What's Everyone Using?
Part 75 CEMS Equipment Trends - 2009 Update

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Introduction

The vast majority of fossil-fired utility generating units and many industrial sources within the US have installed and certified continuous emission monitoring systems (CEMS) in accordance with EPA's 40 CFR Part 75 CEM Rule as required under the Acid Rain Program as well as the NO_X Budget Program and Clean Air Interstate Rule (CAIR). Under Part 75, sources are required to report emissions data on a quarterly basis and submit monitoring plan information that identifies the source, power generating units, the emissions being monitored, analyzer manufacturer, and the sample acquisition methods. The required format for the quarterly reports, which are also known as Electronic Data Reports (EDRs), recently changed. The monitoring plan information was previously included within the 500 group records of each quarterly report submitted to the EPA. Under the new XML reporting requirements, monitoring plan information is submitted separately only when changes are made.

This report presents data from the raw EDR files submitted to the EPA in late 2008, which was extracted and compiled using a custom application designed by RMB. It was hoped that this update could be prepared from new XML monitoring plan files that were reported as part of the recently required conversion, but EPA did not respond to our request for access to the files that were submitted for the first quarter 2009. Using the 2009Q1 data, however, would have presented problems since a substantial number of sources were unable to successfully submit their data without "critical errors" during this first mandatory reporting period. Nonetheless, the XML monitoring plans for the fraction of sources that submitted data in the new format during then 2008 transition year could have been used in this analysis, but the older EDR format data was used for all Part 75 sources for consistency and simplicity.

This report presents the Data Acquisition and Handling Systems (DAHS), analyzer types, sample acquisition methods, and CEMS manufacturers for all EDRs submitted in 2008. This analysis only considered those systems that were reported as "primary." The analysis did not include any analyzers identified as backup, redundant backup, or "like-kind" replacements since these backup monitors are often shared by several units and would make consistent accounting difficult. This report presents market share represented by the various manufacturers of the DAHS, SO_2, NO_x, CO_2, O_2, and opacity monitoring equipment.

Monitoring Data

The following tables and figures summarize the breakdown of the CEMS manufacturers as well as the sample acquisition methods of the monitors based on the 2008 EDR data. To help identify the recent trends, the tables also show a comparison of the current data to those found during a previous examination of the monitoring plan data for the fourth quarter of 2002. Note, the 2002 evaluation was compared to similar evaluation that which RMB originally presented at an earlier EPRI CEMS Conference.[1]

While the EDR database used is arguably the most accurate source of information for identifying CEMS equipment, the accuracy of the data presented in the following tables and figures is only as good as the data reported in the EDR files. The quality of the EDR data has improved significantly in recent years, however, some records are still improperly reported. While we

[1] Jernigan, J. Ron, *Compilation of Part 75 DAHS & CEM Sampling Equipment Serving the Utility Industry*, EPRI CEMS Users Group Meeting, New Orleans, Louisiana, May 1998.

believe that we were able to resolve many of the improperly reported records, it is possible there may also be missing, outdated, or false information in the database that was not, or could not be identified.

When identifiable, most providers are shown in the tables. Within the figures that illustrate current market share, all vendors with over a 1% share (3% for opacity) are presented.

DAHS Software

The DAHS information is presented in Table 1 and illustrated in Figure 1. The totals indicate the number of "DAHS monitoring systems," which roughly corresponds to the number of EDR files reported,[2] for each software provider. The total for Teledyne/Monitor Labs includes not only its RegPerfect and DASx software but also sources that reported using Odessa software. The totals for Cartwright, CISCO and CONTEC were grouped together since the Cartwright software serves as the EDR generation engine for both the CISCO and CONTEC database/data acquisition platforms.

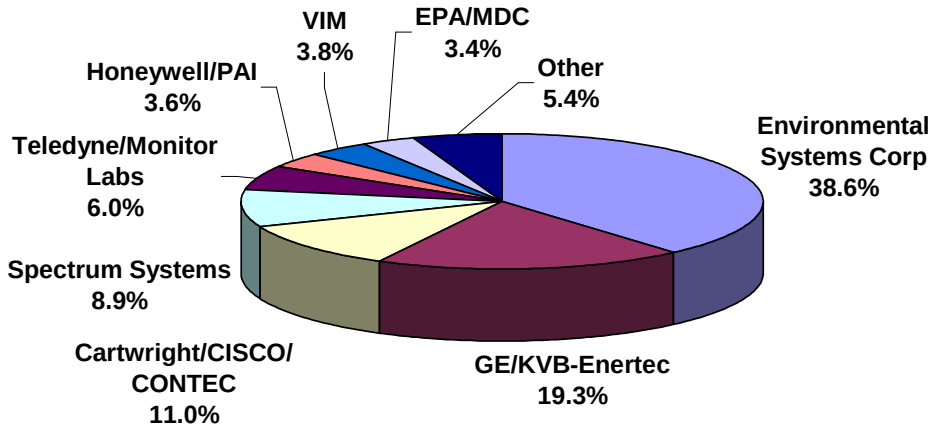

Figure 1. DAHS Software Provider Market Share (2008)

[2] The "DAHS monitoring system" approach identifies a DAHS component for every CEMS location at the plant. For example, a common stack would be identified as a single DAHS monitoring system unless NO_X was monitored on an individual unit basis. Then, in the example, one DAHS monitoring system would be identified for the common stack and additional DAHS monitoring systems for each additional unit where NO_X is monitored. Separate DAHS monitoring systems would also be identified for multiple stack units if CEMS components are identified for each stack.

Table 1. DAHS Software Providers

DAHS Software Providers	2002		2008	
	EDRs	% of Total	EDRs	% of Total
Environmental Systems Corp	1047	31.4	1701	38.6
Teledyne/Monitor Labs	465	14.0	263	6.0
GE/KVB-Enertec	716	21.5	850	19.3
Spectrum Systems	258	7.7	392	8.9
Cartwright/CISCO/CONTEC	286	8.6	487	11.0
Honeywell/PAI	176	5.3	157	3.6
VIM Technologies, Inc.	123	3.7	169	3.8
Alabama Power Company	44	1.3	54	1.2
EPA/MDC	35	1.1	152	3.4
Graseby/STI (TEI)	24	0.7	21	0.5
Foxboro	21	0.6	9	0.2
LA Dept. of Water & Power	16	0.5	17	0.4
Oil Systems Inc./Duke Power	16	0.5	0	0.0
Trace Environmental	16	0.5	54	1.2
JDL	14	0.4	15	0.3
Analytical Process Systems	13	0.4	0	0.0
SAIC/Ameren	12	0.4	0	0.0
ROVISIS	11	0.3	0	0.0
Eagle Mountain Scientific	5	0.2	0	0.0
Enviroplan, Inc.	4	0.1	0	0.0
EC Systems/ORR Safety	1	0.0	0	0.0
Other/Unknown	28	0.8	70	1.6
Grand Total	**3331**	**100.0**	**4411**	**100.0**

The table show that, while there have been a significant increase in the number of DAHS systems installed during the past five years, the top three DAHS supplier have continued to retain there relative positions and still represent about two-thirds of the market. The table does show the entry of some new providers and the exodus of several others such as Enviroplan, EC Systems/ORR Safety, Eagle Mountain Scientific, and SAIC. The data also suggests that some sources, such as Duke Power that may have initially developed there own DAHS software have since elected to turn to commercially available options.

SO_2 Analyzers

Unlike the NO_X analyzers, the number of SO_2 analyzers has dropped slightly during the past five years, reflecting the fact that nearly all the SO_2 analyzers are installed on coal-fired units, which have not seen the growth that combustion turbines have seen. Most of the SO_2 analyzers use pulsed- or continuous-fluorescence technology in dilution systems. Thermo Environmental and Teledyne/Monitor Labs have maintained about 85% of the market, with Thermo Environmental holding the bulk of the market.

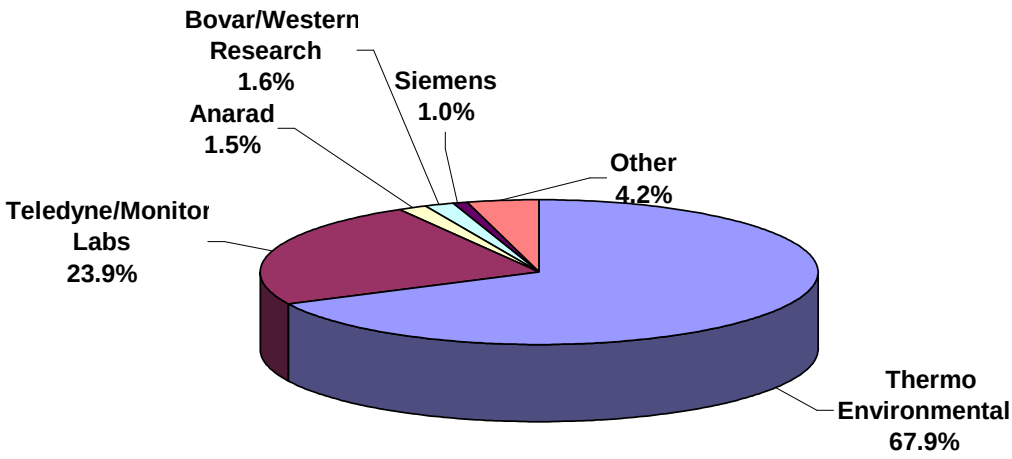

Figure 2a. SO_2 Analyzer Market Share (2008)

Table 2a. SO_2 Analyzer Manufacturers

SO_2 Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
Thermo Environmental	744	71.0	701	67.9
Teledyne/Monitor Labs/API	165	15.7	247	23.9
Anarad	37	3.5	15	1.5
Bovar/Western Research/Ametek	28	2.7	17	1.6
Siemens	19	1.8	10	1.0
Forney/Columbia Scientific	17	1.6	6	0.6
ABB Opsis	15	1.4	2	0.2
Environment SA	7	0.7	15	1.5
Horiba	6	0.6	5	0.5
Dasibi	4	0.4	0	0.0
Altech	3	0.3	3	0.3
Sick Maihak	2	0.2	5	0.5
Perkin Elmer MCS-100	1	0.1	1	0.1
Rosemount	0	0.0	0	0.0
Ecochem	0	0.0	6	0.6
Grand Total	**1048**	**100.0**	**1033**	**100.0**

Table 2b. SO_2 Analyzer Sample Acquisition Methods (2008)

Sample Acquisition Method	Analyzers	% of Total
Dilution	938	90.8
Dry Extractive	74	7.2
Wet Extractive	7	0.7
Point/Path InSitu	14	1.4
Grand Total	**1033**	**100.0**

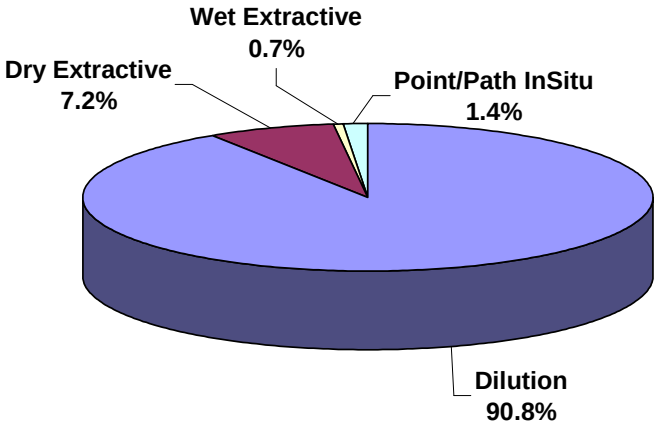

Figure 2b. SO_2 Analyzer Sample Acquisition Methods (2008)

NO_X Analyzers

The number of installed NO_X anlayzers under Part 75 has increased by about 800 analyzers in the past six years, reflecting new anlyzers on combustion turbines, NO_X Budget/CAIR units, and low-range anlyzers added to units with selective catalytic reduction controls, etc. Over 90% of the analyzers use chemiluminescence technology. Thermo Envrionmental retains the largest share of thew market but Teledyne/Monitor Labs and Rosemount have bettered their positions. The analyzers are split about evenly between dilution and dry extractive systems.

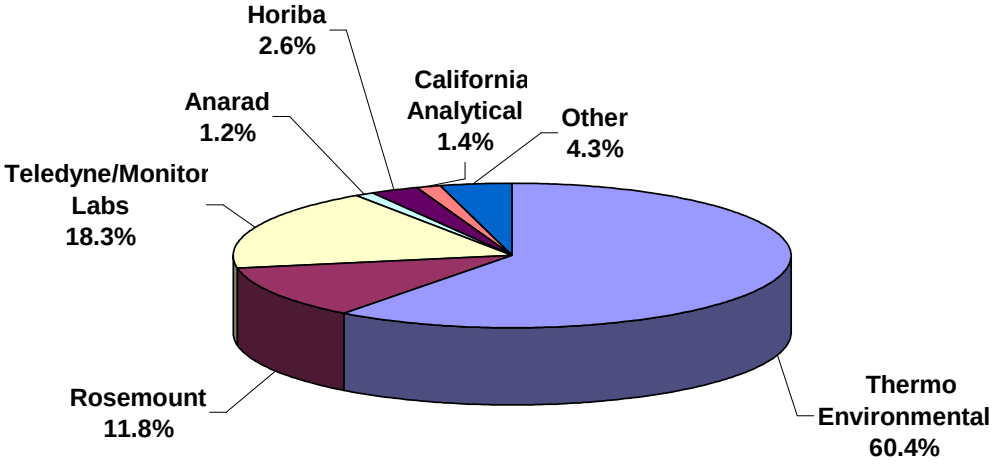

Figure 3a. NO_x Analyzer Manufacturers (2008)

Table 3a. NO_x Analyzer Manufacturers

NO_X Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
Thermo Environmental	1746	63.1	2149	60.4
Rosemount	285	10.3	419	11.8
Teledyne/Monitor Labs/API	349	12.6	652	18.3
Anarad	92	3.3	44	1.2
Horiba	88	3.2	93	2.6
Forney/Columbia Scientific	82	3.0	15	0.4
Perkin Elmer MCS-100	29	1.0	19	0.5
Bovar/Western Research/Ametek	20	0.7	5	0.1
ABB Opsis	16	0.6	15	0.4
Altech	11	0.4	10	0.3
Servomex	11	0.4	3	0.1
Siemens	8	0.3	10	0.3
ECOPhysics	8	0.3	18	0.5
Environment SA	7	0.3	16	0.4
Hartman & Braun	6	0.2	6	0.2
California Analytical Instruments	3	0.1	49	1.4
Dasibi	2	0.1	0	0.0
Sick Maihak	2	0.1	2	0.1
Ecochem	0	0.0	25	0.7
Brand Gaus	0	0.0	8	0.2
Emerson	0	0.0	1	0.0
Grand Total	**2765**	**100.0**	**3559**	**100.0**

Table 3b. NO_x Analyzer Sample Acquisition Methods (2008)

Sample Acquisition Method	Analyzers	% of Total
Dilution	1561	43.9
Dry Extractive	1939	54.5
Wet Extractive	29	0.8
Point/Path InSitu	30	0.8
Grand Total	3559	100.0

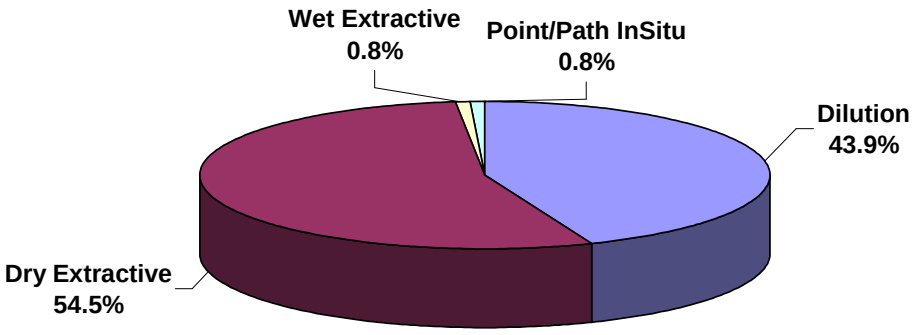

Figure 3b. NO_x Analyzer Sample Acquisition Methods (2008)

CO_2 Analyzers

California Analytical, Thermo Environmental, Siemens, and Teledyne/Monitor Labs provide over 95% of the Part 75 CO_2 analyzers. Nearly all the CO_2 analyzers use non-dispersive infrared technology with over 90% in dilution system applications.

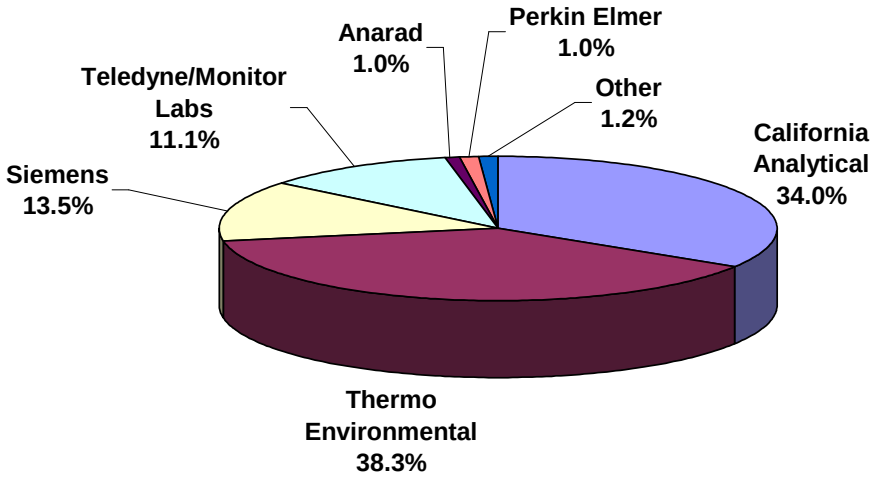

Figure 4a. CO_2 Analyzer Manufacturers (2008)

Table 4a. CO_2 Analyzer Manufacturers

CO_2 Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
California Analytical	623	42.1	557	34.0%
Thermo Environmental	488	33.0	627	38.2%
Siemens	162	10.9	221	13.5%
Teledyne/Monitor Labs	100	6.8	181	11.0%
Anarad	36	2.4	16	1.0%
Perkin Elmer	19	1.3	16	1.0%
Bovar/Western Research/Ametek	17	1.1	3	0.2%
ABB Opsis	14	0.9	0	0.0%
Environment SA	9	0.6	0	0.0%
Horiba	5	0.3	8	0.5%
Altech	3	0.2	3	0.2%
ECOCHEM	0	0.1	2	0.1%
Sick Maihak	2	0.1	6	0.4%
Enviromax	1	0.1	0	0.0%
Grand Total	**1481**	**100.0**	**1640**	**100.0**

Table 4b. CO_2 Analyzers Sample Acquisition Methods (2008)

Sample Acquisition Method	Analyzers	% of Total
Dilution	1524	92.9
Dry Extractive	94	5.7
Wet Extractive	15	0.9
Point/Path InSitu	7	0.4
Grand Total	**1640**	**100.0**

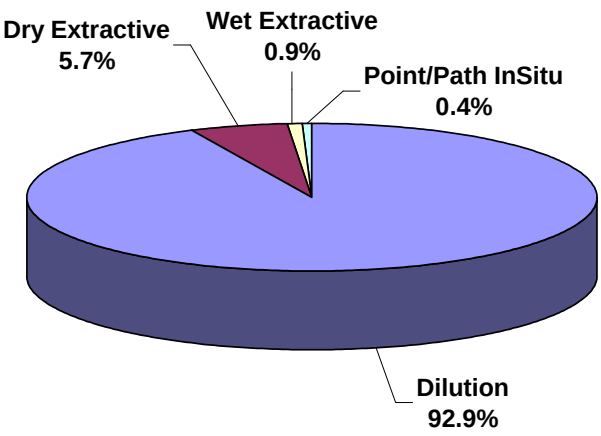

Figure 4b. CO_2 Analyzer Sample Acquisition Methods (2008)

O_2 Analyzers

The number of O_2 analyzers used under Part 75 has increased slightly in the past six years. The largest provider of O_2 analyzers is now Servomex, representing about 40% of the market. Nearly all the analyzers use paramagnetic technology and are used in dry extractive systems although there are some insitu analyzers and a number of wet extractive analyzers used in a differential O_2 configuration to determine stack moisture.

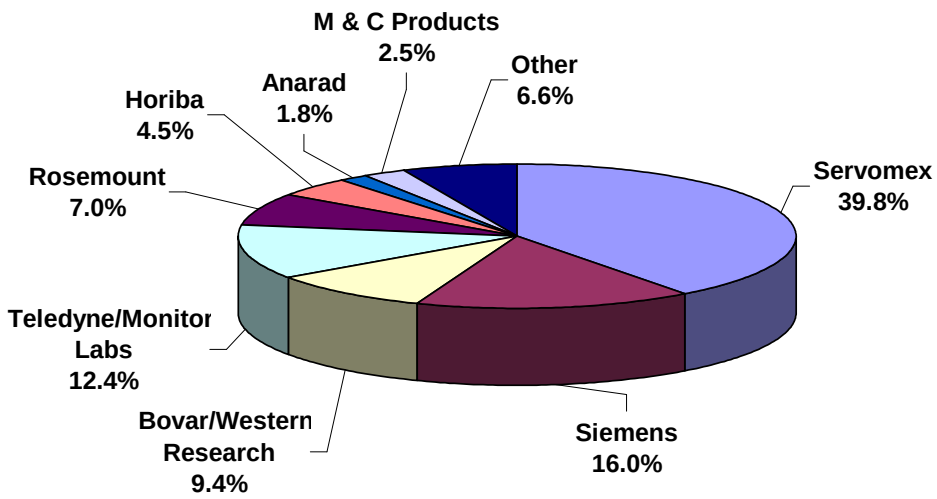

Figure 5a. O_2 Analyzer Manufacturers (2008)

Table 5a. O_2 Analyzer Manufacturers

O_2 Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
Servomex	530	39.8	765	39.8
Siemens	187	14.0	308	16.0
Bovar/Western Research/Ametek	149	11.2	181	9.4
Teledyne/Monitor Labs/API	124	9.3	238	12.4
Rosemount	92	6.9	134	7.0
Horiba	82	6.2	86	4.5
Anarad	75	5.6	35	1.8
M & C Products	32	2.4	49	2.5
Forney/Columbia Scientific	12	0.9	8	0.4
Graseby/STI (TEI)	11	0.8	6	0.3
Johnson Yokogawa	11	0.8	8	0.4
Buhler	6	0.5	16	0.8
Hartman & Braun	6	0.5	5	0.3
California Analytical Instruments	4	0.3	14	0.7
Westinghouse/Hagen	2	0.2	2	0.1
Novatech	2	0.2	2	0.1
ABB Kent	2	0.2	10	0.5
Land	1	0.1	3	0.2
Brand Gaus	2	0.2	11	0.6
Ecochem	0	0.0	18	0.9
CEMTEK	0	0.0	5	0.3
SICK	0	0.0	4	0.2
Other	3	0.2	7	0.4
Grand Total	**1333**	**100.0**	**1922**	**100.0**

Table 5b. O_2 Analyzer Sample Acquisition Methods (2008)

Sample Acquisition Method	Analyzers	% of Total
Dry Extractive	1840	95.7
Wet Extractive	43	2.2
Point/Path InSitu	35	1.8
Unknown	4	0.2
Grand Total	1922	100.0

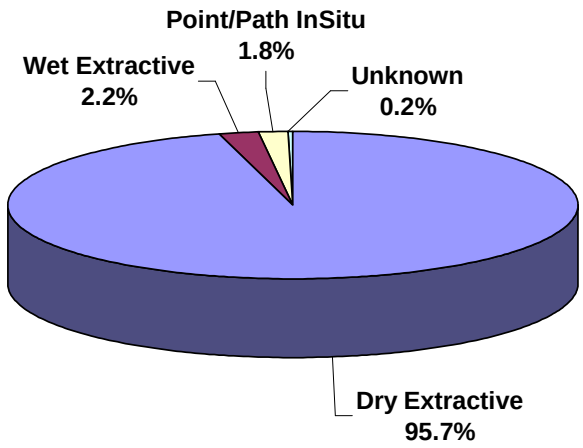

Figure 5b. O_2 Analyzer Sample Acquisition Methods (2008)

Flow Monitors

About two-thirds of the volumetric flow monitors are ultrasonic flowmeters, with differential pressure making up the bulk of the rest of the flow monitors. The largest provider of flowmeters is Teledyne/United Sciences, and EMRC is the priciple provider of differential pressure type flow monitors.

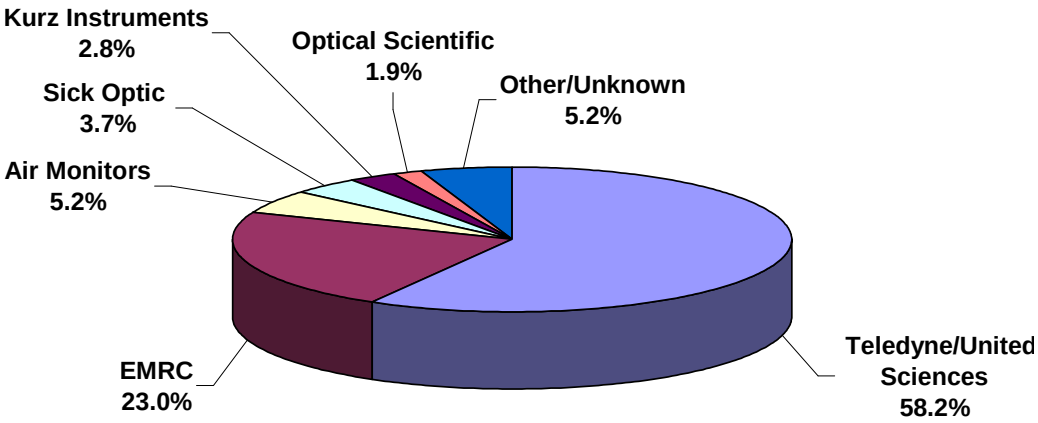

Figure 6a. Flow Monitor Manufacturers (2008)

Table 6a. Flow Rate Monitor Manufacturers

Flow Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
Teledyne/United Sciences	688	57.8	751	58.2
EMRC	270	22.7	297	23.0
Air Monitors	56	4.7	68	5.3
Sick Optic	51	4.3	48	3.7
Kurz Instruments	35	2.9	36	2.8
Optical Scientific	24	2.0	24	1.9
Dieteric Standard	23	1.9	20	1.6
Thermo Environmental	12	1.0	9	0.7
Panametrics	11	0.9	11	0.9
Scientific Engineering Inc.	4	0.3	1	0.1
Sierra Instruments	0	0.0	3	0.2
Flow Components International	0	0.0	2	0.2
Other/Unknown	16	1.3	20	1.6
Grand Total	**1190**	**100.0**	**1290**	**100.0**

Table 6b. Flow Monitoring Equipment Types (2008)

Sample Acquisition Method	Analyzer	% of Total
Ultrasonic	813	63.0
Differential Pressure	414	32.1
Thermal	41	3.2
Other	22	1.7
Grand Total	1290	100

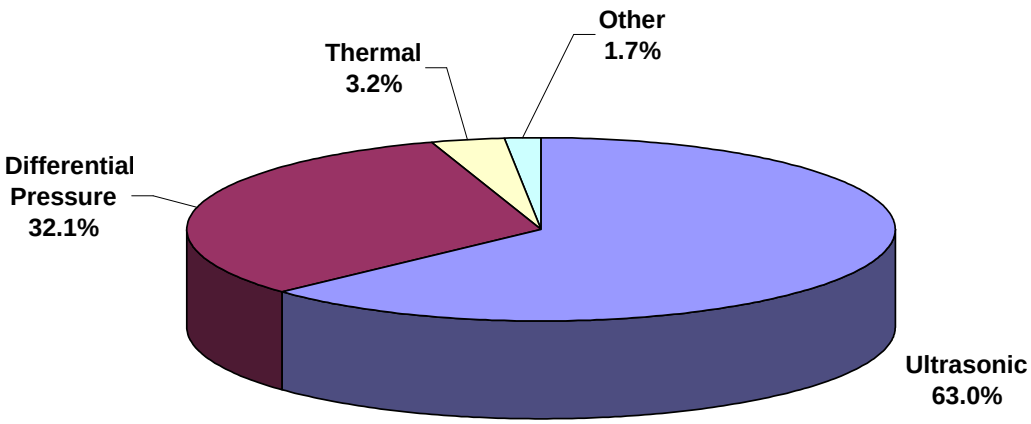

Figure 6b. Flow Monitoring Equipment Types (2008)

Opacity Analyzers

Some of the opacity monitors represented in the EDR database predate the Acid Rain Program. Reflecting the age of the equipment, a significant amount of opacity analyzer replacement has occurred in recent years. Although it has lost a portion of the marketshare that it held in the 1990s (~75%), Teledyne/Monitor Labs still maintains the majority of the analyzers.

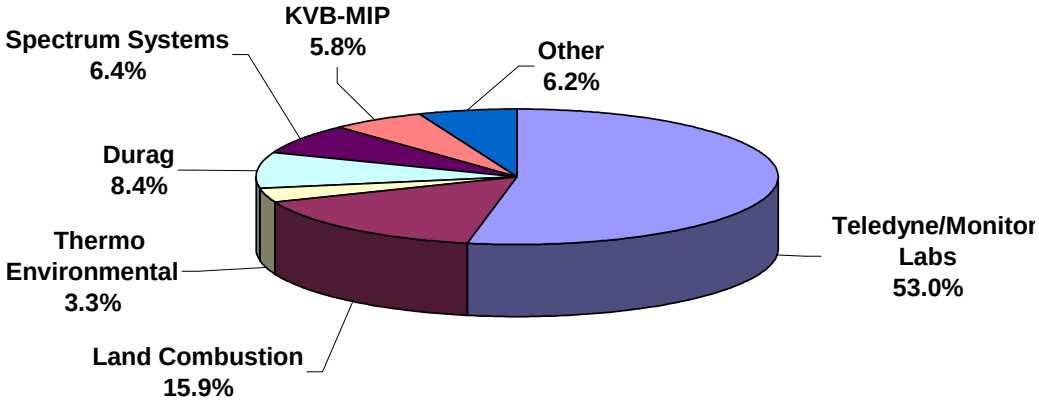

Figure 7b. Opacity Monitors Manufacturers (2008)

Table 7a. Opacity Monitor Manufacturers (2008)

Opacity Analyzer Manufacturers	2002		2008	
	Analyzers	% of Total	Analyzers	% of Total
Teledyne/Monitor Labs	685	57.3	666	53.0
Land Combustion	102	8.5	200	15.9
Thermo Environmental	96	8.0	42	3.3
Durag	82	6.9	106	8.4
Spectrum Systems, In.	76	6.4	91	7.2
Sick Optic	47	3.9	3	0.2
KVB-MIP	38	3.2	73	5.8
Phoenix Instruments, Inc.	23	1.9	27	2.1
Rosemount	22	1.8	4	0.3
Environmental Monitoring Services	20	1.7	28	2.2
RAI	4	0.3	0	0.0
CONTRAVES	0	0.0	3	0.2
DYNATRON	0	0.0	5	0.4
DUCON	0	0.0	5	0.4
Axiomtek	0	0.0	2	0.2
Unknown	0	0.0	1	0.1
Grand Total	**1195**	**100.0**	**1256**	**100.0**

Summary

The data generally show only moderate changes since 2002, with the manufacturers who had the "lion's share" of the market typically retaining that position. ESC and GE/KVB-Enertec together represent about 60% of the DAHS software market. Thermo Environmental has provided the majority of the SO_2 and NO_X analyzers used under Part 75 (about 70% and 60%, respectively). Most volumetric stack flow monitors installed under the Acid Rain Program have been ultrasonic flow meters with Teledyne/United Sciences providing the majority of this equipment. California Analytical and Thermo Environmental represent over 70% of the CO_2 analyzer market combined.

The number of O_2 analyzers installed in Part 75 service had dramatically increased, and significant changes in the market shares represented by each manufacturer were seen. Servomex has provided the most with about 40% of the market, followed by Siemens and Teledyne/Monitor Labs. The opacity monitor market is considerably more fractured than it was in the 1990s although Teledyne/Monitor Labs still represents the majority of installed systems.

While there do seem to be some technologies that are being "weeded out" of the market, it should be realized that downward trends market share may not necessarily convey poor analyzer performance, but may reflect marketing choices, analyzer/utility consolidations, or a variety of other factors. Also, again, while the EDR database used is arguably the most accurate source of information for identifying CEMS equipment, the accuracy of the data presented in the report is only as good as the data reported in the EDR files. While the quality of the EDR data has improved in recent years, it is possible there may be missing, outdated, or false information in the database that was not or could not be identified in our evaluation.