECEIVING AND STORAGE

| | | | |
|---|---|---|---|
| 1-8 | 10 | Cask Unloading Crane | September 1983 |
| 1-9 | 9 | Operation of the Fuel Pool Canister Crane | September 1983 |
| 1-10 | 8 | Operation of the Fuel Pool Service Bridge and Fuel Hoist | September 1983 |
| 1-12 | 13 | Fuel Pool Water System | March 1981 |
| 1-14 | 11 | FRS Accountability | November 1983 |
| 1-16 | 7 | Operation of the Cask Unloading Pool Lift Rack | September 1983 |
| 1-34 | 6 | Operation of the FRS Cask Decon Stall, the High-Pressure Pump, and the Diesel Engine | September 1983 |
| 1-35 | 12 | FRS Filter Media and Resin Disposal and Replacement | July 1983 |
| 1-36 | 7 | Operation of the FRS Pool Cooling System | September 1983 |

TABLE A.10.4-2 (Page 4 of 6)

LIST OF PROJECT STANDARD OPERATING PROCEDURES

FUEL RECEIVING AND STORAGE (CONTINUED)

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 1-38 | 6 | Operation of the FRS Ventilation System | October 1983 |
| 1-39 | 2 | NFS-4 Cask Handling | April 1981 |
| 1-40 | 5 | Loading and Preparation for Shipment of the NLI 1/2 Cask | February 1984 |
| 1-41 | 0 | Loading and Preparation for Shipment of the TN-9 Cask | November 1983 |
| PMC-GPC | | | |
| 2-4 | 10 | General Purpose Cell Two-Ton Crane | June 1981 |
| 2-5 | 8 | General Purpose Cell Power Manipulator | June 1981 |
| 2-6 | 7 | Operation of GPC Fire Protection System | February 1982 |
| 2-8 | 10 | PMC Two-Ton Cranes | June 1981 |
| 2-12 | 5 | Scrap Removal Crane Operation | May 1981 |
| 2-13 | 12 | Scrap Removal Shielded Access Door Operation | February 1982 |
| 2-14 | 8 | Scrap Removal-General Purpose Cell Hatch Operation | October 1981 |
| 2-20 | 7 | PMC Crane Room Door | May 1981 |

TABLE A.10.4-2 (Page 5 of 6)

LIST OF PROJECT STANDARD OPERATING PROCEDURES

PMC-GPC (CONTINUED)

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 2-27 | 7 | PMC Fire Fighting Equipment | February 1982 |
| 2-36 | 6 | GPC Crane Room Door and Hinged Rails | May 1981 |
| DISSOLUTION AND FEED PREPARATION | | | |
| 3-1 | 9 | Chemical Processing Cell 16-Ton, 2-Tone Crane | June 1981 |
| 3-2 | 10 | CPC Combo-Manipulator Crane | June 1981 |
| 3-10 | 5 | CPC-EDR Shielding Door and Equipment Transfer Cart | |
| 3-11 | 6 | CPC Crane Room Door | February 1982 |
| 3-13 | 1 | EDR Crane Operation | April 1981 |
| VENTILATION | | | |
| 6-2 | 14 | Vessel Off-Gas System | April 1981 |
| 6-5 | 0 | Replace VOG Filter | August 1982 |
| LIQUID WASTE TREATMENT AND ACID RECOVERY | | | |
| 7-8 | 4 | Processing Building Liquid Waste | March 1981 |
| LIQUID WASTE SOTRAGE AND DISPOSAL | | | |
| 8-1 | 16 | Waste Tank Operation | December 1981 |

TABLE A.10.4-2 (Page 6 of 6)

## LIST OF PROJECT STANDARD OPERATING PROCEDURES

### COLD CHEMICAL MAKEUP

| SOP NO. | REV. NO | TITLE | DATE |
|---|---|---|---|
| 14-1 | 1C | Receipt and Distribution of Bulk Liquid Chemicals | November 1981 |
| 31-1 | 10 | Plant Utility and Instrument | January 1982 |
| 31-2 | 14 | Steam Generation | January 1984 |
| 31-2 | 5 | 4K-1 Pulser Air Compressor | January 1982 |
| 31-4 | 4 | Operation of Zeolite Water Softeners | June 1981 |

### ELECTRICAL DISTRIBUTION FACILITIES

| | | | |
|---|---|---|---|
| 30-1 | 13 | Emergency Power Generation | April 1983 |

### COOLING AND SERIVCE WATER EQUIPMENT

| | | | |
|---|---|---|---|
| 32-1 | 13 | Plant Water System | March 1984 |
| 32-2 | 10 | Demineralized Water System | March 1981 |
| 32-4 | 9 | Potable Water System | January 1982 |
| 32-5 | 11 | Fire Water System | March 1981 |
| 32-6 | 9 | Cooling Water System | November 1981 |

## A.10.5 EMERGENCY PLANNING

### A.10.5.1 BASIC PLAN

#### A.10.5.1.1 Purpose

This plan provides an organized plan of action, identifies authorities and responsibilities of emergency response personnel and organizations, and identifies the manpower and equipment resources available to cope with emergencies at the West Valley Demonstration Project (WVDP).

#### A.10.5.1.2 Scope

This plan applies to emergency actions relative to radiological, industrial, safeguards and security (theft of Special Nuclear Materials (SNM), threats, or acts of violence, etc.), and natural emergencies at the West Valley Demonstration Project. The primary purpose of this plan is to minimize the impact of any emergency upon the health and safety of plant personnel and the general public.

#### A.10.5.1.3 Emergency Response Organizations

##### A.10.5.1.3.1 Department of Energy

Emergency Planning and Preparedness

The Manager of the Idaho Operations Office, through the DOE WVDP Project Director, is responsible for overall executive direction of Emergency Planning, Preparedness, and Response for the West Valley Demonstration Project.

A.10.5.1.3.2 **WVDP Emergency Organization**

**Succession of Authority**

The WVNS Project Manager (the Emergency Director) has the ultimate responsibility for all WVNS activities. The WVNS Project Manager interacts with the DOE Project Director and off-site resources as he deems it to be prudent for the mitigation of emergency conditions. The Project Manager will designate a listing of qualified Emergency Directors and associated Emergency Control Group Personnel. This list will be periodically updated and will be maintained in the Emergency Procedures Manual. The WVNS Project Manager will retain responsibility and authority for assessment and mitigation of emergency conditions at WVDP unless relieved by higher authority.

**Emergency Direction**

The Project Manager or his alternate, as identified in this plan, shall:

(1) Maintain executive control of all emergency situations affecting WVDP operations (Figure A.10.5-1);

(2) Activate the WVDP Emergency Control Group and other WVDP emergency response personnel, as needed;

(3) Direct emergency response actions utilizing personnel and resources to mitigate consequences of the emergency;

(4) Authorize site-wide evacuation of personnel, as needed;

(5) Activate WVNS personnel, as necessary;

(6) Maintain WVNS succession of authority;

(7) Authorize obtaining assistance from off-site organizations such as hospitals, health departments, highway departments, law enforcement agencies, ambulance services, etc.;

(8) Authorize mutual aid or other emergency assistance from off-site agencies or organizations; and

(9) Authorize notification of off-site local, county, and state officials when WVDP-originated hazardous material releases to the environment may affect persons or property outside of the site boundary. DOE-ID assistance will be requested as necessary.

## Emergency Control Group

Whenever a major WVDP emergency occurs, the Emergency Director shall convene this group or their designated alternates in the Administration complex. This group provides administrative and technical assistance to the Emergency Director, as needed, and consists of:

(1) Technical Director,

(2) DOE Representative,

(3) Technical Support Center Manager,

(4) Radiological and Decommissioning Operations Manager,

(5) Operations Manager,

(6) Facilities Manager,

(7) Security Manager,

(8) Public Information Manager,

(9) Radiation and Safety Manager,

(10) Plant Systems Operations Manager, and

(11) Data Recorders.

Other members of the WVDP Project Director's staff may be requested to participate when it is deemed prudent for the mitigation of the emergency.

**On-Scene Commander (During Nonregular Working Hours)**

On the back shifts, the responsibility for emergency direction for the WVDP rests with the following individuals, until relieved by higher authority:

(1) Operations Shift Supervisor: for situations where fire and health concerns are paramount (i.e., radiological, chemical, toxic, etc.) and actual or imminent threats of natural emergencies (i.e., high winds, blizzards, flooding, earthquakes, tornados, etc.); and

(2) Security Shift Supervisor: for situations involving safeguards and security (i.e., bomb threats, law enforcement, terrorist, civil violence, etc.).

**Activation of the Emergency Control Group**

The initial emergency response centers on the shift operating crew which is staffed with personnel qualified to institute immediate protective measures and to implement other aspects of the emergency plan. The minimum crew on any shift is self-sufficient until additional emergency personnel can assemble. As shown in Figure A.10.5-2, the initial emergency response organization consists of the Operations Shift Supervisor, the Radiation Control Technician (on call), Qualified Operator, and the Security Shift Supervisor. The responsibilities of these individuals are identified below.

Operations Shift Supervisor - is responsible for directing equipment shutdown or other actions which are required to mitigate emergency situations and is the Director of the Fire Brigade. He reviews the emergency with the personnel on duty and initiates contact with the Emergency Director and the Operations Manager.

Radiation and Safety Technician (on call) - is responsible for evaluating the radiological health aspects of the emergency situation and advises the Operations Shift Supervisor of precautionary measures to be taken.

Qualified Operators - assist the Operations Shift Supervisor with the initial assessment and mitigation of the emergency situation.

Security Shift Supervisor - receives and records all incoming communications until he is relieved by the Security Manager. He is also responsible for maintaining the Emergency Log and assisting the Operations Shift Supervisor in obtaining additional emergency support personnel. The Security Shift Supervisor also functions as the On-Scene Commander for security incidents which occur during nonregular working hours.

Immediate response activities should be limited to first aid and life-saving activities, firefighting, and emergency equipment operation as prescribed by existing operating procedures. Immediate response activities should be performed in parallel with the initial contact of the Emergency Director.

The Emergency Director will determine the level of emergency response to an actual or potential emergency involving WVDP facilities. Upon notification of the emergency, the Emergency Director will contact appropriate Project personnel, assess the emergency, and maintain liaison with the Operations Shift Supervisor. If deemed necessary, the Emergency Director will convene the Emergency Control Group. The Emergency Director may request the attendance of additional members of his staff (e.g. the Technical Director, the Technical Support Center Manager, the Public Information Manager, and additional technical support personnel). Depending on the type of emergency

in progress, the Emergency Director will have the Operations Shift Supervisor or the Security Shift Supervisor contact the members of the Emergency Control Group in accordance with the Strict Order of Call.

The emergency organization following the integration of additional plant personnel is shown in Figure A.10.5-1.

The responsibilities for each position are listed below:

Emergency Director - directs and coordinates all emergency action.

Operations Manager - has the primary responsibility for the shutdown or continued operation of plant equipment, as appropriate, to mitigate the consequences of an emergency. He is responsible for providing the Emergency Director with an accurate appraisal of plant equipment status. He advises the Emergency Director in matters of plant operations and directs the activities of the On-Scene Commander and other operations personnel.

Radiological and Decommissioning Operations Manager - is responsible for the evaluation of the emergency and the rescue and/or care of involved personnel. He notifies the plant physician of injuries. He supervises additional R/DO specialists in taking and processing environmental survey samples. He will advise the Emergency Director and the Facilities Manager when an accident is serious enough to report to regulatory authorities.

Radiation and Safety Manager - is responsible for evaluating the radiological aspects of the emergency and the rescue and/or care of involved individuals. He advises the R/DO Manager concerning radiological health and safety, personnel monitoring, and treatment of contaminated injured personnel.

DOE Representative - is responsible for providing DOE overview of WVDP emergency response actions. He is also responsible for the notification of off-site state and federal authorities, with the exception of urgent support agencies (e.g., ambulance service, fire department, sheriff, and state police).

Facilities Manager - working with the DOE-ID On-Site Representative, the Facilities Manager is responsible for the notification of off-site authorities (local, county, state, and federal officials). If the DOE On-Site Representative cannot be located, the Facilities Manager, with explicit instructions and approval from the WVDP Emergency Director, will notify off-site authorities.

Public Information Manager - is responsible for structuring all news releases. He works in conjunction with the Facilities Manager and the DOE On-Site Representative. No information will be released without prior approval of the WVDP Emergency Director. All statements and requests for information to the public will be made through the Public Information Manager.

Security Manager - receives all incoming communications and records requests for information.

Data Recorder - records pertinent information about emergency situations and response actions for the Operations Manager, the R/DO Manager, and other members of the Emergency Control Group. These individuals may also be used to provide technical support information to the Emergency Control Group.

Plant Systems Operations Manager - helps the Operations Manager by providing technical information and by supervising emergency support activities which are beyond the control of the Operations Shift Supervisor.

Operations Shift Supervisor - functions as the On-Scene Commander responsible for the supervision of plant personnel performing emergency response actions.

## WVDP Emergency Planning Coordinator

The Operations Manager shall designate a member of his staff to function as the WVDP Emergency Planning Coordinator and coordinate WVDP emergency planning and preparedness activities with DOE and local, state, and federal agencies.

A.10.5.1.3.3 **WVDP Emergency Response Groups**

**Security**

Upon the awareness or notification of a WVDP-related emergency, security personnel will take action consistent with the WVDP Safeguards and Security Plan. Security personnel, as directed by the Emergency Director, will initiate appropriate access and traffic control measures.

Emergency-related functions of this group include:

(a) Personnel accountability.

(b) Routine law enforcement activities.

(c) Courier service.

(d) Security Guard Shift Supervisor will assume acting On-Scene Commander responsibilities (for Safeguard and Security emergencies) during nonregular working hours until relieved by the Plant Security Manager or the WVDP Emergency Director, as appropriate.

(e) Reception of all incoming calls and records requests for information.

(f) Assistance of the Operations Shift Supervisor in requesting assistance from emergency support agencies (West Valley Fire Department and ambulance service).

(g) As directed by the Operations Shift Supervisor, the Security Guard Shift Supervisor will notify the WVDP Emergency Director and other emergency support personnel.

(h) Security will meet emergency support vehicles at the plant gate and will escort them immediately to the location of the emergency.

## Fire Brigade

The Operations Shift Supervisor shall be in charge of first aid and firefighting activities and nothing in this plan shall alter this unless the Emergency Director determines that other hazardous conditions would override the firefighting considerations. In addition, the Shift Supervisor will direct emergency action as necessary in fire/explosions and similar hazardous situations (e.g., immediate threats to life) to order the evacuation or isolation of the affected areas or facilities.

Additional emergency functions of this group include:

(a) Administration of first aid.

(b) Search and rescue operations.

(c) The Operations Shift Supervisor will assume On-Scene Commander responsibilities for Radiological and Industrial emergencies during nonregular work hours until relieved by the WVDP Emergency Director.

## Environmental and Dosimetry Laboratories

The Safety and Environmental Assessment and Radiation and Safety Groups will assess the impact of any release of radioactivity to the environment and the impact on personnel and property both on and off-site.

Specific emergency-related activities include:

(a) Analyze environmental samples and coordinate analysis by other laboratories;

(b) Operate WVDP meteorology system and interpret data to plot trajectories of airborne releases;

(c) Supply and process personnel dosimeters and report their results;

(d) Determine body burdens through whole body counting and analysis of body wastes;

(e) Return nuclear accident dosimeters to RESL for processing;

(f) Perform radiological surveys on and off site;

(g) Maintain the WVDP Environmental Mobile Lab and record its movements (i.e., release, return and location);

(h) Provide first aid support; and

(i) Decontaminate contaminated casualties.

## Emergency Response Teams

Emergency Response Teams are composed of trained technicians and volunteers who will be called to respond to an emergency situation at the request of the WVDP Emergency Director. These teams are identified in Figure A.10.5-3 and are described as follows:

Personnel Monitoring Team - is composed of one radiation control technician designated Team Leader and three radiation-worker-qualified individuals trained in personnel monitoring and decontamination. The R/DO Manager is responsible for selecting team members and for providing necessary support equipment. The personnel monitoring team will assemble in the Environmental and Dosimetry Lab where its support equipment will be stored. The Training Department will train backup personnel and maintain auditable training records. The Personnel Monitoring Team will be activated only in the event of a plant evacuation or at the request of the Radiation and Safety Manager. The Monitoring Team will report to the Radiation and Safety Manager or his alternate. The Monitoring Team is responsible for conducting personnel surveys and decontamination of individuals as directed by the Team Leader.

Radiological Control Team - is composed of a Team Leader and three Radcon Technicians. The Radiological and Decommissioning Operations Manager has delegated the responsibility of Team Leader to the R/S Manager or his delegate. The R/DO Manager is responsible for selecting team members and for providing necessary support equipment. The Radiological Control Team will assemble in the Environmental Lab. The Radiation and Safety Department maintains an emergency response instrument kit in the R/S shift office. If a site or general emergency occurs during the off-shift, the Operations Shift Supervisor is responsible for having the Emergency Response Kit transported to the Environmental Lab. If a site or general emergency occurs during normal working hours, the Radiological Control Team members are responsible for bringing the necessary support equipment to the assembly point. The Radiological Control Team will be activated for any event which results in the activation of the Emergency Control Group and will report to the R/DO Manager or his alternate. Responsibilities of this team include on-scene radiological monitoring and radiological support of the search and reentry team.

Search and Re-entry Team - is composed of a Team Leader who will be a Senior Decontamination and Decommissioning Supervisor, a Radiological Control Technician assigned from the Radiological Control Team, and two qualified operators. The Operations Manager is responsible for selecting D/D and operations members of this team and for providing necessary support equipment. All team members must be radiation-worker-qualified and must also be trained in first aid. The Search and Reentry Team will assemble in the training area (room 48) of the Administrative Complex, where its support equipment will be stored. The Search and Reentry Team will be activated for any event which results in the activation of the Emergency Control Group and will report to the Operations Manager or his alternate. Emergency responsibilities of this group include:

(a) Reentry into the plant during an emergency situation for the purpose of rescuing injured personnel;

(b) Reentry into the plant during an emergency situation for the purpose of shutting down equipment which is causing the emergency condition;

(c) Providing Emergency First Aid Services; and

(d) Obtaining information necessary for accident assessment.

Environmental Monitoring Team - is composed of a Team Leader and two team members. The Team Leader is designated to be a Safety and Environmental Assessment Engineer or a Senior Environmental Technician. All Team Members must be knowledgeable in the usage of all environmental lab instrumentation, in sample collection techniques, mapping, and communications. The Environmental Monitoring Team will assemble in the Environmental and Dosimetry Lab. Support equipment for this team will be stored either in the Mobile Lab or in the Environmental Lab. The Environmental Monitoring Team will be activated for any event which results in the activation of the Emergency Control Group and will report to the R/DO Manager or his alternate. Emergency Responsibilities of this group include:

(a) Sample collection and field analysis;

(b) Plotting release trajectories; and

(c) Providing necessary information to assess the release so that appropriate notification and follow-up monitoring requirements can be determined. Follow-up monitoring will be coordinated, if required, with outside agencies through DOE.

Administrative Complex Wardens - These individuals are selected by and report to the WVNS Controller. They are responsible for maintaining control of the Administrative Complex during any emergency situation which results in the activation of the Emergency Control Group. Their prime responsibility is maintaining order and preventing unauthorized access to the Emergency Control Center. In the event of a plant evacuation, the wardens will separate

personnel wearing anticontamination clothing from personnel who are not. The Personnel Monitoring Team is responsible for handling potentially contaminated personnel beyond this point.

### A.10.5.1.3.4 Medical Facilities

Medical services are located in the office complex across from the Process Building. The facilities consist of a nurse's station, a first aid station, and doctor's office. First aid services will be performed on-site. Site personnel manifesting serious injuries or illnesses are transported by ambulance to Chaffee Hospital in Springville, New York. Ambulance service will be provided by the West Valley Fire Department.

### A.10.5.1.3.5 Off-Site County and State Agencies

If an emergency situation occurs which impacts or has the potential of impacting off-site areas, WVNS will maintain close liaison with appropriate county and state officials. Information pertinent to the emergency and resulting situation will be promptly disseminated by the Facilities Manager in conjunction with the DOE On-Site Representative so that state and local response organizations are accurately informed.

### A.10.5.1.4 Emergency Control Facilities

### A.10.5.1.4.1 WVDP Administrative Complex

The WVDP administrative complex, located just outside of the security fence to the southwest of the Process Building, is used by management and the Emergency Control group during emergency situations.

#### Emergency Control Center (ECC)

Conference Room 44 in the administrative trailer complex has been designated as the Emergency Control Center. This room is furnished with conference tables, chairs, wall maps (WVDP site, surrounding counties and state),

wall-mounted site page speakers, remote meteorological data terminal, emergency supply cabinet, portable radio transceiver, and plug-in wall telephone jacks.

### Technical Support Center

The Library reading room in the Administrative Trailer Complex has been designated as the Technical Support Center. This room is furnished with conference tables, chairs, plug-in wall telephone jacks, and an emergency supplies cabinet.

### A.10.5.1.4.2 Environmental and Dosimetry Laboratories

The Environmental Lab is located in the administrative trailer complex. The facility contains instrumentation necessary for processing and analyzing environmental samples, source term identification, and determining meteorological trajectories. The Dosimetry Lab is located in the office trailer complex. This facility contains instrumentation necessary for performing whole body counts and processing personnel dosimetry.

### Environmental Mobile Lab

The Environmental Mobile Lab is available for responses to on-site and off-site emergencies. This self-contained unit is capable of functioning as a Health Physics and Radio-Analytical Field Laboratory. The Mobile Lab may also be used to transport injured personnel. Its use is coordinated by Safety and Environmental Assessment.

### WVDP Meteorological System

The Meteorological Monitoring System is designed to provide atmospheric dispersion data specific to the topography of the site. The system consists of an on-site tower and a regional tower connected to a digital data acquisition and display system.

The regional installation is a 10 metre tower located on an unobstructed hilltop near the site. This tower measures wind speed and wind direction which have not been influenced by local terrain. These data are telemetered to the on-site digital acquisition system and are used to calculate the standard deviation in wind direction. The other tower is located on-site. It is 60 metres high and measures wind speed and wind direction at 10 and 60 metres. These data are recorded by the data acquisition system. The data recorded by the on-site and regional towers will be used to calculate stability class; in combination with source term data, they will be used to calculate dose and concentration for real or hypothetical accident releases. The data collected by the data acquisition system can be accessed in the Environmental and Dosimetry Lab or on a remote terminal located in the Emergency Control Center.

### A.10.5.1.5 Communications

During emergencies and recovery operations, communications are maintained between emergency response personnel and the Emergency Control Center with corporate management, DOE-ID, and related emergency services (i.e., fire, security and medical), etc.

#### A.10.5.1.5.1 WVDP Communications Equipment

**WVDP Radio Network**

The WVDP radio network consists of the following:

| Net | Assignment |
|---|---|
| A | WVDP Security |
| B | WVDP Operations, Radiological and Decontamination Operations, Emergency Control Center and Security |

## Sheriff's Radio

WVNS has a mutual aid agreement with the Cattaraugus County Sheriff's Office. This radio link can be used to request assistance or as a source of emergency information.

## Other Equipment

Other equipment available for communication purposes includes:

(a) 181/182 Plant Page System,
(b) Plant Telephone System,
(c) Power Down Telephone System, and
(d) Telecopier.

### A.10.5.1.6 Detection and Warning Systems

#### A.10.5.1.6.1 Fire

On-site facilities generally utilize locally annunciated audible signals.

#### A.10.5.1.6.2 Radiation/Contamination

Continuous Air Monitors - These instruments have local audible and visual alarms and instruments are placed strategically around the plant. R/S is responsible for determining monitoring points and for the calibration and maintenance of these instruments.

Radiation Area Monitors - At present, there is one instrument located in the Fuel Receiving and Storage area on the north aisle near the pool. It is provided with local audible and visual alarms and remote audible and visual alarms in the Control Room. R/S is responsible for the calibration and maintenance of this instrument.

Cooling Water Monitors - Currently, there are three instruments located in the following areas:

(1) Waste Tank Farm - monitoring cooling water discharge from 8D-3 and 8D-4. It has a local audible and visual alarm and a remote audible and visual alarm in the Control Room. The alarm condition also shuts down the cooling water flow.

(2) Fuel Receiving and Storage - Cooling Tower Basin Monitor. The instrument has an audible and visual alarm located at the east mechanical operating aisle alarm panel and in the Control Room.

(3) Utility Room - Plant Cooling Water Return Monitor. The instrument has local audible and visual alarms in the utility room.

R/S is responsible for the maintenance, calibration, and semiannual tests of these instruments.

Steam Condensate Return Monitor - This instrument is located in the Utility Room and monitors all process building steam condensate return. The instrument has an audible and visual alarm in the Utility Room. R/S is responsible for the maintenance, calibration, and semiannual tests of this instrument.

Stack Monitor - WVDP currently has a continuous isokinetic stack monitor and one installed spare. This instrument monitors gross beta-gamma activity. Activity is indicated locally and recorded in the Control Room. The instrument has local audible and visual alarms outside of the Control Room and remote audible and visual alarms in the Control Room. S & EA is responsible for the maintenance, calibration, and periodic testing of this instrument.

Portal Monitor - Instruments are located at each of the three entrance/exits to the site (main gatehouse, administrative complex and construction gatehouse). It has local audible and visual alarms. R/S is responsible for the maintenance, calibration, and periodic test of this equipment.

Criticality Monitors - These instruments are located in areas of the plant where the occurrence of a criticality accident is possible. These instruments have local audible and visual alarms consisting of a "howling" horn and brilliant blue strobe lights. R/S is responsible for the maintenance, calibration, and periodic test of this instrumentation.

**A.10.5.1.6.3 Evacuation Signal**

**Process Plant Evacuation**

A series of oscillating siren tones (at approximately 5 to 10 second intervals) for at least a three-minute duration.

When the Evacuation signal is given, all Process Plant personnel are to go immediately to the Personnel Assembly Area in the Administrative Complex unless directed to do otherwise by the Operations Shift Supervisor or the Emergency Director.

Immediately after the Evacuation Signal has been sounded, a 182-Page System announcement will be made to place the Administrative Complex in a condition of BUILDING ALERT. The announcement should be as follows:

Attention: This is not a drill. The Process Plant is being evacuated. The Administrative Complex is now in a condition of BUILDING ALERT. Close all windows and secure all ventilation and air conditioning systems. Personnel located in the Administrative Complex are to remain indoors. Please stay calm and stand fast in your assigned work areas.

Repeat: (As above)

**All Clear**

The All Clear will be given by voice announcement over the 182-Page System by the Emergency Director or his alternate.

### A.10.5.1.7 Evacuation Routes and Roadblocks

Should the Emergency Director conclude that Plant Personnel Evacuation beyond the location of the personnel assembly area in the administrative trailer complex would be prudent in order to maximize personnel safety, he will select the most favorable evacuation route based on information received from plant or area meteorological equipment and R/DO guidance.

Should the Emergency Director conclude that access to public roadways, such as Rock Springs Road, should be controlled to minimize exposure or the spread of contamination, he will direct the Security Manager to implement roadblocks in conjunction with the county and state police agencies.

### A.10.5.1.8 Training, Tests, and Exercises

#### A.10.5.1.8.1 Personnel Training

West Valley Nuclear Services must assure that its employes are adequately trained in emergency preparedness principles and practices. The Training Manager is responsible for providing personnel training and maintaining auditable personnel training records. Line management is responsible for establishing appropriate training standards and assuring that only qualified personnel are assigned responsibilities in performance of response actions as required by this plan.

#### A.10.5.1.8.2 Equipment Testing

Instruments used to detect and evaluate of emergencies, systems used for warning and directing personnel, and communication systems must be provided routine maintenance and tested as required by technical specifications, or at least monthly, to assure their reliability under emergency conditions. Results of these tests must be documented and needed repairs implemented as soon as possible. Portable instrumentation must be checked periodically for operability and recalibrated as required by the instrument manufacturer.

In-plant emergency control and recovery equipment (such as firefighting apparatus, evacuation vehicles, control point equipment, etc.) should be tested periodically and results recorded.

### A.10.5.1.8.3 Exercises and Drills

West Valley Nuclear Services is required to perform emergency exercises or drills at least quarterly; one drill requiring site evacuation must be performed annually. The Training Manager is responsible for developing realistic drill scenarios. Before any drill scenario is initiated, it must be reviewed by the Facilities Manager and the Technical Director to ensure the protection of plant personnel, equipment, and the general public. The scope and depth of the exercises should be commensurate with potential emergencies at the facility. Realistic scenarios should test the adequacy of personnel, equipment, plans, and procedures to cope with emergency situations.

Emergency-oriented personnel (such as Security, Fire Department, Medical, Transportation, Radiological Assistance, etc.) should be integrated into exercises consistent with the programmatic demands and the objectives of the exercise.

Tests and exercises should include (but not be limited to) the following considerations: evacuation and assembly, personnel accountability, activation of emergency control centers, emergency management damag assessment actions, reentry and recovery efforts, notification of DOE-ID and contractor management, utilization of communication equipment, facility and equipment shutdown, public information releases, etc.

Exercises should be terminated at the first indication of danger to life or property, should include an appropriate number of observers, and should include a critique immediately following termination of the exercise.

Facilities with multi-shift operations shall conduct appropriate shift drills independent of the annual emergency exercise to assure that all crews respond to one drill per year.

A preliminary report of the exercise, noting errors, deficiencies and proposed corrective actions, should be submitted to the DOE On-Site Representative within 10 calendar days and a follow-up summary report within 60 days.

General training sessions include a review and explanation of the Emergency Procedures Manual; they are to be held annually to inform each employe of any changes in details or procedures as well as to refresh their familiarity with the overall plan.

### A.10.5.1.9 Emergency Response Levels

The manner of response and degree of involvement in an emergency will depend upon the level of severity of real or potential emergencies. Incidents and emergencies occurring at the WVDP must be classified and reported to the WCC in accordance with the following categories:

#### A.10.5.1.9.1 Unusual Event

An "Unusual Event" is an event in progress or having occurred which normally would not constitute an emergency but which indicates a significant release of radioactive or other toxic material. Activation of off-site response organizations is not expected. Emergency response actions are limited to facility areas.

#### A.10.5.1.9.2 Alert

An "Alert" is an event in progress or having occurred which involves an actual or potential substantial reduction of the level of safety of the facility. Off-facility releases of radioactive or toxic materials may occur but are not expected to exceed applicable, permissible limits. The purpose of the Alert level is to assure that on-site and off-site emergency response personnel are promptly advised and available to initiate and perform confirmatory monitoring as required if the situation becomes more serious and to assure appropriate notification of emergency response organizations.

### A.10.5.1.9.3 Site Emergency

A "Site Emergency" is an event in progress or having occurred which involves actual or likely major failures of facility functions needed for the protection of on-site personnel, the public health and safety, and the environment. Releases off-site of radioactive materials (not in excess of 365 times the DOE concentration limit for unrestricted areas) are likely or are occurring; however, protective Response Recommendations will not be exceeded. For other toxic materials, off-site releases have the potential to exceed permissible limits. The purpose of the Site Emergency level is to assure that Emergency Control Centers are manned, appropriate monitoring teams are dispatched, personnel required for determining on-site protective measures are available, and predetermined protective measures for on-site personnel are initiated, and to provide current information to DOE-ID and consultation with off-site officials and organizations.

### A.10.5.1.9.4 General Emergency

A "General Emergency" is an event in progress or having occurred which involves actual or imminent substantial reduction of facility safety systems. Releases of radioactive materials are occurring or are expected to occur (in excess of 365 times the DOE concentration limit for unrestricted areas) beyond WVDP boundaries. Off-site releases of other toxic materials are expected to exceed applicable permissible limits. Protective Response Recommendations are expected to be or are being exceeded. The purpose of the General Emergency level is to initiate predetermined protective measures for on-site personnel, the public health and safety, and the environment to provide continuous assessment of emergency conditions and exchange of information both on-site and off-site. A General Emergency can only be declared by the WVDP Emergency Director. Declaration of a General Emergency will initiate major activation of DOE-wide resources required to effectively mitigate the consequences of emergency conditions and assure the protection of on-site personnel, the public health and safety, and the environment to the greatest extent possible.

### A.10.5.1.10 Notifications

#### A.10.5.1.10.1 West Valley Demonstration Project

WVDP is required to report any emergency impacting its operations promptly to the DOE On-Site Representative. The notifications shall include the severity (emergency response level), magnitude, type, cause of emergency (if known), extent of damage (including injuries), assistance needed (if any), and areas or personnel affected. The ID Warning Control Center will be notified in the most expeditious manner by the DOE On-Site Representative or by the WNDP Facilities Manager or his alternate, if the DOE On-Site Representative cannot be located. The emergency notification order and priority is shown in Table A.10.5-1.

#### A.10.5.1.10.2 Notification of Off-Site Agencies and Authorities

Notification to off-site authorities (local, county, state, and federal officials) will be made by or under direction of the DOE On-Site Representative in conjunction with the WVNS Facilities Manager. Notifications will be made as soon as information is available to warrant such action.

#### A.10.5.1.10.3 Notification of DOE Headquarters

Notification of DOE Headquarters will be made by the Idaho Operations Office after sufficient information is provided by the West Valley Project Office.

#### A.10.5.1.10.4 Notification of New York State

The New York State Emergency Plan for major radiological accidents involving WVDP facilities requires that in the event of an accident having potential off-site consequences, the DOE shall immediately contact the State Warning Point. The Warning Point will notify the State Department of Health. Upon request by the State Commissioner of Health, the warning point will initiate

notification of other state agencies. Pursuant to the state plan, these agencies will begin to mobilize their resources to react in preventing or minimizing radiological impact to the public.

### A.10.5.1.10.5 Special Notification

In the event of an emergency affecting the railway or utility service, the Facilities Manager, at the direction of the Emergency Director, will notify the following local utilities and railroad whose lines are on the site:

(1) Railroad - Chessy Systems,

(2) Natural Gas - National Fuel Gas Corporation, and

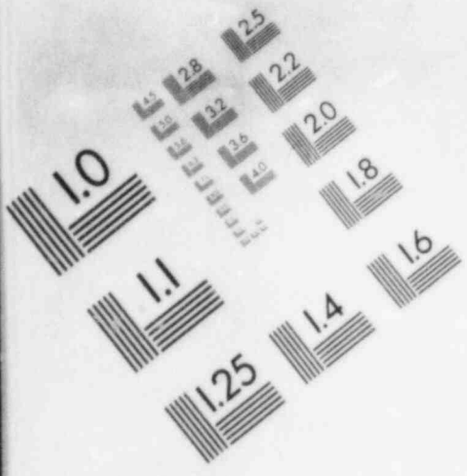
(3) Electric Utility - Niagara Mohawk Power Corporation.

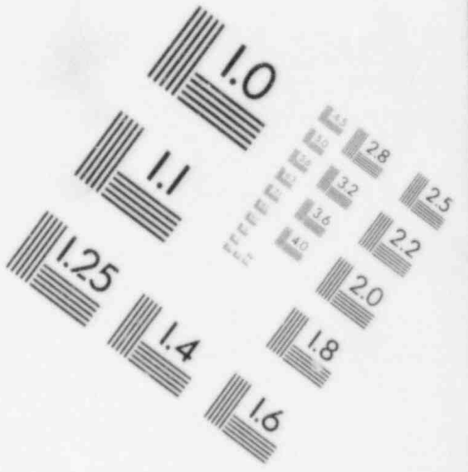
### A.10.5.1.11 Public Information

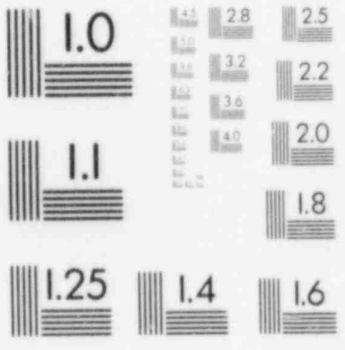
#### A.10.5.1.11.1 Policy

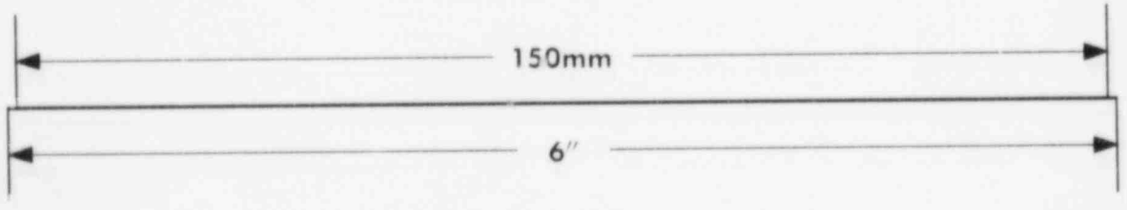
Information regarding WVDP site emergencies will be released to the news media as quickly as possible after sufficient details are known to provide a clear and accurate account of the situation. But depending on the circumstances, it may be necessary to release information before all facts are known to reassure the public and prevent rumors, fear, or panic. All news releases will be coordinated with the ID Assistant to the Manager for Public Affairs and consistent with the provisions of ID Order 5500.4, "ID Public Affairs and Planning Requirements for Emergencies."

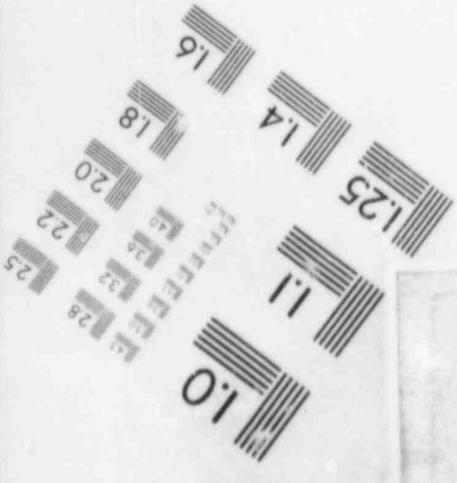
# IMAGE EVALUATION
# TEST TARGET (MT-3)

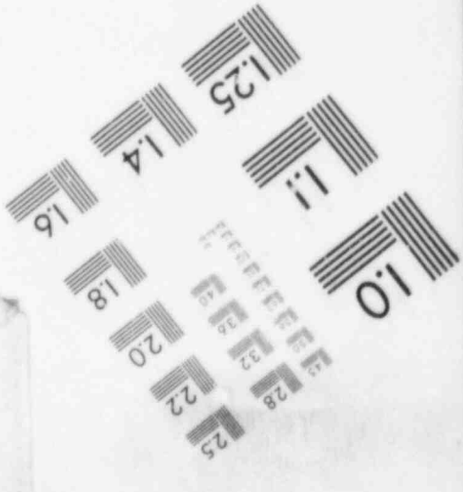


### A.10.5.1.11.2 Organization

The Emergency Public Information Organization is composed of the following personnel:

EMERGENCY DIRECTOR

| | | |
|---|---|---|
| DOE-ID On-Site Representative | Facilities Manager | Public Information Manager |

Their responsibilities are identified below:

Emergency Director - must review and approve all information prior to its release for use in notification of outside agencies, or to provide public information.

Facilities Manager - with information provided by the Operations Manager and Operational Safeguards Manager, provides the Public Information Manager with accurate technical information about the status and assessment of an emergency situation.

Public Information Manager - is responsible for structuring and presenting all information which is to be released to the public.

DOE On-Site Representative - is responsible for keeping DOE-Idaho and other DOE organizations accurately apprised of information pertinent to the assessment of the news media and helpful in the response to them during any emergency event.

### A.10.5.1.11.3 Emergency Operations and Response Concepts

Emergency public affairs functions are an integral part of emergency response operations. If an emergency occurs, the Emergency Director shall advise the Public Information Manager of the emergency and the general situation as soon as possible so that a proper response to the media and public can be presented.

### A.10.5.1.11.4 Preparation and Dissemination of News Statements and Releases

The Public Information Manager is responsible for developing procedures to facilitate the preparation of news statements and other information materials. The procedures must also assure technical accuracy, obtain approval for release, and coordinate dissemination to the media.

### A.10.5.1.11.5 Facilities

The reception lobby, lunch room, and specified offices in the north wing of the Administrative complex will be used as a media center.

The Public Information Manager is responsible for procedures for the activation of the facility.

### A.10.5.1.11.6 Exercises

The Public Affairs Plan for Emergencies shall be exercised as a key element in field organization exercises.

## A.10.5.1.12 Emergency Resources

### A.10.5.1.12.1 Emergency Equipment and Supplies

#### Emergency Rescue Packs

Emergency Rescue Packs are located in the Control Room, Analytical Aisle, Mechanical Operating Aisle, and the Utility Room. Each Rescue Pack contains enough equipment for a 3-man team to enter and retrieve an injured worker. The Operations department is responsible for identifying the contents of the rescue packs and for their maintenance and monthly inspection.

#### Self-Contained Breathing Apparatus

Self-contained breathing apparatus for use only during an emergency is maintained throughout the plant as listed below:

| Number | Location |
|---|---|
| 2 | Control Room |
| 1 | Mechanical Operating Aisle |
| 1 | Analytical Aisle |
| 2 | Fire Pump House |
| 2 | Gate House |

The maintenance and periodic inspection of self-contained breathing apparatus is the responsibility of the Radiation and Safety department.

## Medical and Surgical Supplies

Medical supplies are located in the plant first aid room and the physician's office. The Personnel Relations Department is responsible for determining adequate inventory levels, storage locations, maintenance, and periodic inspection of medical supplies.

## Anti-Contamination Clothing and Respirators

Clean protective clothing and respirators are stored in the personnel equipment room. The responsibility for the maintenance and periodic inspection of anticontamination clothing and respirators is shared by Operations, Operational Safeguards, and Quality Assurance.

## Emergency Control Center Supplies

Emergency Control Center supplies are stored in two lockers. One is located in Conference Room 44 and one is located behind the Xerox machine in the hallway outside of the Conference Room. The maintenance and periodic inspection of these supplies is the responsibility of the Operations department.

## Radiation Control Equipment

Instrumentation necessary for the support of the Radiological Control Team, Personnel Monitoring Team, Operations Search and Reentry Team, and the Environmental Monitoring Team is the responsibility of the R/S department. The Radiological and Nuclear Safety department is responsible for determining adequate inventory levels and storage locations. The R/S department is also responsible for the maintenance and biannual inspection of this instrumentation.

## Emergency Food Supply Locker

The emergency food storage locker is located beneath the stairwell to the second floor, just outside of the Operations Shift Supervisor's office. An adequate supply of food will be maintained in this locker to support fifteen people, the shift operating crew and security for a period of three days. The Assistant to the Facilities Manager is responsible for rotating the food supply annually, and determining adequate inventory levels.

## Fire Fighting Systems

A reserve of 300,000 gallons of water is available at all times for fire-fighting purposes. This reserve is piped to fire stations throughout the plant and also to hydrants around the perimeter of the plant.

## Media Center Supplies

Supplies and equipment for use in the Media Center are stored in a cabinet in the lunch room (room 30). The maintenance and periodic inspection of this material is the responsibility of the Public Information Department.

### A.10.5.1.12.2 DOE-Wide Resources

A great variety of emergency resources (manpower and equipment) are available from DOE-ID and other DOE sources, as well as from other federal agencies. The resources of DOE and other federal agencies may be called upon to cope with on-site or off-site DOE emergencies. In the interest of time, resources will be obtained from the nearest location.

### A.10.5.1.13 Emergency Plan Review

WVNS is responsible for reviewing the Emergency Plan annually. The review should include the following items:

(a) Organization for responding to emergencies;

(b) Procedures to be used in emergencies;

(c) List of persons with special qualifications for coping with emergencies;

(d) Equipment and supply inventories;

(e) Agreements for assistance by off-site organizations; and

(f) Documentation and resolution of review comments.

TABLE A.10.5-1

EMERGENCY NOTIFICATION ORDER AND PRIORITIES

EMERGENCY DIRECTOR

FACILITIES MANAGER

--Ambulance Service

--Fire Department

--County Sheriff

--State Police, Batavia

--Medical Assistance
Physicians, Hospitals

--National Fuel Gas Corp.

--Chessy System

--Niagara Mohawk Power Co.

DOE REPRESENTATIVE

--Warning Communications Center,
US DOE, Idaho

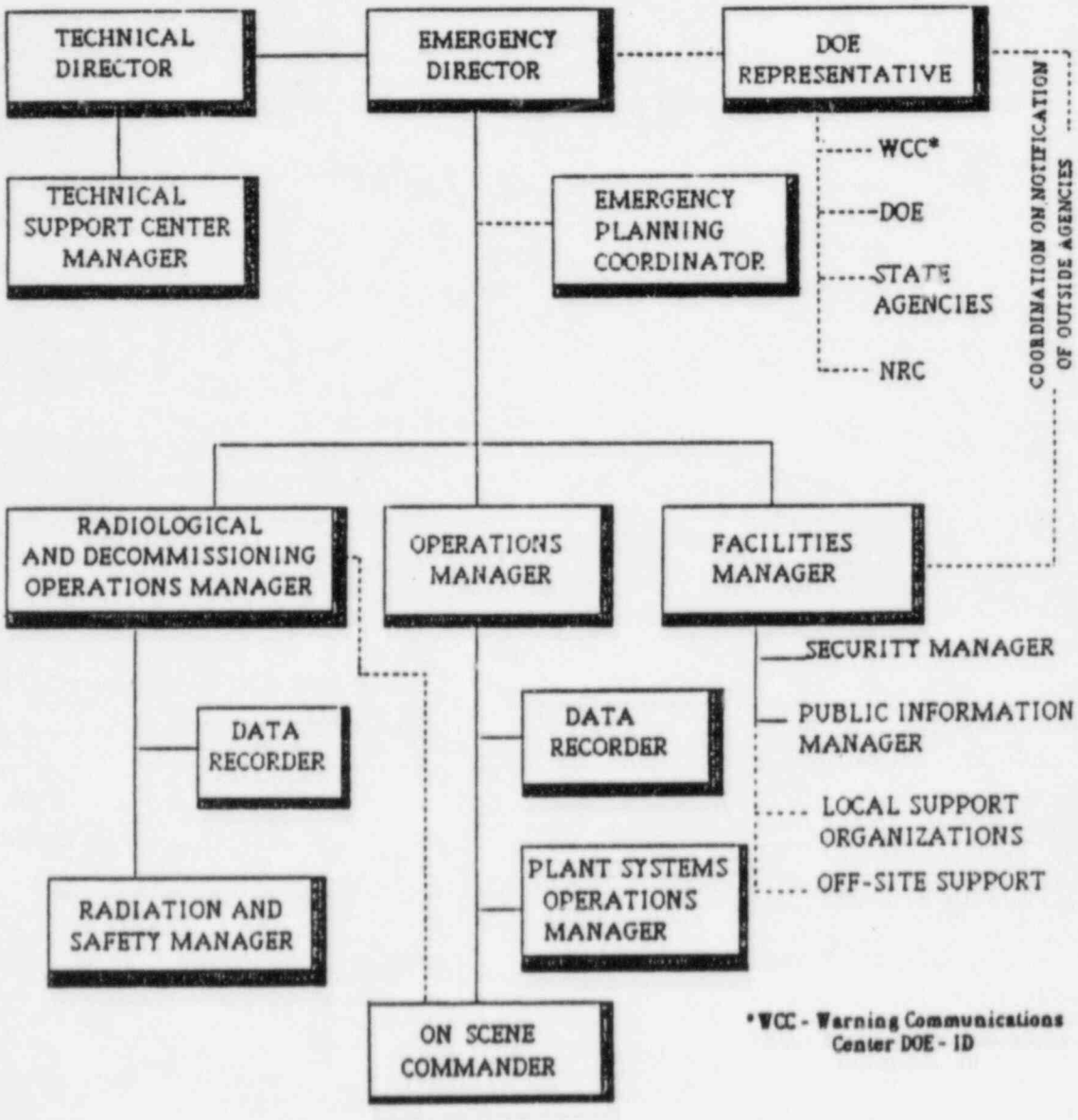
--State of New York Warning Point,
Albany

--New York State Energy Research
and Development Authority

--Cattaraugus County Emergency
Director

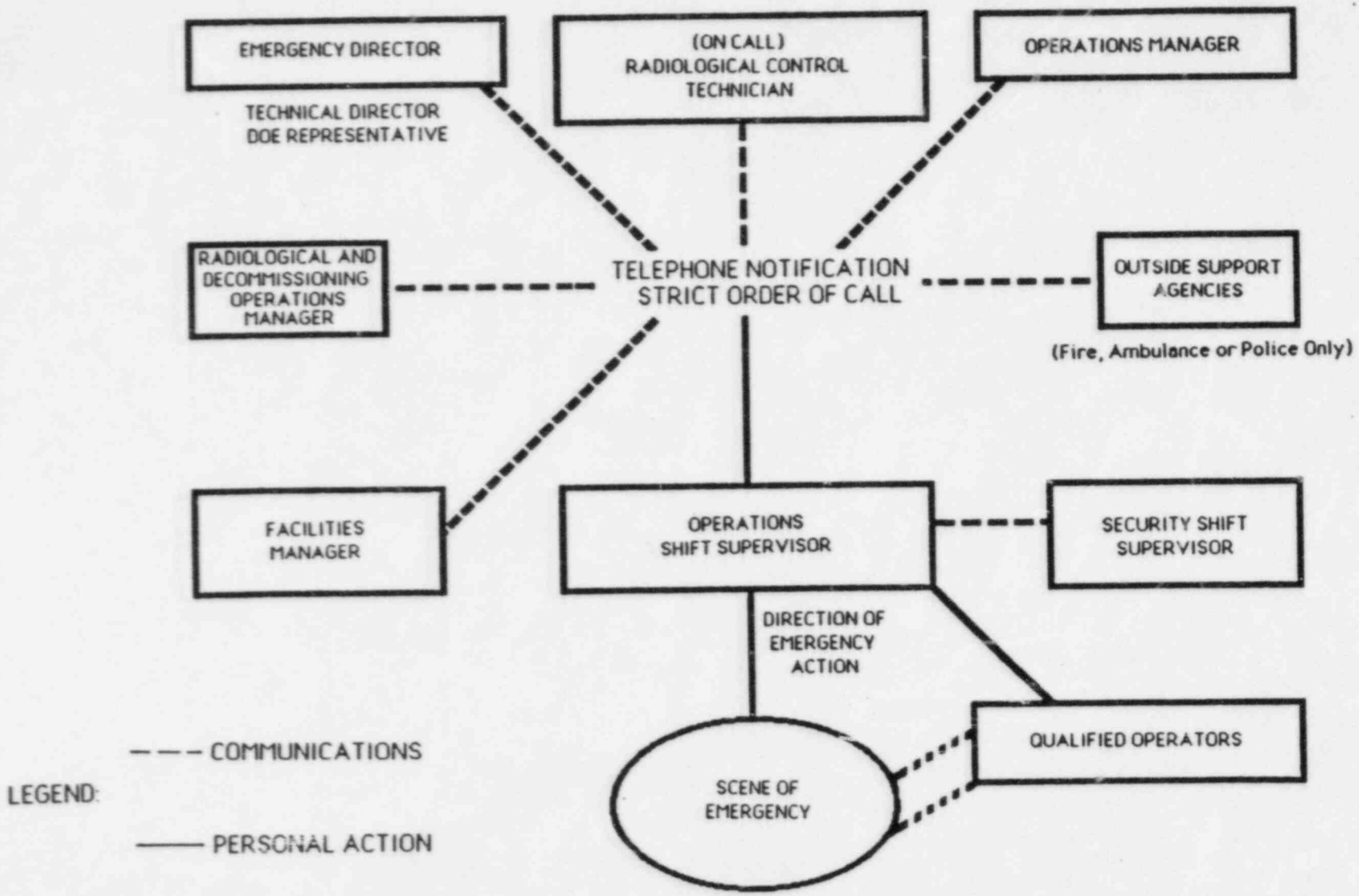
--Erie County Emergency Director

FIGURE A.10.5-1
WEST VALLEY DEMONSTRATION PROJECT EMERGENCY ORGANIZATION




QUALIFIED OPERATORS AND SUPPORT PERSONNEL

# INITIAL EMERGENCY ORGANIZATION




FLOW CHART

FIGURE A.10.5-2

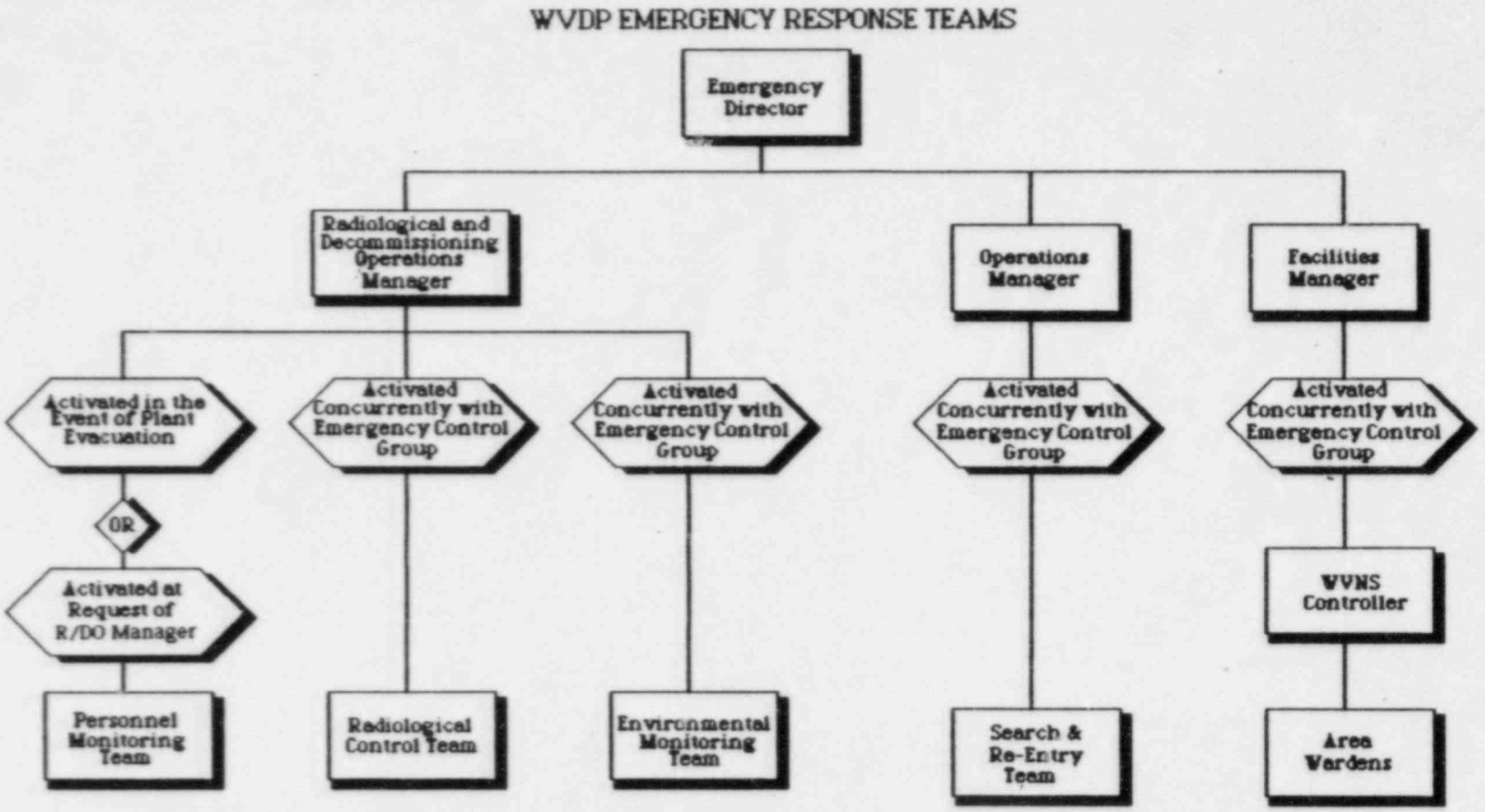



FIGURE A.10.5-3

## A.10.6 DECOMMISSIONING

### A.10.6.3 AGREEMENTS WITH OUTSIDE ORGANIZATIONS

The Department of Energy, as dictated in the West Valley Demonstration Project Act (PL 96-368), entered into agreements with the US NRC and New York State.

The agreement between DOE and NRC is in the form of a MOU which defines the relationships between these two federal organizations. As regards decontamination and decommissioning, the MOU indicates that DOE will D and D the Project Facilities at the end of the Project according to criteria developed by the NRC.

DOE also entered into a Cooperative Agreement with New York State Energy Research and Development Authority. The Cooperative Agreement and the act establish a 90 percent-10 percent cost-sharing between the federal and New York State governments. The Cooperative Agreement further defines the Project Facilities to be decontaminated to include the entire process facility at the end of the Project.

### A.10.6.4 ARRANGEMENTS FOR FUNDING

Decontamination of Project Facilities is a requirement of the WVDP Act, the MOU, and the Cooperative Agreement. The total scope of the final D and D cannot be determined until the NRC promulgates the D and D criteria, nor can the total cost be estimated. As mentioned previously, however, the cost of the Project will be shared by the federal and New York State governments on a 90 percent-10 percent basis through the end of the Project.

After completion of the WVDP, the Project facilities revert back to the State of New York for future monitoring and maintenance.

## A.10.7 SECURITY AND SAFEGUARDS PLAN

### A.10.7.1 SITE AND FACILITY DESCRIPTION

#### A.10.7.1.1 General Layout

The facility is located on a 1335 ha site located in Cattaraugus, New York, about 48 km south of Buffalo, New York. The facility was licensed to conduct fuel reprocessing and waste burial operations under License Number CSF-1 issued by the Atomic Energy Commission, now known as the Nuclear Regulatory Commission. The facility stores highly irradiated spent fuel elements discharged from nuclear reactors and the liquid HLW resulting from the chemical reprocessing of these elements.

#### A.10.7.1.2 Protection of Material

Spent fuel was chopped into small pieces and dissolved in nitric acid; the valuable uranium and plutonium were separated from the fission products and recovered in solution as uranium nitrate and plutonium nitrate.

The fission products were neutralized and stored in large underground waste storage tanks. Neutralized high-level waste is stored in Tank 8D-2, a 2,839,059-litre mild steel tank confined within a two-foot thick concrete vault which is covered with a minimum of eight feet of soil. There are two ports into the top of the tank which are closed with concrete-filled plugs weighing in excess of 136 kg. The concrete is provided to shield the surroundings from the intense radiation from the tank; the weight of the plugs prevents any individual from removing them. Specific equipment is required to lift the plug(s), thus delaying the opening of the vault and increasing the detectability of the operation. Tank 8D-1 is a spare tank for 8D-2; it contains condensate, but not HLW.

Thorium-bearing high-level waste is stored in Tank 8D-4, a 56,781-litre stainless steel tank equipped with cooling coils. Tank 8D-3 is of similar size and is an empty spare tank for 8D-4; it presents no hazard. Both 8D-3 and 8D-4 are located within a single reinforced concrete vault with walls 0.5m thick buried under a maximum of 1.8m of heavy clay soil. The few openings in the vault are filled with concrete and would require special equipment for removal, thus increasing the detectability of any such operation.

The wastes in Tanks 8D-2 and 8D-4 are not self-boiling and the destruction of the air condensers or the shutting off of the cooling water would not cause any significant release of radioactivity from the tanks. For this reason none of the equipment or structures on the surface within the HLW area are essential to the protection of the public and, hence, are not vital equipment. (Refer to Figure A.10.7-1.)

The spent fuel was stored in FRS area after it was received from the utility. The received casks were unloaded from the rail car or truck and lowered to the bottom of the Cask Unloading Pool which is filled with water to a depth of 13.4m. The fuel was removed and stored in canisters in the fuel storage pool under a minimum of 3.4m of water. (Refer to Figure A.10.7-2.)

The spent fuel is self-protecting in that it is not readily separable from the other radioactive material and the combination of the SNM and other radioactive material delivers an external radiation dose of approximately 100 rem per hour at one metre from any accessible surface without intervening shielding material.

An individual fuel element is a substantial piece of hardware, 3-4.9m in length and weighing in excess of 180 kg. Even ignoring the intense radiation field surrounding the fuel element, it would not be possible for an individual to remove and carry off a fuel element without detection.

There are only two areas where significant inventory of radioactive materials is maintained: the FRS Building, and the HLW Tanks. These are shown in Figure A.10.7-2.

During the operations preparing the fuel for shipment, security measures consistent with requirements for storage and shipping of irradiated fuel will be taken. In accordance with DOE Order 5632.2, the irradiated fuel cask transport vehicles will be given a detailed search before loading and shipment to ensure that sabotage devices have not been implanted or that sabotage has not been initiated. The cask will also be sealed with a tamper-indicating seal prior to shipment.

Handling and loading of an irradiated fuel assembly will be performed inside the security area of the FRS, which is inside the protected area.

For truck shipments WVNS security personnel will observe loading and shipping operations outside the FRS until the shipment is released to the shipper at the gate to the protected area. At that point, the shipment is under the cognizance of the shipper/carrier (not DOE or WVNS) and is governed by NRC requirements.

For rail shipments, while the large rail cask is inside the protected area, the massive weight of the rail cask is sufficient security for fuel inside the sealed container while the cask is within the protected area. Once the cask is placed on the rail car for transport outside the protected area, it will be released to DOE for shipment under their cognizance.

### A.10.7.2 SECURITY AREAS

#### A.10.7.2.1 Protected Area

The protected area is described as the approximately 80 ha surrounding the plant area enclosed by the security fence with entry at the main gate. (Refer to Figure A.10.7-1.)

The protected area perimeter fence is chain link, two-inch mesh, No. 9 gauge, topped with three strands of barbed wire for a total height of eight feet. The barbed wire topping is angled outward between 30° and 45° from the vertical. The fence posts are spaced on 3m centers.

### A.10.7.2.2 Other Specific Security Areas

Except for the last two, the following areas of security interest are within the protected area:

(1) The Fuel Receiving and Storage Area,
(2) The High-Level Waste Area,
(3) The Alpha Lab, and Analytical Cells,
(4) The Uranium Product Cell,
(5) The Uranium Loadout Area,
(6) The NRC Burial Area,
(7) The Low-Level Waste Burial Area, and
(8) The 1388 Hectare Environs.

All areas are patrolled as outlined under the section entitled "Post and Patrols." The Central Alarm Station (CAS) is located adjacent to the main road entrance to the plant at the security fence and is the entry point for the plant. This station, including the guard house and adjacent vehicle entrance gate, will be continuously staffed by the guard force.

The nearest office of the Sheriff of Cattaraugus County is located in Little Valley, some 46.8 km southwest of the plant, and the nearest substation of the State Police is located in Franklinville, some 24 km southeast.

### A.10.7.2.3 Post and Patrols

The Central Alarm Station is the principal post for the guard force. It is staffed at all times, ensuring continuous monitoring of the alarm console and communications equipment.

Vehicular traffic control duties are assigned to guard in the CAS.

A contract security shift supervisor, supplemented by contract guards, is assigned to each shift, three shifts per day, seven days per week.

Guard patrols are performed at random times and by various routes so as to preclude prediction of time of patrol at any given point. The guard on patrol is equipped with a portable radio to maintain communications with the central station. Radio communication is supplemented by the plant intercom system and plant telephones.

There are less than 350 grams of plutonium, uranium-233, and uranium enriched to 20 percent or greater on site. This material is designated as Category IIIA quantities and is located in the analytical laboratory. All the material to be protected is located in the Alpha Lab and the Analytical Cells, both on the third floor of the processing plant.

The door to the Alpha Lab is secured with a security padlock and a watchclock key positioned next to the doors for use during guard rounds. The entry door to the access aisle behind the cells is also secured with a security padlock and a watchclock key positioned next to the door for guard rounds.

The remote controllers on the cells are secured with a security padlock and are checked for integrity on the guard rounds, which are made in this area at least once every two hours.

Access to these two areas is infrequent and strict control is maintained over keys.

Additional SNM is stored in the UPC Tanks 5D-15A1 and 5D-15A2 and in the ULO Weigh Tank 5V-1. The total material in these tanks is 3,271 kg total uranium and 8.015 kg U-235 with an enrichment of 0.25 percent.

This SNM is isolated within process vessels, which provide inaccessible containment and effective protection against malevolent use or theft.

All pertinent valves on these tanks are sealed. The door to the Uranium Product Cell is secured with a security padlock and a watchclock key is positioned next to the door for guard rounds. The door to the Uranium Loadout Area is secured with a security padlock and a watchclock key is positioned next to the door.

Guard rounds are made of these areas no less than once every two hours.

Access to these two areas is infrequent and strict control is maintained over the keys available.

The FRS area and HLW area are subject to guard rounds at least once every two hours.

The NRC burial area and the low-level waste burial area are patrolled once a day on the day shift.

The lakes, pump house, rail siding, schoolhouse, and remaining environs (1338 ha) are patrolled occasionally as directed or as the situation demands, but not less than two times per month. Patrolling is also based on intelligence information.

**A.10.7.2.4 Protected and Isolation Zone Monitoring**

An isolated zone surrounds the protected area and consists of a band on both sides of the fence with a minimum width of 3m. No buildings, obstructions, or structures are within this zone.

The protected area perimeter fence is patrolled by armed guards on a random schedule, but at least once every eight hours.

The protected area fence and isolation zone are illuminated as necessary for surveillance and safety purposes.

### A.10.7.3 ACCESS CONTROLS

#### A.10.7.3.1 Badge System

[1] General Description - The badge system used for both employe and visitor badges is the Polaroid ID-2 Land Identification System.

[2] Type of Badge - The badge is made by inserting a laminated photograph into a plastic pouch which is then sealed. The insert shows a full-color photograph of the person to whom it is issued.

[3] Coding - The background in the photograph is color coded to indicate whether a security clearance is held or not. The photograph is laminated to a piece of clear plastic film which cannot be removed without destroying the card. The badge shows the employe name, address, signature, and badge number.

Special badges are prepared to show "Visitor - Escort Required." Special picture badges are prepared for nonemployees who frequently enter the plant on business.

[4] Control System - The badges will be prepared and issued by the Security Office. A record will be maintained showing the badge number issued to each individual. The badge remains the property of WVNS and must be returned during the exit interview upon termination of employment .

[5] Utilization - The badge system consists of two parts: a take-home I.D. card, and an in-plant badge equipped with a clip for fastening onto clothing.

When the employee enters the plant through the CAS, the I. D. card is presented to the guard who, after identifying the employee by either (a) recognition, or (b) comparison of the photograph with the individual, issues the in-plant badge. The in-plant badge should be in plain view at all times when within the security fence. Upon leaving the plant, the in-plant badge is returned to the guard who then returns the I.D. card to the employee.

The exceptions for wearing the badge in plain view include: (a) employees who are suited up for entry into a surface contamination or airborne contamination area requiring special protective clothing for health and safety reasons. Wearing badge under this condition serves no useful purpose and could contribute to the spread of contamination. After leaving the contaminated area and resuming normal wearing apparel, the badge will again be displayed. (b) Employees who are in transit between or outside buildings during severe weather.

**Access Authorization**

The authority to approve access of non-employees, and vehicles to the protected area will be limited to the following:

Project Manager
Technical Director
Facilities Manager
Security Manager
Operations Shift Supervisors

Such authorization will be provided to the Security Office.

**Access Registration**

A log book is maintained in the CAS for registration of the names of all visitors to the plant area who are not regularly employed at the West Valley plant. The following entries shall be made:

Name
Date
Time of Entry
Time of Exit
Purpose of Visit
Employment Affiliation
Citizenship
Name of Escort
Badge Number of Escort
Name of person to be Visited (if appropriate)

**A.10.7.3.2 Personnel Escort**

Escort personnel may be guards or designated employees. All persons other than those authorized and badged to enter the protected area will be escorted. When a visitor is transferred from one escort to another, it is the responsibility of the first escort to notify the guard force of the change.

**A.10.7.3.3 Personnel Access**

**A.10.7.3.3.1 Protected Area**

Access to the protected area is controlled by the guard force at the point of personnel access. After identification by the guard force, authorized individuals will be permitted to enter the protected area.

A.10.7.3.3.2 **Personnel Searches**

Personnel searches are conducted at the entrance to the protected area. All personnel are subject to search before entry to the protected area and upon exit. This search is either a physical hands-on frisk or a search with detectors.

A.10.7.3.3.3 **Package Searches**

Hand-carried packages, tool boxes, valises, lunch pails, etc. are subject to search before entry to the protected area and upon exit.

Nonhand-carried packages and containers will be checked for verification of address and need to enter the area.

A.10.7.3.4 **Vehicle Access**

Vehicle access will be at the main gate. Packages or other deliveries by vehicle will be checked for proper identification and authorization. The vehicle will be escorted to the delivery point and at all times will be within the protected area.

There is no need for personal vehicles to enter the protected area and entry of personal vehicles will not be permitted unless specifically approved by the security office.

A.10.7.4 **INTRUSION AND DETECTION ALARMS**

A.10.7.4.1 **Design and Performance Characteristics**

The fence protection system is installed on the perimeter fences around the FRS area and the HLW area. (Refer to Figures A.10.7-1 and A.10.7-2.)

An infrared system is installed across the two gates at the FRS perimeter. In addition, the entry and exit doors in the FRS Building proper are equipped with alarms.

The system is supplied with auxiliary power capable of maintaining operation for not less than 24 hours.

The system has two modes of operation: the "secure" mode and the "access" mode.

In the "secure" mode, any tampering with the circuit or switches or any open switch will give an audible and visual alarm in the central station. The visual alarm consists of a flashing red light on the graphic panel. The flashing light will be changed to steady red when the guard depresses the acknowledge button in the CAS to indicate that the alarm has been noted and that the guard force is responding to the alarm. The steady red light will be displayed until the open switch has been closed.

The system or portions of it can be placed in the "access" mode. Alarms do not sound in his zone while in this mode. However, the alarms annunciate when the system is changed from "secure" to "access" and again when the system returns to the "secure" mode. No individual zone of the alarm system will reset to "secure" if there is any malfunction or opening of any kind. This serves as a test of the system after being in "access" mode.

In addition to the graphic panel at the CAS, a printer which records a change in the state in the alarm circuits has been installed in the CAS. The printer records the date, time, zone affected, and an indication of the type of change. Space is left on the record for the guard force to insert the response given to the alarm indication.

**A.10.7.4.2 Annunciators**

The security alarms annunciate in the CAS, which is located at the main plant entrance at the outer security fence.

### A.10.7.4.3 Emergency Power

Emergency power is supplied from a battery pack of storage batteries located in the CAS. The battery pack operates from a trickle charger that keeps it fully charged. The battery pack is sized to maintain all intrusion and detection alarms in operation for not less than 24 hours. The infrared detectors have their own emergency power storage battery pack operating from a trickle charger.

## A.10.7.5 SECURITY ORGANIZATION AND RESPONSIBILITIES

### A.10.7.5.1 Management Organization

The management structure for the West Valley Plant is shown in Figure A.10.7-3. The responsibility for all activities on-site rests with the Project Manager. The Administrative Services Manager reports to the Project Manager. The Security Manager reports to the Administrative Services Manager. The Guard Force consists of one Contract Site Manager and four Security Supervisors supplemented by the contract guard force.

### A.10.7.5.2 Security Organization

The security organization is shown in Figure A.10.7-4. The Security Manager is responsible for overall security, training, intrusion detection system, access control, clearances, and the routine operation of the guard force. The Security Manager reports to the Administrative Service Manager. The guard force will consist of a minimum of one supervisor and two guards per shift. The guard force is supplemented by authorized WVNS employees serving as escorts as required.

### A.10.7.5.3 Security Personnel

#### A.10.7.5.3.1 Minimum Employment Qualifications

Guards must be capable of performing duties involving moderate to arduous physical exertion and must be able to withstand exposure to unusual or inclement weather conditions. Guards must possess eyesight and hearing necessary to meet DOE Regulation 5632.1. Guards are required to pass a physical examination prior to employment and annually thereafter.

Guards must have attained an age of at least 21 years and must have a diploma from a secondary school or equivalent experience, which will be subject to examination by WVNS.

Previous experience as a guard or police officer is desirable but not required.

#### A.10.7.5.3.2 Authorization and Permits

Guards are required to obtain and retain the necessary State permit to bear sidearms and also be able to obtain a DOE security clearance of the "L" level.

#### A.10.7.5.3.3 Training

Training and qualification of guards will follow DOE Regulation 5632.1. They will receive additional training in the operation of the specialized equipment required in the performance of their duties.

Most guard training will be performed in-house. The training program consists of classroom, practical, and weapons training. A record of guard training and annual requalification courses will be maintained in the security office. Training in the area of a guard's legal responsibility is conducted to ensure that each guard possesses an understanding of: [1] the general limits of legal authority of a private security guard as provided by state statutes and the common law; [2] the differences between a felony and a misdemeanor insofar as that difference affects the guard's authority; [3] the permissible legal

extent of a search and seizure as affected by his suspicion of a crime and by his actual witness of a crime; [4] the evidence generally necessary to define the commission of a crime and particularly the importance of the preservation of "real evidence"; and [5] the use of force legally permissible in self-defense or in prevention of a crime involving property.

Formal tests are the basis for determining guard qualification and will be given initially and annually thereafter.

**A.10.7.5.3.4 Qualification with Sidearms**

Guards shall qualify at least semi-annually with their sidearm, and annually fire the 12-gauge shotgun and the semi-automatic rifle for familiarization. A record will be maintained of their qualifying scores.

**A.10.7.5.3.5 Use of Weapons**

A guard shall carry only the weapons specifically authorized and shall not display or relinquish them to any person other than a supervisor or relief guard.

If it becomes necessary, guards shall apply a sufficient degree of force to counter a degree of force directed at them. This includes the use of deadly force when the guard has a reasonable belief it is necessary in self-defense or defense of others.

**A.10.7.5.3.6 Arms and Ammunition**

When authorized and on duty, all guards shall be armed with sidearms of not less than .38 caliber, owned and authorized by DOE. Such weapons shall be in serviceable condition, loaded and ready for use at all times. Additional weapons are available and are stored in an unloaded condition.

All DOE-issued firearms will remain at the site after each tour of duty in lockers provided for storage. Specific authorization will be given to carry firearms off-site for such activities as qualification.

### A.10.7.5.4 Security Equipment

The following equipment is available to the guard force:

[1] Weapons: One .38 caliber revolver (or approved equivalent) for each member of the guard force who is authorized by DOE to bear sidearms. Twelve-gauge shotguns, AR-15 semi-automatic rifles, combat helmets, full-face gas masks, body armor (bullet resistant vest), flashlights and batteries, batons, handcuffs, ammunition/equipment belts, and binoculars. Appropriate ammunition for shotguns, revolvers, and rifles is stored in the CAS.

[2] Portable communications equipment: 2-channel (one operating and one emergency).

[3] Fixed base radio to law enforcement agency.

[4] Telephone.

[5] Uniform: When on duty, guards will be furnished with and wear a distinctive uniform which designates them as security guards.

### A.10.7.6 RESPONSES TO SECURITY THREATS AND ALARM ANNUNCIATORS

The criteria used in assessing the significance of an alarm or threat to the security of the facility is the size of the group, the presence of arms, and the apparent intent of the group as applicable to security.

### A.10.7.6.1 Suspected Intrusion into the Protected Area

When an alarm condition arises from either the fence protection system monitor or the infrared detector, the guard force will inspect the area and the CAS will maintain radio communications with the responding guard. Response time will vary from a few seconds to a few minutes depending upon the location of the guard and upon weather conditions.

### A.10.7.6.2 Apparent Attempt to Smuggle Contraband

If there is an apparent attempt to smuggle contraband into the protected area, the guard force, if not already present, will be notified and a guard will be dispatched to the scene.

The entrance to the protected area will be closed and secured if it is not already in a secure condition. The shift supervisor or higher authority will be notified. The shift supervisor will report to the scene and direct further measures to evaluate and control the situation.

### A.10.7.6.3 Bomb Threat

In the event of a bomb threat, the guard force will alert the shift supervisor and higher authority and take such actions as directed.

### A.10.7.6.4 Civil Disturbance

In the event of a civil disturbance, the main plant entrance will be closed and secured. The shift supervisor and higher authority will be notified. The guard force will take such actions as directed and notify the local law enforcement agencies.

### A.10.7.6.5 Site Evacuation

In the event that a site evacuation is required (by nuclear criticality alarm or otherwise), the objective of access control will not be allowed to compromise health and safety; however, security surveillance will be maintained to the greatest extent practical. Personnel other than guards will be directed to the assembly point and instructed to remain there until further instructions are received. The routine plant evacuation plan requires that a roll call be taken by the guard at the CAS to determine that all personnel are accounted for and ensure that no one has remained in the evacuated area. The alarm circuits at the CAS will be monitored as long as allowed by radiation levels in order to determine if any intrusion is attempted under cover of the evacuation procedure.

### A.10.7.6.6 Fire or Explosion

The guard force will notify the shift supervisor and higher authority and will take such actions as directed.

### A.10.7.6.7 Outage of Plant Protection Equipment

Should an intrusion alarm fail, the security shift supervisor will initiate continual visual surveillance utilizing CCTV in an area that can be surveilled by that means. If not, 30-minute rounds of the affected area will be initiated. The Security Manager will be notified and repairs will be initiated. Should multiple alarms fail, the guard supervisor will initiate continual visual surveillance with 30-minute time clock rounds of the affected zone. The security manager will be notified and will initiate repairs.

Should the failure occur on the off-shift or on a weekend, the on-site supervisor is to be notified. Additionally, if the failure is estimated to persist in excess of four (4) hours or past the security guard shift change, the Security Manager is to be called.

The Security Manager is to evaluate the situation and ensure that plant security provisions are not weakened. Special orders or arrangements for additional guards will be made and higher authority notified if required.

Should other security equipment fail, alternate measures will be taken so that security effectiveness will not be decreased.

### A.10.7.6.8 Action Response

Local law enforcement authorities will be contacted for assistance when there is a perceived threat to the facility that could cause significant harm to the facility, personnel, or to the public.

The shift supervisor has authority to contact the local law enforcement agencies and to direct the guard force, as required, during the off-shifts. The security shift supervisor on duty will be authorized to contact law enforcement agencies immediately in the event of a clear and present threat to the security of the facility. Higher authority will promptly be notified of the action taken.

### A.10.7.7 CENTRAL ALARM AND COMMUNICATIONS SYSTEM

#### A.10.7.7.1 Staffing

The CAS houses guards and primary security equipment. This station is located at the main plant entrance within the outer security fence.

#### A.10.7.7.2 Local Communications

The alarm station is equipped with a radio transceiver for communication with the guard force; the guard on patrol will carry a portable transceiver to communicate with the alarm station while on patrol.

#### A.10.7.7.3 Radio Communications

The CAS is equipped with a radio transceiver tied in with the radio net of the Sheriff of Cattaraugus County and a radio transceiver base station which can communicate with all portable units. The system is continuously operated.

The radio is supplied with auxiliary power from the batter pack emergency power for the detection systems. The battery pack is sized to maintain operations for 24 hours without other sources of power and is located at the CAS.

### A.10.7.8 LOCAL LAW ENFORCEMENT AUTHORITIES

### A.10.7.8.1 Size of Force

The Sheriff's Department of Cattaraugus County will respond with their maximum ability to any call for assistance from the facility, using regular and special deputies and keeping consistent with alarm circumstances.

Additionally, the Sheriff has assured that law enforcement agencies of the neighboring counties and towns will offer immediate reinforcement support as required. The Sheriff believes the combined response capability of the area's law enforcement agencies can provide any necessary additional support to WVNS.

### A.10.7.8.2 Kind of Assistance

The Sheriff's Department will provide normal police power, including crowd control and investigation work. County, town and state agencies will provide additional assistance as the condition warrants.

### A.10.7.8.3 Arrangements

Liaison has been established with the Sheriff and the New York State Police. Permission was received for WVNS security to use the radio frequency assigned to Cattaraugus County Sheriff's Department. Shift radio checks are routine.

## A.10.7.9 TEST AND INSPECTION

### A.10.7.9.1 Physical Barriers

The guard force performs a weekly visual inspection of fences, gates, and doors in the course of their routine patrols, the results of which are documented.

### A.10.7.9.2 Alarms and Annunciators

Special tests will be performed as required. In particular, the alarm system will be tested immediately following any required maintenance work to verify that the system is operating properly.

### A.10.7.9.3 Detectors

The metal detectors are functionally checked daily.

### A.10.7.9.4 Communications

Communications equipment is tested at the beginning of each guard force work shift. The following items are tested for operability:

[1] Portable radio between guards and the alarm station; and
[2] Radio communication to local law enforcement office from the CAS.

### A.10.7.9.5 Other Security Related Equipment

#### A.10.7.9.5.1 Illumination

The guard force is instructed to report immediately any defective or inoperative lights or lamps in the security system. Maintenance work will promptly be performed.

#### A.10.7.9.5.2 Closed Circuit TV

Closed circuit TV monitors and cameras are tested for operability in their daily usage. Malfunction of these units is detected at the CAS. Maintenance and repairs are instituted promptly.

### A.10.7.10 REPORTS TO THE US DOE

### A.10.7.10.1 Incidents

In the event of a theft or unlawful diversion of SNM or if an attempt has been made to commit an act of radiological sabotage, an immediate report will be made by telephone or telegram to Safeguards and Security Division, US DOE-ID. A written report setting forth details of the incident will be submitted to the above office of US DOE and the US DOE site representative within 15 days. The order of notification is presented in Table A.10.7-1.

## A.10.7.11 CONTROL RECORDS

### A.10.7.11.1 Security, Tours, Inspections, and Tests

Records of security tours, barrier inspections, and communication tests are maintained by the Security Department through the use of the Weekly Checklist Report which is shown in Figure A.10.7-5.

A written report shall be submitted to the Security Manager by the security shift supervisor detailing any incident, alarm, or intrusion other than false alarms and routine checks. This report will be the basis for the submission of any incident reports to the US DOE.

## REFERENCES FOR SECTION A.10


ANSI/ASME NQA-1-1979, Quality Assurance Program Requirements for Nuclear Power Plants.

Memorandum of Understanding Between the Nuclear Regulatory Commission and the Department of Energy: Implementation of the West Valley Demonstration Project Act of 1980. FR Doc. 81-33439, filed 11/18/81, 8:45 a.m.

U.S. DOE Order 1300.1 (1980), Micrographic Management.

U.S. DOE Order 1324.2 (1980), Records Disposition.

U.S. DOE Order 5480.1A (1981), Environmental Protection, Safety, and Health Protection Program for DOE Operations.

U.S. DOE Order 5481.1 (1981), Safety Analysis and Review Systems.

U.S. DOE Order 5500.4 ID Public Affairs and Planning Requirements for Emergencies.

U.S. DOE Order 5632.1 (1979), Physical Protection of Classified Matter.

U.S. DOE Order 5632.2 (1979), Physical Protection of Special Nuclear Materials.

West Valley Demonstration Project Act, October 1, 1980, Public Law 96-368.

West Valley Nuclear Services Co., Inc., Policies and Procedures Manual.

West Valley Nuclear Services Co., Inc., Procedure WV-906, Safety Review Program.

West Valley Nuclear Services Co., Inc., Purchasing Policies and Procedures Manual.

West Valley Nuclear Services Co., Inc., Quality Method and Procedure (QMP) 10-1, Inspection and Test Planning.

West Valley Nuclear Services Co., Inc., Quality Method and Procedure (QMP) 11-1, Test Control at WVNS.

TABLE 10.7.1

SECURITY RELATED REPORTS TO THE US DOE

Violations of Laws and Losses of Security Inters

Alleged, suspected, or known "violations," theft or loss of "Government property," shall be reported immediately to:

A. Director, ID Safeguards and Security Division, 526-1555; or

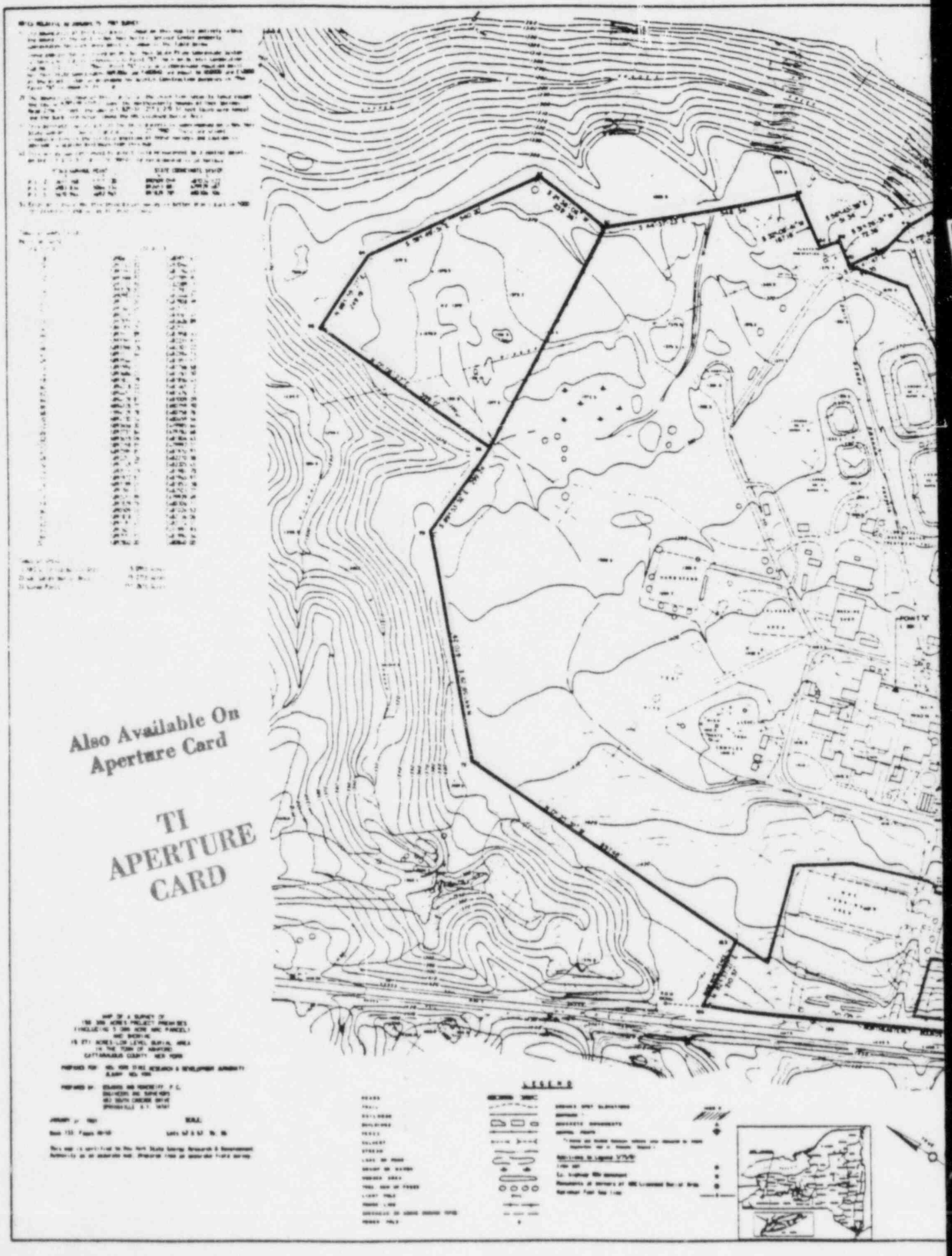
B. Deputy Director, ID Safeguards and Security Division, 526-1556; or

C. Chief, ID Personnel Security Branch, 526, 1557, during normal working hours; or

D. Duty Officer, Patrol Headquarters, during nonnormal working hours; or

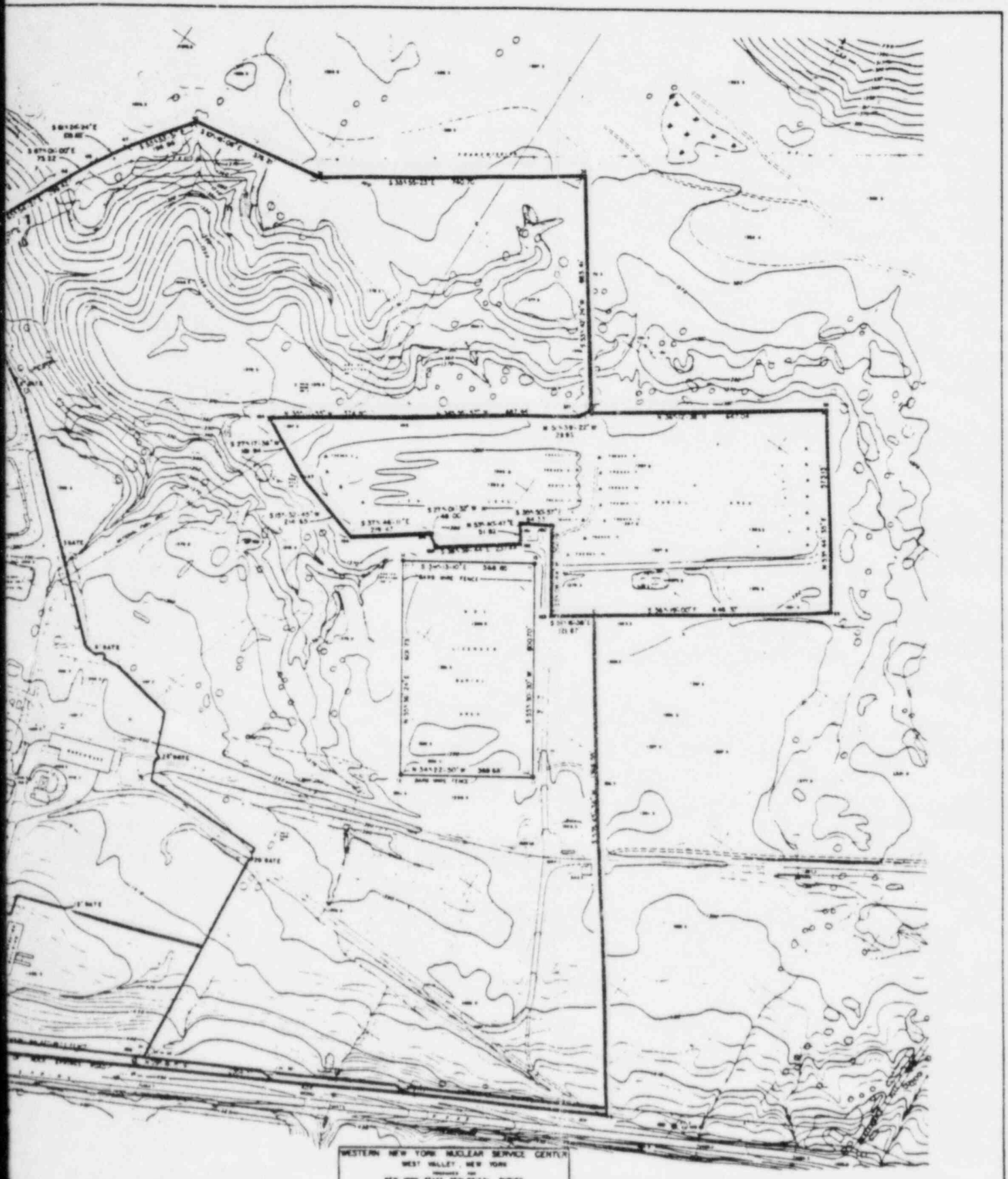
E. Chief, ID Safeguards and Materials Management Branch, 526-1393; or

F. The nearest FBI office



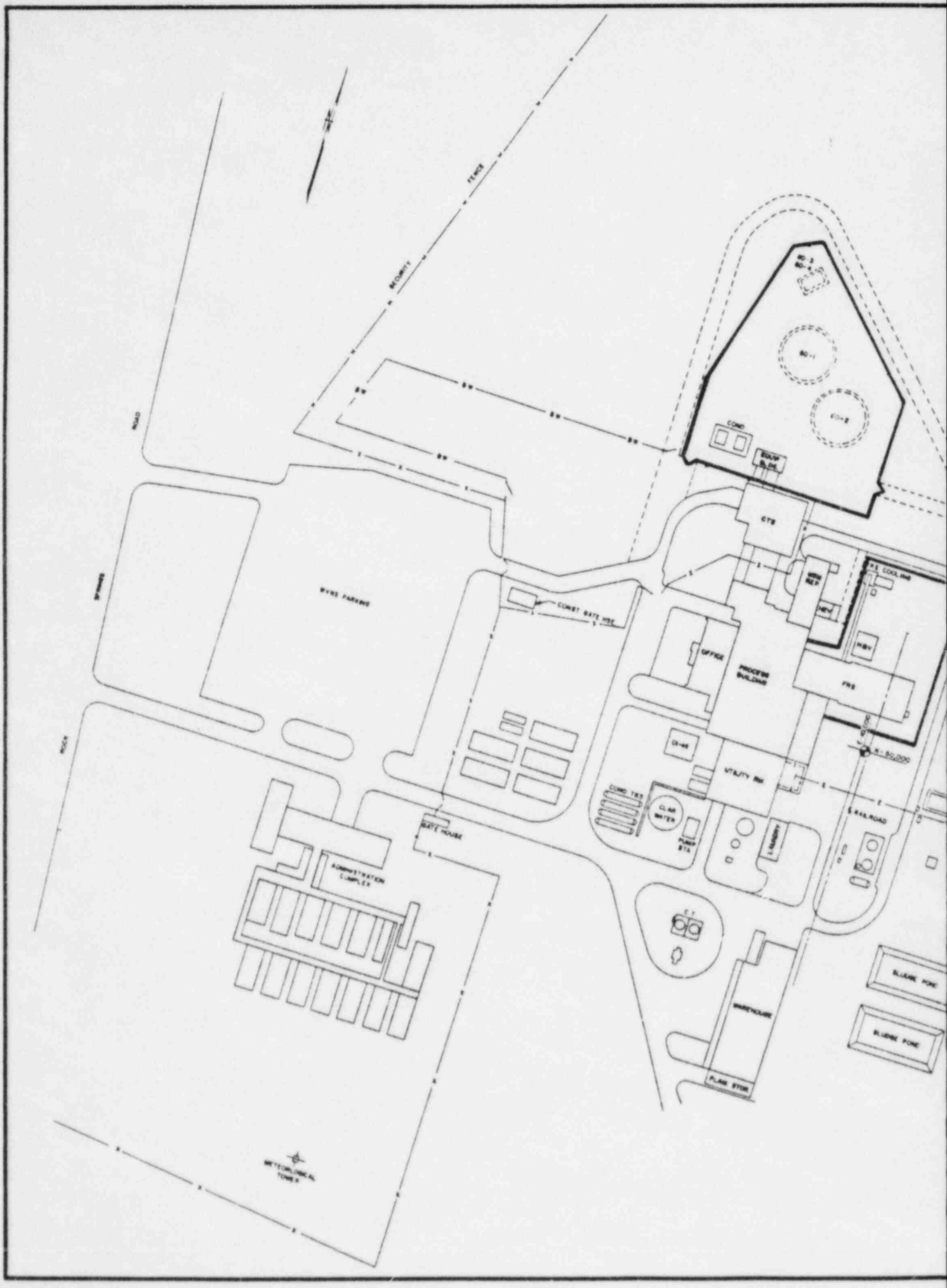
Also Available On
Aperture Card

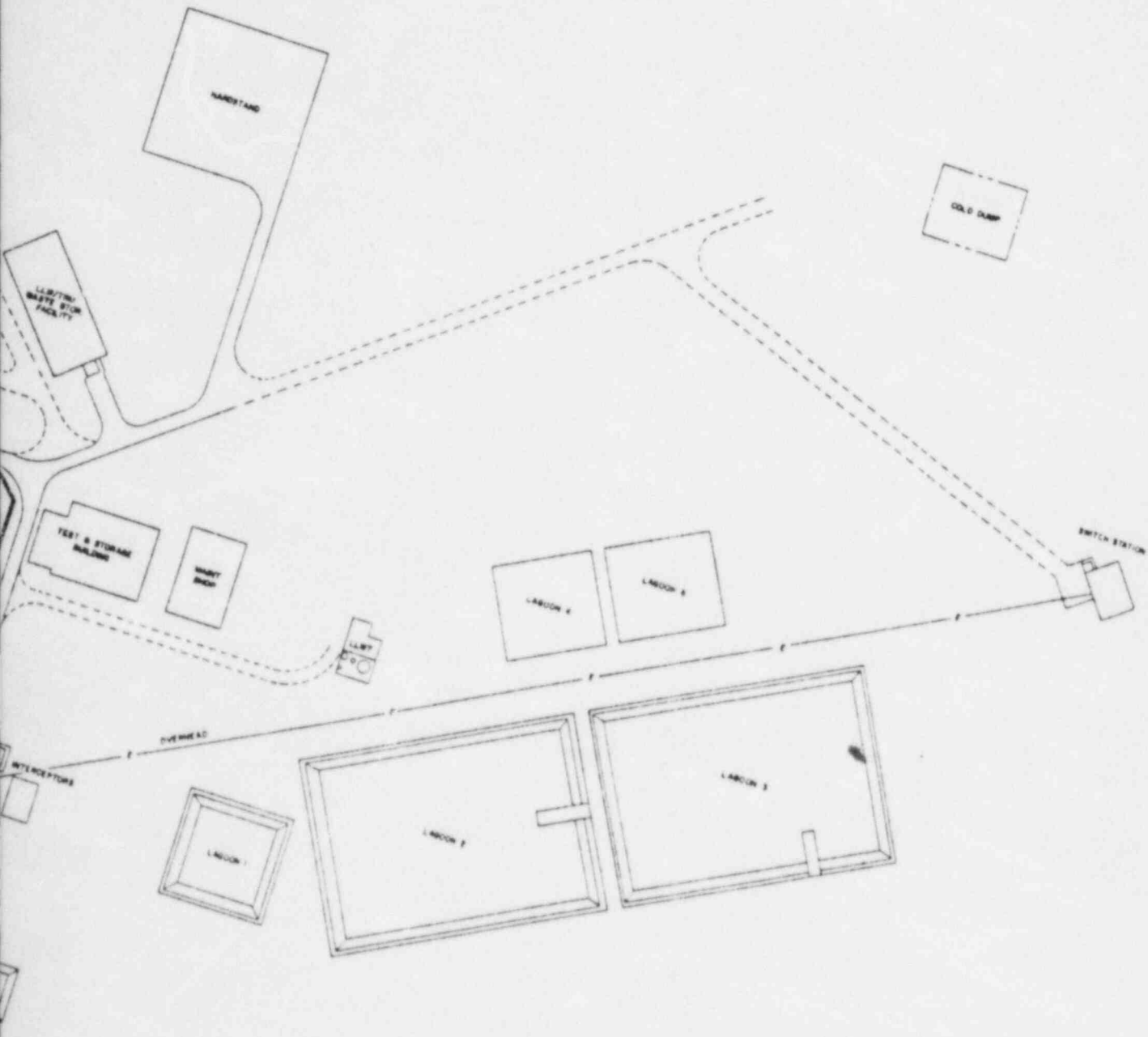
TI
APERTURE
CARD



WEST VALLEY DEMONSTRATION PROJECT
PROTECTED AREA

FIGURE A.10.7-1


SECURITY FENCE
ROAD
SPRINGS
ROCK
BYRD PARKING
CONST GATE HSE
GATE HOUSE
ADMINISTRATION COMPLEX
METEOROLOGICAL TOWER
CTS
OFFICE
PROCESS BUILDING
FHB
UTILITY BLD
CLAM WATER
LAUNDRY
RAILROAD
WAREHOUSE
PLANT STOR
BLDG FDN
BLDG FDN
COND
BOILER BLDG




Also Available On
Aperture Card

HIGH SECURITY AREAS

TI
APERTURE
CARD

FIGURE A.10.7-2

8507030441 

# WEST VALLEY NUCLEAR SERVICES, INC.
# SECURITY MANAGEMENT STRUCTURE

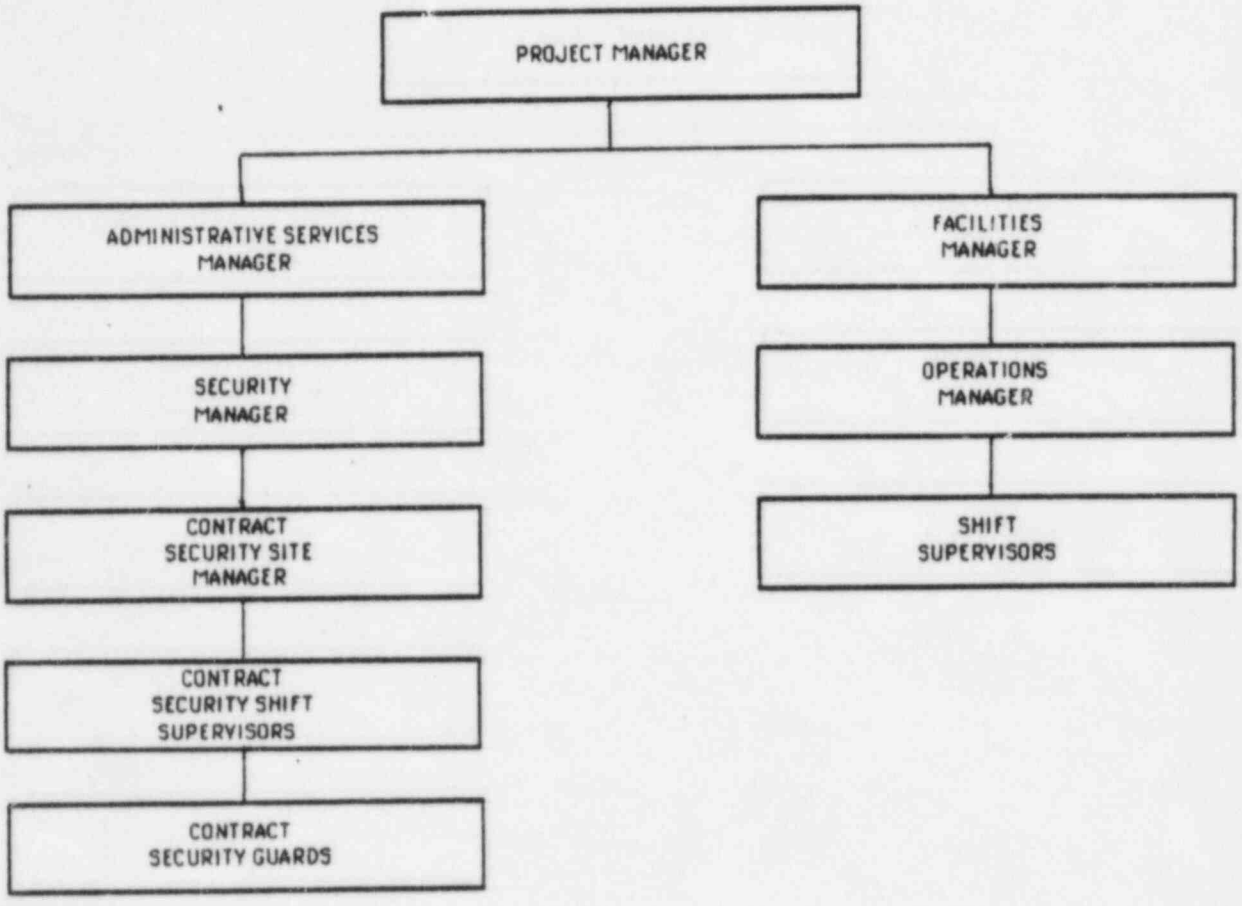



FIGURE A.10.7-3

SECURITY ORGANIZATION

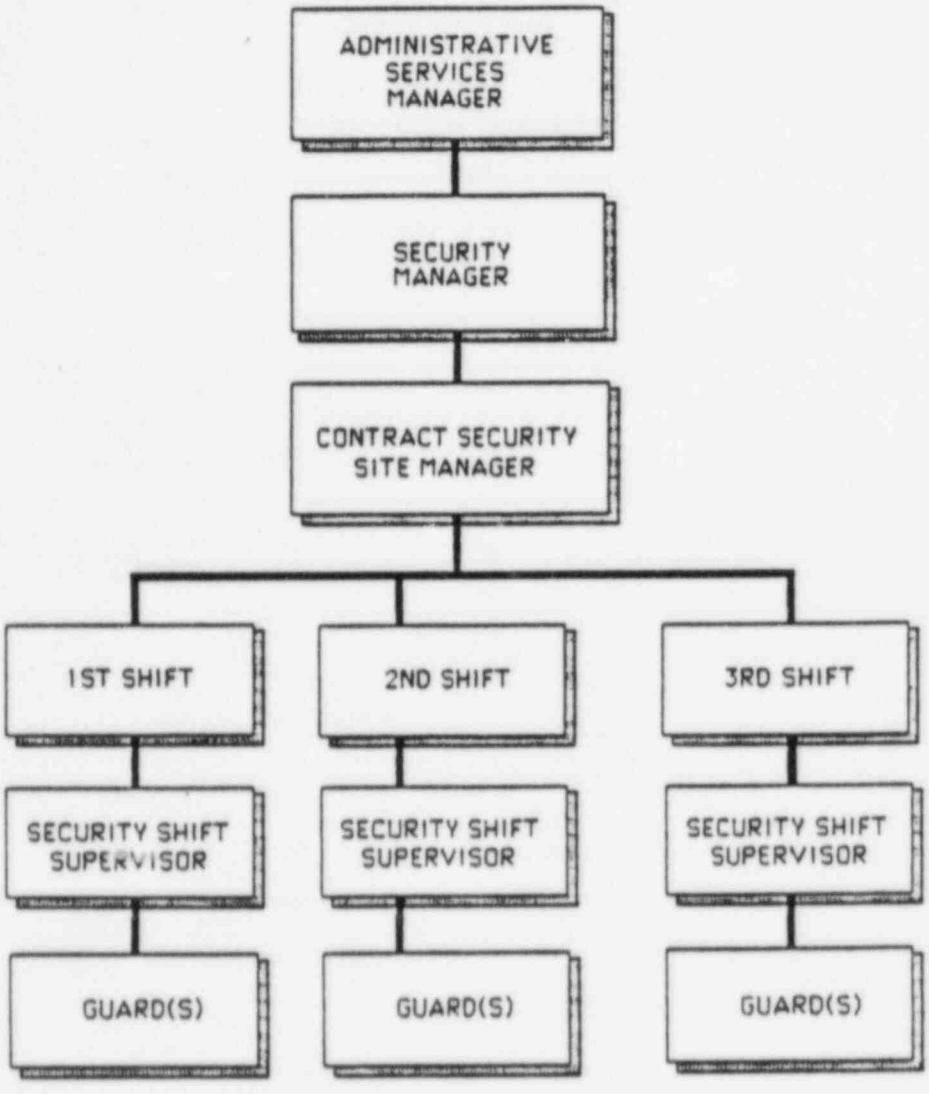



FIGURE A.10.7-4

## GUARD SUPERVISOR CHECKLIST REPORT

To be completed at the end of the shift.

| | MONDAY | | | TUESDAY | | | WEDNESDAY | | | THURSDAY | | | FRIDAY | | | SATURDAY | | | SUNDAY | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shifts | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Contract Supervisor | | | | | | | | | | | | | | | | | | | | | |
| Contract Guard Name | | | | | | | | | | | | | | | | | | | | | |
| Contract Guard Name | | | | | | | | | | | | | | | | | | | | | |
| Contract Guard Name | | | | | | | | | | | | | | | | | | | | | |
| Contract Guard Name | | | | | | | | | | | | | | | | | | | | | |
| Contract Guard Name | | | | | | | | | | | | | | | | | | | | | |
| Service Vehicles Ent. | | | | | | | | | | | | | | | | | | | | | |
| Delivery Vehicles Ent. | | | | | | | | | | | | | | | | | | | | | |
| Package Searches | | | | | | | | | | | | | | | | | | | | | |
| Personnel Searches | | | | | | | | | | | | | | | | | | | | | |
| Visitor Escorted | | | | | | | | | | | | | | | | | | | | | |
| Radiation Monitor | | | | | | | | | | | | | | | | | | | | | |
| Metal Detector | | | | | | | | | | | | | | | | | | | | | |
| CCTV | | | | | | | | | | | | | | | | | | | | | |
| Electronic Systems | | | | | | | | | | | | | | | | | | | | | |
| Time Clock Rounds | | | | | | | | | | | | | | | | | | | | | |
| Barrier Conditions | | | | | | | | | | | | | | | | | | | | | |
| Security Violations | | | | | | | | | | | | | | | | | | | | | |
| Incidents | | | | | | | | | | | | | | | | | | | | | |
| Base & Port. Radio Oper. | | | | | | | | | | | | | | | | | | | | | |
| Phone Operability | | | | | | | | | | | | | | | | | | | | | |
| Radio Oper. (Sheriff's) | | | | | | | | | | | | | | | | | | | | | |
| Lights | | | | | | | | | | | | | | | | | | | | | |
| Administration Building | | | | | | | | | | | | | | | | | | | | | |
| Plant Conditions | | | | | | | | | | | | | | | | | | | | | |
| Warehouse/Maint. Conditions | | | | | | | | | | | | | | | | | | | | | |
| Parking Lot Conditions | | | | | | | | | | | | | | | | | | | | | |
| Gate Checkout | | | | | | | | | | | | | | | | | | | | | |
| Off Site Warehouse | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

Notes, suggestions & comments ...
Use reverse side or separate sheet.

FIGURE A.10.7-5

## A.12.0 QUALITY ASSURANCE

This chapter describes the Quality Assurance (QA) program to be established by WVNS for the US DOE, WVDP, and by major Project participants -- the Architect-Engineer (A-E), the Commercial Waste Treatment Program Contractor, and the Safety and Environmental Assessment Contractor. WVNS, a subsidiary of Westinghouse Electric Corporation, has been contracted by the US DOE to carry out a high-level radioactive waste management demonstration project. This chapter addresses the quality assurance aspects of the design, procurement, construction, installation, modification, operation, and testing phases of the WVDP.

The major Project participants' QA programs are structured to comply, as applicable, with the requirements of ANSI/ASME NQA-1-1979 and selected supplements to activities in the WVDP design, procurement and construction. The A-E, Ebasco, has been delegated the prime responsibility for quality assurance during design. They must ensure that appropriate controls are applied to the actual design process and that appropriate technical and quality requirements are included in design output documents such as drawings and specifications. Dames and Moore, an environmental and earth science consulting firm, has been delegated the prime responsibility for quality in the safety and environmental assessment for the WVDP. Dames and Moore's QA Program has established the methods for appropriate technical and quality requirements for installation, testing, and operation of meteorological sensors and systems for the WVDP Meteorological Program. Battelle, Pacific Northwest Laboratories has been delegated the prime responsibility for quality in providing design, procurement, fabrication, shipment, and functional testing of the Commercial Waste Treatment Program for some Component Test Stand (CTS) equipment associated with testing and processing of liquid high-level radioactive wastes for the Project.

The prime responsibility of ensuring the quality of the Project rests with WVNS and is implemented through combined efforts with US DOE and the major Project participants.

## A.12.1 ORGANIZATION

### A.12.1.1 STRUCTURES AND RESPONSIBILITIES

This section describes the organizational structures, functional responsibilities, levels of authority, and lines of communication for activities affecting quality. The organizational structure of the WVNS is described in Chapter A.10. The overall responsibility for QA during the WVDP design, procurement, construction, installation, modification, operation, and testing rests with WVNS. The overall WVDP QA Program is implemented through the combined efforts of the WVNS, US DOE, and the major Project participants.

#### A.12.1.1.1 WVNS Responsibilities

WVNS is responsible for:

[1] Establishing the Project QA Program Plan delineating requirements and responsibilities during the design, procurement, construction, installation, modification, testing, and operation phases of the Project in accordance with the WVNS QA Program and the criteria of ANSI/ASME NQA-1-1979 and selected supplements;

[2] Establishing, documenting, and implementing a program for control of Project activities in accordance with the WVNS QA Program Plan;

[3] Developing design criteria and safety analysis reports;

[4] Monitoring and review of the A-E and the Safety and Environmental Assessment activities;

[5] Assuring completion of decontamination and decommissioning (D/D) activities; and

[6] Complete processing, operation and safe disposal of nuclear wastes.

### A.12.1.1.2 WVNS Quality Assurance Department Responsibilities

The WVNS QA Department is responsible for:

[1] Establishing a WVNS QA Program Plan that is based on the requirements of ANSI/ASME NQA-1-1979 and its supplements;

[2] Providing Project support in quality assurance activities;

[3] Reviewing test documentation;

[4] Providing Project support in witnessing and approving construction tests;

[5] Performing audit activities of WVNS and the major Project participants to determine compliance with the Project requirements;

[6] Recommending quality assurance hold points in system operability test procedures and coordinating the release of these hold points;

[7] Identifying deficiencies in the QA programs of the major Project participants and suppliers; and

[8] Coordinating A-E activities.

### A.12.1.1.3 Ebasco Responsibilities

The A-E, Ebasco, is responsible for:

[1] Preparing and implementing a QA Program during the design phase of the Project that is based upon the applicable requirements of ANSI/ASME NQA-1-1979 and its supplements;

[2] Providing complete Project design documentation; and

[3] Providing Project support in identifying and resolving design and construction problems.

### A.12.1.1.4 Dames and Moore Responsibilities

The Safety and Environmental Assessment contractor, Dames and Moore, is responsible for:

[1] Implementing a QA Program consistent with the WVNS QA Program Plan based on the requirements of ANSI/ASME NQA-1-1979 and other commercial standards;

[2] Monitoring all environmental data for the Project; and

[3] Preparing safety analysis reports.

#### A.12.1.1.5 Battelle, Pacific Northwest Laboratories, Responsibilities

The Commercial Waste Treatment Program contractor, Battelle, Pacific Northwest Laboratories, is responsible for:

[1] Preparing and implementing a QA Program during the design and process phase of the Project that is based on the appropriate requirements of US DOE Order 5700.1, "QA";

[2] Providing Project design and support for the overall management and the laboratory studies (e.g., melter runs and glass formulation studies) for the Project;

[3] Providing the design, procurement, fabrication, shipment, and functional test of the Component Test Stand (CTS) equipment; and

[4] Providing written procedures for the safe handling of bulk chemicals and radioactive materials.

#### A.12.1.1.6 US DOE Responsibilities

The US DOE is responsible for:

[1] Technical direction of the Project;

[2] Review of the Project Progress Reports;

[3] Assessment of the Project; and

[4] Report to the Congress of Project development and progress.

### A.12.1.2 QUALITY ASSURANCE MANUALS

Major Project participants' QA Program Plans are reviewed and approved by WVNS. The Project participants' QA implementation procedures and instructions are reviewed by WVNS, as appropriate.

### A.12.1.3 US DOE REVIEWS

The US DOE periodically reviews the program management of WVNS and the major Project participants to ensure adequacy and compliance with the contract.

## A.12.2 QUALITY ASSURANCE PROGRAM

The WVDP QA Program policies and requirements for the Project are established by WVNS. The QA Program for the Project complies with the provisions of ANSI/ASME NQA-1-1979 and supplements thereto, as applicable to the design, procurement, construction, installation, modification, operation, and testing. The quality required for the Project scope of work is achieved by work performed and verified in accordance with written approved procedures. The WVDP scope of work consists of:

[1] Shutdown and maintenance operations;
[2] Design, construction, and modification of facilities;
[3] Processing, interim storage, and disposal of nuclear wastes (waste characterization, sludge mobilization, supernatant processing, waste vitrification, and high-level waste storage);
[4] Decontamination and decommissioning activities (LLW treatment and disposal; transuranic waste segregation,storage and shipping; radwaste volume reduction); and
[5] Project management and administrative support activities.

The basic requirements of NQA-1 which apply to the WVDP scope of work are identified in Figure A.12.2-1. The basic requirements of NQA-1 which apply to the major Project participants are shown in Figure A.12.2-2.

The major Project participants will develop and implement plans and procedures for their contracted work scopes. The US DOE contract, directives, regulations, and ANSI/ASME NQA-1 with its applicable supplements define the quality assurance guidelines to be followed by WVNS and passed on to the major Project participants associated with quality system requirements.

Quality requirements will be applied to WVDP and suppliers by including appropriate quality and documentation requirements in contractual provisions and in technical specifications.

The WVDP QA program will be implemented as defined in the major Project participants' QA plans for the quality-related activities. The degree of control and verification of the QA Program to the WVDP work scope shall be consistent with criteria delineated by implementing procedures and work instructions using the following considerations to develop the criteria:

[1] Safety classification of equipment;
[2] Consequence of malfunction or failure of an item, system, or process;
[3] Need for special controls and surveillance over processes and equipment;
[4] Degree to which functional compliance can be demonstrated by inspection or test;
[5] Quality history and degree of standardization of an item, system, or process; and
[6] Difficulty of repair or replacement of an item.

An assessment of the adequacy of the WVDP QA Program is conducted by the Westinghouse Waste Technology Services Division and the US DOE and reported annually to the WVNS Project Manager and staff management.

### A.12.2.1 DESIGN CONTROL

The quality required for the Project design control is achieved by ensuring that the design of structures, systems, components, assemblies, test equipment, processes, and facilities is adequately defined, controlled, and verified in accordance with design control procedures which comply with ANSI/ASME NQA-1.

The US DOE participates in the review and approval responsibility for all phases of design on the Project, including design changes, by the review and approval of design documents and associated documentation, and by periodic audits of the design control practices of the Project.

The extent of independent design verification will depend upon the safety aspects of the item, the complexity of the design, the similarity of the design with proven designs, and the present state of the art. Acceptable verification methods include (but are not limited to) one or a combination of design reviews, alternate independent calculations, and qualification testing.

Design changes initiated by the A-E or other Project participants are processed in accordance with design control procedures. These procedures provide for the independent review of designs and for control of the review, approval, and release of drawings and specifications.

### A.12.2.2 PROCUREMENT DOCUMENT CONTROL

The US DOE has delegated prime responsibility for the procurement and the administration of contracts to WVNS. The preparation and processing of procurement documents are performed in accordance with the WVNS Policy and Procedures Manual and the Project QA Methods and Procedures. These procedures will ensure that procurement documents contain appropriate technical and quality requirements. To the extent necessary, procurement documents will require contractors and suppliers to have quality programs which are adequate to control the quality of the involved items or services.

The prepared procurement documents specify the scope of work, technical requirements, and application of quality requirements in accordance with the considerations specified in Section A.12.2.0. The appropriate procurement documents with quality assurance requirements specified therein will be reviewed and approved by the WVNS QA Department. Procurement documents will be controlled by WVNS' standard procurement procedures and practices. Changes to procurement documents will be made under written WVNS procedures.

Following the preparation and approval of a procurement document and selection of an acceptable supplier, the purchase order will be prepared and issued, along with the supporting procurement documents. If verification of the quality of supplied items cannot be performed at receiving inspection, work

performed by the supplier shall be verified by the WVNS QA organization during the course of procurement to assure that the purchase order requirements are met. Verification activities conducted by QA may include auditing, receiving inspection, surveillance, or inspection at mandatory holding points during processing, final inspection, and shipping.

The US DOE reviews and approves selected procurement documents which contain technical specifications, drawings, and sole-source justification. The US DOE also reviews the WVNS procurement document control procedures and periodically audits the implementation of these procedures.

Procurement documents prepared by the major Project participants will be controlled by the major Project participants' standard procurement procedures and practices unless otherwise defined within their contracts.

### A.12.2.3 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

Components, systems, structures, and associated services that are important to the safe and reliable operation of the WVDP are designed, fabricated, erected, inspected, and tested in accordance with approved specifications and drawings. Instructions, procedures, and drawings will be issued and controlled for the performance of the work scope in accordance with the considerations specified in Section A.12.2. The documents prepared by the issuing organization will be approved by the WVNS QA and other interfacing organizations. Documents are prepared in formats suitable to their application. Where appropriate, the written documents contain quantitative and qualitative acceptance criteria to form the basis for verifying that all involved quality-related activities are satisfactorily accomplished.

The US DOE reviews drawings and technical specifications as they are assembled into Project packages. The US DOE may also request that instructions, procedures, and drawings prepared by major Project participants be submitted for review and/or approval where designs of components, systems, and structures are to be further refined by major Project participants. If shop drawings are required, they will be submitted by the major Project participants for review and approval prior to use.

The US DOE or a designated representative periodically monitors the work practices of all Project participants to verify the availability and effective implementation of instructions, procedures, specifications, and drawings.

### A.12.2.4 DOCUMENT CONTROL

The preparation, issuance, and changes to the document that implements the considerations stated in Section A.12.2 shall be controlled to assure that correct documents, including the proper revision level, are being used. These documents, including any changes, shall be reviewed for adequacy and approved for use.

WVNS and the major Project participants have established and implemented appropriate measures to control the preparation, review, approval, and issuance of documents such as standard operating procedures, drawings, procedures, specifications, and instructions, including changes, which prescribe activities affecting quality. Changes to documents are reviewed by cognizant major Project participants and are subject to review and approval by the WVDP major Project participants. Submittals may include back-up calculations, design drawings analysis, operations and maintenance manuals, etc., and will be specifically called for in their contracts.

Documents shall be controlled to assure that correct and applicable documents are available at the location where they are to be used. Any change to controlled documents shall be reviewed and approved by the same organizations that performed the original review and approval unless other organizations are specifically designated. The reviewing organization shall have access to any background data or information upon which to base their approval.

The US DOE reserves the right to review and approve documents and associated document control procedures prepared by WVNS and the major Project participants. In addition, the US DOE or a designated representative monitors and audits the execution of the Document Control System at the WVNS to ensure that such systems are adequate and effectively implemented.

## A.12.2.5 CONTROL OF PURCHASED ITEMS AND SERVICES

Measures have been established and implemented at the WVDP to ensure that purchased materials, equipment, and services conform to the requirements outlined in the procurement documents. The extent of controlling purchased materials, equipment, services, and supplier selection shall be implemented in accordance with the considerations specified in Section A.12.2. These measures include contract provisions as appropriate for source inspections, receiving inspections, monitoring of site construction activities, equipment installation activities, acceptance testing, and objective evidence of compliance submitted by contractors and suppliers to demonstrate compliance with contract requirements.

Before a purchase order is issued, the selected supplier, if required, shall be evaluated by WVNS to assess the adequacy of the supplier's quality program, technical abilities, and the facilities and organization necessary to produce an acceptable material, equipment, or service.

When required, purchase orders shall contain the requirements for suppliers to submit documents and revisions thereto (i.e., technical specifications, drawings, processing procedures, inspection, and test plans, procedures and quality programs/procedures) for WVNS review and approval.

Mandatory supplier holding points may be identified to facilitate QA determination of the acceptability of the item or service. Instructions issued with the hold-point direct the supplier not to proceed beyond the hold-point until the work has been released by a WVNS QA representative. Hold-points may be identified at receiving, during processing, and at final inspection and shipping.

The US DOE reserves the right to review the procurement control procedures of WVNS and the major Project participants and periodically audits the WVDP to verify that they are maintaining adequate control of the procurement of materials, equipment, and services.

### A.12.2.6 IDENTIFICATION AND CONTROL OF ITEMS

WVNS and the major Project participants have established measures to provide for identification and control of materials, parts, and components in order to provide assurance that only correct and acceptable items are used and installed in the WVDP.

Procedures shall implement requirements for traceability from receipt to the end-use or installation of items in accordance with the considerations specified in Section A.12.2. Requirements for the identification and traceability of supplier-furnished materials, equipment, and services shall be included in the purchase order to maintain the traceability throughout the supplier's work scope and shipping cycle.

Physical identification shall be used where possible to provide for clear and legible identification which does not affect the function or service life of an item. When physical identification is not practical, other administrative controls such as tagging or physical separation and lot or batch control shall be employed to maintain traceability.

The US DOE monitors the material identification and control procedures and practices of the WVDP Project participants to verify that such procedures and practices are adequate and are effectively implemented.

### A.12.2.7 CONTROL OF PROCESSES

Provisions for the control of processes (e.g., welding, nondestructive examination, installation, construction, and testing phases) have been incorporated into the Project. Processes that could affect the quality of the final items or services in accordance with the considerations of Section 12.2 shall be controlled. Special processes that control or verify quality shall be performed by qualified personnel using qualified procedures in accordance with approved requirements.

Requirements for control of supplier processes shall be included in the procurement documents. The process control provisions included in the technical specifications will vary depending on the importance and complexity of the involved process, component, system, or structure. As appropriate, the control specified will include the use of documented procedures, qualification of procedures, qualification of personnel, and qualification of equipment.

### A.12.2.8 INSPECTION

Measures have been established and implemented by WVNS to ensure that inspections required to verify acceptance of an item, test, or service are performed in accordance with documented requirements. Inspection plans include measures to ensure that qualified procedures and personnel shall be provided to perform the following inspection activities during the procurement, installation, construction, and testing phases of the Project:

[1] source surveillance and inspection;
[2] receiving inspection;
[3] fabrication, assembly, or installation inspection;
[4] on-site construction inspection; and
[5] testing.

Personnel performing inspection activities for the purpose of product acceptance shall be qualified and trained to perform the inspection task. Inspector training and qualification for the WVNS personnel shall be prescribed, defined, maintained, and documented.

WVDP inspection planning shall be documented showing each characteristic to be inspected, method to be utilized, and acceptance criteria, and shall provide for recording objective evidence of inspection results. When sampling is used to verify acceptability of a group of products, the sampling plan shall be based on a recognized standard practice and documented as part of inspection planning.

Final inspection performed for the Project shall include a review of all previously performed inspections, reworks, repairs, or recalibrations, and the resolution of nonconformances. Quality records shall also be examined for acceptance and accuracy prior to final acceptance of the product.

The US DOE or a designated representative monitors the inspection planning and control procedures and practices of the WVDP Project to verify that such procedures and practices are adequate and effectively implemented.

A.12.2.9 **TEST CONTROL**

Measures have been established and implemented at WVNS to assure that tests required to verify conformance of items or services to requirements shall be performed in accordance with documented procedures. Whenever possible, tests are to be performed by trained and qualified personnel. The results shall be documented and evaluated against approved acceptance criteria. Test programs will be established to ensure that components, systems, and structures perform safely, that operational functions are satisfactory when in service, and that the testing is identified and documented in written test procedures which incorporate or reference the requirements and acceptance limits contained in applicable design documents.

Requirements for the performance of tests by WVNS or its Project suppliers shall be included in the procurement documents. The procurement documents will, when necessary, specify those procedures required to be submitted to WVNS for review, approval, or information. Test requirements and acceptance criteria will be included in design documents.

The US DOE monitors the test control which involves the review of testing procedures established by WVNS to verify that such procedures are effectively implemented. An audit of the Project test programs and practices is conducted periodically. The US DOE or a designated representative performs surveillance during the construction and testing phase to verify that tests performed are in accordance with approved procedures and performed by qualified personnel and that the results are acceptable and adequately documented.

## A.12.2.10 CONTROL OF MEASURING AND TEST EQUIPMENT

Measures have been established at WVNS to ensure that gauges, instruments, measuring devices, and testing equipment used to determine conformance with specified requirements of drawing and specifications or for obtaining test data are of the proper range, type, and accuracy. To ensure accuracy, selected measuring and test equipment will be calibrated at established intervals against certified standards which have a known valid relationship to nationally recognized standards. Purchase orders may be issued for calibration of measuring and test equipment through a qualified supplier. Specific categories of equipment and instrumentation may be listed, classified, and identified as "No Calibration Required." Such equipment is generally used as a "controller" with subsequent measurements being made by more sensitive calibrated equipment. Test equipment found to be out of calibration shall be identified and/or segregated from other equipment.

Calibration records shall include (if appropriate) an Instrument Data Card and a History of Repair Card for each instrument utilized for acceptance or testing. The calibration system shall provide for recall of equipment for recalibration.

The US DOE or a designated representative periodically audits the inspection and testing activities of the Project participants to ensure that appropriate controls are being exercised over the use and calibration of measuring and test equipment.

## A.12.2.11 HANDLING, STORAGE, AND SHIPPING

Procedures shall be established to control the handling, storage, and shipping of items and materials by WVNS to prevent damage or deterioration. Handling, storage, packaging, preservation, and shipping requirements contained in government and industry safety codes and standards apply as required by the contract. In special circumstances, the specific requirements may be cited in the technical specifications for material, parts, components, or equipment involved.

Controls are established to ensure that special handling tools and lifting equipment are inspected and tested at required intervals to show that these items are adequately and safely maintained. Personnel who operate and maintain special handling tools and lifting equipment shall be trained in the use of the equipment. Purchase orders may be issued for load testing of lifting equipment and special handling tools through a qualified supplier.

Purchase orders shall include appropriate requirements for qualified suppliers to ensure that items are protected to prevent damage during handling, shipping, and storage. WVNS QA performs surveillance during handling, storage, and shipping activities for critical items.

The US DOE or a designated representative routinely monitors the handling, storage, and shipping practices of WVNS and equipment suppliers to verify that such practices are adequate and in compliance with the contract.

**A.12.2.12 INSPECTION, TEST, AND OPERATING STATUS**

Measures are established to determine the status of inspection and test activities, and are identified in documents traceable to the items. Established controls are made to identify nonconforming, inoperative, or malfunctioning components or systems and to prevent items from being processed beyond the required inspections, tests, installation, or inadvertent use of the items.

Status of items shall be maintained on the processing documents or test plan. Equipment status is also maintained by use of shop documents or visible indicators. Review of suppliers' QA programs and procedures is conducted by WVNS to verify that the status of inspections and tests is adequately addressed.

The WVNS QA representative performs surveillance and audit of the supplier for conformance to documented procedures regarding the identification of inspection status of work in process by inspection records, tags, markings, stamps, labels, shop travelers, or other means as appropriate. A system has been established to: (1) designate status of items or equipment as "accepted," "hold," or "rejected"; (2) control application and removal of inspection tags by authorized persons; and (3) prevent bypassing of required inspections, tests, or other critical operations.

The US DOE or a designated representative periodically audits the inspection, test, and operating status programs of the Project to ensure that appropriate controls are being exercised and to verify that such programs are adequate and in compliance with the Project contract.

### A.12.2.13 CONTROL OF NONCONFORMING ITEMS

Materials, parts, components, equipment, structures, and systems that deviate from approved specifications, drawings, codes, or other applicable documents are considered as nonconforming items and are controlled to prevent inadvertent use or installation. Nonconforming items discovered during manufacture, fabrication, or shop test activities are required to be controlled and documented in accordance with written procedures.

In procurement documents, WVNS provides requirements for suppliers' and major Project participants' procedures for control and reporting of nonconforming items. Suppliers' and major Project participants' procedures are reviewed by WVNS as part of the overall review of their QA program. These procedures will address, as applicable: identification, tagging, and segregation of nonconforming items; documentation of nonconforming items; disposition of the nonconformance; notification of affected organizations; and rework or repair, reinspection and retest requirements.

Measures are established for recommended disposition which is "use-as-is" or "repair." These "use-as-is" and "repair" dispositions and the corresponding proposed repair procedure must be approved by the purchaser prior to implementation by the supplier or major Project participant.

The US DOE periodically monitors the control exercised by WVNS over nonconforming items and conditions. Any deficiencies shall be promptly documented, contractually administered, and either corrected or removed to prevent their inadvertent use.

**A.12.2.14 CORRECTIVE ACTION**

Measures are established and implemented by WVNS and major Project participants to ensure that adverse conditions such as failures, malfunctions, deficiencies, deviations, defective material or equipment are promptly identified and corrected. In case of significant adverse conditions, the measures will ensure that the cause is determined and that appropriate corrective action is taken by the responsible organization.

Identification of situations which may need corrective action is accomplished through periodic review of supplier surveillance activities, QA surveillance and monitoring programs, QA audits, and nonconformance reports. Correction Action Reports document the identification of all significant conditions adverse to quality including the cause of the condition, corrective action taken, and cost and/or schedule impact (when applicable). Corrective actions are reported to appropriate levels of management. Final verification or follow-up is documented by responsible parties.

The US DOE reviews the Corrective Action Systems of the Project to verify that they are adequate and effectively implemented.

## A.12.2.15 QUALITY ASSURANCE RECORDS

The Project QA record system includes requirements and responsibilities for identification, filing, transmittal, receipt, storage, retention, maintenance, retrieval, and disposition of QA records. The system addresses the records associated with design, QA, and procurement including duration for each type of record. Sufficient information is provided to enable traceability to the item or activity to which it is associated.

Records are classified as lifetime or nonpermanent. Lifetime records are those which meet one or more of the following criteria; they are to be maintained for the life of the particular item. Lifetime records include:

[1] Those which would be of significant value in demonstrating capability for safe operation;
[2] Those which would be of significant value in maintaining, reworking, repairing, replacing, or modifying the item;
[3] Those which would be of significant value in determining the cause of an accident or malfunction of an item;
[4] Those which provide baseline data for in-service inspection; and
[5] Those which establish significant technical or administrative decisions relative to quality assurance.

Nonpermanent records contain data that do not require a QA record and are used to show evidence that an activity was performed in accordance with the applicable requirements; they need not be retained for the life of the item because they do not meet the criteria for lifetime records.

QA records provide sufficient information to permit matching of the record and the item(s) or activity to which it applies. These include the following information as applicable: document title, number, revision, date, reference to appropriate contract, purchase order, work order numbers, references to appropriate drawings, specifications, procedures, and instructions. Records are indexed and maintained to provide for the retrieval of information within

a reasonable time. The Project QA records include but are not limited to the following: results of reviews, inspections, tests, audits, monitoring of work performance, personnel qualifications, drawings, specifications, calculations, procurement documents, calibration procedures, nonconformance reports, and corrective action reports.

Inspection and test records identify the data, type of observation, results, acceptability, and the action taken with regard to any deficiencies noted.

The US DOE periodically monitors the overall WVDP QA Records Program to ensure that adequate records are being prepared and appropriately protected and controlled.

**A.12.2.16 AUDITS**

A comprehensive program of planned and periodic WVNS audits is carried out under the direction of QA personnel to verify compliance with the various aspects of the QA program and to determine the effectiveness of the program. The audits include review of indoctrination and training activities, processes, items, and reviews of documents and records of corrective actions, calibrations, and nonconforming items control. The audits will be scheduled to cover essential early design activities, procurement, construction, installation, and system acceptance testing phases of the WVDP Project. The program includes internal audits of supplier and major Project participants' activities in support of the Project.

Audits are performed in accordance with written procedures or checklists by appropriately trained personnel not having direct responsibility for the areas being audited. The audits are conducted by appropriately trained and qualified personnel within the QA organization and/or representatives from other organizations. Audit results are documented by auditing personnel and are reported to and reviewed by management personnel having responsibility for the area audited. Responsible management personnel must take timely and appropriate action to correct and prevent recurrence of deficiencies revealed by the audit.

QA audit teams under the direction of the Manager of QA Westinghouse Technical Services Division (WTSD) conduct management assessment audits of Project activities at least annually, and the results are reported to WVNS Project Manager and cognizant Project management.

The major Project participants are responsible for auditing quality-related functions performed by their respective organizations. The major Project participants are also responsible for auditing the performance of their subcontractors and suppliers to verify compliance with WVDP requirements.

The US DOE or a designated representative periodically audits the quality-related activities of the Project to assure that appropriate audit programs are established and implemented and to verify that such audit programs are adequate and in compliance with the Project contract.

| WEST VALLEY WORK SCOPE / NQA-1 BASIC REQUIREMENTS | ORGANIZATION | QUALITY ASSURANCE PROGRAM | DESIGN CONTROL | PROCUREMENT DOCUMENT CONTROL | INSTRUCTIONS, PROCEDURES AND DRAWINGS | DOCUMENT CONTROL | CONTROL OF PURCHASED ITEMS AND SERVICES | IDENTIFICATION AND CONTROL OF ITEMS | CONTROL OF PROCESSES | INSPECTION | TEST CONTROL | CONTROL OF MEASURING AND TEST EQUIPMENT | HANDLING, STORAGE AND SHIPPING | INSPECTION, TEST AND OPERATING STATUS | CONTROL OF NONCONFORMING ITEMS | CORRECTIVE ACTION | QUALITY ASSURANCE RECORDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shutdown & Maintenance Operations | A | LA | LA | LA | LA | PA | LA | LA | A | LA | LA | LA | LA | LA | LA | A | LA |
| Construction/ Modifications of Facilities | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |
| Processing of Nuclear Waste | A | LA | LA | PA | A | A | PA | A | A | A | LA | A | A | A | A | A | A |
| Decontamination & Decommission Activities | A | LA | LA | LA | A | A | A | A | A | A | LA | LA | A | A | A | A | A |

KEY
A - APPLIES
LA - LIMITED APPLICATION
PA - PROBABLE APPLICATION

BASIC REQUIREMENTS OF NQA-1
APPLICABLE TO WVDP WORK SCOPE

FIGURE A.12.2-1

| NQA-1 BASIC REQUIREMENTS | ORGANIZATION | QUALITY ASSURANCE PROGRAM | DESIGN CONTROL | PROCUREMENT DOCUMENT CONTROL | INSTRUCTIONS, PROCEDURES AND DRAWINGS | DOCUMENT CONTROL | CONTROL OF PURCHASED ITEMS AND SERVICES | IDENTIFICATION AND CONTROL OF ITEMS | CONTROL OF PROCESSES | INSPECTION | TEST CONTROL | CONTROL OF MEASURING AND TEST EQUIPMENT | HANDLING, STORAGE AND SHIPPING | INSPECTION, TEST AND OPERATING STATUS | CONTROL OF NONCONFORMING ITEMS | CORRECTIVE ACTION | QUALITY ASSURANCE RECORDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEST VALLEY NUCLEAR SERVICES | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |
| EBASCO | A | A | A | | A | A | LA | | | | | | | | | A | A |
| DAMES AND MOORE | A | A | | LA | | A | | A | | LA | A | A | LA | | A | A | A |
| BATTELLE PACIFIC NORTHEST LABS (PNL) | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |

KEY
A - APPLIES
LA - LIMITED APPLICATION

BASIC REQUIREMENTS OF NQA-1 APPLICABLE TO PROJECT PARTICIPANTS' QUALITY ASSURANCE PROGRAM FOR THE WEST VALLEY DEMONSTRATION PROJECT

FIGURE A 12 2-2

## A.12.3 QUALITY ASSURANCE IMPLEMENTATION

The WVNS Quality Assurance Program is implemented by way of the Quality Level and Service Classification Systems described in Section A.4.4. The quality levels are briefly described in the following paragraphs and their application to various Project areas are described in the following subsections.

### Quality Level A

A Quality Level A designation provides the greatest control and effort in assuring quality. This amount of effort is to be applied to those critical structures, systems, and components, or parts designated Safety Class A.

Quality Level A requires the implementation of a quality assurance program which conforms to the eighteen criteria of ANSI/ASME-NQA-1 by West Valley Nuclear Services Co. and any sub-tier supplier. The formalized quality assurance program and its requirements shall apply to all applicable aspects of the work covered during the design, procurement, construction/fabrication, and operation whether performed by the WVNS, the Supplier, or his lower tier suppliers.

### Quality Level B

A Quality Level B designation is provided for those structures, systems, subsystems, or components designated Safety Class B . Quality Level B requires implementation of a quality assurance program in accordance with selected criteria of NQA-1 by WVNS and any sub-tier supplier. The eighteen criteria of NQA-1 apply; however, the formalization of a supplier's quality assurance program may be limited to imposing specific criteria relative to their scope of work. This could include such administrative requirements as inspection, test control, special processes, and documentation of compliance with design and procurement documents.

**Quality Level C**

A Quality Level C designation is provided for those structures, systems, subsystems, or components that are designated Safety Class C. Quality Level C requires a quality assurance program in accordance with selected criteria of NQA-1 by WVNS and any sub-tier suppliers but does not require the formalization of a supplier quality assurance program related to any specific criterion. The Quality Level C designation may be used for those structures, systems, and components that require special features, testing, and reliability greater than those available under normal commercial practices. The Quality Level C designation may be used for commercially available items that require specific certification or testing that are not normally provided when the item is purchased on a commercial basis. This designation also applies when the acceptability of the structure, system, or components can be determined by inspection or tests performed by WVNS or its suppliers.

**Quality Level N**

A Quality Level N designation provides for those structures, systems, subsystems, or components that are not important to radiological safety. The quality requirements are equivalent to conventional commercial practices. The items may be supplier catalog type items or unique items that are designed, purchased, and fabricated following conventional practices.

Quality Assurance documentation and records will not normally be required for items designated Quality Level N. However, supporting documents and records for these items may be requested by the Cognizant Engineer for information. No QA verification of receipt of these documents is required.

## A.12.3.1 UTILIZATION OF QUALITY LEVELS IN DESIGN

### Quality Level A

Design activities for Quality Level A shall be performed in strict compliance with written design procedures and design control procedures. The design shall be defined, controlled, and verified. Materials and processes are to be defined in writing by design criteria, drawings, or specifications.

Fabrication and construction processes, codes, and standards are to be designated. Acceptance criteria are to be defined in the specification or drawing. The required tests, inspections, and examinations are to be designated. Design verification may be accomplished by either a detailed design review, alternate calculations and WVNS review, or qualification testing and WVNS review. Design documentation and records must provide evidence that the design verification process was performed in accordance with the requirements of design criteria, drawings, or specifications.

Changes to final design, including field changes, shall be justified and subject to design control measures commensurate with those applied to the original design and approved by the same affected groups or organizations which reviewed and approved the original design documents except where an organization which originally was responsible for approving a particular design document is no longer responsible. Personnel authorized to sign QA Level A design documents must be approved by WVNS Project Manager and QA Manager.

### Quality Level B

Design activities shall be performed in accordance with written design procedures and design control procedures. Materials and processes are to be defined in writing by design criteria, drawings, or specifications. Construction/Fabrication processes, codes, and standards are to be designated. Acceptance criteria are to be defined in specifications or on

drawings. Design verification may be by a design review, calculations, or qualification testing. Personnel authorized to sign Quality Level B design documents must be approved by WVNS Staff Manager and QA Manager.

**Quality Level C**

Design documents are to define the required specifications, codes, and standards. Verification may be by design review, calculations, or qualification testing. Personnel authorized to sign Quality Level C design documents must be approved by WVNS Staff Management; the QA Manager is to be informed of all such authorizations.

**Quality Level N**

Design documents may designate a supplier catalog item. Where unique items are not available as supplier catalog items, they may be designed using commercial design practices.

### A.12.3.2 UTILIZATION OF QUALITY LEVELS IN PROCUREMENT

**Quality Level A**

Written approval of the supplier is required by the WVNS Quality Assurance Manager and Cognizant WVNS Staff Manager prior to placement of a purchase order for items designated with Quality Level A. The supplier is to provide a Quality Assurance Program and implementing procedures for WVNS Quality Assurance and Cognizant Departmental approval prior to the initiation of contract. Suppliers of items or services assigned as Quality Level A must invoke on their lower-tier suppliers Quality Assurance Program requirements appropriate to the activities to be performed by the lower-tier supplier.

Suppliers are to prepare and provide flowcharts (or the equivalent) of fabrication, processing, and inspection control points for WVNS Quality Assurance and Cognizant Departmental approval. Flowcharts (or the equivalent) are to include reference to pertinent specifications and procedures. Procurement documents are to reference applicable detail specifications, codes, and standards. Supplier documentation is required for the purchased materials, processes, fabrication history, testing, and inspection. Material traceability shall be provided per established procedures. Nondestructive testing of welds and the inspection of critical dimensions and characteristics should be by personnel not assigned to production responsibilities of the item are required of the supplier. WVNS verification, audits, inspection, and testing are to be permitted, and specified critical suppliers' tests and inspections are to be witnessed. Procurement document changes shall be subject to the same degree of control as utilized in the preparation of the original documents.

**Quality Level B**

Approval of the supplier is required by the WVNS Quality Assurance and cognizant WVNS organizations before placing a purchase order for items designated with Quality Level B. The supplier will provide a Quality Assurance Program for WVNS Quality Assurance and Cognizant Departmental approval prior to the initiation of contract. Suppliers of items or services assigned as Quality Level B may, at the agreement of WVNS and based on the complexity of the item or service being procured, elect not to invoke the Quality Assurance Program Requirements on their lower-tier suppliers. This however does not relieve WVNS and/or their supplier from compliance with the assigned Quality Assurance requirements. Suppliers are to prepare and provide a flowchart (or equivalent) of fabrication, processing, and inspection control points for WVNS Quality Assurance and Engineering approval. Flowcharts (or equivalent) are to include reference to pertinent specifications, codes, and standards. Supplier documentation is required for the purchased materials, processes, testing, and inspection. Material certification, nondestructive testing of welds based on approved sampling plan, and inspection of the items

are required of the supplier where these may be relevant to the safety functions of the system, subsystem, structure, or component being satisfied. WVNS verifications and audits are to be permitted and the witness of supplier tests and inspections may be specified.

**Quality Level C**

Procurement documents for Quality Level C will be reviewed by WVNS Quality Assurance to verify that the applicable Quality Assurance and technical requirements have been clearly specified. Procurement documents shall reference any applicable specifications, codes, and standards. Certification, testing, inspection documentation, and performance testing shall be specified if applicable. WVNS witness of any testing and inspection is to be permitted.

**Quality Level N**

Quality Level N procurement does not require any Quality Assurance involvement.
Requisitioner may elect to invoke quality assurance requirements on a case-by-case basis.

### A.12.3.3 UTILIZATION OF QUALITY LEVELS IN CONSTRUCTION/FABRICATION

**Quality Level A**

Construction/Fabrication plans and procedures shall be approved by WVNS. Personnel authorized to sign Quality Level A construction/fabrication documents must be approved by WVNS Technical Director and QA Manager. Documentation is required for materials, processes, fabrication history, testing, and inspection. Traceability of materials, per established procedures, is to be provided. Nondestructive testing of welds is to be performed. Critical dimensions and characteristics are to be inspected by

personnel not assigned to construction/fabrication tasks of the items being inspected. WVNS verification, inspection, and testing are to be permitted and specified critical tests and inspections are to be witnessed.

**Quality Level B**

Construction/Fabrication plans and procedures shall be approved by WVNS. Personnel authorized to sign Quality Level B construction/fabrication documents must be approved by WVNS Staff Manager and QA Manager. Documentation is required for materials, processes, testing, and inspection. Certification of specified materials shall be provided. Nondestructive testing of welds and detailed inspection of the items shall be performed based on an approved sampling plan. WVNS verifications and audits are to be permitted and the witness of tests and inspections may be specified.

**Quality Level C**

Testing and inspection documentation shall be required. Certificate of conformance is to be furnished. WVNS witness of testing and inspection is to be permitted.

**Quality Level N**

Commercial practices are to be employed for fabrication or construction activities for these items.

**A.12.3.4 UTILIZATION OF QUALITY LEVELS IN OPERATIONS**

For Quality and Safety Levels A, B and C, operation is contingent upon Radiation and Safety Committee review and approval (and DOE approval when necessary) of hazard classification and safety analysis. Readiness Reviews must be held prior to initiation of new operations, and WVNS Management approval must be obtained prior to initiation of operation.

**Quality Level A**

Operation and maintenance of Quality Level A equipment and facilities shall be in accordance with approved procedure. Auditing of these activities shall be performed by WVNS management.

**Quality Level B**

Operation and maintenance of Quality Level B equipment and facilities shall be in accordance with approved procedures. Auditing and surveillance of these activities shall be performed by WVNS Quality Assurance.

**Quality Level C**

Operation and maintenance of Quality Level C equipment and facilities shall be in accordance with approved procedures. Auditing and surveillance shall be performed.

**Quality Level N**

Written procedures may or may not be required. Operation and maintenance of Quality Level N equipment and facilities shall be in accordance with approved procedures, when required.

## REFERENCES FOR SECTION A.12

American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME), NQA-1, 1979. "Quality Assurance Program Requirements for Nuclear Power Plants."

Battelle, Pacific Northwest Laboratories, Quality Assurance Plan for the West Valley Support Project for Commercial Waste Treatment Program.

Dames and Moore Quality Assurance Procedures for Meteorological Program West Valley Demonstration Project.

Ebasco Quality Assurance Plan for the West Valley Demonstration Project.

US DOE Order ID 5481.1, "Safety Analysis and Review System."

US DOE Order 5700.1 (1980), Major System Acquisition.

US DOE Order ID 5700.6 and 5700.6B, "Quality Assurance."

US DOE Order ID 5820, "Radioactive Waste Management."

West Valley Nuclear Services Company, QA Program, "Quality Methods and Procedures."

West Valley Nuclear Services Company, West Valley Demonstration Project, Quality Assurance Program Plan.