



Project Summary

EPA Utility FGD Survey July—September 1981

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The report, generated by a computerized data base system, presents a survey of operational and planned domestic utility flue gas desulfurization (FGD) systems. It summarizes information contributed by the utility industry, system and equipment suppliers, system designers, research organizations, and regulatory agencies. It presents data on system design, fuel characteristics, operating history, and actual performance. Unit by unit dependability parameters are included and problems and solutions associated with the boilers, scrubbers, and FGD systems are discussed.

The FGD systems are tabulated alphabetically by development status (operational, under construction, or in the planning stages), utility company, system supplier, process, waste disposal practice, and regulatory class. FGD system economic data, definitions, and a glossary of terms are appended to the report. Current data for domestic FGD systems show 92 systems in operation, 42 systems under construction, and 88 planned systems. Projected 1999 FGD controlled capacity in the U.S. is 107,197 MW.

This Project Summary was developed by EPA's Industrial Environmental 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

The quarterly FGD survey report is generated by a computerized data system known as the Flue Gas Desulfuriza-

tion Information System (FGDIS). A structure diagram of the FGDIS is illustrated in Figure 1, which presents 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 the operational FGD systems include monthly dependability parameters, along with service time and problem/solution descriptions.

In addition to generating the survey report, the FGDIS is available for remote terminal access. Because the report is available only through purchase from NTIS, 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 quarterly report. Information concerning access to the FGDIS can be obtained from Walter Finch, NTIS, 5285 Port Royal Road, Springfield, VA 22161; (703) 487-4808. Custom searches of the FGDIS data can also be arranged.

Executive Summary

Table 1 summarizes the status of FGD systems in the U.S. at the end of September 1981. Table 2 lists the units that have changed status during the third quarter 1981, and Table 3 shows the performance of operating units during this period. The units included in the figures presented in Table 1 are identified in Table 4, and categorical FGD system cost data are presented in Table 5.

Table 1. Number and Total Capacity of FGD Systems

Status	No. of units	Total controlled capacity, MW*	Equivalent scrubbed capacity, MW†
Operational	92	34,937	31,738
Under construction	42	18,226	17,457
Planned:			
Contract awarded	16	9,385	9,169
Letter of intent	11	8,293	8,235
Requesting/evaluating bids	10	5,630	5,630
Considering only FGD systems	51	30,726	30,398
TOTAL	222	107,197	102,627

* The summation of the gross unit capacities (MW) brought into compliance with FGD systems regardless of the percent of the flue gas scrubbed by the FGD system(s).

† The summation of the effective scrubbed flue gas in equivalent MW based on the percent of the flue gas scrubbed by the FGD system(s).

Table 2. Summary of Changes July-September 1981

FGD status report	Operational		Under construction		Contract awarded		Letter of intent		Requesting/eval. bids		Considering FGD		Total	
	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a
July 31, 1981	88	30,158	40	15,887	21	11,599 ^b	11	8,235	19	10,340	48	28,618 ^b	227	104,83
Arizona Public Service														
Four Corners 4			+1	755	-1	755								
Four Corners 5			+1	755	-1	755								
Basin Electric Power														
Antelope Valley 2			+1	440	-1	440								
Laramie River 2	+1	570	-1	570										
Central Illinois Light														
Duck Creek 2									-1	450	+1	450		
East Kentucky Power														
J.K. Smith 2							-1	650					-1	650
Kentucky Utilities														
Hancock 1							+1	650	-1	650				
Hancock 2									-1	650	+1	650		
Nevada Power														
Warner Valley 1									-1	295			-1	295
Warner Valley 2									-1	295			-1	295
Northern States Power														
Wisconsin Coal 1											-1	670	-1	670
Pacific Power & Light														
Jim Bridger 1									-1	550	+1	550		
Jim Bridger 2									-1	550	+1	550		
Jim Bridger 3									-1	550	+1	550		
Plains Electric G & T														
Plains Escalante 1			+1	233	-1	233								
San Miguel Electric														
San Miguel 1	+1	400	-1	400										
Seminole Electric														
Seminole 1			+1	620	-1	620								
South Carolina Public Service														
Winyah 4	+1	280	-1	280										

ble 2. (continued)

	Operational		Under construction		Contract awarded		Letter of intent		Requesting/eval. bids		Considering FGD		Total	
	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a	No.	MW ^a
D status report July 31, 1981	88	30,158	40	15,887	21	11,599 ^b	11	8,235	19	10,340	48	28,618 ^b	227	104,837 ^b
thern Illinois Power Marion 5											-1	300	-1	300
nflower Electric Holcomb 1			+1	347	-1	347								
ah Power & Light Vaughton 3	+1	330	-1	330										
st Texas Utilities Oklaunion 1					+1	720			-1	720				
Total	92	31,738	42	17,457	16	9,169	11	8,235	10	5,630	51	30,398	222	102,627

Equivalent scrubbed capacity.

This value was modified slightly due to a MW correction.

ble 3. Performance of Operational Units July-September 1981

Plant	FGD system capacity, MW ^a	Flue gas % scrubbed	FGD capacity on line during period MW ^{a,b}	No information for this period, MW ^a	Shut down throughout period, MW ^a	July 1981 Dependability % ^{c,e}				August 1981 Dependability % ^{c,e}				September 1981 Dependability % ^{c,e}					
						AVL	OPR	REL	UTL	AVL	OPR	REL	UTL	AVL	OPR	REL	UTL		
Alabama Electric Tombigbee 2	179	70		179															
Tombigbee 3	179	70		179															
Arizona Electric Power Apache 2	98	50	98			100	91	100	91	100	40	100	36	100	99	100	99		
Apache 3	98	50	98			100	69	100	69	100	100	100	100	62	63	62	62		
Arizona Public Service Cholla 1	119	100		119															
Cholla 2	264	100		264															
Cholla 4	126	33		126															
Four Corners 1	175	100		175															
Four Corners 2	175	100		175															
Four Corners 3	229	100		229															
asin Electric Power Coop Laramie River 1	570	100	570			100	95	100	95	97	96	100	92	100	94	100	25		
Laramie River 2	570	100	570							96	69	100	68	100	82	100	67		
Big Rivers Electric Green 1	242	100	242			98	96	96	96	95	93	93	85	85	96	96	80		
Green 2	242	100	242			94	89	89	77	97	94	94	86	100	99	99	98		
Central Illinois Light Duck Creek 1	416	100	416			72	63	75	54	75	74	76	74						
Central Illinois Public Service Newton 1	617	100	617			89	70	99	68	100	82	100	82	100	81	100	69		
Cincinnati Gas & Electric East Bend 2	650	100	650																
Colorado Ute Electric Association Craig 1	410	90			410	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Craig 2	410	90	410			0	0	0	0	33	34	34	33	51	52	53	50		
Columbus & Southern Ohio Electric Conesville 5	411	100	411			100	100	100	55	99	53	92	41	94	54	91	6		
Conesville 6	411	100	411			99	100	100	74	99	90	93	74	95	86	96	36		
Commonwealth Edison Powerton 51	450	100			450					0			0						

Table 3. (continued)

Plant	FGD system capacity, MW ^a	Flue gas % scrubbed	FGD capacity on line during period MW ^{a,b}	No information for this period, MW ^a	Shut down throughout period, MW ^a	July 1981 Dependability % ^{c,e}				August 1981 Dependability % ^{c,e}				September 1981 Dependability % ^{c,e}			
						AVL	OPR	REL	UTL	AVL	OPR	REL	UTL	AVL	OPR	REL	UTL
Cooperative Power Association																	
Coal Creek 1	327	60	327			37	37			45	36						
Coal Creek 2	327	60	327			42	37			44	34		60	60			
Delmarva Power & Light																	
Delaware City 1	60	100	60			99	99	99	99	77	77	77	47	95			
Delaware City 2	60	100	60			77	77	77	77	99	98	98	98	99			
Delaware City 3	60	100	60			99	99	99	99	100	100	100	100	90			
Duquesne Light																	
Eirama 1-4	510	100	510			99	95	99	95	98	81	98	81				
Phillips 1-6	408	100	408			74	72	73	72	75	64	70	58				
Indianapolis Power & Light																	
Petersburg 3	532	100		532													
Kansas City Power & Light																	
Hawthorn 3	90	100	90			100	100		52	100	100		10	100			
Hawthorn 4	90	100	90			96	100		49	100	100		18	100			
La Cygne 1	820	100	820			97	80	95	54					3			
Kansas Power & Light																	
Jeffrey 1	540	75	540														
Jeffrey 2	490	70	490														
Lawrence 4	125	100	125														
Lawrence 5	420	100	420														
Kentucky Utilities																	
Green River 1-3	64	100			64	100			0	100			0	100			
Louisville Gas & Electric																	
Cane Run 4	188	100	188			73	100	100	73	40	66	66	40	61			
Cane Run 5	200	100	200			46	100	100	46	50	100	100	50	75			
Cane Run 6	299	100	299			57	100	100	57	68	73	73	68	29			
Mill Creek 1	358	100	358			76	75	75	72	99	99	99	99	86			
Mill Creek 3	427	100	427			63	74	74	63	89	92	92	88	81			
Paddy's Run 6	72	100			72	100			0	100			0	100			
Minnesota Power & Light																	
Clay Boswell 4	475	85	475			100	86	100	75	100	80	100	73	100			
Minnkota Power & Light																	
Milton R. Young 2	185	42	185			29	32	33	29	58	49	50	44	100			
Monongahela Power																	
Pleasants 1	618	100		618													
Pleasants 2	618	100		618													
Montana Power																	
Colstrip 1	360	100		360													
Colstrip 2	360	100		360													
Montana-Dakota Utilities																	
Coyote 1	440	100	440														
Nevada Power																	
Reid Gardner 1	125	100	125			100	99	100	95	99	99	99	93	96			
Reid Gardner 2	125	100	125			99	97	99	78	98	98	98	96	100			
Reid Gardner 3	125	100	125			97	96	97	93	98	98	98	98	100			
Northern Indiana Public Service																	
Dean H. Mitchell 11	115	99			115	100	0		0	100	0		0	100			
Northern States Power																	
Riverside 6, 7	110	N/A ^d		110													
Sherburne 1	740	91	740														
Sherburne 2	740	91	740														
Pacific Power & Light																	
Jim Bridger 4	550	100		550													
Pennsylvania Power																	
Bruce Mansfield 1	917	100	917							97							
Bruce Mansfield 2	917	100	917							97							
Bruce Mansfield 3	917	100	917							99							

Table 3. (continued)

Plant	FGD system capacity, MW ^a	Flue gas % scrubbed	FGD capacity on line during period MW ^{a, b}	No information for this period, MW ^a	Shut down throughout period, MW ^a	July 1981 Dependability % ^{c, e}				August 1981 Dependability % ^{c, e}				September 1981 Dependability % ^{c, e}			
						AVL	OPR	REL	UTL	AVL	OPR	REL	UTL	AVL	OPR	REL	UTL
<i>Public Service Co. of New Mexico</i>																	
San Juan 1	361	100	361			100	97	100	96	100	100	100	100	100	75	90	32
San Juan 2	350	100	350			93	80	86	80	100	54	100	43	69	19	19	19
San Juan 3	534	100	534			98	96	97	96	86	86	86	86	97	32	32	31
<i>Salt River Project</i>																	
Coronado 1	280	80	280														
Coronado 2	280	80	280														
<i>San Miguel Electric</i>																	
San Miguel 1	400	100	400														
<i>Sikeston Board of Municipal Utilities</i>																	
Sikeston 1	235	100			235					0			0				0
<i>South Carolina Public Service Authority</i>																	
Winyah 2	140	50	140			89	93	96	44	98	98	98	98	96	98	96	88
Winyah 3	280	100	280			88	83	84	82	82	84	82	70	98	96	98	86
Winyah 4	280	100	280														
<i>South Mississippi Electric</i>																	
R.D. Morrow, Sr. 1	124	62	124			100	99	99	94	100	100	100	100	99	99	99	98
R.D. Morrow, Sr. 2	124	62	124			100	97	100	93	100	100	100	96	98	98	98	98
<i>Southern Illinois Power Coop</i>																	
Marion 4	173	100	173			74	74	94	74	52	47	60	47				
<i>Southern Indiana Gas and Electric</i>																	
A.B. Brown 1	265	100	265			91	84	87	84	92	89	89	89	98	97	90	90
<i>Springfield City Utilities</i>																	
Southwest 1	194	100	194			97	93	96	93	98	87	90	87	89	78	85	76
<i>Springfield Water, Light & Power</i>																	
Dallman 3	185	90	185			54	44	44	42	0	0	0	0				
<i>St. Joe Zinc</i>																	
G.F. Weaton 1	60	N/A ^d	60			0	0	0	0	0	0	0	0	5	5	5	5
<i>Tennessee Valley Authority</i>																	
Shawnee 10A	10	N/A ^d		10													
Shawnee 10B	10	N/A ^d		10													
Widows Creek 7	575	100	575														
Widows Creek 8	550	100			550					0			0				0
<i>Texas Power & Light</i>																	
Sandow 4	382	70	382														
<i>Texas Utilities</i>																	
Martin Lake 1	595	75	595														
Martin Lake 2	595	75	595														
Martin Lake 3	595	75	595														
Monticello 3	800	100	800														
<i>Utah Power & Light</i>																	
Hunter 1	360	90	360														
Hunter 2	360	90	360														
Huntington 1	366	85	366														
Naughton 3	330	100	330														
Total	31,738		25,228	4,614	1,896												

^a Equivalent scrubbed capacity.

^b This category includes the flue gas capacity being handled by the FGD system at least part of the time during the report period.

^c The percent figures listed are average values for all system scrubbing trains during the period.

^d Flue gas % scrubbed for prototype and demonstration units is not applicable unless the system is designed to bring a unit into compliance with SO₂ emission standard.

^e Availability, operability, reliability, and utilization as defined in Appendix C of this report.

Table 4. Summary of Operational and Planned Domestic FGD Systems

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Alabama Electric</i>					
<i>Tombigbee 2</i>	<i>255</i>	<i>1.15</i>	<i>Limestone</i>	<i>1</i>	<i>Peabody Process System</i>
<i>Tombigbee 3</i>	<i>255</i>	<i>1.15</i>	<i>Limestone</i>	<i>1</i>	<i>Peabody Process System</i>
<i>Arizona Electric Power</i>					
<i>Apache 2</i>	<i>195</i>	<i>0.50</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Apache 3</i>	<i>195</i>	<i>0.50</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Arizona Public Service</i>					
<i>Cholla 1</i>	<i>119</i>	<i>0.50</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Cholla 2</i>	<i>264</i>	<i>0.50</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Cholla 4</i>	<i>375</i>	<i>0.50</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Four Corners 1</i>	<i>175</i>	<i>0.75</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>GE Environmental Servic</i>
<i>Four Corners 2</i>	<i>175</i>	<i>0.75</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>GE Environmental Servic</i>
<i>Four Corners 3</i>	<i>229</i>	<i>0.75</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>GE Environmental Servic</i>
<i>Four Corners 4</i>	<i>755</i>	<i>0.75</i>	<i>Lime</i>	<i>2</i>	<i>United Engineers</i>
<i>Four Corners 5</i>	<i>755</i>	<i>0.75</i>	<i>Lime</i>	<i>2</i>	<i>United Engineers</i>
<i>Associated Electric</i>					
<i>Thomas Hill 3</i>	<i>730</i>	<i>4.80</i>	<i>Limestone</i>	<i>2</i>	<i>Pullman Kellogg</i>
<i>Atlantic City Electric</i>					
<i>Cumberland 1</i>	<i>330</i>	<i>3.25</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Basin Electric Power</i>					
<i>Antelope Valley 1</i>	<i>440</i>	<i>0.68</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>Antelope Valley 2</i>	<i>440</i>	<i>0.68</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>Laramie River 1</i>	<i>570</i>	<i>0.81</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Laramie River 2</i>	<i>570</i>	<i>0.81</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Laramie River 3</i>	<i>570</i>	<i>0.54</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Babcock & Wilcox</i>
<i>Big Rivers Electric</i>					
<i>D.B. Wilson 1</i>	<i>440</i>		<i>Limestone</i>	<i>2</i>	<i>Pullman Kellogg</i>
<i>D.B. Wilson 2</i>	<i>440</i>		<i>Limestone</i>	<i>3</i>	<i>Pullman Kellogg</i>
<i>Green 1</i>	<i>242</i>	<i>3.75</i>	<i>Lime</i>	<i>1</i>	<i>American Air Filter</i>
<i>Green 2</i>	<i>242</i>	<i>3.75</i>	<i>Lime</i>	<i>1</i>	<i>American Air Filter</i>
<i>Cajun Electric Power</i>					
<i>Chicot 1</i>	<i>562</i>	<i>1.70</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Chicot 2</i>	<i>562</i>	<i>1.70</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Chicot 3</i>	<i>562</i>	<i>1.70</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Chicot 4</i>	<i>562</i>	<i>1.70</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Oxbow 1</i>	<i>540</i>	<i>0.60</i>	<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Oxbow 2</i>	<i>540</i>	<i>0.60</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Central Illinois Light</i>					
<i>Duck Creek 1</i>	<i>416</i>	<i>3.66</i>	<i>Limestone</i>	<i>1</i>	<i>Environeering, Riley Stoker</i>
<i>Duck Creek 2</i>	<i>450</i>	<i>3.30</i>	<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Central Illinois Public Service</i>					
<i>Newton 1</i>	<i>617</i>	<i>2.25</i>	<i>Dual alkali</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Central Maine Power</i>					
<i>Sears Island 1</i>	<i>600</i>	<i>2.23</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Central Power & Light</i>					
<i>Coletto Creek 2</i>	<i>720</i>	<i>0.39</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>

(continued)

Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Cincinnati Gas & Electric</i>					
<i>East Bend 1</i>	<i>650</i>	<i>4.00</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>East Bend 2</i>	<i>650</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>Babcock & Wilcox</i>
<i>Colorado Ute Electric</i>					
<i>Craig 1</i>	<i>455</i>	<i>0.45</i>	<i>Limestone</i>	<i>1</i>	<i>Peabody Process Systems</i>
<i>Craig 2</i>	<i>455</i>	<i>0.45</i>	<i>Limestone</i>	<i>1</i>	<i>Peabody Process Systems</i>
<i>Craig 3</i>	<i>447</i>	<i>0.45</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Babcock & Wilcox</i>
<i>Columbus & Southern Ohio Electric</i>					
<i>Conesville 5</i>	<i>411</i>	<i>4.67</i>	<i>Lime</i>	<i>1</i>	<i>Air Correction Division, UOP</i>
<i>Conesville 6</i>	<i>411</i>	<i>4.67</i>	<i>Lime</i>	<i>1</i>	<i>Air Correction Division, UOP</i>
<i>Poston 5</i>	<i>425</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Poston 6</i>	<i>425</i>	<i>2.50</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Commonwealth Edison</i>					
<i>Powerton 51</i>	<i>450</i>	<i>3.53</i>	<i>Limestone</i>	<i>1</i>	<i>Air Correction Division, UOP</i>
<i>Cooperative Power Association</i>					
<i>Coal Creek 1</i>	<i>545</i>	<i>0.63</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Coal Creek 2</i>	<i>545</i>	<i>0.63</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Delmarva Power & Light</i>					
<i>Delaware City 1</i>	<i>60</i>	<i>7.00</i>	<i>Wellman Lord</i>	<i>1</i>	<i>Davy McKee</i>
<i>Delaware City 2</i>	<i>60</i>	<i>7.00</i>	<i>Wellman Lord</i>	<i>1</i>	<i>Davy McKee</i>
<i>Delaware City 3</i>	<i>60</i>	<i>7.00</i>	<i>Wellman Lord</i>	<i>1</i>	<i>Davy McKee</i>
<i>Vienna 9</i>	<i>550</i>	<i>2.50</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Deseret Generation & Transmission</i>					
<i>Bonanza 1</i>	<i>410</i>	<i>0.50</i>	<i>Limestone</i>	<i>2</i>	<i>Combustion Engineering</i>
<i>Bonanza 2</i>	<i>410</i>	<i>0.50</i>	<i>Limestone</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Duquesne Light</i>					
<i>Elrama 1-4</i>	<i>510</i>	<i>2.20</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Phillips 1-6</i>	<i>408</i>	<i>1.92</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>East Kentucky Power</i>					
<i>J.K. Smith 1</i>	<i>650</i>	<i>1.50</i>	<i>Lime</i>	<i>4</i>	<i>Babcock & Wilcox</i>
<i>Spurlock 2</i>	<i>500</i>	<i>3.50</i>	<i>Lime</i>	<i>2</i>	<i>Thyssen/CEA</i>
<i>Florida Power & Light</i>					
<i>Martin 3</i>	<i>800</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Martin 4</i>	<i>800</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>General Public Utilities</i>					
<i>Coal 1</i>	<i>625</i>	<i>3.50</i>	<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Coal 2</i>	<i>625</i>	<i>3.50</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Coal 3</i>	<i>625</i>	<i>3.50</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Coal 4</i>	<i>625</i>	<i>3.50</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Seward 7</i>	<i>690</i>		<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Grand Haven Board of Light & Power</i>					
<i>J.B. Sims 3</i>	<i>65</i>	<i>2.75</i>	<i>Lime</i>	<i>2</i>	<i>Babcock & Wilcox</i>

(continued)

Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Hoosier Energy</i>					
<i>Merom 1</i>	490	3.50	<i>Limestone</i>	2	<i>Mitsubishi Heavy Industrie</i>
<i>Merom 2</i>	490	3.50	<i>Limestone</i>	2	<i>Mitsubishi Heavy Industrie</i>
<i>Houston Lighting & Power</i>					
<i>Limestone 1</i>	750	1.08	<i>Limestone</i>	3	<i>Combustion Engineering</i>
<i>Limestone 2</i>	750	1.08	<i>Limestone</i>	3	<i>Combustion Engineering</i>
<i>W.A. Parish 8</i>	600	0.6	<i>Limestone</i>	2	<i>GE Environmental Service</i>
<i>Indianapolis Power & Light</i>					
<i>Patriot 1</i>	650	3.50	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>Patriot 2</i>	650	3.50	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>Patriot 3</i>	650	3.50	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>Petersburg 3</i>	532	3.25	<i>Limestone</i>	1	<i>Air Correction Division, UO</i>
<i>Petersburg 4</i>	530	3.50	<i>Limestone</i>	2	<i>Research Cottrell</i>
<i>Iowa Electric Light & Power</i>					
<i>Guthrie Co. 1</i>	720	0.40	<i>Limestone</i>	4	<i>Combustion Engineering</i>
<i>Jacksonville Electric Authority</i>					
<i>St. Johns River Power 1</i>	600	2.50	<i>Limestone</i>	5	<i>Vendor not selected</i>
<i>St. Johns River Power 2</i>	600	2.50	<i>Limestone</i>	5	<i>Vendor not selected</i>
<i>Kansas City Power & Light</i>					
<i>Hawthorn 3</i>	90	0.60	<i>Lime</i>	1	<i>Combustion Engineering</i>
<i>Hawthorn 4</i>	90	0.60	<i>Lime</i>	1	<i>Combustion Engineering</i>
<i>La Cygne 1</i>	820	5.39	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>Kansas Power & Light</i>					
<i>Jeffrey 1</i>	720	0.32	<i>Limestone</i>	1	<i>Combustion Engineering</i>
<i>Jeffrey 2</i>	700	0.30	<i>Limestone</i>	1	<i>Combustion Engineering</i>
<i>Lawrence 4</i>	125	0.55	<i>Limestone</i>	1	<i>Combustion Engineering</i>
<i>Lawrence 5</i>	420	0.55	<i>Limestone</i>	1	<i>Combustion Engineering</i>
<i>Kentucky Utilities</i>					
<i>Green River 1-3</i>	64	4.00	<i>Lime</i>	1	<i>American Air Filter</i>
<i>Hancock 1</i>	708	3.50	<i>Limestone</i>	4	<i>Babcock & Wilcox</i>
<i>Hancock 2</i>	708	3.50	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>Lakeland Utilities</i>					
<i>McIntosh 3</i>	364	2.56	<i>Limestone</i>	2	<i>Babcock & Wilcox</i>
<i>Lansing Board of Water and Light</i>					
<i>Erickson 2</i>	160		<i>Process not selected</i>	6	<i>Vendor not selected</i>
<i>Los Angeles Department of Water & Power</i>					
<i>Intermountain 1</i>	820	0.79	<i>Lime</i>	6	<i>Vendor not selected</i>
<i>Intermountain 2</i>	820	0.79	<i>Lime</i>	6	<i>Vendor not selected</i>
<i>Intermountain 3</i>	820	0.79	<i>Lime</i>	6	<i>Vendor not selected</i>
<i>Intermountain 4</i>	820	0.79	<i>Lime</i>	6	<i>Vendor not selected</i>

(continued)

Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Louisville Gas & Electric</i>					
<i>Cane Run 4</i>	<i>188</i>	<i>3.75</i>	<i>Lime</i>	<i>1</i>	<i>American Air Filter</i>
<i>Cane Run 5</i>	<i>200</i>	<i>3.75</i>	<i>Lime</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Cane Run 6</i>	<i>299</i>	<i>4.80</i>	<i>Dual alkali</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Mill Creek 1</i>	<i>358</i>	<i>3.75</i>	<i>Limestone</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Mill Creek 2</i>	<i>350</i>	<i>3.75</i>	<i>Lime</i>	<i>2</i>	<i>Combustion Engineering</i>
<i>Mill Creek 3</i>	<i>427</i>	<i>3.75</i>	<i>Lime</i>	<i>1</i>	<i>American Air Filter</i>
<i>Mill Creek 4</i>	<i>495</i>	<i>3.75</i>	<i>Lime</i>	<i>2</i>	<i>American Air Filter</i>
<i>Paddy's Run 6</i>	<i>72</i>	<i>2.50</i>	<i>Lime</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Trimble County 1</i>	<i>575</i>	<i>4.00</i>	<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Trimble County 2</i>	<i>575</i>	<i>4.00</i>	<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Lower Colorado River Authority</i>					
<i>Fayette Power Project 3</i>	<i>435</i>	<i>1.70</i>	<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Marquette Board of Light and Power</i>					
<i>Shiras 3</i>	<i>44</i>		<i>Lime/spray drying</i>	<i>2</i>	<i>GE Environmental Services</i>
<i>Michigan South Central Power Agency</i>					
<i>Project 1</i>	<i>55</i>	<i>2.25</i>	<i>Limestone</i>	<i>2</i>	<i>Babcock & Wilcox</i>
<i>Middle South Utilities</i>					
<i>Arkansas Lignite 5</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Arkansas Lignite 6</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Unassigned 1</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Unassigned 2</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Wilton 1</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Wilton 2</i>	<i>890</i>	<i>0.50</i>	<i>Limestone</i>	<i>4</i>	<i>Combustion Engineering</i>
<i>Minnesota Power & Light</i>					
<i>Clay Boswell 4</i>	<i>554</i>	<i>0.94</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Peabody Process Systems</i>
<i>Minnesota Power</i>					
<i>Milton R. Young 2</i>	<i>440</i>	<i>0.70</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Monongahela Power</i>					
<i>Pleasants 1</i>	<i>618</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>Babcock & Wilcox</i>
<i>Pleasants 2</i>	<i>618</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>Babcock & Wilcox</i>
<i>Montana Power</i>					
<i>Colstrip 1</i>	<i>360</i>	<i>0.77</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Colstrip 2</i>	<i>360</i>	<i>0.77</i>	<i>Lime/alkaline flyash</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Colstrip 3</i>	<i>700</i>	<i>0.77</i>	<i>Lime/alkaline flyash</i>	<i>2</i>	<i>Thyssen/CEA</i>
<i>Colstrip 4</i>	<i>700</i>	<i>0.77</i>	<i>Lime/alkaline flyash</i>	<i>2</i>	<i>Thyssen/CEA</i>
<i>Montana-Dakota Utilities</i>					
<i>Coyote 1</i>	<i>440</i>	<i>0.87</i>	<i>Sodium carbonate/spray drying</i>	<i>1</i>	<i>Wheelabrator-Fry/R.I.</i>
<i>Muscatine Power & Water</i>					
<i>Muscatine 9</i>	<i>166</i>	<i>3.21</i>	<i>Limestone</i>	<i>2</i>	<i>Research-Cottrell</i>

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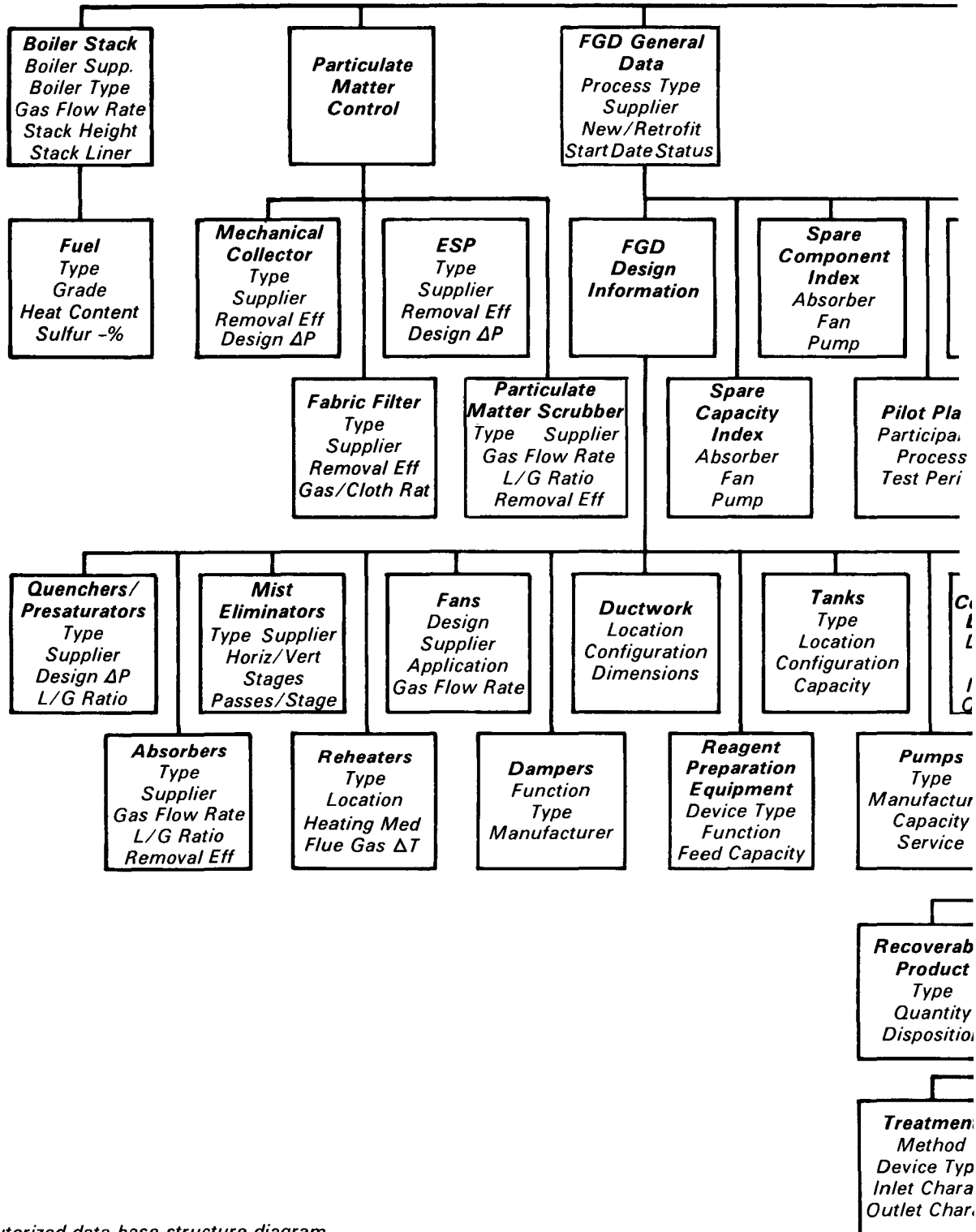


Figure 1. Computerized data base structure diagram.

Unit Performance
 Date
 Boiler Hours
 Boiler Avail
 Capacity Factor

Removal Performance
 SO₂ REM -%
 Part REM -%

Literal Information
 Comments/
 Abstract

FGD System Performance
 Service Hrs
 Avail -%
 Oper -%
 Rel -%
 Util -%

Problems Solutions
 Comments

Process Control and Instrumentation
 Proc Stream
 Parameters
 -Chemical
 -Physical

Chemicals
 Function
 Name
 Consumption

Problem/Solution
 Description

Problem Area

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 Additions
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Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Nebraska Public Power District Fossil III 1</i>	<i>650</i>	<i>0.36</i>	<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Nevada Power</i>					
<i>Harry Allen 1</i>	<i>500</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Harry Allen 2</i>	<i>500</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Harry Allen 3</i>	<i>500</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Harry Allen 4</i>	<i>500</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Reid Gardner 1</i>	<i>125</i>	<i>0.50</i>	<i>Sodium carbonate</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Reid Gardner 2</i>	<i>125</i>	<i>0.50</i>	<i>Sodium carbonate</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Reid Gardner 3</i>	<i>125</i>	<i>0.50</i>	<i>Sodium carbonate</i>	<i>1</i>	<i>Thyssen/CEA</i>
<i>Reid Gardner 4</i>	<i>250</i>	<i>0.75</i>	<i>Sodium carbonate</i>	<i>4</i>	<i>Thyssen/CEA</i>
<i>New York State Electric & Gas Somerset 1</i>	<i>625</i>	<i>2.20</i>	<i>Limestone</i>	<i>4</i>	<i>Peabody Process System</i>
<i>Niagara Mohawk Power</i>					
<i>Charles R. Huntley 66</i>	<i>100</i>	<i>1.80</i>	<i>Aqueous carbonate/spray drying</i>	<i>2</i>	<i>Rockwell International</i>
<i>Northern Indiana Public Service</i>					
<i>Dean H. Mitchell 11</i>	<i>116</i>	<i>3.50</i>	<i>Wellman Lord</i>	<i>1</i>	<i>Davy McKee</i>
<i>Schahfer 17</i>	<i>421</i>	<i>3.20</i>	<i>Dual alkali</i>	<i>2</i>	<i>FMC</i>
<i>Schahfer 18</i>	<i>421</i>	<i>3.20</i>	<i>Dual alkali</i>	<i>3</i>	<i>FMC</i>
<i>Northern States Power</i>					
<i>Metro Coal 1</i>	<i>200</i>	<i>1.00</i>	<i>Lime</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Riverside 6-7</i>	<i>110</i>	<i>1.20</i>	<i>Lime/spray drying</i>	<i>1</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>Sherburne 1</i>	<i>740</i>	<i>0.80</i>	<i>Limestone/alkaline flyash</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Sherburne 2</i>	<i>740</i>	<i>0.80</i>	<i>Limestone/alkaline flyash</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Sherburne 3</i>	<i>860</i>	<i>1.00</i>	<i>Lime</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Pacific Gas & Electric</i>					
<i>Montezuma 1</i>	<i>800</i>	<i>0.80</i>	<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Montezuma 2</i>	<i>800</i>	<i>0.80</i>	<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Pacific Power & Light</i>					
<i>Jim Bridger 1</i>	<i>550</i>	<i>0.56</i>	<i>Sodium carbonate</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Jim Bridger 2</i>	<i>550</i>	<i>0.56</i>	<i>Sodium carbonate</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Jim Bridger 2A</i>	<i>550</i>	<i>0.56</i>	<i>Lime/sodium carbonate</i>	<i>2</i>	<i>Flakt</i>
<i>Jim Bridger 3</i>	<i>550</i>	<i>0.56</i>	<i>Sodium carbonate</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Jim Bridger 4</i>	<i>550</i>	<i>0.56</i>	<i>Sodium carbonate</i>	<i>1</i>	<i>Air Correction Division, UO</i>
<i>Pennsylvania Power</i>					
<i>Bruce Mansfield 1</i>	<i>917</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Bruce Mansfield 2</i>	<i>917</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Bruce Mansfield 3</i>	<i>917</i>	<i>3.00</i>	<i>Lime</i>	<i>1</i>	<i>Pullman Kellogg</i>
<i>Philadelphia Electric</i>					
<i>Cromby 1</i>	<i>150</i>	<i>3.00</i>	<i>Magnesium oxide</i>	<i>2</i>	<i>United Engineers</i>
<i>Eddystone 1</i>	<i>240</i>	<i>2.60</i>	<i>Magnesium oxide</i>	<i>2</i>	<i>United Engineers</i>
<i>Eddystone 2</i>	<i>334</i>	<i>2.50</i>	<i>Magnesium oxide</i>	<i>2</i>	<i>United Engineers</i>
<i>Plains Electric G&T</i>					
<i>Plains Escalante 1</i>	<i>233</i>	<i>0.80</i>	<i>Limestone</i>	<i>2</i>	<i>Combustion Engineering</i>
<i>Platte River Power Authority</i>					
<i>Rawhide 1</i>	<i>279</i>	<i>0.25</i>	<i>Lime/spray drying</i>	<i>3</i>	<i>Joy Mfg/Niro Atomizer</i>

(continued)

Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Public Service Indiana Gibson 5</i>	650	3.30	<i>Limestone</i>	2	<i>Pullman Kellogg</i>
<i>Public Service of New Mexico</i>					
<i>San Juan 1</i>	361	0.80	<i>Wellman Lord</i>	1	<i>Davy McKee</i>
<i>San Juan 2</i>	350	0.80	<i>Wellman Lord</i>	1	<i>Davy McKee</i>
<i>San Juan 3</i>	534	0.80	<i>Wellman Lord</i>	1	<i>Davy McKee</i>
<i>San Juan 4</i>	534	0.80	<i>Wellman Lord</i>	2	<i>Davy McKee</i>
<i>Power Authority of State of New York Fossil</i>	700	3.00	<i>Process not selected</i>	6	<i>Vendor not selected</i>
<i>Salt River Project</i>					
<i>Coronado 1</i>	350	0.50	<i>Limestone</i>	1	<i>Pullman Kellogg</i>
<i>Coronado 2</i>	350	0.50	<i>Limestone</i>	1	<i>Pullman Kellogg</i>
<i>Coronado 3</i>	400	0.60	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>San Miguel Electric San Miguel 1</i>	400	1.70	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>Seminole Electric</i>					
<i>Seminole 1</i>	620	2.75	<i>Limestone</i>	2	<i>Peabody Process Systems</i>
<i>Seminole 2</i>	620	2.75	<i>Limestone</i>	3	<i>Peabody Process Systems</i>
<i>Sikeston Board of Municipal Utilities Sikeston 1</i>	235	2.80	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>South Carolina Public Service</i>					
<i>Cross 1</i>	500	1.80	<i>Limestone</i>	3	<i>Peabody Process Systems</i>
<i>Cross 2</i>	500	1.80	<i>Limestone</i>	2	<i>Peabody Process Systems</i>
<i>Winyah 2</i>	280	1.10	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>Winyah 3</i>	280	1.10	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>Winyah 4</i>	280	1.70	<i>Limestone</i>	1	<i>American Air Filter</i>
<i>South Mississippi Electric Power</i>					
<i>R.D. Morrow, Sr. 1</i>	200	1.30	<i>Limestone</i>	1	<i>Envroneering, Riley Stoker</i>
<i>R.D. Morrow, Sr. 2</i>	200	1.30	<i>Limestone</i>	1	<i>Envroneering, Riley Stoker</i>
<i>Southern Illinois Power</i>					
<i>Marion 4</i>	173	3.75	<i>Limestone</i>	1	<i>Babcock & Wilcox</i>
<i>Southern Indiana Gas & Electric</i>					
<i>A.B. Brown 1</i>	265	3.35	<i>Dual alkali</i>	1	<i>FMC</i>
<i>A.B. Brown 2</i>	265	3.35	<i>Process not selected</i>	5	<i>Vendor not selected</i>
<i>Southwestern Electric Power</i>					
<i>Dolet Hills 1</i>	720	0.70	<i>Limestone</i>	3	<i>Air Correction Division, UOP</i>
<i>Dolet Hills 2</i>	720	0.70	<i>Limestone</i>	6	<i>Vendor not selected</i>
<i>Henry W. Pirkey 1</i>	720	0.80	<i>Limestone</i>	3	<i>Air Correction Division, UOP</i>
<i>Soyland Power Soyland 1</i>	500	3.00	<i>Process not selected</i>	6	<i>Vendor not selected</i>
<i>Springfield City Utilities</i>					
<i>Southwest 1</i>	194	3.50	<i>Limestone</i>	1	<i>Air Correction Division, UOP</i>

(continued)

Table 4. (continued)

<i>Company name/ unit name</i>	<i>Capacity MW (gross)</i>	<i>Fuel % sulfur</i>	<i>FGD process</i>	<i>FGD status</i>	<i>System supplier</i>
<i>Springfield Water, Light & Power Dallman 3</i>	<i>205</i>	<i>3.30</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>St. Joe Zinc G.F. Weaton 1</i>	<i>60</i>	<i>2.00</i>	<i>Citrate</i>	<i>1</i>	<i>Morrison & Knudsen/U.S.B.</i>
<i>Sunflower Electric Holcomb 1</i>	<i>347</i>	<i>0.47</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>Tampa Electric Big Bend 4</i>	<i>475</i>	<i>2.35</i>	<i>Lime/limestone</i>	<i>3</i>	<i>Research-Cottrell</i>
<i>Tennessee Valley Authority</i>					
<i>Paradise 1</i>	<i>704</i>	<i>4.20</i>	<i>Limestone</i>	<i>2</i>	<i>GE Environmental Services</i>
<i>Paradise 2</i>	<i>704</i>	<i>4.20</i>	<i>Limestone</i>	<i>2</i>	<i>GE Environmental Services</i>
<i>Shawnee 10A</i>	<i>10</i>	<i>2.90</i>	<i>Lime/limestone</i>	<i>1</i>	<i>Air Correction Division, UO</i>
<i>Shawnee 10b</i>	<i>10</i>	<i>2.90</i>	<i>Lime/limestone</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Widows Creek 7</i>	<i>575</i>	<i>3.70</i>	<i>Limestone</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Widows Creek 8</i>	<i>550</i>	<i>3.70</i>	<i>Limestone</i>	<i>1</i>	<i>Tennessee Valley Authority</i>
<i>Texas Municipal Power Agency</i>					
<i>Gibbons Creek 1</i>	<i>443</i>	<i>1.06</i>	<i>Limestone</i>	<i>2</i>	<i>Combustion Engineering</i>
<i>Texas Power & Light</i>					
<i>Sandow 4</i>	<i>545</i>	<i>1.60</i>	<i>Limestone</i>	<i>1</i>	<i>Combustion Engineering</i>
<i>Twin Oaks 1</i>	<i>750</i>	<i>0.70</i>	<i>Limestone</i>	<i>3</i>	<i>GE Environmental Service</i>
<i>Twin Oaks 2</i>	<i>750</i>	<i>0.70</i>	<i>Limestone</i>	<i>3</i>	<i>GE Environmental Services</i>
<i>Texas Utilities</i>					
<i>Forst Grove 1</i>	<i>750</i>	<i>0.80</i>	<i>Process not selected</i>	<i>5</i>	<i>Vendor not selected</i>
<i>Martin Lake 1</i>	<i>793</i>	<i>0.90</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Martin Lake 2</i>	<i>793</i>	<i>0.90</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Martin Lake 3</i>	<i>793</i>	<i>0.90</i>	<i>Limestone</i>	<i>1</i>	<i>Research-Cottrell</i>
<i>Martin Lake 4</i>	<i>793</i>	<i>0.90</i>	<i>Limestone</i>	<i>3</i>	<i>Research-Cottrell</i>
<i>Mill Creek 1</i>	<i>750</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Mill Creek 2</i>	<i>750</i>		<i>Process not selected</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Monticello 3</i>	<i>800</i>	<i>1.50</i>	<i>Limestone</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Tucson Electric Power</i>					
<i>Springerville 1</i>	<i>370</i>	<i>0.61</i>	<i>Lime/spray drying</i>	<i>3</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>Springerville 2</i>	<i>370</i>	<i>0.61</i>	<i>Lime/spray drying</i>	<i>3</i>	<i>Joy Mfg/Niro Atomizer</i>
<i>United Power Association</i>					
<i>Stanton 1A</i>	<i>60</i>	<i>0.77</i>	<i>Lime/spray drying</i>	<i>2</i>	<i>Research-Cottrell</i>
<i>Utah Power & Light</i>					
<i>Hunter 1</i>	<i>400</i>	<i>0.55</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Hunter 2</i>	<i>400</i>	<i>0.55</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Hunter 3</i>	<i>400</i>	<i>0.55</i>	<i>Limestone</i>	<i>2</i>	<i>GE Environmental Services</i>
<i>Hunter 4</i>	<i>400</i>	<i>0.55</i>	<i>Limestone</i>	<i>2</i>	<i>GE Environmental Services</i>
<i>Huntington 1</i>	<i>430</i>	<i>0.55</i>	<i>Lime</i>	<i>1</i>	<i>GE Environmental Services</i>
<i>Naughton 3</i>	<i>330</i>	<i>0.55</i>	<i>Sodium carbonate</i>	<i>1</i>	<i>Air Correction Division, UO</i>
<i>Washington Water Power</i>					
<i>Creston Coal 1</i>	<i>570</i>		<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Creston Coal 2</i>	<i>570</i>		<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Creston Coal 3</i>	<i>570</i>		<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>
<i>Creston Coal 4</i>	<i>570</i>		<i>Limestone</i>	<i>6</i>	<i>Vendor not selected</i>

(continued)

Table 4. (continued)

Company name/ unit name	Capacity MW (gross)	Fuel % sulfur	FGD process	FGD status	System supplier
West Penn Power Mitchell 33	300	2.80	Lime	2	GE Environmental Services
West Texas Utilities Oklaunion 1	720	0.34	Process not selected	3	GE Environmental Services
Oklaunion 2	720	0.34	Process not selected	6	Vendor not selected

- 1 Operational units.
- 2 Units under construction.
- 3 Planned - contract awarded.
- 4 Planned - letter of intent signed.
- 5 Planned - requesting/evaluating bids.
- 6 Planned - considering only FGD systems.

Table 5. Categorical Results of the Reported and Adjusted Capital and Annual Costs for Operational FGD Systems

	Reported						Adjusted					
	Capital			Annual			Capital			Annual		
	Range, \$/kW	Average, \$/kW	σ	Range, mills/kWh	Average, mills/kWh	σ	Range, \$/kW	Average, \$/kW	σ	Range, mills/kWh	Average, mills/kWh	σ
All	23.7-243.0	79.1	45.4	0.05-13.02	2.64	3.14	35.1-258.9	113.5	54.6	1.69-18.67	7.27	3.82
New	23.7-243.0	77.5	47.2	0.05-5.52	1.84	1.84	35.1-242.1	103.8	43.3	1.69-12.83	6.31	2.68
Retrofit	29.4-157.4	83.2	41.4	0.46-13.02	4.54	4.64	57.5-258.9	132.3	69.4	4.23-18.67	9.12	4.99
Saleable	132.8-185.0	153.0	23.8	13.02-13.02	13.02	0.0	233.6-258.9	249.1	13.6	15.23-18.67	16.44	1.94
Throwaway	23.7-243.0	73.7	41.8	0.05-11.32	2.35	2.65	35.1-242.1	104.2	42.5	1.69-16.27	6.64	3.03
Alkaline flyash/lime	100.3-101.4	101.0	0.6	0.53-2.97	2.16	1.41	133.8-142.9	136.8	5.2	5.75-7.62	6.99	1.08
Alkaline flyash/ limestone	49.3-49.3	49.3	0.0	0.75-0.75	0.75	0.0	94.4-94.4	94.4	0.0	4.99-4.99	4.99	0.0
Dual alkali	47.2-174.8	97.8	67.7	1.30-1.30	1.30	0.0	80.6-242.1	134.6	93.1	4.59-12.83	7.79	4.41
Lime	29.4-243.0	80.1	50.6	0.92-11.32	3.65	3.02	57.5-192.7	105.1	39.1	3.70-16.27	7.79	3.63
Limestone	23.7-168.0	65.0	34.9	0.05-7.76	1.78	2.54	35.1-148.7	93.4	42.5	1.69-10.44	5.61	2.65
Sodium carbonate	42.9-100.8	69.2	30.7	0.23-0.46	0.38	0.13	79.9-138.5	101.7	28.0	5.29-6.78	5.88	0.73
Wellman Lord	132.8-185.0	153.1	23.8	13.02-13.02	13.02	0.0	233.6-258.9	249.1	13.6	15.23-18.67	16.44	1.94

Current projections indicate that the total power generating capacity of the U.S. electric utility industry will be approximately 831 GW by the end of 1999.¹ (This value reflects the annual loss resulting from the retirement of older units, which is considered to be 0.4% of the average generating capacity at the end of each year.²) Approximately 373 GW or 45% of the 1999 total will come from coal-fired units. The distribution of power generation sources, both present (December 1980) and future (December 1999) is shown in Table 6.¹

In light of the revised New Source Performance Standards, actual FGD control is expected to be greater than that reflected by the figures above. For example, about 50 to 60 systems representing approximately 29,000 to 31,000 MW of generating capacity presently fall into

the uncommitted category. These are systems that cannot be included in the committed group at this time because information regarding their status is not ready for public release.

In an effort to show general FGD usage trends, Table 8 gives current (September 1981) and projected (December 1999) breakdowns of throwaway product systems versus saleable product systems as a percent of the total known commitments to FGD as of the end of the third quarter 1981.

Highlights: July-September 1981

The following paragraphs highlight FGD system developments during the third quarter 1981.

Arizona Electric Power reported that the Apache 2 FGD system achieved

100% availability for July, August, and September. The Apache 3 FGD system achieved 100% availability during July and August but dropped to 62% availability during September as a result of damper problems.

Arizona Public Service announced that construction began during the period on the lime FGD systems that are being retrofitted to control SO₂ emissions from Four Corners 4 and 5. Both units are rated at 755 MW (gross) and burn coal with an average sulfur content of 0.75%. The FGD systems are being supplied by United engineers and are slated for initial start-up in December 1984.

Basin Electric Power announced that construction of the lime/spray drying FGD system being installed on Antelope Valley 2 began during the third quarter.

Table 6. Power Generation Sources: Present and Future

	Coal	Nuclear	Oil	Hydro	Gas	Other	GW (total)
December 1980	41%	10%	24%	12%	12%	1%	616
December 1999	45%	15%	19%	11%	9%	1%	831

Based on the known commitments to FGD by utilities as presented in Table 1, the percentage of electrical generating capacity controlled by FGD for both the present (September 1981) and the future (December 1999) is shown in Table 7.

Table 7. FGD Controlled Generating Capacity: Present and Future

	Coal-fired generating capacity controlled by FGD, %	Total generating capacity controlled by FGD, %
September 1981*	13.8	5.7
December 1999	28.7	12.9

*The number of committed FGD systems is as of September 1981; however, the figure used for the total generating capacity and coal-fired generating capacity is based on the available December 1980 figures.

Table 8. Summary of FGD Systems by Process

	Percent of total MW	
	September 1981	December 1999
Throwaway product process		
•Wet systems		
Lime	36.8	20.6
Limestone	48.7	36.9
Dual alkali	3.7	2.0
Sodium carbonate	4.0	3.1
NA ^a	—	5.2
•Dry systems		
Lime	0.3	3.4
Lime/sodium carbonate	—	0.1
Sodium carbonate	1.4	0.4
Saleable product process		
•Process		•Byproduct
Aqueous carbonate/ spray drying		Elemental sulfur
		—
Citrate		Elemental sulfur
		0.2
Lime		Gypsum
		—
Limestone		Gypsum
		—
Lime/limestone		Gypsum
		—
Magnesium oxide		Sulfuric acid
		—
Wellman Lord		Sulfuric acid
		2.3
Wellman Lord		Elemental sulfur
		2.6
Process undecided		—
		24.6
Total	100.0	100.0

^a NA - Not available (these systems are committed to a throwaway product process; however, the actual process is unknown at this time).

This new unit will be rated at 440 M (gross) and will fire coal with an average sulfur content of 0.68%. The FGD system is being supplied by Joy Manufacturing/Niro Atomizer and is scheduled for initial operation in October 1985.

The Laramie River 1 FGD system achieved availabilities of 100%, 97% and 100% during July, August, and September, respectively. Corrosion encountered in the modular quencher sections necessitated repairs during the period; however, overall system availability remained high as a result of spare module capacity.

Initial operations of the Laramie River 2 FGD system of Basin Electric Power began during July. Laramie River 2 is rated at 570 MW (gross) and fires coal with an average sulfur content of 0.81%. The limestone FGD system, which was supplied by Research-Cottrell, consists of five absorber modules and is preceded by an ESP for primary particulate matter removal. Availability of the FGD system during August and September exceeded 95%.

Big Rivers Electric reported that the Green 1 FGD system achieved availabilities of 98%, 95%, and 85% during July, August, and September, respectively. The availability dropped slightly in September due to the replacement of the chevron mist eliminators in both modules. The Green 2 FGD system achieved availabilities of 96%, 97%, and 100% for the same 3 months with only minor problems being encountered.

Plans for the installation of Unit 2 at the Duck Creek Generating Station have been delayed as a result of current load projections and economic conditions. As a result, the utility has temporarily suspended requesting/evaluating bids for an FGD system.

Columbus and Southern Ohio Electric reported availabilities of 100%, 99% and 94% for the Conesville 5 FGD system during July, August, and September, respectively. Conesville 6 achieved availabilities of 99%, 99%, and 95% during the same 3 months. Both units were removed from service on September 19 as a result of low power demand.

Deseret Generation and Transmission announced during the third quarter that Moon Lake 1 and 2 have been renamed. The units are now Bonanza 1 and 2.

East Kentucky Power announced the plans for the installation of J.K. Smith have been postponed indefinitely as a result of power demand not meeting utility projections. In addition, initial start-up

.K. Smith 1 has been pushed back to August 1987.

A letter of intent was signed during the period by Kentucky Utilities with Babcock and Wilcox for the installation of a nestone FGD system to control SO₂ emissions from the planned Hancock 1. This new unit is to be rated at 708 MW (gross) and will fire coal with an average sulfur content of 3.50%. The FGD system is scheduled to begin initial operations in April 1989.

Plans for the installation of Unit 2 at the Hancock Generating Station have been delayed and Kentucky Utilities has temporarily suspended requested/evaluating bids for the installation of an FGD system for SO₂ control. The unit, which is to be rated at 708 MW (gross), is currently scheduled for operation in 1994.

Nevada Power announced during the period that plans for Warner Valley 1 and have been postponed indefinitely. Due to projected SO₂ emissions and the planned station location with respect to Class I area in Utah, the utility has been unable to obtain a permit from the EPA. The units were to be rated at 295 MW (gross) and were slated for operation in June 1985 and June 1986, respectively.

Plans for the installation of Wisconsin Coal 1 by Northern States Power have been postponed indefinitely. The unit was to be rated at 670 MW (gross) and was slated for initial operations in 1981.

Pacific Power and Light has temporarily suspended requesting/evaluating bids for the installation of FGD systems at the planned Jim Bridger Units 1, 2, and 3 as a result of obtaining a modification in the compliance deadline for Unit 3. The units are to be rated at 550 MW (gross) each and are scheduled for operation in 1988, 1990, and 1986, respectively.

Construction began during the third quarter 1981 on the limestone FGD system being installed on Plains Escalante 1 of Plains Electric Generation and Transmission. This new unit will be rated at 233 MW (gross) and will fire coal with an average sulfur content of 0.80%. The FGD system, which is being supplied by Combustion Engineering, is slated for initial operation in December 1983.

Initial operations of the limestone FGD system installed on San Miguel 1 of San Miguel Electric began in August 1981 when one of the four absorber modules was placed in service. San Miguel 1 is rated at 400 MW (gross) and fires coal with an average sulfur content of 1.70%. The FGD system, which was supplied by

Babcock and Wilcox, is preceded by a cold-side ESP for primary particulate matter control. Initial reports indicate that boiler problems have limited operation of the FGD system.

Construction of the Seminole 1 limestone FGD system of Seminole Electric began during the period. The 620 MW (gross) new unit will fire coal with an average sulfur content of 2.75%. The FGD system is being supplied by Peabody Process Systems and will be preceded by ESPs for primary particulate matter removal. Initial operation is scheduled for March 1983.

Initial operations of the American Air Filter limestone FGD system installed on Winyah 4 began in July when one module was placed in service. Winyah 4 is rated at 280 MW (gross) and fires coal with an average sulfur content of 1.70%. A fire in the second module 2 months prior to projected start-up has kept that module off line. Integrated operation of both modules is expected to begin in January or February 1982.

South Mississippi Electric Power reported availabilities of 100%, 100%, and 99% for the R.D. Morrow 1 FGD system during July, August, and September, respectively. The R.D. Morrow 2 FGD system achieved availabilities of 100%, 100%, and 98% during the same 3 months. No major FGD related problems were encountered during the third quarter.

Southern Illinois Power has announced that plans for the installation of Marion 5 have been postponed indefinitely as a result of current load projections, economic conditions, and environmental concerns. The unit was to have been rated at 300 MW (gross) and was slated for operation in 1988.

The A.B. Brown 1 FGD system of Southern Indiana Gas and Electric achieved availabilities of 91%, 92%, and 98% during July, August, and September, respectively. Some pump liner problems were noted during the 3 months.

Construction of the lime/spray drying FGD system being installed on Holcomb 1 of Sunflower Electric began during the third quarter. Holcomb 1 is to be rated at 347 MW (gross) and will fire coal with an average sulfur content of 0.47%. The FGD system, which is being supplied by Joy Manufacturing/Niro Atomizer, is scheduled to begin initial operations in September 1983.

Initial operations of the sodium carbonate FGD system retrofitted on Naughton 3 of Utah Power and Light

began in early September. Naughton 3 is rated at 330 MW (gross) and fires coal with an average sulfur content of 0.55%. The FGD system was supplied by the Air Correction Division, UOP and is preceded by an ESP for primary particulate matter control. The FGD system is currently in the start-up phase of operations and is not required to be in full service until the end of the year.

West Texas Utilities announced that a contract has been awarded to General Electric Environmental Services for the installation of a limestone FGD system to control SO₂ emissions from Oklaunion 1. This new unit will be rated at 720 MW (gross) and will fire coal with an average sulfur content of 0.34%. FGD system start-up is scheduled for December 1986.

References

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2. Berman, Ira M. *New Generating Capacity: When, Where, and by Whom*. Power Engineering 85(4)72. April 1981.

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The complete report, entitled "EPA Utility FGD Survey, July-September 1981," (Order No. PB 82-231 150; Cost: \$27.00, subject to change) will be available only from:

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