

RELATIONSHIPS BETWEEN INDUSTRIAL ENVIRONMENTAL LABORATORIES AND CONTRACT ENVIRONMENTAL LABORATORIES

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Environmental stewardship within a large industrial company has become a complex business employing a significant portion of the corporation's resources. A significant portion of these resources are spent on its environmental laboratories which may be consolidated into one central resource with many employees and considerable equipment or may be dispersed widely through the company in a number of small laboratories. Several large companies employ both kinds of laboratories with large central facilities acting as centers of expertise for outlying laboratories in other operating units and at manufacturing sites.

Companies that are large or small, those that centralize their facilities, and those that disperse them, all seem to contract for a portion of their environmental laboratory needs with environmental laboratories outside their own companies. Some large companies have even leased to sell off a part of their laboratory capacity while contracting for environmental laboratory services in another area.

The definition of what constitutes an environmental laboratory has been left a bit vague much as the environmental science is a bit vague, seeming to be related only by an interest in the environment and the need for a laboratory.

This paper reports the result of two surveys of environmental laboratories. First we will show how eight leading U.S. industrial firms handle their environmental laboratory needs and then we will show the results of a pricing survey of 24 U.S. contract laboratories. All data are less than 1 1/2 years old with some cost data taken from advertising.

Methods:

I. Survey of Corporate Environmental Laboratories

An informal telephone survey was made of seven major Chemical and Petroleum Companies to get general information about their environmental sections. We were interested in the organization of the section within the Company, the type of work (regulatory, analytical, environmental assessment), the size of the section, and whether the section is increasing or decreasing in size.

II. Survey of Contract Laboratory

The following report contains information about the costs and capabilities of 24 contract laboratories that are currently being used or have been used in the past by the Monsanto Environmental Sciences Center. The laboratories that were surveyed ranged in function from routine analytical environmental laboratories, to bioassay laboratories to sampling contractors. The size of each contractor in regards to the number of personnel, equipment, and size of facility varied. However, these contractors represent a good sampling of the hundreds of such vendors that are in business across the country.

Results and Discussion:

I. Survey of Corporate Environmental Laboratories

In general, all of the companies surveyed had strong environmental sections which are staying the same size or increasing because of the increase in the number of regulations and their complexity. Most of the sections are combined with the health and safety department. As a matter of

fact, one company has combined their environmental groups with the health and safety department within the year. Almost all of the companies have CORPORATE environmental sections, although many also had environmental groups in their operating divisions. Finally, the amount of environmental (analytical data and assessment studies) obtained in-house varies widely. Some do 90% in-house, others do 90% at contract labs. One company is asking a big push to do analytical work and assessment studies in-house because of incorrect data they have obtained from contract labs. The two companies which send the most analytical and assessment work outside are also the ones which have had some of the most serious environmental problems.

The results of this survey are shown in Table 1.

II. Survey of Contract Laboratory Charges

The environmental regulations that have been implemented since the 1970's have required that manufacturing companies have analyses performed in order to be in compliance with state and federal permits for wastewater discharges, for disposal of solid wastes, and for groundwater monitoring. Analytical methods have been developed and validated by laboratories of the Environmental Protection Agency (EPA) for the analyses of priority pollutants and other compounds for compliance with these regulations. An industry has grown-up to service companies such as the Monsanto Company by performing these analyses on water, soil and waster. The environmental regulations such as the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), the Superfund Amendments (CERCLA and SARA), which require the plants to report measurements to the EPA also specify which analytical methods are needed to be performed to report those measurements. Hundreds of these environmental laboratories provide the service of performing these methods, which are priced according to the method that is performed, along with considerations as to the matrix, the number of samples, etc.

A method that is frequently requested at these laboratories is the EPA Method 624, which is the analysis of volatile compounds in water using the purge and trap concentration technique. This method is also performed with a coupled gas chromatography and mass spectrometry technique. The EPA Method 624 is requested especially in the case of analysis of discharge water for compliance with NPDES (National Pollution Discharge Elimination System) permits. EPA Method 625, the analysis of semi-volatile compounds in water or soil matrix is the method requested in order to report the presence or absence of priority pollutants. This method involves a liquid/liquid extraction of the sample followed by analysis by GC/MS. Two other similar EPA methods, Methods 1624 and 1625, are alike 624 and 625 in analysis technique but further refines methods 624 and 625 by using the process of addition of a radio labelled analogue of each priority pollutant to the sample prior to the analysis. The isotope dilution technique allows for correction of matrix effects that may occur during the extraction, concentration, or analysis. The use of EPA Methods 1624 and 1625 for the reporting of priority pollutant data on plant outfalls is expected to increase in the future due to changes in regulations.

A description of EPA Methods that are listed in the survey are included in Appendix A. A glossary of acronyms is included in Appendix B.

The analytical laboratories that provide data on environmental measurements for compliance with such acts as RCRA, CWA, CERCLA and SARA are not required to function under the EPA TSCA/FIFRA GLP regulations. However, the bioassay laboratories that do tests such as acute and chronic toxicology, environmental fate, etc., are required to operate under GLP's for such studies.

The prices that were furnished by these vendors are current as of June, 1988. However, numerous contractors emphasized that pricing is most often negotiable, depending on the size of the sample batch, and the amount of business done with the customer. Thus, the prices shown in this report should be considered estimates only.

APPENDIX A

ANALYTICAL METHODS USED TO GENERATE ENVIRONMENTAL DATA

EPA Method 601 - Analysis of Purgeable Halocarbons using GC - Purge and Trap with Hall Detector

EPA Method 624 - Analysis of Purgeables using GC/MS - Purge and Trap

EPA Method 625 - Analysis of Base/Neutral Extractable Organics using GC/MS - Extraction

EPA Method 1624 - Analysis of Purgeables using GC/MS - Purge and Trap with Isotope Dilution

EPA Method 1625 - Analysis of Base/Neutral Extractable Organics using GC/MS - Extraction with Isotope Dilution

Priority Pollutant Pesticides and PCB's - GC-Extraction-ECD Detector (EPA method 608)

Analysis for 2,3,7,8-TCDD - GC/MS - Extraction

Analysis for Total Dioxins and Furans - GC/MS - Extraction

Appendix IV Compounds- A list of over 300 compounds which are regulated in relation to hazardous waste treatment, storage, and disposal. The methods of analyses for these compounds are numerous.

Acute Toxicity Test- A bioassay which measures the effect of a chemical on effluent to an organism during short term exposure, generally 48-96 hours exposure. Results of test are reported as the concentration which effects in kills of 50% of the test organisms (LC50).

Acute Daphnia Toxicity Test - A bioassay such as described above using the invertebrate Daphnia.

Acute Static Ceriodaphnia Toxicity Test (LC50) - A bioassay such as described above using the invertebrate Ceriodaphnia.

APPENDIX B

ACRONYMS

CLP - Contract Laboratory Program, A program established by the Office of Solid Waste and Emergency Response of the EPA. This program has quality assurance specifications and data reporting requirements. CLP contracts are offered to the laboratories on a bid basis on samples in which the EPA is the customer. The samples are related to a Superfund site. The laboratory must satisfy the requirements of the contract in order to be paid. The CLP contract is often misinterpreted to be a certification of the laboratory by the EPA, however, it is not, and in most cases, CLP contract samples are given preferential treatment over non-CLP samples.

CWA -Clean Water Act of 1977

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

ECD - Electron Capture Detector

FIFRA - *Federal Insecticide, Fungicide, and Rodenticide Act*

GC - Gas Chromatograph

GC/MS - Gas Chromatograph/Mass Spectrometer

GLP - Good Laboratory Practices regulations. Three GLP regulations exist. Food and Drug Administration Good Laboratory Practice regulations, Federal Register, 09/04/87, EPA FIFRA GLP regulations, Federal Register, 11/29/83, EPA TSCA GLP regulations, 11/29/83.

LC50 - The concentration at which 50% of the animal test population has been killed.

NPDES - National Pollution Discharge Elimination System, CWA 1977.

RCRA - Resource Conservation and Recovery Act, 1976.

SARA - Superfund Amendments and Reauthorization Act, 1986.

TSCA - Toxic Substances Control Act.

KEY

1. Price for relatively clean water sample, soil or sediment approximately 20-50% more. Large volumes of samples may be given a discount.
2. Ranges for labor, technician - Ph.D.
Ranges for equipment, low resolution GC/MS to high resolution MS but not research equipment which is not available.
3. Extra charge for more detailed package and for non-priority pollutant peaks (library search) mass spectral identification.
4. Confirmation by GC/MS, and extra \$100-\$150.
5. Mass spectral identification of non-priority pollutant compounds an additional \$85 for volatiles, an additional \$170 for BN/A, and CLP report package (required for EPA samples), and additional \$100 for volatiles and an additional \$250 for BN/A.
6. Analytical method development only in support of toxicology studies.
Minimum charge stated.
7. Field sampling only.
8. Library search, an additional \$100, CLP report package, an additional \$275.
9. Field sampling, \$45/hr.
10. Library search, an additional \$100.
11. CLP reporting package, \$60 extra for volatiles, \$50 extra for BN/A's.
12. CLP reporting package, \$120-\$130 extra.
13. PCB's in transformer oil, \$30, PCB's in water, soil, etc., \$95.

TABLE 1. CORPORATE ENVIRONMENTAL LABORATORIES

Company	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Section Name	Health and Environmental Safety	Health and Environmental Laboratories	Environmental Safety Department	Central Research Engineering Technology	Environmental Affairs Department	Environmental Services	Industrial Hygiene Toxicology Labs
Corporate Function	Yes and at Plants	Yes	Yes	Independent Group	Yes	Yes	Yes
Envir. with H and S	Yes	Yes	Yes	Yes	No	Yes	Yes
Includes Analytical	Yes	Yes	Yes	Small Effort	Small Effort	Yes	Yes
Includes Regulatory Assessment	Yes	Yes	No	Yes	Yes	No	No
Includes Environmental Assessment	Yes	Yes	No	No	Yes	Yes	No
% Data Obtained In House	90%	90%	20%	10%	10%	65%	65%
Status	Expect 10% Growth Rate Next 5 Years	Stable	Stable for 10 Years	Growing 5% Per Year	Stable - Will Not Increase	Stable - Slowly Growing	Stable - Slowly Growing
Size	300	211	40	85	12	4	90

1990

Table 2 (a)

Contract Laboratory Survey

(Prices in Dollars)

Environmental Analytical Method	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F
Volatiles: EPA Method 601 EPA Method 624 CLP EPA Method 1624		250.00	200.00	190.00 225.00 (1,5) 325.00	201.00 (1,3)	162.00 275.00
Semi-Volatiles: EPA Method 625 CLP EPA Method 1625		400.00	500.00	400.00 (1,5) 625.00	450.00 (1,3)	
PCBs: PP Pesticide/PCBs All Priority Pollutants			150.00	185.00 (1)	152.00 (1,3)	60.00 300.00
Dioxins 2,3,7,8-TCDD Total dioxins/furans Appendix IV				1200.00 (1)		
Appendix IV Compounds Volatiles Semi-Volatiles PCBs Total						
Acute Static Daphnia Toxicity Ceriodaphnia	1400.00					
Special Projects Labor Principal Scientist Senior Scientist Scientist Technician Secretary Expert Witness			(9) 75/hr 90/hr			
Equipment ICP GC/MS GC/HRMS GC/TOMS LC/MS						

Table 2 (b)

Contract Laboratory Survey

(Prices in Dollars)

Environmental Analytical Method	Lab G	Lab H	Lab I	Lab J	Lab K	Lab L
Volatiles: EPA Method 601 EPA Method 624 CLP EPA Method 1624	240.00 (4)	Organics by quote only	110.00 220.00	225.00 225.00 275.00 450.00	201.00 (1,11)	275.00 (1)
Semi-Volatiles: EPA Method 625 CLP EPA Method 1625	420.00 (4)		250.00 375.00	475.00 (1) 550.00 (1) 950.00 (1)	450.00 (1,11)	400.00 (1)
PCBs: PP Pesticide/PCBs	150.00		90.00 190.00	120.00 (1)	250.00 (1,11)	230.00 (1)
All Priority Pollutants	1195.00					830.00 (1)
Dioxins 2,3,7,8-TCDD Total dioxins/furans Appendix IV	580.00 1150.00		185.00 750.00	350.00 (1) 850.00 (1)		700.00
Appendix IV Compounds Volatiles Semi-Volatiles PCBs Total				400.00 (1) 850.00 (1)		2850.00
Acute Static Daphnia Toxicity Ceriodaphnia				825.00 1400.00		
Special Projects Labor Principal Scientist Senior Scientist Scientist Technician Secretary Expert Witness	50/hr	75/hr		100/hr (2) 80/hr (2) 50/hr (2) 40/hr (2) 30/hr (2) 150-300/hr(2)		
Equipment ICP GC/MS GC/HRMS GC/TQMS LC/MS				120/hr 250/hr 350/hr 350/hr 300/hr		

Table 2 (c)

Contract Laboratory Survey

(Prices in Dollars)

Environmental Analytical Method	Lab M	Lab N	Lab O	Lab P	Lab Q	Lab R
Volatiles: EPA Method 601 EPA Method 624 CLP EPA Method 1624		225.00	125.00 195.00 (1) 250.00 (1)		150.00 500.00	220.00 (1)
Semi-Volatiles: EPA Method 625 CLP EPA Method 1625		475.00	480.00 (1) 535.00 (1)		350.00 900.00	450.00 (1)
PCBs: PP Pesticide/PCBs All Priority Pollutants	30/ (13) 95.00	125.00	1150.00 (8)		280.00 (1, 12)	150.00
Dioxins 2,3,7,8-TCDD Total dioxins/furans Appendix IV		400.00 1000.00	250.00 1050.00		275.00	360.00 600.00
Appendix IV Compounds Volatiles Semi-Volatiles PCBs Total						
Acute Static Daphnia Toxicity Ceriodaphnia						
Special Projects Labor Principal Scientist Senior Scientist Scientist Technician Secretary Expert Witness		115/hr 71/hr 59/hr 45/hr 25/hr		(7)		
Equipment ICP GC/MS GC/HRMS GC/TQMS LC/MS						

Table 2 (d)

Contract Laboratory Survey

(Prices in Dollars)

Environmental Analytical Method	Lab S	Lab T	Lab U	Lab V	Lab W	Lab X
Volatiles: EPA Method 601 EPA Method 624 CLP EPA Method 1624	475.00	120.00 200.00 (1,10)	N/A	195.00 225.00		110.00 250.00
Semi-Volatiles: EPA Method 625 CLP EPA Method 1625	1125.00		N/A	500.00		375.00
PCBs: PP Pesticide/PCBs All Priority Pollutants			N/A N/A	145.00		135.00
Dioxins 2,3,7,8-TCDD Total dioxins/furans Appendix IV		400.00 800.00	N/A			
Appendix IV Compounds Volatiles Semi-Volatiles PCBs Total			N/A			
Acute Static Daphnia Toxicity Ceriodaphnia		600.00	N/A	270.00 950.00		
Special Projects Labor Principal Scientist Senior Scientist Scientist Technician Secretary Expert Witness		100/hr 75/hr 50/hr 40/hr 25/hr	4000/min (6)	75/hr	Bids Only	
Equipment ICP GC/MS GC/HRMS GC/TQMS LC/MS						