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Research Laboratory
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Research and Development

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Project Summary

Flue Gas Desulfurization Information System (FGDIS) Data Base User's Manual

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This document is a user's manual and reference book/primer for Flue Gas Desulfurization Information System (FGDIS) users and recipients of the quarterly Utility FGD Survey. Part I is the interactive computer procedures for the FGDIS; it addresses the use of and terminology related to the use of the computerized data base. Part II is the FGDIS terminology; it addresses FGD technology as it relates to this computerized data base. The primary thrust of Part II concerns equipment/component classifications: major equipment items and construction materials are broken down into primary, secondary, and tertiary categories referred to as generic type, specific type, and trade/common name (or common design). These are supported by an appendix that describes the use of the problem/solution codes. A glossary defines common scrubber and boiler-related FGD terms, including definitions of data field titles in FGDIS that may be unclear to new FGDIS users or individuals somewhat detached from the system.

The Utility FGD Survey, a major product of the FGDIS, is available through the Research Reports Center of the Electric Power Research Institute (EPRI), Palo Alto, CA (415/965-4081). The Survey includes a significant portion of the information collected within the FGDIS; however, important data (e.g., dependability, cost, specific design) are not included and can only be obtained through access of the FGDIS.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Utilities in the U.S., operating or planning to install flue gas desulfurization (FGD) systems, are contacted regularly throughout each year to provide data that constitute the basis for the Utility FGD Survey.

The quarterly Survey is generated by a computerized data system known as the Flue Gas Desulfurization Information System (FGDIS). Figure 1 (see pages 4 and 5), a structure diagram of the FGDIS, shows the informational areas addressed in the system and some representative data items contained in each. The design data contained in the system encompass the entire emission control system and the power generating unit to which it is applied. Performance data for operational FGD systems include monthly dependability parameters, along with service time and problem/solution descriptions.

In addition to generating the Survey, the FGDIS is available for remote terminal access. Because the Survey is available through purchase from the National Technical Information Service (NTIS) (after June 1983, it may be purchased from Electric Power Research Institute (EPRI)), the data base is the most immediate method for examining the data acquired under the survey program. Access to the FGDIS also enables users to obtain data that are too specific for inclusion in the Survey. Information concerning access to the FGDIS can be obtained from Walter Finch, NTIS, 5285 Port Royal Road,

Springfield, VA 22161, (703) 487-4808, or Norman Kaplan, USEPA, Air and Energy Engineering Research Laboratory, Mail Drop 61, Research Triangle Park, NC 27711, (919) 541-2556. Custom searches of the FGDIS data can also be arranged.

Part I: Interactive Computer Procedures for the FGDIS

This manual is a guide to the use of the FGDIS, a collection of data base files stored at EPA's National Computer Center (NCC) in Research Triangle Park, NC. These files are accessed and their data are manipulated using SYSTEM 2000®, a general data base management system developed by INTEL Corporation and supported by NCC's Univac 1100 hardware.

The FGDIS is a collection of data files pertaining to the design, performance (SO_2 and dependability), and cost of FGD systems. The data stored as logical entries (elements), linked by a common structure consisting of various levels of repeating groups (or levels of information). Figure 1 shows the FGDIS structure, along with some key data items. A given FGD system may have as many as 574 design data entries (14 of which are cost-related) and 74 monthly performance data items. (NOTE: The FGDIS can address any FGD system design; not all data entry fields are applicable to every FGD system.)

To access the FGDIS, a user must be able to log into the Univac system at NCC. This requires a telephone and coupler modem, unless using a terminal that is wired directly to the system (e.g., the onsite terminals at NCC). The terminal also must be compatible with the Univac 1100 system. Any terminal, hard copy, or cathode ray tube (CRT) that emulates a Teletype at 30 or 120 bits per second can be supported. The terminal, however, must use the ASCII character set and be set in the half-duplex mode (one-way telecommunication between terminal and computer).

Compatible terminals include: (1) Anderson Jacobson 63x, 83x; (2) Hazeltine 1000, 2000 (CRT); (3) Hewlett-Packard 2622A; (4) Sperry Univac DCT 500, 1000, Uniscope 100 (DCT 1000s and Uniscope 100s can be supported only over dedicated circuits in synchronous mode); (5) Tektronix 401x, 4051; (6) Teletype 33, 35, 37, 38 (ASR/KSR); and (7) Texas Instruments 7xx, 770/2. They do not include all available compatible terminals, nor do they represent recommended terminals. More than 100 manufacturers produce hardcopy and CRT terminals, and as long as a terminal can emulate a teletype, it can be supported.

Access to the NCC system is available to 300- and 1200-baud (baud is a variable unit of data transmission speed, usually equal to 1 bit per second) users through a nationwide telephone communications system (TYMNET) that offers local dialing numbers in more than 100 cities; WATS service is available to those for whom local numbers are not available.

Actual charges for on-line access depend on the type of retrieval commands used. A simple command to print a report may cost only $10; whereas, a more sophisticated statistical analysis of the data base may cost $150. Users are charged only for the computer resources used, not actual on-line computer connect time. There is no charge for obtaining an account number.

The user's manual shows in detail NCC access (computer log-on/log-off), System 2000 execution/termination, immediate access features, the report writer (canned program) feature, and output control.

The immediate access feature describes the execution of extensive cross referencing possibilities, with examples. It includes formatting options and system functions (e.g., addition, subtraction, multiplication, division, averaging, standard deviation, and maximum/minimum value).

The report writer feature illustrates System 2000's ability to prepare standard report programs that may be used (in conjunction with the immediate access feature) to exclude or include specific subsets within the FGDIS files.

Also included in Part I are nine appendices. Appendix A, which lists the nine report writer programs prepared to date, contains an abstract illustrating the use of the program, a sample run stream (what the user would type in), a sample output, and other suggested uses/comments. Table 1 lists the available report writer programs, along with brief descriptions.

Table 1. *Available Report Writer Programs*

Report Writer Program	*Description*
TOTPRO	*Breaks down the various FGD processes with respect to system status (operational, under construction, contract awarded, planned) as well as salable v throwaway product designs.*
TOTMW	*Breaks down the status of the various FGD systems in the data base. Included each classification is the total number of systems and the total megawatt value terms of both total controlled capacity (gross) and equivalent scrubbed capaci (percent of gas scrubbed).*
COLIST	*Displays company name, unit name and number, unit location, initial start-u date, status, and regulatory class. The list is displayed alphabetically by compa and unit.*
PERAVG	*Displays the four dependability parameters (availability, reliability, operabili utilization) as well as capacity factors, boiler hours, FGD system operating hou and hours for the time period and unit(s) specified.*
ABSTCT	*Generates a brief abstract for units specified in addition to unit megawatt ratin location, boiler and FGD system type, FGD process utilized, etc.*
IDS	*Displays the identification number for each unit in the FGDIS. Included a company and unit names and unit numbers.*
FNOTES	*Lists footnotes contained in the data base for the unit(s) and element(s) question. The output provides the element number to which the footnote pertain*
ECON	*Displays reported capital and annual costs, and adjusted costs.*
PEDATA	*Briefly describes FGD-related problems, solutions, and/or comments for specific period.*
REMOVE	*Displays removal performance data for SO_2, particulate, and NO_x at a specific u for a designated period. Opacity readings and SO_2 analysis parameters a included.*

Table 2 shows examples of run streams and sample outputs of two report writer programs, PERAVG and ABSTCT. The nine appendices are described briefly in Table 3.

Part II. FGDIS Terminology

This section discusses terminology used in the FGDIS, in both tabular and graphic form.

Part II covers 12 major equipment/component classifications for FGD systems, as categorized in the FGDIS: (1) scrubbers/absorbers; (2) mist eliminators; (3) reheaters; (4) solids dewatering devices; (5) sludge processors; (6) sludge disposal sites; (7) reagent preparation equipment; (8) pumps; (9) valves; (10) dampers; (11) construction material; and (12) fans.

Each section shows a breakdown in three categories: generic type, specific type, and trade/common name (or common design). Exceptions to this categorization are valves (addressed only as generic and specific) and fans (classified separately).

The sixth group, sludge disposal sites, is used as an example. Table 4 gives a breakdown of generic, specific, and common design types of sludge disposal sites. Figure 2 presents typical graphic representations of one of these generic types, the pond.

Each item in Table 4 is described in a short paragraph. Similar brief descriptions are given in the text throughout Part II.

Table 2. Sample Run Stream and Output for PERAVG and ABSTCT

Run Stream:

```
@ Add FGDIS.PERAVG
---
---
>Generate PERAVG WH C1 EQ 46 and C3401 EQ 8201* 8206:
 -479- lowest selected record common to all reports is 3440.
```

Output:

Kansas City Power & Light
La Cygne
1

Net Generating Capacity with FGD - 820
Gross Generating Capacity - 874
% Scrubbed - 100

Date	Capacity Factor	Period Hours	Boiler Hours	FGD Hours	Availability	Operability	Reliability	Utilization
8201	33.4	744	511	483	92.5	91.3	89.7	64.9
8202	24.0	672	348	367	96.4	90.6	93.5	58.3
8203	33.3	744	441	449	95.8	93.8	93.2	60.4
8204	20.5	720	282	278	98.9	94.7	97.3	38.6
8205	0.0	744	00	0	100.0	***	***	0.0
8206	13.0	720	197	206	97.5	93.9	91.7	28.7
Average	20.7				96.8	92.9	93.1	41.8

*NOTE: *'s indicate that the value does not exist.*

```
---
>
```

Run Stream:

```
>@Add FGDIS.ABSTCT
---
---
>Generate ABSTCT where C1 EQ 157:
-479- Lowest Selected Record Common to all Reports is 4000 -
```

Output:

Big Rivers Electric
Green
2

MW-Gross; 242
MW-Net with FGD; 222
MW-ESC; 242

Unit 2 of Big Rivers Electric's Green Station is located in Sebree, Kentucky. The dry bottom pulverized Coal (3.75% S, 9750 Btu/lb) fired boiler supplies 1,000,000 acfm to a cold side ESP followed by two American air filter lime spray towers which remove 90% of the SO_2. The cleaned gas passes through a chevron mist eliminator and exist a Sauerisen 72 lined stack after it is heated by a steam coil reheater. The sludge from the closed water loop system is POZ-O-TEC stabilized. Operations commenced in November 1980.

```
---
>
```

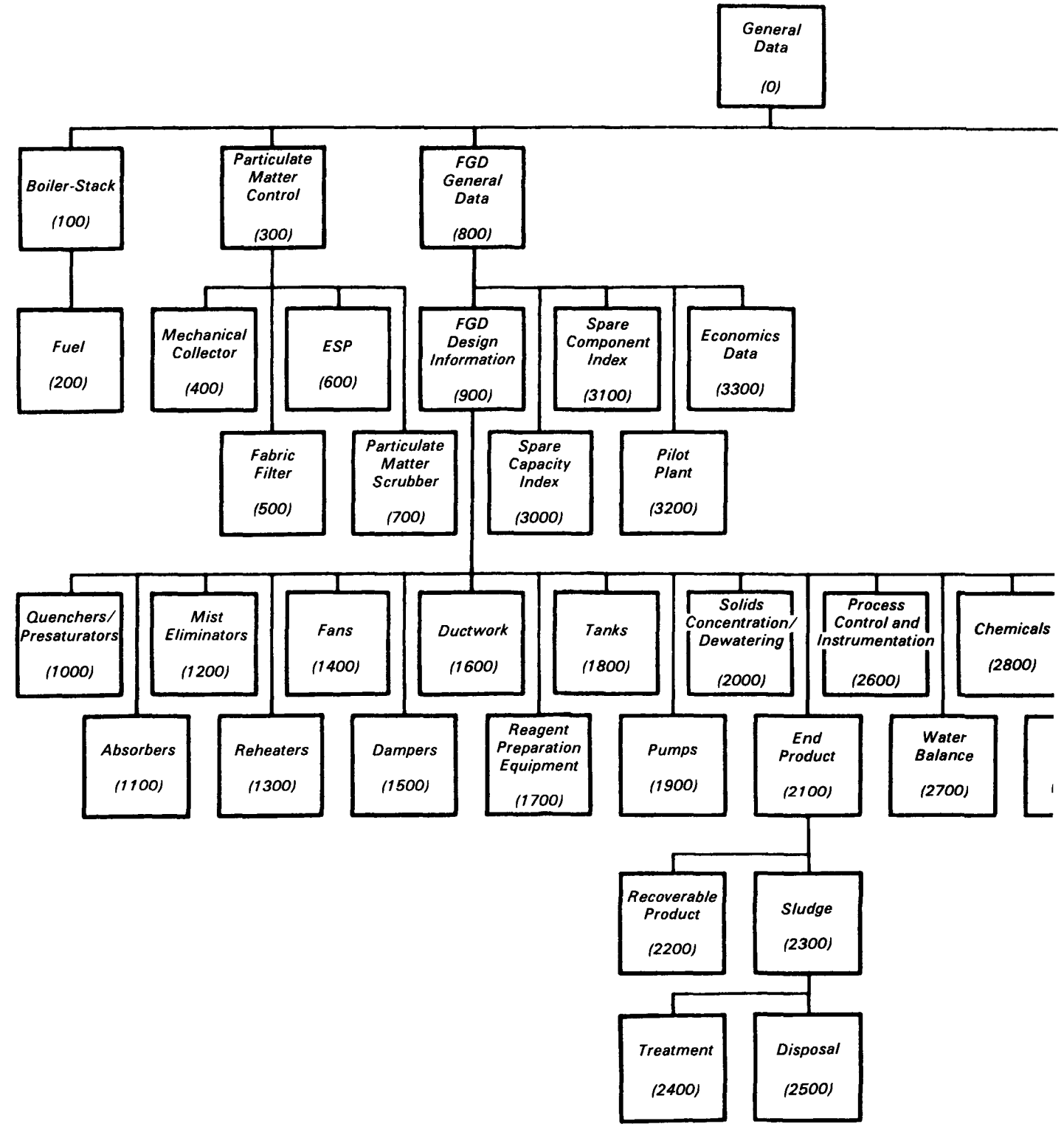


Figure 1. *Structure diagram of FGDIS.*

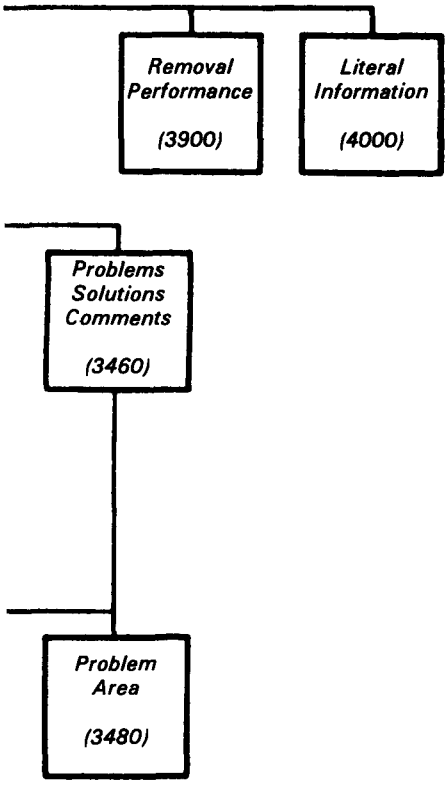
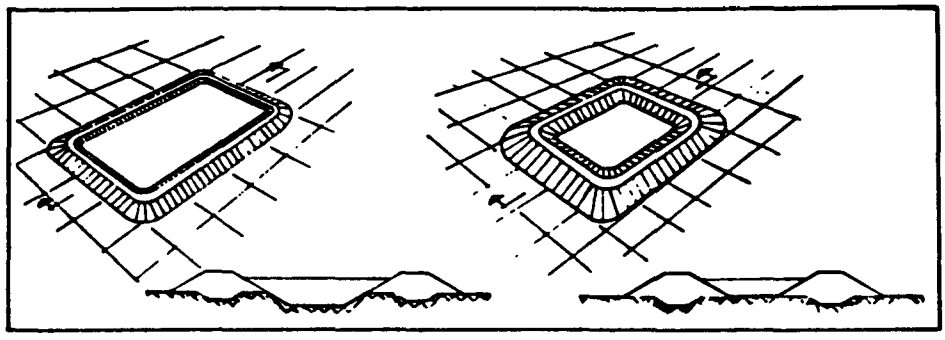


Table 3. *User's Manual Appendices*

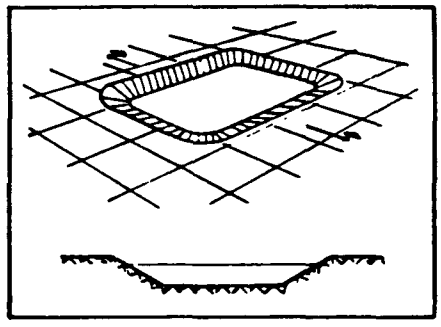
Appendix	Title	Description
A	Report Writer Programs	Specialized programs designed to generate formatted reports in conjunction with the FGDIS.
B	File Creation/File Manipulation	Creation and editing of data files within Univac 1100.
C	TYMNET Diagnostic Messages	System-supplied messages associated with log-on problems.
D	SYSTEM 2000 Diagnostic Messages	System-supplied messages encountered during SYSTEM 2000® sessions.
E	NTIS Application Form	Procedure for obtaining access to on-line data bases at the USEPA's National Computer Center (NCC).
F	FGDIS Dump Program	Procedure for obtaining complete data dumps on individual units within the FGDIS.
G	NCC Cost of Services	Explanation of NCC charges for use of Univac 1100.
H	Problem/Solution Access Codes	Two-character codes used for quick retrieval of comments and problems reported on utility FGD systems.
I	Glossary of FGD Systems/FGDIS-Related Definitions	Terms associated with utility FGD systems and the FGDIS.

Table 4. *Sludge Disposal Sites*

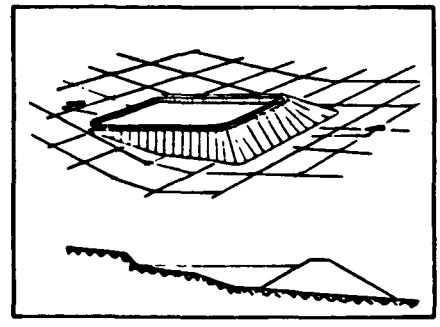
Generic	Specific	Common Designs
Pond	Diked	Above grade Below grade
	Incised Existing basin	Abandoned surface mine Abandoned quarry
	Side hill Cross valley	Impoundment dam
Landfill	Heaped fill Side-hill fill Valley fill Deep-mine fill	
Stacking	Gypsum stack	Upstream method



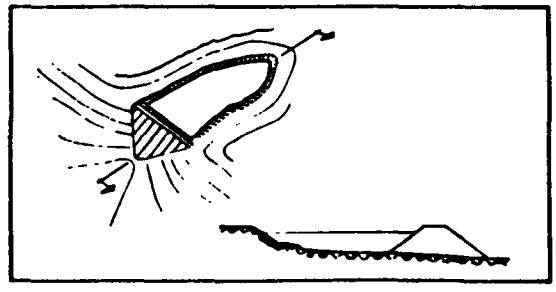
Diked



Incised



Side Hill



Cross Valley

Figure 2. *Examples of pond types included in FGDIS.*

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The complete report, entitled "Flue Gas Desulfurization Information System (FGDIS) Data Base User's Manual," (Order No. PB 86-104 122/AS; Cost: $22.95, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
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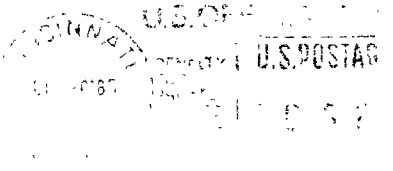
Information
Cincinnati OH 45268



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