N00639.AR.000851
NSA MID SOUTH
5090.3a

FINAL DRAFT PRELIMINARY ASSESSMENT REPORT FOR SITES 10, 11 AND 12
MILLINGTON SUPPACT TN (DRAFT ACTING AS FINAL)
11/16/1989
NAVFAC SOUTHERN

FINAL DRAFT

# PRELIMINARY ASSESSMENT REPOR
# FOR
# NAS MEMPHIS SITES NO. 10, 11, AN
# NAS MEMPHIS
# MILLINGTON, TENNESSEE

Prepared For:
Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina
Contract No. N62467-88-C-0198

Prepared By:
ERC Environmental and Energy Services Co.
725 Pellissippi Parkway
P.O. Box 22879
Knoxville, Tennessee 37933

16 November 1989

FINAL DRAFT

725 Pellissippi Parkway
P.O. Box 22879
Knoxville, Tennessee 37933
Telephone: 615-966-9761
Fax: 615-966-4155

**ERC/EDGe Environmental and Energy Services Co.**

16 November 1989

Commanding Officer
Attn: (Code 11519)
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
P.O. Box 10068
Charleston, SC 29411-0068

RE: Preliminary Assessment Reports for NAS Memphis Sites No. 10, 11, and 12 Contract N62467-88-C-0198

Dear Mr. Moser:

Enclosed are three copies of the final draft Preliminary Assessment (PA) Reports for NAS Memphis Sites No. 10, 11, and 12, as identified in the Final Draft RCRA Facility Assessment (RFA) report.

Please call me at (615) 966-9788 if you have any questions, corrections, or additions, or exceptions.

Sincerely,

ERC ENVIRONMENTAL AND ENERGY SERVICES CO.

Harry A. Bryson

Harry A. Bryson, CHMM
Senior Project Manager

HAB:ldl

Attachments/Enclosures

cc: Mr. George Robertson, Public Works Engineering, NAS Memphis (w/15 enclosures)
Mr. Charles H. Higgins, ERCE/EDGe Group (w/1 enclosure)
Ms. Cindy Lin, ERCE/EDGe Group (w/1 enclosure)
Mr. Dwight C. Flynn, ERCE/EDGe Group (w/0 enclosure)
Mr. Wayne McCoy, ERCE/EDGe Group (w/0 enclosure)

# FINAL DRAFT

# PRELIMINARY ASSESSMENT REPORTS FOR NAS MEMPHIS SITES NO. 10, 11, AND 12 NAS MEMPHIS MILLINGTON, TENNESSEE

Prepared For:
Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina
Contract No. N62467-88-C-0198

Prepared By:
ERC Environmental and Energy Services Co.
725 Pellissippi Parkway
P.O. Box 22879
Knoxville, Tennessee 37933

16 November 1989

FINAL DRAFT

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

# REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

| | |
|---|---|
| 1a. REPORT SECURITY CLASSIFICATION<br>Unclassified | 1b. RESTRICTIVE MARKINGS<br>None |
| 2a. SECURITY CLASSIFICATION AUTHORITY | 3. DISTRIBUTION/AVAILABILITY OF REPORT |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE<br>Not applicable | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S) | 5. MONITORING ORGANIZATION REPORT NUMBER(S) |
| 6a. NAME OF PERFORMING ORGANIZATION<br>ERC Environmental and Energy Services Co. — 6b. OFFICE SYMBOL (If applicable): ERCE | 7a. NAME OF MONITORING ORGANIZATION<br>SOUTHDIV NAVFACENGCOM |
| 6c. ADDRESS (City, State, and ZIP Code)<br>725 Pellissippi Parkway<br>Knoxville, TN 37933-0879 | 7b. ADDRESS (City, State, and ZIP Code)<br>2155 Eagle Drive/P.O. Box 10068<br>Charleston, SC 29411-0068 |
| 8a. NAME OF FUNDING/SPONSORING ORGANIZATION<br>See 7a. — 8b. OFFICE SYMBOL (If applicable) | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER<br>Contract No. N62467-88-C-0198 |
| 8c. ADDRESS (City, State, and ZIP Code)<br>See 7c. | 10. SOURCE OF FUNDING NUMBERS<br>PROGRAM ELEMENT NO. / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO. |
| 11. TITLE (Include Security Classification) | |
| 12. PERSONAL AUTHOR(S)<br>Bryson, Harry A.; Lin, Y.C.; Pucker, S. | |
| 13a. TYPE OF REPORT<br>Final Draft — 13b. TIME COVERED FROM 20 Jun89 TO 16 Nov89 | 14. DATE OF REPORT (Year, Month, Day)<br>16 November 1989 — 15. PAGE COUNT |
| 16. SUPPLEMENTARY NOTATION<br>None | |

| 17. COSATI CODES | | | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) |
|---|---|---|---|
| FIELD | GROUP | SUB-GROUP | NAS Memphis PA CRP<br>CERCLA RI/FS<br>RCRA RFI |
| | | | |
| | | | |

19. ABSTRACT (Continue on reverse if necessary and identify by block number)


This report contains a stand-alone Preliminary Assessments (PAs) for each of these sites at Naval Air Station (NAS) Memphis, Millington, Tennessee. These sites were identified as Sites No. 10, 11, and 12 in the NAS-wide RCRA Facility Assessment (RFA) report.

The US Navy plans to address these sites under CERCLA/SARA.


| | |
|---|---|
| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT<br>☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS | 21. ABSTRACT SECURITY CLASSIFICATION<br>Unclassified |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Robert Moser | 22b. TELEPHONE (Include Area Code)<br>(803) 743-0573 — 22c. OFFICE SYMBOL<br>Code 11519 |

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

S/N 0102-LF-014-6603 — Unclassified

FINAL DRAFT

# PRELIMINARY ASSESSMENT REPORT
# FOR
# NAS MEMPHIS SITE NO. 10
# NAS MEMPHIS
# MILLINGTON, TENNESSEE

Prepared For:
Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina
Contract No. N62467-88-C-0198

Prepared By:
ERC Environmental and Energy Services Co.
725 Pellissippi Parkway
P.O. Box 22879
Knoxville, Tennessee 37933

16 November 1989

FINAL DRAFT

## FOREWORD

This Preliminary Assessment (PA) Report was generated to provide documentation for NAS Memphis Site No. 10 as required by the rules and regulations implementing the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. This report is formatted per the current PA report outline preferred by the Tennessee Department of Health and Environment (TDHE) under the US Environmental Protection Agency (EPA) Region IV - State of Tennessee Preliminary Assessment/Site Inspection (PS/SI) Cooperative Agreement Program.

The PA report is the basic decision document for TDHE's use in deciding the disposition of a potentially contaminated site. Based on the content of the PA report, TDHE determines whether a site requires no further study, or whether an SI is warranted. Normally, an SI is warranted (1) if there is strong evidence, visual or otherwise, of site contamination, or (2) if available site information provided in the PA is insufficient to make a determination of site conditions.

A revised RCRA Facility Assessment (RFA) was prepared in August 1989 for sixty (60) sites at NAS Memphis that were tentatively identified as having potential for environmental contamination. Twelve of these sites (Sites No. 1 through 12) have been recommended by the Navy for further investigation under CERCLA. Plans for a Remedial Investigation/Feasibility Study (RI/FS) of Sites No. 1 through 9 are in progress. This site (Site No. 10) and Sites No. 11 and 12 have a low probability of contamination, and are being recommended by the Navy for removal from further consideration as potentially contaminated sites. This report and similar reports for Sites No. 11 and 12 were prepared to provide supporting documentation of site conditions.

Sites No. 13 through 60 are variously being recommended by the Navy for no further action, further investigation under RCRA, or inclusion in the Navy's UST program.

## TABLE OF CONTENTS


| | | PAGE |
|---|---|---|
| **FOREWORD** | | ii |
| **TABLE OF CONTENTS** | | iv |
| **LIST OF FIGURES AND EXHIBITS** | | vii |
| **GLOSSARY AND LIST OF ACRONYMS** | | viii |
| **1.0** | **INTRODUCTION** | 1 |
| 1.1 | PHYSICAL SETTING | 1 |
| 1.2 | MISSIONS OF NAVAL AIR STATION MEMPHIS ORGANIZATIONS | 1 |
| **2.0** | **SITE CHARACTERIZATION** | 9 |
| 2.1 | SITE BACKGROUND AND HISTORY | 9 |
| 2.1.1 | Ownership History | 9 |
| 2.1.2 | Regulatory History | 10 |
| 2.1.3 | Process and Waste Disposal History | 13 |
| 2.2 | SITE DESCRIPTION | 13 |
| 2.2.1 | Site Features and Layout | 13 |
| 2.2.2 | Accessibility | 15 |
| 2.2.3 | Waste Characteristics | 16 |
| 2.3 | ENVIRONMENTAL/REGIONAL SETTING | 16 |
| 2.3.1 | Demography | 16 |
| 2.3.2 | Land Use | 16 |
| 2.3.3 | Sensitive Environments | 19 |
| 2.4 | HYDROLOGY | 19 |
| 2.4.1 | Climatology | 19 |
| 2.4.2 | Overland Drainage | 22 |

**TABLE OF CONTENTS**
**(continued)**


| | | PAGE |
|---|---|---|
| 2.4.3 | Potentially Affected Water Bodies | 24 |
| 2.5 | REGIONAL AQUIFER CHARACTERISTICS | 24 |
| 2.5.1 | Aquifer Description | 24 |
| 2.5.2 | Aquifer Use | 28 |
| **3.0** | **TARGET ANALYSIS - POTENTIALLY AFFECTED POPULATIONS** | 29 |
| 3.1 | SURFACE WATER PATHWAY | 29 |
| 3.2 | GROUNDWATER PATHWAY | 29 |
| 3.3 | AIR PATHWAY | 30 |
| 3.4 | ONSITE EXPOSURE | 30 |
| **4.0** | **SUMMARY** | 31 |
| 4.1 | SUMMARY OF FIELD INVESTIGATION RESULTS TO DATE | 31 |
| 4.2 | SUMMARY OF POTENTIALLY AFFECTED TARGETS SURVEY | 31 |
| 4.3 | CONCLUSIONS AND RECOMMENDATIONS | 31 |
| 4.3.1 | Conclusions | 31 |
| 4.3.2 | Recommendations | 31 |
| 4.4 | DATA SOURCE LIST | 32 |
| 4.4.1 | Reports | 32 |
| 4.4.2 | Letters and Memoranda | 32 |
| REFERENCES | | 34 |
| BIBLIOGRAPHY | | 35 |

**TABLE OF CONTENTS**
**(continued)**

APPENDIX A - Topographic Maps

APPENDIX B - Geologic Maps

APPENDIX C - Site Photographs

APPENDIX D - Preliminary Assessment Report Form

APPENDIX E - Site Screening Analysis: Hazard Ranking System (HRS 1) Preliminary and Projected Scores

## LIST OF FIGURES AND EXHIBITS


| FIGURE NO. | TITLE | PAGE |
|---|---|---|
| 1-1 | Location Map - NAS Memphis | 2 |
| 1-2 | NAS Memphis and Vicinity | 3 |
| 1-3 | NAS Memphis Map | 4 |
| 2-1 | Site Features - Site No. 10 | 14 |
| 2-3 | Wind Rose - NAS Memphis | 23 |
| 2-4 | Generalized Geologic Column | 26 |
| 2-5 | Geologic Cross-Section of the Uppermost Surficial Sediments | 27 |

| EXHIBIT NO. | TILE | PAGE |
|---|---|---|
| 2-1 | Memphis, Tennessee Local Climatological Data | 20 |
| 2-2 | NAS Memphis Station Climatic Data Summary | 21 |

## GLOSSARY AND LIST OF ACRONYMS

**ARAR** - applicable or relevant and appropriate requirements.

**Bench scale** - Treatability tests performed on a small scale, usually in a laboratory, to better define parameters of a treatment technology.

**CAA** - Clean Air Act.

**CERCLA** - Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

**CRP** - Community Relations Plan.

**CWA** - Clean Water Act.

**DOD** - Department of Defense.

**DQO** - Data quality objectives: Statements that specify the data needed to support decisions regarding remedial response activities.

**ESI** - Expanded Site Inspection.

**Excess lifetime cancer risk** - The potential for cargiongenic effects from exposure to one or more chemicals.

**FS** - Feasibility Study.

**General Response Action** - General types of action, such as containment, that may be taken to achieve exposure limits specified by remedial action objectives.

**GAC** - Granular activated carbon; used for absorption of organic contaminants and trace heavy metals.

**Galley** - Navy term for kitchen and cooking apparatus. Expanded to include entire food service facility (dining hall or mess hall).

**HRS** - Hazard Ranking System, Appendix A of the NCP.

**HRS Score** - Total migration route score ($S_M$) calculated for use of the HRS.

**Innovative technologies** - Technologies that are fully developed but lack sufficient cost or performance data for routine use at CERCLA sites.

**Lead agency** - The agency, either the EPA, Federal agency, or appropriate State agency having primary responsibility and authority for planning and executing the remediation at a site.

**MCL** - Maximum contaminant level: Established under the Safe Drinking Water Act.

**MCLG** - Maximum contaminant level goal: Established under the Safe Drinking Water Act.

**NAAQS** - National Ambient Air Quality Standards.

**NAS** - Naval Air Station

**NCP** - National Oil and Hazardous Substances Contingency Plan.

**NEPA** - National Environmental Policy Act of 1969, as amended.

**NPDES** - National Pollutant Discharge Elimination System.

**NPL** - National Priorities List, Appendix B of the NCP.

**O&M** - Operation and Maintenance.

**OSHA** - Occupational Safety and Health Administration.

**OSWER** - Office of Solid Waste and Emergency Response (USEPA).

**Operable Unit** - A discrete action that comprises an incremental step(s) toward a final remedy. Operable units may address geographic portions of a site, specific site problems, or this initial phase of an action.

**PA** - Public Affairs.

**PAO** - Public Affairs Office, Public Affairs Officer.

**PA/SI** - Preliminary Assessment/Site Inspection.

**Pilot scale** - Treatability tests performed on a large scale to simulate the physical, as well as chemical, parameters of a process.

**POTW** - Publicly owned treatment works, as defined by US Environmental Protection Agency at 40 CFR 122 (see STP).

**Present Worth Analysis** - A summary of costs to be incurred over a period of time, discounted to the present.

**PRD** - Preliminary Review Document.

**Rating Value** - Rating factor numeral assigned in using the HRS.

**RCRA** - Resource Conservation and Recovery Act.

**RD/RA** - Remedial Design/Remedial Action.

**RD** - Remedial design.

**Remedial Action Alternatives** - A potential approach to preventing or mitigating site-specific contamination problems, defined in terms of a remedial action technology option or combination of options and the volumes or areas of media to which the option or options will be applied.

**Remedial action objective** - A description of remedial goals for each medium of concern at a site; expressed in terms of the contamination of concern exposure route(s) and receptor(s), and maximum acceptable exposure level(s).

**Remedial action technology type (or technology type)** - A general category encompassing a number of remedial action technology options that address a similar problem (e.g., capping, contaminant barriers, chemical treatment).

**Remedial action technology process option (or process option)** - A specific process, system, or action that may be used to clean up or mitigate contaminant problems (e.g., clay cap, slurry wall, neutralization).

**RI/FS** - Remedial investigation/feasibility study.

**ROD** - Record of Decision: Documents selection of cost-effective Superfund -financed remedy.

**SARA** - Superfund Amendments and Reauthorization Act of 1986. (See CERCLA).

**SDWA** - Safe Drinking Water Act.

**Sensitivity Analysis** - A test of a procedure to determine the overall changes that will result from any small change in one or more procedural elements.

**$S_M$** - Total migration route score calculated from use of the HRS (also called HRS score or migration score). Incorporates groundwater, surface water, and air route scores.

**STP** - Sewage Treatment Plant; may or may not be publicly owned (See POTW).

**SOUTHDIV** - Southern Division (NAVFACENGCOM).

**Support Agency** - The agency, either the Federal EPA or the State agency, responsible for review and concurrence in developing and selecting a remedy at a CERCLA site.

**SWDA** - Solid Waste Disposal Act.

**SWMU** - Solid Waste Management Unit.
TCL - Target compound list.

**TDHE** - Tennessee Department of Health and Environment.

**Technology process option** - See remedial action technology process option.

**TSCA** - Toxic Substances Control Act.

**Treatability studies** - Studies performed to better define the physical and chemical parameters of technology process options being evaluated.

**USACE** - US Army Corps of Engineers.

**USATHAMA** - US Army Toxic and Hazardous Materials Agency.

**USMCR** - US Marine Corps Reserve.

**USN** - US Navy.

**USNR** - US Navy Reserve.

**UST** - Underground Storage Tank.

# 1.0 INTRODUCTION

## 1.1 PHYSICAL SETTING

Naval Air Station (NAS) Memphis is located approximately 16 miles north-northeast of Memphis, Tennessee in the City of Millington. The Air Station is situated in the north central portion of Shelby County; it is the westernmost county of Tennessee which borders on the Mississippi River. Shelby County is part of a six county, three state regional planning organization called the Mississippi-Arkansas-Tennessee Council of Governments/Memphis Delta Development District (MATCOG/MDDD). Figures 1-1 and 1-2 illustrate the location of the Air Station in its regional setting. The City of Millington, located west of and adjacent to the Air Station, is the most dominant feature in the immediate vicinity of NAS Memphis. Figure 1-3 is a map of NAS Memphis.

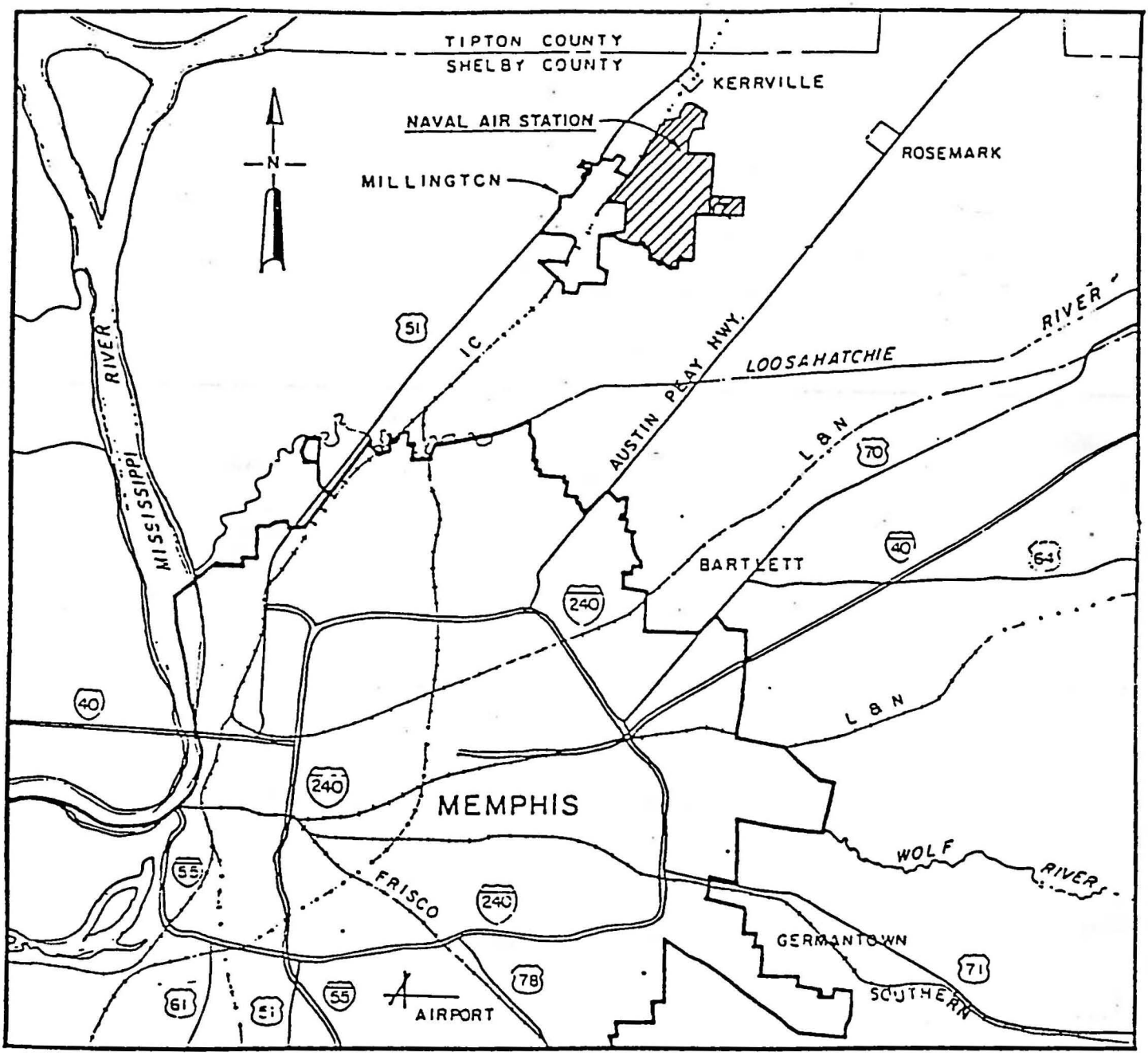
North of the Air Station, the land if primarily agricultural with some residential development found along the roadways. The small town of Kerrville is located north of the facility. To the east, the land is almost entirely in agricultural production. The Casper Creek Park is located east of the northern most portion of the Air Station. South of NAS Memphis the land is primarily agricultural with some scattered residential development found in recently completed subdivisions.

## 1.2 MISSIONS OF NAVAL AIR STATION MEMPHIS ORGANIZATIONS

The following is a brief description of the missions of the major organizations operating at NAS Memphis (AICUZ, 1981; ERCE, 1989).

<u>Naval Air Station</u>

The Naval Air Station provides maintenance, operates facilities, provides services and material to support operations of aviation




0 1 2 3 4 MILES
SCALE

FIGURE 1-1. LOCATION MAP - NAS MEMPHIS

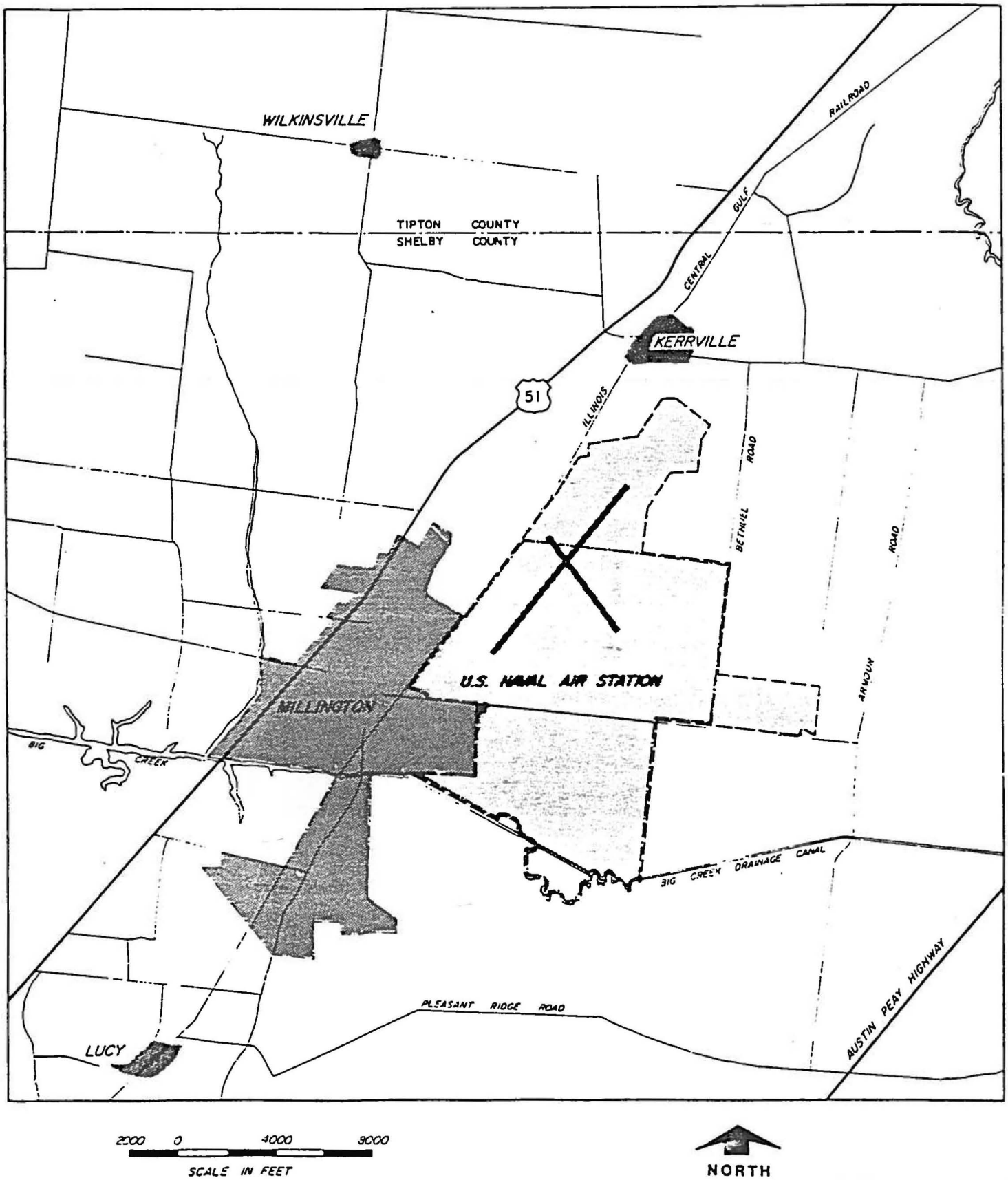



FIGURE 1-2. NAS MEMPHIS AND VICINITY

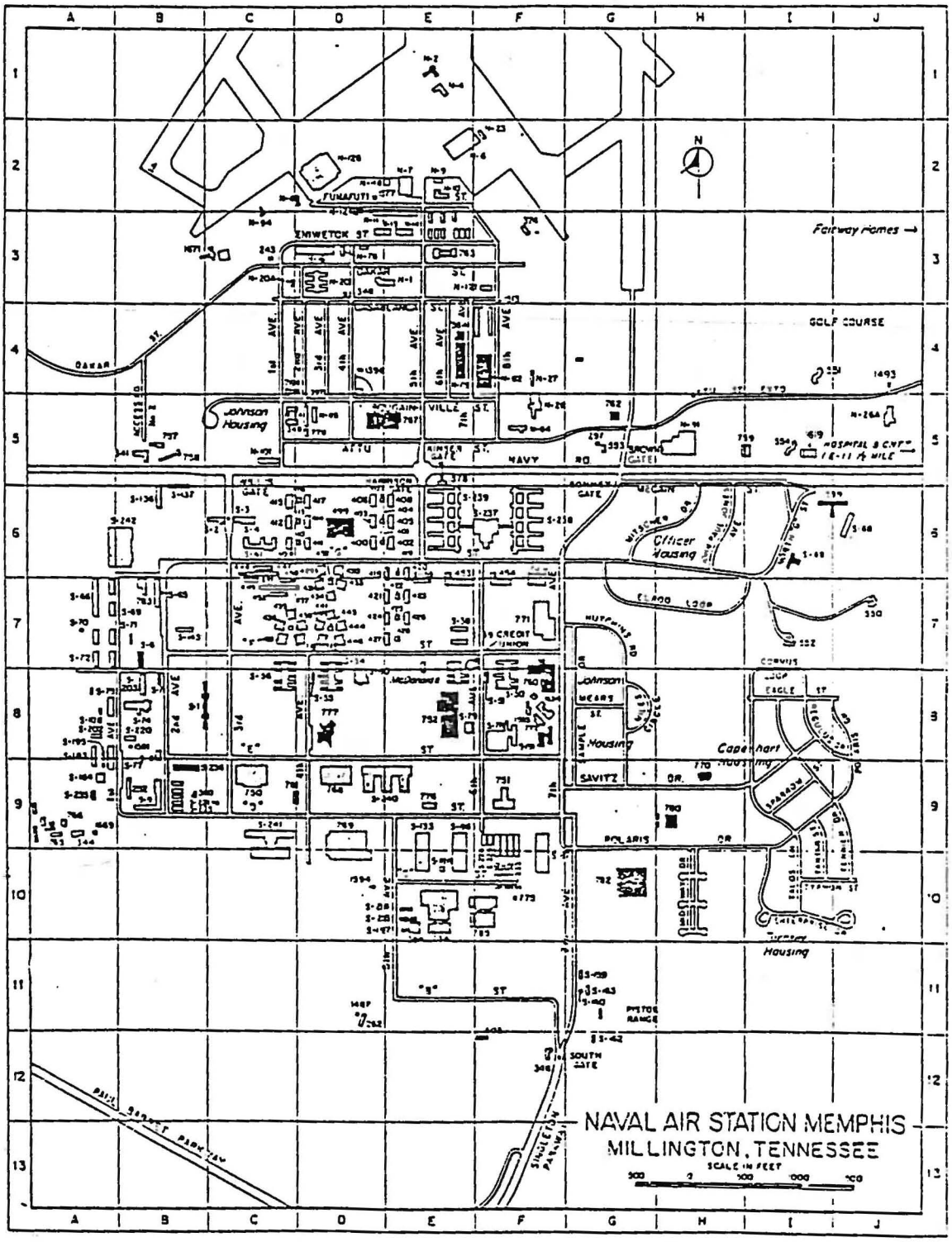



FIGURE 1-3. NAS MEMPHIS MAP

activities and units of the Naval Education and Training Command, and to Naval Hospital Millington and other activities as designated by the Chief of Naval Operations.

Naval Hospital Millington

Naval Hospital Millington provides clinical and hospitalization services for active duty military, and, where facilities and staff capability permit, to other persons as authorized in Title 10 of the United States Code (USC) on a "not-to-interfere" basis. The Center also coordinates clinical health care services to assigned medical treatment facilities, participates as an integral element of Naval and Tri-Service Regional Health Care Systems, and cooperates with military and civil authorities in public health, disaster recovery or other emergencies.

The Naval Education and Training Command, Management Information and Instructional System Activity (MIISA) Detachment, Memphis

The MIISA detachment provides automatic data processing services to activities designated by the Chief of Naval Education and Training.

Marine Aviation Training Support Group - 90 (MATSG-90)

The MATSG-90 provides administrative and logistical support for assigned Marine Corps personnel and performs other tasks and functions as directed by the Commandant of the Marine Corps.

Chief of Naval Technical Training (CNTECHTRA)

The CNTECHTRA coordinates and directs Navy recruit and technical training, Marine Corps Aviation Technical Training, and other training as directed to be undertaken at activities under the Chief of Naval Technical Training.

Naval Legal Service Office (NAVLEGSVOFF)

The NAVLEGSVOFF provides necessary legal services and counsel within an assigned geographical area, and performs other functions

or tasks as directed by competent authority.

Naval Air Technical Training Center (NATTC)
The NATTC trains aviation personnel in the technical phases of Naval aviation and related subjects as directed by the Chief of Naval Operations.

Naval Air Reserve Memphis (NAVAIRES)
The NAVAIRES trains individuals for mobilization assignments, directs and coordinates procurement for the Aviation Air Reserve Force, furnishes logistic support for the Marine Air Reserve Training Command and performs other functions as directed by the Chief of Naval Operations.

Navy Campus for Achievement (NCFA)
The NCFA manages the NAS Memphis off-duty Education Program for NAS Memphis personnel.

Naval Investigation Service Office (NAVINSERVO)
The NAVINSERVO provides investigative and courier intelligence support to area commands.

Aviation Intermediate Maintenance Department (AIMD)
The AIMD performs intermediate and organizational maintenance for assigned aircraft and tenant squadrons including related equipment and materials.

Naval Reserve Readiness Command Nine (NAVRESREDCOMNINE)
NAVRESREDCOMNINE is assigned to Naval Reserve activities and units to direct their prescribed programs to assure mobilization readiness and act as a field manager for CNAVRES for assigned resources.

Navy Exchange (NEX)
The NEX provides a convenient and reliable source from which

authorized patrons may obtain, at the lowest practicable cost, articles and services required for their well-being and contentment; to provide through profits, a source of funds to be used for the Welfare and Recreation of Naval Personnel; and to promote the morale of the Command in which it is established through the operation of a well-managed, attractive and serviceable Exchange.

National Weather Service Environmental Detachment (NWSED)

The NWSED collects, plots, analyzes and disseminates weather data, making maximum use of processed weather briefings to pilots and keeps the Air Operations Officer as well as the CO's of all tenants informed of impending weather conditions.

Naval Construction Battalion Unit 404 (NCBU-404)

The NCBU-404 conducts training, provides habitability of facilities, and supports Naval Reserve Forces.

Naval Air Maintenance Training Group (MAMTG)

The MAMTGs primary mission is to provide, by means of detachments, technical instruction for officer and enlisted personnel in the maintenance of aircraft weapons systems and associated equipment, aviation support equipment, maintenance administration, and other training.

Marine Air Reserve Training Detachment (MARTD)

The MARTD's primary mission is to coordinate, supervise and support the accomplishment of requisite training for attached Marine Corps Reserve Units and personnel; and to supervise pre-mobilization, planning and logistic functions to insure orderly mobilization within time and readiness levels prescribed by current plans.

Navy Commissary Store (NAVCOMSYSTO)

The primary mission of NAVCOMSYSTO is to provide a convenient and reliable source from which authorized patrons may obtain foodstuffs

and other authorized items at the lowest practicable cost.

# 2.0 SITE CHARACTERIZATION

NAS Memphis is a 3,490-acre facility located in Millington, Tennessee, approximately twenty miles northeast of the City of Memphis and thirteen miles east of the Mississippi River. The facility is bordered on the west and south by the City of Millington and the north and east by agricultural and residential areas. The general location is shown on Figure 1-1.

## 2.1 SITE BACKGROUND AND HISTORY

### 2.1.1 Ownership History

Since it was commissioned in 1942, the mission of the NAS has been to provide services and material to support operations of aviation activities, units of the Naval Education and Training Command and other activities and units as designated by the Chief of Naval Operations (CNO). Naval Hospital Millington is located adjacent to the NAS and is part of the entire installation.

During World I, the U.S. Army constructed Park Field, a military aviation training facility. Between the World Wars, the site was used for approximately eight years as a civilian airfield and, beginning in 1929, as a government-supported agricultural research facility.

The Memphis Naval Air Station was originally conceived in 1942 on the site of Park Field, a US Army installation which was the first aviation facility in Shelby County, Tennessee. The mission of Park Field was as an Army Signal Corps Aviation School intended as a training center for pilots and ground crews for service with the Allied Forces during World War I. Park Field consisted of 912.5 acres, all of which was situated south of the present alignment of Millington-Arlington (Navy) Road, Tennessee Highway 205 (TN Hwy 205).

On September 15, 1942, the facility was commissioned as a Naval Reserve Air Base (NRAB) with the principal mission of training aviation cadets to pilot proficiency for action in World War II. On January 1, 1943, the official designation of the facility was changed to a Naval Air Station (NAS). When the war ended, the northside of NAS Memphis was assigned to the Reserve Training Command and was almost exclusively used for reserve training until 1948.

Currently, the Air Station encompasses an area of approximately 3,400 acres with some 980 buildings located on both sides on Navy Road, which makes NAS Memphis the largest inland naval station. NAS Memphis maintains and operates facilities and provides services and material to support operations of aviation activities and units of the Naval Education and Training Command and other activities and units as designated by the Chief of Naval Operations. This role is carried out with approximately 2,000 civilian and military personnel. Additionally, NAS Memphis serves as an essential refueling stop for transient aircraft.

With twenty-three resident commands at NAS Memphis, the facility functions as a self-contained city, including housing, food services, entertainment facilities and utilities. Today, NAS Memphis Naval tenants include Chief of Naval Technical Training (CNTECHTRA), Naval Air Technical Training Center, Naval Air Maintenance Training Group, Marine Aviation Training Support Group-90, Marine Aircraft Group-42 Detachment B, Patrol Squadron VP-67, Fleet Logistic Support Squadron VR-60, and Naval Construction Battalion Unit CBU-404.

### 2.1.2 Regulatory History

The following is a brief description of the regulatory history of NAS Memphis and Site No. 10 with respect to state and federal environmental laws, rules, and regulations.

2.1.2.1 Federal Regulatory History

Federal regulatory history for protection and enhancement of the environment and protection of the public health deals primarily with the following issues:

- Solid Waste Management, both hazardous and non-hazardous.
- Surface water protection/non-degradation.
- Groundwater protection/non-degradation.
- Management of fuels and other chemicals.
- Air quality.
- Noise (aircraft operation).

The Department of Defense (DOD) initiated the Defense Environmental Restoration Program (DERP) activities in 1976, the same year the Resource Conservation and Recovery Act (RCRA) was passed. DERP was given a federal statutory basis with the passage of SARA in 1986. Section 120 of SARA codified the DERP as 10 USC 160. As a part of DERP, the Defense Environmental Restoration Account (DERA) was formally established to provide for dedicated DERP funding. Additional capability for addressing sites formerly owned by DOD was provided by the 1984 Defense Authorization Act.

By 1978, the Services (Army, Navy [Marines], and Air Force) had developed programs to identify and assess problems or active military installations. The DOD and EPA signed a Memorandum of Understanding (MOU) on responsibilities under CERCLA on 12 August 1983. At this time, the US Navy had already begun work to assess environmental conditions at naval installations under a formal Installation Restoration Program (IRP). The IRP has two objectives:

- To identify and evaluate past hazardous material disposal sites on DOD facilities and control contamination migration that present a hazard to health or welfare.

- To review and decontaminate, as necessary, land and facilities determined to be in excess of DOD requirements.

Because this IRP proceeded CERCLA and subsequent EPA regulations, the IRP process and procedures were similar but not exactly analogous to the procedural steps required by the NCP. Current IRP guidance is coordinated with the NCP to provide the same procedural steps (PA/SI, RI/FS, RD/RA) for CERCLA work.

The DERP currently consists of three programs:

- The IRP (CERCLA/SARA Compliance)
- Hazardous Waste Management (RCRA Compliance), and
- Building demolition and debris removal (solid waste compliance).

The IRP initially provided for a four-phase process:

- Phase I - Initial Assessment
- Phase II - Confirmation Study
- Phase III - Technology Development
- Phase IV - Remedial Action

EPA Regulation

The EPA issued a partial RCRA permit to the NAS on 15 September 1988. The partial permit required the NAS to investigate past and current solid waste management units at the NAS, and to prepare a report of the findings. This partial permit, issued under the HSWA provisions, and permits issued to the NAS by TDHE for hazardous waste storage completed the RCRA permit.

2.1.2.2 State of Tennessee Regulatory History

State regulatory history regarding NAS Memphis is concerned chiefly with wastewater treatment plants and sanitary and/or industrial

waste landfills. In past times, the NAS operated wastewater treatment facilities on both the north and south sides. Neither of these former facilities exist at present. NAS wastewater is discharged to the City of Millington plant. The only NPDES permit currently held by the NAS is for operation of six oil/water separators.

At various times, NAS Memphis utilized several landfills for various purposes. These facilities, including Site No. 10, were identified in the NAS-wide RFA. Site 10 is currently being redeveloped under TDHE supervision. Work includes leveling and addition of topsoil from work in progress in the NAS housing area. Asphalt and concrete rubble will be left in place. Any other waste materials discovered during site work will be removed for proper disposal in an appropriate permitted disposal facility.

### 2.1.3 Process and Waste Disposal History

It is reported that the area was originally a ravine used for the disposal of construction debris. The only documented description of waste disposal at this site is found in several 1980 contract documents which require contractors to use the area for disposal of rubbish and debris material, i.e., construction materials, paper, metal scrap, ashes, leaves, bones.

NOTE: Site 10 is being built up by addition of "clean" topsoil from the NAS housing area. The site will be regraded to drain to the north.

## 2.2 SITE DESCRIPTION

### 2.2.1 Site Features and Layout

The site is a former construction/demolition landfill. Figure 2-1 shows basic site features.

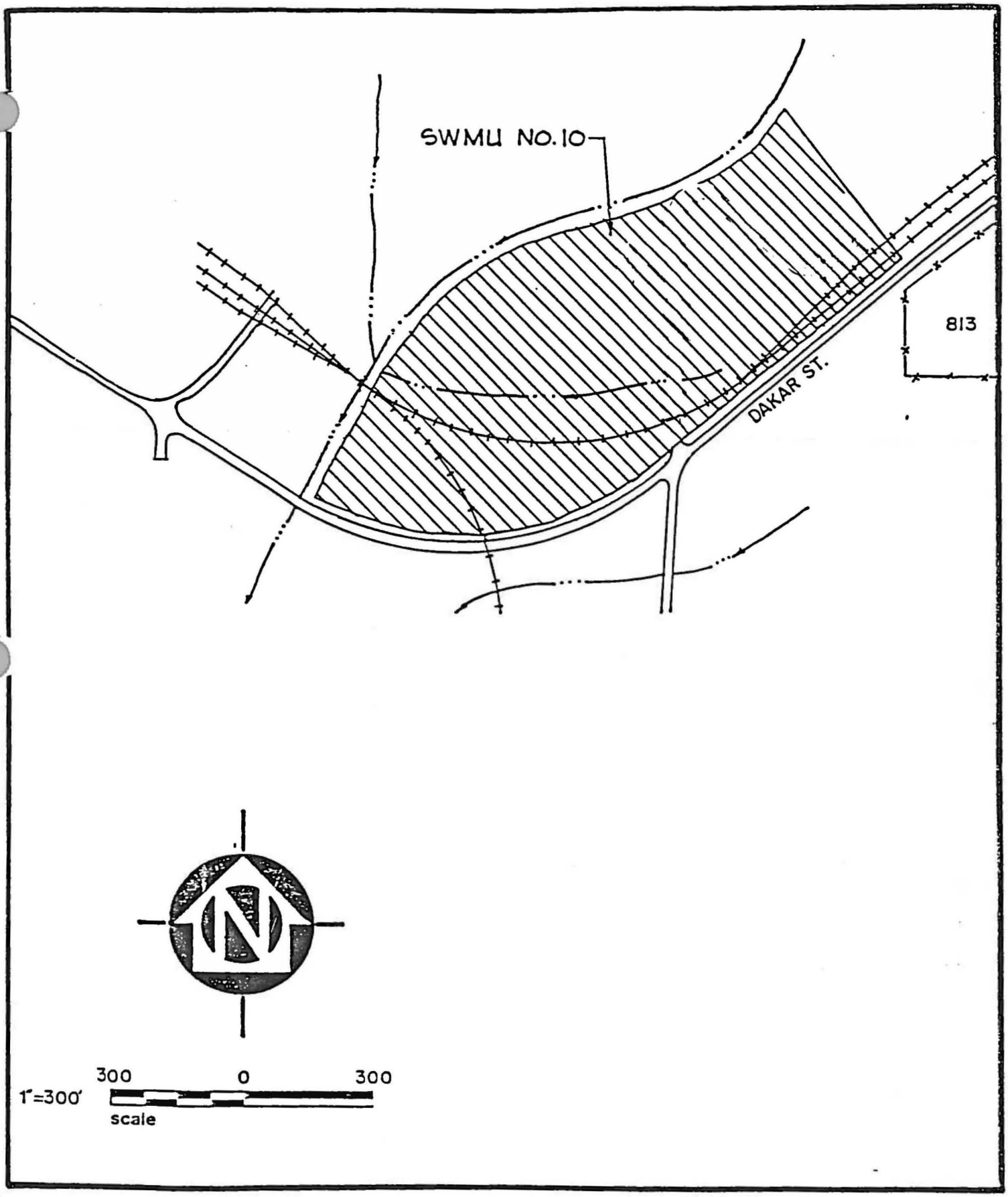



FIGURE 2-1. DEMOLITION DEBRIS LANDFILL

2.2.1.1 Size and Layout

The areal extent of Site 10 is approximately 13 acres. Depth is shallow, but not precisely known. The facility was used as a shallow landfill/open dump for largely inert building material.

2.2.1.2 Buildings and Roads

Buildings. There are no buildings on site.

Roads. There are no on site roads. Site access is via Dakar Road an NAS road.

2.2.1.3 Drainage

Site drainage is being redeveloped at time of report preparation. The site will be regraded to drain to the north, thence to the drainage ditch that forms the western boundary of the site.

2.2.1.4 Onsite Sampling Location

There are no established sampling locations on the site for any medium.

2.2.1.5 Onsite Well Location

There are no on site wells.

2.2.1.6 Disposal Areas

The entire site was used for rubble disposal.

2.2.2 Site Accessibility

The site boundary is readily accessible via Dakar Street. Accessibility into the site interior was until recently hindered by vegetation and standing water or saturated surface soil during rainy periods. A railroad track transverses the western corner of the site (See Figure 2-1).

### 2.2.3 Waste Characteristics

#### 2.2.3.1 Waste Types

Wastes consisted of construction and demolition waste and rubble from NAS construction activities.

#### 2.2.3.2 Disposal Methods

Wastes were disposed of by dumping and/or shallow burial. It is unlikely that wastes were buried more than 10 feet below original grade. It is reported that a ravine formerly existed at the site, and was filled during site operation.

## 2.3 ENVIRONMENTAL/REGIONAL SETTINGS

### 2.3.1 Demography

The following demographic information was taken from the 1981 Air Installation Compatible Use Zone report (AICUZ, 1981). In general, the NAS and vicinity would be considered urban. Site No. 10 is not located near schools, kindergartens, or day care centers.

### 2.3.2 Land Use

NAS Memphis is located in a predominately agricultural area, just outside the current Memphis metropolitan area. Land uses in these rural lands consist of low density residential uses, churches, schools, occasional commercial buildings, predominantly food and variety stores used by local residents. Adjacent to NAS Memphis on the west and southwest is the community of Millington. This small, primarily residential community is contiguous with the Air Station. Community housing is generally single family residential on small to medium-sized lots with some high density apartment areas and trailer parks. It also has extensive commercial development, almost all of this along the town's two main streets, Route 51 and Navy Road. Industrial uses are minor and generally oriented toward the railroad line which runs along the Air Station's western boundary. Millington also has a large and well

maintained school system along with numerous churches.

Millington is generally a well kept community with only minor and infrequent areas of substandard housing. Opportunities for urban redevelopment are almost non-existent. Millington is strongly oriented toward NAS Memphis in terms of its economy, it politics, its social and cultural activities and its governance, as well as in its geographical and land use patterns. Thus many of the conflicts often characteristic of airport communities are entirely absent. The harmonious and mutually supportive relationship between the Air Station and the community strongly affects the pattern of land use and of public decision making generally.

All of the land around NAS Memphis is zoned. Agricultural zoning predominates in all rural areas to the north of the airfield with the exception of a small area of residential zoning around the village of Kerrville. Within Millington to the west, residential use predominates with small areas of commercial zones around the major thoroughfares. Significant areas of industrial zoning occur along the Illinois Central rail line to the west and south. Additionally significant areas of residentially zoned land occurs on the South and to the east of the Air Station. Both the Shelby County and the Millington Zoning Ordinances are relatively thorough and up to date.

Tall structures are regulated in both Millington and in Shelby County. Additionally, the Shelby County Ordinance includes airport zoning based on the appropriate navigational surfaces.

Development Trends

The pace and distribution of development in any city or regional area are governed by a variety of factors. Among these are local zoning and development policies, the availability of financing and urban services; the land itself and its characteristics; its location; and finally the nature of the demand itself including

family size, income characteristics, and individual subjective preferences. The following text reviews the strongest of these forces in order of importance.

Shelby County and the areas around NAS Memphis are expected to experience substantial growth over the coming two decades. Past growth for Shelby County has exceeded both the overall growth rate for the State of Tennessee and of the United States as a whole. A ten year growth rate of 16.5 percent is forecast for the next two decades. While must of this additional population can be expected to locate within the City of Memphis, a substantial fraction will be in the NAS Memphis vicinity. The primary attractions are the availability of land and city services; improved transportation; and, to a lesser extent, the activity at NAS Memphis itself.

2.3.2.1 Commercial/Industrial/Institutional

Commercial, industrial, and institutional facilities are located within one mile of Site 10, principally along Navy Road (TN Hwy 205), approximately 1/4 mile south of the site.

2.3.2.2 Single or Multi-family Residential

Single and multi-family residences are located within one mile of Site 10, principally along Navy Road (TN Hwy 205), approximately 1/4 mile south of the site.

2.3.2.3 Parks

The nearest park is Casper Creek Park, located approximately 3 miles northeast of Site No. 10. Meeman-Shelby Forest State Park is approximately 10 miles west of the NAS.

2.3.2.4 Agricultural

Land use to the north, east, and south of the NAS is largely agricultural. A portion of adjacent Site No. 60 and other nearby locations on the NAS northside is currently being cultivated (soybeans).

### 2.3.3 Sensitive Environment

#### 2.3.3.1 Sensitive Environments Within 4-mile Radius of NAS Memphis

There are no known sensitive environments within a four-mile radius of NAS Memphis.

#### 2.3.3.2 Sensitive Environments Along Surface Water Migration Pathways

There are no known sensitive environments along surface water migration pathways from Site 10.

## 2.4 HYDROLOGY

### 2.4.1 Climatology

Exhibits 2-1 and 2-2 are is climatic data summaries for the Memphis, Tennessee, area and NAS Memphis, respectively. The climate at NAS Memphis is characterized by warm summers and cool moderate winters. Extreme temperatures are rare with only about 66 days per year with maximum temperatures over 90 degrees and only 57 days with minimum temperature under 32 degrees. The average annual temperature is 61.9°F. The hottest month is July with an average temperature of 81.4° and the coldest month is January with an average temperature of 40.6°.

Precipitation at NAS Memphis is heaviest in the winter and early spring as numerous low pressure systems move through the area. Precipitation during the spring and early summer is more localized and related to thunderstorms of short duration. Annual average precipitation at NAS Memphis is approximately 49 inches.

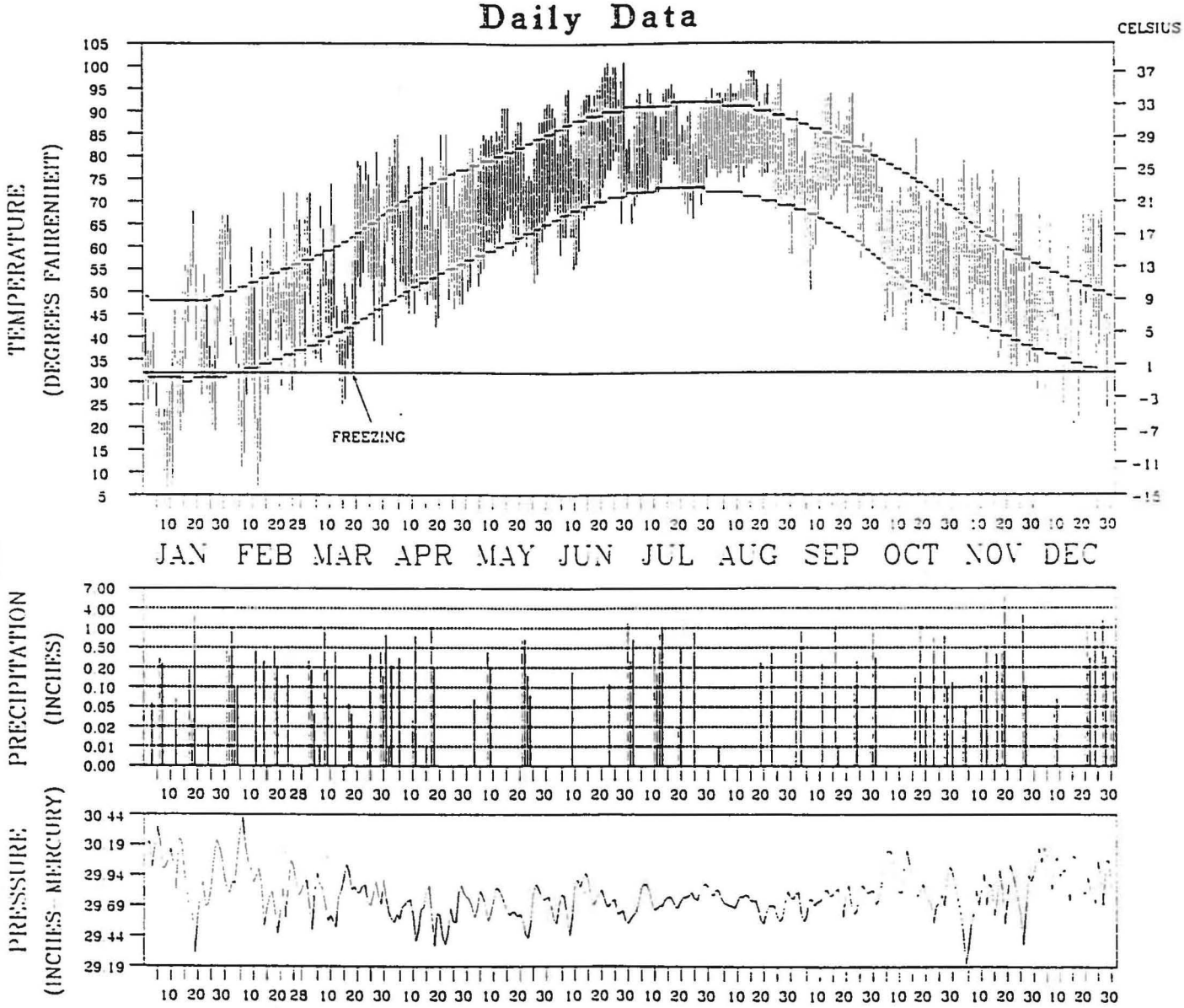
Snowstorms in the Memphis area occur infrequently with an average annual snowfall of approximately four inches. Freezing rain and ice storms occur once or twice each year.

EXHIBIT 2-1. MEMPHIS, TENNESSEE LOCAL CLIMATOLOGICAL DATA

ISSN 0198-4829

# 1988 LOCAL CLIMATOLOGICAL DATA
## ANNUAL SUMMARY WITH COMPARATIVE DATA
## MEMPHIS, TENNESSEE

### Daily Data




TEMPERATURE DEPICTS NORMAL MAXIMUM, NORMAL MINIMUM AND ACTUAL DAILY HIGH AND LOW VALUES (FAHRENHEIT)
PRECIPITATION IS MEASURED IN INCHES. SCALE IS NON-LINEAR
STATION PRESSURE IS MEASURED IN INCHES OF MERCURY

I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND IS COMPILED FROM RECORDS ON FILE AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE, NORTH CAROLINA, 28801

noaa

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE

NATIONAL CLIMATIC DATA CENTER ASHEVILLE NORTH CAROLINA

DIRECTOR
NATIONAL CLIMATIC DATA CENTER

# METEOROLOGICAL DATA FOR 1988

MEMPHIS, TENNESSEE

LATITUDE: 35°03' N LONGITUDE: 90°00' W ELEVATION: FT. GRND 258 BARO 271 TIME ZONE: CENTRAL WBAN: 13893

| | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TEMPERATURE °F:** | | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | |
| -Daily Maximum | 44.6 | 52.9 | 62.9 | 74.1 | 83.9 | 92.4 | 90.0 | 93.3 | 85.6 | 69.1 | 65.5 | 54.4 | 72.4 |
| -Daily Minimum | 29.0 | 31.4 | 41.7 | 51.5 | 59.6 | 68.2 | 73.1 | 74.1 | 67.0 | 49.1 | 43.7 | 35.3 | 52.0 |
| -Monthly | 36.8 | 42.2 | 52.3 | 62.8 | 71.8 | 80.3 | 81.6 | 83.7 | 76.3 | 59.1 | 54.6 | 44.9 | 62.2 |
| -Monthly Dewpt. | 25.9 | 29.2 | 38.1 | 46.4 | 53.5 | 58.5 | 70.8 | 70.7 | 65.5 | 45.7 | 44.1 | 32.7 | 48.4 |
| Extremes | | | | | | | | | | | | | |
| -Highest | 68 | 72 | 81 | 85 | 92 | 101 | 96 | 99 | 94 | 84 | 79 | 68 | 101 |
| -Date | 19 | 27 | 29 | 23 | 31 | 29 | 17 | 17 | 23 | 17 | 4 | 27 | JUN 29 |
| -Lowest | 6 | 6 | 25 | 42 | 50 | 55 | 65 | 58 | 50 | 40 | 33 | 20 | 6 |
| -Date | 9 | 12 | 15 | 19 | 1 | 10 | 2 | 31 | 7 | 31 | 28 | 16 | FEB 12 |
| **DEGREE DAYS BASE 65 °F:** | | | | | | | | | | | | | |
| Heating | 367 | 657 | 393 | 108 | 0 | 0 | 0 | 0 | 1 | 202 | 314 | 619 | 3161 |
| Cooling | 0 | 0 | 7 | 52 | 221 | 469 | 518 | 586 | 347 | 24 | 8 | 0 | 2232 |
| **% OF POSSIBLE SUNSHINE** | | | | | | | | | | | | | |
| **AVG. SKY COVER (tenths)** | | | | | | | | | | | | | |
| Sunrise - Sunset | 6.5 | 5.4 | 5.5 | 5.1 | 4.1 | 3.7 | 6.7 | 4.7 | 5.5 | 4.8 | 4.8 | 4.9 | 5.1 |
| Midnight - Midnight | 5.7 | 4.7 | 5.3 | 4.9 | 3.6 | 3.1 | 5.8 | 3.9 | 4.9 | 4.3 | 4.5 | 4.9 | 4.6 |
| **NUMBER OF DAYS:** | | | | | | | | | | | | | |
| Sunrise to Sunset | | | | | | | | | | | | | |
| -Clear | 9 | 11 | 13 | 12 | 14 | 16 | 7 | 13 | 10 | 13 | 13 | 17 | 148 |
| -Partly Cloudy | 5 | 7 | 3 | 6 | 11 | 7 | 9 | 12 | 10 | 9 | 6 | 1 | 86 |
| -Cloudy | 17 | 11 | 15 | 12 | 6 | 7 | 15 | 6 | 10 | 9 | 11 | 13 | 132 |
| Precipitation .01 inches or more | 9 | 9 | 14 | 8 | 7 | 3 | 9 | 3 | 9 | 8 | 9 | 10 | 98 |
| Snow, Ice pellets 1.0 inches or more | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Thunderstorms | 2 | 1 | 3 | 4 | 6 | 3 | 10 | 6 | 4 | 5 | 4 | 2 | 50 |
| Heavy Fog, visibility 1/4 mile or less | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 10 |
| Temperature °F | | | | | | | | | | | | | |
| -Maximum | | | | | | | | | | | | | |
| 90° and above | 0 | 0 | 0 | 0 | 5 | 23 | 18 | 27 | 9 | 0 | 0 | 0 | 82 |
| 32° and below | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| -Minimum | | | | | | | | | | | | | |
| 32° and below | 21 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 53 |
| 0° and below | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **AVG. STATION PRESS. (mb)** | 1014.6 | 1011.9 | 1008.5 | 1003.4 | 1005.3 | 1006.1 | 1007.3 | 1005.9 | 1007.5 | 1011.2 | 1006.4 | 1013.9 | 1008.5 |
| **RELATIVE HUMIDITY (%)** | | | | | | | | | | | | | |
| Hour 00 | 69 | 67 | 66 | 67 | 64 | 56 | 82 | 75 | 82 | 71 | 76 | 70 | 70 |
| Hour 06 (Local Time) | 75 | 77 | 75 | 75 | 74 | 69 | 87 | 84 | 87 | 90 | 84 | 77 | 79 |
| Hour 12 | 60 | 55 | 53 | 45 | 43 | 37 | 62 | 55 | 59 | 52 | 62 | 53 | 53 |
| Hour 18 | 64 | 57 | 51 | 47 | 43 | 37 | 61 | 54 | 62 | 58 | 63 | 59 | 55 |
| **PRECIPITATION (inches):** | | | | | | | | | | | | | |
| Water Equivalent | | | | | | | | | | | | | |
| -Total | 4.25 | 3.49 | 4.20 | 2.85 | 2.38 | 2.15 | 5.21 | 0.85 | 4.73 | 3.62 | 10.52 | 5.99 | 50.24 |
| -Greatest (24 hrs) | 2.85 | 1.49 | 1.15 | 1.35 | 1.34 | 1.85 | 2.09 | 0.55 | 1.50 | 1.37 | 5.65 | 2.55 | 5.65 |
| -Date | 18-19 | 1- 2 | 8- 9 | 17-18 | 21-22 | 30 | 12-13 | 23 | 16 | PM- 1 | 19-20 | 27-28 | NOV 19-20 |
| Snow, Ice pellets | | | | | | | | | | | | | |
| -Total | 9.2 | 3.0 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 11.2 |
| -Greatest (24 hrs) | 7.7 | 3.0 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 7.7 |
| -Date | 6- 7 | 11 | 17 | | | | | | | | | 28 | JAN 6- 7 |
| **WIND:** | | | | | | | | | | | | | |
| Resultant | | | | | | | | | | | | | |
| -Direction (!!!) | 249 | 315 | 224 | 315 | 175 | 087 | 193 | 139 | 119 | 032 | 206 | 204 | 185 |
| -Speed (mph) | 0.9 | 1.4 | 1.6 | 1.3 | 1.5 | 1.4 | 2.6 | 1.9 | 2.1 | 1.0 | 2.7 | 0.7 | 0.7 |
| Average Speed (mph) | 9.9 | 9.4 | 9.6 | 8.4 | 8.0 | 7.0 | 6.6 | 6.0 | 6.8 | 7.6 | 9.5 | 9.3 | 8.2 |
| Fastest Obs. 1 Min. | | | | | | | | | | | | | |
| -Direction (!!!) | 21 | 20 | 18 | 28 | 18 | 02 | 22 | 03 | 08 | 35 | 18 | 34 | 34 |
| -Speed (mph) | 23 | 23 | 23 | 28 | 32 | 15 | 26 | 30 | 20 | 21 | 29 | 37 | 37 |
| -Date | 30 | 22 | 12 | 5 | 21 | 9 | 25 | 18 | 30 | 23 | 16 | 27 | DEC 27 |
| Peak Gust | | | | | | | | | | | | | |
| -Direction (!!!) | S | SW | S | W | W | N | NE | NE | SE | N | S | NW | W |
| -Speed (mph) | 32 | 37 | 36 | 46 | 44 | 29 | 39 | 30 | 32 | 32 | 45 | 44 | 46 |
| -Date | 30 | 22 | 12 | 5 | 8 | 9 | 25 | 18 | 30 | 23 | 16 | 27 | APR 5 |

(!!!) See Reference Notes on Page 68

# NORMALS, MEANS, AND EXTREMES

MEMPHIS, TENNESSEE

LATITUDE: 35°03'N LONGITUDE: 90°00'W ELEVATION: FT. GRND 258 BARO 271 TIME ZONE: CENTRAL WBAN: 13893

| | (a) | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE °F: | | | | | | | | | | | | | | |
| Normals: | | | | | | | | | | | | | | |
| -Daily Maximum | | 48.3 | 53.0 | 61.4 | 72.9 | 81.0 | 88.4 | 91.5 | 90.3 | 84.3 | 74.5 | 61.4 | 52.3 | 71.6 |
| -Daily Minimum | | 30.9 | 34.1 | 41.9 | 52.2 | 60.9 | 68.9 | 72.6 | 70.8 | 64.1 | 51.3 | 41.1 | 34.3 | 51.9 |
| -Monthly | | 39.6 | 43.5 | 51.7 | 62.6 | 71.0 | 78.7 | 82.1 | 80.6 | 74.2 | 62.9 | 51.3 | 43.3 | 61.8 |
| Extremes | | | | | | | | | | | | | | |
| -Record Highest | 47 | 78 | 81 | 85 | 94 | 99 | 104 | 108 | 105 | 103 | 95 | 85 | 81 | 108 |
| -Year | | 1972 | 1962 | 1986 | 1987 | 1977 | 1954 | 1980 | 1943 | 1954 | 1954 | 1955 | 1982 | JUL 1980 |
| -Record Lowest | 47 | -4 | -11 | 12 | 29 | 38 | 48 | 52 | 48 | 36 | 25 | 9 | -13 | -13 |
| -Year | | 1985 | 1951 | 1943 | 1987 | 1944 | 1966 | 1947 | 1946 | 1949 | 1952 | 1950 | 1963 | DEC 1963 |
| NORMAL DEGREE DAYS: | | | | | | | | | | | | | | |
| Heating (base 65°F) | | 787 | 602 | 433 | 126 | 25 | 0 | 0 | 0 | 9 | 137 | 415 | 673 | 3207 |
| Cooling (base 65°F) | | 0 | 0 | 20 | 54 | 211 | 411 | 530 | 484 | 285 | 72 | 0 | 0 | 2067 |
| % OF POSSIBLE SUNSHINE | 35 | 50 | 54 | 56 | 64 | 69 | 74 | 74 | 75 | 69 | 70 | 58 | 50 | 64 |
| MEAN SKY COVER (tenths) | | | | | | | | | | | | | | |
| Sunrise - Sunset | 38 | 6.8 | 6.4 | 6.5 | 6.0 | 5.8 | 5.3 | 5.4 | 5.0 | 5.0 | 4.6 | 5.6 | 6.3 | 5.7 |
| MEAN NUMBER OF DAYS: | | | | | | | | | | | | | | |
| Sunrise to Sunset | | | | | | | | | | | | | | |
| -Clear | 36 | 8.0 | 7.9 | 8.2 | 8.9 | 8.9 | 10.2 | 10.3 | 11.8 | 12.4 | 14.3 | 10.2 | 9.0 | 120.1 |
| -Partly Cloudy | 36 | 5.9 | 5.8 | 6.5 | 7.1 | 9.7 | 11.0 | 11.8 | 11.4 | 7.8 | 7.2 | 6.3 | 5.8 | 96.3 |
| -Cloudy | 36 | 17.2 | 14.6 | 16.3 | 14.0 | 12.4 | 8.8 | 8.9 | 7.7 | 9.9 | 9.5 | 13.5 | 16.2 | 149.0 |
| Precipitation .01 inches or more | 38 | 9.9 | 9.5 | 10.8 | 10.2 | 9.1 | 8.3 | 8.6 | 7.8 | 7.1 | 6.2 | 8.8 | 9.6 | 105.9 |
| Snow, Ice pellets 1.0 inches or more | 38 | 0.9 | 0.6 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.* | 0.2 | 1.9 |
| Thunderstorms | 38 | 1.8 | 2.3 | 4.5 | 6.4 | 6.7 | 7.2 | 8.2 | 6.2 | 3.4 | 2.0 | 2.2 | 1.6 | 52.6 |
| Heavy Fog Visibility 1/4 mile or less | 38 | 2.1 | 1.3 | 0.8 | 0.3 | 0.2 | 0.2 | 0.3 | 0.4 | 0.6 | 1.1 | 1.4 | 1.8 | 10.4 |
| Temperature °F | | | | | | | | | | | | | | |
| -Maximum | | | | | | | | | | | | | | |
| 90° and above | 47 | 0.0 | 0.0 | 0.0 | 0.1 | 3.2 | 14.7 | 21.6 | 18.5 | 7.8 | 0.7 | 0.0 | 0.0 | 66.6 |
| 32° and below | 47 | 3.4 | 1.3 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.3 | 6.2 |
| -Minimum | | | | | | | | | | | | | | |
| 32° and below | 47 | 18.5 | 12.6 | 5.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 5.7 | 14.5 | 57.3 |
| 0° and below | 47 | 0.1 | 0.* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| AVG. STATION PRESS. (mb) | 16 | 1011.6 | 1009.7 | 1006.4 | 1005.6 | 1004.5 | 1005.4 | 1006.4 | 1006.8 | 1007.4 | 1009.4 | 1009.4 | 1010.9 | 1007.8 |
| RELATIVE HUMIDITY (%) | | | | | | | | | | | | | | |
| Hour 00 | 49 | 75 | 73 | 70 | 71 | 76 | 77 | 79 | 80 | 80 | 77 | 74 | 74 | 76 |
| Hour 06 (Local Time) | 49 | 78 | 78 | 76 | 78 | 82 | 82 | 84 | 86 | 86 | 83 | 80 | 78 | 81 |
| Hour 12 | 49 | 63 | 60 | 56 | 53 | 55 | 56 | 57 | 57 | 56 | 51 | 56 | 61 | 57 |
| Hour 18 | 49 | 67 | 62 | 56 | 54 | 56 | 57 | 58 | 60 | 62 | 60 | 63 | 67 | 60 |
| PRECIPITATION (inches): | | | | | | | | | | | | | | |
| Water Equivalent | | | | | | | | | | | | | | |
| -Normal | | 4.61 | 4.33 | 5.44 | 5.77 | 5.06 | 3.58 | 4.03 | 3.74 | 3.62 | 2.37 | 4.17 | 4.85 | 51.57 |
| -Maximum Monthly | 38 | 12.21 | 9.39 | 12.08 | 12.29 | 11.58 | 6.88 | 8.84 | 9.65 | 7.61 | 7.75 | 10.52 | 13.81 | 13.81 |
| -Year | | 1951 | 1956 | 1975 | 1955 | 1953 | 1951 | 1959 | 1978 | 1958 | 1984 | 1988 | 1992 | DEC 1982 |
| -Minimum Monthly | 38 | 0.57 | 1.12 | 1.50 | 2.05 | 0.83 | 0.04 | 0.43 | 0.43 | 0.19 | T | 0.75 | 1.05 | T |
| -Year | | 1986 | 1980 | 1966 | 1965 | 1977 | 1953 | 1954 | 1953 | 1953 | 1963 | 1965 | 1955 | OCT 1963 |
| -Maximum in 24 hrs | 38 | 3.89 | 3.63 | 5.95 | 4.35 | 4.94 | 4.76 | 4.71 | 4.04 | 4.63 | 3.40 | 5.65 | 5.42 | 5.95 |
| -Year | | 1974 | 1966 | 1975 | 1985 | 1958 | 1980 | 1980 | 1978 | 1957 | 1981 | 1988 | 1978 | MAR 1975 |
| Snow, Ice pellets | | | | | | | | | | | | | | |
| -Maximum Monthly | 38 | 12.4 | 8.3 | 17.3 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 14.3 | 17.3 |
| -Year | | 1985 | 1985 | 1968 | 1971 | | | | | | | 1976 | 1963 | MAR 1968 |
| -Maximum in 24 hrs | 38 | 8.1 | 5.8 | 16.1 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 14.3 | 16.1 |
| -Year | | 1985 | 1960 | 1968 | 1971 | | | | | | | 1976 | 1963 | MAR 1968 |
| WIND: | | | | | | | | | | | | | | |
| Mean Speed (mph) | 40 | 10.2 | 10.2 | 10.9 | 10.4 | 8.8 | 8.0 | 7.5 | 7.0 | 7.5 | 7.7 | 9.1 | 9.8 | 8.9 |
| Prevailing Direction through 1963 | | S | S | S | S | S | S | S | S | E | S | S | S | S |
| Fastest Obs. 1 Min. | | | | | | | | | | | | | | |
| -Direction (!!!) | 13 | 34 | 32 | 16 | 24 | 34 | 02 | 34 | 20 | 36 | 28 | 23 | 30 | 24 |
| -Speed (MPH) | 13 | 35 | 35 | 40 | 46 | 40 | 40 | 35 | 35 | 39 | 40 | 40 | 36 | 46 |
| -Year | | 1976 | 1984 | 1973 | 1979 | 1979 | 1977 | 1982 | 1980 | 1972 | 1984 | 1979 | 1972 | APR 1979 |
| Peak Gust | | | | | | | | | | | | | | |
| -Direction (!!!) | | | | | | | | | | | | | | |
| -Speed (mph) | | | | | | | | | | | | | | |
| -Date | | | | | | | | | | | | | | |

(!!!) See Reference Notes on Page 68.

## PRECIPITATION (inches)

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 4.34 | 5.21 | 3.56 | 3.73 | 1.85 | 4.82 | 8.84 | 4.56 | 2.73 | 1.57 | 2.66 | 5.33 | 49.20 |
| 1960 | 3.74 | 3.08 | 4.20 | 3.65 | 4.20 | 5.34 | 1.30 | 7.84 | 4.05 | 4.11 | 3.62 | 4.30 | 49.43 |
| 1961 | 0.84 | 6.89 | 7.13 | 4.65 | 4.40 | 1.49 | 3.97 | 1.71 | 0.66 | 1.28 | 8.06 | 8.56 | 49.64 |
| 1962 | 4.19 | 4.22 | 4.80 | 3.62 | 0.84 | 5.71 | 3.94 | 4.18 | 5.28 | 2.57 | 2.31 | 1.35 | 43.01 |
| 1963 | 1.28 | 2.91 | 6.17 | 5.60 | 3.77 | 4.33 | 4.38 | 2.15 | 2.06 | T | 2.72 | 3.31 | 36.68 |
| 1964 | 3.73 | 3.50 | 7.34 | 11.03 | 3.28 | 1.39 | 6.14 | 5.76 | 2.74 | 2.21 | 2.59 | 7.97 | 57.68 |
| 1965 | 4.79 | 6.78 | 5.35 | 2.05 | 7.42 | 0.98 | 1.60 | 3.98 | 7.38 | 0.54 | 0.75 | 1.17 | 42.79 |
| 1966 | 2.84 | 6.88 | 1.50 | 5.42 | 5.69 | 0.52 | 2.18 | 4.28 | 3.23 | 1.92 | 1.57 | 5.21 | 41.24 |
| 1967 | 2.23 | 2.33 | 4.65 | 4.46 | 6.38 | 1.70 | 6.01 | 5.17 | 1.86 | 2.38 | 1.90 | 7.37 | 46.44 |
| 1968 | 5.57 | 1.98 | 6.52 | 5.15 | 5.21 | 3.76 | 2.69 | 1.61 | 5.58 | 2.87 | 4.89 | 6.04 | 51.87 |
| 1969 | 3.14 | 3.20 | 2.63 | 8.29 | 1.34 | 1.60 | 1.92 | 6.62 | 0.90 | 1.24 | 4.19 | 7.05 | 42.12 |
| 1970 | 1.16 | 3.87 | 5.32 | 7.08 | 3.70 | 5.76 | 4.99 | 1.78 | 3.80 | 6.20 | 2.62 | 3.71 | 49.99 |
| 1971 | 2.15 | 7.21 | 3.64 | 2.89 | 3.90 | 3.82 | 2.90 | 6.00 | 3.42 | 0.06 | 1.49 | 6.71 | 44.19 |
| 1972 | 4.73 | 2.23 | 4.80 | 3.51 | 4.55 | 5.50 | 4.89 | 1.94 | 5.46 | 3.92 | 8.05 | 9.37 | 58.95 |
| 1973 | 4.62 | 3.62 | 7.63 | 9.44 | 6.23 | 1.00 | 4.49 | 4.88 | 5.06 | 3.37 | 8.49 | 5.35 | 64.18 |
| 1974 | 8.90 | 4.65 | 3.40 | 6.34 | 7.76 | 6.30 | 6.33 | 4.78 | 3.45 | 2.67 | 4.96 | 5.03 | 64.57 |
| 1975 | 4.65 | 5.53 | 12.08 | 4.98 | 8.72 | 2.42 | 2.26 | 2.03 | 2.62 | 2.69 | 7.77 | 2.93 | 58.68 |
| 1976 | 2.85 | 4.41 | 7.68 | 2.41 | 4.73 | 4.06 | 3.82 | 0.86 | 5.40 | 5.66 | 1.83 | 1.79 | 45.50 |
| 1977 | 2.57 | 1.99 | 4.13 | 5.42 | 0.83 | 3.38 | 3.41 | 1.62 | 6.43 | 2.02 | 6.01 | 3.39 | 41.20 |
| 1978 | 8.13 | 1.31 | 4.05 | 2.14 | 8.14 | 4.45 | 3.89 | 9.65 | 1.52 | 1.82 | 5.56 | 13.12 | 63.78 |
| 1979 | 5.98 | 5.66 | 6.60 | 11.47 | 7.78 | 4.93 | 3.12 | 5.92 | 4.49 | 2.60 | 7.42 | 4.92 | 70.89 |
| 1980 | 3.23 | 1.12 | 10.86 | 7.53 | 4.43 | 5.75 | 4.73 | 1.23 | 5.32 | 3.14 | 5.23 | 1.86 | 54.43 |
| 1981 | 1.38 | 3.66 | 4.98 | 3.57 | 7.06 | 2.93 | 1.71 | 4.21 | 0.61 | 5.83 | 2.12 | 1.84 | 40.00 |
| 1982 | 6.61 | 4.16 | 4.47 | 6.76 | 5.50 | 6.68 | 4.13 | 3.11 | 1.92 | 5.23 | 6.43 | 13.81 | 68.81 |
| 1983 | 2.32 | 2.61 | 3.66 | 8.84 | 9.58 | 3.50 | 3.83 | 0.61 | 1.52 | 2.94 | 9.56 | 8.68 | 57.65 |
| 1984 | 1.88 | 4.37 | 6.07 | 5.24 | 9.06 | 1.12 | 4.59 | 5.00 | 1.96 | 7.75 | 5.85 | 4.35 | 57.24 |
| 1985 | 3.78 | 4.10 | 4.96 | 6.51 | 2.23 | 4.55 | 3.50 | 3.50 | 4.03 | 3.36 | 3.87 | 3.27 | 47.66 |
| 1986 | 0.57 | 2.50 | 1.90 | 3.72 | 4.63 | 3.80 | 1.21 | 2.74 | 1.21 | 3.75 | 8.67 | 3.92 | 38.62 |
| 1987 | 1.76 | 5.81 | 3.38 | 3.78 | 2.96 | 3.66 | 2.06 | 4.12 | 2.01 | 1.96 | 10.45 | 11.39 | 53.34 |
| 1988 | 4.25 | 3.49 | 4.20 | 2.85 | 2.38 | 2.15 | 5.21 | 0.85 | 4.73 | 3.62 | 10.52 | 5.99 | 50.24 |
| Record Mean | 4.86 | 4.29 | 5.21 | 5.10 | 4.39 | 3.65 | 3.40 | 3.26 | 2.96 | 2.86 | 4.46 | 4.77 | 49.21 |

See Reference Notes on Page 68.



## AVERAGE TEMPERATURE (deg. F)

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 39.5 | 44.4 | 51.7 | 61.5 | 74.4 | 77.4 | 79.3 | 81.1 | 75.7 | 64.5 | 46.6 | 45.4 | 61.8 |
| #1960 | 41.9 | 40.8 | 40.2 | 64.8 | 68.5 | 77.8 | 81.8 | 81.6 | 76.1 | 63.8 | 50.8 | 37.2 | 60.4 |
| 1961 | 36.1 | 47.2 | 55.1 | 58.2 | 66.7 | 75.1 | 80.2 | 77.8 | 74.6 | 62.5 | 49.6 | 42.4 | 60.4 |
| 1962 | 36.2 | 50.3 | 47.3 | 58.8 | 76.8 | 77.1 | 81.3 | 80.8 | 73.4 | 65.9 | 50.2 | 39.9 | 61.5 |
| 1963 | 34.4 | 37.6 | 56.7 | 64.2 | 71.1 | 78.6 | 80.1 | 80.2 | 73.4 | 68.6 | 53.4 | 31.5 | 60.8 |
| 1964 | 41.1 | 40.2 | 51.7 | 64.0 | 71.9 | 79.3 | 80.6 | 78.6 | 72.9 | 58.9 | 54.4 | 44.3 | 61.5 |
| 1965 | 43.4 | 42.9 | 44.0 | 66.4 | 74.7 | 78.1 | 81.8 | 80.2 | 73.7 | 60.8 | 55.8 | 45.8 | 62.3 |
| 1966 | 34.2 | 42.2 | 52.8 | 60.6 | 67.9 | 76.6 | 84.7 | 76.9 | 70.8 | 58.1 | 53.7 | 41.4 | 60.0 |
| 1967 | 42.2 | 39.2 | 56.7 | 66.5 | 68.8 | 78.3 | 77.7 | 76.0 | 70.3 | 62.4 | 49.1 | 45.0 | 61.0 |
| 1968 | 38.9 | 37.3 | 50.9 | 62.7 | 69.7 | 79.5 | 80.8 | 82.0 | 71.3 | 62.2 | 50.9 | 41.7 | 60.7 |
| 1969 | 41.2 | 43.3 | 45.0 | 62.9 | 72.1 | 78.8 | 84.9 | 79.3 | 72.9 | 62.9 | 49.0 | 40.1 | 61.1 |
| 1970 | 35.3 | 41.7 | 48.7 | 65.0 | 72.3 | 77.3 | 79.7 | 81.2 | 77.9 | 61.7 | 49.8 | 46.4 | 61.4 |
| 1971 | 39.6 | 43.5 | 48.4 | 60.5 | 66.6 | 80.6 | 80.6 | 78.6 | 76.1 | 69.3 | 50.9 | 50.7 | 62.1 |
| 1972 | 42.3 | 44.7 | 53.2 | 63.1 | 69.7 | 77.5 | 79.4 | 79.7 | 75.9 | 61.4 | 45.5 | 40.0 | 60.9 |
| 1973 | 38.6 | 40.5 | 57.3 | 59.8 | 68.3 | 81.0 | 83.2 | 79.6 | 76.1 | 67.6 | 57.3 | 43.3 | 62.7 |
| 1974 | 45.7 | 45.6 | 58.7 | 61.8 | 72.1 | 74.7 | 82.5 | 79.2 | 68.5 | 62.4 | 53.3 | 45.2 | 62.5 |
| 1975 | 45.9 | 46.2 | 49.9 | 61.9 | 73.5 | 78.8 | 81.1 | 81.2 | 70.9 | 65.8 | 53.8 | 44.1 | 62.8 |
| 1976 | 39.5 | 53.8 | 58.5 | 63.6 | 65.6 | 76.4 | 81.5 | 78.9 | 73.0 | 58.9 | 45.5 | 41.9 | 61.5 |
| 1977 | 30.7 | 45.1 | 58.6 | 66.9 | 76.4 | 81.9 | 84.7 | 82.6 | 79.0 | 62.2 | 55.1 | 44.1 | 64.0 |
| 1978 | 32.7 | 35.0 | 50.3 | 66.3 | 70.9 | 79.8 | 83.8 | 80.9 | 77.7 | 62.5 | 57.7 | 44.0 | 61.8 |
| 1979 | 30.9 | 38.5 | 54.3 | 63.0 | 70.0 | 77.9 | 82.6 | 80.9 | 73.4 | 65.8 | 50.7 | 45.4 | 61.1 |
| 1980 | 43.2 | 39.5 | 49.4 | 60.9 | 72.5 | 80.9 | 88.5 | 87.2 | 80.5 | 62.7 | 53.3 | 45.9 | 63.8 |
| 1981 | 40.9 | 47.3 | 54.3 | 70.2 | 70.0 | 82.5 | 84.6 | 81.8 | 74.0 | 62.5 | 53.8 | 40.9 | 63.6 |
| 1982 | 36.6 | 40.5 | 55.5 | 58.5 | 74.5 | 78.0 | 85.0 | 82.9 | 73.3 | 63.7 | 53.4 | 49.5 | 62.6 |
| 1983 | 40.4 | 45.3 | 51.9 | 56.8 | 68.2 | 77.2 | 83.6 | 84.9 | 75.2 | 66.2 | 53.1 | 34.7 | 61.5 |
| 1984 | 35.9 | 47.6 | 51.1 | 61.0 | 69.5 | 80.9 | 80.9 | 79.8 | 71.9 | 68.4 | 50.9 | 53.8 | 62.6 |
| 1985 | 32.4 | 40.6 | 57.7 | 65.0 | 71.9 | 78.9 | 82.2 | 80.2 | 73.6 | 67.2 | 57.6 | 36.9 | 63.0 |
| 1986 | 41.9 | 48.0 | 55.2 | 64.4 | 72.5 | 81.0 | 86.5 | 79.2 | 79.1 | 64.2 | 51.1 | 42.6 | 63.8 |
| 1987 | 39.6 | 47.1 | 54.7 | 62.2 | 76.5 | 80.0 | 82.5 | 83.6 | 75.3 | 59.2 | 54.4 | 46.7 | 63.5 |
| 1988 | 36.8 | 42.2 | 52.3 | 62.8 | 71.8 | 80.3 | 81.6 | 83.7 | 76.3 | 59.1 | 54.6 | 44.9 | 62.2 |
| Record Mean | 40.8 | 44.0 | 52.4 | 62.2 | 70.6 | 78.4 | 81.4 | 80.2 | 74.2 | 63.5 | 51.8 | 43.5 | 61.9 |
| Max | 48.7 | 52.5 | 61.4 | 71.5 | 79.8 | 87.4 | 90.2 | 89.0 | 83.5 | 73.5 | 60.8 | 51.5 | 70.8 |
| Min | 32.8 | 35.6 | 43.4 | 52.9 | 61.4 | 69.3 | 72.7 | 71.3 | 64.9 | 53.4 | 42.7 | 35.6 | 53.0 |

See Reference Notes on Page 68.

## HEATING DEGREE DAYS Base 65 deg. F

MEMPHIS, TENNESSEE

| SEASON | JULY | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959-60 | 0 | 0 | 0 | 111 | 547 | 602 | 713 | 691 | 763 | 91 | 69 | 0 | 3587 |
| *1960-61 | 0 | 0 | 0 | 104 | 425 | 853 | 892 | 490 | 309 | 249 | 70 | 2 | 3394 |
| 1961-62 | 0 | 0 | 8 | 148 | 467 | 690 | 887 | 410 | 543 | 229 | 5 | 0 | 3387 |
| 1962-63 | 0 | 0 | 14 | 107 | 436 | 772 | 944 | 760 | 291 | 119 | 34 | 0 | 3477 |
| 1963-64 | 0 | 0 | 10 | 33 | 352 | 1034 | 739 | 713 | 406 | 91 | 13 | 0 | 3391 |
| 1964-65 | 0 | 0 | 13 | 202 | 335 | 634 | 666 | 614 | 645 | 72 | 0 | 0 | 3181 |
| 1965-66 | 0 | 0 | 22 | 162 | 275 | 590 | 947 | 634 | 382 | 175 | 47 | 5 | 3239 |
| 1966-67 | 0 | 0 | 9 | 227 | 344 | 732 | 707 | 715 | 301 | 60 | 35 | 0 | 3130 |
| 1967-68 | 0 | 0 | 34 | 144 | 469 | 613 | 803 | 795 | 444 | 114 | 21 | 0 | 3437 |
| 1968-69 | 0 | 0 | 1 | 149 | 423 | 716 | 733 | 601 | 608 | 103 | 12 | 0 | 3346 |
| 1969-70 | 0 | 0 | 0 | 151 | 473 | 768 | 917 | 648 | 500 | 97 | 20 | 0 | 3574 |
| 1970-71 | 0 | 0 | 7 | 150 | 455 | 571 | 781 | 593 | 509 | 171 | 50 | 0 | 3287 |
| 1971-72 | 0 | 0 | 9 | 13 | 432 | 435 | 698 | 582 | 391 | 146 | 27 | 0 | 2733 |
| 1972-73 | 0 | 0 | 12 | 172 | 583 | 766 | 809 | 679 | 237 | 200 | 32 | 0 | 3490 |
| 1973-74 | 0 | 0 | 8 | 67 | 244 | 665 | 599 | 535 | 235 | 150 | 1 | 0 | 2504 |
| 1974-75 | 0 | 0 | 28 | 121 | 367 | 607 | 591 | 521 | 463 | 180 | 2 | 0 | 2880 |
| 1975-76 | 0 | 0 | 40 | 90 | 352 | 643 | 783 | 326 | 238 | 100 | 58 | 0 | 2630 |
| 1976-77 | 0 | 0 | 0 | 231 | 581 | 708 | 1056 | 547 | 212 | 61 | 4 | 0 | 3400 |
| 1977-78 | 0 | 0 | 0 | 123 | 313 | 640 | 995 | 835 | 454 | 74 | 47 | 0 | 3481 |
| 1978-79 | 0 | 0 | 0 | 116 | 230 | 643 | 1049 | 734 | 345 | 121 | 23 | 0 | 3261 |
| 1979-80 | 0 | 0 | 0 | 76 | 426 | 598 | 669 | 733 | 478 | 156 | 7 | 0 | 3143 |
| 1980-81 | 0 | 0 | 5 | 146 | 362 | 586 | 739 | 492 | 342 | 18 | 23 | 0 | 2713 |
| 1981-82 | 0 | 0 | 9 | 153 | 331 | 739 | 873 | 680 | 324 | 215 | 2 | 0 | 3326 |
| 1982-83 | 0 | 0 | 20 | 134 | 352 | 500 | 759 | 543 | 406 | 273 | 25 | 0 | 3012 |
| 1983-84 | 0 | 0 | 27 | 73 | 368 | 935 | 894 | 499 | 426 | 162 | 24 | 0 | 3408 |
| 1984-85 | 0 | 0 | 37 | 48 | 423 | 367 | 1004 | 683 | 254 | 100 | 6 | 0 | 2922 |
| 1985-86 | 0 | 0 | 17 | 54 | 257 | 864 | 708 | 475 | 307 | 102 | 8 | 0 | 2792 |
| 1986-87 | 0 | 0 | 0 | 102 | 413 | 687 | 782 | 492 | 322 | 154 | 0 | 0 | 2952 |
| 1987-88 | 0 | 0 | 0 | 186 | 324 | 559 | 867 | 657 | 393 | 108 | 0 | 0 | 3094 |
| 1988-89 | 0 | 0 | 1 | 202 | 314 | 619 | | | | | | | |

See Reference Notes on Page 68.



## COOLING DEGREE DAYS Base 65 deg. F

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 | 0 | 0 | 0 | 48 | 240 | 422 | 627 | 449 | 243 | 91 | 0 | 0 | 2120 |
| 1970 | 3 | 0 | 0 | 104 | 251 | 375 | 463 | 509 | 400 | 51 | 6 | 2 | 2164 |
| 1971 | 0 | 0 | 3 | 46 | 107 | 474 | 489 | 426 | 349 | 154 | 14 | 0 | 2062 |
| 1972 | 0 | 0 | 3 | 95 | 179 | 383 | 449 | 464 | 346 | 66 | 6 | 0 | 1991 |
| 1973 | 0 | 0 | 4 | 48 | 143 | 486 | 571 | 458 | 350 | 156 | 19 | 0 | 2235 |
| 1974 | 6 | 0 | 46 | 59 | 228 | 299 | 550 | 445 | 138 | 46 | 23 | 0 | 1840 |
| 1975 | 8 | 0 | 3 | 93 | 272 | 421 | 507 | 510 | 224 | 121 | 23 | 2 | 2184 |
| 1976 | 0 | 7 | 44 | 64 | 84 | 349 | 519 | 438 | 247 | 48 | 0 | 0 | 1800 |
| 1977 | 0 | 0 | 23 | 123 | 362 | 516 | 619 | 551 | 426 | 41 | 20 | 0 | 2681 |
| 1978 | 0 | 0 | 6 | 122 | 235 | 452 | 590 | 501 | 387 | 46 | 18 | 0 | 2357 |
| 1979 | 0 | 0 | 19 | 68 | 184 | 394 | 553 | 499 | 259 | 108 | 4 | 0 | 2088 |
| 1980 | 0 | 0 | 0 | 40 | 249 | 480 | 744 | 695 | 476 | 80 | 18 | 2 | 2784 |
| 1981 | 0 | 5 | 20 | 181 | 184 | 532 | 614 | 527 | 285 | 80 | 2 | 0 | 2430 |
| 1982 | 0 | 1 | 36 | 26 | 305 | 399 | 623 | 563 | 275 | 100 | 14 | 25 | 2367 |
| 1983 | 0 | 0 | 7 | 32 | 131 | 373 | 584 | 622 | 338 | 116 | 17 | 0 | 2220 |
| 1984 | 0 | 1 | 4 | 51 | 169 | 482 | 502 | 462 | 249 | 162 | 5 | 23 | 2110 |
| 1985 | 0 | 6 | 30 | 107 | 224 | 425 | 540 | 478 | 285 | 129 | 42 | 0 | 2266 |
| 1986 | 0 | 3 | 12 | 91 | 247 | 487 | 673 | 448 | 427 | 81 | 4 | 0 | 2473 |
| 1987 | 0 | 0 | 9 | 78 | 366 | 458 | 549 | 584 | 315 | 12 | 13 | 0 | 2384 |
| 1988 | 0 | 0 | 7 | 52 | 221 | 469 | 518 | 586 | 347 | 24 | 8 | 0 | 2232 |

See Reference Notes on Page 63.

## SNOWFALL (inches)

MEMPHIS, TENNESSEE

| SEASON | JULY | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959-60 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.0 | 6.5 | 7.6 | 6.4 | 0.0 | 0.0 | 0.0 | 20.5 |
| 1960-61 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | T | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 |
| 1961-62 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 5.0 | T | T | 0.0 | 0.0 | 0.0 | 5.0 |
| 1962-63 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 1.2 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| 1963-64 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.5 | T | T | 0.0 | 0.0 | 0.0 | 14.8 |
| 1964-65 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | 3.3 | 4.6 | 0.0 | 0.0 | 0.0 | 7.9 |
| 1965-66 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.2 | T | T | 0.0 | 0.0 | 0.0 | 12.2 |
| 1966-67 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.7 | 0.6 | T | 0.3 | 0.0 | 0.0 | 0.0 | 1.6 |
| 1967-68 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 2.0 | 4.5 | 17.3 | 0.0 | 0.0 | 0.0 | 23.8 |
| 1968-69 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | 0.0 | 0.0 | 0.0 | T |
| 1969-70 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.1 | 3.3 | 0.2 | T | 0.0 | 0.0 | 0.0 | 3.6 |
| 1970-71 | 0.0 | 0.0 | 0.0 | 0.0 | T | 1.0 | T | 6.7 | 1.6 | T | 0.0 | 0.0 | 9.3 |
| 1971-72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.3 | 0.1 | T | 0.0 | 0.0 | 0.0 | 1.2 |
| 1972-73 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 1.4 | T | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 |
| 1973-74 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.9 | 0.5 | T | 0.0 | 0.0 | 0.0 | 1.6 |
| 1974-75 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.2 | 3.9 | 0.5 | 1.4 | 0.0 | 0.0 | 0.0 | 6.0 |
| 1975-76 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 |
| 1976-77 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.3 | 3.5 | T | 0.0 | 0.0 | 0.0 | 0.0 | 5.3 |
| 1977-78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 4.3 | 3.2 | T | 0.0 | 0.0 | 0.0 | 7.5 |
| 1978-79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 3.0 | 7.4 | 0.0 | 0.0 | 0.0 | 0.0 | 10.4 |
| 1979-80 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.0 | 1.3 | 1.5 | 0.8 | 0.0 | 0.0 | 0.0 | 3.6 |
| 1980-81 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | T | 0.0 | 0.0 | 0.0 | 0.0 | T |
| 1981-82 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 4.5 | 0.7 | 1.2 | 0.0 | 0.0 | 0.0 | 6.4 |
| 1982-83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 7.3 | T | 0.2 | 0.0 | 0.0 | 0.0 | 7.5 |
| 1983-84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 2.0 | T | 0.5 | 0.0 | 0.0 | 0.0 | 3.3 |
| 1984-85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 12.4 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 | 20.7 |
| 1985-86 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| 1986-87 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | T | T | 0.4 | 0.0 | 0.0 | 0.0 | |
| 1987-88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 8.2 | 3.0 | T | 0.0 | 0.0 | 0.0 | 11.2 |
| 1988-89 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | | | | | | | |
| Record Mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 2.6 | 1.5 | 0.9 | T | 0.0 | 0.0 | 5.8 |

See Reference Notes on Page 6B.



## REFERENCE NOTES

MEMPHIS, TENNESSEE

GENERAL
T - TRACE AMOUNT.
BLANK ENTRIES DENOTE MISSING/UNREPORTED DATA.
# INDICATES A STATION OR INSTRUMENT RELOCATION.
SEE STATION LOCATION TABLE ON PAGE 8.

SPECIFIC
PAGE 2
PM - INCLUDES LAST DAY OF PREVIOUS MONTH

PAGE 3
(a) - LENGTH OF RECORD IN YEARS, ALTHOUGH INDIVIDUAL MONTHS MAY BE MISSING.
* LESS THAN .05
NORMALS - BASED ON THE 1951-1980 RECORD PERIOD.
EXTREMES - DATES ARE THE MOST RECENT OCCURRENCE
WIND DIR. - NUMERALS SHOW TENS OF DEGRESS CLOCKWISE FROM TRUE NORTH. "00" INDICATES CALM.
RESULTANT DIRECTIONS ARE GIVEN TO WHOLE DEGREES.

PAGE 4B
MAX AND MIN ARE LONG TERM MEAN DAILY MAXIMUM AND MEAN DAILY MINIMUM TEMPERATURES.

EXCEPTIONS

PAGES 4A, 4B, 6A
RECORD MEANS ARE THROUGH THE CURRENT YEAR, BEGINNING IN 1875 FOR TEMPERATURE
1872 FOR PRECIPITATION
1951 FOR SNOWFALL

# MEMPHIS, TENNESSEE

Topography varies from the level alluvial area in east-central Arkansas to the slightly rolling area in northwestern Mississippi and southwestern Tennessee.

Agricultural interests are varied, with major crops being cotton, corn, hay, soybeans, peaches, apples, and a considerable number of vegetables. The climate is quite favorable for dairy interests, and for the raising of cattle and hogs.

The growing season is about 230 days in length. The average date for the last occurrence of temperatures as low as 32 degrees is late March. The average date of the first temperature of 32 degrees or below is early November.

Precipitation of nearly 50 inches per year is fairly well distributed. Crops and pastures receive, on the average, an adequate supply of moisture during the growing season, with lesser amounts during the fall harvesting period.

Sunshine averages slightly over 70 percent of the possible amount during the growing season. Relative humidity averages about 70 percent for the year.

Memphis, although not in the normal paths of storms coming from the Gulf or from western Canada, is affected by both, and thereby has comparatively frequent changes in weather. Extremely high or low temperatures, however, are relatively rare.

# STATION LOCATION

MEMPHIS, TENNESSEE

| Location | Occupied from | Occupied to | Airline distance and direction from previous location | Latitude North | Longitude West | Elevation above Sea level: Ground at temperature site | Elevation above Ground: Wind instruments | Extreme thermometers | Psychrometer | Sunshine Switch | Tipping bucket rain gage | Weighing rain gage | 8" rain gage | Hygrothermometer | Automatic Observing Equipment * | * Type M = AMOS T = AUTOB Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CITY | | | | | | | | | | | | | | | | |
| Jackson Block Main and Gayoso | 2/28/71 | 10/09/71 | | 35° 08' | 90° 03' | 261? | 80 | 49 | 49 | | | | 70 | | | Thermometers in North window. |
| Irwin (Irving) Block 54 North Second | 10/09/71 | 5/14/79 | 1700' NNE | 35° 09' | 90° 03' | 261? | *82 | 39 | 39 | | | | **62 | | | Thermometers in North window. *80 feet to 9/7/76. **66 feet to 4/16/73 and 82 feet to 9/7/76. |
| McClellan Building Front near Court | 5/14/79 | 2/01/89 | 800' West | 35° 09' | 90° 03' | 270? | 77 | *58 | *58 | | | | 51 | | | *In North window at 53 feet to 11/1/85, then roof exposure. |
| Cotton Exchange Second between South Court and Madison | 2/01/89 | 6/30/95 | 700' ESE | 35° 09' | 90° 03' | 262? | 116 | 108 | 108 | | | | 100 | | | Triple register added 5/9/90. Porter Building built to West in early 1895 had some affect on wind. |
| Porter Building 10 North Main (Main and South Court) | 7/01/95 | 3/31/05 | 300' West | 35° 09' | 90° 03' | 268 | 154 | *146 | *146 | | *134 | | 134 | | | * 140 feet to 8/5/03. * Added 2/20/96. |
| Post Office Building Front at Madison | 4/01/05 | 8/29/58 | 600' West | 35° 09' | 90° 03' | 271 | a86 | b78 | b78 | | c70 e | d70 | c70 | | | a - 97 feet to 10/29/31. b - 76 feet to 10/29/31; psychrometer discontinued 3/31/41. c - 67 feet to 2/11/08; 69 feet to 10/29/31. d - Added from Airport 9/11/50. e - Moved to Airport 9/11/50. Effect of tall buildings on easterly winds began about 1910 and became quite noticeable by 1924. |
| Shrine Building Front at Monroe | 8/30/58 | 9/25/62 (A) | 415' South | 35° 09' | 90° 03' | 271 | | 78 | | | | 70 | 70 | | | Instruments on Post Office roof. (A) Office moved to Airport. Climatological records from Post Office roof until 8/18/65. |
| AIRPORT | | | | | | | | | | | | | | | | |
| Curtiss-Wright Hangar 2nd floor Municipal AP | 10/24/31 | 9/20/32 | | 35° 03' | 89° 59' | 264 | 31 | 5 | 5 | | | | 3 | | | |
| American Airways Hangar Municipal Airport | 9/20/32 | 9/21/36 | 800' West | 35° 03' | 89° 59' | 263 | 49 | 5 | 5 | | | | 3 | | | |
| Dept. of Commerce Bldg. (Radio) Municipal AP | 9/21/36 | 5/28/38 | 300' East | 35° 03' | 89° 59' | 263 | 49 | 5 | 5 | | | | 5 | | | |
| Administration Building Municipal Airport * * International Airport Effective in 1969 | 5/28/38 | 4/17/73 | 100' West | 35° 03' | 89° 59' | e258 | *22 | **6 | c5 | | a4 d | b4 | 3 | *4 | | * 55 feet to 7/22/58. ** 5 feet to 11/7/47 and 7 feet to 11/10/59. Standby status after 9/30/60. * Commissioned about 1300 feet NE of thermometer site 10/1/60. a - Added 9/11/50. b - Decommissioned 9/11/50. c - Discontinued 9/30/60; using psychrometer as standby. d - Effective 5/9/62. e - 263 feet to 10/1/60. |
| 3171 Director's Row International Airport | 4/17/73 | 10/12/85 | 0.1 mi. NNW | 35° 03' | 90° 00' | 258 | f22 | NA | NA | 60 | 58 h | NA g58 | 58 | f4 | NA | f - Same site as prior to 4/17/73. g - Installed on roof 4/1/81. h - Removed 4/1/81. |
| 2488 Winchester Road International Airport | 10/12/85 | 03/01/88 | 0.3 mi. East | 35° 03' | 89° 59' | 258 | k22 | 6 | NA | NA | 2 | NA j4 | 2 | 4 | NA | FAA operation eff. 10/12/85. Office returned to pre-1973 location. WSFO moved to 7777 Walnut Grove Rd. with no observing program. i - Not moved 10/12/85. Station type changed from FAA to FCMOS 9/1/87. j - Installed 10/01/87. k - Not moved 03/01/88. |
| 2496 Winchester Road International Airport | 03/01/88 | Present | Unknown | 35° 03' | 89° 59' | 258 | k22 | k6 | NA | NA | 4 | 4 | 4 | k4 | NA | |

SUBSCRIPTION: Price and ordering information available through: National Climatic Center, Federal Building, Asheville, N. C. 28801

USCOMM-NOAA-ASHEVILLE, N.C. - 505

U.S. DEPARTMENT OF COMMERCE
NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM 210

EXHIBIT 2-2. NAS MEMPHIS STATION CLIMATIC DATA SUMMARY

# STATION CLIMATIC SUMMARY

PREPARED BY THE NAVAL OCEANOGRAPHY COMMAND DETACHMENT, ASHEVILLE, N.C.

PREPARED UNDER, COMMANDER, NAVAL OCEANOGRAPHY COMMAND, NSTL, MS 39529

## NARRATIVE SUMMARY

Naval Air Station Memphis, Tennessee is located 22 miles north-northeast of Memphis International Airport in the southwestern corner of Tennessee on a relatively flat area of the Mississippi River basin. The terrain in the immediate vicinity of the station being a low rolling type with an elevation of 295 feet above mean sea level.

Dominating air masses for the local area are the continental polar air mass, and associated polar front, during the winter months and the maritime tropical air mass which is a part of the Bermuda high circulation during the summer months. Pre frontal squall lines produce severe thunderstorms and tornado activity in the local area during the winter and spring. During the summer months, pre-frontal squall line thunderstorms are replaced by convective type thunderstorms. Occasionally tropical cyclones moving inland produce heavy rains and gusty winds throughout the area.

The average mean temperature for the year is in the low 60's, varying from the upper 30's in January to the low 80's in July. A record high of 106 degrees F. has been recorded during both the months of June and July. Temporary relief from the high temperatures occur during the fall with cold fronts passing occasionally through the area. With the onset of winter, radical temperature changes become more common with a 50 degree temperature drop during a cold frontal passage being not at all uncommon.

Precipitation of about 49 inches per year is fairly well distributed throughout the year, with the only frozen or freezing precipitation occuring during the winter when the Texas panhandle lows pass just south of the station. Haze in the area usually reduces visibility to 5 miles.

Flying conditions are generally good with ceilings and visibilities greater than 1,000 feet and 3 miles more than 80% of the time even during the bad weather months of winter. During the months of May, June, and July Visual Flight Rules (VFR) are experienced more than 96% of the time. Thunderstorms are the principal cause of reduction in flight operations during the summer months. The low ceilings and visibilities brought on by these storms are usually of short duration.

MEMPHIS, TENNESSEE

PREPARED BY: NOAA ASHEVILLE
JUNE 1986

STATION NAME: MEMPHIS, TENNESSEE
LOCATION: 35 21N 89 52W

PERIOD: SEP 51 - DEC 82
ELEVATION: 322 FEET

STN LTRS KNQA
WBAN #: 93839
WMO #:

| | TEMPERATURE (F) | | | | | PRECIPITATION (INCHES) | | | | | | | RELATIVE HUMIDITY | | VAPOR PRESSURE (MILLIBARS) | DEW POINT (F) | PRESSURE ALTITUDE FEET (MSL) | SURFACE WIND (KTS) | | | MEAN CLOUD AMOUNT | MEAN NUMBER OF DAYS WITH | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEANS | | | EXTREME | | | | | | SNOWFALL | | | | | | | | | | | | PRECIPITATION | | | | THUNDERSTORMS | VISIBILITY < 7 MI IN FOG | TEMPERATURE | | | |
| | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | MEAN | MAXIMUM | MINIMUM | 24-HR MAXIMUM | MEAN | MAXIMUM | 24-HR MAXIMUM | 0300 LST | 1200 LST | | | | DIRECTION | SPEED | MAX GUST | | >= 0.01 | >= 0.50 | SNOWFALL >= 0.1 | SNOWFALL >= 1.5 | | | >= 90 | >= 75 | <= 32 | <= 00 |
| JAN | 47 | 30 | 38 | 71 | -2 | 4.2 | 10.2 | .8 | 3.7 | 3 | 13 | 9 | 77 | 66 | .15 | 27 | 800 | N | 6 | 59 | 7 | 10 | 3 | 2 | 1 | 2 | 14 | 0 | # | 18 | # |
| FEB | 51 | 33 | 43 | 80 | 5 | 4.3 | 9.3 | 1.4 | 4.8 | 1 | 8 | 6 | 76 | 61 | .17 | 31 | 800 | N | 6 | 55 | 6 | 9 | 3 | 1 | # | 3 | 12 | 0 | 1 | 12 | 0 |
| MAR | 61 | 42 | 51 | 87 | 12 | 5.1 | 12.4 | .7 | 3.5 | 1 | 15 | 8 | 75 | 58 | .20 | 41 | 850 | S | 7 | 58 | 7 | 11 | 3 | 1 | # | 5 | 11 | 0 | 3 | 5 | 0 |
| APR | 72 | 52 | 62 | 91 | 32 | 5.4 | 12.3 | 2.0 | 4.6 | # | # | # | 76 | 53 | .34 | 48 | 750 | S | 7 | 107 | 6 | 11 | 4 | 0 | 0 | 7 | 10 | # | 13 | # | 0 |
| MAY | 80 | 61 | 71 | 96 | 38 | 5.0 | 11.9 | .9 | 3.6 | # | # | # | 80 | 56 | .49 | 58 | 700 | S | 5 | 58 | 6 | 10 | 3 | 0 | 0 | 7 | 11 | 3 | 24 | 0 | 0 |
| JUN | 86 | 66 | 79 | 106 | 49 | 3.6 | 9.3 | .4 | 5.4 | 0 | 0 | 0 | 81 | 54 | .62 | 65 | 550 | S | 5 | 66 | 6 | 8 | 2 | 0 | 0 | 7 | 11 | 14 | 29 | 0 | 0 |
| JUL | 91 | 72 | 82 | 106 | 56 | 3.5 | 6.5 | .5 | 3.5 | # | # | # | 84 | 57 | .74 | 70 | 450 | S | 4 | 56 | 5 | 9 | 2 | 0 | 0 | 9 | 15 | 20 | 31 | 0 | 0 |
| AUG | 90 | 70 | 80 | 104 | 54 | 3.1 | 7.4 | .2 | 3.6 | 0 | 0 | 0 | 85 | 59 | .69 | 68 | 450 | E | 4 | 49 | 5 | 7 | 2 | 0 | 0 | 7 | 17 | 16 | 31 | 0 | 0 |
| SEP | 84 | 63 | 74 | 104 | 40 | 3.6 | 9.5 | .1 | 3.0 | 0 | 0 | 0 | 84 | 59 | .56 | 62 | 550 | N | 4 | 42 | 6 | 7 | 2 | 0 | 0 | 4 | 16 | 6 | 26 | 0 | 0 |
| OCT | 74 | 51 | 62 | 91 | 28 | 2.4 | 6.3 | # | 3.0 | # | # | # | 80 | 51 | .34 | 48 | 600 | N | 4 | 44 | 5 | 6 | 2 | 0 | 0 | 2 | 13 | # | 16 | # | 0 |
| NOV | 61 | 41 | 51 | 83 | 16 | 4.1 | 9.9 | 1.4 | 2.6 | # | 2 | 2 | 78 | 58 | .29 | 40 | 600 | S | 5 | 55 | 6 | 8 | 3 | # | # | 2 | 12 | 0 | 3 | 6 | 0 |
| DEC | 51 | 34 | 43 | 80 | 14 | 5.0 | 13.7 | .9 | 4.7 | 1 | 13 | 13 | 76 | 62 | .19 | 33 | 800 | S | 6 | 53 | 6 | 10 | 3 | # | # | 2 | 14 | 0 | # | 13 | # |
| ANN | 71 | 51 | 61 | 106 | 14 | 49.3 | 13.7 | # | 5.4 | 6 | 15 | 13 | 79 | 58 | .35 | 49 | 750 | S | 5 | 107 | 6 | 106 | 32 | 4 | 1 | 57 | 156 | 59 | 177 | 54 | # |
| EYR | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | &10 | &10 | &10 | &10 | & 10 | &10 | &10 | 31 | &10 | 31 | 31 | 31 | 31 | 29 | 29 | 31 | 31 | 31 | 31 |

REMARKS: * DATA NOT AVAILABLE # LESS THAN 0.5 DAYS, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE.
THE VALUE LISTED UNDER PRESSURE ALTITUDE INDICATES THAT VALUE IS EXCEEDED ONLY 0.05 % OF THE TIME.
EYR IS EQUIVALENT YEARS OF RECORD (I.E. THE ACTUAL NUMBER OF YEARS UTILIZED IN THE CACULATIONS
FROM THE OVERALL PERIOD OF RECORD. & PERIOD OF RECORD ENDS 19821
HAIL WAS INCLUDED IN SNOWFALL PRIOR TO JANUARY 1956 AND AFTER DECEMBER 1979

MEMPHIS, TENNESSEE

# FLYING WEATHER, - PERCENT OF HOURS

| HOUR (EST) | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN | YRS* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEILING LESS THAN 5000 FEET AND/OR VISIBILITY LESS THAN 5 MI | | | | | | | | | | | | | | |
| 00 | 41 | 36 | 31 | 22 | 23 | 13 | 17 | 24 | 27 | 19 | 31 | 32 | 26 | 10 |
| 03 | 41 | 39 | 35 | 26 | 25 | 21 | 22 | 34 | 35 | 24 | 37 | 36 | 31 | 10 |
| 06 | 45 | 42 | 45 | 34 | 38 | 40 | 50 | 58 | 62 | 44 | 43 | 40 | 45 | 10 |
| 09 | 44 | 50 | 44 | 32 | 36 | 32 | 32 | 46 | 42 | 30 | 41 | 45 | 40 | 10 |
| 12 | 44 | 46 | 40 | 34 | 37 | 32 | 34 | 41 | 42 | 22 | 38 | 41 | 38 | 10 |
| 15 | 42 | 42 | 37 | 31 | 31 | 22 | 26 | 29 | 30 | 19 | 35 | 40 | 32 | 10 |
| 18 | 38 | 38 | 35 | 25 | 23 | 17 | 22 | 21 | 29 | 17 | 33 | 35 | 28 | 10 |
| 21 | 36 | 33 | 28 | 20 | 19 | 16 | 19 | 21 | 25 | 16 | 30 | 33 | 25 | 10 |
| ALL HRS | 41 | 41 | 37 | 28 | 29 | 24 | 28 | 34 | 37 | 24 | 36 | 38 | 33 | 10 |
| CEILING LESS THAN 3000 FEET AND/OR VISIBILITY LESS THAN 3 MI | | | | | | | | | | | | | | |
| 00 | 33 | 27 | 21 | 13 | 13 | 5 | 6 | 6 | 16 | 10 | 23 | 26 | 17 | 10 |
| 03 | 32 | 27 | 23 | 15 | 13 | 7 | 5 | 11 | 22 | 11 | 26 | 29 | 19 | 10 |
| 06 | 37 | 33 | 28 | 20 | 20 | 16 | 21 | 34 | 41 | 21 | 29 | 31 | 28 | 10 |
| 09 | 36 | 38 | 33 | 23 | 22 | 14 | 16 | 20 | 26 | 19 | 33 | 32 | 26 | 10 |
| 12 | 37 | 36 | 30 | 22 | 19 | 13 | 13 | 17 | 24 | 16 | 29 | 32 | 24 | 10 |
| 15 | 32 | 28 | 26 | 18 | 16 | 8 | 7 | 9 | 15 | 12 | 26 | 31 | 19 | 10 |
| 18 | 29 | 28 | 22 | 15 | 10 | 6 | 5 | 6 | 12 | 11 | 22 | 28 | 16 | 10 |
| 21 | 28 | 23 | 19 | 11 | 10 | 5 | 6 | 5 | 10 | 9 | 22 | 25 | 14 | 10 |
| ALL HRS | 33 | 30 | 25 | 17 | 16 | 9 | 10 | 13 | 21 | 14 | 26 | 29 | 20 | 10 |
| CEILING LESS THAN 1000 FEET AND/OR VISIBILITY LESS THAN 3 MI | | | | | | | | | | | | | | |
| 00 | 18 | 14 | 10 | 5 | 6 | 3 | 4 | 2 | 12 | 4 | 10 | 12 | 8 | 10 |
| 03 | 20 | 11 | 9 | 8 | 7 | 4 | 5 | 7 | 13 | 5 | 14 | 13 | 10 | 10 |
| 06 | 22 | 17 | 12 | 11 | 16 | 13 | 16 | 30 | 35 | 14 | 16 | 14 | 18 | 10 |
| 09 | 25 | 20 | 10 | 7 | 9 | 5 | 9 | 15 | 17 | 9 | 18 | 17 | 13 | 10 |
| 12 | 21 | 14 | 8 | 5 | 4 | 2 | 3 | 4 | 9 | 4 | 14 | 13 | 8 | 10 |
| 15 | 16 | 11 | 7 | 4 | 4 | 3 | 3 | 2 | 7 | 3 | 11 | 11 | 7 | 10 |
| 18 | 16 | 14 | 7 | 5 | 4 | 2 | 3 | 2 | 4 | 3 | 10 | 10 | 7 | 10 |
| 21 | 15 | 13 | 8 | 3 | 4 | 1 | 4 | 2 | 5 | 3 | 10 | 10 | 7 | 10 |
| ALL HRS | 19 | 14 | 9 | 6 | 7 | 4 | 6 | 8 | 13 | 5 | 13 | 12 | 10 | 10 |
| CEILING LESS THAN 500 FEET AND/OR VISIBILITY LESS THAN 1 MI | | | | | | | | | | | | | | |
| 00 | 6 | 3 | 1 | 1 | 1 | 0 | 1 | 0 | 2 | 1 | 2 | 2 | 2 | 10 |
| 03 | 6 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 3 | 1 | 3 | 2 | 2 | 10 |
| 06 | 6 | 4 | 4 | 1 | 2 | 1 | 4 | 4 | 8 | 3 | 3 | 2 | 4 | 10 |
| 09 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 3 | 2 | 2 | 10 |
| 12 | 4 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 10 |
| 15 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 10 |
| 18 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 10 |
| 21 | 6 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 10 |
| ALL HRS | 6 | 2 | 2 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 10 |
| CEILING LESS THAN 200 FEET AND/OR VISIBILITY LESS THAN 1/2 MI | | | | | | | | | | | | | | |
| 00 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 03 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 10 |
| 06 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 10 |
| 09 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |
| 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 18 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 10 |
| 21 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |
| ALL HRS | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 10 |

* PERIOD ENDS 1982

MEMPHIS, TENNESSEE

MEAN TEMPERATURE (F)

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 73.4 | 63.8 | 45.5 | 45.2 | M |
| 1952 | 46.6 | 48.2 | 50.3 | 59.4 | 71.2 | 85.3 | 84.0 | 81.6 | 72.6 | 55.7 | 49.9 | 43.5 | 62.4 |
| 1953 | 45.4 | 46.7 | 56.0 | 58.1 | 71.9 | 85.4 | 82.1 | M | 74.9 | 65.4P | 50.9 | 41.6 | M |
| 1954 | 41.6 | 50.3 | 50.9 | 67.1 | 66.2 | 81.5 | 86.8 | 85.0 | 77.7 | 63.7 | 51.4 | 43.4 | 63.8 |
| 1955 | 41.2 | 44.3 | 52.3 | 66.1 | 73.3 | 74.5 | 82.6 | 81.5 | 77.1 | 62.0 | 49.6 | 42.2 | 62.2 |
| 1956 | 36.4 | 47.5 | 51.4 | 60.2 | 73.3 | 77.3 | 82.8 | 82.0 | 73.1 | 66.1 | 50.5 | 48.8 | 62.6 |
| 1957 | 38.3 | 49.2 | 50.5 | 64.4 | 71.4 | 78.5 | 80.5 | 79.4 | 71.7 | 59.3 | 50.4 | 47.5 | 61.7 |
| 1958 | 37.4 | 33.4 | 45.2 | 60.1 | 71.2 | 78.1 | 81.3 | 80.2 | 73.1 | 62.4 | 54.0 | 38.2 | 59.6 |
| 1959 | 37.2 | 42.5 | 50.1 | 60.0 | 72.9 | 76.2 | 78.4 | 81.1 | 75.2 | 63.8 | 46.0 | 45.1 | 60.7 |
| 1960 | 46.4 | 39.5 | 39.5 | 64.0 | 68.4 | 77.7 | 81.1 | 80.9 | 76.1 | 64.0 | 51.1 | 37.7 | 60.0 |
| 1961 | 37.0 | 47.2 | 54.9 | 58.6 | 67.2 | 76.8 | 79.4 | 78.5 | 73.5 | 61.6 | 48.6 | 41.4 | 60.4 |
| 1962 | 36.5 | 45.1 | 48.2 | 59.8 | 77.4 | 77.9 | 81.1 | 80.1 | 72.7 | 64.7 | 50.0 | 38.3 | 61.3 |
| 1963 | 33.2 | 36.0 | 55.3 | 62.6 | 69.7 | 77.9 | 79.7 | 80.5 | 73.1 | 67.0 | 52.6 | 30.9 | 59.9 |
| 1964 | 40.3 | 40.0 | 51.5 | 64.2 | 71.9 | 78.2 | 79.6 | 77.2 | 70.5 | 59.2 | 53.5 | 42.8 | 60.7 |
| 1965 | 41.6 | 42.4 | 43.5 | 65.6 | 74.9 | 78.3 | 80.7 | 78.6 | 74.5 | 61.8 | 56.1 | 45.7 | 62.0 |
| 1966 | 33.5 | 42.0 | 53.5 | 61.1 | 68.5 | 78.0 | 84.1 | 77.0 | 71.4 | 58.4 | 53.4 | 40.8 | 60.2 |
| 1967 | 42.3 | 39.6 | 57.3 | 65.7 | 67.5 | 78.4 | 77.1 | 75.0 | 69.4 | 62.1 | 49.1 | 45.2 | 60.7 |
| 1968 | 37.9 | 36.1 | 50.3 | 63.6 | 70.1 | 79.0 | 80.2 | 81.0 | 71.2 | 63.0 | 49.9 | 39.8 | 60.2 |
| 1969 | 35.7 | 42.4 | 44.1 | 62.1 | 70.5 | 78.8 | 83.6 | 78.2 | 73.3 | 62.2 | 48.6 | 39.0 | 60.2 |
| 1970 | 33.8 | 40.2 | 48.4 | 63.9 | 71.7 | 74.9 | 77.9 | 79.6 | 75.7 | 60.9 | 48.6 | 46.5 | 60.2 |
| 1971 | 38.2 | 42.5 | 48.1 | 60.4 | 66.5 | 80.1 | 79.2 | 78.1 | 76.0 | 69.5 | 50.4 | 50.5 | 61.6 |
| 1972 | 41.2 | 43.8 | 52.2 | 63.4 | 69.8 | 76.7 | 78.7 | 79.4 | 75.6 | 61.0 | 45.6 | 39.7 | 60.6 |
| 1973 | 38.4 | 40.6 | 59.3 | 58.3 | 67.4 | 79.6 | 82.0 | 77.8 | 75.9 | 66.5 | 55.6 | 42.0 | 62.0 |
| 1974 | 43.2 | 43.9 | 57.6 | 61.4 | 72.0 | 73.7 | 82.2 | 78.8 | 67.6 | 60.5 | 51.4 | 43.5 | 61.3 |
| 1975 | 44.4 | 43.9 | 48.0 | 59.9 | 72.1 | 78.2 | 80.3 | 79.5 | 68.6 | 63.5 | 52.6 | 42.9 | 61.2 |
| 1976 | 37.7 | 51.6 | 56.8 | 61.4 | 64.5 | 75.1 | 80.1 | 76.3 | 70.6 | 55.2 | 41.7 | 39.1 | 59.2 |
| 1977 | 26.6 | 42.2 | 55.9 | 65.2 | 75.7 | 80.1 | 83.4 | 80.4 | 76.5 | 59.9 | 52.7 | 41.4 | 61.7 |
| 1978 | 29.3 | 31.0 | 47.6 | 64.2 | 69.5 | 78.6 | 82.0 | 78.7 | 75.9 | 60.2 | 55.7 | 42.8 | 59.6 |
| 1979 | 29.7 | 35.9 | 51.7 | 59.9 | 67.3 | 75.8 | 79.7 | 77.6 | 69.3 | 62.1 | 47.4 | 42.4 | 58.3 |
| 1980 | 39.9 | 36.3 | 46.4 | 58.7 | 71.2 | 80.2 | 87.2 | 85.0 | 77.6 | 59.8 | 50.3 | 43.0 | 61.3 |
| 1981 | 37.3 | 41.7 | 51.0 | 68.2 | 67.5 | 81.1 | 83.1 | 79.5 | 71.7 | 61.6 | 53.1 | 40.7 | 61.6 |
| 1982 | 35.9 | 40.3 | 56.3 | 57.7 | 74.5 | 76.2 | 83.7 | 80.7 | 72.6 | 63.5 | 52.5 | 48.6 | 61.9 |
| MEAN | 38.2 | 42.4 | 51.1 | 62.1 | 70.6 | 78.3 | 81.4 | 79.6 | 73.4 | 62.1 | 50.6 | 42.5 | 61.0 |

"M" INDICATES MISSING DATA, "P" DENOTES PARTIAL RECORD, I.E. LESS THAN 10 DAYS MISSING.

PARTIAL MONTHLY VALUES WERE NOT INCLUDED IN MEANS.

MEMPHIS, TENNESSEE

TOTAL PRECIPITATION (INCHES)

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 5.67 | 4.49 | 4.01 | 8.06 | M |
| 1952 | 3.23 | 4.41 | 7.01 | 2.34 | 2.05 | .78 | .67 | 2.19 | 2.92 | .84 | 4.19 | 3.01 | 33.64 |
| 1953 | 5.02 | 5.42 | 7.50 | 7.12 | 11.91 | 3.08 | 4.79 | M | .12 | .30 | 1.89 | 5.27 | M |
| 1954 | 9.42 | 4.10 | 1.84 | 3.28 | 3.23 | 1.40 | .53 | 2.31 | 2.78 | .84 | 1.35 | 4.16 | 35.24 |
| 1955 | 1.63 | 6.62 | 7.04 | 6.53 | 4.09 | 5.45 | 2.54 | 1.54 | 1.44 | 1.58 | 2.27 | 1.12 | 43.85 |
| 1956 | 5.45 | 9.28 | 3.16 | 5.56 | 2.92 | 6.20 | 2.25 | 2.49 | .41 | 1.37 | 3.08 | 3.81 | 45.98 |
| 1957 | 9.65 | 4.60 | 2.63 | 6.56 | 6.63 | 6.26 | 3.00 | 2.72 | 3.60 | 5.53 | 9.86 | 5.42 | 66.70 |
| 1958 | 2.66 | 3.17 | 4.55 | 6.38 | 4.79 | 2.52 | 3.35 | 2.71 | 7.13 | 1.10 | 3.50 | 2.37 | 44.23 |
| 1959 | 4.06 | 7.51 | 3.11 | 1.95 | 1.20 | 1.64 | 8.49 | 3.92 | 1.60 | 1.07 | 2.36 | 4.71 | 41.62 |
| 1960 | 4.28 | 2.39 | 3.14 | 3.10 | 3.56 | 3.48 | 3.19 | 3.19 | 2.58 | 5.67 | 3.70 | 5.21 | 43.49 |
| 1961 | 1.38 | 6.08 | 7.38 | 4.93 | 6.54 | 2.57 | 4.46 | .55 | .88 | .77 | 6.77 | 9.72 | 52.03 |
| 1962 | 5.62 | 8.12 | 4.34 | 3.25 | 1.08 | 3.16 | 4.37 | 2.16 | 8.00 | 1.37 | 1.41 | .93 | 44.01 |
| 1963 | .83 | 2.08 | 4.28 | 2.87 | 6.30 | 3.26 | 3.07 | 1.08 | 1.75 | .02 | 3.11 | 4.77 | 33.42 |
| 1964 | 3.52 | 3.07 | 8.34 | 9.32 | 3.01 | 2.06 | 2.26 | 5.22 | 2.26 | 2.09 | 2.74 | 6.46 | 50.35 |
| 1965 | 3.36 | 7.33 | 5.30 | 3.12 | 3.06 | 5.30 | 4.23 | 2.84 | 7.94 | .36 | 2.01 | .88 | 45.73 |
| 1966 | 3.49 | 5.00 | .67 | 5.80 | 6.30 | .41 | 3.26 | 6.09 | 4.30 | 1.84 | 1.71 | 5.53 | 44.40 |
| 1967 | 1.56 | 1.78 | 3.56 | 5.25 | 5.07 | 1.63 | 6.90 | 2.05 | 1.45 | 2.17 | 1.64 | 5.63 | 38.69 |
| 1968 | 5.09 | 1.49 | 7.91 | 6.35 | 4.68 | 2.00 | 1.39 | .52 | 2.95 | 1.95 | 3.92 | 4.05 | 42.30 |
| 1969 | 2.77 | 1.66 | 1.96 | 4.23 | .88 | .90 | 1.28 | 7.40 | .88 | 1.33 | 3.34 | 7.34 | 33.97 |
| 1970 | 1.56 | 3.08 | 5.39 | 7.80 | 3.53 | 8.23 | 4.95 | 2.29 | 4.69 | 6.29 | 2.68 | 4.68 | 55.17 |
| 1971 | 2.25 | 5.81 | 3.11 | 4.19 | 4.66 | 4.13 | 4.53 | 5.98 | 6.32 | .13 | 2.17 | 7.06 | 50.34 |
| 1972 | 4.37 | 2.10 | 4.78 | 3.42 | 2.62 | 2.33 | 4.71 | 5.11 | 4.66 | 3.68 | 6.57 | 8.22 | 52.57 |
| 1973 | 5.13 | 3.68 | 6.57 | 11.05 | 7.72 | 1.14 | 5.06 | 1.55 | 5.06 | 2.33 | 9.38 | 4.46 | 63.13 |
| 1974 | 7.66 | 5.50 | 3.43 | 6.84 | 7.79 | 9.27 | 1.62 | 6.35 | 3.11 | 2.34 | 3.86 | 3.74 | 61.51 |
| 1975 | 4.13 | 5.15 | 12.37 | 3.27 | 7.48 | 1.04 | 4.23 | 1.91 | 4.43 | 2.73 | 6.59 | 2.67 | 56.06 |
| 1976 | 2.86 | 1.92 | 5.95 | 1.95 | 4.65 | 6.36 | 4.15 | .18 | 3.31 | 6.22 | 1.87 | 1.93 | 44.37 |
| 1977 | 2.68 | 2.34 | 4.70 | 4.50 | 2.30 | 3.53 | 1.77 | 2.46 | 9.49 | 1.26 | 7.03 | 4.01 | 46.27 |
| 1978 | 10.24 | 1.40 | 5.16 | 2.08 | 8.67 | 5.39 | 3.60 | 5.83 | 4.06 | 1.19 | 5.46 | 10.93 | 64.01 |
| 1979 | 4.46 | 6.00 | 6.96 | 12.31 | 7.64 | 2.85 | 3.14 | 4.41 | 6.31 | 2.05 | 6.97 | 4.89 | 67.99 |
| 1980 | 2.60 | 1.40 | 10.01 | 6.29 | 4.10 | 2.21 | 2.71 | .60 | 4.43 | 3.81 | 5.39 | 1.83 | 45.38 |
| 1981 | 1.65 | 3.09 | 5.17 | 3.44 | 10.54 | 5.11 | 4.51 | 1.60 | .42 | 4.91 | 2.22 | 1.88 | 44.54 |
| 1982 | 6.24 | 3.92 | 1.48 | 9.92 | 4.69 | 8.03 | 4.57 | 5.40 | 1.58 | 1.90 | 6.65 | 13.71 | 68.09 |
| MEAN | 4.17 | 4.27 | 5.14 | 5.39 | 4.96 | 3.60 | 3.53 | 3.09 | 3.64 | 2.30 | 4.05 | 4.95 | 49.09 |

"M" INDICATES MISSING DATA, "P" DENOTES PARTIAL RECORD, I.E. LESS THAN 10 DAYS MISSING.

PARTIAL MONTHLY VALUES WERE NOT INCLUDED IN MEANS.

MEMPHIS, TENNESSEE

# HEATING DEGREE DAYS

| YEAR | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-52 | | | 8 | 130 | 582 | 618 | 569 | 481 | 454 | 210 | 21 | 0 | M |
| 52-53 | 0 | 0 | 2 | 294 | 457 | 660 | 604 | 505 | 282 | 232 | 31 | 0 | 3067 |
| 53-54 | 0 | M | 3 | M | 417 | 716 | 710 | 407 | 446 | 63 | 74 | 0 | M |
| 54-55 | 0 | 0 | 1 | 167 | 404 | 663 | 727 | 580 | 414 | 60 | 0 | 1 | 3017 |
| 55-56 | 0 | 0 | 0 | 158 | 488 | 703 | 816 | 498 | 425 | 190 | 7 | 1 | 3286 |
| 56-57 | 0 | 0 | 0 | 47 | 443 | 499 | 822 | 438 | 442 | 142 | 25 | 0 | 2858 |
| 57-58 | 0 | 0 | 7 | 195 | 431 | 537 | 847 | 878 | 608 | 164 | 38 | 0 | 3705 |
| 58-59 | 0 | 0 | 13 | 135 | 341 | 824 | 856 | 627 | 455 | 182 | 15 | 0 | 3448 |
| 59-60 | 0 | 0 | 2 | 125 | 567 | 608 | 761 | 733 | 791 | 99 | 72 | 0 | 3758 |
| 60-61 | 0 | 0 | 0 | 96 | 415 | 840 | 861 | 495 | 319 | 246 | 63 | 0 | 3337 |
| 61-62 | 0 | 0 | 16 | 152 | 497 | 725 | 878 | 446 | 516 | 202 | 1 | 0 | 3433 |
| 62-63 | 0 | 0 | 6 | 123 | 443 | 819 | 981 | 804 | 317 | 130 | 40 | 0 | 3663 |
| 63-64 | 0 | 0 | 11 | 39 | 369 | 1053 | 758 | 718 | 411 | 87 | 16 | 0 | 3462 |
| 64-65 | 0 | 1 | 33 | 140 | 358 | 683 | 720 | 627 | 659 | 81 | 0 | 0 | 3352 |
| 65-66 | 0 | 0 | 23 | 138 | 264 | 591 | 969 | 639 | 366 | 162 | 42 | 0 | 3194 |
| 66-67 | 0 | 0 | 2 | 214 | 348 | 747 | 701 | 705 | 293 | 75 | 46 | 0 | 3131 |
| 67-68 | 0 | 1 | 38 | 152 | 468 | 607 | 829 | 829 | 458 | 104 | 10 | 0 | 3496 |
| 68-69 | 0 | 0 | 1 | 118 | 448 | 774 | 780 | 627 | 642 | 112 | 14 | 0 | 3516 |
| 69-70 | 0 | 0 | 0 | 162 | 484 | 799 | 963 | 690 | 511 | 110 | 17 | 0 | 3736 |
| 70-71 | 1 | 0 | 15 | 152 | 484 | 569 | 823 | 622 | 522 | 180 | 42 | 0 | 3410 |
| 71-72 | 0 | 0 | 3 | 12 | 437 | 440 | 728 | 606 | 390 | 136 | 20 | 0 | 2772 |
| 72-73 | 0 | 0 | 11 | 180 | 576 | 775 | 817 | 676 | 184 | 225 | 31 | 0 | 3475 |
| 73-74 | 0 | 0 | 12 | 83 | 293 | 708 | 670 | 586 | 257 | 160 | 7 | 0 | 2776 |
| 74-75 | 0 | 0 | 35 | 161 | 420 | 664 | 634 | 586 | 523 | 214 | 2 | 0 | 3239 |
| 75-76 | 0 | 0 | 79 | 138 | 375 | 681 | 840 | 385 | 275 | 153 | 78 | 0 | 3004 |
| 76-77 | 0 | 0 | 10 | 304 | 689 | 799 | 1181 | 632 | 287 | 83 | 3 | 0 | 3993 |
| 77-78 | 0 | 0 | 0 | 175 | 371 | 725 | 1098 | 943 | 526 | 105 | 69 | 0 | 4012 |
| 78-79 | 0 | 0 | 0 | 165 | 279 | 680 | 1086 | 808 | 409 | 178 | 51 | 0 | 3656 |
| 79-80 | 0 | 0 | 14 | 147 | 522 | 693 | 771 | 824 | 570 | 216 | 16 | 0 | 3773 |
| 80-81 | 0 | 0 | 11 | 205 | 438 | 678 | 853 | 565 | 438 | 34 | 54 | 0 | 3276 |
| 81-82 | 0 | 0 | 18 | 166 | 351 | 746 | 896 | 608 | 313 | 236 | 6 | 0 | 3420 |
| 82-83 | 0 | 0 | 25 | 150 | 380 | 524 | | | | | | | |
| MEAN | 0 | 0 | 12 | 151 | 432 | 692 | 824 | 634 | 436 | 147 | 29 | 0 | 3357 |

THE DEGREE DAY TOTAL FOR THE MONTH IS THE SUM OF THE DEPARTURES OF THE DAILY MEAN TEMPERATURES FROM THE BASE OF 65 DEGREES F.
"M" INDICATES MISSING DATA

MEMPHIS, TENNESSEE

# COOLING DEGREE DAYS

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 267 | 103 | 3 | 9 | M |
| 1952 | 6 | 0 | 6 | 50 | 221 | 616 | 595 | 521 | 238 | 14 | 7 | 0 | 2274 |
| 1953 | 0 | 0 | 8 | 43 | 252 | 617 | 537 | M | 304 | M | 1 | 0 | M |
| 1954 | [illegible] | 4 | 17 | 132 | 117 | 501 | 682 | 628 | 386 | 134 | 0 | 0 | 2601 |
| 1955 | 0 | 5 | 27 | 98 | 263 | 291 | 551 | 520 | 370 | 73 | 31 | 3 | 2232 |
| 1956 | 0 | 0 | 11 | 54 | 272 | 376 | 559 | 532 | 247 | 86 | 13 | 3 | 2153 |
| 1957 | 0 | 2 | 0 | 130 | 229 | 407 | 489 | 452 | 215 | 29 | 0 | 0 | 1953 |
| 1958 | 0 | 0 | 0 | 23 | 237 | 400 | 511 | 477 | 265 | 61 | 19 | 0 | 1993 |
| 1959 | 0 | 0 | 1 | 38 | 266 | 344 | 422 | 507 | 316 | 94 | 5 | 0 | 1993 |
| 1960 | 1 | 0 | 4 | 75 | 184 | 389 | 564 | 501 | 341 | 74 | 5 | 0 | 2078 |
| 1961 | 0 | 0 | 9 | 62 | 134 | 357 | 452 | 425 | 278 | 54 | 10 | 0 | 1781 |
| 1962 | 0 | 6 | 2 | 54 | 392 | 393 | 504 | 476 | 241 | 121 | 0 | 0 | 2189 |
| 1963 | 0 | 0 | 21 | 66 | 193 | 394 | 461 | 484 | 259 | 106 | 5 | 0 | 1989 |
| 1964 | 0 | 0 | 1 | 72 | 238 | 402 | 462 | 389 | 206 | 16 | 19 | 0 | 1805 |
| 1965 | 2 | 0 | 0 | 104 | 316 | 405 | 495 | 429 | 315 | 46 | 5 | 0 | 2117 |
| 1966 | 0 | 0 | 15 | 50 | 154 | 398 | 600 | 378 | 201 | 16 | 7 | 1 | 1820 |
| 1967 | 4 | 0 | 61 | 104 | 129 | 408 | 380 | 317 | 174 | 67 | 0 | 0 | 1644 |
| 1968 | 0 | 0 | 8 | 71 | 173 | 424 | 477 | 501 | 193 | 64 | 2 | 0 | 1913 |
| 1969 | 0 | 0 | 0 | 32 | 191 | 421 | 580 | 416 | 254 | 83 | 0 | 0 | 1977 |
| 1970 | 1 | 0 | 0 | 85 | 235 | 306 | 408 | 458 | 342 | 32 | 2 | 3 | 1872 |
| 1971 | 0 | 0 | 4 | 49 | 97 | 462 | 447 | 409 | 342 | 160 | 8 | 0 | 1978 |
| 1972 | 0 | 0 | 0 | 95 | 174 | 359 | 431 | 451 | 337 | 65 | 4 | 0 | 1916 |
| 1973 | 0 | 0 | 16 | 31 | 114 | 446 | 533 | 404 | 348 | 137 | 16 | 0 | 2045 |
| 1974 | 1 | 0 | 36 | 59 | 230 | 270 | 534 | 436 | 119 | 26 | 21 | 0 | 1737 |
| 1975 | 3 | 0 | 2 | 71 | 231 | 401 | 484 | 459 | 193 | 100 | 12 | 1 | 1957 |
| 1976 | 0 | 2 | 29 | 55 | 73 | 307 | 480 | 357 | 185 | 14 | 0 | 0 | 1502 |
| 1977 | 0 | 0 | 14 | 98 | 340 | 460 | 576 | 485 | 353 | 21 | 9 | 0 | 2356 |
| 1978 | 0 | 0 | 0 | 87 | 214 | 416 | 530 | 432 | 332 | 25 | 8 | 0 | 2044 |
| 1979 | 0 | 0 | 5 | 31 | 127 | 332 | 460 | 398 | 148 | 63 | 3 | 0 | 1567 |
| 1980 | 0 | 0 | 0 | 32 | 217 | 461 | 696 | 630 | 396 | 49 | 4 | 0 | 2485 |
| 1981 | 0 | 1 | 11 | 134 | 137 | 488 | 568 | 456 | 229 | 68 | 2 | 0 | 2094 |
| 1982 | 0 | 1 | 50 | 24 | 305 | 345 | 588 | 494 | 259 | 112 | 11 | 23 | 2212 |
| MEAN | 1 | 1 | 12 | 68 | 208 | 406 | 516 | 461 | 270 | 68 | 7 | 1 | 2019 |

THE DEGREE DAY TOTAL FOR THE MONTH IS THE SUM OF THE DEPARTURES OF THE DAILY MEAN TEMPERATURES FROM THE BASE OF 65 DEGREES F.
"M" INDICATES MISSING DATA

MEMPHIS, TENNESSEE

| WBAN NO: 93839 | STATION NAME: MEMPHIS, TENNESSEE | LATITUDE: 35 21N | LONGITUDE: 89 52W | ELEVATION: 322 | CALL SIGN: KMQA | WMO NO: |
|---|---|---|---|---|---|---|

# STATION LOCATION AND INSTRUMENTATION HISTORY

| BAROMETER LOCATION NUMBER | GEOGRAPHICAL LOCATION & NAME | TYPE OF STATION | AT THIS LOCATION FROM | AT THIS LOCATION TO | LATITUDE | LONGITUDE | ELEVATION ABOVE MSL FEET | ELEVATION ABOVE MSL TYPE BAROMETER | OBS PER DAY |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Weather Service Office, main deck Ops bldg | Navy | 1949 | 1960 | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 2. | Moved within Weather Office | Navy | 1960 | 1968 | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 3. | Replacement installed | Navy | 1968 | | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 1a. | Weather Service Office | Navy | 1960 | | 35 21N | 89 52W | 295 | Aneroid | 24 |

| NUMBER OF LOCATION | DATE OF CHANGE | SURFACE WIND EQUIPMENT INFORMATION: LOCATION | TYPE OF TRANSMITTER | TYPE OF RECORDER | HT ABV GROUND FEET | REMARKS, ADDITIONAL EQUIPMENT, OR REASON FOR CHANGE |
|---|---|---|---|---|---|---|
| 1. | | Installed atop control tower | 3-Cup | | 67 | 1. Barograph |
| 1a. | Unkn | Atop control tower | Selsyn | Triple | 69 | 2. Automatic Met Station(AN/GMQ-29) |
| 2. | 1953 | Atop control tower | AN/UMQ-5 | RD-108 | 67 | 3. Ceiling Light(ML-121) |
| 3. | 1958 | 1500 feet from Ops bldg N-Z, bearing 350 | AN/UMQ-5C | RD-108 | 12 | 4. Cloud Height Set(AN/GMQ-13B) |
| 4. | 1962 | Same as #3 | AN/UMQ-5C | RD-108 | 8 | 5. Transmissometer(AN/GMQ-10C) |
| | | | | | | 6. Wind Measuring Set(AN/PMQ-3C) |

MEMPHIS, TENNESSEE

Prevailing winds are from the south and are of relatively low velocities. Wind speeds less than 12 miles per hour occur approximately 74 percent of the time. Speeds of 13 to 24 miles per hour occur about 25 percent of the time and speeds of 25 miles per hour or higher occur approximately one percent of the time. Figure 2-2 is the NAS Memphis Wind Rose.

### 2.4.2 Overland Drainage

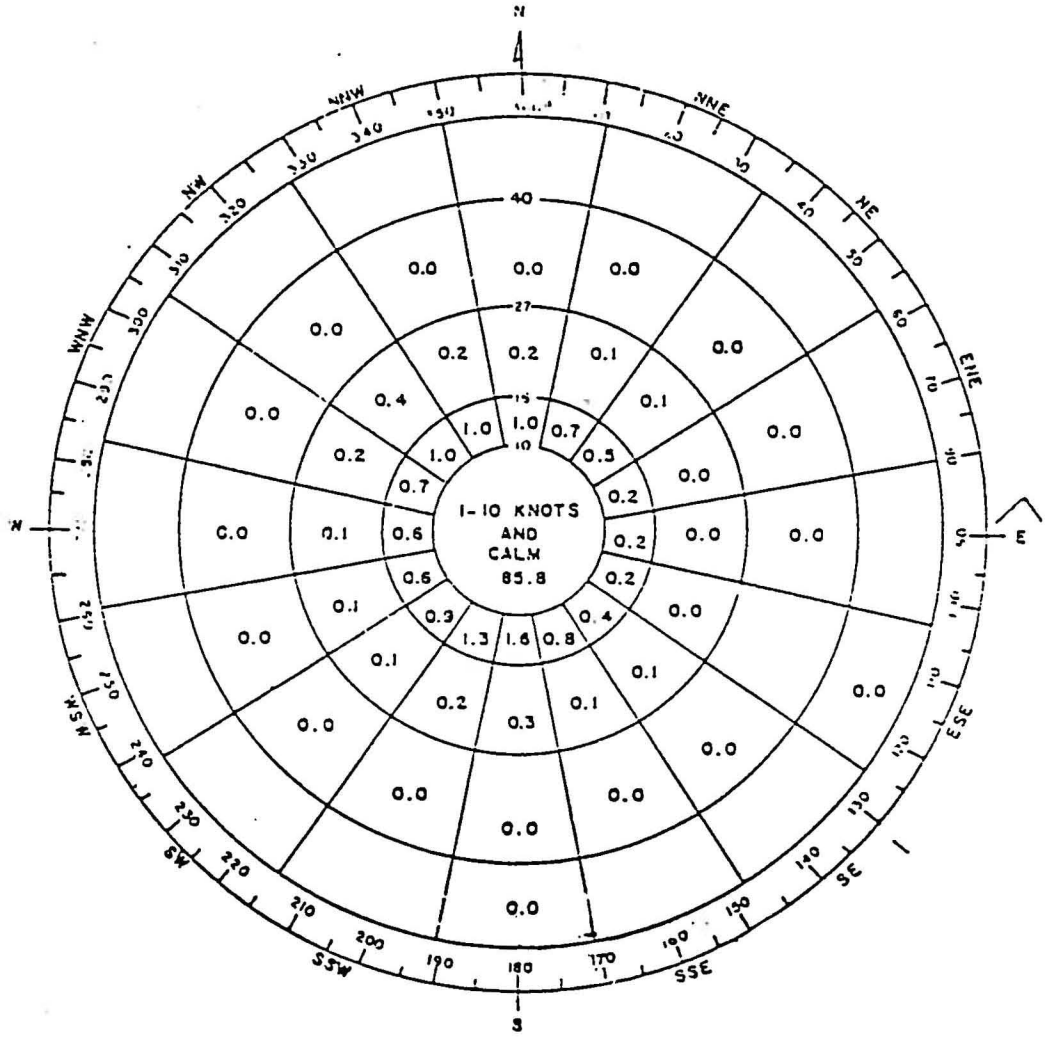
#### 2.4.2.1 Topography and Soils

NAS Memphis lies in the East Gulf Coastal Plain section of the Coastal Plain Province and is characterized by a gently sloping terrain and moderately steep hills. The majority of the installation has a slope of between one and five percent. In general, land surface elevations vary from 270 feet MSL (feet above mean seal level) in the southeast border along Big Creek Drainage Canal to 350 feet MSL in the northern portion of the base near Tanya Lake.

There are ten soil classifications found on the station; these within two major Soil Associations. In the proximity of the Big Creek Drainage Canal is the Falaya-Waverly-Colins Association. Soils in this association range from level, poor drainage to moderately well-drained, silty soils on first bottoms and are subject to high water tables. The balance of the Complex is composed of the Memphis-Granada-Loring Association. Soils in this association range from nearly level to sloping, well-drained and moderately well-drained, silty soils on broad uplands.

#### 2.4.2.2 Surface Water

NAS Memphis consists of a total of over 3,490 acres of land. The topography on the station slopes gently downward from the northeast quadrant of the property to the southwest quadrant and the Big Creek Drainage Canal. Surface runoff is slow, particularly on the south side, due to minimal slopes and high water tables.




WIND ROSE

FIGURE 2-2. WIND ROSE FOR NAS MEMPHIS

The station is surrounded on three sides by water courses, including the North Fork Creek to the west and the Big Creek Drainage Canal to the south. Casper Creek cuts through the eastern portion of the station separating the Headquarters of Naval Technical Training and the Naval Regional Medical Center. Both North Fork Creek and Casper Creek drain into the Big Creek Drainage Canal. The flood plain of this drainage system covers a significant portion of the installation, limiting development potential both on and off the station. A levee has been constructed on the installation along the north edge of the Big Creek Drainage Canal. Because the levee does not follow the entire edge of the Canal, it serves as only a partial deterrent to on-site flooding.

### 2.4.3 Potentially Affected Water Bodies

The source of potable water for both NAS Memphis and the City of Millington is the Memphis Sand Aquifer, the top of which lies at a depth of approximately 400 feet below land surface. The NAS Memphis supply wells are all located on base property and the city supply wells are located approximately 0.3 miles west of NAS Memphis. Reportedly, the existing supply wells penetrate a depth that ranges from 345 feet to approximately 1500 feet below land surface. The shallow groundwater generally has relatively high levels of iron; however, occasionally, it is tapped for small-capacity wells for non-potable uses.

## 2.5 REGIONAL AQUIFER CHARACTERISTICS

### 2.5.1 Aquifer Description

The Naval base is located in the north-central part of the

Mississippi embayment where the subsurface sediments are formed by depositional processes of wind and streams. This geologic and hydrogeologic setting was described by Geraghty and Miller, Inc., in 1985 during the Navy IRP Verification Study (G&M, 1985).

The sequence of geologic sediments underlying NAS Memphis is illustrated in Figure 2-3, a generalized geologic column. The uppermost stratigraphic unit consists of sand, gravel, silt and clay and extends to a depth of approximately 175 feet in some areas. These units are underlain by clays of the Jackson Formation.

The nature of the surficial sediments at the NAS are illustrated in the geologic cross section presented in Figure 2-4, which was prepared originally by Geraghty and Miller, Inc., from logs of the borings drilled during their 1985 investigation. The figure shows that the surficial sediments are composed of soft gray clay, firm silty blue clay and gravelly sand. Water contained within the uppermost aquifer is sometimes used for industrial and irrigation purposes.

Beneath these undifferentiated sediments lies the Jackson Formation, which consists primarily of gray, bluish-gray and tan clays. The low-permeability sediments of the Jackson Formation comprise the confining deposits which retard vertical movements of water and hydraulically separate the uppermost aquifer from the underlying Memphis Sand. The Memphis Sand, or "500-foot Sand", which consists of fine to coarse grain sand, is the primary aquifer in the Memphis area. The clayey confining bed located beneath the Memphis Sand is the Wilcox Group.

Stratigraphic units within the upper sediments at NAS contain a perched zone and an uppermost aquifer. The perched zone located within the soft gray clay is formed due to the underlying firm blue clay which restricts vertical groundwater flow to the underlying sands which make up the uppermost aquifer. Permeability tests run on Shelby tube samples collected during monitor well installation suggests vertical permeabilities within the gray clay and blue clay that range from $1.5 \times 10^{-6}$ to $5.2 \times 10^{-7}$ cm/sec (centimeters per second) and $5.9 \times 10^{-6}$ to $8.5 \times 10^{-6}$ cm/sec, respectively.

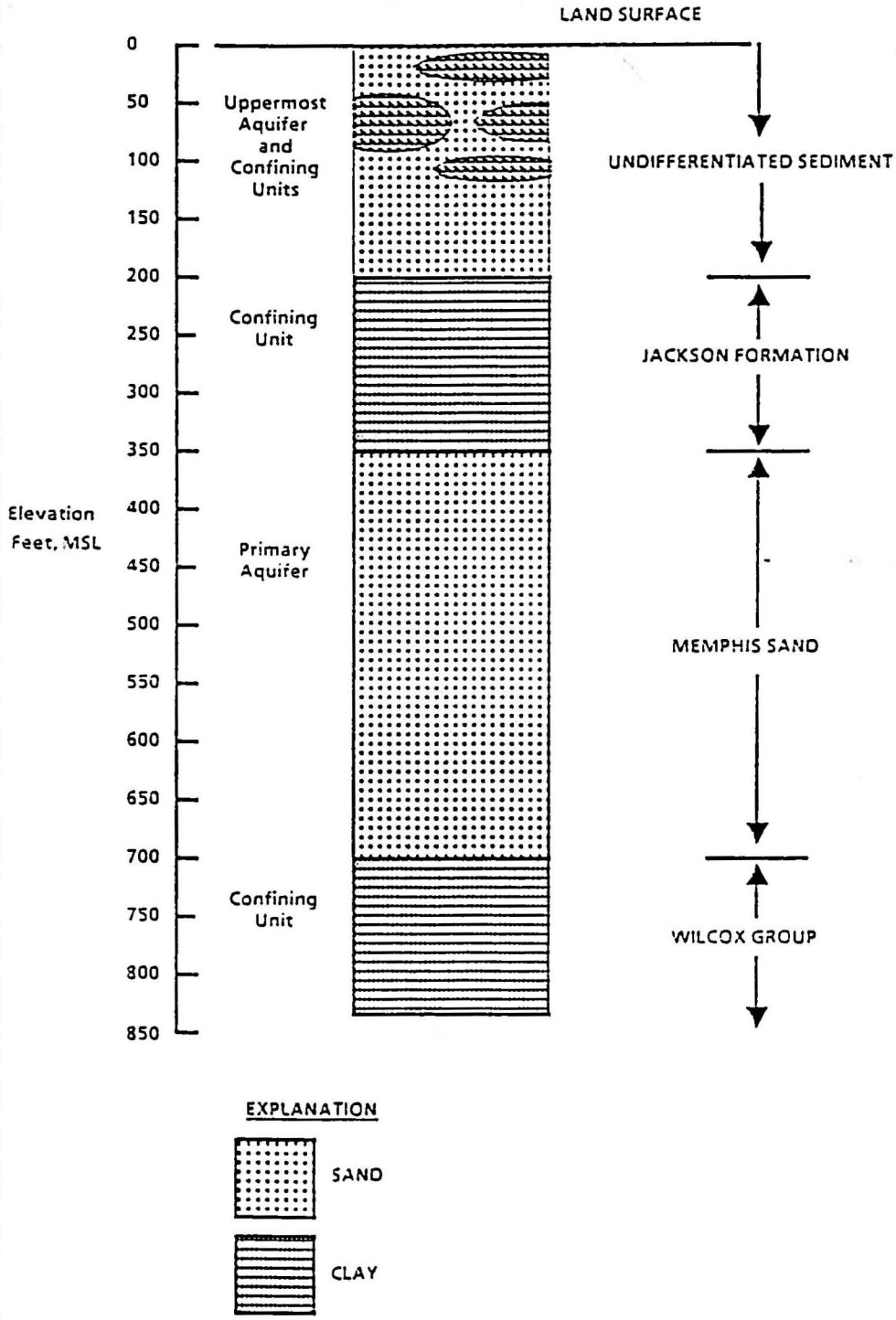



FIGURE 2-3. GENERALIZED GEOLOGIC COLUMN

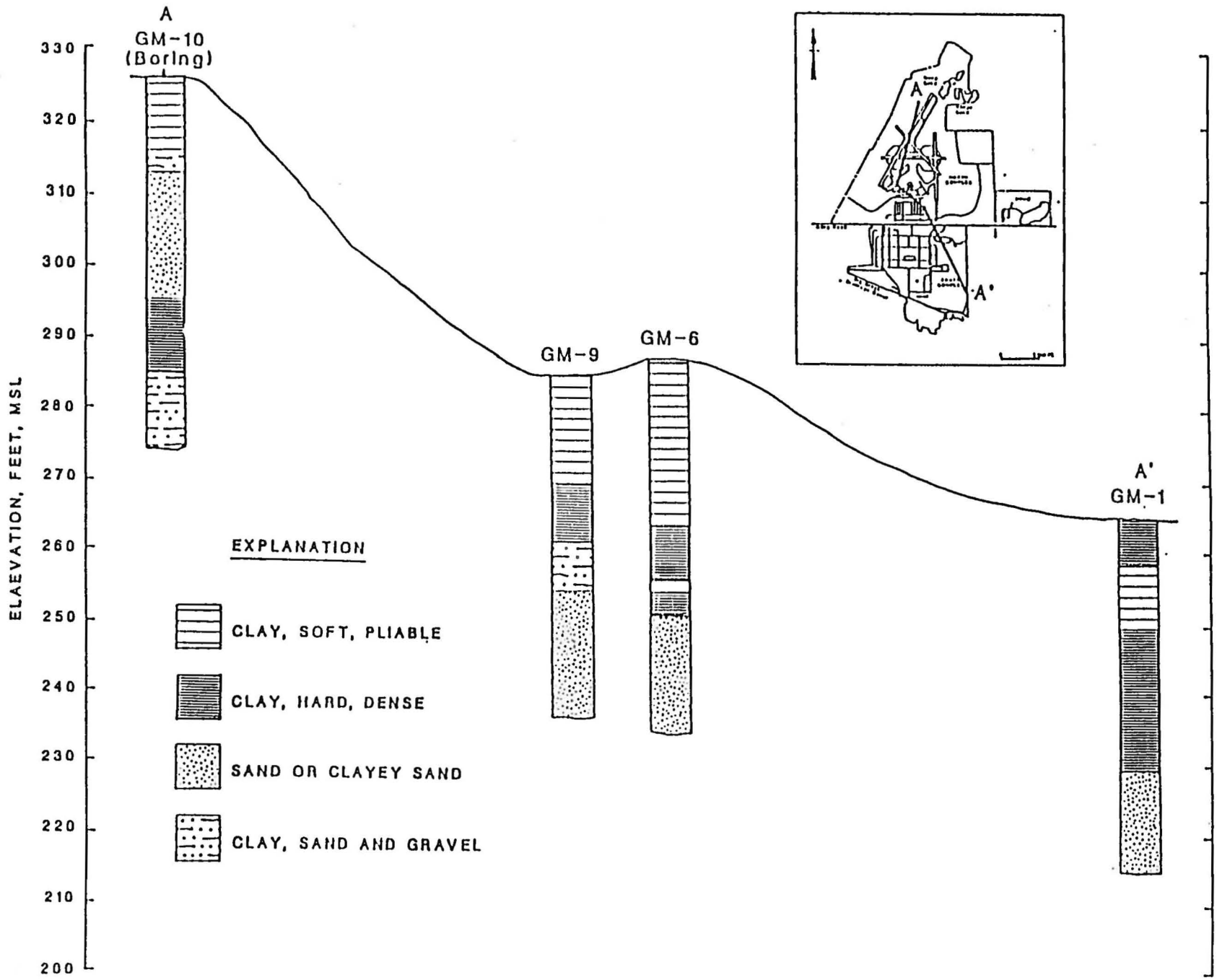



FIGURE 2-4. GEOLOGIC CROSS-SECTON OF THE UPPERMOST SURFICIAL SEDIMENTS

### 2.5.2 Aquifer Use

The NAS uses five well for water supply. They are located in the developed area of the NAS South-Side. Three are approximately 1500 feet deep and two are approximately 500 feet deep.

The City of Millington has production wells for the public water supply. One main and one standby well are located 0.3 miles west of the NAS. One main and three standby wells are located approximately 1/2 mile southwest of the NAS. The two main wells draw from the Fort Pillow sand aquifer (1400' b.g.l.); the four standby wells draw from the Memphis Sand Aquifer (500' b.g.l.).

The Memphis-Shelby County Health Department estimates there are approximately 20 private wells in the Millington area.

All public water supplies in Shelby County draw from groundwater. No surface waters are used.

## 3.0 TARGET ANALYSIS: POTENTIALLY AFFECTED POPULATIONS

The following is a description of potentially affected populations for four pathways:

- Surface water (to 15 miles downstream)
- Groundwater (4 miles radius)
- Air (4 miles radius)
- On-site exposure (to resident population, or other population within one mile).

Because no toxic or hazardous substances have been identified for the site, the probable routes of transport of contaminants from the site for potential exposure of the receptors are not applicable. However, a brief, general description of potential pathways is provided below.

### 3.1 SURFACE WATER PATHWAY

Surface drainage is used primarily for livestock and wildlife watering and to support aquatic life. Contamination of the Big Creek drainage system would pose the greatest threat to potential environmental receptors if there were contaminants associated with the site. However, no toxic or hazardous substances have been identified at this site.

The Big Creek Drainage Canal discharges to the Loosahatchie River approximately 5 miles southwest of the NAS. The Loosahatchie River discharges to the Mississippi River approximately 10 miles further downstream.

### 3.2 GROUNDWATER PATHWAY

Aquifer use in the area is described in Subsection 2.5.2. The NAS and City of Millington water sources would not be affected by the site. If contaminants were present any nearby shallow private wells could be potentially be affected.

### 3.3 AIR PATHWAY

The air pathway of exposure is not applicable to this site.

### 3.4 ON-SITE EXPOSURE

On-site exposure is not a consideration for this unit, in light of past site usage and ongoing site work.

# 4.0 SUMMARY

## 4.1 SUMMARY OF FIELD INVESTIGATIONS RESULTS TO DATE

Site No. 10 topography has been extensively altered within the past year by deposition of soil and organic matter from NAS construction work. Prior to recent site work, the site was being rapidly revegetated by natural processes. Site topography was uneven as a result of material deposited by dump truck. Site drainage was principally by subsurface flow. On site vegetation showed no sign of environmental stress.

## 4.2 SUMMARY OF POTENTIALLY AFFECTED TARGETS SURVEY

The US Navy has determined that there are no potentially affected targets associated with Site No. 10.

## 4.3 CONCLUSIONS AND RECOMMENDATIONS

### 4.3.1 Conclusions

The US Navy has concluded that Site No. 10 does not pose a threat to human health or the environment.

### 4.3.2 Recommendations

The US Navy recommends that Site No. 10 be removed from further consideration as a potential hazardous waste site. Site No. 10, the inactive North-side demolition/debris landfill (Eastern portion), was used for disposal of construction/demolition rubble from NAS activities. (NOTE: Site No. 10 originally consisted of the entire North-Side Landfill. The western portion of the landfill, which may be contaminated with hazardous or toxic substances, had been redesignated as Site No. 60, and will be investigated as part of the planned NAS-wide RCRA Facility Investigation (RFI). Sites No. 10 and 60 are separated by a drainage ditch.)

## 4.4 DATA SOURCE LIST

### 4.4.1 Reports

The following reports contain information relevant to Site No. 10:

- RCRA Facility Assessment (Draft), NAS Memphis, Millington, Tennessee, prepared by ERC Environmental and Energy Services Co., Nashville, Tennessee, for Southern Division, Naval Facilities Engineering Command, Charleston, SC, April 1987.
- RCRA Facility Assessment (Final Draft), NAS Memphis, Millington, Tennessee, prepared by ERC Environmental and Energy Services Co., Knoxville, Tennessee, for Southern Division, Naval Facilities Engineering Command, August 1989.
- Initial Assessment Study of Naval Air Station Memphis, Millington, Tennessee, NEESA 13-038, Naval Energy and Environmental Support Activity, Port Hueneme, CA, November 1983.
- NACIP Program Confirmation Study, Verification Phase, NAS Memphis, prepared by Geraghty and Miller, Tampa, Florida for the US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, November 1985.
- Air Installation Compatible Use Zone (AICUZ) Study, prepared by (unknown) for US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, 1981.
- Letter dated 31 August 1989 from TDHE (Memphis) to NAS Memphis, granting permission for continuance of ongoing site work.

### 4.4.2 Letters and Memoranda

The following is a summary of correspondence between the US Navy and federal and state regulatory agencies (EPA Region IV and TDHE).

- Letter dated 29 July 1986 from TDHE to NAS Memphis with comments on the 1983 Initial Assessment Study and the 1985 Verification Study.
- Letter dated 11 April 1989 from TDHE, to NAS Memphis with comments on the April 1987 RCRA Facility Assessment.
- Letter dated 08 June 1989 from Southern Division, Naval Facilities Engineering Command, to Commanding Officer, NAS Memphis, with response to TDHE comments on NAS Memphis studies transmittal of 29 July 1989.

Site No. 10 has not been the subject of special concern.

## REFERENCES


EPA, 1984, Uncontrolled Hazardous Waste Site Ranking System: A Users Manual (HW-10), US EPA, Washington, DC, 1984.

EPA, 1988, Preliminary Assessment Guidance for Fiscal Year 1988, OSWER Direction 9345.0-01, US Environmental Protection Agency, Washington, DC, January 1988.

NUS/EPA IV, 1988, Hazard Ranking System Data Collection and Documentation Techniques for HRS Scoring of Hazardous Waste Site, prepared by NUS Corporation in Cooperation with Region IV, US Environmental Protection Agency, Atlanta, Georgia, December 1988.

TDHE, 1986, Tennessee's "Superfund" Act, Explanatory Document Produced by Office of General Council, Tennessee Department of Health and Environment, Nashville, Tennessee, 1986.

TDHE, 1988, Part 2 - Hazardous Waste Management Act of 1983, State of Tennessee, Nashville, Tennessee, Revision Effective August 1988.

TDHE, 1989, Memorandum from Mr. Gordon Caruthers to Field Office Staff, Dated 23 January 1989, With Guidance on Conducting Preliminary Assessment (PAs) on Superfund Sites and Assembling PA Reports (Included Conceptual Outline for PA Reports).

## BIBLIOGRAPHY

AICUZ, 1981, Air Installation Compatible Use Zone (AICUZ) Study, US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, 1981.

G&M, 1985, NACIP Program Confirmation Study, Verification Phase, NAS Memphis, prepared by Geraghty & Miller, Inc., Tampa, Florida, for US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, November, 1985.

NEESA, 1983, Initial Assessment Study of Naval Air Station Memphis, Millington, Tennessee, Naval Energy and Environmental Support Activity (NEESA/13-038), Port Hueneme, CA, November 1983.

RFA, 1989, RCRA Facility Assessment (RFA) for NAS Memphis, Millington, Tennessee (Final Draft), prepared by ERC Environmental and Energy Services Company, Knoxville, Tennessee for the US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, August 1989.

# APPENDIX A

## TOPOGRAPHIC MAPS AND DRINKING WATER SOURCES
## FOR
## NAS MEMPHIS AND ADJACENT LAND
## (4 MILE RADIUS OF NAS)

November 1989

NOTE: Topographical maps not supplied with this submittal. Topographical maps were supplied for the 90% draft and will be supplied for the final document.

# APPENDIX B

## GEOLOGIC MAPS
## FOR
## NAS MEMPHIS AND ADJACENT LAND

November 1989

NOTE NOTE NOTE

Geologic maps are unavailable for a 4-mile radius of NAS Memphis. The 7.5' quadrangles geologic maps needed correspond to the 7.5' quadrangle topographic maps (i.e., the Brunswick, Drummonds, Millington, and Munford quadrangles): The subject area has not been geologically mapped, and preparation of geologic maps has not been scheduled. Hence, there is no projected availability date for these maps (Information provided by Mr. James Moore, Tennessee Division of Geology, Maps and Publications Department, Nashville, Tennessee, (615) 742-6696), 05 September 1989).

# APPENDIX C

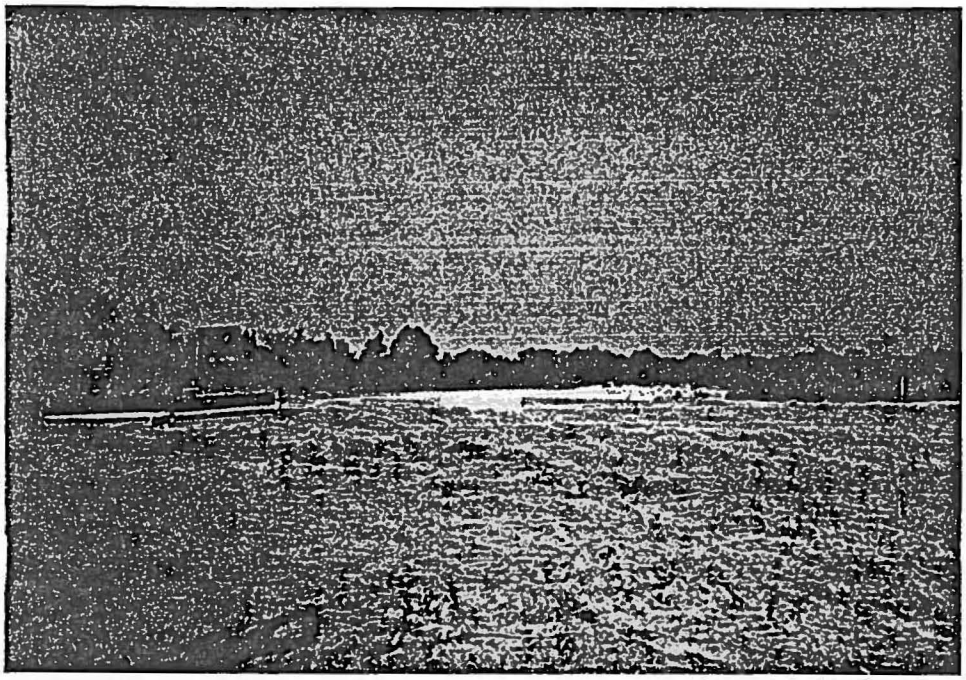
## SITE PHOTOGRAPHS
## FOR
## NAS MEMPHIS SITE NO. 10 - NORTH-SIDE LANDFILL (EAST)

NAS MEMPHIS
MILLINGTON, TENNESSEE

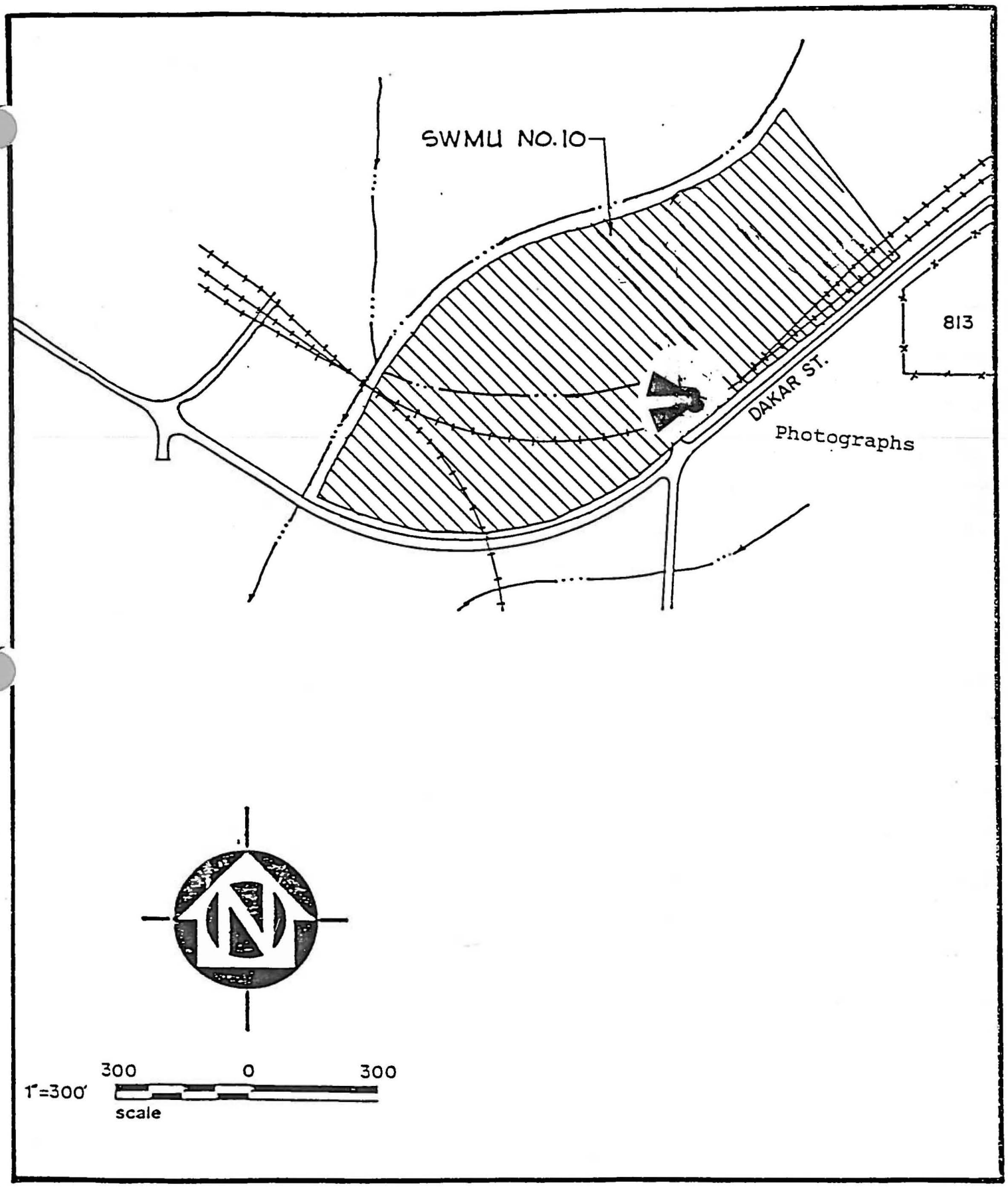
September 1989

## Site No. 10: North-Side Landfill - Eastern Section

The Landfill was being filled and regraded at time photographs taken (8 September 1989). Photographs taken from location shown on accompanying site sketch.



Photographs of Site No. 10. North-Side Landfill - Eastern Section.




DEMOLITION DEBRIS LANDFILL

# APPENDIX D

## PRELIMINARY ASSESSMENT FORM
## (EPA FORM 2070-12)

FOR

NAS MEMPHIS SITE NO. 10 - NORTH-SIDE LANDFILL (EAST)

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

# Preliminary Assessment

(ERA Form 2070-12)

FOR

NAS Memphis Site No. 10 (North-Side Landfill)

NAS Memphis, Millington, Tennessee

01 September 1989

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 1 - SITE INFORMATION AND ASSESSMENT

**I. IDENTIFICATION**

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

**II. SITE NAME AND LOCATION**

| 01 SITE NAME (Legal, common, or descriptive name of site) | 02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER |
|---|---|
| NAS Memphis Site No. 10 | NAS Memphis North-Side Landfill (inactive) |

| 03 CITY | 04 STATE | 05 ZIP CODE | 06 COUNTY | 07 COUNTY CODE | 08 CONG DIST |
|---|---|---|---|---|---|
| Millington | TN | 38054 | Shelby | 79 | 9th |

| 09 COORDINATES LATITUDE | LONGITUDE | |
|---|---|---|
| 35 20 41.0N | 0 8 9 5 2 46.0 W | Approx. Center of 13-acre (±) site |

10 DIRECTIONS TO SITE (Starting from nearest public road)

Enter NAS Memphis at Kinser gate (North-side) from TN Hwy 205. Proceed north on 5th Avenue to Dakar Street, turn left, proceed to access road No. 2. Site is North side of road, opposite intersection.

**III. RESPONSIBLE PARTIES**

| 01 OWNER (If known) | 02 STREET (Business, mailing, residential) | | |
|---|---|---|---|
| Commander, NAS Memphis | NAS Memphis | | |
| **03 CITY** | **04 STATE** | **05 ZIP CODE** | **06 TELEPHONE NUMBER** |
| Millington | TN | 38054 | (901) 873-5101 |
| **07 OPERATOR (If known and different from owner)** | **08 STREET (Business, mailing, residential)** | | |
| Commander, Public Works Division | NAS Memphis | | |
| **09 CITY** | **10 STATE** | **11 ZIP CODE** | **12 TELEPHONE NUMBER** |
| Millington | TN | 38054 | (901) 873-5209 |

13 TYPE OF OWNERSHIP (Check one)

☐ A. PRIVATE ☒ B. FEDERAL: US Navy (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL

☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)

☐ A. RCRA 3001 DATE RECEIVED: ___/___/___ (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED: ___/___/___ (MONTH DAY YEAR) ☐ C. NONE

**IV. CHARACTERIZATION OF POTENTIAL HAZARD**

01 ON SITE INSPECTION

☒ YES DATE Sept 08 1989 (MONTH DAY YEAR)
☐ NO

BY (Check all that apply)

☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR
☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: _____ (Specify)

CONTRACTOR NAME(S): ERC Environmental and Energy Services Co.

02 SITE STATUS (Check one)

☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION

1951 (BEGINNING YEAR) | 1986 (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED

Construction wastes and demolition rubble from NAS activities. No hazardous substances NAS identified on site.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

None

**V. PRIORITY ASSESSMENT**

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)

☐ A. HIGH (Inspection required promptly) ☐ B. MEDIUM (Inspection required) ☐ C. LOW (Inspect on time available basis) ☒ D. NONE (No further action needed, complete current disposition form)

**VI. INFORMATION AVAILABLE FROM**

| 01 CONTACT | 02 OF (Agency/Organization) | 03 TELEPHONE NUMBER |
|---|---|---|
| Mr. George Robertson | Public Works Engineering, NAS Memphis | (901) 873-5209 |

| 04 PERSON RESPONSIBLE FOR ASSESSMENT | 05 AGENCY | 06 ORGANIZATION | 07 TELEPHONE NUMBER | 08 DATE |
|---|---|---|---|---|
| Mr. Robert Moser | US Navy | SOUTHDIV | (803) 743-0573 | Sept. 11 1989 (MONTH DAY YEAR) |

EPA FORM 2070-12 (7-81)

NAVFACENGCOM
Charleston, SC

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 2 - WASTE INFORMATION

**I. IDENTIFICATION**

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

**II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS**

01 PHYSICAL STATES (Check all that apply)

X A SOLID
B POWDER, FINES
C SLUDGE
D OTHER _____ (Specify)
E SLURRY
F LIQUID
G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS _____
CUBIC YARDS unknown
NO OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

A TOXIC
B CORROSIVE
C RADIOACTIVE
D. PERSISTENT
E SOLUBLE
F INFECTIOUS
G FLAMMABLE
H IGNITABLE
I HIGHLY VOLATILE
J EXPLOSIVE
K REACTIVE
L INCOMPATIBLE
X M NOT APPLICABLE

**III. WASTE TYPE**

| CATEGORY | SUBSTANCE NAME | 01 GROSS AMOUNT | 02 UNIT OF MEASURE | 03 COMMENTS |
|---|---|---|---|---|
| SLU | SLUDGE | | | |
| OLW | OILY WASTE | | | |
| SOL | SOLVENTS | | | |
| PSD | PESTICIDES | | | |
| OCC | OTHER ORGANIC CHEMICALS | | | |
| IOC | INORGANIC CHEMICALS | unknown | cubic yard | Demolition rubble |
| ACD | ACIDS | | | |
| BAS | BASES | | | |
| MES | HEAVY METALS | | | |

**IV. HAZARDOUS SUBSTANCES** (See Appendix for most frequently cited CAS Numbers)

| 01 CATEGORY | 02 SUBSTANCE NAME | 03 CAS NUMBER | 04 STORAGE/DISPOSAL METHOD | 05 CONCENTRATION | 06 MEASURE OF CONCENTRATION |
|---|---|---|---|---|---|
| | | | | | |
| | None | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**V. FEEDSTOCKS** (See Appendix for CAS Numbers)

| CATEGORY | 01 FEEDSTOCK NAME | 02 CAS NUMBER | CATEGORY | 01 FEEDSTOCK NAME | 02 CAS NUMBER |
|---|---|---|---|---|---|
| FDS | None | | FDS | | |
| FDS | | | FDS | | |
| FDS | | | FDS | | |
| FDS | | | FDS | | |

**VI. SOURCES OF INFORMATION** (Cite specific references, e.g., state files, sample analysis, reports)

NAS Memphis historical records and environmental reports.

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

## II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ B. SURFACE WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ C CONTAMINATION OF AIR
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ D FIRE/EXPLOSIVE CONDITIONS
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ E. DIRECT CONTACT
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ F CONTAMINATION OF SOIL
03 AREA POTENTIALLY AFFECTED: 0 (Acres)
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ G DRINKING WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ H. WORKER EXPOSURE/INJURY
03 WORKERS POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ I. POPULATION EXPOSURE/INJURY
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

| I. IDENTIFICATION | |
|---|---|
| 01 STATE | 02 SITE NUMBER |
| TN | 2 170 022 600 |

**II. HAZARDOUS CONDITIONS AND INCIDENTS** (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

None

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills/runoff/standing liquids, leaking drums) — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

Not applicable

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

None

**III. TOTAL POPULATION POTENTIALLY AFFECTED:** None

**IV. COMMENTS**

No releases/no hazardous materials were identified.

**V. SOURCES OF INFORMATION** (Cite specific references, e.g., state files, sample analysis, reports)

NAS Memphis historical records and environmental reports.

# APPENDIX E

# SITE SCREENING ANALYSIS:

# HAZARD RANKING SYSTEM (HRS 1)

# PRELIMINARY AND PROJECTED SCORES

# FOR

# NAS MEMPHIS SITE NO. 10 - NORTH-SIDE LANDFILL (EAST)

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

**HRS DOCUMENTATION RECORDS**

NAS MEMPHIS SITE NO. 10

SITE SCREENING ANALYSIS

(PRELIMINARY AND PROJECTED SCORES)

QA Review Draft:
Site Name NAS Memphis - SWMU Site No. 10

Author: H. Bryson
Date: 9/10/89

# DOCUMENTATION RECORDS FOR HAZARD RANKING SYSTEM

**INSTRUCTIONS: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.**

**FACILITY NAME:** NAS Memphis SWMU Site No. 10 - NAS North Side Demolition Landfill (Eastern Portion)

**LOCATION:** NAS Memphis (Northside), Millington, Tennessee

**DATE SCORED:** 9 September 1989

**PERSON SCORING:** Harry A. Bryson, CHMM
ERC Environmental and Energy Services Co.
Knoxville, Tennessee

**PRIMARY SOURCE(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.):**

NAS Memphis historical records and environmental reports.

**FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:**

None

**COMMENTS OR QUALIFICATIONS:**

Based on existing information.

# GROUND WATER ROUTE

## 1 OBSERVED RELEASE

**Contaminants detected (5 maximum):**
None

**Rationale for attributing the contaminants to the facility:**

Because the construction debris had been disposed at this location the site was included for preliminary consideration during NAS-wide RCRA Facility Assessment initiated in 1986. * * *

## 2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

**Name/description of aquifer(s) of concern:**

Memphis Sand (also called the "500 foot sand"). Confined Aquifer, fine to coarse sand.

**Depth(s) from the ground surface to the highest seasonal level of the saturated zone (water table(s)) of the aquifer(s) of concern:**

350 feet (approx.)

**Depth from the ground surface to the lowest point of waste disposal/storage:**

Assumed to be 20 feet or less

## Net Precipitation

**Mean annual or seasonal precipitation (list months for seasonal):**

49.3"

**Mean annual lake or seasonal evaporation (list months for seasonal):**

40"

**Net precipitation (subtract the above figures):**

9.3"

## Permeability of Unsaturated Zone

**Soil type in unsaturated zone:**

Memphis - Granular-Loring Association; disturbed fill in near-surface zone (assumes top 10-20 feet)

**Permeability associated with soil type:**

Moderate; the available data indicated the permeability of the soft gray clay found at the NAS site ranges from $5.2 \times 10^{-7}$ to $15. \times 10^{-6}$ cm/sec.

## Physical State

**Physical state of substances at time of disposal (or at present time for generated gases):**

Nonhazardous inert or biodegradable construction wastes and demolition rubble.

## 3 CONTAINMENT

### Containment

**Method(s) of waste or leachate containment evaluated:**

Not Applicable

**Method with highest score:**

Not Applicable

## 4 WASTE CHARACTERISTICS

### Toxicity and Persistence

**Compound(s) evaluated:**

None identified. For Projected score, heavy metals are assumed.

**Compound with highest score:**

Not applicable to Preliminary score. For projected score, assumed persistence of 3, toxicity of 2, for T&P score of 15.

### Hazardous Waste Quantity

**Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):**

Zero

**Basis of estimating and/or computing waste quantity:**

Not applicable. None has been identified. For projected score, a HWQ score of 1 was read.

* * *

## 5 TARGETS

### Ground Water Use

**Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:**

Memphis Sand Aquifer used for drinking water by NAS, City of Millington.

### Distance to Nearest Well

**Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:**

NAS Memphis wells.

**Distance to above well or building:**

Approximately 1/2 mile.

### Population Served by Ground Water Wells Within a 3-Mile Radius

Identify water-supply wells(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

NAS Memphis - 2000 permanent (approx.)
City of Millington - 20,000 (approx.)

**Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):**

None

**Total population served by ground water within a 3-mile radius:**

22,000 (approx.)

# SURFACE WATER ROUTE

## 1 OBSERVED RELEASE

**Contaminants detected in surface water at the facility or downhill from it (5 maximum):**

None

**Rationale for attributing the contaminants to the facility:**

Not applicable

* * *

## 2 ROUTE CHARACTERISTICS

**Facility Slope and Intervening Terrain**

**Average slope of facility in percent:**

3% (when grading complete)

**Name/description of nearest downslope surface water:**

Drainage ditch on west side of site; drains to Big Creek Drainage Canal to southwest, thence to Mississippi River.

**Average slope of terrain between facility and above-cited surface water body in percent:**

3%

**Is the facility located either totally or partially in surface water?**

No

**Is the facility completely surrounded by areas of higher elevation?**

No

**1-Year 24-Hour Rainfall in Inches**

3.25"

**Distance to Nearest Downslope Surface Water**

Zero feet. (Surface water is drainage ditch that forms west boundary of site).

**Physical State of Waste**

Inert (or nearly so) inorganic materials

* * *

## 3 CONTAINMENT

**Containment:**

**Method(s) of waste or leachate containment evaluated:**

Abandoned landfill/dump. Currently being filled will clean topsoil and regrade.

**Method with highest score:**

Uncontrolled landfill (3)

## 4 WASTE CHARACTERISTICS

### Toxicity and Persistence

**Compound(s) evaluated:**

None identified. For projected score, heavy metals are assumed.

**Compound with highest score:**

Not applicable. For projected score, heavy metals are assumed (score = 3 for persistence, score = 2 for toxicity) for projected score of 15.

### Hazardous Waste Quantity

**Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):**

Zero. For projected score, HWQ score of 1 assumed.

**Basis of estimating and/or computing waste quantity:**

No hazardous waste has been identified.

* * *

## 5 TARGETS

### Surface Water Use

**Use(s) of surface water within 3 miles downstream of the hazardous substance:**

Non-potable water for livestock, wildlife, aquatic biota score = 0 for projected score, a score of 1 was assumed.

**Is there tidal influence?**

No

**Distance to a Sensitive Environment**

**Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:**

Not applicable

**Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:**

Not applicable

**Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:**

Not applicable

**Population Served by Surface Water**

**Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:**

None

**Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):**

Not applicable

**Total population served:**

Zero

**Name/description of nearest of above-cited intakes:**

None known

**Distance to above-cited intakes, measured in stream miles:**

Not applicable

## AIR ROUTE

### 1 OBSERVED RELEASE

**Contaminants detected:**

None

**Date and location of detection of contaminants:**

Not applicable

**Methods used to detect the contaminants:**

Not applicable

**Rationale for attributing the contaminants to the site:**

Not applicable

* * *

### 2 WASTE CHARACTERISTICS

**Reactivity and Incompatibility**

**Most reactive compound:**

None

**Most incompatible pair of compounds:**

None

Toxicity

**Most toxic compound:**

None

Hazardous Waste Quantity

**Total quantity of hazardous waste:**

None

**Basis of estimating and/or computing waste quantity:**

None identified

* * *

## 3 TARGETS

Population Within 4-Mile Radius

**Circle radius used, give population, and indicate how determined:**

**0 to 4 mi** **0 to 1 mi** **0 to 1/2 mi** **0 to ¼ mi**

22,000. Permanent NAS, City population

Distance to a Sensitive Environment

**Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:**

Not applicable

**Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:**

Not applicable

**Distance to critical habitat of an endangered species, if 1 mile or less:**

Not applicable

**Land Use**

**Distance to commercial/industrial area, if 1 mile or less:**

Approximately 1/4 mile

**Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:**

Not applicable

**Distance to residential area, if 2 miles or less:**

Approximately 1/4 mile

**Distance to agricultural land in production within past 5 years, if 1 mile or less:**

Zero (southwestern portion of adjacent Site No. 60 is under cultivation)

**Distance to prime agricultural land in production within past 5 years, if 2 miles or less:**

Not applicable

**Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?**

No

# FIRE AND EXPLOSION HAZARD

## 1 CONTAINMENT

**Hazardous substances present:**

None

**Type of containment, if applicable:**

Not applicable

* * *

## 2 WASTE CHARACTERISTICS

**Direct Evidence**
**Type of instrument and measurements:**

Not applicable

**Ignitability**
**Compound used:**

Not applicable

**Reactivity**
**Most reactive compound:**

Not applicable

**Incompatibility**
**Most incompatible pair of compounds:**

Not applicable

Hazardous Waste Quantity
**Total quantity of hazardous substances at the facility:**

Zero

**Basis of estimating and/or computing waste quantity:**

None identified

* * *

## 3 TARGETS

Distance to Nearest Population

1/4 mile (approx.)

Distance to Nearest Building

400 feet (approx.)

Distance to Sensitive Environment
**Distance to wetlands:**
> 5 miles

**Distance to critical habitat:**
> 5 miles

Land Use
**Distance to commercial/industrial area, if 1 mile or less:**

1/4 mile (approx.)

**Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:**

Not applicable

**Distance to residential area, if 2 miles of less:**

1/4 mile (approx.) - Navy Road

**Distance to agricultural land in production within past 5 years, if 1 mile or less:**

Zero. (southwest corner of site in cultivation)

**Distance to prime agricultural land in production within past 5 years, if 2 miles or less:**

Not applicable ( $>$2 miles)

**Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?**

No

**Population Within 2-Mile Radius**

10,000

**Buildings Within 2-Mile Radius**

2,000

## DIRECT CONTACT HAZARD

### 1 OBSERVED INCIDENT

**Date, location, and pertinent details of incident:**

None

* * *

### 2 ACCESSIBILITY

**Describe type of barrier(s):**

None

* * *

### 3 CONTAINMENT

**Type of containment, if applicable:**

None

* * *

### 4 WASTE CHARACTERISTICS

**Toxicity**

**Compounds evaluated:**

None identified

**Compound with highest score:**

Not applicable

* * *

## 5 TARGETS

**Population within a 1-mile radius:**

Approximately 10,000 (NAS permanent + transient, plus local off-station residences)

**Distance to critical habitat of endangered species:**

> 5 miles

APPENDIX E-1

HAZARD RANKING SYSTEM (HRS 1)

PRELIMINARY HRS SCORES

FOR

NAS MEMPHIS SITE NO. 10 - NORTH-SIDE LANDFILL (EAST)

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

Facility name: NAS Memphis Site No. 10

Location: NAS Memphis (North side) Millington, Tennessee

EPA Region: IV

Person(s) in charge of the facility: Captain Jerry (NMI) Baker, Jr., USN
Commanding Officer, NAS Memphis
Millington, Tennessee

Name of Reviewer: Harry A. Bryson Date: 10 September 1989

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Former Demolition Rubble Landfill/dump. No known hazardous waste disposal.
Site is presently being filled and graded under TDHE supervision

Scores: $S_M = 0$ ($S_{gw} = 0$ $S_{sw} = 0$ $S_a = 0$ )
$S_{FE} = 0$
$S_{DC} = 0$

# HRS COVER SHEET

PRELIMINARY SCORE

## Ground Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 3.1 |
| If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 3.2 |
| Depth to Aquifer of Concern | 0 1 2 3 | 2 | 0 | 6 | |
| Net Precipitation | 0 1 2 3 | 1 | 3 | 3 | |
| Permeability of the Unsaturated Zone | 0 1 2 3 | 1 | 2 | 3 | |
| Physical State | 0 1 2 3 | 1 | 0 | 3 | |
| | Total Route Characteristics Score | | 5 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 3.3 |
| 4 Waste Characteristics | | | | | 3.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 0 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| | Total Waste Characteristics Score | | 0 | 26 | |
| 5 Targets | | | | | 3.5 |
| Ground Water Use | 0 1 2 3 | 3 | 6 | 9 | |
| Distance to Nearest Well/Population Served | 0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40 | 1 | 35 | 40 | |
| | Total Targets Score | | 41 | 49 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 57,330 | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | $S_{gw}$ = 0 | | | |

## Surface Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 4.1 |
| If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 4.2 |
| Facility Slope and Intervening Terrain | 0 1 2 3 | 1 | 0 | 3 | |
| 1-yr. 24-hr. Rainfall | 0 1 2 3 | 1 | 3 | 3 | |
| Distance to Nearest Surface Water | 0 1 2 3 | 2 | 6 | 6 | |
| Physical State | 0 1 2 3 | 1 | 0 | 3 | |
| | Total Route Characteristics Score | | 9 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 4.3 |
| 4 Waste Characteristics | | | | | 4.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 0 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| | Total Waste Characteristics Score | | 0 | 26 | |
| 5 Targets | | | | | 4.5 |
| Surface Water Use | 0 1 2 3 | 3 | 0 | 9 | |
| Distance to a Sensitive Environment | 0 1 2 3 | 2 | 0 | 6 | |
| Population Served/Distance to Water Intake Downstream | 0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40 | 1 | 0 | 40 | |
| | Total Targets Score | | 0 | 55 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 64,350 | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | $S_{SW}$ = | 0 | | |

## Air Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 5.1 |
| Date and Location: Not applicable | | | | | |
| Sampling Protocol: Not applicable | | | | | |
| If line 1 is 0, the $S_a$ = 0. Enter on line 5<br>If line 1 is 45, then proceed to line 2 | | | | | |
| 2 Waste Characteristics | | | | | 5.2 |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | |
| Toxicity | 0 1 2 3 | 3 | | 9 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | |
| | Total Waste Characteristics Score | | N/A | 20 | |
| 3 Targets | | | | | 5.3 |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | |
| Land Use | 0 1 2 3 | 1 | | 3 | |
| | Total Targets Score | | N/A | 39 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 35,100 | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | $S_a$ = | 0 | | |

| | S | $S^2$ |
|---|---|---|
| Groundwater Route Score ($S_{gw}$) | 0 | 0 |
| Surface Water Route Score ($S_{sw}$) | 0 | 0 |
| Air Route Score ($S_a$) | 0 | 0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 0 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 0 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 0 |

## WORKSHEET FOR COMPUTING $S_M$

## Fire and Explosion Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Containment | 1 3 | 1 | 1 | 3 | 7.1 |
| 2 Waste Characteristics | | | | | 7.2 |
| Direct Evidence | 0 3 | 1 | 0 | 3 | |
| Ignitability | 0 1 2 3 | 1 | 0 | 3 | |
| Reactivity | 0 1 2 3 | 1 | 0 | 3 | |
| Incompatibility | 0 1 2 3 | 1 | 0 | 3 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 20 | |
| 3 Targets | | | | | 7.3 |
| Distance to Nearest Population | 0 1 2 3 4 5 | 1 | 3 | 5 | |
| Distance to Nearest Building | 0 1 2 3 | 1 | 1 | 3 | |
| Distance to Sensitive Environment | 0 1 2 3 | 1 | 0 | 3 | |
| Land Use | 0 1 2 3 | 1 | 3 | 3 | |
| Population Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 5 | 5 | |
| Buildings Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 4 | 5 | |
| Total Targets Score | | | 16 | 24 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | $S_{FE}$ = 0 | | |

## Direct Contact Work Sheet

| | Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|---|
| 1 | Observed Incident | 0 45 | 1 | 0 | 45 | 8.1 |
| | If line 1 is 45, proceed to line 4<br>If line 1 is 0, proceed to line 2 | | | | | |
| 2 | Accessibility | 0 1 2 3 | 1 | 3 | 3 | 8.2 |
| 3 | Containment | 0 15 | 1 | 15 | 15 | 8.3 |
| 4 | Waste Characteristics<br>Toxicity | 0 1 2 3 | 5 | 0 | 15 | 8.4 |
| 5 | Targets | | | | | 8.5 |
| | Population Within a 1-Mile Radius | 0 1 2 3 4 5 | 4 | 20 | 20 | |
| | Distance to a Critical Habitat | 0 1 2 3 | 4 | 0 | 12 | |
| | Total Targets Score | | | 20 | 32 | |
| 6 | If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 21,600 | |
| 7 | Divide line 6 by 21,600 and multiply by 100 | | $S_{DC}$ = | 0 | | |

APPENDIX E-2

HAZARD RANKING SYSTEM (HRS 1)

PROJECTED HRS SCORES

FOR

NAS MEMPHIS SITE NO. 10 - NORTH-SIDE LANDFILL (EAST)

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

Facility name: NAS Memphis Site No. 10

Location: NAS Memphis (Northside), Millington, Tennessee

EPA Region: IV

Person(s) in charge of the facility: Captain Jerry Baker, Jr., USN

Commanding Officer, NAS Memphis

Millington, Tennessee

Name of Reviewer: Harry A. Bryson Date: 10 September 1989

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Former Demolition Rubble landfill/dump. No known hazardous waste disposal

Site is presently being filled and graded under TDHE supervision

Scores: $S_M$ = 10.3 ($S_{gw}$ = 17.2 $S_{sw}$ = 4.7 $S_a$ = 0 )

$S_{FE}$ = 0

$S_{DC}$ = 41.7

**HRS COVER SHEET**

PROJECTED SCORE

## Ground Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 3.1 |
| If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 3.2 |
| Depth to Aquifer of Concern | 0 1 2 3 | 2 | 0 | 6 | |
| Net Precipitation | 0 1 2 3 | 1 | 3 | 3 | |
| Permeability of the Unsaturated Zone | 0 1 2 3 | 1 | 2 | 3 | |
| Physical State | 0 1 2 3 | 1 | 0 | 3 | |
| | Total Route Characteristics Score | | 5 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 3.3 |
| 4 Waste Characteristics | | | | | 3.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 15 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 1 | 8 | |
| | Total Waste Characteristics Score | | 16 | 26 | |
| 5 Targets | | | | | 3.5 |
| Ground Water Use | 0 1 2 3 | 3 | 6 | 9 | |
| Distance to Nearest Well/Population Served | 0 4 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 35 | 40 | |
| | Total Targets Score | | 41 | 49 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 9840 | 57,330 | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | $S_{gw}$ = | 17.2 | | |

## Surface Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 4.1 |
| If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 4.2 |
| Facility Slope and Intervening Terrain | 0 1 2 3 | 1 | 0 | 3 | |
| 1-yr. 24-hr. Rainfall | 0 1 2 3 | 1 | 3 | 3 | |
| Distance to Nearest Surface Water | 0 1 2 3 | 2 | 6 | 6 | |
| Physical State | 0 1 2 3 | 1 | 0 | 3 | |
| | Total Route Characteristics Score | | 9 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 4.3 |
| 4 Waste Characteristics | | | | | 4.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 15 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 1 | 8 | |
| | Total Waste Characteristics Score | | 16 | 26 | |
| 5 Targets | | | | | 4.5 |
| Surface Water Use | 0 1 2 3 | 3 | 3 | 9 | |
| Distance to a Sensitive Environment | 0 1 2 3 | 2 | 0 | 6 | |
| Population Served/Distance to Water Intake Downstream | 0 4 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 4 | 40 | |
| | Total Targets Score | | 7 | 55 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 3024 | 64,350 | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | | $S_{sw}$ = 4.7 | | |

## Air Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 5.1 |
| Date and Location: | Not applicable | | | | |
| Sampling Protocol: | Not applicable | | | | |
| If line 1 is 0, the $S_a$ = 0. Enter on line 5<br>If line 1 is 45, then proceed to line 2 | | | | | |
| 2 Waste Characteristics | | | | | 5.2 |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | |
| Toxicity | 0 1 2 3 | 3 | | 9 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | |
| | Total Waste Characteristics Score | | N/A | 20 | |
| 3 Targets | | | | | 5.3 |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | |
| Land Use | 0 1 2 3 | 1 | | 3 | |
| | Total Targets Score | | N/A | 39 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 35,100 | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | $S_a$ = | 0 | | |

| | S | $S^2$ |
|---|---|---|
| Groundwater Route Score ($S_{gw}$) | 17.2 | 295.84 |
| Surface Water Route Score ($S_{sw}$) | 4.7 | 22.09 |
| Air Route Score ($S_a$) | 0 | 0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 317.93 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 17.83 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 10.3 |

## WORKSHEET FOR COMPUTING $S_M$

## Fire and Explosion Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Containment | 1 3 | 1 | 1 | 3 | 7.1 |
| 2 Waste Characteristics | | | | | 7.2 |
| Direct Evidence | 0 3 | 1 | 0 | 3 | |
| Ignitability | 0 1 2 3 | 1 | 0 | 3 | |
| Reactivity | 0 1 2 3 | 1 | 0 | 3 | |
| Incompatibility | 0 1 2 3 | 1 | 0 | 3 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 20 | |
| 3 Targets | | | | | 7.3 |
| Distance to Nearest Population | 0 1 2 3 4 5 | 1 | 3 | 5 | |
| Distance to Nearest Building | 0 1 2 3 | 1 | 1 | 3 | |
| Distance to Sensitive Environment | 0 1 2 3 | 1 | 0 | 3 | |
| Land Use | 0 1 2 3 | 1 | 3 | 3 | |
| Population Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 5 | 5 | |
| Buildings Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 4 | 5 | |
| Total Targets Score | | | 16 | 24 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | $S_{FE}$ = 0 | | |

## Direct Contact Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Incident | 0 45 | 1 | 0 | 45 | 8.1 |
| If line 1 is 45, proceed to line 4<br>If line 1 is 0, proceed to line 2 | | | | | |
| 2 Accessibility | 0 1 2 3 | 1 | 3 | 3 | 8.2 |
| 3 Containment | 0 15 | 1 | 15 | 15 | 8.3 |
| 4 Waste Characteristics<br>Toxicity | 0 1 2 3 | 5 | 10 | 15 | 8.4 |
| 5 Targets | | | | | 8.5 |
| Population Within a 1-Mile Radius | 0 1 2 3 4 5 | 4 | 20 | 20 | |
| Distance to a Critical Habitat | 0 1 2 3 | 4 | 0 | 12 | |
| Total Targets Score | | | 20 | 32 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 9000 | 21,600 | |
| 7 Divide line 6 by 21,600 and multiply by 100 | | | $S_{DC}$ = 41.7 | | |

FINAL DRAFT

# PRELIMINARY ASSESSMENT REPORT
# FOR
# NAS MEMPHIS SITE NO. 11
# NAS MEMPHIS
# MILLINGTON, TENNESSEE

Prepared For:
Department of the Navy
Southern Division, Naval Facilities Engineering Command
Charleston, South Carolina
Contract No. N62467-88-C-0198

Prepared By:
ERC Environmental and Energy Services Co.
725 Pellissippi Parkway
P.O. Box 22879
Knoxville, Tennessee 37933

15 November 1989

FINAL DRAFT

## FOREWORD

This Preliminary Assessment (PA) Report was generated to provide documentation for NAS Memphis Site No. 11 as required by the rules and regulations implementing the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. This report is formatted per the current PA report outline preferred by the Tennessee Department of Health and Environment (TDHE) under the US Environmental Protection Agency (EPA) Region IV - State of Tennessee Preliminary Assessment/Site Inspection (PS/SI) Cooperative Agreement Program.

The PA report is the basic decision document for TDHE's use in deciding the disposition of a potentially contaminated site. Based on the content of the PA report, TDHE determines whether a site requires no further study, or whether an SI is warranted. Normally, an SI is warranted (1) if there is strong evidence, visual or otherwise, of site contamination, or (2) if available site information provided in the PA is insufficient to make a determination of site conditions.

A revised RCRA Facility Assessment (RFA) was prepared in August 1989 for sixty (60) sites at NAS Memphis that were tentatively identified as having potential for environmental contamination. Twelve of these sites (Sites No. 1 through 12) have been recommended by the Navy for further investigation under CERCLA. Plans for a Remedial Investigation/Feasibility Study (RI/FS) of Sites No. 1 through 9 are in progress. This site (Site No. 11) and Sites No. 10 and 12 have a low probability of contamination, and are being recommended by the Navy for removal from further consideration as potentially contaminated sites. This report and similar reports for Sites No. 10 and 12 were prepared to provide supporting documentation of site conditions.

Sites No. 13 through 60 are variously being recommended by the Navy for no further action, further investigation under RCRA, or inclusion in the Navy's UST program.

## TABLE OF CONTENTS


| | | PAGE |
|---|---|---|
| **FOREWORD** | | ii |
| **TABLE OF CONTENTS** | | iv |
| **LIST OF FIGURES AND EXHIBITS** | | vii |
| **GLOSSARY AND LIST OF ACRONYMS** | | viii |
| **1.0** | **INTRODUCTION** | 1 |
| 1.1 | PHYSICAL SETTING | 1 |
| 1.2 | MISSIONS OF NAVAL AIR STATION MEMPHIS ORGANIZATIONS | 1 |
| **2.0** | **SITE CHARACTERIZATION** | 9 |
| 2.1 | SITE BACKGROUND AND HISTORY | 9 |
| 2.1.1 | Ownership History | 9 |
| 2.1.2 | Regulatory History | 10 |
| 2.1.3 | Process and Waste Disposal History | 13 |
| 2.2 | SITE DESCRIPTION | 13 |
| 2.2.1. | Site Features and Layout | 13 |
| 2.2.2 | Accessibility | 15 |
| 2.2.3 | Waste Characteristics | 15 |
| 2.3 | ENVIRONMENTAL/REGIONAL SETTING | 16 |
| 2.3.1 | Demography | 16 |
| 2.3.2 | Land Use | 16 |
| 2.3.3 | Sensitive Environments | 18 |
| 2.4 | HYDROLOGY | 19 |
| 2.4.1 | Climatology | 19 |
| 2.4.2 | Overland Drainage | 23 |

**TABLE OF CONTENTS**
**(continued)**


| | | PAGE |
|---|---|---|
| 2.4.3 | Potentially Affected Water Bodies | 24 |
| 2.5 | REGIONAL AQUIFER CHARACTERISTICS | 24 |
| 2.5.1 | Aquifer Description | 24 |
| 2.5.2 | Aquifer Use | 26 |
| **3.0** | **TARGET ANALYSIS - POTENTIALLY AFFECTED POPULATIONS** | 29 |
| 3.1 | SURFACE WATER PATHWAY | 29 |
| 3.2 | GROUNDWATER PATHWAY | 29 |
| 3.3 | AIR PATHWAY | 30 |
| 3.4 | ONSITE PATHWAY | 30 |
| **4.0** | **SUMMARY** | 31 |
| 4.1 | SUMMARY OF FIELD INVESTIGATION RESULTS | 31 |
| 4.2 | SUMMARY OF POTENTIALLY AFFECTED TARGETS SURVEY | 31 |
| 4.3 | CONCLUSIONS AND RECOMMENDATIONS | 31 |
| 4.3.1 | Conclusions | 31 |
| 4.3.2 | Recommendations | 31 |
| 4.4 | DATA SOURCE LIST | 31 |
| 4.4.1 | Reports | 31 |
| 4.4.2 | Letters and Memoranda | 32 |
| REFERENCES | | 33 |
| BIBLIOGRAPHY | | 34 |

**TABLE OF CONTENTS**
**(continued)**


| | | PAGE |
|---|---|---|
| APPENDIX A - | Topographic Maps | |
| APPENDIX B - | Geologic Maps | |
| APPENDIX C - | Site Photographs | |
| APPENDIX D - | Preliminary Assessment Report Form | |
| APPENDIX E - | Site Screening Analysis: Hazard Ranking System (HRS 1) Preliminary and Projected Scores | |

## LIST OF FIGURES AND EXHIBITS


| FIGURE NO. | TITLE | PAGE |
|---|---|---|
| 1-1 | Location Map - NAS Memphis | 2 |
| 1-2 | NAS Memphis and Vicinity | 3 |
| 1-3 | Vicinity Map - NAS Memphis | 4 |
| 2-1 | Site Features - Site No. 11 | 14 |
| 2-2 | Wind Rose - NAS Memphis | 22 |
| 2-3 | Generalized Geologic Column | 25 |
| 2-4 | Geologic Cross-Section of the Uppermost Surficial Sediments | 27 |

| EXHIBIT NO. | TILE | PAGE |
|---|---|---|
| 2-1 | Memphis, Tennessee Climatological Data Summary | 20 |
| 2-2 | NAS Memphis Station Climatic Data Summary | 21 |

## GLOSSARY AND LIST OF ACRONYMS

**ARAR** - applicable or relevant and appropriate requirements.

**Bench scale** - Treatability tests performed on a small scale, usually in a laboratory, to better define parameters of a treatment technology.

**CAA** - Clean Air Act.

**CERCLA** - Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

**CRP** - Community Relations Plan.

**CWA** - Clean Water Act.

**DOD** - Department of Defense.

**DQO** - Data quality objectives: Statements that specify the data needed to support decisions regarding remedial response activities.

**Excess lifetime cancer risk** - The potential for cargiongenic effects from exposure to one or more chemicals.

**FS** - Feasibility Study.

**General Response Action** - General types of action, such as containment, that may be taken to achieve exposure limits specified by remedial action objectives.

**GAC** - Granular activated carbon; used for absorption of organic contaminants and trace heavy metals.

**GALLEY** - Navy term for kitchen and cooking apparatus. Expanded to include entire food service facility (dining hall or mess hall).

**HRS** - Hazard Ranking System, Appendix A of the NCP.

**HRS Score** - Total migration score ($S_M$) calculated for use of the HRS.

**Innovative technologies** - Technologies that are fully developed but lack sufficient cost or performance data for routine use at CERCLA sites.

**Lead agency** - The agency, either the EPA, Federal agency, or appropriate State agency having primary responsibility and authority for planning and executing the remediation at a site.

**MCL** - Maximum contaminant level: Established under the Safe Drinking Water Act.

**MCLG** - Maximum contaminant level goal: Established under the Safe Drinking Water Act.

**NAAQS** - National Ambient Air Quality Standards.

**NCP** - National Oil and Hazardous Substances Contingency Plan.

**NEPA** - National Environmental Policy Act of 1969, as amended.

**NPDES** - National Pollutant Discharge Elimination System.

**NPL** - National Priorities, Appendix B of the NCP.

**O&M** - Operation and Maintenance.

**OSHA** - Occupational Safety and Health Administration.

**OSWER** - Office of Solid Waste and Emergency Response (USEPA).

**Operable Unit** - A discrete action that comprises an incremental step(s) toward a final remedy. Operable units may address geographic portions of a site, specific site problems, or this initial phase of an action.

**PA** - Public Affairs.

**PAO** - Public Affairs Office (R).

**PA/SI** - Preliminary Assessment/Site Inspection.

**Pilot scale** - Treatability tests performed on a large scale to simulate the physical, as well as chemical, parameters of a process.

**POTW** - Publicly owned treatment works, as defined by US Environmental Protection Agency at 40 CFR 122 (see STP).

**Present Worth Analysis** - A summary of costs to be incurred over a period of time, discounted to the present.

**PRD** - Preliminary Review Document.

**Rating Value** - Rating factor numeral assigned in using the HRS.

**RCRA** - Resource Conservation and Recovery Act.

**RD/RA** - Remedial Design/Remedial Action.

**RD** - Remedial design.

**Remedial Action Alternatives** - A potential approach to preventing or mitigating site-specific contamination problems, defined in terms of a remedial action technology option or combination of options and the volumes or areas of media to which the option or options will be applied.

**Remedial action objective** - A description of remedial goals for each medium of concern at a site; expressed in terms of the contamination of concern exposure route(s) and receptor(s), and maximum acceptable exposure level(s).

**Remedial action technology type (or technology type)** - A general category encompassing a number of remedial action technology options that address a similar problem (e.g., capping, contaminant barriers, chemical treatment).

**Remedial action technology process option (or process option)** - A specific process, system, or action that may be used to clean up or mitigate contaminant problems (e.g., clay cap, slurry wall, neutralization).

**RI/FS** - Remedial investigation/feasibility study.

**ROD** - Record of Decision: Documents selection of cost-effective Superfund -financed remedy.

**SARA** - Superfund Amendments and Reauthorization Act of 1986. (See CERCLA).

**SDWA** - Safe Drinking Water Act.

**Sensitivity Analysis** - A test of a procedure to determine the overall changes that will result from any small change in one or more procedural elements.

**$S_M$** - The total migration score calculated using the HRS (also called the HRS score or migration score). Incorporates groundwater, surface water, and air route scores.

**SOUTHDIV** - Southern Division (NAVFACENGCOM).

**STP** - Sewage Treatment Plant; may or may not be publicly owned (See POTW).

**Support Agency** - The agency, either the Federal EPA or the State agency, responsible for review and concurrence in developing and selecting a remedy at a CERCLA site.

**SWDA** - Solid Waste Disposal Act.

**SWMU** - Solid Waste Management Unit.

**TCL** - Target compound list.

**TDHE** - Tennessee Department of Health and Environment.

**Technology process option** - See remedial action technology process option.

**TSCA** - Toxic Substances Control Act.

**Treatability studies** - Studies performed to better define the physical and chemical parameters of technology process options being evaluated.

**USACE** - US Army Corps of Engineers.

**USATHAMA** - US Army Toxic and Hazardous Materials Agency.

**USMCR** - US Marine Corps Reserve.

**USN** - US Navy.

**USNR** - US Navy Reserve.

**UST** - Underground Storage Tank.

# 1.0 INTRODUCTION

## 1.1 PHYSICAL SETTING

Naval Air Station (NAS) Memphis is located approximately 16 miles north-northeast of Memphis, Tennessee in the City of Millington. The Air Station is situated in the north central portion of Shelby County; it is the western-most county of Tennessee which borders on the Mississippi River. Shelby County is part of a six county, three state regional planning organization called the Mississippi-Arkansas-Tennessee Council of Governments/Memphis Delta Development District (MATCOG/MDDD). Figures 1-1 and 1-2 illustrate the location of the Air Station in its regional setting. The City of Millington, located west of and adjacent to the Air Station, is the most dominant feature in the immediate vicinity of NAS Memphis. Figure 1-3 is a map of the NAS.

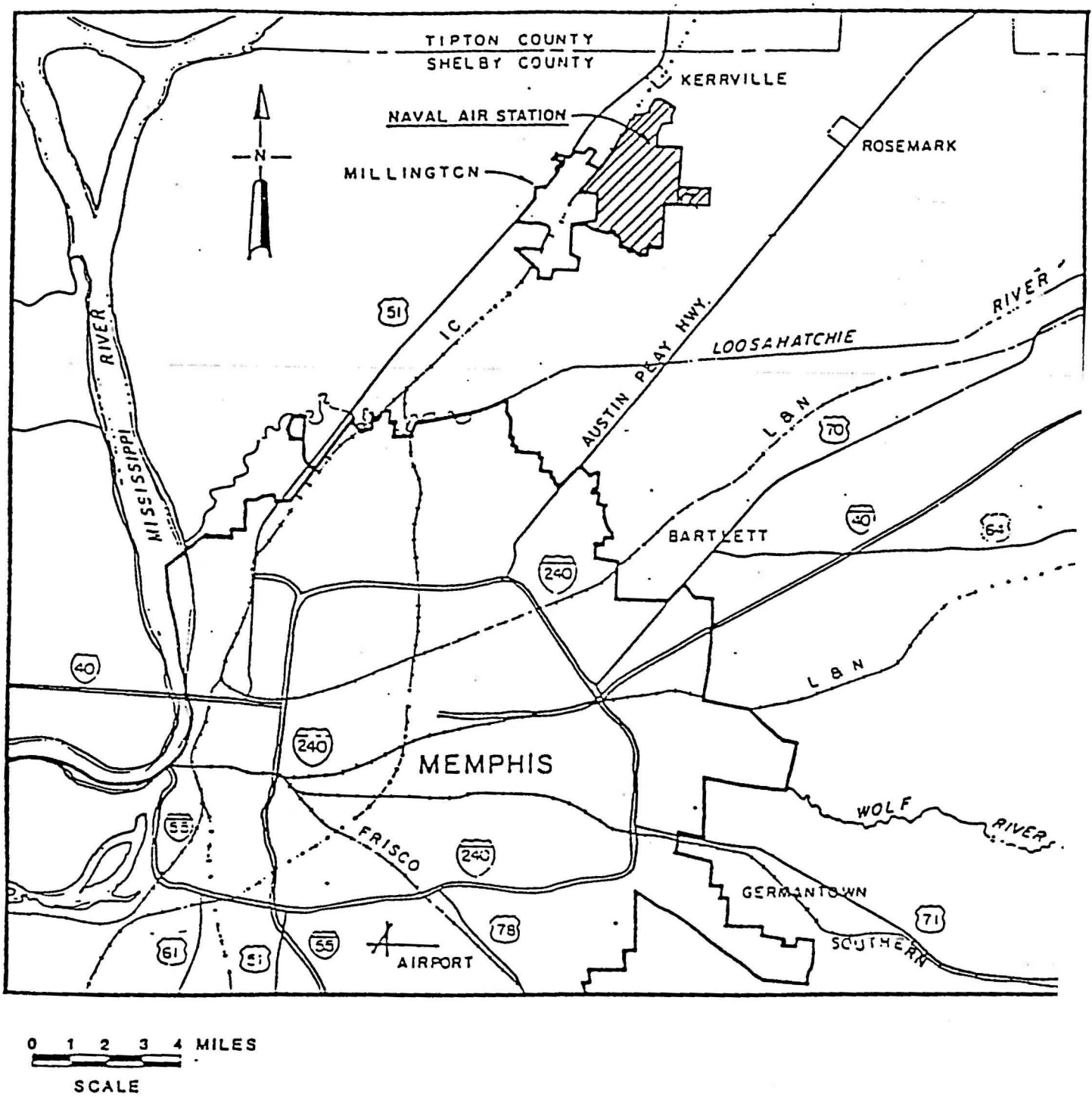
North of the Air Station, the land is primarily agricultural with some residential development found along the roadways. The small town of Kerrville is located north of the facility. To the east, the land is almost entirely in agricultural production. The Casper Creek Park is located east of the northern most portion of the Air Station. South of NAS Memphis the land is primarily agricultural with some scattered residential development found in recently completed subdivisions.

## 1.2 MISSIONS OF NAVAL AIR STATION MEMPHIS ORGANIZATIONS

The following is a brief description of the missions of the major organizations operating at NAS Memphis (AICUZ, 1981; ERCE, 1989).

<u>Naval Air Station</u>

The Naval Air Station provides maintenance, operates facilities, provides services and material to support operations of aviation activities and units of the Naval Education and Training Command,




0 1 2 3 4 MILES
SCALE

FIGURE 1-1. LOCATION MAP - NAS MEMPHIS

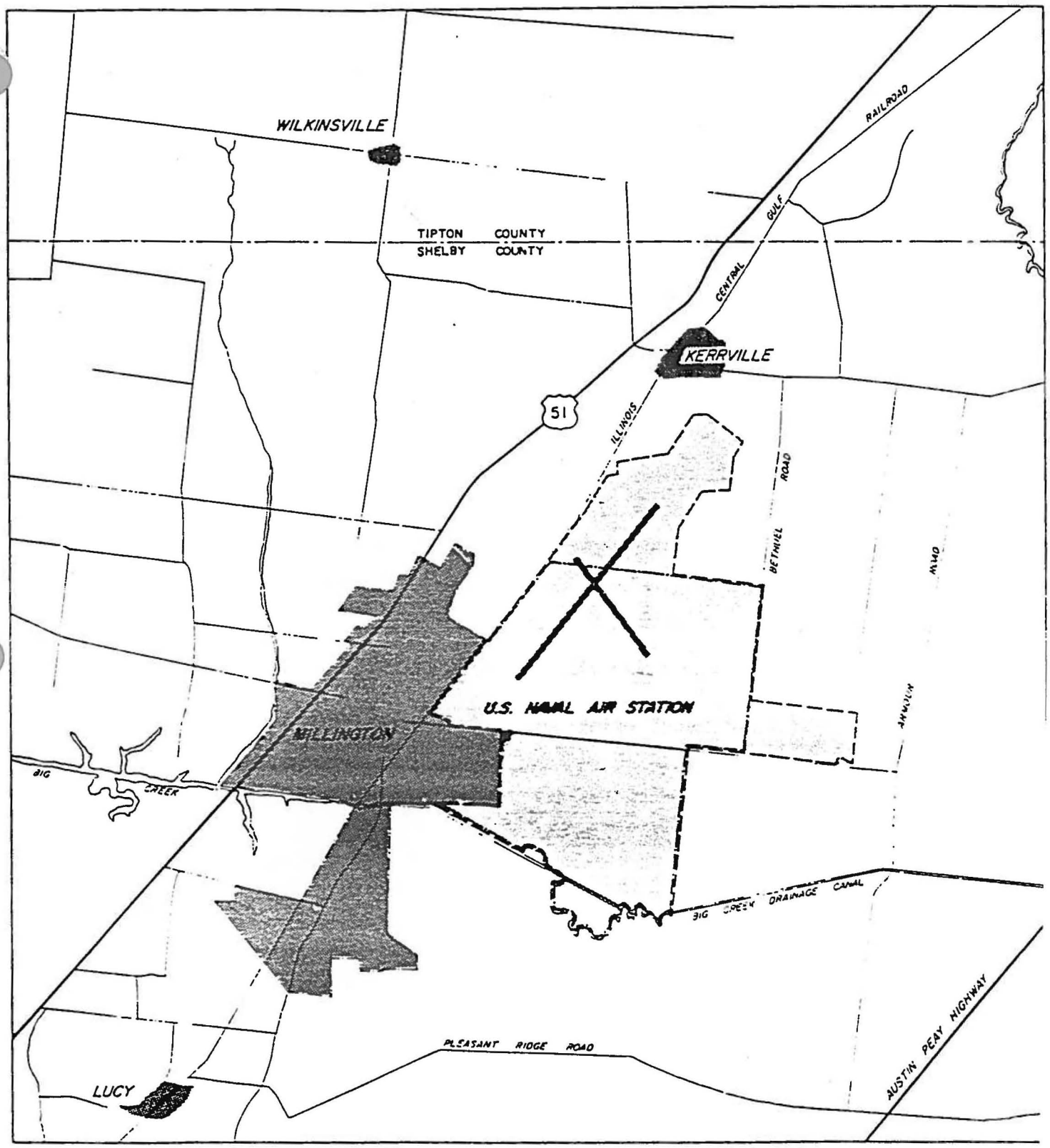



FIGURE 1-2. NAS MEMPHIS AND VICINITY

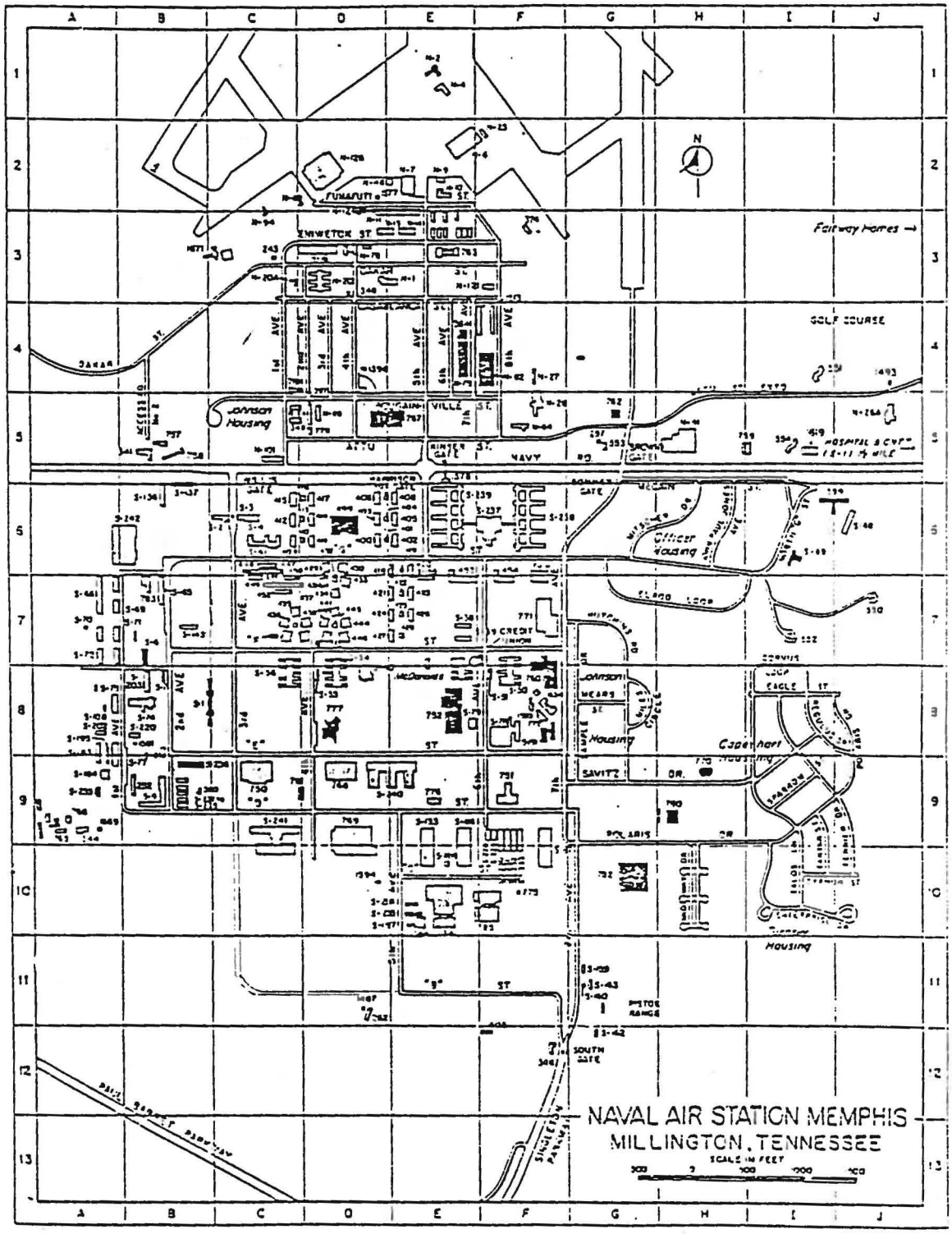



FIGURE 1-3. NAS MEMPHIS MAP

and to Naval Hospital Millington and other activities as designated by the Chief of Naval Operations.

Naval Hospital Millington

Naval Hospital Millington provides clinical and hospitalization services for active duty military, and, where facilities and staff capability permit, to other persons as authorized in Title 10 of the United States Code (USC) on a "not-to-interfere" basis. The Center also coordinates clinical health care services to assigned medical treatment facilities, participates as an integral element of Naval and Tri-Service Regional Health Care Systems, and cooperates with military and civil authorities in public health, disaster recovery or other emergencies.

The Naval Education and Training Command, Management Information and Instructional System Activity (MIISA) Detachment, Memphis

The MIISA detachment provides automatic data processing services to activities designated by the Chief of Naval Education and Training.

Marine Aviation Training Support Group - 90 (MATSG-90)

The MATSG-90 provides administrative and logistical support for assigned Marine Corps personnel and performs other tasks and functions as directed by the Commandant of the Marine Corps.

Chief of Naval Technical Training (CNTECHTRA)

The CNTECHTRA coordinates and directs Navy recruit and technical training, Marine Corps Aviation Technical Training, and other training as directed to be undertaken at activities under the Chief of Naval Technical Training.

Naval Legal Service Office (NAVLEGSVOFF)

The NAVLEGSVOFF provides necessary legal services and counsel within an assigned geographical area, and performs other functions or tasks as directed by competent authority.

Naval Air Technical Training Center (NATTC)
The NATTC trains aviation personnel in the technical phases of Naval aviation and related subjects as directed by the Chief of Naval Operations.

Naval Air Reserve Memphis (NAVAIRES)
The NAVAIRES trains individuals for mobilization assignments, directs and coordinates procurement for the Aviation Air Reserve Force, furnishes logistic support for the Marine Air Reserve Training Command and performs other functions as directed by the Chief of Naval Operations.

Navy Campus for Achievement (NCFA)
The NCFA manages the NAS Memphis off-duty Education Program for NAS Memphis personnel.

Naval Investigation Service Office (NAVINSERVO)
The NAVINSERVO provides investigative and courier intelligence support to area commands.

Aviation Intermediate Maintenance Department (AIMD)
The AIMD performs intermediate and organizational maintenance for assigned aircraft and tenant squadrons including related equipment and materials.

Naval Reserve Readiness Command Nine (NAVRESREDCOMNINE)
NAVRESREDCOMNINE is assigned to Naval Reserve activities and units to direct their prescribed programs to assure mobilization readiness and act as a field manager for CNAVRES for assigned resources.

Navy Exchange (NEX)
The NEX provides a convenient and reliable source from which authorized patrons may obtain, at the lowest practicable cost, articles and services required for their well-being and

contentment; to provide through profits, a source of funds to be used for the Welfare and Recreation of Naval Personnel; and to promote the morale of the Command in which it is established through the operation of a well-managed, attractive and serviceable Exchange.

National Weather Service Environmental Detachment (NWSED)
The NWSED collects, plots, analyzes and disseminates weather data, making maximum use of processed weather briefings to pilots and keeps the Air Operations Officer as well as the CO's of all tenants informed of impending weather conditions.

Naval Construction Battalion Unit 404 (NCBU-404)
The NCBU-404 conducts training, provides habitability of facilities, and supports Naval Reserve Forces.

Naval Air Maintenance Training Group (MAMTG)
The MAMTGs primary mission is to provide, by means of detachments, technical instruction for officer and enlisted personnel in the maintenance of aircraft weapons systems and associated equipment, aviation support equipment, maintenance administration, and other training.

Marine Air Reserve Training Detachment (MARTD)
The MARTDs primary mission is to coordinate, supervise and support the accomplishment of requisite training for attached Marine Corps Reserve Units and personnel; and to supervise pre-mobilization, planning and logistic functions to insure orderly mobilization within time and readiness levels prescribed by current plans.

Navy Commissary Store (NAVCOMSYSTO)
The primary mission of NAVCOMSYSTO is to provide a convenient and

reliable source from which authorized patrons may obtain foodstuffs and other authorized items at the lowest practicable cost.

# 2.0 SITE CHARACTERIZATION

NAS Memphis is a 3,490-acre facility located in Millington, Tennessee, approximately twenty miles northeast of the City of Memphis and thirteen miles east of the Mississippi River. The facility is bordered on the west and south by the City of Millington and the north and east by agricultural and residential areas. The general location is shown on Figure 1-1.

## 2.1 SITE BACKGROUND AND HISTORY

### 2.1.1 Ownership History

Since it was commissioned in 1942, the mission of the NAS has been to provide services and material to support operations of aviation activities, units of the Naval Education and Training Command and other activities and units as designated by the Chief of Naval Operations (CNO). Naval Hospital Millington is located adjacent to the NAS and is part of the entire installation.

During World I, the U.S. Army constructed Park Field, a military aviation training facility. Between the World Wars, the site was used for approximately eight years as a civilian airfield and, beginning in 1929, as a government-supported agricultural research facility.

The Memphis Naval Air Station was originally conceived in 1942 on the site of Park Field, which was the first aviation facility in Shelby County, Tennessee. The mission of Park Field was as an Army Signal Corps Aviation School intended as a training center for pilots and ground crews for service with the Allied Forces during World War I. Park Field consisted of 912.5 acres, all of which was situated south of the present alignment of Millington-Arlington (Navy) Road, Tennessee Highway 205 (TN Hwy 205).

On September 15, 1942, the facility was commissioned as a Naval Reserve Air Base (NRAB) with the principal mission of training aviation cadets to pilot proficiency for action in World War II. On January 1, 1943, the official designation of the facility was changed to a Naval Air Station (NAS). When the war ended, the northside of NAS Memphis was assigned to the Reserve Training Command and was almost exclusively used for reserve training until 1948.

Currently, the Air Station encompasses an area of approximately 3,400 acres with some 980 buildings located on both sides on Navy Road, which makes NAS Memphis the largest inland naval station. NAS Memphis maintains and operates facilities and provides services and material to support operations of aviation activities and units of the Naval Education and Training Command and other activities and units as designated by the Chief of Naval Operations. This role is carried out with approximately 2,000 civilian and military personnel. Additionally, NAS Memphis serves as an essential refueling stop for transient aircraft.

With twenty-three resident commands at NAS Memphis, the facility functions as a self-contained city, including housing, food services, entertainment facilities and utilities. Today, NAS Memphis Naval tenants include Chief of Naval Technical Training (CNTECHTRA), Naval Air Technical Training Center, Naval Air Maintenance Training Group, Marine Aviation Training Support Group-90, Marine Aircraft Group-42 Detachment B, Patrol Squadron VP-67, Fleet Logistic Support Squadron VR-60, and Naval Construction Battalion Unit CBU-404.

### 2.1.2 Regulatory History

The following is a brief description of the regulatory history of NAS Memphis and Site No. 11 with respect to state and federal environmental laws, rules, and regulations.

2.1.2.1 Federal Regulatory History

Federal regulatory history for protection and enhancement of the environment and protection of the public health deals primarily with the following issues:

- Solid Waste Management, both hazardous and non-hazardous.
- Surface water protection/non-degradation.
- Groundwater protection/non-degradation.
- Management of fuels and other chemicals.
- Air quality.
- Noise (aircraft operation).

The Department of Defense (DOD) initiated the Defense Environmental Restoration Program (DERP) activities in 1976, the same year the Resource Conservation and Recovery Act (RCRA) was passed DERP was given a federal statutory basis with the passage of SARA in 1986. Section 120 of SARA codified the DERP as 10 USC 160. As a part of DERP, the Defense Environmental Restoration Account (DERA) was formally established to provide for dedicated DERP funding. Additional capability for addressing sites formerly owned by DOD was provided by the 1984 Defense Authorization Act.

By 1978, the Services (Army, Navy [Marines], and Air Force) had developed programs to identify and assess problems or active military installations. The DOD and EPA signed a Memorandum of Understanding (MOU) on responsibilities under CERCLA on 12 August 1983. At this time, the US Navy had already begun work to assess environmental conditions at naval installations under a formal Installation Restoration Program (IRP). The IRP has two objectives:

- To identify and evaluate past hazardous material disposal sites on DOD facilities and control

contamination migration that present a hazard to health or welfare.

- To review and decontaminate, as necessary, land and facilities determined to be in excess of DOD requirements.

Because this IRP proceeded CERCLA and subsequent EPA regulations, the IRP process and procedures were similar but not exactly analogous to the procedural steps required by the NCP. Current IRP guidance is coordinated with the NCP to provide the same procedural steps (PA/SI, RI/FS, RD/RA) for CERCLA work.

The DERP currently consists of three programs:

- The IRP (CERCLA/SARA Compliance)
- Hazardous Waste Management (RCRA Compliance)
- Building demolition and debris removal (Solid Waste Management)

The IRP initially provided for a four-phase process:

- Phase I - Initial Assessment
- Phase II - Confirmation Study
- Phase III - Technology Development
- Phase IV - Remedial Action

<u>EPA Regulation</u>

The EPA issued a partial RCRA permit to the NAS on 15 September 1988. The partial permit required the NAS to investigate past and current solid waste management units at the NAS, and to prepare a report of the findings. This partial permit, issued under the HSWA provisions, and permits issued to the NAS by TDHE for hazardous waste storage completed the RCRA permit.

2.1.2.2 State of Tennessee Regulatory History

State regulatory history regarding NAS Memphis is concerned chiefly with wastewater treatment plants and sanitary and/or industrial waste landfills. In past times, the NAS operated wastewater treatment facilities on both the north and south sides. Neither of these former facilities exist at present. NAS wastewater is discharged to the City of Millington plant.

2.1.3 Process and Waste Disposal History

Used oil was used for dust suppression on unpaved NAS roads from 1942 to the early 1970's.

## 2.2 SITE DESCRIPTION

2.2.1 Site Features and Layout

Site No. 11 consists of unpaved perimeter and access roads throughout the periphery of NAS. From 1942 until the early 1970's, used oil from NAS activities was sprayed on the roads as a dust suppressant. Figure 2-1 is a representative depiction of a section of road.

2.2.1.1 Size and Layout

The amount of road area sprayed with the oil is estimated at 150,000 square feet (from CERCLA 103c Notification). The oil spreading practice was not confined to any specific area or road.

2.2.1.2 Buildings and Roads

There are no buildings associated with Site No. 11. The site as defined consists entirely of unpaved ("dirt") roads within the NAS boundary.

2.2.1.3 Drainage

Site drainage is provided by shallow ditches, slightly elevated road bed, etc., typical of unpaved roads.

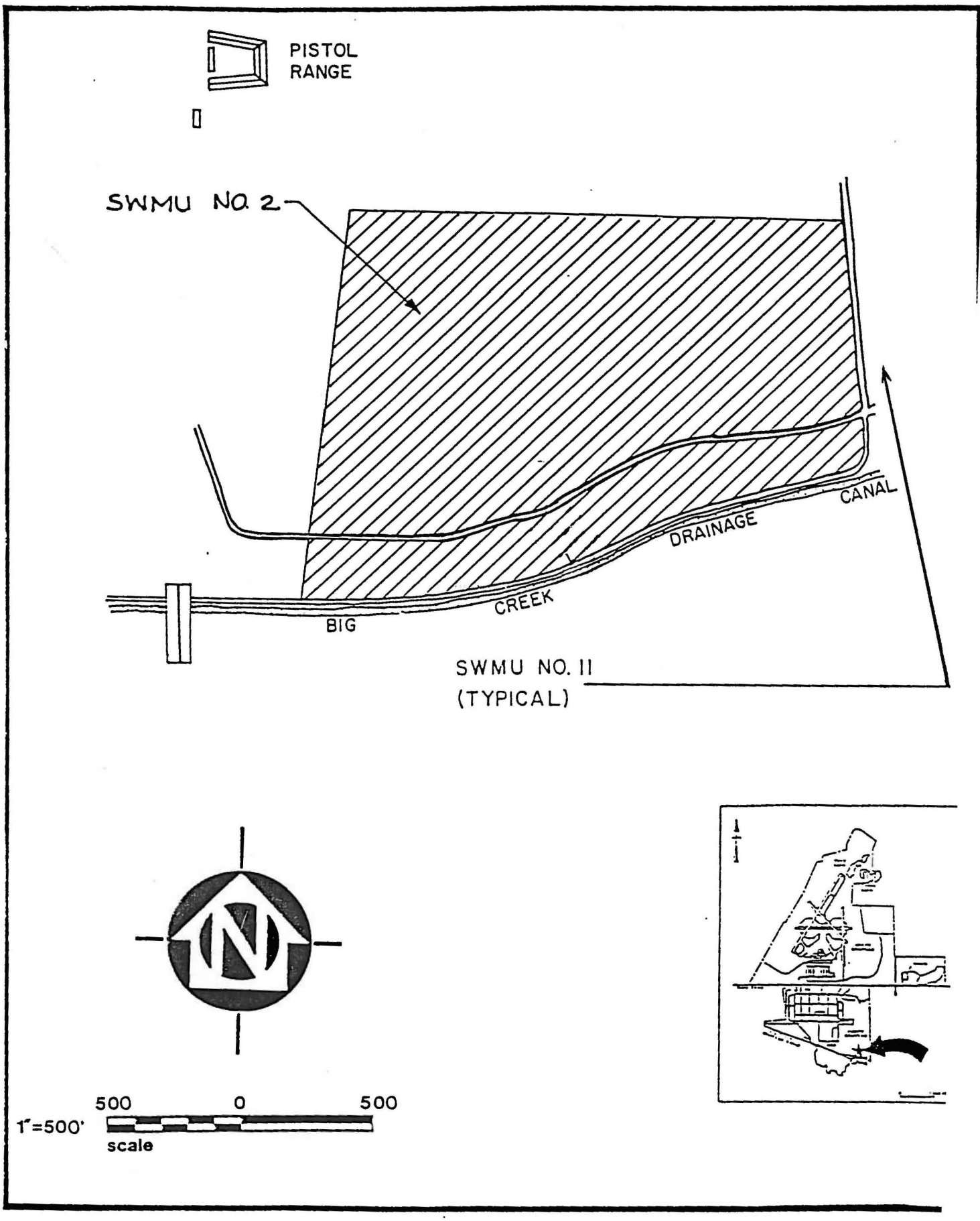



FIGURE 2-1. OILED, DIRT ROADS

2.2.1.4 On-Site Sampling Locations

Surface soil samples were taken for chemical analysis during the Navy's 1983 Initial Assessment Study (IAS) of the NAS (NEESA, 1983). Samples were analyzed for polychlorinated biphenyls (PCBs). Results of analyses failed to show PCBs at detectable levels. Samples were taken from sections of roads most frequently subjected to oiling.

2.2.1.5 Onsite Well Locations

There are no wells located on Site 11.

2.2.1.6 Disposal Areas

Approximately 150,000 square feet of unpaved road surface was treated with waste oil.

2.2.2 Site Accessibility

The site is easily accessible from paved NAS Memphis streets and roads. By definition, the entire site is accessible by automobile.

2.2.3 Waste Characteristics

2.2.3.1 Waste Types

Waste oil was used to spray the roads. Since PCBs were not a concern at the time of spraying, it is assumed that oils containing PCBs were mixed with other waste oils and sprayed on the roads. The amount of PCB-containing oil, or the area sprayed with this oil, could not be determined.

2.2.3.2 Disposal Methods

Disposal was by periodic spraying as a thin film on road surface. Significant runoff or seepage to depths of 1 foot or more would be unlikely.

affects the pattern of land use and of public decision making generally.

All of the land around NAS Memphis is zoned. Agricultural zoning predominates in all rural areas to the north of the airfield with the exception of a small area of residential zoning around the village of Kerrville. Within Millington to the west, residential use predominates with small areas of commercial zones around the major thoroughfares. Significant areas of industrial zoning occur along the Illinois Central rail line to the west and south. Additionally significant areas of residentially zoned land occurs on the South and to the east of the Air Station. Both the Shelby County and the Millington Zoning Ordinances are relatively thorough and up to date.

Tall structures are regulated in both Millington and in Shelby County. Additionally, the Shelby County Ordinance includes airport zoning based on the appropriate navigational surfaces.

Development Trends

The pace and distribution of development in any city or regional area are governed by a variety of factors. Among these are local zoning and development policies, the availability of financing and urban services; the land itself and its characteristics; its location; and finally the nature of the demand itself including family size, income characteristics, and individual subjective preferences. The following text reviews the strongest of these forces in order of importance.

Shelby County and the areas around NAS Memphis are expected to experience substantial growth over the coming two decades. Past growth for Shelby County has exceeded both the overall growth rate for the State of Tennessee and of the United States as a whole. A ten year growth rate of 16.5 percent is forecast for the next two decades. While must of this additional population

can be expected to locate within the City of Memphis, a substantial fraction will be in the NAS Memphis vicinity. The primary attractions are the availability of land and city services; improved transportation; and, to a lesser extent, the activity at NAS Memphis itself.

2.3.2.1 Commercial/Industrial/Institutional

The NAS and vicinity has a mixture of commercial, light industrial, and institutional entities. They are principally NAS operations, commercial businesses largely supported by the NAS, and city buildings.

2.3.2.2 Single or Multi-family Residential

Single and multi-family residential housing exists both on and off station.

2.3.2.3 Parks

The nearest park is Casper Creek Park, located just northeast of the NAS. Meeman-Shelby Forest State Park is located approximately 10 miles west of the NAS.

2.3.2.4 Agricultural

Land use to the north, east, and south of the NAS is largely agricultural. However, no agricultural land if affected by Site No. 11.

2.3.3 Sensitive Environment

There are no sensitive environments located within a 4 miles radius of the NAS.

2.3.3.1 Sensitive Environments Within 4-mile Radius of NAS Memphis

There are no sensitive environments located within a 4 miles radius of the NAS.

2.3.3.2 Sensitive Environments Along Surface Water Migration Pathways

There are no known sensitive environments along surface water migration pathways for Site No. 11.

## 2.4 HYDROLOGY

### 2.4.1 Climatology

Exhibits 2-1 and 2-2 are climatic data summaries for the Memphis, Tennessee area and NAS Memphis, respectively. The climate at NAS Memphis is characterized by warm summers and cool moderate winters. Extreme temperatures are rare with only about 66 days per year with maximum temperatures over 90 degrees and only 57 days with minimum temperature under 32 degrees. The average annual temperature is 61.9°F. The hottest month is July with an average temperature of 81.4° and the coldest month is January with an average temperature of 40.6°.

Precipitation at NAS Memphis is heaviest in the winter and early spring as numerous low pressure systems move through the area. Precipitation during the spring and early summer is more localized and related to thunderstorms of short duration. Annual average precipitation at NAS Memphis is approximately 49 inches.

Snowstorms in the Memphis area occur infrequently with an average annual snowfall of approximately four inches. Freezing rain and ice storms occur once or twice each year.

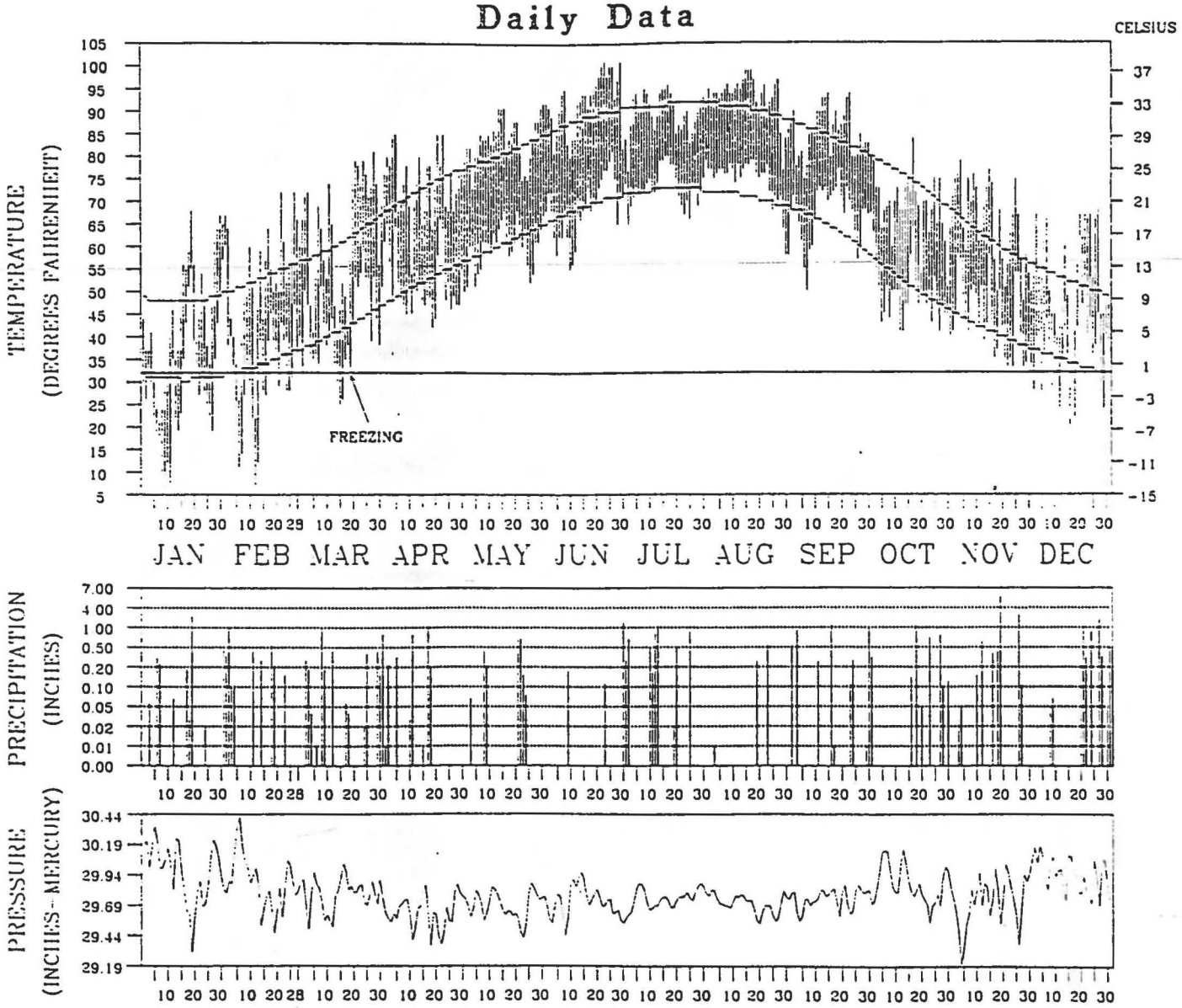
Prevailing winds are from the south and are of relatively low velocities. Wind speeds less than 12 miles per hour occur approximately 74 percent of the time. Speeds of 13 to 24 miles per hour occur about 25 percent of the time and speeds of 25 miles per hour or higher occur approximately one percent of the time. Figure 2-2 is the NAS Memphis Wind Rose.

EXHIBIT 2-1. MEMPHIS, TENNESSEE LOCAL CLIMATOLOGICAL DATA

ISSN 0198-4829

# 1988 LOCAL CLIMATOLOGICAL DATA
## ANNUAL SUMMARY WITH COMPARATIVE DATA
MEMPHIS,
TENNESSEE

### Daily Data




TEMPERATURE DEPICTS NORMAL MAXIMUM, NORMAL MINIMUM AND ACTUAL DAILY HIGH AND LOW VALUES (FAHRENHEIT)
PRECIPITATION IS MEASURED IN INCHES. SCALE IS NON-LINEAR
STATION PRESSURE IS MEASURED IN INCHES OF MERCURY

I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND IS COMPILED FROM RECORDS ON FILE AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE, NORTH CAROLINA, 28801

noaa

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE

NATIONAL CLIMATIC DATA CENTER ASHEVILLE NORTH CAROLINA

Kenneth D. Eisler
DIRECTOR
NATIONAL CLIMATIC DATA CENTER

# METEOROLOGICAL DATA FOR 1988

MEMPHIS, TENNESSEE

LATITUDE: 35°03' N LONGITUDE: 90°00' W ELEVATION: FT. GRND 258 BARO 271 TIME ZONE: CENTRAL WBAN: 13893

| | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TEMPERATURE °F:** | | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | |
| -Daily Maximum | 44.6 | 52.9 | 62.9 | 74.1 | 83.9 | 92.4 | 90.0 | 93.3 | 85.6 | 69.1 | 65.5 | 54.4 | 72.4 |
| -Daily Minimum | 29.0 | 31.4 | 41.7 | 51.5 | 59.6 | 68.2 | 73.1 | 74.1 | 67.0 | 49.1 | 43.7 | 35.3 | 52.0 |
| -Monthly | 36.8 | 42.2 | 52.3 | 62.8 | 71.8 | 80.3 | 81.6 | 83.7 | 76.3 | 59.1 | 54.6 | 44.9 | 62.2 |
| -Monthly Dewpt | 25.9 | 29.2 | 38.1 | 46.4 | 53.5 | 58.5 | 70.8 | 70.7 | 65.5 | 45.7 | 44.1 | 32.7 | 48.4 |
| Extremes | | | | | | | | | | | | | |
| -Highest | 68 | 72 | 81 | 85 | 92 | 101 | 96 | 99 | 94 | 84 | 79 | 68 | 101 |
| -Date | 19 | 27 | 28 | 23 | 31 | 29 | 17 | 17 | 23 | 17 | 4 | 27 | JUN 29 |
| -Lowest | 6 | 6 | 25 | 42 | 50 | 55 | 65 | 58 | 50 | 40 | 33 | 20 | 6 |
| -Date | 9 | 12 | 15 | 19 | 1 | 10 | 2 | 31 | 7 | 31 | 28 | 16 | FEB 12 |
| **DEGREE DAYS BASE 65 °F:** | | | | | | | | | | | | | |
| Heating | 867 | 657 | 393 | 108 | 0 | 0 | 0 | 0 | 1 | 202 | 314 | 619 | 3161 |
| Cooling | 0 | 0 | 7 | 52 | 221 | 469 | 518 | 586 | 347 | 24 | 8 | 0 | 2232 |
| **% OF POSSIBLE SUNSHINE** | | | | | | | | | | | | | |
| **AVG. SKY COVER (tenths)** | | | | | | | | | | | | | |
| Sunrise - Sunset | 6.5 | 5.4 | 5.5 | 5.1 | 4.1 | 3.7 | 6.7 | 4.7 | 5.5 | 4.8 | 4.8 | 4.9 | 5.1 |
| Midnight - Midnight | 5.7 | 4.7 | 5.3 | 4.9 | 3.6 | 3.1 | 5.8 | 3.9 | 4.9 | 4.3 | 4.5 | 4.9 | 4.6 |
| **NUMBER OF DAYS:** | | | | | | | | | | | | | |
| Sunrise to Sunset | | | | | | | | | | | | | |
| -Clear | 9 | 11 | 13 | 12 | 14 | 16 | 7 | 13 | 10 | 13 | 13 | 17 | 148 |
| -Partly Cloudy | 5 | 7 | 3 | 6 | 11 | 7 | 9 | 12 | 10 | 9 | 6 | 1 | 86 |
| -Cloudy | 17 | 11 | 15 | 12 | 6 | 7 | 15 | 6 | 10 | 9 | 11 | 13 | 132 |
| Precipitation .01 inches or more | 9 | 9 | 14 | 8 | 7 | 3 | 9 | 3 | 9 | 8 | 9 | 10 | 98 |
| Snow, Ice pellets 1.0 inches or more | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Thunderstorms | 2 | 1 | 3 | 4 | 6 | 3 | 10 | 6 | 4 | 5 | 4 | 2 | 50 |
| Heavy Fog, visibility 1/4 mile or less | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 10 |
| Temperature °F | | | | | | | | | | | | | |
| -Maximum | | | | | | | | | | | | | |
| 90° and above | 0 | 0 | 0 | 0 | 5 | 23 | 18 | 27 | 9 | 0 | 0 | 0 | 82 |
| 32° and below | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| -Minimum | | | | | | | | | | | | | |
| 32° and below | 21 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 53 |
| 0° and below | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **AVG. STATION PRESS. (mb)** | 1014.6 | 1011.9 | 1008.5 | 1003.4 | 1005.3 | 1006.1 | 1007.3 | 1005.9 | 1007.5 | 1011.2 | 1006.4 | 1013.9 | 1008.5 |
| **RELATIVE HUMIDITY (%)** | | | | | | | | | | | | | |
| Hour 00 | 69 | 67 | 66 | 67 | 64 | 56 | 82 | 75 | 82 | 71 | 76 | 70 | 70 |
| Hour 06 (Local Time) | 75 | 77 | 75 | 75 | 74 | 69 | 87 | 84 | 87 | 80 | 84 | 77 | 79 |
| Hour 12 | 60 | 55 | 53 | 45 | 43 | 37 | 62 | 55 | 59 | 52 | 62 | 53 | 53 |
| Hour 18 | 64 | 57 | 51 | 47 | 43 | 37 | 61 | 54 | 62 | 58 | 63 | 59 | 55 |
| **PRECIPITATION (inches):** | | | | | | | | | | | | | |
| Water Equivalent | | | | | | | | | | | | | |
| -Total | 4.25 | 3.49 | 4.20 | 2.85 | 2.38 | 2.15 | 5.21 | 0.85 | 4.73 | 3.62 | 10.52 | 5.99 | 50.24 |
| -Greatest (24 hrs) | 2.85 | 1.49 | 1.15 | 1.35 | 1.34 | 1.85 | 2.09 | 0.55 | 1.50 | 1.37 | 5.65 | 2.55 | 5.65 |
| -Date | 18-19 | 1- 2 | 8- 9 | 17-18 | 21-22 | 30 | 12-13 | 23 | 15 | PM- 1 | 19-20 | 27-28 | NOV 19-20 |
| Snow, Ice pellets | | | | | | | | | | | | | |
| -Total | 8.2 | 3.0 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 11.2 |
| -Greatest (24 hrs) | 7.7 | 3.0 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 7.7 |
| -Date | 6- 7 | 11 | 17 | | | | | | | | | 28 | JAN 6- 7 |
| **WIND:** | | | | | | | | | | | | | |
| Resultant | | | | | | | | | | | | | |
| -Direction (!!!) | 248 | 315 | 224 | 315 | 175 | 087 | 193 | 139 | 119 | 032 | 206 | 204 | 185 |
| -Speed (mph) | 0.3 | 1.4 | 1.6 | 1.3 | 1.5 | 1.4 | 2.6 | 1.9 | 2.1 | 1.0 | 2.7 | 0.7 | 0.7 |
| Average Speed (mph) | 9.9 | 9.4 | 9.6 | 8.4 | 8.0 | 7.0 | 6.6 | 6.0 | 6.8 | 7.6 | 9.5 | 9.3 | 8.2 |
| Fastest Obs. 1 Min. | | | | | | | | | | | | | |
| -Direction (!!!) | 21 | 20 | 18 | 28 | 18 | 02 | 22 | 03 | 08 | 35 | 18 | 34 | 34 |
| -Speed (mph) | 23 | 23 | 23 | 28 | 32 | 18 | 26 | 30 | 20 | 21 | 29 | 37 | 37 |
| -Date | 30 | 22 | 12 | 5 | 21 | 9 | 25 | 18 | 30 | 23 | 16 | 27 | DEC 27 |
| Peak Gust | | | | | | | | | | | | | |
| -Direction (!!!) | S | SW | S | W | W | N | NE | NE | SE | N | S | NW | W |
| -Speed (mph) | 32 | 37 | 36 | 46 | 44 | 28 | 39 | 30 | 32 | 32 | 45 | 44 | 46 |
| -Date | 30 | 22 | 12 | 5 | 8 | 9 | 25 | 18 | 30 | 23 | 16 | 27 | APR 5 |

(!!!) See Reference Notes on Page 6B

# NORMALS, MEANS, AND EXTREMES

MEMPHIS, TENNESSEE

LATITUDE: 35°03'N LONGITUDE: 90°00' W ELEVATION: FT. GRND 258 BARO 271 TIME ZONE: CENTRAL WBAN: 13893

| | (a) | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE °F: | | | | | | | | | | | | | | |
| Normals* | | | | | | | | | | | | | | |
| -Daily Maximum | | 48.3 | 53.0 | 61.4 | 72.9 | 81.0 | 88.4 | 91.5 | 90.3 | 84.3 | 74.5 | 61.4 | 52.3 | 71.6 |
| -Daily Minimum | | 30.9 | 34.1 | 41.9 | 52.2 | 60.9 | 68.9 | 72.6 | 70.8 | 64.1 | 51.3 | 41.1 | 34.3 | 51.9 |
| -Monthly | | 39.6 | 43.5 | 51.7 | 62.6 | 71.0 | 78.7 | 82.1 | 80.6 | 74.2 | 62.9 | 51.3 | 43.3 | 61.8 |
| Extremes | | | | | | | | | | | | | | |
| -Record Highest | 47 | 78 | 81 | 85 | 94 | 99 | 104 | 108 | 105 | 103 | 95 | 85 | 81 | 108 |
| -Year | | 1972 | 1962 | 1986 | 1987 | 1977 | 1954 | 1980 | 1943 | 1954 | 1954 | 1955 | 1982 | JUL 1980 |
| -Record Lowest | 47 | -4 | -11 | 12 | 29 | 38 | 48 | 52 | 48 | 36 | 25 | 9 | -13 | -13 |
| -Year | | 1985 | 1951 | 1943 | 1987 | 1944 | 1966 | 1947 | 1946 | 1949 | 1952 | 1950 | 1963 | DEC 1963 |
| NORMAL DEGREE DAYS: | | | | | | | | | | | | | | |
| Heating (base 65°F) | | 787 | 602 | 433 | 126 | 25 | 0 | 0 | 0 | 9 | 137 | 415 | 673 | 3207 |
| Cooling (base 65°F) | | 0 | 0 | 20 | 54 | 211 | 411 | 530 | 484 | 285 | 72 | 0 | 0 | 2067 |
| % OF POSSIBLE SUNSHINE | 35 | 50 | 54 | 56 | 64 | 69 | 74 | 74 | 75 | 69 | 70 | 58 | 50 | 64 |
| MEAN SKY COVER (tenths) | | | | | | | | | | | | | | |
| Sunrise - Sunset | 38 | 6.8 | 6.4 | 6.5 | 6.0 | 5.8 | 5.3 | 5.4 | 5.0 | 5.0 | 4.6 | 5.6 | 6.3 | 5.7 |
| MEAN NUMBER OF DAYS: | | | | | | | | | | | | | | |
| Sunrise to Sunset | | | | | | | | | | | | | | |
| -Clear | 36 | 8.0 | 7.9 | 8.2 | 8.9 | 8.9 | 10.2 | 10.3 | 11.8 | 12.4 | 14.3 | 10.2 | 9.0 | 120.1 |
| -Partly Cloudy | 36 | 5.9 | 5.8 | 6.5 | 7.1 | 9.7 | 11.0 | 11.8 | 11.4 | 7.8 | 7.2 | 6.3 | 5.8 | 96.3 |
| -Cloudy | 36 | 17.2 | 14.6 | 16.3 | 14.0 | 12.4 | 8.8 | 8.9 | 7.7 | 9.9 | 9.5 | 13.5 | 16.2 | 149.0 |
| Precipitation .01 inches or more | 38 | 9.9 | 9.5 | 10.8 | 10.2 | 9.1 | 8.3 | 8.6 | 7.8 | 7.1 | 6.2 | 8.8 | 9.6 | 105.9 |
| Snow, Ice pellets 1.0 inches or more | 38 | 0.9 | 0.6 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.* | 0.2 | 1.9 |
| Thunderstorms | 38 | 1.8 | 2.3 | 4.5 | 6.4 | 6.7 | 7.2 | 8.2 | 6.2 | 3.4 | 2.0 | 2.2 | 1.6 | 52.6 |
| Heavy Fog Visibility 1/4 mile or less | 38 | 2.1 | 1.3 | 0.8 | 0.3 | 0.2 | 0.2 | 0.3 | 0.4 | 0.6 | 1.1 | 1.4 | 1.8 | 10.4 |
| Temperature °F | | | | | | | | | | | | | | |
| -Maximum | | | | | | | | | | | | | | |
| 90° and above | 47 | 0.0 | 0.0 | 0.0 | 0.1 | 3.2 | 14.7 | 21.6 | 18.5 | 7.8 | 0.7 | 0.0 | 0.0 | 66.6 |
| 32° and below | 47 | 3.4 | 1.3 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.3 | 6.2 |
| -Minimum | | | | | | | | | | | | | | |
| 32° and below | 47 | 18.5 | 12.6 | 5.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 5.7 | 14.5 | 57.3 |
| 0° and below | 47 | 0.1 | 0.* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| AVG. STATION PRESS. (mb) | 16 | 1011.6 | 1009.7 | 1006.4 | 1005.6 | 1004.5 | 1005.4 | 1006.4 | 1006.8 | 1007.4 | 1009.4 | 1009.4 | 1010.9 | 1007.8 |
| RELATIVE HUMIDITY (%) | | | | | | | | | | | | | | |
| Hour 00 | 49 | 75 | 73 | 70 | 71 | 76 | 77 | 79 | 80 | 80 | 77 | 74 | 74 | 76 |
| Hour 06 (Local Time) | 49 | 78 | 78 | 76 | 78 | 82 | 82 | 84 | 86 | 86 | 83 | 80 | 78 | 81 |
| Hour 12 | 49 | 63 | 60 | 56 | 53 | 55 | 56 | 57 | 57 | 56 | 51 | 56 | 61 | 57 |
| Hour 18 | 49 | 67 | 62 | 56 | 54 | 56 | 57 | 58 | 60 | 62 | 60 | 63 | 67 | 60 |
| PRECIPITATION (inches): | | | | | | | | | | | | | | |
| Water Equivalent | | | | | | | | | | | | | | |
| -Normal | | 4.61 | 4.33 | 5.44 | 5.77 | 5.06 | 3.58 | 4.03 | 3.74 | 3.62 | 2.37 | 4.17 | 4.85 | 51.57 |
| -Maximum Monthly | 38 | 12.21 | 9.39 | 12.08 | 12.29 | 11.58 | 6.88 | 8.84 | 9.65 | 7.61 | 7.75 | 10.52 | 13.81 | 13.81 |
| -Year | | 1951 | 1956 | 1975 | 1955 | 1953 | 1951 | 1959 | 1978 | 1958 | 1984 | 1988 | 1982 | DEC 1982 |
| -Minimum Monthly | 38 | 0.57 | 1.12 | 1.50 | 2.05 | 0.83 | 0.04 | 0.43 | 0.43 | 0.19 | T | 0.75 | 1.05 | T |
| -Year | | 1986 | 1980 | 1966 | 1965 | 1977 | 1953 | 1954 | 1953 | 1953 | 1963 | 1965 | 1955 | OCT 1963 |
| -Maximum in 24 hrs | 38 | 3.89 | 3.63 | 5.95 | 4.35 | 4.94 | 4.76 | 4.71 | 4.04 | 4.63 | 3.40 | 5.65 | 5.42 | 5.95 |
| -Year | | 1974 | 1966 | 1975 | 1985 | 1958 | 1980 | 1980 | 1978 | 1957 | 1981 | 1988 | 1978 | MAR 1975 |
| Snow, Ice pellets | | | | | | | | | | | | | | |
| -Maximum Monthly | 38 | 12.4 | 8.3 | 17.3 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 14.3 | 17.3 |
| -Year | | 1985 | 1985 | 1968 | 1971 | | | | | | | 1976 | 1963 | MAR 1968 |
| -Maximum in 24 hrs | 38 | 8.1 | 5.8 | 16.1 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 14.3 | 16.1 |
| -Year | | 1985 | 1960 | 1968 | 1971 | | | | | | | 1976 | 1963 | MAR 1968 |
| WIND: | | | | | | | | | | | | | | |
| Mean Speed (mph) | 40 | 10.2 | 10.2 | 10.9 | 10.4 | 8.8 | 8.0 | 7.5 | 7.0 | 7.5 | 7.7 | 9.1 | 9.8 | 8.9 |
| Prevailing Direction through 1963 | | S | S | S | S | S | S | S | S | E | S | S | S | S |
| Fastest Obs. 1 Min. | | | | | | | | | | | | | | |
| -Direction (!!!) | 13 | 34 | 32 | 16 | 24 | 34 | 02 | 34 | 20 | 36 | 28 | 23 | 30 | 24 |
| -Speed (MPH) | 13 | 35 | 35 | 40 | 46 | 40 | 40 | 35 | 35 | 39 | 40 | 40 | 36 | 46 |
| -Year | | 1976 | 1984 | 1973 | 1979 | 1979 | 1977 | 1982 | 1980 | 1972 | 1984 | 1979 | 1972 | APR 1979 |
| Peak Gust | | | | | | | | | | | | | | |
| -Direction (!!!) | | | | | | | | | | | | | | |
| -Speed (mph) | | | | | | | | | | | | | | |
| -Date | | | | | | | | | | | | | | |

!!!! See Reference Notes on Page 68

## PRECIPITATION (inches)

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 4.34 | 5.21 | 3.56 | 3.73 | 1.85 | 4.82 | 8.84 | 4.56 | 2.73 | 1.57 | 2.66 | 5.33 | 49.20 |
| 1960 | 3.74 | 3.08 | 4.20 | 3.65 | 4.20 | 5.34 | 1.30 | 7.84 | 4.05 | 4.11 | 3.62 | 4.30 | 49.43 |
| 1961 | 0.84 | 6.89 | 7.13 | 4.65 | 4.40 | 1.49 | 3.97 | 1.71 | 0.66 | 1.28 | 8.06 | 8.56 | 49.64 |
| 1962 | 4.19 | 4.22 | 4.80 | 3.62 | 0.84 | 5.71 | 3.94 | 4.18 | 5.28 | 2.57 | 2.31 | 1.35 | 43.01 |
| 1963 | 1.28 | 2.91 | 6.17 | 5.60 | 3.77 | 4.33 | 4.38 | 2.15 | 2.06 | T | 2.72 | 3.31 | 38.62 |
| 1964 | 3.73 | 3.50 | 7.34 | 11.03 | 3.28 | 1.39 | 6.14 | 5.76 | 2.74 | 2.21 | 2.59 | 7.97 | 57.68 |
| 1965 | 4.79 | 6.78 | 5.35 | 2.05 | 7.42 | 0.98 | 1.60 | 3.98 | 7.38 | 0.54 | 0.75 | 1.17 | 42.79 |
| 1966 | 2.84 | 6.88 | 1.50 | 5.42 | 5.69 | 0.52 | 2.18 | 4.28 | 3.23 | 1.92 | 1.57 | 5.21 | 41.24 |
| 1967 | 2.23 | 2.33 | 4.65 | 4.46 | 6.38 | 1.70 | 6.01 | 5.17 | 1.86 | 2.38 | 1.90 | 7.37 | 46.44 |
| 1968 | 5.57 | 1.98 | 6.52 | 5.15 | 5.21 | 3.76 | 2.69 | 1.61 | 5.58 | 2.87 | 4.89 | 6.04 | 51.87 |
| 1969 | 3.14 | 3.20 | 2.63 | 8.29 | 1.34 | 1.60 | 1.92 | 6.62 | 0.90 | 1.24 | 4.19 | 7.05 | 42.12 |
| 1970 | 1.16 | 3.87 | 5.32 | 7.08 | 3.70 | 5.76 | 4.99 | 1.78 | 3.80 | 6.20 | 2.62 | 3.71 | 49.99 |
| 1971 | 2.15 | 7.21 | 3.64 | 2.89 | 3.90 | 3.82 | 2.90 | 6.00 | 3.42 | 0.06 | 1.49 | 6.71 | 44.19 |
| 1972 | 4.73 | 2.23 | 4.80 | 3.51 | 4.55 | 5.50 | 4.89 | 1.94 | 5.46 | 3.92 | 8.05 | 9.37 | 58.95 |
| 1973 | 4.62 | 3.62 | 7.63 | 9.44 | 6.23 | 1.00 | 4.49 | 4.88 | 5.06 | 3.37 | 8.49 | 5.35 | 64.18 |
| 1974 | 8.90 | 4.65 | 3.40 | 6.34 | 7.76 | 6.30 | 6.33 | 4.78 | 3.45 | 2.67 | 4.96 | 5.03 | 64.57 |
| 1975 | 4.65 | 5.53 | 12.08 | 4.98 | 8.72 | 2.42 | 2.26 | 2.03 | 2.62 | 2.69 | 7.77 | 2.93 | 58.68 |
| 1976 | 2.85 | 4.41 | 7.68 | 2.41 | 4.73 | 4.06 | 3.82 | 0.86 | 5.40 | 5.66 | 1.83 | 1.79 | 45.50 |
| 1977 | 2.57 | 1.99 | 4.13 | 5.42 | 0.83 | 3.38 | 3.41 | 1.62 | 6.43 | 2.02 | 6.01 | 3.39 | 41.20 |
| 1978 | 8.13 | 1.31 | 4.05 | 2.14 | 8.14 | 4.45 | 3.89 | 9.65 | 1.52 | 1.82 | 5.56 | 13.12 | 63.78 |
| 1979 | 5.98 | 5.66 | 6.60 | 11.47 | 7.78 | 4.93 | 3.12 | 5.92 | 4.49 | 2.60 | 7.42 | 4.92 | 70.89 |
| 1980 | 3.23 | 1.12 | 10.86 | 7.53 | 4.43 | 5.75 | 4.73 | 1.23 | 5.32 | 3.14 | 5.23 | 1.86 | 54.43 |
| 1981 | 1.38 | 3.66 | 4.98 | 3.67 | 7.06 | 2.93 | 1.71 | 4.21 | 0.61 | 5.83 | 2.12 | 1.84 | 40.00 |
| 1982 | 6.61 | 4.16 | 4.47 | 6.76 | 5.50 | 6.68 | 4.13 | 3.11 | 1.92 | 5.23 | 6.43 | 13.81 | 68.81 |
| 1983 | 2.32 | 2.61 | 3.66 | 8.84 | 9.58 | 3.50 | 3.83 | 0.61 | 1.52 | 2.94 | 9.56 | 8.68 | 57.65 |
| 1984 | 1.88 | 4.37 | 6.07 | 5.24 | 9.06 | 1.12 | 4.59 | 5.00 | 1.96 | 7.75 | 5.85 | 4.35 | 57.24 |
| 1985 | 3.78 | 4.10 | 4.96 | 6.51 | 2.23 | 4.55 | 3.50 | 3.50 | 4.03 | 3.36 | 3.87 | 3.27 | 47.66 |
| 1986 | 0.57 | 2.50 | 1.90 | 3.72 | 4.63 | 3.80 | 1.21 | 2.74 | 1.21 | 3.75 | 8.67 | 3.92 | 38.62 |
| 1987 | 1.76 | 5.81 | 3.38 | 3.78 | 2.96 | 3.66 | 2.06 | 4.12 | 2.01 | 1.96 | 10.45 | 11.39 | 53.34 |
| 1988 | 4.25 | 3.49 | 4.20 | 2.85 | 2.38 | 2.15 | 5.21 | 0.85 | 4.73 | 3.62 | 10.52 | 5.99 | 50.24 |
| Record Mean | 4.86 | 4.29 | 5.21 | 5.10 | 4.39 | 3.65 | 3.40 | 3.26 | 2.96 | 2.86 | 4.46 | 4.77 | 49.21 |

See Reference Notes on Page 6B.



## AVERAGE TEMPERATURE (deg. F)

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 39.5 | 44.4 | 51.7 | 61.5 | 74.4 | 77.4 | 79.3 | 81.1 | 75.7 | 64.5 | 46.6 | 45.4 | 61.8 |
| #1960 | 41.9 | 40.8 | 40.2 | 64.8 | 68.5 | 77.8 | 81.8 | 81.6 | 76.1 | 63.8 | 50.8 | 37.2 | 60.4 |
| 1961 | 36.1 | 47.2 | 55.1 | 58.2 | 66.7 | 75.1 | 80.2 | 77.8 | 74.6 | 62.5 | 49.6 | 42.4 | 60.4 |
| 1962 | 36.2 | 50.3 | 47.3 | 58.8 | 76.8 | 77.1 | 81.3 | 80.8 | 73.4 | 65.9 | 50.2 | 39.9 | 61.5 |
| 1963 | 34.4 | 37.6 | 56.7 | 64.2 | 71.1 | 78.6 | 80.1 | 80.2 | 73.4 | 68.6 | 53.4 | 31.5 | 60.8 |
| 1964 | 41.1 | 40.2 | 51.7 | 64.0 | 71.9 | 79.3 | 80.6 | 78.6 | 72.9 | 58.9 | 54.4 | 44.3 | 61.5 |
| 1965 | 43.4 | 42.9 | 44.0 | 66.4 | 74.7 | 78.1 | 81.8 | 80.2 | 73.7 | 60.8 | 55.8 | 45.8 | 62.3 |
| 1966 | 34.2 | 42.2 | 52.8 | 60.6 | 67.9 | 76.6 | 84.7 | 76.9 | 70.8 | 58.1 | 53.7 | 41.4 | 60.0 |
| 1967 | 42.2 | 39.2 | 56.7 | 66.5 | 68.8 | 78.3 | 77.7 | 76.0 | 70.3 | 62.4 | 49.1 | 45.0 | 61.0 |
| 1968 | 38.9 | 37.3 | 50.9 | 62.7 | 69.7 | 79.5 | 80.8 | 82.0 | 71.3 | 62.2 | 50.9 | 41.7 | 60.7 |
| 1969 | 41.2 | 43.3 | 45.0 | 62.9 | 72.1 | 78.8 | 84.9 | 79.3 | 72.9 | 62.9 | 49.0 | 40.1 | 61.1 |
| 1970 | 35.3 | 41.7 | 48.7 | 65.0 | 72.3 | 77.3 | 79.7 | 81.2 | 77.9 | 61.7 | 49.8 | 46.4 | 61.4 |
| 1971 | 39.6 | 43.5 | 48.4 | 60.5 | 66.6 | 80.6 | 80.6 | 78.6 | 76.1 | 69.3 | 50.9 | 50.7 | 62.[illegible] |
| 1972 | 42.3 | 44.7 | 52.2 | 63.1 | 69.7 | 77.5 | 79.4 | 79.7 | 75.9 | 61.4 | 45.5 | 40.0 | 60.9 |
| 1973 | 38.6 | 40.5 | 57.3 | 59.8 | 68.3 | 81.0 | 83.2 | 79.6 | 76.1 | 67.6 | 57.3 | 43.3 | 62.7 |
| 1974 | 45.7 | 45.6 | 58.7 | 61.8 | 72.1 | 74.7 | 82.5 | 79.2 | 68.5 | 62.4 | 53.3 | 45.2 | 62.5 |
| 1975 | 45.9 | 46.2 | 49.9 | 61.9 | 73.5 | 78.8 | 81.1 | 81.2 | 70.9 | 65.8 | 53.8 | 44.1 | 62.6 |
| 1976 | 39.5 | 53.8 | 58.5 | 63.6 | 65.6 | 76.4 | 81.5 | 78.9 | 73.0 | 58.9 | 45.5 | 41.9 | 61.5 |
| 1977 | 30.7 | 45.1 | 58.6 | 66.9 | 76.4 | 81.9 | 84.7 | 82.6 | 79.0 | 62.2 | 55.1 | 44.1 | 64.0 |
| 1978 | 32.7 | 35.0 | 50.3 | 66.3 | 70.9 | 79.8 | 83.8 | 80.9 | 77.7 | 62.5 | 57.7 | 44.0 | 61.9 |
| 1979 | 30.9 | 38.5 | 54.3 | 63.0 | 70.0 | 77.9 | 82.6 | 80.9 | 73.4 | 65.8 | 50.7 | 45.4 | 61.[illegible] |
| 1980 | 43.2 | 39.5 | 49.4 | 60.9 | 72.5 | 80.9 | 88.8 | 87.2 | 80.5 | 62.7 | 53.3 | 45.9 | 63.[illegible] |
| 1981 | 40.9 | 47.3 | 54.3 | 70.2 | 70.0 | 82.5 | 84.6 | 81.8 | 74.0 | 62.5 | 53.8 | 40.9 | 63.[illegible] |
| 1982 | 36.6 | 40.5 | 55.5 | 58.5 | 74.5 | 79.0 | 85.0 | 82.9 | 73.3 | 63.7 | 53.4 | 49.5 | 62.[illegible] |
| 1983 | 40.4 | 45.3 | 51.9 | 56.8 | 68.2 | 77.2 | 83.6 | 84.9 | 75.2 | 66.2 | 53.1 | 34.7 | 61.[illegible] |
| 1984 | 35.9 | 47.6 | 51.1 | 61.0 | 69.5 | 80.9 | 80.9 | 79.8 | 71.9 | 68.4 | 50.9 | 53.8 | 62.[illegible] |
| 1985 | 32.4 | 40.6 | 57.7 | 65.0 | 71.8 | 78.9 | 82.2 | 80.2 | 73.6 | 67.2 | 57.6 | 36.9 | 62.[illegible] |
| 1986 | 41.9 | 48.0 | 55.2 | 64.4 | 72.5 | 81.0 | 86.5 | 79.2 | 79.1 | 64.2 | 51.1 | 42.6 | 63.[illegible] |
| 1987 | 39.6 | 47.1 | 54.7 | 62.2 | 76.5 | 80.0 | 82.5 | 83.6 | 75.3 | 59.2 | 54.4 | 46.7 | 63.[illegible] |
| 1988 | 36.8 | 42.2 | 52.3 | 62.8 | 71.8 | 80.3 | 81.6 | 83.7 | 76.3 | 59.1 | 54.6 | 44.9 | 62.[illegible] |
| Record Mean | 40.8 | 44.0 | 52.4 | 62.2 | 70.6 | 78.4 | 81.4 | 80.2 | 74.2 | 63.5 | 51.8 | 43.5 | 61.[illegible] |
| Max | 48.7 | 52.5 | 61.4 | 71.5 | 79.8 | 87.4 | 90.2 | 89.0 | 83.5 | 73.5 | 60.8 | 51.5 | 70.[illegible] |
| Min | 32.8 | 35.6 | 43.4 | 52.9 | 61.4 | 69.3 | 72.7 | 71.3 | 64.9 | 53.4 | 42.7 | 35.6 | 53.[illegible] |

See Reference Notes on Page 6B.

## HEATING DEGREE DAYS Base 65 deg. F

MEMPHIS, TENNESSEE

| SEASON | JULY | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959-60 | 0 | 0 | 0 | 111 | 547 | 602 | 713 | 691 | 763 | 91 | 69 | 0 | 3587 |
| #1960-61 | 0 | 0 | 0 | 104 | 425 | 853 | 892 | 490 | 309 | 249 | 70 | 2 | 3394 |
| 1961-62 | 0 | 0 | 8 | 148 | 467 | 690 | 887 | 410 | 543 | 229 | 5 | 0 | 3387 |
| 1962-63 | 0 | 0 | 14 | 107 | 436 | 772 | 944 | 760 | 291 | 119 | 34 | 0 | 3477 |
| 1963-64 | 0 | 0 | 10 | 33 | 352 | 1034 | 739 | 713 | 406 | 91 | 13 | 0 | 3391 |
| 1964-65 | 0 | 0 | 13 | 202 | 335 | 634 | 666 | 614 | 645 | 72 | 0 | 0 | 3181 |
| 1965-66 | 0 | 0 | 22 | 162 | 275 | 590 | 947 | 634 | 382 | 175 | 47 | 5 | 3239 |
| 1966-67 | 0 | 0 | 9 | 227 | 344 | 732 | 707 | 715 | 301 | 60 | 35 | 0 | 3130 |
| 1967-68 | 0 | 0 | 34 | 144 | 469 | 613 | 803 | 795 | 444 | 114 | 21 | 0 | 3437 |
| 1968-69 | 0 | 0 | 1 | 149 | 423 | 716 | 733 | 601 | 608 | 103 | 12 | 0 | 3346 |
| 1969-70 | 0 | 0 | 0 | 151 | 473 | 768 | 917 | 648 | 500 | 97 | 20 | 0 | 3574 |
| 1970-71 | 0 | 0 | 7 | 150 | 455 | 571 | 781 | 593 | 509 | 171 | 50 | 0 | 3287 |
| 1971-72 | 0 | 0 | 9 | 13 | 432 | 435 | 698 | 582 | 391 | 146 | 27 | 0 | 2733 |
| 1972-73 | 0 | 0 | 12 | 172 | 583 | 766 | 809 | 679 | 237 | 200 | 32 | 0 | 3490 |
| 1973-74 | 0 | 0 | 8 | 67 | 244 | 665 | 599 | 535 | 235 | 150 | 1 | 0 | 2504 |
| 1974-75 | 0 | 0 | 28 | 121 | 367 | 607 | 591 | 521 | 463 | 180 | 2 | 0 | 2880 |
| 1975-76 | 0 | 0 | 40 | 90 | 352 | 643 | 783 | 326 | 238 | 100 | 58 | 0 | 2630 |
| 1976-77 | 0 | 0 | 0 | 231 | 581 | 708 | 1056 | 547 | 212 | 61 | 4 | 0 | 3400 |
| 1977-78 | 0 | 0 | 0 | 123 | 313 | 640 | 995 | 835 | 454 | 74 | 47 | 0 | 3481 |
| 1978-79 | 0 | 0 | 0 | 116 | 230 | 643 | 1049 | 734 | 345 | 121 | 23 | 0 | 3261 |
| 1979-80 | 0 | 0 | 0 | 76 | 426 | 598 | 669 | 733 | 478 | 156 | 7 | 0 | 3143 |
| 1980-81 | 0 | 0 | 5 | 146 | 362 | 586 | 739 | 492 | 342 | 18 | 23 | 0 | 2713 |
| 1981-82 | 0 | 0 | 9 | 153 | 331 | 739 | 873 | 680 | 324 | 215 | 2 | 0 | 3326 |
| 1982-83 | 0 | 0 | 20 | 134 | 352 | 500 | 759 | 543 | 406 | 273 | 25 | 0 | 3012 |
| 1983-84 | 0 | 0 | 27 | 73 | 368 | 935 | 894 | 499 | 426 | 162 | 24 | 0 | 3408 |
| 1984-85 | 0 | 0 | 37 | 48 | 423 | 367 | 1004 | 683 | 254 | 100 | 6 | 0 | 2922 |
| 1985-86 | 0 | 0 | 17 | 54 | 257 | 864 | 708 | 475 | 307 | 102 | 8 | 0 | 2792 |
| 1986-87 | 0 | 0 | 0 | 102 | 413 | 687 | 782 | 492 | 322 | 154 | 0 | 0 | 2952 |
| 1987-88 | 0 | 0 | 0 | 186 | 324 | 559 | 867 | 657 | 393 | 108 | 0 | 0 | 3094 |
| 1988-89 | 0 | 0 | 1 | 202 | 314 | 619 | | | | | | | |

See Reference Notes on Page 6B.


## COOLING DEGREE DAYS Base 65 deg. F

MEMPHIS, TENNESSEE

| YEAR | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEP | OCT | NOV | DEC | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 | 0 | 0 | 0 | 48 | 240 | 422 | 627 | 449 | 243 | 91 | 0 | 0 | 2120 |
| 1970 | 3 | 0 | 0 | 104 | 251 | 375 | 463 | 509 | 400 | 51 | 6 | 2 | 2164 |
| 1971 | 0 | 0 | 3 | 46 | 107 | 474 | 489 | 426 | 349 | 154 | 14 | 0 | 2062 |
| 1972 | 0 | 0 | 3 | 95 | 179 | 383 | 449 | 464 | 346 | 66 | 6 | 0 | 1991 |
| 1973 | 0 | 0 | 4 | 48 | 143 | 486 | 571 | 458 | 350 | 156 | 19 | 0 | 2235 |
| 1974 | 6 | 0 | 46 | 59 | 228 | 299 | 550 | 445 | 138 | 46 | 23 | 0 | 1840 |
| 1975 | 8 | 0 | 3 | 93 | 272 | 421 | 507 | 510 | 224 | 121 | 23 | 2 | 2184 |
| 1976 | 0 | 7 | 44 | 64 | 84 | 349 | 519 | 438 | 247 | 48 | 0 | 0 | 1800 |
| 1977 | 0 | 0 | 23 | 123 | 362 | 516 | 619 | 551 | 426 | 41 | 20 | 0 | 2681 |
| 1978 | 0 | 0 | 6 | 122 | 235 | 452 | 590 | 501 | 387 | 46 | 18 | 0 | 2357 |
| 1979 | 0 | 0 | 19 | 68 | 184 | 394 | 553 | 499 | 259 | 108 | 4 | 0 | 2088 |
| 1980 | 0 | 0 | 0 | 40 | 249 | 480 | 744 | 695 | 476 | 80 | 18 | 2 | 2784 |
| 1981 | 0 | 5 | 20 | 181 | 184 | 532 | 614 | 527 | 285 | 80 | 2 | 0 | 2430 |
| 1982 | 0 | 1 | 36 | 26 | 305 | 399 | 623 | 563 | 275 | 100 | 14 | 25 | 2367 |
| 1983 | 0 | 0 | 7 | 32 | 131 | 373 | 584 | 622 | 338 | 116 | 17 | 0 | 2220 |
| 1984 | 0 | 1 | 4 | 51 | 169 | 482 | 502 | 462 | 249 | 162 | 5 | 23 | 2110 |
| 1985 | 0 | 6 | 30 | 107 | 224 | 425 | 540 | 478 | 285 | 129 | 42 | 0 | 2266 |
| 1986 | 0 | 3 | 12 | 91 | 247 | 487 | 673 | 448 | 427 | 81 | 4 | 0 | 2473 |
| 1987 | 0 | 0 | 9 | 78 | 366 | 458 | 549 | 584 | 315 | 12 | 13 | 0 | 2384 |
| 1988 | 0 | 0 | 7 | 52 | 221 | 469 | 518 | 586 | 347 | 24 | 8 | 0 | 2232 |

See Reference Notes on Page 6B.

## SNOWFALL (inches)

MEMPHIS, TENNESSEE

| SEASON | JULY | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959-60 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.0 | 6.5 | 7.6 | 6.4 | 0.0 | 0.0 | 0.0 | 20.5 |
| 1960-61 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | T | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 |
| 1961-62 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 5.0 | T | T | 0.0 | 0.0 | 0.0 | 5.0 |
| 1962-63 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 1.2 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| 1963-64 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.5 | T | T | 0.0 | 0.0 | 0.0 | 14.8 |
| 1964-65 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | 3.3 | 4.6 | 0.0 | 0.0 | 0.0 | 7.9 |
| 1965-66 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.2 | T | T | 0.0 | 0.0 | 0.0 | 12.2 |
| 1966-67 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.7 | 0.6 | T | 0.3 | 0.0 | 0.0 | 0.0 | 1.6 |
| 1967-68 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 2.0 | 4.5 | 17.3 | 0.0 | 0.0 | 0.0 | 23.8 |
| 1968-69 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | 0.0 | 0.0 | 0.0 | T |
| 1969-70 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.1 | 3.3 | 0.2 | T | 0.0 | 0.0 | 0.0 | 3.6 |
| 1970-71 | 0.0 | 0.0 | 0.0 | 0.0 | T | 1.0 | T | 6.7 | 1.6 | T | 0.0 | 0.0 | 9.3 |
| 1971-72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.3 | 0.1 | T | 0.0 | 0.0 | 0.0 | 1.2 |
| 1972-73 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 1.4 | T | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 |
| 1973-74 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.9 | 0.5 | T | 0.0 | 0.0 | 0.0 | 1.6 |
| 1974-75 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.2 | 3.9 | 0.5 | 1.4 | 0.0 | 0.0 | 0.0 | 6.0 |
| 1975-76 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | T | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 |
| 1976-77 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.3 | 3.5 | T | 0.0 | 0.0 | 0.0 | 0.0 | 5.3 |
| 1977-78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 4.3 | 3.2 | T | 0.0 | 0.0 | 0.0 | 7.5 |
| 1978-79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 3.0 | 7.4 | 0.0 | 0.0 | 0.0 | 0.0 | 10.4 |
| 1979-80 | 0.0 | 0.0 | 0.0 | 0.0 | T | 0.0 | 1.3 | 1.5 | 0.8 | 0.0 | 0.0 | 0.0 | 3.6 |
| 1980-81 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | T | T | 0.0 | 0.0 | 0.0 | 0.0 | T |
| 1981-82 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 4.5 | 0.7 | 1.2 | 0.0 | 0.0 | 0.0 | 6.4 |
| 1982-83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 7.3 | T | 0.2 | 0.0 | 0.0 | 0.0 | 7.5 |
| 1983-84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 2.0 | T | 0.5 | 0.0 | 0.0 | 0.0 | 3.3 |
| 1984-85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 12.4 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 | 20.7 |
| 1985-86 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | T | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| 1986-87 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | T | T | 0.4 | 0.0 | 0.0 | 0.0 | |
| 1987-88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | 8.2 | 3.0 | T | 0.0 | 0.0 | 0.0 | 11.2 |
| 1988-89 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | T | | | | | | | |
| Record Mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 2.6 | 1.5 | 0.9 | T | 0.0 | 0.0 | 5.8 |

See Reference Notes on Page 6B.



## REFERENCE NOTES

MEMPHIS, TENNESSEE

GENERAL
T - TRACE AMOUNT.
BLANK ENTRIES DENOTE MISSING/UNREPORTED DATA.
# INDICATES A STATION OR INSTRUMENT RELOCATION.
SEE STATION LOCATION TABLE ON PAGE 8.

SPECIFIC
PAGE 2
PM - INCLUDES LAST DAY OF PREVIOUS MONTH

PAGE 3
(a) - LENGTH OF RECORD IN YEARS, ALTHOUGH
INDIVIDUAL MONTHS MAY BE MISSING.
* LESS THAN .05
NORMALS - BASED ON THE 1951-1980 RECORD PERIOD.
EXTREMES - DATES ARE THE MOST RECENT OCCURRENCE
WIND DIR.- NUMERALS SHOW TENS OF DEGRESS CLOCKWISE
FROM TRUE NORTH. "00" INDICATES CALM.
RESULTANT DIRECTIONS ARE GIVEN TO WHOLE DEGREES.

PAGE 4B
MAX AND MIN ARE LONG TERM MEAN DAILY MAXIMUM
AND MEAN DAILY MINIMUM TEMPERATURES.

EXCEPTIONS

PAGES 4A, 4B, 6A
RECORD MEANS ARE THROUGH THE CURRENT YEAR,
BEGINNING IN 1875 FOR TEMPERATURE
1872 FOR PRECIPITATION
1951 FOR SNOWFALL

# MEMPHIS, TENNESSEE

Topography varies from the level alluvial area in east-central Arkansas to the slightly rolling area in northwestern Mississippi and southwestern Tennessee.

Agricultural interests are varied, with major crops being cotton, corn, hay, soybeans, peaches, apples, and a considerable number of vegetables. The climate is quite favorable for dairy interests, and for the raising of cattle and hogs.

The growing season is about 230 days in length. The average date for the last occurrence of temperatures as low as 32 degrees is late March. The average date of the first temperature of 32 degrees or below is early November.

Precipitation of nearly 50 inches per year is fairly well distributed. Crops and pastures receive, on the average, an adequate supply of moisture during the growing season, with lesser amounts during the fall harvesting period.

Sunshine averages slightly over 70 percent of the possible amount during the growing season. Relative humidity averages about 70 percent for the year.

Memphis, although not in the normal paths of storms coming from the Gulf or from western Canada, is affected by both, and thereby has comparatively frequent changes in weather. Extremely high or low temperatures, however, are relatively rare.

# STATION LOCATION

MEMPHIS, TENNESSEE

| Location | Occupied from | Occupied to | Airline distance and direction from previous location | Latitude North | Longitude West | Elevation above Sea level: Ground at temperature site | Elevation above Ground: Wind instruments | Extreme thermometers | Psychrometer | Sunshine Switch | Tipping bucket rain gage | Weighing rain gage | 8" rain gage | Hygrothermometer | Automatic Observing Equipment * | * Type M = AMOS T = AUTOB Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CITY | | | | | | | | | | | | | | | | |
| Jackson Block Main and Gayoso | 2/28/71 | 10/09/71 | | 35° 08' | 90° 03' | 261? | 80 | 49 | 49 | | | | 70 | | | Thermometers in North window. |
| Irwin (Irving) Block 54 North Second | 10/09/71 | 5/14/79 | 1700' NNE | 35° 09' | 90° 03' | 261? | *82 | 39 | 39 | | | | **62 | | | Thermometers in North window. *80 feet to 9/7/76. **66 feet to 4/16/73 and 82 feet to 9/7/76. |
| McClellan Building Front near Court | 5/14/79 | 2/01/89 | 800' West | 35° 09' | 90° 03' | 270? | 77 | *58 | *58 | | | | 51 | | | *In North window at 53 feet to 11/1/85, then roof exposure. |
| Cotton Exchange Second between South Court and Madison | 2/01/89 | 6/30/95 | 700' ESE | 35° 09' | 90° 03' | 264? | 116 | 108 | 108 | | | | 100 | | | Triple register added 5/9/90. Porter Building built to West in early 1895 had some affect on wind. |
| Porter Building 10 North Main (Main and South Court) | 7/01/95 | 3/31/05 | 300' West | 35° 09' | 90° 03' | 268 | 154 | *146 | *146 | | *134 | | 134 | | | * 140 feet to 8/5/03. * Added 2/20/96. |
| Post Office Building Front at Madison | 4/01/05 | 8/29/58 | 600' West | 35° 09' | 90° 03' | 271 | a86 | b78 | b78 | | c70 e | d70 | c70 | | | a - 97 feet to 10/29/31. b - 76 feet to 10/29/31; psychrometer discontinued 3/31/41. c - 67 feet to 2/11/08; 69 feet to 10/29/31. d - Added from Airport 9/11/50. e - Moved to Airport 9/11/50. Effect of tall buildings on easterly winds began about 1910 and became quite noticeable by 1924. |
| Shrine Building Front at Monroe | 8/30/58 | 9/25/6- (A) | 435' South | 35° 09' | 90° 03' | 271 | | 78 | | | | 70 | 70 | | | Instruments on Post Office roof. (A) Office moved to Airport. Climatological records from Post Office roof until 8/18/65. |
| AIRPORT | | | | | | | | | | | | | | | | |
| Curtiss-Wright Hangar 2nd floor Municipal AP | 10/24/31 | 9/20/32 | | 35° 03' | 89° 59' | 269 | 31 | 5 | 5 | | | | 3 | | | |
| American Airways Hangar Municipal Airport | 9/20/32 | 9/21/36 | 800' West | 35° 03' | 89° 59' | 263 | 49 | 5 | 5 | | | | 3 | | | |
| Dept. of Commerce Bldg. (Radio) Municipal AP | 9/21/36 | 5/28/38 | 300' East | 35° 03' | 89° 59' | 263 | 49 | 5 | 5 | | | | 5 | | | |
| Administration Building Municipal Airport * * International Airport Effective in 1969 | 5/28/38 | 4/17/73 | 100' West | 35° 03' | 89° 59' | e258 | *22 | **6 | c5 | | a4 d | b4 | 3 | *4 | | * 55 feet to 7/22/58. ** 5 feet to 11/7/47 and 7 feet to 11/10/59. Standby status after 9/30/60. * Commissioned about 1300 feet NE of thermometer site 10/1/60. a - Added 9/11/50. b - Decommissioned 9/11/50. c - Discontinued 9/30/60; sling psychrometer as standby. d - Effective 5/6/64. e - 263 feet to 10/1/60. |
| 3171 Director's Row International Airport | 4/17/73 | 10/12/85 | 0.1 mi. NNW | 35° 03' | 90° 00' | 258 | f22 | NA | NA | 60 | 58 h | NA g58 | 58 | f4 | NA | f - Same site as prior to 4/17/73. g - Installed on roof 4/1/81. h - Removed 4/1/81. |
| 2488 Winchester Road International Airport | 10/12/85 | 03/01/88 | 0.1 mi. ESE | 35° 03' | 89° 59' | 258 | i22 | 6 | NA | NA | 2 | NA j4 | 2 | 4 | NA | FAA operation eff. 10/12/85. Office returned to pre-1973 location. WSFO moved to 2777 Walnut Grove Rd. with no observing program. |
| 2496 Winchester Road International Airport | 03/01/88 | Present | Unknown | 35° 03' | 89° 59' | 258 | k22 | k6 | NA | NA | 4 | 4 | 4 | k4 | NA | i - Not moved 10/12/85. Station type changed from FAA to FCMOS 9/1/87. j - Installed 10/01/87. k - Not moved 03/01/88. |

SUBSCRIPTION: Price and ordering information available through: National Climatic Center, Federal Building, Asheville, N. C. 28801

USCOMM-NOAA-ASHEVILLE, N.C. - 505

U.S. DEPARTMENT OF COMMERCE
NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM 210

# STATION CLIMATIC SUMMARY

PREPARED BY THE NAVAL OCEANOGRAPHY COMMAND DETACHMENT, ASHEVILLE, N.C.

PREPARED UNDER, COMMANDER, NAVAL OCEANOGRAPHY COMMAND, NSTL, MS 39529

## NARRATIVE SUMMARY

Naval Air Station Memphis, Tennessee is located 22 miles north-northeast of Memphis International Airport in the southwestern corner of Tennessee on a relatively flat area of the Mississippi River basin. The terrain in the immediate vicinity of the station being a low rolling type with an elevation of 295 feet above mean sea level.

Dominating air masses for the local area are the continental polar air mass, and associated polar front, during the winter months and the maritime tropical air mass which is a part of the Bermuda high circulation during the summer months. Pre frontal squall lines produce severe thunderstorms and tornado activity in the local area during the winter and spring. During the summer months, pre-frontal squall line thunderstorms are replaced by convective type thunderstorms. Occasionally tropical cyclones moving inland produce heavy rains and gust winds throughout the area.

The average mean temperature for the year is in the low 60's, varying from the upper 30's in January to the low 80's in July. A record high of 106 degrees F. has been recorded during both the months of June and July. Temporary relief from the high temperatures occur during the fall with cold fronts passing occasionally through the area. With the onset of winter, radical temperature changes become more common with a 50 degree temperature drop during a cold frontal passage being not at all uncommon.

Precipitation of about 49 inches per year is fairly well distributed throughout the year, with the only frozen or freezing precipitation occuring during the winter when the Texas panhandle lows pass just south of the station. Haze in the area usually reduces visibility to 5 miles.

Flying conditions are generally good with ceilings and visibilities greater than 1,000 feet and 3 miles more than 80% of the time even during the bad weather months of winter. During the months of May, June, and July Visual Flight Rules (VFR) are experienced more than 96% of the time. Thunderstorms are the principal cause of reduction in flight operations during the summer months. The low ceilings and visibilities brought on by these storms are usually of short duration.

MEMPHIS, TENNESSEE

EXHIBIT 2-2. NAS MEMPHIS STATION CLIMATIC DATA SUMMARY

PREPARED BY: NOAA ASHEVILLE
JUNE 1986

STATION NAME: MEMPHIS, TENNESSEE
LOCATION: 35 21N 89 52W

PERIOD: SEP 51 - DEC 82
ELEVATION: 322 FEET

STN LTRS KNQA
WBAN #: 93839
WMO #:

| | TEMPERATURE (F) MEANS | | | TEMPERATURE (F) EXTREME | | PRECIPITATION (INCHES) | | | | SNOWFALL | | | RELATIVE HUMIDITY | | VAPOR PRESSURE INCHES OF MERCURY | DEW POINT (F) | PRESSURE ALTITUDE FEET (99.95%) | SURFACE WIND (KTS) | | | MEAN CLOUD AMOUNT | MEAN NUMBER OF DAYS WITH PRECIPITATION | | | | THUNDERSTORMS | VISIBILITY < 7 MI IN FOG | TEMPERATURE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | SNOWFALL | | | | | | | |
| | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | MEAN | MAXIMUM | MINIMUM | 24-HR MAXIMUM | MEAN | MAXIMUM | 24-HR MAXIMUM | 0300 LST | 1200 LST | | | | DIRECTION | SPEED | MAX GUST | | >= 0.01 | >= 0.50 | >= 0.1 | >= 1.5 | | | >= 90 | >= 75 | <= 32 | <= 00 |
| JAN | 47 | 30 | 38 | 76 | -2 | 4.2 | 10.2 | .8 | 3.7 | 3 | 13 | 9 | 77 | 66 | .15 | 27 | 800 | N | 6 | 59 | 7 | 10 | 3 | 2 | 1 | 2 | 14 | 0 | # | 18 | # |
| FEB | 51 | 33 | 43 | 80 | 9 | 4.3 | 9.3 | 1.4 | 4.8 | 1 | 8 | 6 | 76 | 61 | .17 | 31 | 800 | N | 6 | 55 | 6 | 9 | 3 | 1 | # | 3 | 12 | 0 | 1 | 12 | 0 |
| MAR | 61 | 42 | 51 | 87 | 12 | 5.1 | 12.4 | .7 | 3.9 | 1 | 15 | 8 | 75 | 58 | .20 | 41 | 850 | S | 7 | 58 | 7 | 11 | 3 | 1 | # | 5 | 11 | 0 | 3 | 5 | 0 |
| APR | 72 | 52 | 62 | 91 | 32 | 5.4 | 12.3 | 2.0 | 4.6 | # | # | # | 76 | 53 | .34 | 48 | 750 | S | 7 | 107 | 6 | 11 | 4 | 0 | 0 | 7 | 10 | # | 13 | # | 0 |
| MAY | 80 | 61 | 71 | 96 | 36 | 5.0 | 11.9 | .9 | 3.8 | # | # | # | 80 | 56 | .49 | 58 | 700 | S | 5 | 56 | 6 | 10 | 3 | 0 | 0 | 7 | 11 | 3 | 24 | 0 | 0 |
| JUN | 88 | 68 | 79 | 106 | 49 | 3.6 | 9.3 | .4 | 5.4 | 0 | 0 | 0 | 81 | 54 | .62 | 65 | 550 | S | 5 | 68 | 6 | 8 | 2 | 0 | 0 | 7 | 11 | 14 | 29 | 0 | 0 |
| JUL | 91 | 72 | 82 | 106 | 51 | 3.5 | 8.5 | .9 | 3.5 | # | # | # | 84 | 57 | .74 | 70 | 450 | S | 4 | 56 | 5 | 9 | 2 | 0 | 0 | 9 | 15 | 20 | 31 | 0 | 0 |
| AUG | 90 | 70 | 80 | 101 | 54 | 3.1 | 7.4 | .2 | 3.6 | 0 | 0 | 0 | 85 | 59 | .69 | 68 | 450 | E | 4 | 49 | 5 | 7 | 2 | 0 | 0 | 7 | 17 | 16 | 31 | 0 | 0 |
| SEP | 84 | 63 | 74 | 104 | 40 | 3.6 | 9.5 | .1 | 3.0 | 0 | 0 | 0 | 84 | 59 | .51 | 62 | 550 | N | 4 | 42 | 6 | 7 | 2 | 0 | 0 | 4 | 16 | 6 | 26 | 0 | 0 |
| OCT | 74 | 51 | 62 | 91 | 28 | 2.4 | 6.3 | # | 3.0 | # | # | # | 80 | 51 | .34 | 48 | 600 | N | 4 | 44 | 5 | 6 | 2 | 0 | 0 | 2 | 13 | # | 16 | # | 0 |
| NOV | 61 | 41 | 51 | 83 | 16 | 4.1 | 9.9 | 1.4 | 2.6 | # | 2 | 2 | 78 | 58 | .25 | 40 | 600 | S | 5 | 55 | 6 | 8 | 3 | # | # | 2 | 12 | 0 | 3 | 6 | 0 |
| DEC | 51 | 34 | 43 | 80 | 14 | 5.0 | 13.7 | .9 | 4.7 | 1 | 13 | 13 | 76 | 62 | .19 | 33 | 800 | S | 6 | 53 | 6 | 10 | 3 | # | # | 2 | 14 | 0 | # | 13 | # |
| ANN | 71 | 51 | 61 | 106 | -14 | 49.3 | 13.7 | # | 5.4 | 6 | 15 | 13 | 79 | 58 | .35 | 49 | 750 | S | 5 | 107 | 6 | 106 | 32 | 4 | 1 | 57 | 156 | 55 | 177 | 54 | # |
| EYR | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | &10 | &10 | &10 | &10 | & 10 | &10 | &10 | 31 | &10 | 31 | 31 | 31 | 31 | 29 | 29 | 31 | 31 | 31 | 31 |

REMARKS: * DATA NOT AVAILABLE # LESS THAN 0.5 DAYS, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE.
THE VALUE LISTED UNDER PRESSURE ALTITUDE INDICATES THAT VALUE IS EXCEEDED ONLY 0.05 % OF THE TIME.
EYR IS EQUIVALENT YEARS OF RECORD (I.E. THE ACTUAL NUMBER OF YEARS UTILIZED IN THE CACULATIONS
FROM THE OVERALL PERIOD OF RECORD. & PERIOD OF RECORD ENDS 19821
HAIL WAS INCLUDED IN SNOWFALL PRIOR TO JANUARY 1956 AND AFTER DECEMBER 1979

MEMPHIS, TENNESSEE

MEAN TEMPERATURE (F)

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 73.4 | 63.8 | 45.5 | 45.2 | M |
| 1952 | 46.6 | 48.2 | 50.3 | 59.4 | 71.2 | 85.3 | 84.0 | 81.6 | 72.6 | 55.7 | 49.9 | 43.5 | 62.4 |
| 1953 | 45.4 | 46.7 | 56.0 | 58.1 | 71.9 | 85.4 | 82.1 | M | 74.9 | 65.4P | 50.9 | 41.6 | M |
| 1954 | 41.6 | 50.3 | 58.9 | 67.1 | 66.2 | 81.5 | 86.8 | 85.0 | 77.7 | 63.7 | 51.4 | 43.4 | 63.8 |
| 1955 | 41.2 | 41.3 | 52.3 | 66.1 | 73.3 | 74.5 | 82.6 | 81.5 | 77.1 | 62.0 | 49.6 | 42.2 | 62.2 |
| 1956 | 36.4 | 47.5 | 51.4 | 60.2 | 73.3 | 77.3 | 82.8 | 82.0 | 73.1 | 66.1 | 50.5 | 48.8 | 62.6 |
| 1957 | 38.3 | 45.2 | 50.5 | 64.4 | 71.4 | 78.5 | 80.5 | 79.4 | 71.7 | 59.3 | 50.4 | 47.5 | 61.7 |
| 1958 | 37.4 | 33.4 | 45.2 | 60.1 | 71.2 | 78.1 | 81.3 | 80.2 | 73.1 | 62.4 | 54.0 | 38.2 | 59.6 |
| 1959 | 37.2 | 42.5 | 50.1 | 60.0 | 72.9 | 76.2 | 78.4 | 81.1 | 75.2 | 63.8 | 46.0 | 45.1 | 60.7 |
| 1960 | 46.4 | 39.5 | 39.5 | 64.0 | 68.4 | 77.7 | 81.1 | 80.9 | 76.1 | 64.0 | 51.1 | 37.7 | 60.0 |
| 1961 | 37.0 | 47.2 | 54.9 | 56.6 | 67.2 | 76.8 | 79.4 | 78.5 | 73.5 | 61.6 | 48.6 | 41.4 | 60.4 |
| 1962 | 36.5 | 45.1 | 46.2 | 59.8 | 77.4 | 77.9 | 81.1 | 80.1 | 72.7 | 64.7 | 50.0 | 38.3 | 61.3 |
| 1963 | 33.2 | 36.0 | 55.3 | 62.6 | 69.7 | 77.9 | 79.7 | 80.5 | 73.1 | 67.0 | 52.6 | 30.9 | 59.9 |
| 1964 | 40.3 | 44.0 | 51.5 | 64.2 | 71.9 | 78.2 | 79.6 | 77.2 | 70.5 | 59.2 | 53.5 | 42.8 | 60.7 |
| 1965 | 41.6 | 42.4 | 43.5 | 65.6 | 74.9 | 78.3 | 80.7 | 78.6 | 74.5 | 61.8 | 56.1 | 45.7 | 62.0 |
| 1966 | 33.5 | 42.0 | 53.5 | 61.1 | 68.5 | 78.0 | 84.1 | 77.0 | 71.4 | 58.4 | 53.4 | 40.8 | 60.2 |
| 1967 | 42.3 | 39.6 | 57.3 | 65.7 | 67.5 | 78.4 | 77.1 | 75.0 | 69.4 | 62.1 | 49.1 | 45.2 | 60.7 |
| 1968 | 37.9 | 36.1 | 50.3 | 63.6 | 70.1 | 79.0 | 80.2 | 81.0 | 71.2 | 63.0 | 49.9 | 39.8 | 60.2 |
| 1969 | 39.7 | 42.4 | 44.1 | 62.1 | 70.5 | 78.8 | 83.6 | 78.2 | 73.3 | 62.2 | 48.6 | 39.0 | 60.2 |
| 1970 | 33.8 | 40.2 | 48.4 | 63.9 | 71.7 | 74.9 | 77.9 | 79.6 | 75.7 | 60.9 | 48.6 | 46.5 | 60.2 |
| 1971 | 38.2 | 42.5 | 48.1 | 60.4 | 66.5 | 80.1 | 79.2 | 78.1 | 76.0 | 69.5 | 50.4 | 50.5 | 61.6 |
| 1972 | 41.2 | 43.8 | 52.2 | 63.4 | 69.8 | 76.7 | 78.7 | 79.4 | 75.6 | 61.0 | 45.6 | 39.7 | 60.6 |
| 1973 | 38.4 | 40.6 | 59.3 | 56.3 | 67.4 | 79.6 | 82.0 | 77.8 | 75.9 | 66.5 | 55.6 | 42.0 | 62.0 |
| 1974 | 43.2 | 43.9 | 57.6 | 61.4 | 72.0 | 73.7 | 82.2 | 78.8 | 67.6 | 60.5 | 51.4 | 43.5 | 61.3 |
| 1975 | 44.4 | 43.9 | 48.0 | 59.9 | 72.1 | 78.2 | 80.3 | 79.5 | 68.6 | 63.5 | 52.6 | 42.9 | 61.2 |
| 1976 | 37.7 | 51.6 | 56.8 | 61.4 | 64.5 | 75.1 | 80.1 | 76.3 | 70.6 | 55.2 | 41.7 | 39.1 | 59.2 |
| 1977 | 26.6 | 42.2 | 55.9 | 65.2 | 75.7 | 80.1 | 83.4 | 80.4 | 76.5 | 59.9 | 52.7 | 41.4 | 61.7 |
| 1978 | 29.3 | 31.0 | 47.8 | 64.2 | 69.5 | 78.6 | 82.0 | 78.7 | 75.9 | 60.2 | 55.7 | 42.8 | 59.6 |
| 1979 | 29.7 | 35.9 | 51.7 | 59.9 | 67.3 | 75.8 | 79.7 | 77.6 | 69.3 | 62.1 | 47.4 | 42.4 | 58.3 |
| 1980 | 39.9 | 36.3 | 46.4 | 58.7 | 71.2 | 80.2 | 87.2 | 85.0 | 77.6 | 59.8 | 50.3 | 43.0 | 61.3 |
| 1981 | 37.3 | 44.7 | 51.0 | 68.2 | 67.5 | 81.1 | 83.1 | 79.5 | 71.7 | 61.6 | 53.1 | 40.7 | 61.6 |
| 1982 | 35.9 | 40.3 | 56.3 | 57.7 | 74.5 | 76.2 | 83.7 | 80.7 | 72.6 | 63.5 | 52.5 | 48.6 | 61.9 |
| MEAN | 38.2 | 42.4 | 51.1 | 62.1 | 70.6 | 78.3 | 81.4 | 79.6 | 73.4 | 62.1 | 50.6 | 42.5 | 61.0 |

"M" INDICATES MISSING DATA, "P" DENOTES PARTIAL RECORD, I.E. LESS THAN 10 DAYS MISSING.

PARTIAL MONTHLY VALUES WERE NOT INCLUDED IN MEANS.

MEMPHIS, TENNESSEE

TOTAL PRECIPITATION (INCHES)

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 5.67 | 4.49 | 4.01 | 8.06 | M |
| 1952 | 3.23 | 4.41 | 7.01 | 2.34 | 2.05 | .78 | .67 | 2.19 | 2.92 | .84 | 4.19 | 3.01 | 33.64 |
| 1953 | 5.02 | 5.42 | 7.90 | 7.12 | 11.91 | 3.08 | 4.79 | M | .12 | .30 | 1.89 | 5.27 | M |
| 1954 | 9.42 | 4.10 | 1.84 | 3.28 | 3.23 | 1.40 | .53 | 2.31 | 2.78 | .84 | 1.35 | 4.16 | 35.24 |
| 1955 | 1.63 | 6.62 | 7.04 | 6.53 | 4.09 | 5.45 | 2.54 | 1.54 | 1.44 | 1.58 | 2.27 | 1.12 | 43.85 |
| 1956 | 5.45 | 9.28 | 3.16 | 5.56 | 2.92 | 6.20 | 2.25 | 2.49 | .41 | 1.37 | 3.08 | 3.81 | 45.98 |
| 1957 | 9.65 | 4.60 | 2.83 | 6.56 | 6.63 | 6.26 | 3.00 | 2.72 | 3.60 | 5.53 | 9.86 | 5.42 | 66.70 |
| 1958 | 2.66 | 3.17 | 4.55 | 6.38 | 4.79 | 2.52 | 3.35 | 2.71 | 7.13 | 1.10 | 3.50 | 2.37 | 44.23 |
| 1959 | 4.06 | 7.51 | 3.11 | 1.95 | 1.20 | 1.64 | 8.49 | 3.92 | 1.60 | 1.07 | 2.36 | 4.71 | 41.62 |
| 1960 | 4.28 | 2.39 | 3.14 | 3.10 | 3.56 | 3.48 | 3.19 | 3.19 | 2.58 | 5.67 | 3.70 | 5.21 | 43.49 |
| 1961 | 1.38 | 6.08 | 7.38 | 4.93 | 6.54 | 2.57 | 4.46 | .55 | .88 | .77 | 6.77 | 9.72 | 52.03 |
| 1962 | 5.82 | 8.12 | 4.34 | 3.25 | 1.08 | 3.16 | 4.37 | 2.16 | 8.00 | 1.37 | 1.41 | .93 | 44.01 |
| 1963 | .83 | 2.08 | 4.28 | 2.87 | 6.30 | 3.26 | 3.07 | 1.08 | 1.75 | .02 | 3.11 | 4.77 | 33.42 |
| 1964 | 3.52 | 3.07 | 8.34 | 9.32 | 3.01 | 2.06 | 2.26 | 5.23 | 2.26 | 2.09 | 2.74 | 6.46 | 50.35 |
| 1965 | 3.36 | 7.33 | 5.30 | 3.12 | 3.06 | 5.30 | 4.23 | 2.84 | 7.94 | .36 | 2.01 | .88 | 45.73 |
| 1966 | 3.49 | 5.00 | .67 | 5.80 | 6.30 | .41 | 3.26 | 6.09 | 4.30 | 1.84 | 1.71 | 5.53 | 44.40 |
| 1967 | 3.56 | 1.78 | 3.56 | 5.25 | 5.07 | 1.63 | 6.90 | 2.05 | 1.45 | 2.17 | 1.64 | 5.63 | 38.69 |
| 1968 | 5.09 | 1.49 | 7.91 | 6.35 | 4.68 | 2.00 | 1.39 | .52 | 2.95 | 1.95 | 3.92 | 4.05 | 42.30 |
| 1969 | 2.77 | 1.66 | 1.96 | 4.23 | .88 | .90 | 1.28 | 7.40 | .88 | 1.33 | 3.34 | 7.34 | 33.97 |
| 1970 | 1.56 | 3.08 | 5.39 | 7.80 | 3.53 | 8.23 | 4.95 | 2.29 | 4.69 | 6.29 | 2.68 | 4.68 | 55.17 |
| 1971 | 2.25 | 5.81 | 3.11 | 4.19 | 4.66 | 4.13 | 4.53 | 5.98 | 6.32 | .13 | 2.17 | 7.06 | 50.34 |
| 1972 | 4.37 | 2.10 | 4.78 | 3.42 | 2.62 | 2.33 | 4.71 | 5.11 | 4.66 | 3.68 | 6.57 | 8.22 | 52.57 |
| 1973 | 5.13 | 3.68 | 6.57 | 11.05 | 7.72 | 1.14 | 5.06 | 1.55 | 5.06 | 2.33 | 9.38 | 4.46 | 63.13 |
| 1974 | 7.66 | 5.50 | 3.43 | 6.84 | 7.79 | 9.27 | 1.62 | 6.35 | 3.11 | 2.34 | 3.86 | 3.74 | 61.51 |
| 1975 | 4.19 | 5.15 | 12.37 | 3.27 | 7.48 | 1.04 | 4.23 | 1.91 | 4.43 | 2.73 | 6.59 | 2.67 | 56.06 |
| 1976 | 2.88 | 4.92 | 5.95 | 1.95 | 4.65 | 6.36 | 4.15 | .18 | 3.31 | 6.22 | 1.87 | 1.93 | 44.37 |
| 1977 | 2.88 | 2.34 | 4.70 | 4.50 | 2.30 | 3.53 | 1.77 | 2.46 | 9.49 | 1.26 | 7.03 | 4.01 | 46.27 |
| 1978 | 10.24 | 1.40 | 5.16 | 2.08 | 8.67 | 5.39 | 3.60 | 5.83 | 4.06 | 1.19 | 5.46 | 10.93 | 64.01 |
| 1979 | 4.46 | 6.00 | 6.96 | 12.31 | 7.64 | 2.85 | 3.14 | 4.41 | 6.31 | 2.05 | 6.97 | 4.89 | 67.99 |
| 1980 | 2.60 | 1.40 | 10.01 | 6.29 | 4.10 | 2.21 | 2.71 | .60 | 4.43 | 3.81 | 5.39 | 1.83 | 45.38 |
| 1981 | 1.65 | 3.09 | 5.17 | 3.44 | 10.54 | 5.11 | 4.51 | 1.60 | .42 | 4.91 | 2.22 | 1.08 | 44.54 |
| 1982 | 6.24 | 3.92 | 1.48 | 9.92 | 4.69 | 8.03 | 4.57 | 5.40 | 1.58 | 1.90 | 6.65 | 13.71 | 68.09 |
| MEAN | 4.17 | 4.27 | 5.14 | 5.39 | 4.96 | 3.60 | 3.53 | 3.09 | 3.64 | 2.30 | 4.05 | 4.95 | 49.09 |

"M" INDICATES MISSING DATA, "P" DENOTES PARTIAL RECORD, I.E. LESS THAN 10 DAYS MISSING.

PARTIAL MONTHLY VALUES HERE NOT INCLUDED IN MEANS.

MEMPHIS, TENNESSEE

# HEATING DEGREE DAYS

| YEAR | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-52 | | | 8 | 130 | 582 | 618 | 569 | 481 | 454 | 210 | 21 | 0 | M |
| 52-53 | 0 | 0 | 2 | 294 | 457 | 660 | 604 | 505 | 282 | 232 | 31 | 0 | 3067 |
| 53-54 | 0 | M | 3 | M | 417 | 716 | 710 | 407 | 446 | 63 | 74 | 0 | M |
| 54-55 | 0 | 0 | 1 | 167 | 404 | 663 | 727 | 580 | 414 | 60 | 0 | 1 | 3017 |
| 55-56 | 0 | 0 | 0 | 158 | 488 | 703 | 816 | 498 | 425 | 190 | 7 | 1 | 3286 |
| 56-57 | 0 | 0 | 0 | 47 | 443 | 499 | 822 | 438 | 442 | 142 | 25 | 0 | 2858 |
| 57-58 | 0 | 0 | 7 | 195 | 431 | 537 | 847 | 878 | 608 | 164 | 38 | 0 | 3705 |
| 58-59 | 0 | 0 | 13 | 135 | 341 | 824 | 856 | 627 | 455 | 182 | 15 | 0 | 3448 |
| 59-60 | 0 | 0 | 2 | 125 | 567 | 608 | 761 | 733 | 791 | 99 | 72 | 0 | 3758 |
| 60-61 | 0 | 0 | 0 | 98 | 415 | 840 | 861 | 495 | 319 | 246 | 63 | 0 | 3337 |
| 61-62 | 0 | 0 | 16 | 152 | 497 | 725 | 878 | 446 | 516 | 202 | 1 | 0 | 3433 |
| 62-63 | 0 | 0 | 6 | 123 | 443 | 819 | 981 | 804 | 317 | 130 | 40 | 0 | 3663 |
| 63-64 | 0 | 0 | 11 | 39 | 369 | 1053 | 758 | 718 | 411 | 87 | 16 | 0 | 3462 |
| 64-65 | 0 | 1 | 33 | 190 | 358 | 683 | 720 | 627 | 659 | 81 | 0 | 0 | 3352 |
| 65-66 | 0 | 0 | 23 | 138 | 264 | 591 | 969 | 639 | 366 | 162 | 42 | 0 | 3194 |
| 66-67 | 0 | 0 | 2 | 214 | 348 | 747 | 701 | 705 | 293 | 75 | 46 | 0 | 3131 |
| 67-68 | 0 | 1 | 38 | 152 | 468 | 607 | 829 | 829 | 458 | 104 | 10 | 0 | 3496 |
| 68-69 | 0 | 0 | 1 | 118 | 448 | 774 | 780 | 627 | 642 | 112 | 14 | 0 | 3516 |
| 69-70 | 0 | 0 | 0 | 162 | 484 | 799 | 963 | 690 | 511 | 110 | 17 | 0 | 3736 |
| 70-71 | 1 | 0 | 15 | 152 | 484 | 569 | 823 | 622 | 522 | 180 | 42 | 0 | 3410 |
| 71-72 | 0 | 0 | 3 | 12 | 437 | 440 | 720 | 606 | 390 | 136 | 20 | 0 | 2772 |
| 72-73 | 0 | 0 | 11 | 180 | 576 | 775 | 817 | 676 | 184 | 225 | 31 | 0 | 3475 |
| 73-74 | 0 | 0 | 12 | 83 | 293 | 708 | 670 | 586 | 257 | 160 | 7 | 0 | 2776 |
| 74-75 | 0 | 0 | 35 | 161 | 420 | 664 | 634 | 586 | 523 | 214 | 2 | 0 | 3239 |
| 75-76 | 0 | 0 | 79 | 138 | 375 | 681 | 840 | 385 | 275 | 153 | 78 | 0 | 3004 |
| 76-77 | 0 | 0 | 10 | 309 | 689 | 799 | 1181 | 632 | 287 | 83 | 3 | 0 | 3993 |
| 77-78 | 0 | 0 | 0 | 175 | 371 | 725 | 1098 | 943 | 526 | 105 | 69 | 0 | 4012 |
| 78-79 | 0 | 0 | 0 | 165 | 279 | 680 | 1086 | 808 | 409 | 178 | 51 | 0 | 3656 |
| 79-80 | 0 | 0 | 14 | 147 | 522 | 693 | 771 | 824 | 570 | 216 | 16 | 0 | 3773 |
| 80-81 | 0 | 0 | 11 | 205 | 438 | 678 | 853 | 565 | 438 | 34 | 54 | 0 | 3276 |
| 81-82 | 0 | 0 | 18 | 166 | 351 | 746 | 896 | 688 | 313 | 236 | 6 | 0 | 3420 |
| 82-83 | 0 | 0 | 25 | 150 | 380 | 524 | | | | | | | |
| MEAN | 0 | 0 | 12 | 151 | 432 | 692 | 824 | 634 | 436 | 147 | 29 | 0 | 3357 |

THE DEGREE DAY TOTAL FOR THE MONTH IS THE SUM OF THE DEPARTURES OF THE DAILY MEAN TEMPERATURES FROM THE BASE OF 65 DEGREES F.
"M" INDICATES MISSING DATA

MEMPHIS, TENNESSEE

# COOLING DEGREE DAYS

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | 267 | 103 | 3 | 9 | M |
| 1952 | 6 | 0 | 6 | 50 | 221 | 616 | 595 | 521 | 238 | 14 | 7 | 0 | 2274 |
| 1953 | 0 | 0 | 6 | 33 | 252 | 617 | 537 | M | 304 | M | 1 | 0 | M |
| 1954 | [illegible] | 4 | 17 | 142 | 117 | 501 | 682 | 628 | 386 | 134 | 0 | 0 | 2601 |
| 1955 | 0 | 5 | 27 | 98 | 263 | 291 | 551 | 520 | 370 | 73 | 31 | 3 | 2232 |
| 1956 | 0 | 0 | 11 | 54 | 272 | 376 | 559 | 532 | 247 | 86 | 13 | 3 | 2153 |
| 1957 | 0 | 2 | 0 | 130 | 229 | 407 | 489 | 452 | 215 | 29 | 0 | 0 | 1953 |
| 1958 | 0 | 0 | 0 | 23 | 237 | 400 | 511 | 477 | 265 | 61 | 19 | 0 | 1993 |
| 1959 | 0 | 0 | 1 | 38 | 266 | 344 | 422 | 507 | 316 | 94 | 5 | 0 | 1993 |
| 1960 | 1 | 0 | 4 | 75 | 184 | 389 | 504 | 501 | 341 | 74 | 5 | 0 | 2078 |
| 1961 | 0 | 0 | 9 | 62 | 134 | 357 | 452 | 425 | 278 | 54 | 10 | 0 | 1781 |
| 1962 | 0 | 6 | 2 | 54 | 392 | 393 | 504 | 476 | 241 | 121 | 0 | 0 | 2189 |
| 1963 | 0 | 0 | 21 | 66 | 193 | 394 | 461 | 484 | 259 | 106 | 5 | 0 | 1989 |
| 1964 | 0 | 0 | 1 | 72 | 238 | 402 | 462 | 389 | 206 | 16 | 19 | 0 | 1805 |
| 1965 | 2 | 0 | 0 | 104 | 316 | 405 | 495 | 429 | 315 | 46 | 5 | 0 | 2117 |
| 1966 | 0 | 0 | 15 | 50 | 154 | 398 | 600 | 378 | 201 | 16 | 7 | 1 | 1820 |
| 1967 | 4 | 0 | 61 | 104 | 129 | 408 | 380 | 317 | 174 | 67 | 0 | 0 | 1644 |
| 1968 | 0 | 0 | 8 | 71 | 173 | 424 | 477 | 501 | 193 | 64 | 2 | 0 | 1913 |
| 1969 | 0 | 0 | 0 | 32 | 191 | 421 | 580 | 416 | 254 | 83 | 0 | 0 | 1977 |
| 1970 | 1 | 0 | 0 | 85 | 235 | 306 | 408 | 458 | 342 | 32 | 2 | 3 | 1872 |
| 1971 | 0 | 0 | 4 | 49 | 97 | 462 | 447 | 409 | 342 | 160 | 8 | 0 | 1978 |
| 1972 | 0 | 0 | 0 | 95 | 174 | 359 | 431 | 451 | 337 | 65 | 4 | 0 | 1916 |
| 1973 | 0 | 0 | 16 | 31 | 114 | 446 | 533 | 404 | 348 | 137 | 16 | 0 | 2045 |
| 1974 | 1 | 0 | 36 | 59 | 230 | 270 | 534 | 436 | 119 | 26 | 21 | 0 | 1737 |
| 1975 | 3 | 0 | 2 | 71 | 231 | 401 | 484 | 459 | 193 | 100 | 12 | 1 | 1957 |
| 1976 | 0 | 2 | 29 | 55 | 73 | 307 | 480 | 357 | 185 | 14 | 0 | 0 | 1502 |
| 1977 | 0 | 0 | 14 | 98 | 340 | 460 | 576 | 485 | 353 | 21 | 9 | 0 | 2356 |
| 1978 | 0 | 0 | 0 | 87 | 214 | 416 | 530 | 432 | 332 | 25 | 8 | 0 | 2044 |
| 1979 | 0 | 0 | 5 | 31 | 127 | 332 | 460 | 390 | 148 | 63 | 3 | 0 | 1567 |
| 1980 | 0 | 0 | 0 | 32 | 217 | 461 | 696 | 630 | 396 | 49 | 4 | 0 | 2485 |
| 1981 | 0 | 1 | 11 | 134 | 137 | 488 | 568 | 456 | 229 | 68 | 2 | 0 | 2094 |
| 1982 | 0 | 1 | 50 | 24 | 305 | 345 | 588 | 494 | 259 | 112 | 11 | 23 | 2212 |
| MEAN | 1 | 1 | 12 | 68 | 208 | 406 | 516 | 461 | 270 | 68 | 7 | 1 | 2019 |

THE DEGREE DAY TOTAL FOR THE MONTH IS THE SUM OF THE DEPARTURES OF THE DAILY MEAN TEMPERATURES FROM THE BASE OF 65 DEGREES F.
"M" INDICATES MISSING DATA

MEMPHIS, TENNESSEE

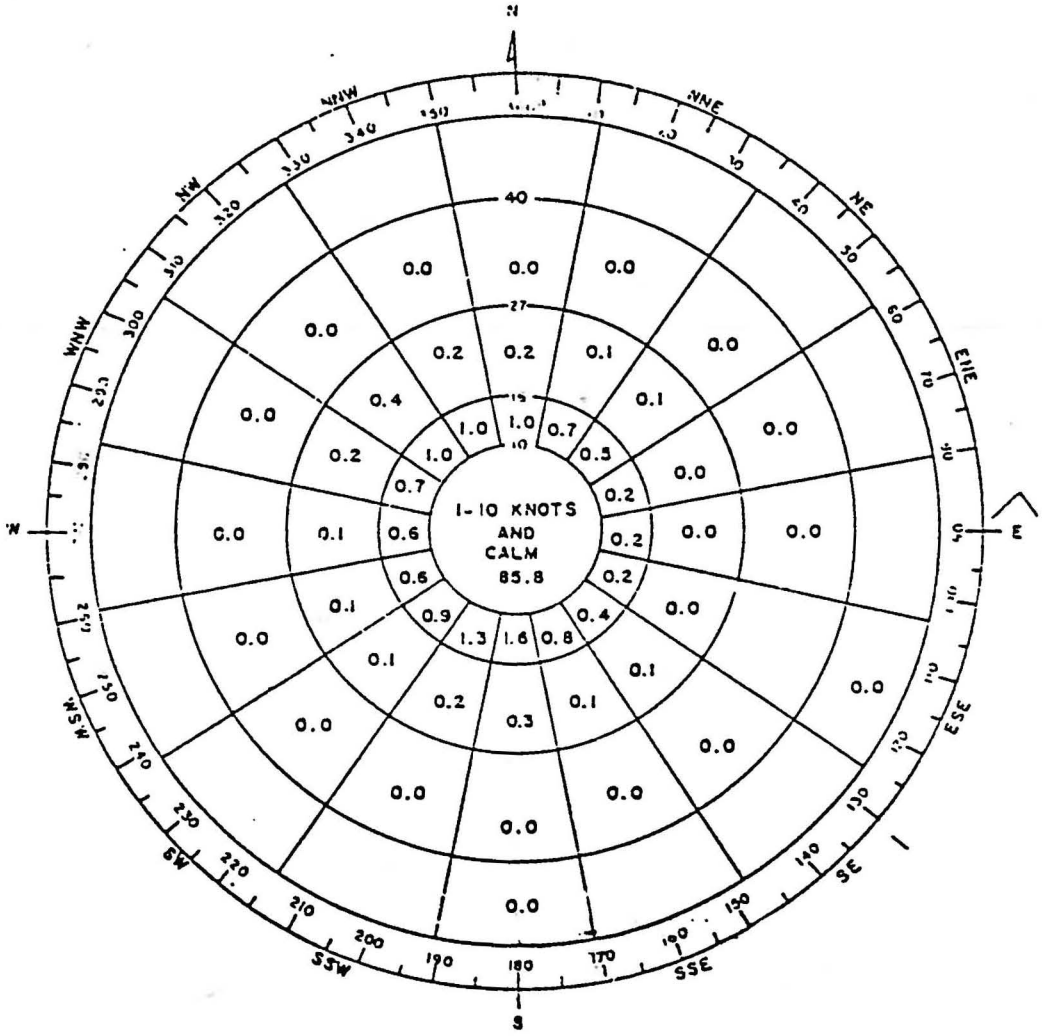
| WBAN NO: | STATION NAME: | LATITUDE: | LONGITUDE: | ELEVATION: | CALL SIGN: | WMO NO: |
|---|---|---|---|---|---|---|
| 93839 | MEMPHIS, TENNESSEE | 35 21N | 89 52W | 322 | KNQA | |

# STATION LOCATION AND INSTRUMENTATION HISTORY

| BAROMETER LOCATION NUMBER | GEOGRAPHICAL LOCATION & NAME | TYPE OF STATION | AT THIS LOCATION FROM | AT THIS LOCATION TO | LATITUDE | LONGITUDE | ELEVATION ABOVE MSL FEET | ELEVATION ABOVE MSL TYPE BAROMETER | OBS PER DAY |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Weather Service Office, main deck Ops bldg | Navy | 1949 | 1960 | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 2. | Moved within Weather Office | Navy | 1960 | 1968 | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 3. | Replacement installed | Navy | 1968 | | 35 21N | 89 52W | 295 | Mercurial | 24 |
| 1a. | Weather Service Office | Navy | 1960 | | 35 21N | 89 52W | 295 | Aneroid | 24 |

| NUMBER OF LOCATION | DATE OF CHANGE | SURFACE WIND EQUIPMENT INFORMATION: LOCATION | TYPE OF TRANSMITTER | TYPE OF RECORDER | HT ABV GROUND FEET | REMARKS, ADDITIONAL EQUIPMENT, OR REASON FOR CHANGE |
|---|---|---|---|---|---|---|
| 1. | | Installed atop control tower | 3-Cup | | 67 | 1. Barograph |
| 1a. | Unkn | Atop control tower | Selsyn | Triple | 69 | 2. Automatic Met Station(AN/GMQ-29) |
| 2. | 1953 | Atop control tower | AN/UMQ-5 | RD-108 | 67 | 3. Ceiling Light(ML-121) |
| 3. | 1958 | 1500 feet from Ops bldg N-Z, bearing 350 | AN/UMQ-5C | RD-108 | 12 | 4. Cloud Height Set(AN/GMQ-13B) |
| 4. | 1962 | Same as #3 | AN/UMQ-5C | RD-108 | 8 | 5. Transmissometer(AN/GMQ-10C) |
| | | | | | | 6. Wind Measuring Set(AN/PMQ-3C) |

MEMPHIS, TENNESSEE




WIND ROSE

FIGURE 2-2. WIND ROSE FOR NAS MEMPHIS

### 2.4.2 Overland Drainage

#### 2.4.2.1 Topography and Soils

NAS Memphis lies in the East Gulf Coastal Plain section of the Coastal Plain Province and is characterized by a gently sloping terrain and moderately steep hills. The majority of the installation has a slope of between one and five percent. In general, land surface elevations vary from 270 feet MSL (feet above mean seal level) in the southeast border along Big Creek Drainage Canal to 350 feet MSL in the northern portion of the base near Tanya Lake.

There are ten soil classifications found on the station; these within two major Soil Associations. In the proximity of the Big Creek Drainage Canal is the Falaya-Waverly-Colins Association. Soils in this association range from level, poor drainage to moderately well-drained, silty soils on first bottoms and are subject to high water tables. The balance of the Complex is composed of the Memphis-Granada-Loring Association. Soils in this association range from nearly level to sloping, well-drained and moderately well-drained, silty soils on broad uplands.

#### 2.4.2.2 Surface Water

NAS Memphis consists of a total of over 3,490 acres of land. The topography on the station slopes gently downward from the northeast quadrant of the property to the southwest quadrant and the Big Creek Drainage Canal. Surface runoff is slow, particularly on the south side, due to minimal slopes and high water tables.

The station is surrounded on three sides by water courses, including the North Fork Creek to the west and the Big Creek Drainage Canal to the south. Casper Creek cuts through the eastern portion of the station separating the Headquarters of Naval Technical Training and Naval Hospital Millington.

Both North Fork Creek and Casper Creek drain into the Big Creek Drainage Canal. The flood plain of this drainage system covers a significant portion of the installation, limiting development potential both on and off the station. A levee has been constructed on the installation along the north edge of the Big Creek Drainage Canal. Because the levee does not follow the entire edge of the Canal, it serves as only a partial deterrent to on-site flooding.

### 2.4.3 Potentially Affected Water Bodies

The source of potable water for both NAS Memphis and the City of Millington is the Memphis Sand Aquifer, the top of which lies at a depth of approximately 350-400 feet below land surface. The City also has two primary wells that draw from the Fort Pillow Aquifer at 1400 feet below land surface. The shallow groundwater generally has relatively high levels of iron; however, occasionally, it is tapped for small-capacity wells for non-potable uses.

## 2.5 REGIONAL AQUIFER CHARACTERISTICS

### 2.5.1 Aquifer Description

The Naval base is located in the north-central part of the Mississippi embayment where the subsurface sediments are formed by depositional processes of wind and streams. This geologic and hydrogeologic setting was described by Geraghty and Miller, Inc., in 1985 (G&M, 1985).

The sequence of geologic sediments underlying NAS Memphis is illustrated in Figure 2-3, a generalized geologic column. The uppermost stratigraphic unit consists of sand, gravel, silt and clay and extends to a depth of approximately 175 feet in some areas. These units are underlain by clays of the Jackson Formation.

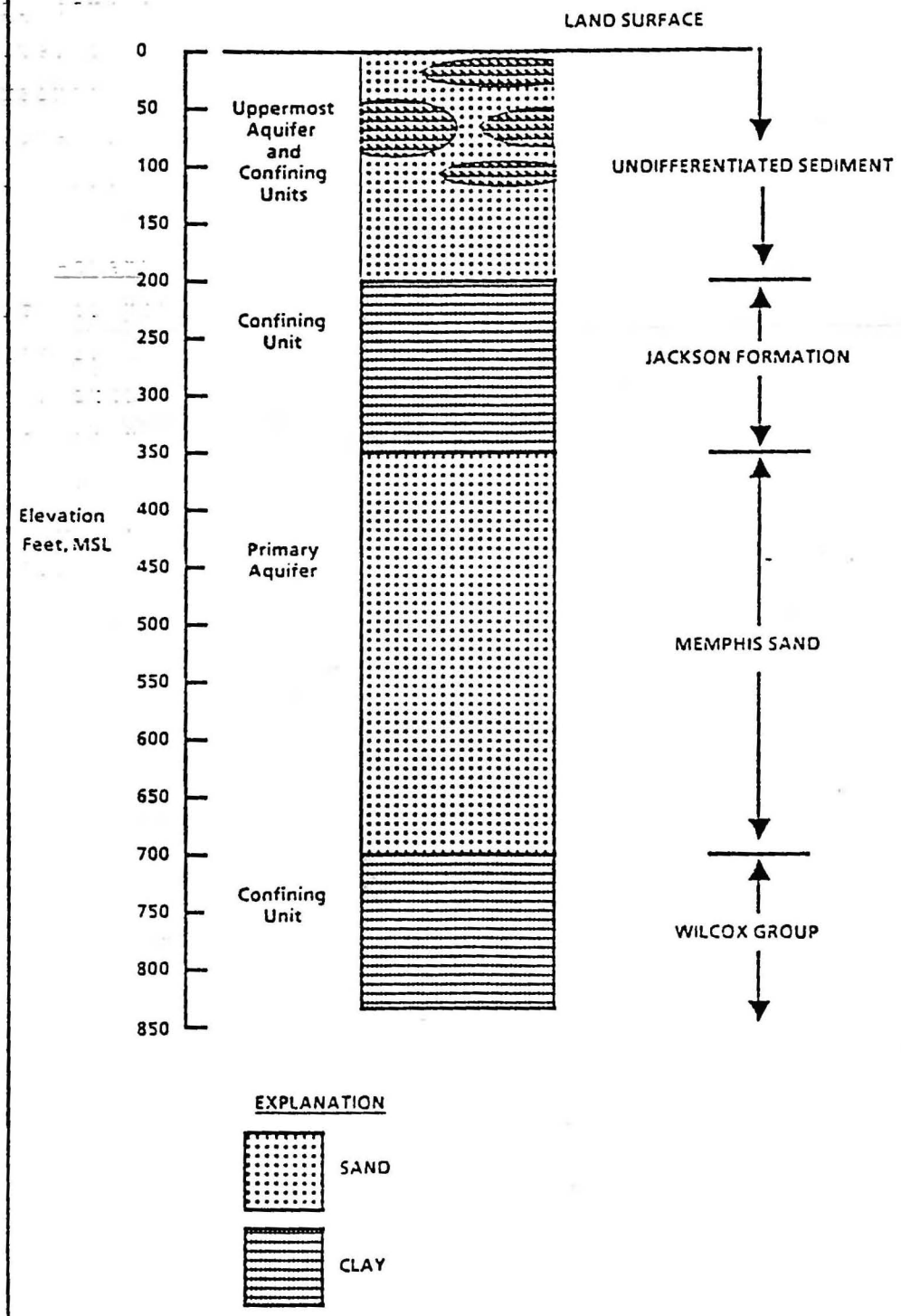



FIGURE 2-3. GENERALIZED GEOLOGIC COLUMN

The nature of the surficial sediments at the NAS are illustrated in the geologic cross section presented in Figure 2-4, which was prepared originally by Geraghty and Miller, Inc., from logs of the borings drilled during their 1985 investigation. The figure shows that the surficial sediments are composed of soft gray clay, firm silty blue clay and gravelly sand. Water contained within the uppermost aquifer is sometimes used for industrial and irrigation purposes.

Beneath these undifferentiated sediments lies the Jackson Formation, which consists primarily of gray, bluish-gray and tan clays. The low-permeability sediments of the Jackson Formation comprise the confining deposits which retard vertical movements of water and hydraulically separate the uppermost aquifer from the underlying Memphis Sand. The Memphis Sand, or "500-foot Sand", which consists of fine to coarse grain sand, is the primary aquifer in the Memphis area. The clayey confining bed located beneath the Memphis Sand is the Wilcox Group.

Stratigraphic units within the upper sediments at NAS contain a perched zone and an uppermost aquifer. The perched zone located within the soft gray clay is formed due to the underlying firm blue clay which restricts vertical groundwater flow to the underlying sands which make up the uppermost aquifer. Permeability tests run on Shelby tube samples collected during monitor well installation suggests vertical permeabilities within the gray clay and blue clay that range from $1.5 \times 10^{-6}$ to $5.2 \times 10^{-7}$ cm/sec (centimeters per second) and $5.9 \times 10^{-6}$ to $8.5 \times 10^{-6}$ cm/sec, respectively.

### 2.5.2 Aquifer Use

The NAS uses five wells for water supply, all located in the developed area of the NAS South-Side. Three are approximately 1500 feet deep, and two are approximately 500 feet deep.

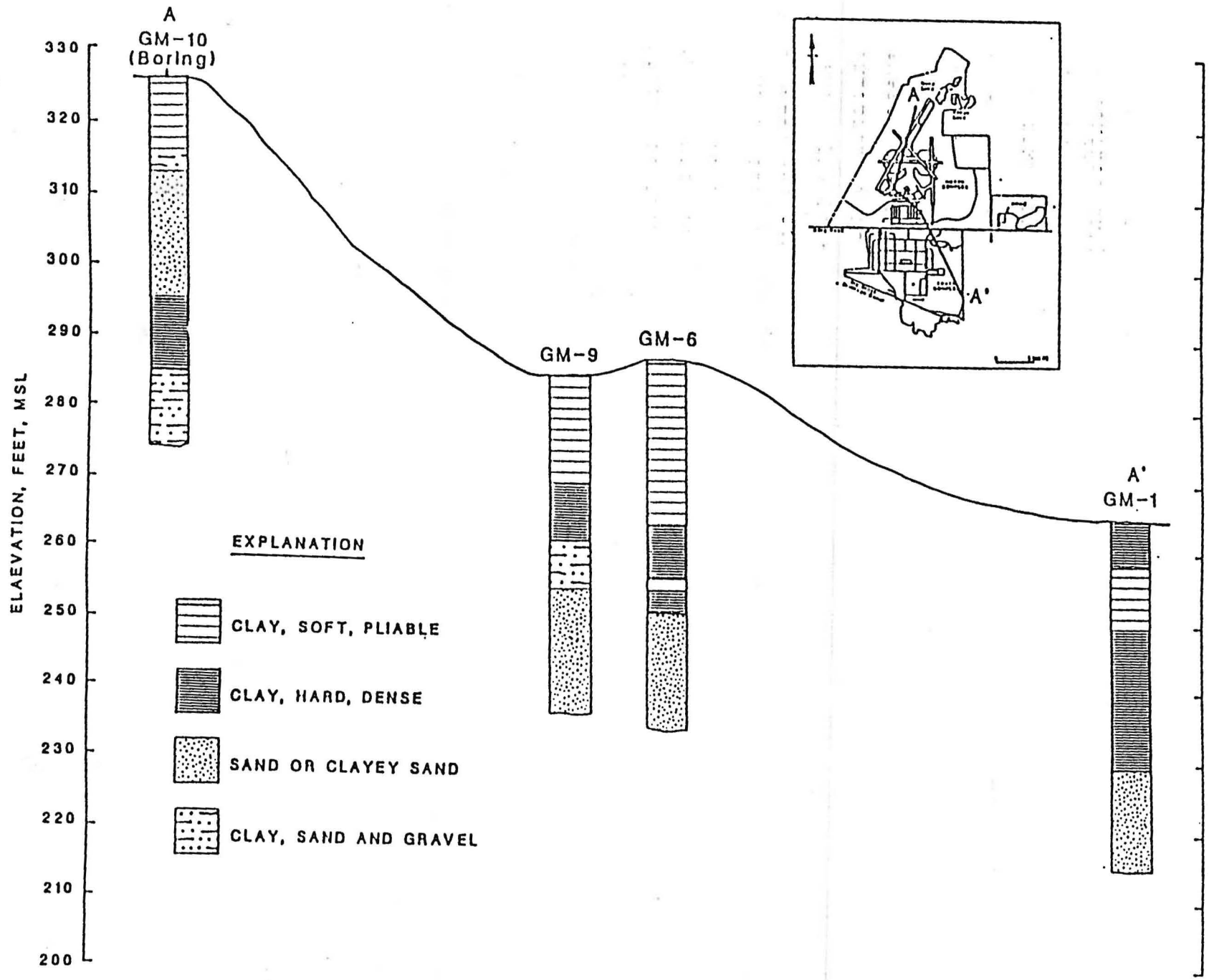



FIGURE 2-4. GEOLOGIC CROSS-SECTON OF THE UPPERMOST SURFICIAL SEDIMENTS

The City of Millington has production wells for the public water supply. One main and one standby well are located 0.3 miles west of the NAS. One main and three standby wells are located approximately 1/2 mile southwest of the NAS. The two main wells draw from the Fort Pillow sand aquifer (1400' b.g.l.); the four standby wells draw from the Memphis Sand Aquifer (500' b.g.l.).

The Memphis-Shelby County Health Department estimates there are approximately 20 private wells in the Millington area.

All public water supplies in Shelby County draw from groundwater. No surface waters are used.

## 3.0 TARGET ANALYSIS: POTENTIALLY AFFECTED POPULATIONS

The following is a description of potentially affected populations for four pathways:

- Surface water (to 15 miles downstream)
- Groundwater (4 miles radius)
- Air (4 miles radius)
- On-site exposure (to resident population, or other population within one mile).

Because no toxic or hazardous substances have been identified for the site, the probable routes of transport of contaminants from the site for potential exposure of receptors are not applicable. However, a brief, general description of potential pathways is provided below.

### 3.1 SURFACE WATER PATHWAY

Surface drainage is used primarily for livestock and wildlife watering and to support aquatic life. Contamination of the Big Creek drainage system would pose the greatest threat to potential environmental receptors. However, no toxic or hazardous substances have been identified at this site.

The Big Creek Drainage Canal discharges to the Loosachatchie River approximately 5 miles southwest of the NAS. The Loosachatchie River discharges to the Mississippi River approximately 10 miles further downstream.

### 3.2 GROUNDWATER PATHWAY

Potable water at NAS Memphis is available from both on-site and off-site sources. The NAS uses five wells for water supply. They are located in the developed area of the facility. The source of supply for the two 500-foot (approximately) wells is groundwater found in a geologic unit commonly known as the

"Memphis Sand". This aquifer is located approximately 350-400 feet below the surface. The three deep (1500 foot approximate) wells draw from the Ft. Pillow aquifer. Water is also available from the City of Millington. Water for the City is drawn principally from two wells screened in the Fort Pillow Aquifer. Four standby wells are screened in the Memphis Sand aquifer. These water supplies would not be affected by Site No. 11.

The Memphis-Shelby County Health Department estimates there are approximately 20 private wells in the Millington area.

### 3.3 AIR PATHWAY

The air pathway is not applicable to waste oil sprayed more than 15 years ago.

### 3.4 ON-SITE EXPOSURE

Since the waste no longer exists on site, on-site exposure is not applicable.

# 4.0 SUMMARY

## 4.1 SUMMARY OF FIELD INVESTIGATION RESULTS

Soil samples collected in 1983 were analyzed for PCB's, the only contaminants of concern. No PCBs were detected. There is no visible evidence of contamination at this time.

## 4.2 SUMMARY OF POTENTIALLY AFFECTED TARGETS SURVEY

The US Navy has determined that there are not potentially affected targets for Site No. 11.

## 4.3 CONCLUSIONS AND RECOMMENDATIONS

### 4.3.1 Conclusions

The US Navy has concluded that Site No. 11 does not pose a threat to human health or the environment.

### 4.3.2 Recommendations

The US Navy recommends that Site No. 11 be removed from further consideration as a potential hazardous waste site.

## 4.4 DATA SOURCE LIST

The following is a summary of reports, letters, memoranda, etc., associated with Site No. 11 environmental conditions.

### 4.4.1 Reports

The following reports contain information relevant to Site No. 10:

- RCRA Facility Assessment (Draft), NAS Memphis, Millington, Tennessee, prepared by ERC Environmental and Energy Services Co., Nashville, Tennessee, for Southern Division, Naval Facilities Engineering Command, Charleston, SC, April 1987.

- RCRA Facility Assessment (Final Draft), NAS Memphis, Millington, Tennessee, prepared by ERC Environmental and Energy Services Co., Knoxville, Tennessee, for Southern Division, Naval Facilities Engineering Command, August 1989.
- Initial Assessment Study of Naval Air Station Memphis, Millington, Tennessee, NEESA 13-038, Naval Energy and Environmental Support Activity, Port Hueneme, CA, November 1983.
- NACIP Program Confirmation Study, Verification Phase, NAS Memphis, prepared by Geraghty and Miller, Tampa, Florida for the US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, November 1985.
- Air Installation Compatible Use Zone (AICUZ) Study, prepared by (unknown) for US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, 1981.

4.4.2 Letters and Memoranda

The following is a summary of correspondence between the US Navy and federal and state regulatory agencies (EPA Region IV and TDHE).

- Letter dated 29 July 1986 from TDHE to NAS Memphis with comments on the 1983 Initial Assessment Study and the 1985 Verification Study.
- Letter dated 11 April 1989 from TDHE, to NAS Memphis with comments on the April 1987 RCRA Facility Assessment.
- Letter dated 08 June 1989 from Southern Division, Naval Facilities Engineering Command, to Commanding Officer, NAS Memphis, with response to TDHE comments on NAS Memphis studies transmittal of 29 July 1989.

## REFERENCES


EPA, 1984, Uncontrolled Hazardous Waste Site Ranking System: A Users Manual (HW-10), US EPA, Washington, DC, 1984.

EPA, 1988, Preliminary Assessment Guidance for Fiscal Year 1988, OSWER Direction 9345.0-01, US Environmental Protection Agency, Washington, DC, January 1988.

NEESA, 1983, Initial Assessment Study of Naval Air Station Memphis, Millington, Tennessee, Naval Energy and Environmental Support Activity (NEESA/13-038), Port Hueneme, CA, November 1983.

NUS/EPA IV, 1988, Hazard Ranking System Data Collection and Documentation Techniques for HRS Scoring of Hazardous Waste Site, prepared by NUS Corporation in Cooperation with Region IV, US Environmental Protection Agency, Atlanta, Georgia, December 1988.

TDHE, 1986, Tennessee's "Superfund" Act, Explanatory Document Produced by Office of General Council, Tennessee Department of Health and Environment, Nashville, Tennessee, 1986.

TDHE, 1988, Part 2 - Hazardous Waste Management Act of 1983, State of Tennessee, Nashville, Tennessee, Revision Effective August 1988.

TDHE, 1989, Memorandum from Mr. Gordon Caruthers to Field Office Staff, Dated 23 January 1989, With Guidance on Conducting Preliminary Assessment (PAs) on Superfund Sites and Assembling PA Reports (Included Conceptual Outline for PA Reports).

## BIBLIOGRAPHY

AICUZ, 1981, Air Installation Compatible Use Zone (AICUZ) Study, US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, 1981.

G&M, 1985, NACIP Program Confirmation Study, Verification Phase, NAS Memphis, prepared by Geraghty & Miller, Inc., Tampa, Florida, for US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, November, 1985.

NEESA, 1983, Initial Assessment Study of Naval Air Station Memphis, Millington, Tennessee, Naval Energy and Environmental Support Activity (NEESA/13-038), Port Hueneme, CA, November 1983.

RFA, 1989, RCRA Facility Assessment (RFA) for NAS Memphis, Millington, Tennessee (Final Draft), prepared by ERC Environmental and Energy Services Company, Knoxville, Tennessee for the US Navy, Southern Division, Naval Facilities Engineering Command, Charleston, SC, August 1989.

# APPENDIX A

## TOPOGRAPHIC MAPS AND DRINKING WATER SOURCES
## FOR
## NAS MEMPHIS AND ADJACENT LAND
## (4 MILE RADIUS OF NAS)

November 1989

NOTE: Topographical maps not supplied with this submittal. Topographical maps were supplied for the 90% draft and will be supplied for the final document.

# APPENDIX B

## GEOLOGIC MAPS
## FOR
## NAS MEMPHIS AND ADJACENT LAND

November 1989

NOTE NOTE NOTE

Geologic maps are unavailable for a 4 miles radius of NAS Memphis. The 7.5' quadrangle geologic maps needed correspond to the 7.5' quadrangle topographic maps (i.e., the Brunswick, Drummonds, Millington, and Munford quadrangles). The subject area has not been geologically mapped, and preparation of geologic maps has not been scheduled. Hence, there is no projected availability data for these maps (Information provided by Mr. James Moore, Tennessee Division of Geology, Maps and Publications Department, Nashville, Tennessee, (615) 742-6696), 05 September 1989).

APPENDIX C

SITE PHOTOGRAPHS

FOR

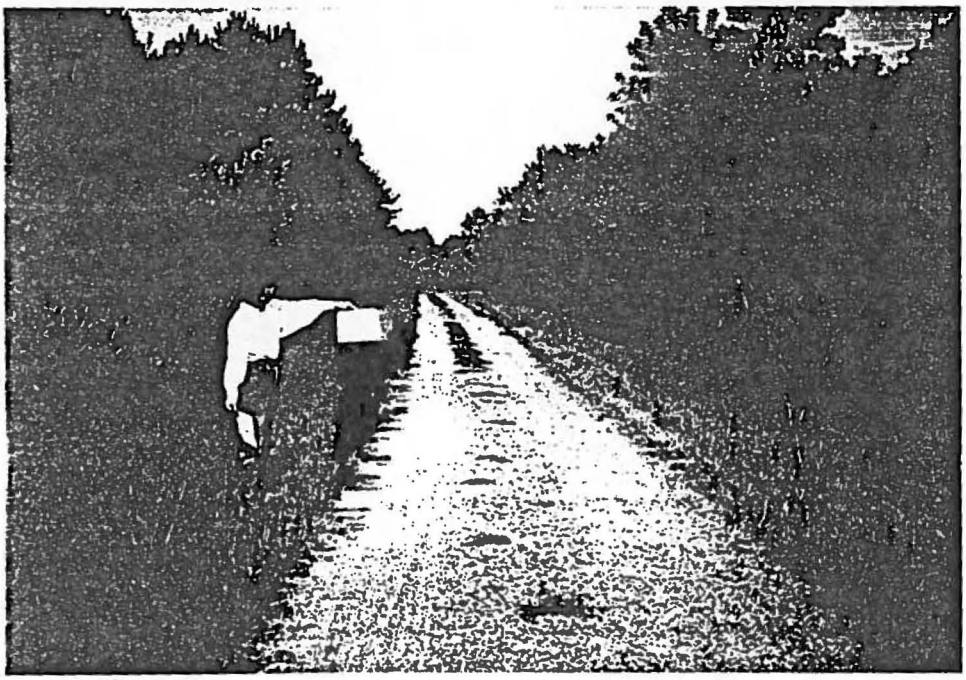
NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

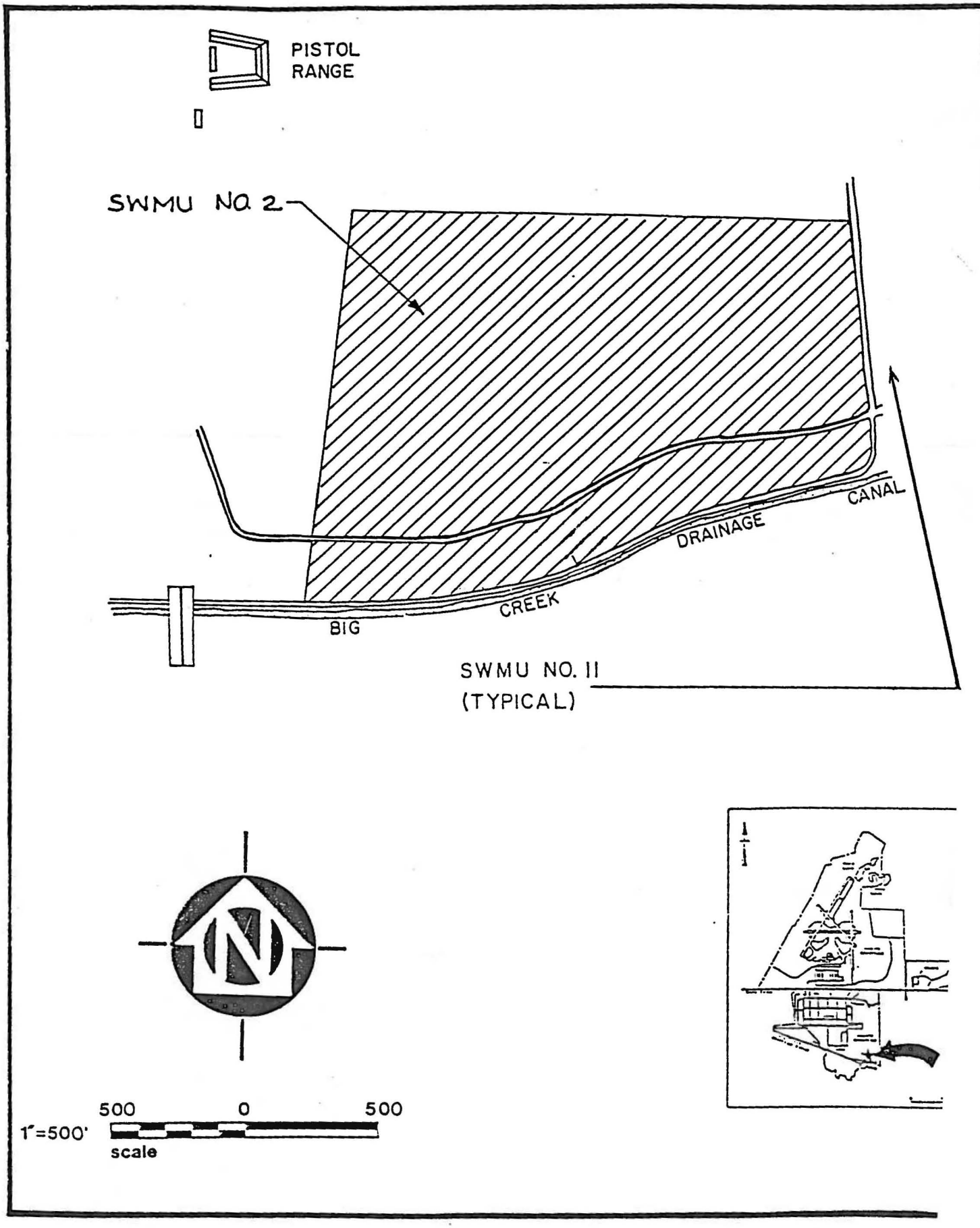
September 1989

## Site No. 11: Oiled, Dirt Roads

Unpaved perimeter roads were, in the past, "oiled" with waste oil to suppress dust. Photograph is of a "typical" section of road, in South-side Landfill area. Photograph taken 17 July 1989. Location of photograph is shown on accompanying sketch.



Photographs of Site No. 11. Oiled, Dirt Roads.




2-1. OILED, DIRT ROADS

APPENDIX D

PRELIMINARY ASSESSMENT FORM
(EPA FORM 2070-12)

FOR

NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

# Preliminary Assessment

(EPA Form 2070-12)

FOR

NAS Memphis Site No. 11 (Oiled, Dirt [unpaved] Roads)
NAS Memphis, Millington, Tennessee

01 September 1989

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 1 - SITE INFORMATION AND ASSESSMENT

**I. IDENTIFICATION**

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

**II. SITE NAME AND LOCATION**

| 01 SITE NAME (Legal, common, or descriptive name of site) | 02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER |
|---|---|
| NAS Memphis Site No. 11 | Oiled, Dirt (unpaved) Roads |

| 03 CITY | 04 STATE | 05 ZIP CODE | 06 COUNTY | 07 COUNTY CODE | 08 CONG DIST |
|---|---|---|---|---|---|
| Millington | TN | 38054 | Shelby | 79 | 9th |

| 09 COORDINATES LATITUDE | LONGITUDE | |
|---|---|---|
| Not applicable | Not applicable | NAS Perimeter/Patrol Roads |

10 DIRECTIONS TO SITE (Starting from nearest public road)
Enter NAS Memphis main gate from TN Hwy 205. Proceed south on 3rd Avenue, turn right on "E" Street. Proceed to Building S-236 (Public Works Division). Meet with guide for site visit.

**III. RESPONSIBLE PARTIES**

| 01 OWNER (If known) | 02 STREET (Business, mailing, residential) |
|---|---|
| Commander, NAS Memphis | NAS Memphis |

| 03 CITY | 04 STATE | 05 ZIP CODE | 06 TELEPHONE NUMBER |
|---|---|---|---|
| Millington | TN | 38054 | (901) 873-5101 |

| 07 OPERATOR (If known and different from owner) | 08 STREET (Business, mailing, residential) |
|---|---|
| Public Works Division | NAS Memphis |

| 09 CITY | 10 STATE | 11 ZIP CODE | 12 TELEPHONE NUMBER |
|---|---|---|---|
| Millington | TN | 38054 | (901) 873-5209 |

13 TYPE OF OWNERSHIP (Check one)
☐ A. PRIVATE ☒ B. FEDERAL: US Navy (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)
☐ A. RCRA 3001 DATE RECEIVED: ___/___/___ (Month Day Year) ☒ B. UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED: May 17, 1980 (Month Day Year) ☐ C. NONE

**IV. CHARACTERIZATION OF POTENTIAL HAZARD**

01 ON SITE INSPECTION
☒ YES DATE July 17, 1989 (Month Day Year)
☐ NO

BY (Check all that apply)
☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☒ D. OTHER CONTRACTOR
☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: _____ (Specify)
CONTRACTOR NAME(S): ERC Environmental and Energy Services Co.

02 SITE STATUS (Check one)
☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION
1942 (Beginning year) | Ca. 1975 (Ending year) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED
Used oil applied on unpaved roads for dust suppression. Waste oil may have contained PCBs. However, testing performed in 1983 revealed no PCBs above method detection level.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION
None. Substance no longer exists.

**V. PRIORITY ASSESSMENT**

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)
☐ A. HIGH (Inspection required promptly) ☐ B. MEDIUM (Inspection required) ☐ C. LOW (Inspect on time available basis) ☒ D. NONE (No further action needed, complete current disposition form)

**VI. INFORMATION AVAILABLE FROM**

| 01 CONTACT | 02 OF (Agency/Organization) | 03 TELEPHONE NUMBE |
|---|---|---|
| Mr. George Robertson | Public Works Engineering, NAS Memphis | (901) 873-52 |

| 04 PERSON RESPONSIBLE FOR ASSESSMENT | 05 AGENCY | 06 ORGANIZATION | 07 TELEPHONE NUMBER | 08 DATE |
|---|---|---|---|---|
| Mr. Robert Moser | US Navy | SOUTHDIV | (803) 743-0573 | Sept 11 19 (Month Day Year) |

EPA FORM 2070-12 (7-81)

NAVFACENGCOM
Charleston, SC

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 2 - WASTE INFORMATION

**I. IDENTIFICATION**

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

**II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS**

01 PHYSICAL STATES (Check all that apply)

- A SOLID
- B. POWDER, FINES
- C SLUDGE
- D OTHER _____ (Specify)
- E SLURRY
- F LIQUID
- G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS _____
CUBIC YARDS _____
NO OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

- A TOXIC
- B CORROSIVE
- C RADIOACTIVE
- D. PERSISTENT
- E. SOLUBLE
- F INFECTIOUS
- G FLAMMABLE
- H IGNITABLE
- I HIGHLY VOLATILE
- J EXPLOSIVE
- K REACTIVE
- L INCOMPATIBLE
- M NOT APPLICABLE

**III. WASTE TYPE**

| CATEGORY | SUBSTANCE NAME | 01 GROSS AMOUNT | 02 UNIT OF MEASURE | 03 COMMENTS |
|---|---|---|---|---|
| SLU | SLUDGE | | | |
| OLW | OILY WASTE | unknown | gallons | used oil for road dust suppression |
| SOL | SOLVENTS | | | |
| PSD | PESTICIDES | | | |
| OCC | OTHER ORGANIC CHEMICALS | | | |
| IOC | INORGANIC CHEMICALS | | | |
| ACD | ACIDS | | | |
| BAS | BASES | | | |
| MES | HEAVY METALS | | | |

**IV. HAZARDOUS SUBSTANCES** (See Appendix for most frequently cited CAS numbers)

| 01 CATEGORY | 02 SUBSTANCE NAME | 03 CAS NUMBER | 04 STORAGE DISPOSAL METHOD | 05 CONCENTRATION | 06 MEASURE OF CONCENTRATION |
|---|---|---|---|---|---|
| | None detected | | | | |

**V. FEEDSTOCKS** (See Appendix for CAS numbers)

| CATEGORY | 01 FEEDSTOCK NAME | 02 CAS NUMBER | CATEGORY | 01 FEEDSTOCK NAME | 02 CAS NUMBER |
|---|---|---|---|---|---|
| FDS | Not applicable | | FDS | | |
| FDS | | | FDS | | |
| FDS | | | FDS | | |
| FDS | | | FDS | | |

**VI. SOURCES OF INFORMATION** (Cite specific references, e.g., state files, sampling analysis, reports)

NAS Memphis historical data and environmental reports. Analytical testing data for PCBs (1983) showned none present at detectable level.

EPA

# POTENTIAL HAZARDOUS WASTE SITE
## PRELIMINARY ASSESSMENT
### PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

| 01 STATE | 02 SITE NUMBER |
|---|---|
| TN | 2 170 022 600 |

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ B. SURFACE WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ C. CONTAMINATION OF AIR
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ E. DIRECT CONTACT
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ F. CONTAMINATION OF SOIL
03 AREA POTENTIALLY AFFECTED: 0 (ACRES)
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ G. DRINKING WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ H. WORKER EXPOSURE/INJURY
03 WORKERS POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ I. POPULATION EXPOSURE/INJURY
03 POPULATION POTENTIALLY AFFECTED: 0
02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

EPA

**POTENTIAL HAZARDOUS WASTE SITE**
**PRELIMINARY ASSESSMENT**
**PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS**

| I. IDENTIFICATION | |
|---|---|
| 01 STATE | 02 SITE NUMBER |
| TN | 2 170 022 600 |

**II. HAZARDOUS CONDITIONS AND INCIDENTS** (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

None

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills, runoff, standing liquids, leaking drums) — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

None

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

None

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

None

**III. TOTAL POPULATION POTENTIALLY AFFECTED:** None

**IV. COMMENTS**

Limited to application of used oil to unpaved roads for dust suppression.

**V. SOURCES OF INFORMATION** (Cite specific references, e.g., state files, sampling results)

NAS Memphis historical records and environmental reports.

# APPENDIX E

# SITE SCREENING ANALYSIS:

# HAZARD RANKING SYSTEM (HRS 1)

# PRELIMINARY AND PROJECTED SCORES

# FOR

# NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

September 1989

**HRS DOCUMENTATION RECORDS**

NAS Memphis Site No. 11
Site Screening Analysis
(Preliminary and Projected Scores)

QA Review Draft:
Site Name NAS Memphis - SWMU Site No. 11

Author: H.A. Bryson
Date: 9/10/89

# DOCUMENTATION RECORDS
# FOR
# HAZARD RANKING SYSTEM

**INSTRUCTIONS: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.**

**FACILITY NAME:** NAS Memphis SWMU Site No. 11 - Oiled, Dirt Roads

**LOCATION:** NAS Memphis (EntireComplex), Millington, Tennessee

**DATE SCORED:** 11 September 1989

**PERSON SCORING:** Harry A. Bryson, CHMM
ERC Environmental and Energy Services Co.
Knoxville, Tennessee

**PRIMARY SOURCE(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.):**

NAS Memphis historical records and environmental reports

**FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:**

None

**COMMENTS OR QUALIFICATIONS:**

Based on existing information.

## GROUND WATER ROUTE

### 1 OBSERVED RELEASE

**Contaminants detected (5 maximum):** None detected; PCBs persummed. Used oil known to have been placed.

**Rationale for attributing the contaminants to the facility:** Used oil had been applied to the dirt road (NAS historical information). Because the oil used was suspected to contain PCBs, preliminary consideration during the NAS-wide RCRA Facility Assessment initiated in 1986 included this site as SWMU No. 11

* * *

### 2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

**Name/description of aquifer(s) of concern:**
Memphis Sands, 350-400 feet below ground surface

**Depth(s) from the ground surface to the highest seasonal level of the saturated zone (water table(s)) of the aquifer(s) of concern:**

350-400 feet

**Depth from the ground surface to the lowest point of waste disposal/storage:**

One foot

## Net Precipitation

**Mean annual or seasonal precipitation (list months for seasonal):** 49.3"

**Mean annual lake or seasonal evaporation (list months for seasonal):** 40"

**Net precipitation (subtract the above figures):** 9.3"

## Permeability of Unsaturated Zone

**Soil type in unsaturated zone:**

Falaya-Waverly-Colins Association

**Permeability associated with soil type:**

Moderate, the available data indicated the permeability of the soft gray clay found at NAS site ranges from $5.2 \times 10^{-7}$ to $1.5 \times 10^{-6}$ cm/sec

## Physical State

**Physical state of substances at time of disposal (or at present time for generated gases):**

Waste Oil:

Sprayed as thin cover on dusty road surface. Oil adsorbed onto dust particles. Subject to volatilization/photodegradation/biodegradation and dispersal by wind, storm water runoff. Score = 3 for physical state (liquid) at time of disposal.

## 3 CONTAINMENT

Containment

**Method(s) of waste or leachate containment evaluated:**

No containment

**Method with highest score:**

Not applicable

## 4 WASTE CHARACTERISTICS

Toxicity and Persistence

**Compound(s) evaluated:**

PCB's for projected score

**Compound with highest score:**

PCB's for projected socre (toxicity = 3, persistive = 3, total of 18)

Hazardous Waste Quantity

**Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):**

None detected. Assumed HWQ score of 1 for projected score

**Basis of estimating and/or computing waste quantity:**

Surface soil analyses (1983) found no PCBs was present.

* * *

## 5 TARGETS

### Ground Water Use

**Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:**

Memphis Sand at 400' below ground level. Used by NAS, City.

### Distance to Nearest Well

**Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:**

NAS Memphis wells

**Distance to above well or building:**

Variable;

### Population Served by Ground Water Wells Within a 3-Mile Radius

Identify water-supply wells(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

NAS Memphis - 2000 permanent (military + civilian) City of Millington - 20,000 (approximately) Score = 3

**Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):**

None; area low-lying, subject to flooding

**Total population served by ground water within a 3-mile radius:**

22,000 (approximately) Score = 5
Score for GW use and distance = 35

## SURFACE WATER ROUTE

### 1 OBSERVED RELEASE

**Contaminants detected in surface water at the facility or downhill from it (5 maximum):**

None

**Rationale for attributing the contaminants to the facility:**

Not applicable

* * *

### 2 ROUTE CHARACTERISTICS

**Facility Slope and Intervening Terrain**

**Average slope of facility in percent:**

<3%

**Name/description of nearest downslope surface water:**

Big Creek Drainage Canal

**Average slope of terrain between facility and above-cited surface water body in percent:**

<3%

**Is the facility located either totally or partially in surface water?**

No

**Is the facility completely surrounded by areas of higher elevation?**

No

**1-Year 24-Hour Rainfall in Inches**

3.25"

**Distance to Nearest Downslope Surface Water**

Approximately 200 feet

**Physical State of Waste**

No longer exists

* * *

## 3 CONTAINMENT

**Containment:**

**Method(s) of waste or leachate containment evaluated:**

Uncovered waste pile

**Method with highest score:**

Uncontrolled, uncovered (3)

## 4 WASTE CHARACTERISTICS

### Toxicity and Persistence

**Compound(s) evaluated:**

PCBs and used oil components

**Compound with highest score:**

PCBs

### Hazardous Waste Quantity

**Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):**

Zero

**Basis of estimating and/or computing waste quantity:**

No hazardous waste remaining on site

* * *

## 5 TARGETS

### Surface Water Use

**Use(s) of surface water within 3 miles downstream of the hazardous substance:**

Non-potable water for livestock, wildlife, aquatic biota

For projected score, a value of 1 was assummed.

**Is there tidal influence?**

No

**Distance to a Sensitive Environment**

**Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:**

Not applicable

**Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:**

Not applicable

**Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:**

Not applicable

**Population Served by Surface Water**

**Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:**

None

**Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):**

Not applicable

**Total population served:**

Zero

**Name/description of nearest of above-cited intakes:**

None known

**Distance to above-cited intakes, measured in stream miles:**

Not applicable

NOTE: for projected score, a value of 4 was assumed

## AIR ROUTE

### 1 OBSERVED RELEASE

**Contaminants detected:**

None

**Date and location of detection of contaminants:**

Not applicable

**Methods used to detect the contaminants:**

Not applicable

**Rationale for attributing the contaminants to the site:**

Not applicable

* * *

### 2 WASTE CHARACTERISTICS

<u>Reactivity and Incompatibility</u>

**Most reactive compound:**

None

**Most incompatible pair of compounds:**

None

Toxicity

**Most toxic compound:**

PCBs

Hazardous Waste Quantity

**Total quantity of hazardous waste:**

None

**Basis of estimating and/or computing waste quantity:**

1983 Soil Sample analysis form affected area

* * *

## 3 TARGETS

Population Within 4-Mile Radius

**Circle radius used, give population, and indicate how determined:**

(0 to 4 mi) 0 to 1 mi 0 to 1/2 mi 0 to ¼ mi

22,000 permanent NAS, City population

Distance to a Sensitive Environment

**Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:**

Not applicable

**Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:**

Not applicable

**Distance to critical habitat of an endangered species, if 1 mile or less:**

Not applicable

**Land Use**

**Distance to commercial/industrial area, if 1 mile or less:**

Approximately 1/4 mile

**Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:**

Not applicable

**Distance to residential area, if 2 miles or less:**

Approximately 1/4 mile

**Distance to agricultural land in production within past 5 years, if 1 mile or less:**

Approximately 1/4 mile (east side NAS)

**Distance to prime agricultural land in production within past 5 years, if 2 miles or less:**

Not applicable

**Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?**

No

# FIRE AND EXPLOSION HAZARD

## 1 CONTAINMENT

**Hazardous substances present:**

None (PCBs assumed for projected socre)

**Type of containment, if applicable:**

None

* * *

## 2 WASTE CHARACTERISTICS

Direct Evidence
**Type of instrument and measurements:**

Soil sample analysis (1983 study)

Ignitability
**Compound used:**

Not applicable

Reactivity
**Most reactive compound:**

Not applicable

Incompatibility
**Most incompatible pair of compounds:**

Not applicable

Hazardous Waste Quantity
**Total quantity of hazardous substances at the facility:**

Zero (preliminary projected scores)

**Basis of estimating and/or computing waste quantity:**

None remaining (1983 soil sampling)

* * *

## 3 TARGETS

Distance to Nearest Population

1/4 mile (approx)

Distance to Nearest Building

1/4 mile (approx)

Distance to Sensitive Environment
**Distance to wetlands:**

> 5 miles

**Distance to critical habitat:**

> 5 miles

Land Use
**Distance to commercial/industrial area, if 1 mile or less:**

1 mile (approx. - off station, Navy Road)

**Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:**

Not applicable

**Distance to residential area, if 2 miles of less:**

1/4 miles (approx.) NAS residential housing

**Distance to agricultural land in production within past 5 years, if 1 mile or less:**

2000' (approx.; south across Paul Barret Pkwy)

**Distance to prime agricultural land in production within past 5 years, if 2 miles or less:**

Not Applicable

**Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?**

No

**Population Within 2-Mile Radius**

>10,000

**Buildings Within 2-Mile Radius**

> 2,000

## DIRECT CONTACT HAZARD

### 1 OBSERVED INCIDENT

**Date, location, and pertinent details of incident:**

None

* * *

### 2 ACCESSIBILITY

**Describe type of barrier(s):**

None

* * *

### 3 CONTAINMENT

**Type of containment, if applicable:**

None

* * *

### 4 WASTE CHARACTERISTICS

**Toxicity**

**Compounds evaluated:** None remaining.
PCBs assumed for projected score.

**Compound with highest score:**
PCBs for projected score (value of 3 used, as per groundwater route)

* * *

## 5 TARGETS

**Population within a 1-mile radius:**

Approximately 10,000 (NAS permanent, transient, plus local off-station residences)

**Distance to critical habitat of endangered species:**

> 5 miles

# APPENDIX E

# SITE SCREENING ANALYSIS:

# HAZARD RANKING SYSTEM (HRS 1)

# PRELIMINARY AND PROJECTED SCORES

# FOR

# NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

APPENDIX E-1

HAZARD RANKING SYSTEM (HRS 1)

PRELIMINARY HRS SCORES

FOR

NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

Facility name: NAS Memphis Site No. 11

Location: NAS Memphis (North and South Sides)

EPA Region: IV

Person(s) in charge of the facility: Captain Jerry (NMI) Baker, Jr., USN Commanding Officer

NAS Memphis; Millington, Tennessee

Name of Reviewer: Harry A. Bryson Date: 10 September 1989

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

NAS Memphis Site No. 11 consists of unpaved perimeter roads that were in the past treated with used oil as a means of dust suppression during the period of 1942 to the early 1970's.

Scores: $S_M$ = 0 ($S_{gw}$ = 0 $S_{sw}$ = 0 $S_a$ = 0 )

$S_{FE}$ = 0

$S_{DC}$ = 0

## HRS COVER SHEET

PRELIMINARY SCORE

## Ground Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 3.1 |
| If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2. X | | | | | |
| 2 Route Characteristics | | | | | 3.2 |
| Depth to Aquifer of Concern | 0 1 2 3 | 2 | 0 | 6 | |
| Net Precipitation | 0 1 2 3 | 1 | 3 | 3 | |
| Permeability of the Unsaturated Zone | 0 1 2 3 | 1 | 2 | 3 | |
| Physical State | 0 1 2 3 | 1 | 3 | 3 | |
| Total Route Characteristics Score | | | 8 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 3.3 |
| 4 Waste Characteristics | | | | | 3.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 0 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 26 | |
| 5 Targets | | | | | 3.5 |
| Ground Water Use | 0 1 2 3 | 3 | 6 | 9 | |
| Distance to Nearest Well/Population Served | 0 4 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 35 | 40 | |
| Total Targets Score | | | 41 | 49 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 57,330 | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | $S_{gw}$ = | 0 | | |

## Surface Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 4.1 |
| If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 4.2 |
| Facility Slope and Intervening Terrain | 0 1 2 3 | 1 | 0 | 3 | |
| 1-yr. 24-hr. Rainfall | 0 1 2 3 | 1 | 3 | 3 | |
| Distance to Nearest Surface Water | 0 1 2 3 | 2 | 3 | 6 | |
| Physical State | 0 1 2 3 | 1 | 0 | 3 | |
| Total Route Characteristics Score | | | 6 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 4.3 |
| 4 Waste Characteristics | | | | | 4.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 0 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 26 | |
| 5 Targets | | | | | 4.5 |
| Surface Water Use | 0 1 2 3 | 3 | 0 | 9 | |
| Distance to a Sensitive Environment | 0 1 2 3 | 2 | 0 | 6 | |
| Population Served/Distance to Water Intake Downstream | 0 4 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 0 | 40 | |
| Total Targets Score | | | 0 | 55 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 64,350 | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | $S_{sw}$ = | 0 | | |

## Air Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 5.1 |
| Date and Location: N/A | | | | | |
| Sampling Protocol: N/A | | | | | |
| If line 1 is 0, the $S_a$ = 0. Enter on line 5<br>If line 1 is 45, then proceed to line 2 | | | | | |
| 2 Waste Characteristics | | | | | 5.2 |
| Reactivity and Incompatibility | (0) 1 2 3 | 1 | 0 | 3 | |
| Toxicity | (0) 1 2 3 | 3 | 0 | 9 | |
| Hazardous Waste Quantity | (0) 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| | Total Waste Characteristics Score | | 0 | 20 | |
| 3 Targets | | | | | 5.3 |
| Population Within 4-Mile Radius | (0) 9 12 15 18 21 24 27 30 | 1 | 0 | 30 | |
| Distance to Sensitive Environment | (0) 1 2 3 | 2 | 0 | 6 | |
| Land Use | (0) 1 2 3 | 1 | 0 | 3 | |
| | Total Targets Score | | 0 | 39 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 35,100 | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | $S_a$ = | 0 | | |

| | S | $S^2$ |
|---|---|---|
| Groundwater Route Score ($S_{gw}$) | 0 | 0 |
| Surface Water Route Score ($S_{sw}$) | 0 | 0 |
| Air Route Score ($S_a$) | 0 | 0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 0 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 0 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 0 |

WORKSHEET FOR COMPUTING $S_M$

## Fire and Explosion Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Containment | 1 3 | 1 | 3 | 3 | 7.1 |
| 2 Waste Characteristics | | | | | 7.2 |
| Direct Evidence | 0 3 | 1 | 0 | 3 | |
| Ignitability | 0 1 2 3 | 1 | 0 | 3 | |
| Reactivity | 0 1 2 3 | 1 | 0 | 3 | |
| Incompatibility | 0 1 2 3 | 1 | 0 | 3 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 20 | |
| 3 Targets | | | | | 7.3 |
| Distance to Nearest Population | 0 1 2 3 4 5 | 1 | 4 | 5 | |
| Distance to Nearest Building | 0 1 2 3 | 1 | 1 | 3 | |
| Distance to Sensitive Environment | 0 1 2 3 | 1 | 0 | 3 | |
| Land Use | 0 1 2 3 | 1 | 1 | 3 | |
| Population Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 5 | 5 | |
| Buildings Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | 3 | 5 | |
| Total Targets Score | | | 14 | 24 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | $S_{FE}$ = 0 | | |

## Direct Contact Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Sectio |
|---|---|---|---|---|---|
| 1 Observed Incident | 0 45 | 1 | 0 | 45 | 8.1 |
| If line 1 is 45, proceed to line 4<br>If line 1 is 0, proceed to line 2 | | | | | |
| 2 Accessibility | 0 1 2 3 | 1 | 3 | 3 | 8.2 |
| 3 Containment | 0 15 | 1 | 15 | 15 | 8.3 |
| 4 Waste Characteristics<br>Toxicity | 0 1 2 3 | 5 | 0 | 15 | 8.4 |
| 5 Targets | | | | | 8.5 |
| Population Within a 1-Mile Radius | 0 1 2 3 4 5 | 4 | 16 | 20 | |
| Distance to a Critical Habitat | 0 1 2 3 | 4 | 0 | 12 | |
| Total Targets Score | | | 16 | 32 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 21,600 | |
| 7 Divide line 6 by 21,600 and multiply by 100 | | $S_{DC}$ = | 0 | | |

APPENDIX E-2

HAZARD RANKING SYSTEM (HRS 1)

PROJECTED HRS SCORES

FOR

NAS MEMPHIS SITE NO. 11 - OILED, DIRT ROADS

NAS MEMPHIS
MILLINGTON, TENNESSEE

November 1989

Facility name: NAS Memphis Site No. 11

Location: NAS Memphis

EPA Region: IV

Person(s) in charge of the facility: Captain Jerry Baker, Jr., USN
Commanding Officer, NAS Memphis
Millington, Tennessee 38054-5000

Name of Reviewer: Harry A. Bryson Date: 10 September 1989

General description of the facility:
(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

NAS Memphis Site No. 11 consists of unpaved perimeter roads that were in the past treated with used oil as a means of dust suppression during the the period of 1942 to the late 1970's.

Scores: $S_M$ = 19.0 ($S_{gw}$ = 32.6 $S_{sw}$ = 3.7 $S_a$ = 0 )
$S_{FE}$ = 0
$S_{DC}$ = 50.0

**HRS COVER SHEET**
PROJECTED SCORE

## Ground Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Sectio |
|---|---|---|---|---|---|
| 1 Observed Release | 0 45 | 1 | 0 | 45 | 3.1 |
| If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 3.2 |
| Depth to Aquifer of Concern | 0 1 2 3 | 2 | 0 | 6 | |
| Net Precipitation | 0 1 2 3 | 1 | 3 | 3 | |
| Permeability of the Unsaturated Zone | 0 1 2 3 | 1 | 2 | 3 | |
| Physical State | 0 1 2 3 | 1 | 3 | 3 | |
| | Total Route Characteristics Score | | 8 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 3.3 |
| 4 Waste Characteristics | | | | | 3.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 18 | 1 | 18 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | 1 | 8 | |
| | Total Waste Characteristics Score | | 19 | 26 | |
| 5 Targets | | | | | 3.5 |
| Ground Water Use | 0 1 2 3 | 3 | 6 | 9 | |
| Distance to Nearest Well/Population Served | 0 4 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 35 | 40 | |
| | Total Targets Score | | 41 | 49 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 18,696 | 57,330 | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | $S_{gw}$ = | 32.6 | | |

## Surface Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 4.1 |
| If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | 4.2 |
| Facility Slope and Intervening Terrain | (0) 1 2 3 | 1 | 0 | 3 | |
| 1-yr. 24-hr. Rainfall | 0 1 2 (3) | 1 | 3 | 3 | |
| Distance to Nearest Surface Water | 0 1 2 (3) | 2 | 6 | 6 | |
| Physical State | (0) 1 2 3 | 1 | 0 | 3 | |
| Total Route Characteristics Score | | | 9 | 15 | |
| 3 Containment | 0 1 2 3 | 1 | 3 | 3 | 4.3 |
| 4 Waste Characteristics | | | | | 4.4 |
| Toxicity/Persistence | 0 3 6 9 12 15 (18) | 1 | 18 | 18 | |
| Hazardous Waste Quantity | 0 (1) 2 3 4 5 6 7 8 | 1 | 1 | 8 | |
| Total Waste Characteristics Score | | | 19 | 26 | |
| 5 Targets | | | | | 4.5 |
| Surface Water Use | 0 (1) 2 3 | 3 | 3 | 9 | |
| Distance to a Sensitive Environment | (0) 1 2 3 | 2 | 0 | 6 | |
| Population Served/Distance to Water Intake Downstream | 0 (4) 6 8 10<br>12 16 18 20<br>24 30 32 35 40 | 1 | 4 | 40 | |
| Total Targets Score | | | 7 | 55 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 3591 | 64,350 | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | $S_{sw}$ = | 5.58 | | |

## Air Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 5.1 |
| Date and Location: N/A | | | | | |
| Sampling Protocol: N/A | | | | | |
| If line 1 is 0, the $S_a$ = 0. Enter on line 5<br>If line 1 is 45, then proceed to line 2 | | | | | |
| 2 Waste Characteristics | | | | | 5.2 |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | |
| Toxicity | 0 1 2 3 | 3 | | 9 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | |
| | Total Waste Characteristics Score | | N/A | 20 | |
| 3 Targets | | | | | 5.3 |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | |
| Land Use | 0 1 2 3 | 1 | | 3 | |
| | Total Targets Score | | N/A | 39 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 35,100 | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | $S_a$ = | 0 | | |

| | S | $S^2$ |
|---|---|---|
| Groundwater Route Score ($S_{gw}$) | 32.6 | 1062.76 |
| Surface Water Route Score ($S_{sw}$) | 5.58 | 31.14 |
| Air Route Score ($S_a$) | 0 | 0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 1093.90 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 33.07 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 19.1 |

## WORKSHEET FOR COMPUTING $S_M$

## Fire and Explosion Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Containment | 1 (3) | 1 | 3 | 3 | 7.1 |
| 2 Waste Characteristics | | | | | 7.2 |
| Direct Evidence | (0) 3 | 1 | 0 | 3 | |
| Ignitability | (0) 1 2 3 | 1 | 0 | 3 | |
| Reactivity | (0) 1 2 3 | 1 | 0 | 3 | |
| Incompatibility | (0) 1 2 3 | 1 | 0 | 3 | |
| Hazardous Waste Quantity | (0) 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 20 | |
| 3 Targets | | | | | 7.3 |
| Distance to Nearest Population | 0 1 2 3 (4) 5 | 1 | 4 | 5 | |
| Distance to Nearest Building | 0 (1) 2 3 | 1 | 1 | 3 | |
| Distance to Sensitive Environment | (0) 1 2 3 | 1 | 0 | 3 | |
| Land Use | 0 (1) 2 3 | 1 | 1 | 3 | |
| Population Within 2-Mile Radius | 0 1 2 3 4 (5) | 1 | 5 | 5 | |
| Buildings Within 2-Mile Radius | 0 1 2 (3) 4 5 | 1 | 3 | 5 | |
| Total Targets Score | | | 14 | 24 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | $S_{FE}$ = 0 | | |

## Direct Contact Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) |
|---|---|---|---|---|---|
| 1 Observed Incident | 0 45 | 1 | 0 | 45 | 8.1 |
| If line 1 is 45, proceed to line 4<br>If line 1 is 0, proceed to line 2 | | | | | |
| 2 Accessibility | 0 1 2 3 | 1 | 3 | 3 | 8.2 |
| 3 Containment | 0 15 | 1 | 15 | 15 | 8.3 |
| 4 Waste Characteristics<br>Toxicity | 0 1 2 3 | 5 | 15 | 15 | 8.4 |
| 5 Targets | | | | | 8.5 |
| Population Within a 1-Mile Radius | 0 1 2 3 4 5 | 4 | 16 | 20 | |
| Distance to a Critical Habitat | 0 1 2 3 | 4 | 0 | 12 | |
| Total Targets Score | | | 16 | 32 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 10,800 | 21,600 | |
| 7 Divide line 6 by 21,600 and multiply by 100 | | $S_{DC}$ = | 50.0 | | |

## Surface Water Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Sectic |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 4.1 |
| If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2. | | | | | |
| 2 Route Characteristics | | | | | |
| Facility Slope and Intervening Terrain | 0 (1) 2 3 | 1 | 1 | | |
| 1-yr. 24-hr. Rainfall | 0 1 2 (3) | 1 | 3 | | |
| Distance to Nearest Surface Water | 0 1 2 (3) | 2 | 6 | | |
| Physical State | (0) 1 2 3 | 1 | | ← 0 | |
| Total Route Characteristics Score | | | 10 | | |
| 3 Containment | 0 1 2 (3) | 1 | 3 | 3 | 4.3 |
| 4 Waste Characteristics | | | | | 4.4 |
| Toxicity/Persistence | 0 3 (6) 9 12 15 18 | 1 | 6 | 18 | |
| Hazardous Waste Quantity | 0 1 2 3 (4) 5 6 7 8 | 1 | 4 | 8 | |
| Total Waste Characteristics Score | | | 10 | 26 | |
| 5 Targets | | | | | 4.5 |
| Surface Water Use | 0 (1) 2 3 | 3 | 3 | 9 | |
| Distance to a Sensitive Environment | (0) 1 2 3 | 2 | 0 | 6 | |
| Population Served/Distance to Water Intake Downstream | 0 (4) 6 8 10 / 12 16 18 20 / 24 30 32 35 40 | 1 | 4 | 40 | |
| Total Targets Score | | | 7 | 55 | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 2100 | 64,350 | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | | $S_{SW}$ = 3.3 | | |

## Air Route Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section |
|---|---|---|---|---|---|
| 1 Observed Release | (0) 45 | 1 | 0 | 45 | 5.1 |
| Date and Location: | Not Applicable | | | | |
| Sampling Protocol: | Not Applicable | | | | |
| If line 1 is 0, the $S_a$ = 0. Enter on line 5<br>If line 1 is 45, then proceed to line 2 | | | | | |
| 2 Waste Characteristics | | | | | 5.2 |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | |
| Toxicity | 0 1 2 3 | 3 | | 9 | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | |
| | Total Waste Characteristics Score | | N/A | 20 | |
| 3 Targets | | | | | 5.3 |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | |
| Land Use | 0 1 2 3 | 1 | | 3 | |
| | Total Targets Score | | N/A | 39 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 35,100 | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | $S_a$ = | 0 | | |

| | S | $S^2$ |
|---|---|---|
| Groundwater Route Score ($S_{gw}$) | 9.4 | 88.36 |
| Surface Water Route Score ($S_{sw}$) | 3.3 | 12.96 |
| Air Route Score ($S_a$) | 0 | 0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 101.32 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 10.06 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 5.8 |

**WORKSHEET FOR COMPUTING $S_M$**

## Fire and Explosion Work Sheet

| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section |
|---|---|---|---|---|---|
| 1 Containment | 1 (3) | 1 | 3 | 3 | 7.1 |
| 2 Waste Characteristics | | | | | 7.2 |
| Direct Evidence | (0) 3 | 1 | 0 | 3 | |
| Ignitability | (0) 1 2 3 | 1 | 0 | 3 | |
| Reactivity | (0) 1 2 3 | 1 | 0 | 3 | |
| Incompatibility | (0) 1 2 3 | 1 | 0 | 3 | |
| Hazardous Waste Quantity | (0) 1 2 3 4 5 6 7 8 | 1 | 0 | 8 | |
| Total Waste Characteristics Score | | | 0 | 20 | |
| 3 Targets | | | | | 7.3 |
| Distance to Nearest Population | 0 1 2 (3) 4 5 | 1 | 3 | 5 | |
| Distance to Nearest Building | 0 (1) 2 3 | 1 | 1 | 3 | |
| Distance to Sensitive Environment | (0) 1 2 3 | 1 | 0 | 3 | |
| Land Use | 0 1 2 (3) | 1 | 3 | 3 | |
| Population Within 2-Mile Radius | 0 1 2 3 4 (5) | 1 | 5 | 5 | |
| Buildings Within 2-Mile Radius | 0 1 2 3 (4) 5 | 1 | 4 | 5 | |
| Total Targets Score | | | 16 | 24 | |
| 4 Multiply 1 x 2 x 3 | | | 0 | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | $S_{FE}$ = 0 | | |

## Direct Contact Work Sheet

| | Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Sectio |
|---|---|---|---|---|---|---|
| 1 | Observed Incident | (0) 45 | 1 | 0 | 45 | 8.1 |
| | If line 1 is 45, proceed to line 4<br>If line 1 is 0, proceed to line 2 | | | | | |
| 2 | Accessibility | 0 1 (2) 3 | 1 | 2 | 3 | 8.2 |
| 3 | Containment | 0 (15) | 1 | 15 | 15 | 8.3 |
| 4 | Waste Characteristics<br>Toxicity | 0 (1) 2 3 | 5 | 5 | 15 | 8.4 |
| 5 | Targets | | | | | 8.5 |
| | Population Within a 1-Mile Radius | 0 1 2 3 4 (5) | 4 | 20 | 20 | |
| | Distance to a Critical Habitat | (0) 1 2 3 | 4 | 0 | 12 | |
| | Total Targets Score | | | 20 | 32 | |
| 6 | If line 1 is 45, multiply 1 x 4 x 5<br>If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 3000 | 21,600 | |
| 7 | Divide line 6 by 21,600 and multiply by 100 | | | $S_{DC}$ = 13.9 | | |