Laboratory, Analytical and Sampling Equipment Preliminary Needs Assessment for the Industrial Wastewater Monitoring & Pretreatment Programs in Baja California, Mexico

Prepared for the State Water Resources Control Board in cooperation with:
STATE COMMISSION OF PUBLIC SERVICES OF MEXICALI
STATE COMMISSION OF PUBLIC SERVICES OF TECATE
STATE COMMISSION OF PUBLIC SERVICES OF TIJUANA
STATE COMMISSION OF PUBLIC SERVICES OF ENSENADA
Baja California Directorate of Ecology
City of San Diego
San Diego State University

May 14, 2003

SAN DIEGO STATE UNIVERSITY FOUNDATION
5250 Campanile Drive
San Diego, California 92182-1934

Attention: Dr. Paul Ganster

Subject: Final Report for Exhibit A, Task A; Agreement under SDSUF Fund # 52989A 7710

Project: RECOMMENDATIONS OF EQUIPMENT TO BUY FOR
VARIOUS AGENCIES IN BAJA CALIFORNIA, MEXICO

We appreciate the opportunity to provide our services on this important bi-national project and we are confident the objectives were met to the benefit of all the agencies involved.

Sincerely,

"LA CALIDAD INICIA CON LA EDUCACION Y TERMINA CON LA EDUCACION"

ALBERTO DURAN HERNANDEZ
Consultant

I. BACKGROUND

The California State Water Resources Control Board (SWRCB) was required to redirect approximately $330,000 destined for assistance to the Industrial Wastewater Monitoring & Pretreatment Programs for the Cities of Tijuana and Tecate, in the State of Baja California, Mexico. This assistance was originally targeted to be in the form of wastewater sampling and chemical analyses, training, and to a lesser extent, donation of laboratory and field sampling equipment. The new plan developed by the SWRCB consists in using these funds to develop a preliminary needs assessment of laboratory, sampling and analytical equipment in addition to the purchase of equipment for the State Commissions of Public Services of Tijuana, Tecate, Mexicali and Ensenada, and the Directorate of Ecology of Baja California, Mexico. Funds from the SWRCB Agreement # 00-254-550-0 with the City of San Diego were redirected for this effort.

II. OBJECTIVES

This project involves an assessment and prioritization of equipment needs in the area of environmental protection, in order to make equipment purchase recommendations for each agency. The objective is to distribute the available funds efficiently to maximize the positive effect on the overall pollution prevention efforts in the State of Baja California, Mexico. The SWRCB established several considerations to take into account in the information-gathering and decision-making processes of this project:

- current and future workloads
- field sampling and analytical methods
- facilities and space requirements
- laboratory accreditation potential
- applicable laws and regulations
- equipment costs and operation and maintenance requirements
- wish lists presented by each agency and discussions with their representatives
- available budget giving a stronger consideration to the State Commissions of Public Services of Tijuana and Tecate
- the potential development of a regional laboratory

A very important limiting factor was the short timeframe set by the SWRCB for the completion of this project. This was due to unexpected changes in the availability of funds.

III. INFORMATION GATHERING

Each agency receiving equipment under this project was asked to name a representative to facilitate the flow of information, schedule meetings, ensure the availability of appropriate personnel to participate as needed, etc. The named representatives were:

- Arturo Venegas, State Commission of Public Services of Mexicali (CESPM)
- Victor Lopez, State Commission of Public Services of Tecate (CESPTe)
- Juan Medina, State Commission of Public Services of Tijuana (CESPT)
- Roberto Serrano, State Commission of Public Services of Ensenada (CESPE)
- Arturo Arano, State General Department of Ecology (DGE)

The information-gathering process was initiated with a questionnaire sent to each representative, requesting information related to their workloads, equipment, personnel, information systems, facilities and budget. A copy of the questionnaire is included in this report as Appendix A.

The next step in the process was to visit the facilities and meet with appropriate personnel from each agency to discuss the different aspects covered by the questionnaire, receive the requested information, tour the facilities, etc. City of San Diego personnel participated in these visits providing technical support in the area of equipment use and specifications. A listing of the personnel present in the discussions for each agency can be found in Appendix B.

Discussions of equipment needs were held during these visits, reviewing a list of equipment for consideration prepared by the SWRCB and going over each item requested by the agencies through “wish lists” previously submitted to the SWRCB. The discussions included the specific intended use for each piece of equipment and the requirements with respect to analytical methods, laboratory space, accessories, operation, maintenance, etc. These discussions led to additions and deletions to the lists and resulted in revised lists for each agency.

IV. RESULTS

A list of final recommendations of equipment purchases for each agency is presented in Table 1. These recommendations were derived from the revised wish lists for each agency, the information obtained through the questionnaires and visits, discussions with representatives from each Baja California agency involved in this project and with City of San Diego and SWRCB personnel, the budget available for purchases and all of the guidelines given for this project by the SWRCB. Tables 2 through 6 contain the preliminary lists given by the SWRCB, the original wish lists, the revised wish lists and the preliminary equipment recommendations for each agency. Each table is followed by descriptions of the agency's operations and requirements pertinent to the decisions needed to be made for this project and other relevant observations, including a brief description of the decision-making process and the justification for the final recommendations.

Table 1 (Page 1/2.) FINAL RECOMMENDATIONS

Description	Supplier	Catalog #	Qty.	Unit Cost	Total Cost	Agency
Precision Thelco Lab Oven	Fisher	13-254-1	2	$1,250	$2,500	Ens and Tec
Analytical Balance	Fisher	01-913-45	2	$3,100	$6,200	Ens and Tec
Muffle Furnance, Thermolyne Multiprogrammable	Fisher	10-505-14	2	$6,500	$13,000	Ens and Tec
General purpose refrigerator/freezer	Fisher	13-986-106A	1	$2,000	$2,000	Ensenada
BOD incubator	Fisher	13-990-203	1	$3,700	$3,700	Ensenada
BOD incubator	Fisher	13-990-204	1	$2,800	$2,800	Tecate
Conductivity meter/Thermo Orion 135A	Fisher	13-302-51	1	$1,200	$1,200	Tecate
pH meter Accumet AP61	Fisher	13-636-AP61	1	$500	$500	Tecate
Benchtop DO meter YSI 5100	Fisher	13-298-22	1	$1,600	$1,600	Tecate
BOD probe YSI 5905	Fisher	13-299-76	1	$600	$600	Tecate
Probe adapter cable YSI 5011	Fisher	13-299-78	1	$75	$75	Tecate
Balance table	Fisher	HMO19945	1	$1,850	$1,850	Tecate
Labconco acid storage cabinet	Fisher	16-305-86	1	$1,200	$1,200	Tecate
Labconco standard storage cabinet	Fisher	16-305-51	1	$850	$850	Tecate
Labconco work surface	Fisher	16-304-123	1	$1,000	$1,000	Tecate
Labconco vent kit	Fisher	16-105-3	1	$50	$50	Tecate
Digesdahl Apparatus	Hach	23130-20	2	$1,000	$2,000	Ens and Tec
Digesdahl Safety Shield	Hach	50040-00	2	$350	$700	Ens and Tec
UV/Vis Spectrophotometer, Hach DR 4000	Hach	48000-00	2	$5,600	$11,200	Ens and Tec
Centrifuge Megafuge	VWR	20300-016	1	$4,200	$4,200	Ensenada
Safety trolley for megafuge	VWR	20300-022	1	$1,000	$1,000	Ensenada
Rotor for megafuge	VWR	20300-268	1	$2,000	$2,000	Ensenada
Swing-out rotor	VWR	20300-326	1	$1,100	$1,100	Ensenada
Vacuum pressure pump	VWR	54908-005	1	$450	$450	Ensenada
Mini Vortexer	VWR	33994-306	1	$250	$250	Ensenada
Specific gravity hydrometer	VWR	34610-002	1	$20	$20	Ensenada
Polyehtylene carboy 10-L case of 6	VWR	16117-007	1	$225	$225	Ensenada
Graduated cylinders, case of 6	VWR	24776-144	1	$200	$200	Ensenada
Centrifuge bottles	VWR	21007-336	1	$125	$125	Ensenada
Centrifuge tubes	VWR	21008-240	1	$150	$150	Ensenada
Disposable pipets	VWR	53300-750	1	$200	$200	Ensenada
Wide mouth bottles	VWR	EP150-02WWM	1	$50	$50	Ensenada

Table 1 (Page 2/2.) FINAL RECOMMENDATIONS

Description	Supplier	Catalog #	Qty.	Unit Cost	Total Cost	Agency
Autosampler ISCO 6712C	ISCO	68-6710-141	2	$2,750	$5,500	Tecate
Rapid transfer device ISCO 581	ISCO	68-6700-056	2	$600	$1,200	Tecate
pH temp module ISCO 701	ISCO	68-6700-082	2	$1,700	$3,400	Tecate
Ni-Cd batteries ISCO 934	ISCO	60-1684-040	4	$250	$1,000	Tecate
Submerged probe flow ISCO 720	ISCO	68-6700-068	1	$1,600	$1,600	Tecate
Ultrasonic flow module ISCO 710	ISCO	68-6700-049	1	$1,600	$1,600	Tecate
Battery charger	ISCO	68-3000-965	1	$450	$450	Tecate
Explosimeter, GasAlertMax Four Gas Detector	Cole Palmer	RH-81990-22	2	$1,800	$3,600	Ens and Tec
LIMS software	Promium		2	$8,500	$17,000	Ens and Tec
LIMS software support	Promium		2	$1,500	$3,000	Ens and Tec
Computer, AMD 2700+, 120GB, 1GB	PC Club		5	$1,400	$7,000	Ens, Tec, DGE(3)
Laptops	PC Club		3	$2,000	$6,000	DGE
GPSMAP 76S	Ham Radio		3	$450	$1,350	DGE
Network analyst software	ESRI		1	$1,500	$1,500	DGE
Spatial analyst software	ESRI		1	$2,500	$2,500	DGE
Gas Chromatograph/Mass Spectrometer (GC/MS)	Agilent		1	$125,000	$125,000	Tijuana
Gas Chromatograph (GC)	Agilent		1	$52,000	$52,000	Mexicali
GC and GC/MS supplies	Agilent		1	$5,500	$5,500	Tij and Mex
Atomic Absorption Spectrophotometer	Thermo		1	$25,000	$25,000	Tecate
				TOTAL ESTIMATE	**$327,195**	

TABLE 2. CESPM

SWRCB	CESPM	REVISED LIST	EQUIPMENT RECOMMENDED	COST ESTIMATE
Ion Chromatograph	Gas Chromatograph for THM and pesticides	Gas Chromatograph for THM and pesticides	Gas Chromatograph for Pesticides, EPA Methods 508,608 & 8080 with Personal Computer	$55,000
Analytical balance	Analytical balance	Analytical balance		
Centrifuge	Centrifuge	Centrifuge		
Incubator	Incubator	Incubator		
Ultrasonic bath	Ultrasonic bath	Ultrasonic bath		
Autoclave	Autoclave	Autoclave		
Muffle furnace	Muffle furnace	Muffle furnace		
Explosimeter	Explosimeter	Explosimeter		
Multiparameter meter	Benchtop multiparameter	Benchtop multiparameter		
	Field multiparameter meter	Field multiparameter meter		
	Vehicle for sampling			
	Soxhlet apparatus			
	Water purification system	Water purification system		
	Microwave for digestions			
	Balance table	Balance table		
	Certified weights	Certified weights		
	Turbidimeter	Turbidimeter		
	UV/VIS Spectrophotometer	UV/VIS Spectrophotometer		
	Supports and columns			
	Digital camera			
		LIMS software		
		PC for LIMS		
			Gas Chromatograph supplies	$2,000
			TOTAL	$57,000

A. Evaluation of CESPM's Needs

CESPM's organizational structure combines their water and wastewater analytical requirements under the same section and under the same main laboratory building. Their laboratory work in support of the industrial monitoring program is limited to some parallel testing being done under a project recently started in conjunction with the City of San Diego. References of the Mexican regulations applicable to their laboratory work are included in Appendix C as NOM-127-SSA1 (potable water,) NOM-001-ECOL (for CESPM's own wastewater discharges into national waters) and NOM-002-ECOL (wastewater discharges into collection systems.) The laboratory does not have any external accreditations or certifications, but they have plans to get the national accreditation, which in Mexico is done by complying with NMX-EC-17025 (see reference in Appendix C.) Their laboratory capabilities include general bacteriology and a variety of physical and chemical methods involving volumetric, gravimetric, potentiometric and colorimetric techniques. Their laboratories do not have the capability to analyze for metals or the organic compounds (trihalomethanes and organochlorine pesticides) listed in the above mentioned regulations. Available water and wastewater analytical data do not indicate there should be a special concern for these pollutants; however, there is a concern for pesticides because of their potential to be found in the water and wastewater, due to the relatively high level of agricultural activities in the area and the nature of their distribution and collection systems, which include significant open-channel segments.

The laboratory facilities were found to be operational, but the available space is very limited. It would be difficult to accommodate all of the requested equipment, but the staff is committed to sacrifice office space and make things tighter in the laboratory in order to get the additional equipment. They have formal approved plans and budget for a laboratory expansion project and they have a strong support from upper management to provide for all costs associated with the operation of the equipment requested. Pictures of the laboratory areas can be found in Appendix D.

The preliminary list given by the SWRCB suggested the option of acquiring a group of items that are for general use in a laboratory or an Ion Chromatograph. Discussions with the CESPM representatives revealed they did not intend to get an Ion Chromatograph; what they really wanted was a Gas Chromatograph (GC) with the capability of analyzing for Trihalomethanes (THM) in water samples and Organochlorine Pesticides in water and wastewater samples. They presented a quote for such an instrument prepared for them by Perkin Elmer.

The soxhlet apparatus was requested for the analysis of Methylene Blue Active Substances and the microwave oven for the digestion of samples for oil & grease, nitrogen and metal analyses. These two items were removed from the list as the approved analytical methods in Mexico do not contemplate the use of this equipment for these analyses, and one of CESPM's goals is to get laboratory accreditation.

Discussions about their data management practices led to the addition of a Laboratory Information Management System (LIMS) software package and a computer to the wish list.

With respect to the requested GC, there are no approved analytical methods in Mexico for the analyses of THM and pesticides in water or wastewater samples. For these cases, the regulations point to the use of international methods, such as those approved by the U.S. Environmental Protection Agency (U.S. EPA.) The technical opinion from the City of San Diego personnel was that the specifications of the instrument proposed by Perkin Elmer in the quote presented to CESPM, did not meet the requirements to perform the intended analyses by approved U.S. methods. The recommendation is to use two separate instruments for these two analyses.

The revised list needed to be trimmed down because the total cost significantly exceeded the funds targeted for this agency. The GC for THM was cut because of the high cost and the main value of THM analyses being in the area of potable water. The vehicle and all of the general-type laboratory equipment were cut because these would increase the laboratory's production potential, but no new analytical methods would be added to their capabilities. The GC for pesticides was recommended because it can be used for CESPM's water and wastewater needs and has the potential to support the needs of the other Baja California agencies, as there are no plans to acquire this capability in the near future by any of the other CESPs. This GC system includes a powerful computer that can be used in the future to support the LIMS software in addition to all of the GC functions.

TABLE 3. CESPTe

SWRCB	CESPTe	REVISED/RECOMMENDED	COST ESTIMATE
Analytical balance	Analytical balance	Analytical balance	$3,100
		Balance table	$1,850
Muffle furnace	Muffle furnace	Muffle furnace	$6,500
Drying oven	Drying oven	Drying oven	$1,250
D.O. meter	D.O. meter	D.O. meter	$1,600
BOD probe	BOD probe	BOD probe	$600
		BOD probe adapter cable	$75
		BOD incubator	$2,800
Field pH meter	Field pH meter	Field pH meter	$500
Field conductivity meter	Field conductivity meter	Field conductivity meter	$1,200
		Explosimeter	$1,800
Flow module for autosamplers	Submerged probe flow module	Submerged probe flow module	$1,600
	Ultrasonic flow module	Ultrasonic flow module	$1,600
pH module for autosamplers	pH module for autosamplers (2)	pH module for autosamplers (2)	$3,400
UV/VIS Spectrophotometer	UV/VIS Spectrophotometer	UV/VIS Spectrophotometer	$5,600
LIMS software		LIMS software	$8,500
Personal Computer for LIMS	Personal Computers (2)	Personal Computer for LIMS	$1,500
	Digesdahl apparatus	Digesdahl apparatus	$1,000
		Digesdahl safety shield	$350
	ISCO autosamplers (2)	ISCO autosamplers (2)	$5,500
	Transfer device for autosamplers (2)	Transfer device for autosamplers (2)	$1,200
	Ni-Cd batteries for autosamplers (2)	Ni-Cd batteries for autosamplers (4)	$1,000
		Battery charger	$450
	Color printer		
	ICP Spectrometer	Atomic Absorption Spectrometer with Personal Computer and Color Printer	$25,000
		Acid storage cabinet	$1,900
		TOTAL	$79,875

B. Evaluation of CESPTe's Needs

CESPTe combines the responsibilities for water and wastewater laboratory analyses into one section. Their wish list concentrates on the needs for wastewater analytical methods and in some cases they ask for a similar piece of equipment to what they already have, with the purpose to separate the water from the wastewater analyses. The Mexican regulations they need to follow in their laboratory work are NOM-127-SSA1 for potable water, NOM-001-ECOL for their treated wastewater discharges into the Tecate River and NOM-002-ECOL as they monitor wastewater discharges into the collection system (see Appendix C for references to these regulations.) In January of 2002 they started an industrial wastewater monitoring program jointly with the City of San Diego, consisting in the weekly collection of two or three wastewater samples. The CESPTe laboratory performs the analyses they are equipped for, such as oil & grease, biochemical oxygen demand, chemical oxygen demand, pH, conductivity, total suspended solids and total solids. They have the capability to analyze for some metals by a colorimetric method not approved in Mexico. They do not have the capability to analyze for organic compounds. The laboratory does not have any external accreditations or certifications, but they are interested in the national accreditation, which is based on NMX-EC-17025 (see reference in Appendix C.) Historical data and the recent industrial wastewater monitoring program indicate the presence of metals in the collection system and at the treatment plant, so there is a concern and a special interest to monitor these parameters.

The main laboratory space is very limited, but there are other rooms in the same building where they can move into and they are already working in the conditioning of a separate small building for sludge analyses. They would need additional laboratory furniture and rearrangement of the available areas, but they should be able to accommodate all of the requested equipment (see laboratory pictures in Appendix D.) They have not spent all the funds they have available for consumables, reagents, standards, glassware, etc. over the last couple of years, because of their lack of equipment to perform analyses and they are at risk of budget cuts. Obtaining equipment under this program will help them maintain the current budget levels as they will have the production to justify the increase in purchases of these types of items. No budget problems are anticipated for the operation and maintenance of the equipment being requested.

CESPTe's wish list contains items not included in the SWRCB's preliminary list. The additional items are a computer, a color printer and an Inductively Coupled Plasma Spectrometer (commonly known as ICP.) The ICP can be used for the determination of metal concentrations in water, wastewater and sludge samples. They presented a quote for $80,000 prepared for them by a local distributor.

New items were added to the wish list as a result of the discussions during the on-site visit. A special table is recommended for the analytical balance as this would be a requirement for accreditation. To complement their request for a bench-top dissolved oxygen (D.O.) meter and probe, it is recommended they also get a probe adapter cable and a Biochemical Oxygen Demand (BOD) incubator. This equipment will enable them to perform BOD analyses by a method approved in Mexico in 2001, under NMX-AA-028-SCFI-2001, and D.O. measurements by NMX-AA-012-SCFI-2001 (references to these methods are in Appendix C.) Although the approved methods for metal analysis in Mexico do not consider the use of an ICP, it is common for the accrediting body to accept the use of an ICP as a substitution for the Atomic Absorption Spectrophotometer (AA) specified in method NMX-AA-051 (see Appendix C.) Buying an ICP for CESPTe would use most of the funds available for them, and although they do have a valid concern for the presence of metals in their collection system, treatment plant and sludges, they don't have the number of samples to justify the initial expense and the relatively high operation and maintenance costs of an ICP. The idea of getting an AA for metal analysis was discussed. This will enable them to monitor for metals following approved methods in Mexico, at a cost that will leave sufficient funds for their laboratory to get stronger in other areas as well. The recommended AA system includes a powerful computer and a color printer that can be used for their other needs, and satisfies their separate request for these items. CESPTe is currently adequately equipped for wastewater sampling, but getting the requested field sampling equipment will make the industrial wastewater monitoring program stronger and capable of increasing the numbers of samples collected, which can then be analyzed for metals in-house, if they get the AA.

TABLE 4. CESPT

SWRCB	CESPT	REVISED/RECOMMENDED	COST ESTIMATE
Gas Chromatograph with FID for volatile organic compounds	Gas Chromatograph/Mass Spectrometer for Semivolatile and Volatile Compounds	Gas Chromatograph/Mass Spectrometer for volatile organics with Personal Computer	$125,000
Personal Computer for LIMS			
	Autosampler for volatile organics (3)		
	ISCO autosamplers (3)		
	pH & temperature modules (4)		
	Field multiparameter meter (2)		
	Wireless communication module (2)		
	Wireless communication base (2)		
	Computer adapter cable		
	Rapid transfer device (2)		
	Battery charger (2)		
	Autosampler batteries (10)		
	Vehicle equipped for sampling		
	Ice making machine		
	Personal computer		
	Digestion apparatus		
		Gas Chromatograph/Mass Spectrometer supplies	$3,500
		TOTAL	$128,500

C. Evaluation of CESPT's Needs

CESPT separates the responsibilities for water and wastewater analyses into two different sections in their organization and has separate laboratories for them. This study only dealt with the wastewater laboratory. The applicable Mexican regulations for their laboratory work are NOM-001-ECOL for their own wastewater ocean discharges and NOM-002-ECOL for monitoring wastewater discharges into their collection system (references to these regulations are in Appendix C.) They are equipped to perform most of the required analyses with the exception of metals by approved methods in Mexico and organic compounds. They have been participating in an industrial wastewater monitoring program with the City of San Diego since 1999. This program has identified the main pollutants of concern as metals and volatile organic compounds. The laboratory does not have external accreditations or certifications, but they are actively working towards getting State certified through a program administered by DGE, and they have done some work in the past towards the national accreditation (NMX-EC-17025; seeAppendix C,) and plan to continue to pursue this goal in the near future.

CESPT's laboratory spaces in use now are a little tight, but adequate. They have two rooms currently unoccupied that are reserved for the instrumentation for metal and organic analyses, and they have space around the laboratory for future expansions. Laboratory space would not be a problem if they were to get all of the equipment they are requesting. See pictures of some of the laboratory areas in Appendix D. The laboratory has a strong support from upper management and it is well funded, so there would be no budget problems for the operation and maintenance of the equipment requested.

SWRCB's preliminary list consists of a Gas Chromatograph with Flame Ionization Detection (GC-FID) for the analysis of volatile organic compounds (VOC) and a computer to run a LIMS software package they recently acquired. CESPT's wish list requests a Gas Chromatograph-Mass Spectrometer (GC-MS) for the analysis of volatile and semi-volatile organic compounds (and not a GC-FID,) the computer to run the LIMS and additional sampling and laboratory equipment. These lists do not include instrumentation for metal analysis because CESPT recently purchased an Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) and is in the process of getting it installed. An evaluation of the overall situation of the laboratory supports the idea to direct the available funds to the area of organic compound analyses and the computer for the LIMS. The field sampling equipment and the rest of the equipment requested would be used basically to support activities already being done with existing equipment. There are no approved methods in Mexico to analyze organic compounds in wastewater samples, so the regulations defer to internationally recognized and approved methods. A GC-FID system configured to meet the requirements of the U.S. EPA approved method for VOC would cost approximately $90,000. A GC-MS system meeting U.S. EPA method requirements for both volatile and semi-volatile organic compounds would cost approximately $150,000, but this setup is not recommended by the City of San Diego personnel as it does not render the best operating conditions for one method or the other. A GC-MS system with optimum conditions for the analysis of VOC

costs approximately $125,000 and a GC-MS with optimum conditions for semi-volatile organic compounds costs approximately $100,000. Purchasing the GC-FID for VOC or the GC-MS for semi-volatile organic compounds would keep the funds within the range of the amount targeted for CESPT. However, VOC were identified as pollutants of concern and the GC-MS for VOC has significant advantages over the GC-FID as far as accuracy and versatility to acquire additional information on the compounds detected by the analysis. The advantages outweigh the difference in cost, so the final recommendation is to get the GC-MS for VOC. This instrument has the capability to support the needs of the other CESPs. The current budget for the laboratory shows funds for a computer that can be used to run the LIMS, so the computer was cut from the recommendations for this project.

TABLE 5. CESPE

SWRCB	CESPE	REVISED/RECOMMENDED	COST ESTIMATE
Drying oven	Drying oven	Drying oven	$2,500
Analytical balance	Analytical balance	Analytical balance	$3,100
Incubator	BOD incubator	BOD incubator	$3,700
Spectrophotometer	UV/VIS Spectrophotometer	UV/VIS Spectrophotometer	$5,600
Reagents			
Pipets	Disposable pipets	Disposable pipets	$200
Tube agitator	Mini vortexer	Mini vortexer	$250
LIMS software		LIMS software	$8,500
Personal Computer for LIMS		Personal Computer for LIMS	$1,400
	Centrifuge	Centrifuge	$4,200
	Safety trolley for centrifuge	Safety trolley for centrifuge	$1,000
	Sealed rotor for centrifuge	Sealed rotor for centrifuge	$2,000
	Swing-out rotor for centrifuge	Swing-out rotor for centrifuge	$1,100
	Vacuum pressure pump	Vacuum pressure pump	$450
	Specific gravity hydrometer	Specific gravity hydrometer	$20
	10-L polyethylene carboy (6)	10-L polyethylene carboy (6)	$225
	1-L plastic graduated cylinders (6)	1-L plastic graduated cylinders (6)	$200
	250-mL centrifuge tubes (12)	250-mL centrifuge tubes (12)	$125
	50-mL centrifuge tubes (500)	50-mL centrifuge tubes (500)	$150
	2-L wide mouth plastic bottles (6)	2-L wide mouth plastic bottles (6)	$50
	Sample refrigerator	Sample refrigerator	$2,000
		Muffle furnace	$6,500
		Digesdahl apparatus	$2,000
		Digesdahl safety shield	$700
		Explosimeter	$1,800
		TOTAL	$47,770

D. Evaluation of CESPE's Needs

CESPE's analytical work is split into two separate laboratories which essentially work as one unit, under the same direct management, with the same personnel and general resources. They monitor potable water and wastewater, with the bulk of their work being in the area of process control for wastewater treatment plants. A joint industrial wastewater monitoring program with the City of San Diego got started in January of this year and CESPE tests for pH, biochemical and chemical oxygen demand, total and volatile suspended solids, oil & grease, conductivity, total dissolved solids, salinity and turbidity. The industrial wastewater monitoring program has not detected pollutants of concern so far, other than perhaps oil & grease. One of CESPE's priorities is recycling the wastewater and they are already using wastewater treatment plant effluent for irrigation of their own plants on an experimental basis. The Mexican regulations the laboratory is concerned with are: NOM-001-ECOL for their ocean discharges, NOM-002-ECOL for their industrial wastewater monitoring program and NOM-003-ECOL to monitor their compliance with water reuse regulations (references to these regulations are in Appendix C.) They do perform total and fecal coliform analyses, but a significant part of the laboratory resources are spent in contracting out the test for helminth eggs, which is a requirement of the water and sludge reuse regulations. The laboratory does not have external accreditations or certifications.

The laboratory space is limited but adequate for the number of tests they perform and there is space available for future expansions. The laboratory management does not have information regarding the budget assigned or available to the laboratories and this is a significant handicap to their operations. They were adequately equipped for wastewater sampling through the bi-national industrial wastewater monitoring program

The revised wish list for CESPE contains all of the items on SWRCB's suggested list and CESPE's original list. CESPE's list contains the equipment and materials necessary to enable them to perform the test for helminth eggs. Having this capability in-house will strengthen their water reuse program and provide important information regarding sludge reuse possibilities. The refrigerator is needed for the conservation of the increased number of samples resulting from the new industrial wastewater monitoring program. The Hach Spectrophotometer will be used now for chemical oxygen demand, ammonia-nitrogen, nitrites and nitrates, and this instrument can be used in the future for many colorimetric tests of interest to wastewater programs. The LIMS software and computer will provide an efficient system for sample tracking, quality assurance/quality control, statistics and reporting.

TABLE 6. DGE

SWRCB	DGE	REVISED/RECOMMENDED	COST ESTIMATE
Geographic Positioning System	Geographic Positioning System (3)	Geographic Positioning System (3)	$1,500
ArcView software	ArcView 8.3 network analysis (2)	ArcView 8.3 network analysis (1)	$1,500
	ArcView 8.3 spatial analysis (2)	ArcView 8.3 spatial analysis (1)	$2,500
	Laptop computer (3)	Laptop computer (3)	$6,000
	Personal computer (3)	Personal Computer (3)	$4,500
	Computer server		
	ISCO autosamplers (6)		
		TOTAL	$16,000

E. Evaluation of DGE's Needs

DGE is the State agency in Baja California responsible not only for the control of industrial wastewater discharges into sewer collection systems, but for all of the State environmental programs. They deal with all kinds of contamination: air, water, wastewater, soil, waste, noise, etc. The agency headquarters are located in Tijuana and they have offices in Mexicali and Ensenada. DGE is an active participant in the industrial wastewater monitoring programs along with the CESPs and the City of San Diego. The federal government in Mexico, in cooperation with the state agencies, is working on the concept of a single environmental permit per discharger. A national register of emissions and contaminant transfer (RETC for Registro de Emisiones y Transferencia de Contaminantes) is being established to document air emissions, wastewater discharges, hazardous materials, hazardous waste and other pertinent information of concern to environmental agencies. DGE is the agency in Baja California with the responsibility to join this effort. The Geographic Positioning System (GPS) and associated computer equipment they are requesting will enable them to interconnect with this important environmental information. The benefits for Baja California's industrial wastewater control program will be to have information readily available of cumulative effects per geographical area. This information can be coupled with information in the system regarding the capacity of receiving bodies, to establish maximum allowable discharge limits and to provide technical support for proposed changes in regulations. The information from the industrial wastewater monitoring program can be cross-referenced to the information in the system, to identify the exact location of possible sources of contamination.

SWRCB's preliminary list contains the GPS equipment and supporting software. DGE's wish list in addition contains field wastewater sampling equipment, the personal computers and laptops to run the GPS program in their three offices and a powerful computer system to be used as a centralized server for the agency. The total cost for these items significantly exceeds the amount of money given as a guideline by the SWRCB for this agency. Field sampling equipment was given a lower priority for DGE because all of the CESPs are now equipped for field wastewater sampling, with approximately twenty automatic samplers distributed among the four cities, and two more new units are being acquired for CESPTe. The computer server was evaluated as very useful to have, but the GPS program can be run in the three cities without it. The rest of the equipment still adds up to an amount higher than anticipated for this agency, but they constitute the elements necessary to run the program effectively and they have to be considered as a package.

V. CONCLUSIONS

The project was successful in distributing the available funds within the established guidelines and objectives. A cost-benefit analysis that would take into consideration the number of samples per test method for each CESP versus the cost of equipment, supplies, operation, maintenance, etc., was beyond the scope of this study, due to time and budget limitations. Therefore, the recommendations do not cover the concept of whether to do a test in-house or contract it out. The recommendations meet immediate needs and expand the capabilities of each agency, as each will now be able to perform new methods of high priority for them. The major pieces of equipment involving the bulk of the funds were assigned considering the needs of the agencies and the readiness of each laboratory to take on the new challenge. At the same time, it was possible to accomplish this without repeating a new major capability among the agencies. This was done to strengthen the overall laboratory capabilities of Baja California while allowing the time necessary for the decision to have a regional laboratory or not, before spending money in duplicate equipment.

VI. RECOMMENDATIONS

1. Establish a procedure to follow-up on the use, operation and maintenance of the equipment. This can be done by committing all the agencies involved to an on-site formal audit in six months from the delivery of the equipment. The audit can be used to identify and provide possible solutions to problems that could be preventing the optimum use of the equipment.

2. Facilitate the signing of agreements between the CESPs to provide laboratory analytical support to each other. These agreements should establish schedules, turn-around-times, number and types of analyses, and a mechanism for compensation.

3. Conduct an in-depth cost-benefit analysis of the laboratory operations of all CESPs to provide recommendations for the most efficient way of distributing the work, sharing resources, etc.

4. Use the revised wish lists for each agency if future funding sources become available for this type of purchases. The revised wish lists for each agency contain items that are needed and are well justified, but that were not acquired through this project due to funding limitations.

5. Establish a work plan for each CESP laboratory to obtain the laboratory certification from DGE. This certification is required to provide the necessary legal support to the data generated through the industrial wastewater monitoring programs.

6. Establish a work plan for each CESP laboratory to obtain the national laboratory accreditation. This accreditation is required to report laboratory data to federal agencies in Mexico. Potable water, wastewater treatment plant effluents and recycled wastewater fall under this requirement.

APPENDIX A. QUESTIONNAIRE USED TO PREPARE FOR THE VISITS

Por este conducto me permito adelantar una relación de la información que habremos de revisar durante mi próxima visita a sus instalaciones. El objetivo de iniciar ahora este proceso es el de ahorrar tiempo, ya que éste es un factor esencial para el éxito de este proyecto. Favor de ir reuniendo la mayor información posible para que esté accesible el día de la visita y favor de asegurarse de que el personal apropiado para apoyar este esfuerzo esté disponible durante la visita.

1.- CARGA DE TRABAJO

a) ¿Monitorean en base a permisos de descarga de aguas residuales? ¿Emitido por que dependencia, para que planta(s), cuáles son los límites máximos permisibles para la descarga y si estos provienen de alguna norma mexicana o son condiciones particulares, con que frecuencia es requerido el monitoreo? ¿En la actualidad se están realizando estos análisis con la frecuencia requerida? ¿Son realizados en su laboratorio, o se mandan fuera?

b) ¿Tienen algún requerimiento de analizar lodos? Parámetros, frecuencia, límites, métodos, etc.

c) En base a permisos de descarga, ¿tienen algún otro requerimiento de análisis? Tipo de muestra, parámetros, frecuencia, límites, métodos, etc.

d) ¿Se realizan análisis para proveer información en apoyo a la operación y mantenimiento de plantas tratadoras de aguas residuales? Tipos de muestras, parámetros, frecuencia, métodos, etc.

e) ¿Se realizan análisis para proveer información en apoyo al programa de control de descargas de aguas residuales industriales? Frecuencia, parámetros, límites, métodos, etc.

f) ¿Se realizan análisis en muestras de agua potable? Parámetros, frecuencia, límites, métodos, etc.

g) ¿Se analiza algún otro tipo de muestras? Tipo de muestras, parámetros, frecuencia, métodos, etc.

h) ¿El laboratorio realiza sus propios muestreos? Tipos de muestras, métodos de muestreo, frecuencias, etc.

i) ¿Hay algún análisis/muestreo que manden hacer fuera? Tipos de muestras, frecuencia, etc.

j) ¿Tienen contemplado realizar algunos otros análisis/muestreos en un futuro cercano? Tipos de muestras, frecuencia, métodos, etc.

Favor de proporcionar cualquier información estadística con que se cuente. Tipos de muestras, números de pruebas realizadas, etc.

2.- EQUIPO

a) ¿Con qué equipo instrumental de laboratorio cuentan para realizar las pruebas? Espectrofotómetros, cromatógrafos, potenciómetros, etc.

b) ¿Qué tipo de equipo de apoyo se tiene? Balanzas, hornos, refrigeradores, incubadoras, purificación de agua, etc.

c) ¿Con qué equipo se cuenta para hacer los muestreos?

d) ¿Tienen programado recibir algunos otros equipos en un futuro cercano?

Favor de proporcionar inventario de equipo o cualquier otra información disponible, incluyendo fechas de compra, modelo, condición actual del equipo, etc

3.- PERSONAL

a) ¿Con cuánto personal se cuenta para los muestreos y realización de las pruebas, y cuál es su perfil?

b) ¿Se cuenta con algún programa de capacitación de personal?

c) ¿Se tiene contemplado algún aumento en el número del personal?

Favor de proporcionar información disponible en cuanto a organigrama, descripción de puestos, experiencia del personal, etc.

4.- SISTEMAS DE INFORMACION

a) ¿Se cuenta con algún software y/o base de datos para el almacenamiento y manejo de los resultados?

b) ¿Qué tipo de registros se utilizan y cómo se emplean? Bitácoras, cuadernos de laboratorio, software para hacer cálculos, etc.

c) ¿Cómo elaboran sus informes de resultados?

d) ¿Con qué equipo de cómputo se cuenta? Número de computadoras, capacidad, configuración, impresoras, etc.

e) ¿Se tiene contemplado adquirir equipo de cómputo en un futuro cercano?

Favor de proporcionar inventario de equipo de cómputo, copias de páginas de las bitácoras, cuadernos de laboratorio, hojas de cálculo, informes, etc.

5.- INSTALACIONES

a) ¿Se cuenta con algunas instalaciones adicionales al laboratorio principal?

b) ¿Cuál es la superficie del laboratorio?

c) ¿Se tiene ocupada y en uso toda el área disponible?

d) ¿Algún proyecto de expansión o se cuenta con algunas otras áreas disponibles?

e) ¿Con qué equipo de seguridad para el trabajador se cuenta? Campanas de extracción, regaderas, fuentes para el enjuague de ojos, primeros auxilios, etc.

f) ¿Se cuenta con algún sistema de control de condiciones ambientales? Temperatura, humedad, polvos, etc.

g) ¿Cuál es la capacidad de la instalación eléctrica? ¿Cuál es el consumo promedio?

Favor de proporcionar croquis, dimensiones, especificaciones de la instalación eléctrica, etc.

6.- PRESUPUESTO

a) ¿Cuál es el presupuesto anual del laboratorio?

b) ¿Se conoce su distribución en cuanto a personal, equipo, mantenimiento, reactivos, cristalería, servicios, etc.?

c) ¿Se cuenta con contrato de servicio, reparación y mantenimiento para algún equipo de laboratorio?

d) ¿El laboratorio recibe algunos otros ingresos o apoyos?

e) ¿Se tiene contemplado algún aumento significativo en el presupuesto en un futuro cercano?

Favor de proporcionar copias de presupuestos o alguna otra información relevante disponible con respecto a ingresos y gastos.

APPENDIX B. PERSONNEL PARTICIPATING IN THE DISCUSSIONS

AGENCY	PERSONNEL
CESPM	Arturo Venegas Subdirector de Agua y Saneamiento, CESPM Benjamin Carrillo Jefe del Departamento de Control de Procesos, CESPM Luis Hernandez Jefe del Departamento de Aguas Residuales, CESPM Armando Villarino Senior Chemist, City of San Diego's Wastewater Department Jose Gallego Associate Chemist, City of San Diego's Wastewater Department Alberto Duran Consultant, Duran & Asociados
CESPTe	Aurelio Padilla Jefe de Planta de Tratamiento de Aguas Residuales y Calidad del Agua, CESPTe Victor Lopez Jefe de Laboratorio, CESPTe Armando Villarino Senior Chemist, City of San Diego's Wastewater Department Ian Lawless Associate Chemist, City of San Diego's Wastewater Department Alberto Duran Consultant, Duran & Asociados
CESPT	Juan Medina Jefe del Departamento del Control de Descargas de Aguas Residuales, CESPT Guadalupe Gonzalez Jefe de Laboratorio de Aguas Residuales, CESPT Armando Villarino Senior Chemist, City of San Diego's Wastewater Department Jose Gallego Associate Chemist, City of San Diego's Wastewater Department Alberto Duran Consultant, Duran & Asociados
CESPE	Luis Vargas Gerente de Saneamiento, CESPE Patricia Silva Jefe del Departamento de Aseguramiento de Calidad, CESPE Roberto Serrano Jefe de Laboratorio, CESPE Armando Villarino Senior Chemist, City of San Diego's Wastewater Department Raul Romero Assistant Chemist, City of San Diego's Wastewater Department Alberto Duran Consultant, Duran & Asociados
DGE	Arturo Arano Subdirector de Normatividad, DGE Ivan Lozano Jefe del Departamento de Auditoria Ambiental, DGE Armando Villarino Senior Chemist, City of San Diego's Wastewater Department Jose Gallego Associate Chemist, City of San Diego's Wastewater Department Alberto Duran Consultant, Duran & Asociados

APPENDIX C. APPLICABLE REGULATIONS, ACCREDITATION REQUIREMENTS AND APPROVED LABORATORY METHODS

Complete copies of the referenced regulations and procedures can be found in:
www.economia-nmx.gob.mx
Web page title: "CATALOGO DE NORMAS MEXICANAS"
Select "TIPO" and "ACEPTAR"
Select "DEFINITIVA" to get the index of approved regulations or "PROYECTO" to get the index of proposed regulations.

WASTEWATER DISCHARGES

NORMA OFICIAL MEXICANA NOM-001-ECOL-1996, QUE ESTABLECE LOS LIMITES MAXIMOS PERMISIBLES DE CONTAMINANTES EN LAS DESCARGAS DE AGUAS RESIDUALES EN AGUAS Y BIENES NACIONALES
(Wastewater discharges to national waters)

NORMA OFICIAL MEXICANA NOM-002-ECOL-1996, QUE ESTABLECE LOS LIMITES MAXIMOS PERMISIBLES DE CONTAMINANTES EN LAS DESCARGAS DE AGUAS RESIDUALES A LOS SISTEMAS DE ALCANTARILLADO URBANO O MUNICIPAL
(Wastewater discharges to urban or municipal sewer collection systems)

RECYCLED WASTEWATER

NORMA OFICIAL MEXICANA NOM-003-ECOL-1997, QUE ESTABLECE LOS LÍMITES MÁXIMOS PERMISIBLES DE CONTAMINANTES PARA LAS AGUAS RESIDUALES TRATADAS QUE SE REUSEN EN SERVICIOS AL PÚBLICO

POTABLE WATER

NORMA OFICIAL MEXICANA NOM-127-SSA1-1994, SALUD AMBIENTAL, AGUA PARA USO Y CONSUMO HUMANO-LÍMITES PERMISIBLES DE CALIDAD Y TRATAMIENTOS A QUE DEBE SOMETERSE EL AGUA PARA SU POTABILIZACIÓN

NATIONAL LABORATORY ACCREDITATION

NMX-EC17025-IMNC-2000. REQUISITOS GENERALES PARA LA COMPETENCIA DE LOS LABORATORIOS DE ENSAYO Y DE CALIBRACIÓN

LABORATORY METHODS

NMX-AA-012-SCFI-2001. ANÁLISIS DE AGUA - DETERMINACIÓN DE OXÍGENO DISUELTO EN AGUAS NATURALES, RESIDUALES Y RESIDUALES TRATADAS - MÉTODO DE PRUEBA
(Dissolved Oxygen)

NMX-AA-028-SCFI-2001. ANÁLISIS DE AGUA - DETERMINACIÓN DE LA DEMANDA BIOQUÍMICA DE OXÍGENO EN AGUAS NATURALES, RESIDUALES (DBO5) Y RESIDUALES TRATADAS - MÉTODO DE PRUEBA
(Biochemical Oxygen Demand)

NMX-AA-051-SCFI-2001. ANÁLISIS DE AGUA - DETERMINACIÓN DE METALES POR ABSORCIÓN ATÓMICA EN AGUAS NATURALES, POTABLES, RESIDUALES Y RESIDUALES TRATADAS - MÉTODO DE PRUEBA
(Metals by Atomic Absorption)

CESPM

CESPTe

CESPT

CESPE