APPENDIX B
PROCESS BENCHMARKING SURVEYS

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CENTRAL CONTRA COSTA SANITARY DISTRICT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Laboratory**
Your name and position: **Bhupinder Dhaliwal, Laboratory Superintendent**
Phone # of relevant contact: **1-925-229-7237**
Address and email: **5019 Imhoff Place, Martinez, CA 94553-4392**
bdhaliwa@centralsan.dst.ca.us

1. Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.

Sample	Analysis	Frequency D = Daily, W = Weekly
Activated Sludge		
Mixed Liquor	TSS	D
	Settleable Solids	D
	Volatile Solids	D
Return Sludge	TSS	D
	Settleable Solids	D
	Volatile Solids	D
Primary Sludge	Total Solids	D
Dewatered Sludge	Total Solids	D
	Total Volatile Solids	2/W
Raw Sludge	Total Solids	D
	Total Volatile Solids	2/W
Centrate	Total Solids	D
Thickened Sludge	Total Solids	D
WAS	Total Solids	D
	TSS	D
Influent (Composite)	COD	1/W
	Organic N	1/W
	Ammonia N	1/W
Primary Effluent (Composite)	COD	1/W
	Organic N	1/W
	Ammonia	1/W
	Total P	1/W
	pH	D
	TSS	D
	Settleable Solids	D
Final Effluent (Composite)	COD	W
	Ammonia N	D
	Settleable Solids	D
	NO3-N	1/W
	Total-P	1/W
	UV Absorption	D
Odor Monitoring	Observation	D
Special Projects	Variable	Variable

2. Have you made any recent reductions in laboratory analyses or are you planning on doing so in the near future? What were they (e.g. process)? What is the approximate annual savings achieved by the reductions?

No. The last reduction was made about 4 years ago with an estimated savings of about $10,000 to 15,000 per year.

3. Have you experienced any adverse impacts from the reductions in process-related analysis?

No.

4. **What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs. laboratory personnel? Explain.**

   Settled solids, TS, and pH.

5. **Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).**

   See attachments CCCSD-1.

6. **Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?**

   Yes. About 4 years ago we negotiated reductions (frequency) for metals from monthly and weekly and TSS BOD from 7/w to 5/w. Savings estimated $10,000 to 15,000 per year.

7. **Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.**

   Yes. Plan on continued efforts to reduce oil, grease, BOD, TSS, etc.

8. **How many labs do you have in your agency? What are the functions of each?**

   One.

9. **How many hours did it take to fill out this questionnaire?**

   1-1/2.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility: **Martinez/ Plant Operations Department**
Your name and position: **Doug Craig/Plant Operations Division Manager**
Phone # of relevant contact: **1-925-229-7284**
Address and email: **5019 Imhoff Place, Martinez, CA 94553-4392**
dcraig@centralsan.dst.ca.us

1. **Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding) utilized to investigate and test this technology.**

   CCCSD is constantly looking for new technology or improvements in current technology. We are very receptive to new technology and when a new application appears viable we conduct smaller scale pilot studies or larger scale demonstration projects.

   Our board of directors has been very supportive of funding new technology based on the success of past projects. A combination of district staff and consultants is used during test periods.

2. **List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).**

Technology 1: Ultraviolet Disinfection (UV)	
Methodology	Conducted in three-month pilot study comparing both vertical and horizontal lamp configurations.
Cost of Test	$400,000
Results	UV disinfection proved to be cost competitive with chlorine with much lower health risks associated with its use. UV also proved to be better in viral kill. The district installed a 90 MGD UV facility that has been in operation for two years. The facility successfully operated as expected by the results of the pilot study.
Report	A large pilot study report was completed and is available upon request
Technology 2: Anaerobic Selector	
Methodology	Bench scale studies and a literature search were conducted to determine the viability of an anaerobic selector upstream of the aeration basins
Cost of Test	Approximately $100,000
Results	Based on positive indications from the bench scale tests, the district determined that more than $100,000 per year could be saved by eliminating the use of chlorine for sludge bulking control. The district subsequently spent approximately $1,000,000 to reroute piping and add mechanical mixers to existing tankage. The full-scale selection has eliminated the use of chlorine by

	controlling the quality of the sludge in an acceptable range.
Report	A report was completed and is available upon request.
Technology 3: Active Harmonic Conditioner (AHC)*	
Methodology	The AHC was invented and developed by a private company and tested at CCCSD on a variable frequency drive. The unit was installed into the motor control cabinet.
Cost of Test	$15,000
Results	The AHC was very effective at controlling the electrical current distortion to less than 2%, which is less than the recommended standard of 5%.
Report	A proper report was written for a national electrical conference. Contact Don Berger 1-925-229-7259
* The application of AHC minimizes the distortion of the electrical sine wave which is caused by variable frequency drives and lighting. If the distortion is not controlled sensitive instruments will not function properly.	
Technology 4: Soil Bed Filters for Control of Dissolved Air Flotation (DAF) Thickening Odors	
Methodology	The district conducted an odor control study that quantified and evaluated all potential odor from the plant. The DAF tanks were identified as a source of odors from this study. A predesign was performed to evaluate the costs and technologies for controlling these odors and it was recommended that biofilters could effectively treat the odors from the DAF tanks at a favorable cost. A dual biofiltration system was installed to treat the odorous gases from the three enclosed DAF tanks.
Cost of Test	The total cost to install the biofiltration odor control system was $525,000. These costs include $80,000 for biofilter work, $330,000 for DAF tank retrofit work and cover installation, $80,000 for blowers and duct work, and $35,000 in electrical and instrumentation work. Annual O&M costs are $24,000, which includes operations labor costs, maintenance labor cost, electrical costs, and annualized biofilter media replacement costs.
Results	Odor testing was performed on the biofiltration system two months after start-up during the peak of the odor season. The results showed that greater than 98 percent odor removal was achieved and the presence of sulfur compounds was eliminated. The biofiltration odor control system has proven to be highly effective at treating DAF odors at the District's treatment plant. The system is simple to operate with exceptional performance and minimal costs.
Report	Available upon request.
Prepared by Joe Pomroy – Assistant Engineer/Engineering Department 1-925-229-7337 jpomroy@centralsan.dst.ca.us	
Technology 5: Household Hazardous Waste Collection Facility (HHWCF)	
Methodology	Trace amounts of common pesticides (diazanon and dursban) have been found in the District's effluent and have caused toxicity for certain aquatic test organisms. These chemicals have been found to originate from households and small businesses that improperly dispose of these and other hazardous wastes into the sanitary sewer system. Rather than building expensive treatment works to remove these chemicals from the wastewater, the District instead focused on developing an effective pollution prevention program. One of the main elements of this program was the construction of a Household Hazardous Waste Collection Facility (HHWCF) to provide a convenient and cost-effective way for residents and small businesses to properly dispose of their unwanted toxic chemicals. The HHWCF was completed in fall 1997. The facility is open 4 days per week for residential use without appointments and one additional day for small businesses. More than 50% of the waste collected is recycled or reused. The facility includes a Reuse Room where products that are brought in that are still in good condition can be picked up by the public free of charge. The facility also features an Integrated Pest Management (IPM) demonstration garden where residents can learn about how to garden using less toxic products.
Cost of Test	The operating and capital costs of the facility are funded by the annual sewer service charge at a cost of approximately $3-4 per household per year including amortized capital costs. Comparatively, the District estimated that it would cost more than $30 million to construct advanced treatment facilities to remove these chemicals from the wastewater.
Results	The facility turned out to be extremely popular with the public. The District originally estimated an annual participation rate of about 4% of the households per year (about 40 cars per day) based on temporary one day collection events that had been held in the community. During the first year of operation, participation rates have been more than double the original projection at over 8%, with over 100 cars per day, visiting the facility on many days. The Reuse Room has also been extremely popular with 4,000- 5,000 containers a month being given away at a substantial cost savings over disposal. Concentrations of pesticides and other toxic chemicals in the influent

	and effluent wastewater will be measured over time to help gauge the effectiveness of the HHWCF. The District anticipates a gradual reduction as residents become aware of this convenient and environmentally acceptable way of disposing of their unwanted toxic products.
Report	Available upon request. Contact Don Berger at 1-925-229-7259 for more information.
Prepared by Don Berger – Associate Engineer/Engineering Department 1-925-229-7259 dberger@centralsan.dst.ca.us	
Technology 6: Aqueous Cyanide Analysis in Multiple Hearth Furnace Scrubber Water*	
Methodology	The bench top analyzer uses flow injection/photometric detection to measure cyanide in aqueous streams. Split scrubber water samples were sent out for analysis by wet method and then compared to bench top results
Cost of Test	$50,000 for analyzer, $20,000 for labor
Results	The bench top analyzer gave cyanide results in ten minutes, which was very close to the wet method, which took 3 weeks. The bench top analyzer will allow real-time pilot testing of cyanide treatment processes.
Report	Report in progress.
* A bench top analyzer that can analyze cyanide in aqueous samples in under five minutes. Prepared by Randy Schmidt – Associate Engineer/Engineering Department 1-925-229-7333 rschmidt@centralsan.dst.ca.us	

4. How many hours did it take to fill out this questionnaire?

2.

AUTOMATION

Treatment Plant/Facility: **Martinez/Plant Operations**
Your name and position: **Garth Williams, Senior Control System Engineer**
Bill McEachen, Assistant Control Systems Engineer
Phone # of relevant contact: **(925) 229-7252**
Address and email: **5019 Imhoff Place, Martinez, CA 94553-4392**
gwilliam@centralsan.dst.ca.us
bmceache@centralsan.dst.ca.us

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

Since our plant was designed from the beginning (1975) fully automated, our "approach" has been to keep the system reliable while upgrading outdated hardware. The upgrade effort is not quite complete, but when it is, a fresh look will be made at the best approach for the future. So for now, our control philosophy, dictated by the original design, is a dual, redundant, central control computer which handles most all control functions, alarm functions, and historical data storage & retrieval. The field instruments & equipment are wired to remote PLCs which do some interlock type logic but mostly just serve as multiplexors to the central system. There are few backup local controllers and the plan is to use the PLCs more to provide distributed type backup to the central system.

2. What type of control systems do you have at the . . .

Machinery and Equipment

Newer equipment has local PLC control functions as well as parallel central control by either operator MMI and/or MINI computer.

Area system controls such as secondary treatment, digesters, etc.

Only some areas, sludge incinerator, Ultra Violet disinfection, Co-Gen, Standby Power, & Filter Plant have local operator control interfaces. The majority of areas have only a local manual mode as backup to the central control.

Centralized Control Room

The centralized control room is the center for the computerized control system. From the 3 consoles located in the room an operator can monitor and control process and equipment located throughout the plant. The computer system provides all of the control, alarming, and historical trending. (FUTURE) there will be a two-control room scheme used. The primary one will be located in our solids building, the heart of our sludge processing, furnace ops, cogen, and steam facilities. This will be used for swing and grave shifts, potentially

for day shift. A second control room (the existing one) is within the admin offices, with redundant capability to the other.

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	3640 main I/O sys, plantwide another order of magnitude approx.
Digital outputs	=	1280 main I/O sys, plantwide another order of magnitude approx.
Analog inputs	=	1,408 main I/O sys, plantwide another order of magnitude approx.
Analog outputs	=	560 main I/O sys, plantwide another order of magnitude approx.
Control loops	=	175 main I/O sys, plantwide another order of magnitude approx.
These are points getting to central system. There are about 15,000 I/O points connected to the PLC.		

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

Yes.

List other automated flow regulation.

Waste and Return Activated Sludge.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

Alarms can be generated by monitoring of an analog or discrete signal, by an output of one of the PLCs, and by the computerized control system. Alarms that are generated by monitoring of the signals are usually annunciated at local alarm panels distributed throughout the plant. Alarms that are the result of a PLC output are generally annunciated at the backup panel level and can be inputted to the computerized control system. The majority of the alarms are generated by the computerized control system and are annunciated and displayed on alarm summary pages by the system, sorted by alarm type. It is essential to have alarming associated with the health of the overall PLC LAN including fiber optic components.

There are four different alarm categories. These are operator notices, analog alarms, discrete events, and discrepancy conditions. If designated critical, an alarm will refresh/resound until acknowledged.

Equipment Start and Stop

Most equipment can not be started and only locked out locally. Primary Start/Stop is from the computerized control system.

Process Data

Very little process data is displayed locally at the transmitter. For the most part the data are not graphed or retained at these locations. Process data can be viewed, graphed, stored, processed and retrieved through the computerized process control system.

Equipment run hours

Equipment run hours are sometimes via local run time hour meters but are mostly computer tracked via equipment run status and stored by the computerized control system and can be retrieved for maintenance purposes.

6. Describe how your system archives information.

Information is archived through a redundant pair of minicomputers. The minicomputers are programmed to request current values of process data from the computerized control system at one-minute interval. The returned data are then archived.

At the end of the day the data are processed to compute totalized values, highs and lows and then compressed and written to disk. The data can be retrieved numerically and graphically. Preprogrammed reports and plots are also generated daily. Alarm and events generated by the computerized control system are also stored on the PC LAN. (Future mods) preparing to have automatic shuttle of plant data via a bus PC server to archive on to our PC LAN. Data is also fed to the lab LIMS.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service. Maintenance has several computerized control system consoles located in their area. Plant superintendent and other engineers view data for normalcy/anomalies. Variable trending can feed into work orders re: change in process or signal behavior, when equipment ran, shutdown, unloaded etc.

Operations

Operations uses the system for control and monitoring of the plant process and to monitor the off-site pumping and treatment stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room. Equipment located throughout the plant can be started or stopped and process set points & control loop tuning parameters can be changed from the control room.

The PLC programmer does similar things for any "PLC only" type I/O and is responsible for PLC PID control tuning.

Process Control or Laboratory

Data collected by the minicomputers is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

Engineering

The engineering section uses primarily historical data for engineering studies. The studies may involve plant additions, collection system impacts, capacity studies, pilot studies of new technologies, subcomponent analyses (cyanide, nitrification, etc).

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

See answer to question 15.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

We have migrated and evolved over time mostly on a year-by-year and project basis. Where possible we have tagged modernization efforts onto known capital projects. This "piecemeal" evolution is useful re: manageability, subsequent training, and cost. Through this approach we have been able to upgrade every major plant control component. This includes replacement of older telemetry with PLC LAN, older CRTs with modern HMIs, electrical cable with fiber optic, and data storage and exchange issues.

10. Describe the following . . .

How does your level of automation help with decisions?

The computerized control system makes detailed current and historical information available for use in decision making. Information is available to be presented in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

We benefited from having mainframes with a very effective shelf life as well as computer staff with long tenure from system startup. The approach of stepwise evolution has worked well for us (see answer to Q#9).

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

We use a lot of PID control, mostly feedback type with some feed forward and other algorithms. We almost never use derivatives. We have the ability to view PLC PID control parameters via HMI interface. We don’t do a lot of control optimization. We find the PI settings that give acceptable control and they remain in place. Our most sophisticated control is done by the newest PLC logic, which is adept at having quick, relevant parameters at its disposal (for interlocking and other prerequisite conditions).

How does your system identify and prioritize critical and non-critical condition information?

Alarms can be designated as critical via user setting. The most critical alarming historically has been separated from the main alarm package to dedicated alarm panels (CL2 system, pump station, plant UPS). This is partly to ensure such alarms don't get lost in the shuffle of normal daily handling.

How does your system store critical and non-critical condition information?

Handling of data storage issues are important. What to store, how often, how the information will be disseminated and integrity are just a few of the key areas. In general data is stored with a time date stamp as well as other bit flags such as a bit to indicate that the data point is invalid (due to say calibration or out-of-service condition). Simple information such as the ability to consistently follow changes to analogs such as their range, location in the database etc are important. Collection system must be able to connect the historical history for an I/O point despite such changes.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

Decide up front the overall philosophy regarding system management. Specifically, tradeoffs such as off-the-shelf plug and play system versus the desire/capability to evolve the system in-house over the years. Our mainframes, while custom, provide the ability to evolve over 25 years to changes in the plant. This seems counter to present industry trends. Obviously one must consider all potential interfaces related to data exchange with our customers, networks etc. Clearly automated control such as VFD's are invaluable. The quick response of PLC-driven control can be an absolute necessity.

12. What are your future plans?

Our future plans are to move to an open architecture system in place of our mainframes. We use quite a mix of equipment, it would be desirable down the road to standardize more within the confines of our contract/bid requirements. We utilize strictly Modicon PLCs but several makes of HMI (Eaton-IDT, Wonderware, other pre-packaged).

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

Most maintenance on the system is performed by in-house personnel. Expansions of the system have involved a mixture of in-house and vendor personnel. The only maintenance that is jobbed out is maintaining the DEC minicomputer hardware. Only major operating system rev level upgrades would involve consultant. Consultant will be used to derive our evolution to open system architecture from our existing proprietary system (Modcomps). We also have PM/emergency response contract w/ pseudo Modcomp tech group as a backup to our Senior CSE being on beeper.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

Major modifications to the control systems have accompanied major plant expansions and have been designed by the consulting engineering firm handling the expansion or their designee. The computerized control system was originally designed and contract bid documents prepared by a consultant specializing such systems. Subsequent operating system rev level change by consultant. Non PLC code additions and changes are made by in-house staff (CSE) on mainframe. New PLC logic for new projects as well as other changes, additions are done primarily by the Process Control engineer. Some ancillary PLC logic mods are made by instrument techs.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

Current approach quite different from the future. Current is labor intensive, involving visiting and testing at each facility weekly with 24 hour coverage via on call operators. Problems exist with not all desired I/O one wants available via our main remote monitoring system. Separate, standalone monitoring, I/O and alarming exist for these pump stations.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

No but we plan to.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

Yes. All CSE's have access from home. One access path is to mainframe operating system and its mass storage drives.
Another access is via standard terminal emultion (ie PC Anywhere) to PC's that can also tie into the mainframe and HMI shells.

18. How many hours did it take to fill out this questionnaire?

Approximately 8 hours.

ENERGY

Treatment Plant/Facility:	**Martinez/Plant Operations**
Your name and position:	**Jim Belcher, Senior Engineer**
Phone # of relevant contact:	**(925)229-7211**
Address and email:	**5019 Imhoff Place , Martinez, CA 94553-4392** **jbelcher@centralsan.dst.ca.us**

1. What is your average plant demand in 1996, what was your peak kVa and total annual electric power costs for the year?

Our facility produces most of its consumed power on site. The answer is the sum of imported and self generated power. 3212 Mw,4503.75 KVA, $364,464 for imported power only.

2. Purchased from?

Pacific Gas & Electric.

3. Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.

We use a Solar Centaur gas combustion turbine, nominal 3300 kw, fired on natural gas to provide on site power and steam. The turbine is base loaded except for low flow periods at night. Two 1600 kw diesel generators provide additional back up but are not used for peak shaving.

4. Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.

We have full access to open market power now. We are currently paying fees for stranded investments, averaging $13,000 per month. This extends to 2003. Currently there seems to be little or no savings to be had on the open market.

5. What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?

We expect to be able purchase power at $.04/kwh at the transformer taps.

6. Describe your implementation of any strategies to obtain market access to power.

We produce most of our power on-site, we have not seen any monetary benefit to open market at this time. We expect that to change in the next five years.

7. What have you done to reduce or control power consumption within your system?

Retrofit install VFD's here practical, require VFD's in all new variable speed equipment. Retrofit and install new high efficiency lighting. Replace old or damaged motors with premium high efficiency motors where warranted.

8. How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?

392,731 decatherms, $1,065,384

9. Purchased from?

Amoco was the gas provider, PG & E was the pipeline owner.

10. Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?

Yes we have access to open markets for natural gas. There are no stranded costs at this time.

11. What do you expect the picture to be over the next five years in your area for gas rates?

Continued stable based on stable world oil market, and new wells.

12. What have you done to reduce gas consumption or improve utilization within your plant?

We consume landfill gas to offset natural gas usage. The landfill gas is available from a nearby landfill and is purchased at a discount off of the burnertip costs of natural gas. Ensure the gas combustion turbine is cleaned quarterly. Put auxiliary boilers on standby when not needed for operations.

13. Describe your implementation of any strategies to obtain competitive priced access to gas.

Solicited competitive bids from interested natural gas suppliers. The last bid period saw quotes from 5 suppliers, negotiate terms with the most competitive suppliers.

14. What other recommendations would you make to other wastewater treatment plants in management of energy purchases and use?

Find alternate to utility monopoly.

15. Attach your electric power and gas rate schedule.

See attachment CCCSD-2a,b,&c.

16. How many hours did it take to fill out this questionnaire?

Two hours.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**CCCSD/Management Information System (MIS)**
Your name and position:	**Mark Greenawalt – MIS Administrator**
Phone # of relevant contact:	**(925) 229-7241**
Address and email:	**5019 Imhoff Place , Martinez, CA 94553-4392** **mgreenaw@centralsan.dst.ca.us**

1. Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?

CAD network/rational database

The Integral Microstation based CAD network is in use, using a Windows NT network. Besides being used for design of pipeline projects, the system is used to maintain the District maps, as built, and "as-is" record drawings. The system and its database capabilities are one of the major record keeping functions of the District. (Bill Brennan – District Manager)

E-mail

The District uses Novell GroupWise for interoffice and Internet e-mail access.

Internet/intranet

The District uses an Internet Service Provider through a firewall and ISDN communication link. The ISP provides Internet access and our web site location. Staff members at CCCSD provide all updates to the web site. Currently, the District is building an Intranet service on an NT Server and hope to have the basic system implemented by 1999.

Automated Timekeeping

Currently, there is no automation of time keeping in the District. In the past the application has been researched but there has been further development for implementation.

Automated Recordkeeping

The Clerk's Office has two systems to capture, index, store and retrieve documents from a record storage facility. The first application is used for the retrieval of documents concerning minutes, projects, financial

reports, personal records, or any record needed to be maintained. The second application is used to maintain records for books and publications used in an established library system.

2. What is the extent of internal access to agency data on-line ?

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?)

None or zero percent for the 97/98 fiscal year. 100% for the 98/99 fiscal year. (Garth Williams)

Breadth and depth of information: What percent of data that would have been tracked in written reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?

Zero percent for the 97/98 fiscal year. 90% for the 98/99 fiscal year. (Garth Williams)

3. Maintenance management system (or related functions).

What type of Maintenance Management system do you use (application, company)?	J.B. Systems "Mainsaver" AS-400 Version 16
Please list several major features of your Maintenance management system.	Equipment Data Equipment History Workorder Tracking Workorder Planning Preventive Maintenance Parts (Spares) Warehouse Management (Not Used) Purchasing (Not Used) Dispatch Module (Shop Floor) Reporting Cost Accounting
When did you implement your MMS?	Went on-line in June, 1997
What was the cost of purchasing/implementating (not including user/operator training)?	Purchasing software and some specific hardware $70,000.00.
What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).	$5,222 per year service agreement
Service request tracking system	Our CMMS, JB Systems Mainsaver, utilities work orders for service requests made to the Plant maintenance division. These work orders capture work requested, work done, failure and action codes, and costs.
Predictive maintenance scheduling	We are currently scheduling and tracking PM, and predictive maintenance through Mainsaver.
Question 3 answered by: Dale Ohda – Maintenance and Reliability Engineer (925) 229-7212, dohda@centralsan.dst.ca.us	

4. Do you use or plan on implementing on-line O&M manuals?

At this point, we do not have on-line O+M manuals, but it is being considered.

5. What technologies/systems does your agency intend to implement soon?

The District intends to implement an Intranet server, integration between the Financial and Service Request systems and a new LIMS system.

6. Have these technologies/systems been studied and recommended?

Yes, in many cases there are established task force groups to analyze the product or process required.

7. Has funding been appropriated?

8. What plans does your agency have for the integration of servers?

Currently, multiple servers are used to support various applications and network users . Currently, systems are capable of limited interaction.

9. What plans does your agency have for data warehousing (cleansing of the best data)?

Currently, various applications each have separate systems or databases. The Financial system and Warehouse system are being researched for enhancements for sharing data concerning inventory and cost.

10. How many support resources (FTE's) does your agency employ?

The MIS Division has 3 regular employees, one contract employee, and one summer student.

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

Yes, we anticipate a small increase in staff and the use of consultants for various projects. The advancement of our technology will require the increase in support resources.

12. How many hours did it take to fill out this questionnaire?

MIS Administrator – 1 hour.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility: **Jim Belcher, Senior Engineer**
Phone # of relevant contact: **(925)229-7211**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
jbelcher@centralsan.dst.ca.us

1. Discuss the typical transition from project to operating system at your facility.

On large projects a staff engineer from the operations/maintenance group is assigned as the key person to coordinate the project elements with the engineering design group. Most of these large projects are designed by non District personnel, so there are three basic players in the design process. It is the primary responsibility of the staff engineer to accurately convey information in two directions. One, the staff engineer communicates the needs of the Operations Department to the design process and secondly reports the impacts of the design on operations. After the project is bid, awarded, and under construction, the same staff engineer is the coordinator between the Construction Manager/Contractor and the Plant Operations Department. The staff engineers knowledge and understanding gained during involvement in the design process provides expertise when planning for plant shutdowns for construction connections to minimize the impact on operations. The staff engineer coordinates the vendor training and provides the "big picture" training for operations and maintenance personnel. The staff engineer works closely with operations during the end stages of the construction work to certify the mechanical and electrical installation as well as "working out the bugs" on initial start-up. The staff engineer then working very closely with operations coordinates the performance tests and the acceptance tests. The new system is then "turned over" to operations for incorporation into everyday operation, problems arising after this acceptance test are handled as punch list items or warranty repairs.
See attachment CCCSD-3.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Small projects say below $250,000 are designed in house. Larger projects are designed by non District personnel.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

See answer to question 1. On the most recent projects user work groups have been involved in the design input and review process. The process has not been formalized to date.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

Yes staff suggestions are evaluated in the design process and incorporated where appropriate. The project coordinator is usually a "Senior or Associate level Engineer". The staff engineer does not usually make significant level decisions without first checking for support from Operations management.

3. Training

Which of the following types of training are provided?

Classroom (lecture, workshop, etc.)

Classroom training provided on individual pieces of equipment, on processes, and on the "big picture".

Review of O&M manuals

Operations and maintenance personnel are encouraged to review O&M manuals when submitted by the contractor for approval. O&M manual is used for training by vendor.

Video of Operating System

All training sessions as well as some equipment start-up training is video taped. The video tapes are edited and reduced to training videos as refreshers or for new personnel.

Hands On

System training is all hands-on.

Self-paced training manuals

The video tapes are used as self paced.

Computer-based training

The control schematics are all computer generated on screens and are used for training.

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

The contractor is required to provide a certain number of hours of training on each piece of equipment. The training is specific according to whether it is an operations training session or a maintenance group. The vendor normally provides effort. The training is provided at least twice so that all three operating shifts can attend the sessions. The contractor is also required to train on the systems provided per the above description. This procedure is followed religiously.

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

The design consultant in conjunction with the plant staff coordinator provides training on the "big picture" including the control theory. The contractor is responsible for the remainder of the training and he usually relies on the equipment vendors.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

Testing and start-up involves the contractor, inspector, plant coordinator and sometimes the design engineer. Each piece of equipment must be certified ready to start by the supplier before power is applied to the equipment. The equipment is started and problems exorcised until ready for testing. The equipment and/or system must meet a functional test or reliability test then a 7 day performance test to meet the criteria.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

Start-up operation is performed jointly between plant coordinator and contractor. There is a joint ownership of the system during this phase. The plant staff usually operate the equipment especially off shift but only with in a narrowly defined limit. If problems occur the equipment is taken off line.

How is performance testing conducted?

There is a test procedure described in the specifications. The system is put on line. The contractor, consultant and plant coordinator evaluate the performance.

What is done to ensure owner satisfaction by the designers?

Provide easy to operate and maintain systems.

What is done to ensure owner satisfaction by the contractors?

Very little.

What is done to ensure owner satisfaction by the equipment suppliers?

Very little.

What is done to ensure owner satisfaction by the staff engineers?

Follow through after start-up to monitor performance, identify problems and provide corrective measures.

What is done to ensure owner satisfaction by the construction management staff?

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

The testing and start-up phases of the project usually require a system operate 7-days without significant problems. If this is successful and all the training requirements have been satisfied, the equipment is turned over to operations. Subsequent problems are handled by punchlisting or warrantee work.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics)?

Yes, drawings must use symbols that are consistent with the District's standards, the drawings must be available on computer disc compatible with District software.

Have standards been developed for O&M manuals?

No standards.

Have standards been developed for control system software and hardware?

Very specific standards have been developed for hardware, modicon, and interface with the modcomp computer.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

A lot of effort has been directed to obtain accurate as-builts, one method that has worked to some degree is to tie progress payments to the accuracy and completeness of the as-builts as the project is being built. This required the inspector to verify the contractors work.

PREDICTIVE MAINTENANCE

Treatment Plant/Facility: **Martinez/Plant Operations Department**
Your name and position: **Dale Ohda – Maintenance and Reliability Engineer**
Phone # of relevant contact: **(925) 229-7212**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
dohda@centralsan.dst.ca.us]

1. Fill in the following to describe maintenance activities at your facility. This should be a reflection of actual maintenance work being performed, (wrench time so to speak). Do not include training; meetings; breaks etc.

Predictive Maintenance (Vibe; Infrared, etc.)	2%
Preventive maintenance (Lubrication & pm's etc.)	16%
Reactive maintenance (Repair work as a result of failure)	37%
Planned or routine maintenance (General repair work and corrections)	32%
Project support by maintenance staff (CIP support; start-ups etc.)	13%
Other types of maintenance work:	0%

Total approximate maintenance staff hours for FY 96/97.

- Mechanical: 25,760 hr.
- Instrument: 9,200 hr.
- Electrical: 7,360 hr.
- Painter & Building and Grounds: 18,400 hr.

2. Does Your Facility have a Predictive Maintenance program?

Yes.

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

In House Maintenance	Contracted Service

	Function	
Vibration Analysis		X
Infrared Monitoring		X
Lubricant Analysis		X
Ultra Sonic Testing	X	
Other (please describe) _____ .		
Equipment Run Time Monitoring - Overhauls based on Hr. Meter	X	

Do your "in-house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis		
Infrared Monitoring		
Lubricant Analysis		
Ultra Sonic Testing		X
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed
Vibration Analysis	X	
Infrared Monitoring	X	
Lubricant Analysis		X
Ultra Sonic Testing		X
Other (please describe below)		

OFF-SHIFT STAFFING

Plant Operations Department
Your name and position: **Steve Colberg – Shift Supervisor**
Phone # of relevant contact: **(925)-229-7270**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
scolberg@centralsan.dst.ca.us

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

The Central San treatment plant is staffed 24 hours per day, 365 days per year. There are five operations crews: dayshift; swing 'a'; swing 'b'; grave 'a'; grave 'b'. The shifts all work 8 hours. The graveyard shift is from 2330 to 0730. Day shift is from 0730 to 1530. The swing shift works from 1530 until 2330.

Each crew works 10 days straight and then is off for 4 days. This 2 week overlapping cycle is as follows:

	S	M	Tu	W	Th	Fr	S	S	M	Tu	W	Th	F	S
2330 – 0730	**Gb**	**Gb**	**Gb**	**Gb**	**Gb**	**Gb**	**Ga**	**Ga**	**Ga**	**Ga**	**Ga**	**Ga**	**Ga**	**Gb**
0730-1530	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**					**D**	**D**
		Sb	**Sb**	**Sb**			**Sa**	**Sa**	**Sa**					

				Ga	Ga	Ga					Gb	Gb	Gb	
1530-2330	Sa	Sa	Sa	Sa	Sb	Sb	Sb	Sb	Sb	Sb	Sb	Sa	Sa	Sa

The grave and swing crews work 3 dayshifts on every two week cycle. The extra crews on dayshift can do cleaning, training, or special assignments. Each crew has one shift supervisor, 2 operator III's and 2 operators I/II's, Soon we will have 3 operator III's per shift and 1 operator I/II at the completion of the current operator II to operator III training program. Minimum staffing on the off shifts is 4 people.

2. Describe the following:

Grade levels and required expertise for off-shift operators. How does this compare to state requirements?

We require operator I's to obtain a state grade I during their probationary period. Likewise, operator II's and III's need state grade II's and III's respectively. Shift supervisors need state grade IV's and the plant superintendent of operations is required to have a state grade IV. Our requirements exceed the state's mandate for operator certification.

Staffing by process area during off-shifts: What numbers do you staff where?

With a 4 person crew, the shift supervisor works the main computer room, one operator III operates the secondary and primary/ headworks areas, another operator III operates the sludge incineration, boilers, and cogen operation. The operator I/II operates the sludge centrifuges. A fifth operator on this crew would work the primary headworks area.

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	Pump station alarm panel in computer room
Troubleshooting of systems/equipment	X	
Emergency response		
Process adjustments	X	
Process sampling	X	Boiler feedwater chemical
Process testing	X	Analysis
Laboratory testing		
Preventive maintenance of equipment		
Equipment repair		
Isolation/shutdown of systems/eqpt.	X	
Coordination of maintenance work	X	Superintendent does this
Construction contractor support	X	One shift supervisor does this full time
Development of monitoring reports		
Buildings & grounds maintenance		
Plant security		
General Housekeeping	X	Hosing, weirs, etc..

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

The sludge incineration process requires continuous operator attention. The boilers associated with the incineration and cogeneration process require that a qualified operator be nearby at all times to respond to boiler alarms. During wet weather conditions, our 4 man minimum staffing standard is increased to 5 operators per shift.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

Operators are expected to find their own coverage and submit a request for leave 2 weeks in advance. To facilitate finding coverage, notices are posted in the main computer room. Operators wishing to provide shift coverage sign their names on these slips. For sick leave, operators are instructed to notify the computer room as soon as possible. Operations training is done on double or triple-staffed dayshifts, although the

crane crew may be asked to stay over or the swing crew come in early on overtime. Emergency leave is handled on a case-by-case basis.

Other scheduling procedures and policies

The operators conceived this long-standing shift schedule which includes working 10 consecutive days without a day off and a double back from day shift to graveyard every two weeks for each graveyard crew. Shift assignment is by seniority with management right to over ride. Shift supervisors change crews annually.

3. **Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.**

   No. One maintenance mechanic is on-call, receives standby pay and is given a pager. One lab technician works on Saturday and Sunday dayshifts.

4. **What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.**

   We hope to reduce that shift staffing to 3 people by increasing equipment automation and reliability.

5. **Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?**

   The current Memorandum of Understanding (MOU) is attached (See attachment CCCSD-4). Nothing in the MOU hinders our effort to reduce back shift staffing although the District has agreed to meet and confer in good faith with the employee union. (Section 2.1)

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   We recently changed our effluent disinfection process from chlorination-dechlorination to ultraviolet disinfection, in part, to allow a reduction of 1 operator on each shift. (Higher staffing was required for chlorine and SO2 emergency response.) Further cutbacks will be the result of improved process and equipment automation and reliability.

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   Unattended operations are unfeasible due to operator-intensive nature of our sludge incineration process.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**Plant Operations Department**
Your name and position:	**Steve Colberg – Shift Supervisor**
Phone # of relevant contact:	**(925)-229-7270**
Address and email:	**5019 Imhoff Place , Martinez, CA 94553-4392** **scolberg@centralsan.dst.ca.us**

1. **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]**

   The operations and maintenance groups are specialized and overlap very little.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attachment CCCSD-5a&b.

3. **Do you have a single manager over both operations and maintenance?**

   Yes, the plant operations and maintenance division managers both report to the same individual; the director of plant operations.

4. **What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance?**

   (From attached handouts)
   - Operations 22/6 = 3.67

- Maintenance 28/5 = 5.6

The electrical and instrument shop each employ one contract employee.

5. Which of the following "maintenance functions" are performed by operators?

Task		Comments
Routine preventive maintenance		
Repair of equipment		
Predictive maintenance activities		
Process modifications	X	Directly involved in modifying the ash and lime system
Non-process modifications		
Cleanout/isolation of systems/eqpt.	X	We isolate, lock out, tag out, and drain
Cleaning and calibration of instruments	X	Cleaning and adjustment of turbidity, Cl2, and pH meters
Simple electrical repairs		
Maintenance of automatic samplers		
Computerized maintenance mgmt.		
Vehicle service		
Buildings & grounds maintenance		
General Housekeeping	X	General cleanup

6. What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?

None. The pumping station crew is not required to be overturned but they perform operating and maintenance tasks. Four of the six people are certified as operators.

7. Do you offer incentive programs to encourage cross-training?

Not between operations and maintenance. We do have an operator I, II, II advancement program to promote cross-training within operations.

8. Provide a copy of your current salary structure for operations and maintenance personnel.

Faxed copy (3 pages). Notes:

- See Organization Chart (Q # 2) for ID description
- Values are dollars per month excluding benefits
- Step A is entry salary
- Step B is salary after 6 months
- Steps C – E are salaries every following year
- Longevity is 2.5% salary increase after working 10 years

9. What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?

None. The operations staff has shrunk over the last several years and is more specialized than before. We are more concerned with combining operation job skills by increasing the ration of Operator IIIs to Operator I/IIs due to the operational complexity of this plant.

10. Cross-functional process-based work teams:

Do you either currently have or plan to implement cross-functional process-based work teams?

No.

11. How many hours did it take to fill out this questionnaire?

One.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility: **Martinez/ Plant Operations Department**

Your name and position: **Doug Craig/Plant Operations Division Manager**
Phone # of relevant contact: **1-925-229-7284**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
dcraig@centralsan.dst.ca.us

1. **Is your agency/has your agency considered re-engineering your work practices and organization structure using:**

   Workforce flexibility?

   Yes. The agency has minimal numbers of major crafts (4). Workscope is broad within crafts. Utility workers and operations staff assist craft personnel. Operations staff perform certain routine maintenance tasks.

   Skill-based pay?

   Yes. Crafts paid for demonstrated skills within their craft as defined by agency. Five step day progression within each craft classification. Electrician paid for demonstrating basic instrumentation skills.

2. **In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, " Combined Operations and Maintenance," to clarify the scope of this question.]**

   How many trades or disciplines are in your current structure and what are they?

   Refer to the organizational charts for a breakdown in disciplines.

   Do trades cross technical boundaries? If yes, please describe their interaction.

   The trades cross technical boundaries to a minor degree and at other times when work needs require immediate response. Cross training is being considered as an approach for future transition.

3. **What is your agency's definition/interpretation of workforce flexibility?**

   - Doing work outside what has been a traditional jurisdictional boundary.
   - Doing work requiring training and skills over and above employee's normal job description/scope of work/work area.

4. **Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.**

   There is no formal plan, but CCCSD does plan to "blur" the lines between Operations and Maintenance by beginning to assign some more light PM activities to operators.

5. **Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?**

   There are no formalized plans to recognize the current structure. However, we have been downsizing by attrition for five years. When a position becomes vacant, we explore other options to complete the work and in some cases, simplify the organizational structure.

6. **What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)**

   Our "demonstration project" has been in our electric shop, where training was provided on principles of basic instrumentation, variable frequency drives, specific process instrumentation presently in service, using PLCs, and fiber optic technology. Practical and written tests were administered to qualify personnel for increased pay.

7. **What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?**

   Refer to question 6: The electricians now receive the same pay as the instrument techs.

8. **What skills, goals or objectives does your agency intend to "incentivize"?**

   The agency has no intent to further incentivize skills, goals, or objectives.

9. **How many hours did it take to fill out this questionnaire?**

   Five hours.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility: **Martinez/ Plant Operations Department**
Your name and position: **Doug Craig/Plant Operations Division Manager**
Phone # of relevant contact: **1-925-229-7284**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
dcraig@centralsan.dst.ca.us

1. **Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisor's unionized? Is the shop open or closed? What is the umbrella union organization(s)?**

   The District is unionized. The general employees are members of the Public Employees Union Local No. 1. The supervisors and confidential employees are in a bargaining unit titled "Management Support and Confidential Group." Both shops are closed.

2. **On what issues do your unions meet and/or negotiate with management**

   Answers 2 and 3 prepared by: Darlene Ross – Human Resources Analysist, 1-925-229-7309, dross@centralsan.dst.ca.us

   Beyond any and all issues related to wage, hours, and working conditions, CCCSD is in the fourth year of a Work Redesign effort which utilizes teams of cross-functional, cross-departmental, cross-bargaining unit members to improve work processes, solve problems etc.

3. **If your answer to 2 (Previous Question) discussed issues outside the traditional hours, wages and working conditions as part of a MOU or Contract, please discuss the formation, structure, roles and empowerment of this process and/or committees.**

   In addition, the District has created labor-management task forces to research, investigate and discuss issues and make recommendations to the Board as to management and all employees for such decisions as:

   - Selection of new medical health plans
   - Success sharing program (similar to profit sharing)
   - DOT drug testing implementation.

4. **Are you working with your union on competitiveness? If so, please describe.**

   There have been more discussions on competitiveness with the unions as a part of discussing labor–management issues. We have not had specific meetings focusing on only competitiveness.

5. **Are you involved with labor on training programs?**

   Not specifically, but we are having discussions on training needs and it may result in a technical training committee.

6. **Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?**

   We have had discussions on interest-based bargaining and, as stated in a previous question, we are experimenting with a task force in resolving a complicated issue using principles similar to interest based bargaining. Its too early to predict the success of the task force.

7. **What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?**

   In addition to the above effort, we have stepped up our efforts to improve relationships and methodologies for resolving areas of disagreement. Improving our relationship with the employees has been identified as a strategic issue in our current strategic planning process.

8. **How many hours did it take to fill out this questionnaire?**

   Less than 1 hour.

FLEET SERVICES

Treatment Plant/Facility: **Collections System Operations**

Your name and position: **John Larson, Director of Collection System Operations**
Phone # of relevant contact **(925)-229-7150**
Address and email: **5019 Imhoff Place, Martinez, CA 94553-4392**

1. Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:

Sedans	17
Pick-up trucks	34
Vans currently in use as commuter vans	0
Vans, general pool and other	3
Solids hauling trucks	0
Trucks equipped for in-plant and collections maintenance purposes	10
Other (describe)	40
Dumps, utility, water, boom	
Electric Carts	0
Bicycles	0

2. What is your current vehicle replacement policy?

- Sedans: 10 years and average age 5.
- Pickups: 12 years and average age 7.
- Other: Case-by-case basis.

3. Do you have a replacement fund?

Yes.

4a. Have you made any recent reductions in the fleet?

No.

4b. Are you planning on doing so in the near future?

Yes.

4c. What is the approximate annual savings achieved by the reductions?

Negligible (offset by reimbursement to employees).

5. Have you experienced any adverse impacts from the reductions in fleet size?

No.

6. How are your fleet vehicles serviced? (In-house or by external contracts?)

In house.

7. What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.

Serviced on 4 month intervals. The basis is that mileage/ use fluctuates by season and that since none of the mileage exceeds 5,000 per 4 month interval.

8. How many Fleet Services staff support the fleet?

Three.

BIOSOLIDS REUSE/DISPOSAL 1.F.8

Treatment Plant/Facility: **Plant Operations Division**
Your name and position: **Randy Grieb, Process Control Engineer**
Phone # of relevant contact: **(925)229-7267**
Address and email: **5019 Imhoff Place , Martinez, CA 94553-4392**
rgrieb@centralsan.dst.ca.us

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. Differentiate work done by staff and contractors. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)**

   The dewatered sludge leaves the centrifuges and drops into hydraulically driven reciprocating piston pumps. These pumps pump the sludge into an 11 hearth multiple hearth furnace where the sludge is incinerated. The ash removed from the furnace is loaded into trucks and hauled to landfill. All of the routine work is by staff except hauling and disposal of the ash. Contractors perform major work such as refractory repair on the furnace.

2. **Annual production:**

   Wet and dry tons by class A, B & C and total

   CCCSD processes about 186 wet tons per day of biosolids. This is equivalent to about 45 dry tons per day. The product, which leaves the plant is ash, not sludge, so the classes of sludge do not apply. The sludge being incinerated is unstablilzed with very low metal content.

   Does the system meet "exceptional quality" for metals? Y or N Comment?

3. **Costs:**

   1997 total operating cost for the program including direct administration, lab support and maintenance including contract costs.

   $1,500,000.

4. **Capital Investments in dollars associated with the biosolids program:**

   Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.)

   The estimated cost of the incineration process is about 40% of the plant cost in 1977. This would be about $37 million dollars. The depreciated value is therefore about $18 million dollars.

   Equipment (Tractors, trailers, spreaders, etc.) N/A

   Land. N/A.

5. **Revenue from use (fertilizer value, energy production, crops, etc.)**

   Does not apply.

4. **What are the number of FTEs in program including administration, operations, maintenance, other.**

   7.

5. **Describe your major reuse customers or approaches including wet and dry tons to each and class of product. Include customer/contractors.**

   Ash is landfilled so there are no customers.

6. **Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?**

   We are looking at different reuse alternatives for the ash and ways to improve the incineration process.

7. **Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.**

   State Law 2588 study was performed to verify that there was no more than 10 –5 health risk to any neighbor. It was found that there was no net increase in cancer risk to the most exposed individual. We are always under watch from the Bay Area Air Quality Management District for visible emissions and must meet other air quality criteria.

CITY OF LOS ANGELES BUREAU OF SANITATION, HYPERION TREATMENT PLANT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Hyperion Treatment Plant/Department of Public Works**
Your name and position: **Lucy Jao – Laboratory Manager II**
Phone # of relevant contact: **(310) 648 - 5262**
Address and email: **12000 Vista Del Mar, Playa Del Rey. CA 90293**
e-mail address: lkj@san.ci.la.ca.us

1. **Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.**

   See attachment: SHTP-DSC, STITP-DSC, SLAG-DSC, and STWRP-DSC.

2. **Have you made any recent reductions in laboratory analyses or are you planning on doing so in the near future? What were they (e.g. process) ? What is the approximate annual savings achieved by the reductions?**

   Yes, we have been working on reducing process-related laboratory analyses annually for the past several years and the savings realized have been substantial. The process that we used to reduce were as follows:

   - Determine the number and frequency of each process-related laboratory analysis;
   - Check the variability of results for each type of test and its frequency; and
   - Determine the intended use of this test by the client.

   We looked for tests that met the criteria where the results varied little within a certain range, and the frequency could be reduced or the test eliminated without negatively impacting the operation. We would then meet with the operational staff and plant managers to discuss our proposals. By mutual consent, we reduced many of the tests that were not providing useful information. The workload of our process control section decreased by 28% from 1993 to 1996, although this reduction included the closing down of the Carver-Greenfield process. The overall reduction amounted to approximately $150,000.

   We are developing a strategy to conduct a more objective study to achieve further reductions. We plan to involve plant operational personnel to develop quantitative criteria to help focus on the areas with the greatest potential for reduction.

3. **Have you experienced any adverse impacts from the reductions in process-related analysis?**

   So far we have not experienced any adverse impacts from the reductions in process-related analysis because we have been conservative in cutting the tests to ensure that the operation staff has sufficient data to operate the plant effectively. There are potential opportunities to further reduce lab data by supplementing lab data with additional on-line monitors.

4. **What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.**

   Operators perform settleable solids test for 5-Mile effluent samples and total solid test for sludge in the field.

   We have not assessed the cost of any analysis being performed by operations vs. laboratory personnel because we had not anticipated any increase in plant operator performing lab analyses other than a few field tests.

5. **Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).**

   See attachment : SHTP-LGL, STITP-LGL, SLAG-LGL, and STWRP-LGL.

6. **Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?**

   Yes, in our 1994 NPDES permit renewal process, we were successful getting some reductions in our ocean-monitoring program for Santa Monica Bay from the Los Angeles Regional Water Quality Control Board. The following is an itemized reduction and increases in the new permit. The total net annual cost saving as a result of changes was $172,004.

Santa Monica Bay Ocean Monitoring Program				
Tests	**Number per Year**		**Changes**	**Total Cost Saving**
	1993	**1996**		
Infauna Sampling, Sorting, and ID	132	108	-24	$9,360
Trawling	48	56	8	($924)
Rig-Fishing	48	79	31	($4,402)
Crab Pots	36	45	9	($747)
Dissection Rig and Trawl	696	607	-89	$890
Micro-layer	24	0	-24	$9,888
Water Quality	1836	519	-1317	$140,919
Current Meter	0	9	9	($24,480)
Annual Report a	1	½	-1/2	$41,500
Total				$172,004

The requirement for submitting annual assessment report became bi-annually in the 1995 NPDES permit.

7. Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.

Yes, we are in the process of evaluating data accumulated since 1987 and assessing data variability. Any monitoring that is not expected to produce new information will be proposed to be reduced and/or eliminated. Furthermore, power analysis will be used to assess the adequacy of monitoring frequencies. Any monitoring that is more frequent than necessary to produce needed information will be proposed to be adjusted. In addition, Hyperion Treatment plant will be provide full secondary treatment by December 31, 1998. With full secondary treatment the effluent will have less impact to the receiving water environment. We are planning to use this fact as additional justification to negotiate with the Los Angeles Regional Quality Control Board to further reduce our receiving water monitoring effort.

8. How many labs do you have in your agency? What are the functions of each?

We have four process control labs, two chemistry labs, one air lab, and one biology lab. The four process labs, located at each treatment plant, provide support to the operational staff by monitoring the performance efficiency of each unit process through testing of conventional pollutants. The chemistry labs, air lab and biology lab are providing support to all activities within the Bureau, such as sour e control and pretreatment programs of the Industrial Waste Management Division, NPDES legally required monitoring tests for all four treatment plants and their respective receiving water, land fill operation, and stormwater programs, etc.

9. How many hours did it take to fill out this questionnaire?

Three hours.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility: **Hyperion Treatment Plant/Department of Public Works**
Your name and position: **Hassan Rad – Sanitary Engineer Associate I, Ben Attai – Mechanical Engineering Associate I, Dwight Riley**
Phone # of relevant contact: **(310) 648-5240**
Address and email: **12000 Vista del Mar, Playa del Rey, CA. 90293**

1. Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding)utilized to investigate and test this technology.

The Bureau of Sanitation, uses several resources including the Bureau of Engineering and its consultants; research JACs (Joint Action Committees). Sanitation's Process Engineering group and plant vendors. Funding is done through O & M as well as capital improvement funds.

2. List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).

Technology 1: Carver-Greenfield process-- Biosolids Drying Facility	
Methodology	Drying of sludge: C-G Prototype system
Cost of Test	$55,000,000.
Results	Unsuccessful project due to high operating and maintenance costs, equipment breakdown, severe pluggage & erosion and unreliable system.
Report	Several reports available from EED (Environmental Engineering Division, Bureau of Engineering). Contact Tim Haug, Division Manager, at (310) 524-8300
Technology 2: Steam Dryers-- Alternate method of drying sludge	
Methodology	Use of steam in direct contact to dry sludge in a pilot project.
Cost of Test	$25,000,000
Results	Economically not competitive with biosolids hauling; inherent design flaws.
Report	Reports available from EED (Environmental Engineering Division, Bureau of Engineering). Contact Tim Haug, Division Manager, at (310) 524-8300 Wastewater Engineering Services: Omar Moghaddam, Sr. Engineer, (310) 648-5423.
Technology 3: UV disinfection of wastewater-- UV testing	
Methodology	Pilot testing of UV disinfection versus use of hazardous chemicals for the disinfection of wastewater.
Cost of Test	To be determined.
Results	Test still ongoing
Report	Being generated by WESD (Wastewater Engineering Services Division, Bureau of Sanitation). Contact Gil Garnas, Division Manager, at (213) 485-1808
Technology 4: Nutrients removal of wastewater effluent-- Biological nutrient removal	
Methodology	Field test at Terminal Island Treatment Plant (TITP), D.C. Tillman Plant (DCT), and LA-Glendale Water Reclamation Plant (LAG).
Cost of Test	At TITP: minimal At LAG: $100,000 At DCT: $750,000
Results	For TITP: achievable, successful For LAG: awaiting construction For DCT: awaiting construction
Report	TITP: available from Y.J. Shao (310-548-7520) LAG: pending DCT: pending
Technology 5: Sludge blanket detection-- Automatic control of sludge pumping system.	
Methodology	Pilot field testing.
Cost of Test	Zero
Results	Successful at Hyperion. Additional testing at outlying plants pending.
Report	Available from Hassan Rad of Hyperion Treatment Plant (310-648-5240).

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

Hyperion Treatment Plant is planning to test new equipment such as: TSS and BOD on-line analyzers to automate existing equipment; WAS Thickening using gravity belt thickeners; Class A biosolids feasibility study; wet cake pumping; new odor scrubber technologies including biotrickling filters, catalytically-activated carbon, nickel catalyst for VOC removal and chemical reduction and various monitor/controllers for chemical reduction; auto-sampler installation; in-vessel composting, and lime stabilization for biosolids reuse.

4. How many hours did it take to fill out this questionnaire?

Three hours.

AUTOMATION

Treatment Plant/Facility: **Hyperion treatment Plant**
Address and email: **12000 Vista Del Mar, Playa Del Rey, CA 90291**
ced@san.ci.la.ca.us

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The Wastewater Program's goal is to achieve full automation of all facilities to achieve optimum efficiencies.

2. What type of control systems do you have at the . . .

Machinery and equipment

- PLC (some with HMI software)
- DCS
- RTU
- Loop(s) Controller

Area system controls such as secondary treatment, digesters, etc.

- SCADA system
- PLC networks (Wonderware, Genesis, etc.)
- DCS

Centralized control room

- PLC plant network
- DCS network

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	10,300
Digital outputs	=	6,500
Analog inputs	=	6,500
Analog outputs	=	6,300
Control loops	=	11,100

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

Yes. ORP meters are installed at all facilities to regulate the chemical flow such as hypochlorite, chlorine, sulfur dioxide, bisulfite, etc.

List other automated flow regulation.

- Influent flow division into 4 primary batteries proportionately.
- Gas flow into storage tank and overflow to gas burners
- Gas/air flow into gas burners
- Primary effluent flow divided between Secondary Treatment and Effluent
- Effluent Pumping Plant flow to ocean
- Sludge flow from Primaries Wetwell to Digesters.
- Oxygen flow to Reactors.
- Steam flow to digesters.

- Disinfection
- Filter Flow
- De-Chlorination
- RAS

For LA/Glendale Plant:

- Influent flow regulated by set point or level control.
- RAS flow paces with influent flow.
- Filter flow regulated by level control.
- Primary sludge flow regulated by timer.
- WAS flow regulated by set point.
- Reclaimed water flow regulated by storage tank level and dist. System pressure.

List applications of automated alarms (notice next question).

- Compressor systems, such as Air, Gas, and Nitrogen.
- Chemical storage and metering.
- Gas Flares operation and system.
- Gas Turbine operation and system.
- Primary tank operation.
- Centrifuge operation.
- Polymer to Centrifuges operation.
- Fire system
- Low Flow
- High flow
- Pump failure
- Low & High chemical
- Turbidity
- High Chlorine Resid.
- Blower failure

For LA/Glendale Plant:

Priority #1 Alarms: Standby operator must acknowledge the priority #1 alarms with 15 minutes, otherwise the plant goes into automatic flow bypass mode. The follow are established in the control system as the priority #1 alarms:

- High chlorine residual to the river.
- Barscreen failure.
- Chlorine water champ failure.
- Process air blower failure.
- Primary pump failure.

Primary #2 Alarms: Standby operator is required to log in the laptop computer, assess the plant status and take action if required. The following are considered priority #2 alarms:

- Plant air system low pressure.
- High final effluent turbidity.
- PLC Ethernet unavailable.
- PLC processor failure
- Hypochlorite chemical area flooded.
- EVRS sewer gate position problems.
- Plant HPE flow problems.
- High influent flow.
- High filter pump wet well level.
- High secondary effluent turbidity.
- High chlorine residual in chlorine contact tank effluent.
- Low WAS flow.
- Too high or too low bisulfite flow.
- Headwork inlet level (too high or too low)
- Reser. Level less than 7 ft.

Priority #3 Alarms: These alarms are not critical. Almost all I/O points (except these listed as Priority #1 and Priority #2 alarms) are alarmable. Currently more than 125 alarms are set up in the plant's I & C system.

- All I/O points are alarmable.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

- Central Control Room
- Paging software (for on-call person)
- Historian
- Local Control Pannels

Equipment Start and Stop

See answer to 5a.

Process Data

See answer to 5a.

Equipment Run Hours

- Central Database
- Local Control Panels
- Control loops

NOTE: See Los Angeles Glendale Alarm Status List (attached).

6. Describe how your system archives information.

- Optical disk
- Centralized Relational Database (WISARD)
- Laboratory Information Management System (LIMS)
- Historical Drop for the Distributed Control Systems

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting through analysis of the historical data to determine time of failure, events leading up to failure, etc. They also used it to determine current status of equipment such as which pump is in lead or lag or which system is in service.

Operations

Operations uses control system information and a central relational database (WISARD) that has both laboratory and control system data to operate to troubleshoot, optimize the process. Standard PC tools such as Excel are used for reporting and analyzing this data.

Process Control or Laboratory

The operational process control strategy is contingent upon narrow banding various equipment and process parameters. Deviation from standardized parameters does yield erroneous results. That these deviations are acknowledged quickly by DCS, alarms/trends/etc., and brought back into proper ranges is a prime element in stable operations. Laboratory results, along with some control systems data, are distributed in daily WISARD data summaries.

Engineering

The process engineering section uses primarily historical data for engineering studies. They also use it for day to day operational analysis, graphic displays, alarm trends are used to analyze processes, project trends and to perform engineering studies.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

- Sewage lift stations monitored using telephone lease lines and SCADA and DCS systems
- One of the treatment plants is unmanned on off shifts. Critical alarms are relayed via pager to on call staff (OFF SITE). The control system at this plant is monitored by Hyperion over the Wastewater network.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

A joint action committee, called " Automation JAC", was formed in late 1996 to deal with the automation issues in the wastewater system. The members included in the committee were representatives from management, control system engineering, instrument repair shops, plant operations and information system division. The mission of the committee is to optimize wastewater systems through automation. The major tasks are D.C. Tillman Plant I & C Upgrade Project, LA/Glendale Plant's Full Automation & Un-staffed operation Program, Current Wastewater System/Control System Inventory, TITP I & C System Upgrade, and Instrument Standardization. More tasks are being developed to be included in the priority list.

The LA/Glendale Plant has implemented the Un-staffed operation during the graveyard shifts since October 1, 1998. Our approach is to try full automation and un-staffed operation program for three months (From October

1,1998 to December 31, 1998) at the LA/Glendale Plant. Both management and operation will jointly re-evaluate the entire program at the end of three months, and make improvement as needed.

10. Describe the following:

How does your level of automation help with decisions?

Facilitates realtime process operational decisions. One plant is being run unstaffed during the night shift because automation provides, paging for priority alarms, remote monitoring from the Hyperion Plant, and the ability of an on call operator to dial in from home and monitor and adjust the process.

How does your approach to automation affect your ability to modify plant operations?

Changes in plant operations can be made quickly with evaluation of response much more quickly than with manual operations.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

Historical trends and automated reports from our WISARD database containing realtime and laboratory data provide insights into the daily operations that allow more accurate tuning of control loops.

How does your system identify and prioritize critical and non-critical condition information?

- Prioritized alarms
- Color coded/numerical alarms

At LA/Glendale Plant, we categorize alarms into three levels. They are Priority #1 Alarms, Priority #2 Alarms and Priority #3 Alarms. The Priority #1 Alarms are the most critical ones. If the alarms are not acknowledged or problem(s) associated with the alarms are not resolved, the plant may violate the NPDES Permits. The Priority #2 Alarms are less critical, but the operator must log in the computer to assess the plant status and take action if required. The Priority #3 Alarms Are not critical and will not cause any treatment upset or permit violation if not dealt with immediately.

How does your system store critical and non-critical condition information?

- Distributed Control System Historian computer
- Central Relational Database (WISARD) that stores laboratory results and data from the plants process control computers that is automatically collected.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

- Use benchmarking and best practices
- Use simple solutions when possible (for example, avoid the tendency of "over instrument" processes)
- Enhance networking and connectivity
- Utilize industry standards (ethernet, modbus, TCP/IP, PCs running Windows NT or Windows-95, etc.)

12 What are your future plans?

- We are working on increasing levels of standardization in the area of PLCs, instrumentation, and other control system and network components.
- We intend to increase the use of networking, connectivity, remote monitoring, and evaluate going to unstaffed operations during night shifts at two more plants operated by the City.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

- Server and PC hardware maintenance is out-sourced
- Networks are maintained by in-house Systems Staff
- Control system maintenance is done by Instrument technicians and control system engineers
- board repair is out-sourced

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

- Major control system replacement projects (such as a complete replacement of the Distributed Control System at our DC Tillman Plant) are designed by the City's Bureau of Engineering.

- Minor and Major modifications to control systems are designed and implemented by the Bureau of Sanitation's Control System Engineering Group, the centralized System Division, and Instrumentation staff. CS vendors, based on designs done by these groups, often perform major improvements.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

- Alarm paging
- Dial in from offsite
- Automatic bypassing
- Prioritized alarming
- Redundant standby
- Remote monitoring

See Los Angeles Glendale (LAGWRP) OPERATION INSTRUCTIONS for unstaffed shifts (attached).

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

The LA-Glendale plant uses auto-paging of alarms during the hours the plant is staffed to alert operators to problems while they are doing rounds around the plant. During unstaffed hours auto-paging is used to send priority alarms to the operator that is on call.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

During unstaffed hours the on-call operator for the LA-Glendale plant can dial into the control system from home using a City supplied laptop. This person can acknowledge alarms, monitor the process, and control the process using the laptop through this dial-in connection.

How many hours did it take to fill out this questionnaire?

30 hours.

ENERGY

Treatment Plant/Facility: **Hyperion Treatment Plant/Department of Public Works**
Your name and position: **Omar Moghaddam – Sr. Engineer, Ben Attai – Mechanical Engineering Associate, Anson Solem - Electrical Engineer Associate**
Phone # of relevant contact: **(310) 648-5423**
Address and email: **12000 Vista del Mar, Playa del Rey, CA 90293**

1. What is your average plant demand in 1996, what was your peak kVa and total annual electric power cost for the year?

Plaant	Avg. Demand	Peak demand	Annual Cost
Hyperion Treatment Plant	19,000 kw	22,500 kw	$3,638,180
Terminal Island Treatment Plant	1,662 kw	3,134 kVa	$1,208,215
LAGlendale	870 kw	1,267 kVa	$631,265
D.C. Tillman Reclamation Plant	3,463 kw	5,220 kVa	$2,421,551

2. Purchased from?

Los Angeles Department of Water and Power, a publicly owned municipal power and water agency.

3. Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.

Used on-site power generation (i.e., gas turbine/combined cycle co-generation and internal combustion engines), exported digester gas to the nearby Los Angeles Department of Water and Power's Scattergood Generating Station in exchange with lower electricity rate ($0.013 per kwh compared to $ .056 per kwh without gas exchange). Scheduled start-ups during off-peak hours.

4. **Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.**

   Served by a publicly owned municipal utility agency. Our organization is not eligible to access the open power market at this time. Our treatment plants may be able to have full access in the year 2002, at the earliest. However, a major portion of our electric usage is covered by an energy exchange agreement, with very competitive rates compared to the open market.

5. **What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?**

   A major portion of our imported load (over 67% of total load for all L. A. Sanitation facilities) is covered by a 20 years energy exchange agreement. The average unit rate for this portion is projected to stay below 2 cents/kwh (includes tax, and all other delivery charges). Another portion (6%) of our load is covered under the discounted "Cogen" rate, when fully used, averaging 7.7 cents/kwh. The remaining load is covered under "large industrial " rated averaging 8.4 cents/kwh. However, these rates are expected to decrease to near national average of $.05 per kwh in four (4) years. The Bureau of Sanitation systemwide average cost is projected to stay below 3.5 cents/kwh.

6. **Describe your implementation of any strategies to obtain market access to power.**

   Negotiating with LADWP to secure further energy agreements, similar to what they are planning to offer to their large industrial customers. Also, we're in contact with at least six (6) independent power suppliers. These power suppliers are willing to sell discounted electricity rate, as soon as the local municipal supplier opens its market for competition. Most probably this will not happen until year 2002.

7. **What have you done to reduce or control power consumption within your system?**

   Modified plant processes to reduce the number of equipment on line (cold boxes, mixers, pumps). Decommissioned the co-generation facility (and its auxiliaries), from its continuous, base load duty to an emergency stand-by mode, in favor of Energy Exchange agreement with LADWP. Reduced the operating hours of Effluent Pumping Plant. Used variable frequency drives wherever possible & economical. Improved the performance efficiency of aeration basins by optimizing oxygen transfer efficiencies and reduced the number of running blowers. Reduced gas handling facilities' load demand by reducing overall system pressure. With much larger digestion capacity (over 85 million gallons) available, and a large increase in detention time, Hyperion will be able to change the mixing strategy from continuous to batch.

8. **How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?**

   - Hyperion Treatment Plant's main meter: 3,196,829 therms of natural gas per year.
   - $796,427 per year.

9. **Purchased from?**

   Transportation: Southern California Gas Co.
   Commodity
   - 95-96: Mock Energy Services
   - 96-97: Louis Dreyfuss Corporation
   - 97-98: Los Angeles Department of Water and Power
   - 98-99: State of California's Department of General Services

10. **Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?**

    Large facilities such as Hyperion have been able to use gas marketers and get better gas prices.

11. **What do you expect the picture to be over the next five years in your area for gas rates?**

    Expect market to stay competitive; gas prices to remain stable.

12. **What have you done to reduce gas consumption or improve utilization within your plant?**

    Compare natural gas prices to digester gas value to optimize plant's selective gas usage. Optimize heating steam usage by reducing digester temperature, using the most efficient steam generator. Minimize flaring.

13. Describe your implementation of any strategies to obtain competitive priced access to gas.

Actively pursue lowest cost arrangement through competitively bid contracts with gas marketers; study other department's energy procurement plans; pool with local and state government agencies in gas purchasing.

14. Other recommendations would you make to other wastewater treatment plants in management of energy purchases/use?

- Renegotiate the energy contracts in the deregulated market of natural gas, and electricity.
- Use digester gas, one of the three major by-products of the wastewater facilities, with a desirable energy value, and as a low NOx fuel, to fuel power boilers, gas turbines, combined cycle cogenerators, or trade it for a discounted electricity rate, if any power plant(s) is in a reasonable distance of treatment plant.
- Reduce energy cost through an aggressive conservation program (see attached graph) by:
  - Conducting a comprehensive energy audit of the treatment plant(s)
  - Reviewing energy billings
  - Identifying potential energy saving targets
  - Shutting down or reducing equipment usage to meet process needs
  - Modifying or replacing older/inefficient equipment
  - Avoiding start up and testing of major equipment during peak hours
  - Eliminating compressed air leaks, and optimize oxygen transfer efficiency in aeration basins
  - Performing economic studies to determine cost/benefit of each conservation project and the payback period
- Particular attention to be given to energy costs during the design phase of the new projects (i.e., Anoxic mode of operation in the secondary reactors). Treatment plants should require long term energy and other operational costs to be part of the overall capital cost evaluation of alternative design options.

15. Attach your electric power and gas rate schedule.

All related graphs and charts are attached.

16. How many hours did it take to fill out this questionnaire?

5 hours.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**Hyperion Treatment Plant**
Your name and position:	**Steve Fan-Plant Manager II, Charles Lee-Control Systems Engineer, Rick Alcala-Instrument Mechanic Supervisor I, Bob Irvin-Sr. Systems Analyst II, John Kagimoto-Machinist Supervisor I**
Phone # of relevant contact:	**(310)648-5244**
Address and email:	**12000 Vista Del Mar, Playa Del Rey, CA 90293** **rbi@san.ci.la.ca.us**

1. Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?

CAD network/rational database

CAD is used for design drawings by the Bureau of Sanitation engineering staff and the Bureau of Engineering. We would like to tie these drawings to on-line O&M manuals and make them available to operations and maintenance staff on-line.

We use relational data base technology for our Maintenance Management System (CLAMMS), Plant Operational Database (WISARD), Laboratory Information Management System (LIMS), and a system that tracks bio-solids hauling (TARE). All these systems provide on-line transaction processing as well as reporting. WISARD has a WEB browser interface and an interface to Excel that allows reports on laboratory data and control systems data to be easily generated. In addition, WISARD has an interface to most of the treatment plant control systems and automatically collects and stores real time data which can be used in combination with laboratory data.

The Bureau of Sanitation plans to implement a training record keeping and scheduling system that will be based on the Peoplesoft Human Resources (HR) system operating over a relational database management

system. The Bureau would like to use this as the basis for a broad based HR system. Peoplesoft is also being used by the City of Los Angeles for it's payroll system and for City wide purchasing.

E-mail

The Wastewater Treatment Plants have had E-mail in use since the mid 1980s. It is an indispensable tool for operational staff to communicate to other shifts, to distribute all forms of information (hot sheet operational reports for example), and to pass documents around electronically. We use e-mail to send bacterial analysis from our beaches to the local health department. This provides very rapid notification of high bacterial counts if they occur.

We were very early adopters of Internet E-mail with our system being connected in the early 1990s. We are piloting the use of alphanumeric E-mail capable pagers for automatic notification of various events and for plant staff to send pager based messages.

Internet/intranet

The networks that support the Bureau of Sanitation's treatment plants have been connected to the Internet since the early 1990s. Any person with a Personal Computer connected to our network has instant access to both Internet and Intranet services. The World Wide Web is used for looking up vendor information, weather event information and numerous other uses. The Bureau of Sanitation also maintains a Web site as part of the City of Los Angeles Web Site. This site contains forms for Industrial Waste Dischargers and other useful public information. (http://www.cityofla.org/SAN/index.htm)

The Bureau of Sanitation's Wastewater Program has had an Intranet since1996. This is used for distribution of a wide variety of information from general procedures, training schedules, to plant operational data. There is a Web based interface to the WISARD relational database that allows the display of plant data in a standard Web browser. We have a number of sections that maintain their own Intranet Site information using Microsoft Frontpage.

We view the Internet/Intranet as a strategic technology. We plan to expand user groups maintaining everything from shift logs to on-line O&M manuals in the common Intranet format. We also plan to evaluate secure tunneling technology to allow users to access Intranet and other plant computing resources (including control systems) from home using and Internet connection through their local ISP.

Automated time keeping

Time sheets are filled out by hand, then electronically scanned into a computer. The data is manually corrected for errors that occurred during the scanning process. The scanning saves significant time over manual data entry of timesheet information.

Automated record keeping

Treatment Plant operational and regulatory data is maintained on-line in a relational database. NPDES and other required reports are generated automatically out of this database. All compliance checking is done automatically as well. These records go back to when the system was first put into production in the early 1990s.

Equipment maintenance history, spare part inventory, purchasing and financial information, and labor cost related to maintenance is kept in the computerized Maintenance Management System (CMMS). The Bureau uses the RDB version of Champs Software.

Bio-solids hauled off site by various trucking companies is tracked by a computerized system. This system automatically collects truck weights from the scales, prints trip tickets for the trucks and maintains all this information in a relational database. This data is used for bio-solids hauler billing, which is based on tonnage hauled.

A Laboratory Information Management System (LIMS) is used to track laboratory Quality assurance data, analysis cost information, etc. The laboratory results are automatically fed into the Plant operational database (WISARD) above. LIMS is still in startup.

The Controllers Office maintains financial data in a City wide Financial Information Management System. In addition, the Bureau of Sanitation maintains financial information in a FOCUS based system for both the solids and liquid side of the bureau.

2. What is the extent of internal access to agency data on-line?

All the systems mentioned in 1 above have some form of on-line access to the data they manage. Basically all financial, operational, and maintenance data is available on-line through the treatment plant computer networks.

Ease of use of this data varies depending on the system. WISARD, for example, has very easy to use client/server tools that allow reports on plant operational data to be generated using Excel. In contrast, the financial data maintained by the Controller which resides on the City's Mainframe computer requires knowledge of the FOCUS programming language for reporting on data stored in that system.

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?)

Virtually all employees at the treatment plants have access to computer terminals that can access much of the information in the above mentioned systems. All managers and many of the supervisors have network connected Personal Computers which are required for the newer client/server based tools and for GUI access to the treatment plant Intranet. The Bureau's Systems Division has a project underway that will provide network infrastructure in the areas where it does not currently exist. This program is combined with a program that will replace all terminals with personal computers over roughly a three year period.

Breadth and depth of information: What percent of data that would have been tracked in written reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?

As indicated in 1.e most core business information is managed in either relational database management systems or automated files. This includes plant operational data, laboratory data, maintenance and inventory information and financials. On-line automated data goes back to mid the 1980's.

3. Maintenance management system (or related functions).

What type of maintenance managementsystem do you use (application, company)?

Champs Software Inc. Oracle RDB version. This systems is used in all four treatment plants and in the Wastewater Collections Systems Division.

The Bureau of Sanitation is planning to convert to Indus Corporations Empac product in the near future. This system will work closely with the new Citywide purchasing system being installed in the same time frame. The Citywide Purchasing system will use Peoplesoft.

Please list several major features of your Maintenance management system.

- PM/CM work order issue and tracking
- Warehouse Stock management
- Labor cost tracking
- Equipment repair history
- Equipment information (vendor, sub-assembly, etc.)
- Work order Planning
- Purchasing and financial information management

In addition to the above features, the new system will interface closely with the citywide automated purchasing system. This will provide compatibility with the rest of the city that doesn't currently and will provide a common financial system.

When did you implement your MMS?

The system was first put into production in1985. A major upgrade was performed to this system in 1997. This system moved to operate using a Relational database management system (Oracle RDB) which necessitated converting the existing data to the new system. There were problems associated with this conversion that resulted in the conversion taking considerably longer than expected.

What was the cost of purchasing/implementating (not including user/operator training)?

Approximately 4 million dollars was spent on the original CMMS over a ten year period. The conversion of this system to a newer version in 1997 cost about $500,000.

The purchase and implementation of the new CMMS from Indus Corp. slated to begin in 1999 is estimated at 1.8 million dollars. The new City wide procurement system, called Prima 2000, is estimated at about 13 million dollars.

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

The Bureau of Sanitation's Systems Division has 5.5 FTE devoted to support the CMMS. It is expected this requirement will remain about the same once the new Indus CMMS is implemented. There will likely be some additional staff required to provide PC support when the system is converted to client/server.

Service request tracking system

The Bureau's CMMS is used for tracking service requests in the form of Corrective Maintenance (CM) Work Orders.

Predictive maintenance scheduling

Preventative maintenance is scheduled from our CMMS. Some use of predictive maintenance procedures using infrared guns or accelerometers combined with analysis software have been used on a limited basis for some equipment.

4. Do you use or plan on implementing on-line O&M manuals?

Manuals for new process being produced by our Human Resources Division are being done using HTML. They are available on our Intranet and viewable on-line using a standard Web browser. We have started a program to make commonly used information available on-line over the plant Intranet. We have converted operational procedures and MSDS for DC Tillman Plant to HTML format as a pilot. We are attempting to require that O&M manuals for new processes be delivered in HTML format but have met with limited success because most manufactures have not yet adopted this technology.

We are also evaluating moving the shift logs into an on-line system likely using a combination of database and Web technology.

5. What technologies/systems does your agency intend to implement soon?

- A CMMS upgrade using Client/server technology from Indus Corporation.
- Procurement, Warehousing, and Financial systems using Peoplesoft software which will be closely tied to the CMMS system above. The Peoplesoft project is begin done on City wide basis.
- On-line Training scheduling and record keeping using Peoplesoft HR software. This will allow supervisors and managers to view training records for their employees instantly on-line.
- Use of handheld pen-based computers with GIS technology that will be used by Collection System Cleaning and Maintenance crews for routing, data entry/upload, and facility location.
- Preventative Maintenance (PM) scheduled based on equipment run-times imported from the plant control systems. Currently PMs are scheduled based on elapsed time without regard to the number of hours a piece of equipment has operated.
- Use of handheld computers and bar-coding for operations staff to use during rounds. The data collected during the rounds would them be uploaded from the handheld to a central database.
- Convert the various shift logs used in the treatment plants to a combination database and Intranet Web based technology. This would provide much wider dissemination of the information contained in the logs and would allow Internet search and database technologies to be used to analyze information contained in the logs. This would include MSDS, operational orders, and other relevant operational information.

6. Have these technologies/systems been studied and recommended?

The first four projects have been studied and are going forward. A detailed requirements analysis was done on the Training/Scheduling system since it was a new system. This included a cost benefit analysis that showed a project payback in about two years. The last three projects are "concept only" at this point, although we do have systems currently that are similar in nature to the PM based on run-time and the handheld projects.

7. Has funding been appropriated?

Funding has been appropriated for the first three projects.

- The first project is projected to cost about 1.8 million dollars with an expected completion date in 2001. There will be an additional cost of about 1.5 million dollars for network infrastructure upgrades and conversion of terminals to personal computers that is related to this project but will be managed separately.
- The second project is a City wide project and is estimated to cost about 13 million dollars. It is expected to be on-line in about the same time frame as the CMMS project mentioned above.

- The Training/scheduling record keeping system has been funded. It is expected to cost about $800,000 and should be on-line by the beginning of 2000.
- The hand held GIS project is being requested in the current budgetary cycle.

8. What plans does your agency have for the integration of servers?

Unlike many organizations with growing LANs we have not had a proliferation of servers all over that would require server integration. In contrast, the Systems Division that supports the treatment plants has had a policy for some time that embodied the use of larger centrally managed servers with distributed networking functions. As new applications are brought on-line or upgraded, such as the CMMS, new dedicated servers are installed to support the transaction levels that are expected for that application. This server philosophy has proved cost effective and has provided a 99.8 percent network uptime record in the ten plus years they have been in operation.

9. What plans does your agency have for data warehousing (cleansing of the best data)?

We find that the term "data warehouse" is a rather loosely defined term in the industry and we believe many of our projects provide the functionality that is normally provided with a data warehouse project. We have a central database for operational and laboratory data (WISARD) that combine laboratory analysis with real-time data from the control systems. This system has a number of easy to use data analysis tools that use standard PC software such as Excel. Data in our CMMS can be reported on using Microsoft Access. Unlike a traditional data warehouse, however, these systems do share the reporting/analysis database with the OLTP database. We are investigating the use of a mirror instance of the CMMS database for exclusive use of reporting tools so it won't compete with the OLTP usage of the database. We have discussed setting up a Datamart that contained regulatory data and limits for analysis and what-if scenarios by operational and engineering staff. We do not have data mining or OLAP technology in use at this time.

10. How many support resources (FTE's) does your agency employ?

Function	FTEs
Networks and System Management	8
Operations & Applications Support	5
CMMS & Maintenance Support	4
LIMS & Laboratory Support	3
Control Systems/SCADA Support	4
I.T. Manager	1
Total	25

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

We expect with the increased number of personal computers and expansion of the networks there may be a need to slightly increase the staff that support these areas. We do anticipate that if new functions are automated that a commensurate increase in support staff for the new system might also be necessary.

12 How many hours did it take to fill out this questionnaire?

36 hours.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility: **Hyperion Treatment Plant/Department of Public Works**
Your name and position: **Anmin Liu – Senior Sanitary Engineer, Les Halstead – Maintenance Manager II**
Phone # of relevant contact: **(310) 648-5421**
Address and email: **12000 Vista del Mar, Playa del Rey, CA. 90293**

1. Discuss the typical transition from project to operating system at your facility.

Project Initiation : Projects may be initiated by legal mandates on effluent quality, emission standards, regulatory code compliance, major equipment replacements, and process efficiency betterment. Project concept and cost information is then presented at the Plant's Strategic Planning Team (SPT) meeting. This SPT consists of

representatives of all employee classifications in the Plant. The project concept is scrutinized by the SPT at all perspectives of the members. The STP will then make the decision to approve or reject the project.

Project Approval: After SPT's approval, the project is then presented at the Project Review Committee (PRC). This PRC consists of Bureau of Sanitation's Executive Management, Financial Management Division, Plant Managers and Bureau of Engineering's Engineering Design Division. The PRC will then discuss the merit of the project, the funding of the project and the priority of the project relative to other on going capital projects. The PRC will make the final approval of the project.

Project Design: The PRC will also determine the designing responsibility of the project. Bureau Engineering's Engineering Design Division will be most likely in charge of the engineering design of the project. Design inputs will be received from the Bureau of Sanitation's operation and maintenance staff. The Engineering Design Division will conduct workshops on the subjects from project design concept to cost estimates and construction schedule. The workshops will also be conducted at different design stages of the project. Inputs received after design reviews will then be incorporated into the final design of the project.

Project Bid/Award: Bureau of Engineering's Construction Program Administration Division will then be responsible for the contract bid and award administration.

Project Construction: The Plant will organize a "Construction Liaison" group to coordinate all aspects of construction activities that related to Plant operation and maintenance. The objectives of this group are to minimize the disruptions of the construction impact and to maintain the information flow from the project to the operation and maintenance staff.

Project Start-up: One year before the projected project completion date, a start-up team is formed to commence the "start-up" activities. The start-up team will look into the logistics of starting up the new facility/process from the perspectives of upstream and downstream of the process, the staff requirements, the sampling and monitoring of the new process, and the optimization of the new process. The start-up team consists of Plant's staff, the construction management staff, the construction contract administration staff and the training division's staff.

Normal Operation: The facility/process will transition from start-up to normal operation when the operating staff is familiar with the operations of the process and the optimization of the process has reached to a stage that stable quality effluent is produced consistently.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Consultants and staff engineers.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

The plant has staff dedicated to work as "design Liaison" and "Construction Liaison". The O & M issues are addressed from plant O & M staff via the "Liaison" group to the design/consultant and Construction Management Division. Coordination meetings are held during the design progress. Records of meetings and memos are tracked and filed for future reference. Construction issues are recorded on "PIF" (Problem Identification Form). All deficiencies are placed in the project file for evaluation for future CIP projects.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

Yes, the plant O & M issues addressed to the design team were mostly incorporated into the design. The "Design Liaison" Group leader attended the design meetings. This group leader carried information from O & M to the design meeting and brought any responses back to the plant O & M staff. Occasionally, the Group Leader makes decisions on obvious solutions.

Yes, the Sr. Liaison Manager makes decisions at the meeting to expedite the project schedule while they are in design or in construction.

3. Training

Classsroom Training

Classroom training is provided for various types of training; management/ supervisor/employee development, safety and regulatory-based training (often supplemented with performance-based field training), City-directive and Bureau directive based training, and technical training.

Review of O&M Manuals

Review of O&M manuals for construction-based training (CIP projects), technical submittals. The early submittals of what eventually become the final O&M manual) are reviewed by HRDD trainers to determine whether the contractor-prepared training material is in alignment with the equipment and processes that have been installed and with the operations and maintenance personnel's training needs.

HRDD has also provided support to Hyperion Treatment Plant and Terminal Island Treatment Plant via the development of O&M manuals for CIP projects as a means to reduce construction costs and provide highly customized, equipment and process specific O&M manuals for the client divisions (a level beyond that provided under the CIP project).

For projects that have O&M manuals developed by the contractor and Bureau of Engineering construction management personnel, HRDD uses that information, in its draft form (typically the final O&M does not receive approval until the project is down to "punch list" items) in conjunction with the Instructional Systems Development (ISD) process to prepare and implement performance-based, hands-on, field-based operator station post training.

HRDD's has been piloting having O&M manuals for various HTP facilities online and accessible via HRDD's web page.

Video of Operating Systems

HRDD has documented contractor training for new facilities. HRDD has used these videos for various purposes:

- As a informational resource for HRDD instructors to develop training material in support of the facility, process, or equipment.
- As a refresher tool for HRDD instructors to re-acquaint themselves with the original construction training for the facility
- As training aids for employees.

HRDD intends to pilot a process where video segments are inserted into instructional CD ROM's to enhance CD ROM computer-based training for safety and process-related training.

Hands On

Yes. The majority of HRDD's Hyperion Treatment Plant operations station post training is hands on, performance-based training with qualification cards that are task-based and directly indicative of whether an employee is properly prepared and competent to operate critical equipment and processes. The qualification cards are critical to determining competent performance and are great tools to provide meaningful feedback to employees and their supervisors. Maintenance training also has elements of performance-based training (e.g. shaft alignment, welding, confined space, lockout tagout) and our vision is to emphasize and increase these types of training offerings in the years to come.

Self-paced Training Manuals

No. WCSD utilizes Ken Kerri wastewater treatment operator training material that is structured to be self-paced and when completed, results in certification for CEUs. HRDD also makes available to the Bureau, CD ROMS and videos on various topics that can be used to conduct self-paced training. As HRDD develops additional courses, one option that will be considered in the training needs analysis phase is whether the training need can be served by self-paced study.

Computer-based training

Yes.

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

HRDD gets involved in the early stages of the design process (at the 50% stage). We review the concept report, review the preliminary plans and specification, and the feedback from operations, maintenance, and engineering staff, to develop draft training specifications that detail the groups to be trained, the processes and topics to be covered, the duration of training, the classifications and numbers to receive training, and the type of training material to be developed and delivered. There are basically three ways that construction-related training is provided:

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.?

The training elements included:

- Training by Equipment Vendors and Manufacturers This type of training is specified when the equipment and processes are of the type currently used by the plant. Training is primarily knowledge-based and quality can vary widely; from very good, to woefully unprepared and inadequate
- Training via a Training Consultant - In this situation, HRDD has specified training consultants brought on my the general contractor that in turn, use vendor information, shop drawing submittals, draft technical submittals and Hyperion SOPs and SMPs to develop and deliver or coordinate primarily knowledge-based training for the facility/process/equipment. This type of training is often supplemented by field trips to the new facility. The training has been tailored for operations or maintenance personnel. Maintenance training is further broken down into the various Crafts Manufacture training (at manufacturer's site).
- Training by a Combination of Design Engineers, Construction Management Engineers, HRDD Trainers, and Vendors

This training was proposed by HRDD as an alternative to the costlier alternative of a training consultant. In this situation, HRDD leads an effort between the design and construction management engineers (who are well versed in the overview and process flow of the facility), the information from the vendors on specific equipment, and the process start up team that works out the process "bugs" in order to facilitate start up, in order to develop first, knowledge-based overview training, followed after beneficial occupancy by station post, performance-based field training. Often times, HRDD's trainer is an active participant of the plant's start up team.

As to whether this process is adhered to, the Bureau of Sanitation tries to adhere to the provisions of the contract, however often times variation occurs due to special causes; varying interpretation of the contract language, willingness/unwillingness of vendors to provide timely information, beneficial occupancy and the difficulty in pinning down a definite date, the subject matter expertise of the training consultant, the continuity of personnel for projects that span 2 to 4 years in duration, and many other factors often times result in training that falls short of the target.

- Constructor training (on site).
- Training hours for each class are specified.
- Materials for training lessons are provided by trainers.
- Start-up group provides the in-house training to the O & M staff

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

Plant has a Start-up Team that consists of process engineers, operation and maintenance staff. The Start-up Team worked with contractors, city's construction management team and Construction Administration Division on the project "Functional Testing". This Functional Testing includes testing of all equipment (mechanical, electrical and instrumentation), hydrological test on all civil work, process performance efficiency and all safety related systems.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

Start-up is started whenever the City takes beneficial use of the facility.

No, During the startup, contractor is also involved. The plant staff operates the equipment during the startup.

How is performance testing conducted?

Start-up group conducts performance testing per the language of the specifications.

What is done to ensure owner satisfaction by the designers?

Through design meetings and review of design drawings.

What is done to ensure owner satisfaction by the contractors?

Contract Administration enforces the specifications and Wastewater Construction Monitoring Division (WCMD) supervises and monitors the construction status.

What is done to ensure owner satisfaction by the equipment suppliers?

Contractor is required to submit shop drawing for approval and compliance prior to purchasing equipment.

What is done to ensure owner satisfaction by the staff engineers?

Plant designates a Design Construction Liaison to interact with WCMD during the design and construction of the project. A start-up team is formed to prepare for/and start–up process.

What is done to ensure owner satisfaction by the construction management staff?

Construction Management is on-site and readily available to Plant for input and coordination.

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

Start-up team is formed one year prior to construction completion date. Team formulates start-up procedures, analyze upstream and downstream process impacts. Team is responsible for monitoring and sampling locations to address performance standards.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics).

Yes.

Have standards been developed for O&M manuals.

Yes.

Have standards been developed for control system software and hardware.

Yes.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

No as-builts provided are accurate or complete. This is due to a difference in understanding of the need to have accurate and complete as-builts with Contract Administration (they are responsible for monitoring Contractor accuracy and completeness during construction), WCMD (they are responsible for final as-built drawings) and the Plant.

6. How many hours did it take to fill out this questionnaire?

Two hours.

PREDICTIVE MAINTENANCE

Treatment Plant/Facility: **Hyperion Treatment Plant/Department of Public Works**
Your name and position: **George Raymond – Maintenance Manager I, Charles Davis – Instrument Mechanic, George Hontiveros – Mechanical Engineering Associate I**
Phone # of relevant contact: **(310) 648-5442**
Address and email: **12000 Vista del Mar, Playa del Rey, CA. 90293**

1. Fill in the following to describe maintenance activities at your facility.

Staff Time (to equal 100%)	
Predictive Maintenance (Vibe; Infrared, etc.)	0.5%
Preventive maintenance (Lubrication & pm's etc.)	26.0%
Reactive maintenance (Repair work as a result of failure)	18.0%
Planned or routine maintenance (General repair work and	40.0%

corrections)	
Project support by maintenance staff (CIP support; start-ups etc.)	4.0%
Other Construction Safety	 9.0% 2.5%

Total approximate maintenance staff hours for FY 96/97.

- Mechanical 120,811 hr.
- Instrument 54,130 hr. Note: figures are for all four plants
- Electrical 62,752 hr.
- Painter 20,263 hr.
- Landscape 3,378 hr
- Janitor 34,744 hr
- Carpenter 18,377 hr
- Others 240,223 hr

2. Does your facility have a predictive maintenance program?

Yes. A Mechanic from the support shop does routine vibration readings on major/critical pieces of equipment. Oil analysis is also performed on this equipment.

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis	X	
Infrared Monitoring	X	
Lubricant Analysis		X
Ultra Sonic Testing *	X	
Other (please describe) Boroscope***_____ .	X	
Equipment Run Time Monitoring – Overhauls based on Hr. Meter **		

* **used for tank shell and roof thickness measurements based on time cycle; also used for rolling element bearings**

** used for gas and steam turbines and electrical switch gear and relays

*** used for boilers, steam and gas turbines.

Do your "In house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

No, dedicated staff yet. Currently in the process of setting it up.

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis	X	
Infrared Monitoring		X
Lubricant Analysis		
Ultra Sonic Testing		X
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed

Vibration Analysis		
Infrared Monitoring		
Lubricant Analysis*	X	X
Ultra Sonic Testing		
Other (please describe below)		

* Lubricant analysis is routinely performed on major/critical pieces of equipment and done on non-critical pieces of equipment, on an as-needed basis.

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Rreduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes, the number of breakdowns and unplanned work orders are reduced. Our CMMS program can reflect this through an Equipment Breakdown History Report. Breakdown-type work orders are coded with a "BR" classification to enable us to distinguish it from other types of work orders.

Reduction in corrective maintenance work orders? Describe how you measure it:

No. Through predictive maintenance tools problems are detected before they occur resulting in less corrective repair work orders. As discussed previously, our CMMS program can generate a report to show this. A history report of equipment by class, repair (RE) or breakdown (BR) can be run to determine whether it is on the increase or decrease.

Reduction in total maintenance staff time? Describe how you measure it:

Uncertain. Our predictive maintenance program has not been in effect that long yet to determine with any accuracy the effect of the impact on total maintenance staff time. With the plant construction and expansion program in progress, and new equipment being tested and put into service, we have not been able to accurately determine what maintenance staff time will be. Maintenance staff time will be more accurately monitored as soon as construction is done and the predictive maintenance program in place.

Increase in planned maintenance work orders? Describe how you measure it:

Yes, the planned maintenance work orders can be detected by our CMMS program. As previously mentioned equipment class code can be entered to run a report.

Reduced energy costs? Describe how you measure it:

Yes, after corrective work was done utilizing stringent alignment and balancing standards, vibration and motor current readings were taken. It was noted that approximately 10-15% drop in current readings occurred and about 15-20% drop in vibration readings, a 10-15% reduction in energy cost was observed as well. Annual energy savings of approximately 37 MW-hrs is estimated only from the digester gas compressors. No records were kept on other equipment aligned and balanced to these standards. The success of this project indicates the value of applying these predictive maintenance tools on other equipment to increase run-times and reduce power costs throughout the Plant.

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Case #1

One of our largest effluent pumps, that pumps effluent out to the ocean, capacity of 125,000 gpm, 54"x54" impeller, and a 2500 hp motor, showed quite a different vibration spectra than the previous ones. The mechanic running the test was convinced that there was a serious problem developing, so he requested that the operating supervisor have the pump taken out of service. Mechanics went to work on it that night and by morning found the problem. Plumbers removed a 2.5' x 3' block of concrete, with rebar in it, located inside the volute, but being moved around by the impeller. The cost of the volute and impeller would have been $95,000 AND $225,000 not to mention that it would take from 6-8 months for the factory to fabricate it, plus the man-hours to install them. Note: see the accompanying charts of the vibration patterns

Case #2

Thirty-two (32) oxygen dissolution mixers all had the same problem of operating at a resonant frequency so that their foundation was tearing up their mounting bolts in a short time. The problem was solved by adding

weight to the impeller of the mixers, so that they were no longer running in resonance. Note: see the accompanying charts of the vibration patterns.

Case #3

LA Glendale Plant aeration blower tripping due to high vibration, had a misalignment problem. Blower was precision aligned and problem was corrected. Note: see the accompanying charts of the vibration patterns.

Case #4

Large belt driven fiberglass foul air blowers that were vibrating, delaminating and exploding into pieces. They were replaced with a direct drive stainless steel blower, and aligned to "excellent" standard. A potential safety problem, and possible fines by SCAQMD for air quality violation and high maintenance cost problem was eliminated. Note: see the accompanying charts of the vibration patterns.

Case #5

A digester gas compressor was found with an unbalance problem. Balance correction was made and the vibration problem was removed. Note: see the accompanying charts of the vibration patterns.

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

Presently, our plans are to make a controlled test in order to determine the direction we will take in terms of predictive maintenance for large rotating equipment. We will be closely observing the maintenance needs of 12 new centrifuges, 6 maintained by predictive maintenance methods and 6 by preventive, for a period of two years. This test is only for DICE II. It will be implemented plant-wide later. Program will be reviewed every six months. If predictive maintenance proves to be better, a dedicated predicting maintenance crew will be set up plant-wide.

7. How many hours did it take to fill out this questionnaire?

12 staff hours.

OFF-SHIFT STAFFING

Treatment Plant/Facility:	**Hyperion Treatment Plant/Department of Public Works**
Your name and position:	**Mike Bell – Shift Superintendent I, Hollis Gould – Wastewater Operator II, Hiddo Netto – Shift Superintendent II, Art Duarte – Wastewater Operator II, Dave Thrasher – Maintenance Manager I**
Phone # of relevant contact:	**(310) 648-5591**
Address and email:	**12000 Vista del Mar, Playa del Rey, CA. 90293**

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

Normal plant operations is three shifts. Hours are 0630-1430 for day shift, 1430-2230 for swing shift, 2230-0630 for graveyard shift. Minimum staffing at HTP is 1 Shift Superintendent and 15 Operators for each offshift. At Terminal Island offshift staffing is 3 operators for each shift. Los Angeles Glendale staffing for offshifts is one operator for swing shift and unstaffed for grave shift. Tillman Treatment plant staffing on offshifts is 3 operators per shift. (Sample schedule for each plant is attached)

2. Describe the following:

Grade levels and required expertise for off-shift operators, how does this compare to State requirements ?

Shift Superintendent II (HTP)	California Grade 5 (Expertise in all areas of Ops)
Shift Superintendent I (HTP,TWRP)	California Grade 4 (Completely familiar with all Ops)
Wastewater Treatment Operator	California Grade 2 (Operation of assigned Section)
Wastewater Treatment Operator	California Grade 1 (Operation of assigned Post)

Meets minimum State requirements for Plant staffing and supervision. Outlying plants such as LAG and Terminal Island (TI) do not use the Shift Superintendent Classification. At HTP, a Superintendent is used on all shifts, TWRP only staffs Superintendent for dayshift. At TI and LAG the Senior Operator works day shift only, on off shifts the WTO II is the Lead Operator

Staffing by process area during off-shifts: What numbers do you staff where?

Hyperion Treatment, in addition to one Shift Superintendent:

- Preliminary/Primary Treatment: 1 (WTO-2), 2 (WTO-1)
- Secondary Treatment:1 (WTO-2), 3 (WTO-1)
- Cryogenic Plant: 1(WTO-1)
- Energy Recovery Building: 2 (ERO-3 or 4)
- Air Pollution Control-: 1 (WTO-1)
- Solids Handling: (1WTO-2, 3 (WTO-1)

Terminal Island Treatment Plant:

- Plant Operations: 2 Operators

Tillman Plant:

- Plant Operation: 2 Operators

Glendale Treatment Plant:

- Plant Operations: 1 Operator (swing shift)
- No Operators on graveyard shift.

(See attached sample schedules for all plants)

Which of the following tasks are performed by off-shift operators?

Treatment plant process monitoring	X
Remote facilities monitoring	X
Troubleshooting of systems/equipment	X
Emergency response	X
Process adjustments	X
Process sampling	X
Process testing	X
Isolation/shutdown of systems/eqpt.	X
Buildings & grounds maintenance	X - Minor
General Housekeeping	X
Other (Please List):	

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

At HTP, additional staffing of two operators is provided for in emergency wet weather, either by standby personnel or adjusted scheduling. During periods of extreme wet weather a EPP (Effluent Pumping Plant) Electrician is staffed in addition to the normal of shift electrician.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

See attachment: vacation G.O. Most shift coverage for vacation is through use of relief operators. Sick calls are covered by 1) combining station posts; 2) paying overtime if minimum staffing levels are not met; 3) operations shift superintendent has authority to call in additional personnel as needed.

Other scheduling procedures and policies

- Shift staffing is based on operational needs
- Schedules are posted two weeks ahead
- Vacations have to be requested two weeks before taken
- Emergency vacation for can be approved for anytime with less than two weeks notice
- Same-day call ins are covered through station post consolidation, working down by lead operators, spreading out of tasks and duties, to defray cost of overtime.
- See attached budget for Holiday overtime and history of overtime cost reduction

3. **Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.**

   The laboratory has a swing shift crew on site until 8:00 p.m. Other support staff is available to the Operations Supervisor on a call-in basis. Support is provided on a standby basis for holiday weekends. Security Staff is two persons per shift. One full time electrician works each off shift. At LAG the plant is unstaffed for graveyard shift operation. Through the use of remote monitoring with priority alarm signaling, the plant is run remotely from a laptop PC. As a back up, signals as well as monitoring points are sent to the HTP Superintendents office.

4. **What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.**

   Off-shift staffing will be reduced through attrition and as automation implementation continues. Estimate 30% operations staff reduction by attrition in the next 5 years.

5. **Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?**

   See attachments. All staff reduction will occur through attrition only.

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   Approach is to provide for minimum staffing for nights and weekends. The main treatment plants are staffed on a continuous basis with operations personnel except for Los Glendale Plant where automation the eliminated the grave shift. Maintenance as well as operations personnel are called in as necessary to respond to emergencies. As further automation is implemented, unstaffing at the outlying plants (LAG,TWRP) will continue in addition to further staffing reductions at HTP.

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   The philosophy is to staff to running levels necessary to operate the facility. Future plans are to implement and integrate automation that will enable unstaffing of shifts and facilities and allow for further staffing reductions through attrition.

8. **How many hours did it take to fill out this questionnaire?**

   1.5 hours.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**Hyperion Treatment Plant/Department of Public Works**
Your name and position:	**Mike Bell – Shift Superintendent I, Hollis Gould – Wastewater Operator II, Hiddo Netto – Shift Superintendent II, Art Duarte – Wastewater Operator II, Dave Thrasher – Maintenance Manager I**
Phone # of relevant contact:	**(310) 648-5591**
Address and email:	**12000 Vista del Mar, Playa del Rey, CA. 90293**

1. **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]**

   Today they are not combined at this time. By November of 1998 O&M will be under the control of the Plant Manager.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attached.

3. **Do you have a single manager over both operations and maintenance?**

   Not at this time. As of November 1998 the plant manager of each facility will be in charge of O&M.

4. **What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance? For the purposes of this question, supervisors are defined as those individuals who routinely perform**

supervisory functions, such as conducting performance appraisals, recommending discipline or termination, and approving employee timesheets.

Span of control: Operations: 7.6 – 1.0
Span of control: Maintenance: 10.0 – 1.0

5. Which of the following "maintenance functions" are performed by operators?

Routine preventive maintenance	Yes, (TITP)
Repair of equipment	No
Predictive maintenance activities	No
Process modifications	No
Non-process modifications	No
Cleanout/isolation of systems/eqpt.	Yes
Cleaning and calibration of instruments	No
Simple electrical repairs	No
Maintenance of automatic samplers	Yes (TITP)
Computerized maintenance mgmt.	No
Vehicle service	No
Buildings & grounds maintenance	Yes – some minor maintenance
General Housekeeping	Yes

6. What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?

Maintenance personnel are not certified as operators at this time. As we progress into cross training as well as blending of job functions and responsibilities, certification would be a requirement.

7. Do you offer incentive programs to encourage cross-training?

Not at this time. Future plans for gain-sharing as well as cross-training bonuses may be offered as incentives for cross-training.

8. Provide a copy of your current salary structure for operations and maintenance personnel.

See attached.

9. What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?

Licensing and MOU/class specifications – issues regarding combined operations and maintenance are presently being discussed in our WLMC environment as well as with the major labor unions.

10. Cross-functional process-based work teams:

Each Operations section has a cross-functional team consisting of Maintenance, Operations and Engineering personnel. The team works in a joint decision making environment to determine the day to day priorities of their operating section. Additionally, we also have interplant teams whose main function is to share ideas on efficiency gains and process improvements that can be beneficially implemented in the outlying facilities.

Do you either currently have or plan to implement cross-functional process-based work teams?

Teams are presently in place.

If so, how are these teams organized and what authority is given to team.

Lead by section Senior Operator and comprised of Process Engineering and Maintenance representatives. Team determines section's operations and maintenance priorities, optimizes treatment, monitors performance as well as section operating costs. Representation from sections is also made on our SPT as well as JAT Teams where input from the team members is essential in CIP considerations.

What is the makeup of the teams?

See attached WLMC,SPT,JAT team make up roster as well as WLMC Handbook.

11. How many hours did it take to fill out this questionnaire?

2 hours.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility:	**Hyperion Treatment Plant/Department of Public Works**
Your name and position:	**Mike Bell – Shift Superintendent I, Hollis Gould – Wastewater Operator II, Hiddo Netto – Shift Superintendent II, Art Duarte – Wastewater Operator II, Dave Thrasher – Maintenance Manager I**
Phone # of relevant contact:	**(310) 648-5591**
Address and email:	**12000 Vista del Mar, Playa del Rey, CA. 90293**

1. Is your agency/has your agency considered re-engineering your work practices and organization structure using:

Workforce flexibility?

Undecided Not yet Evaluated.

Skill-based pay?

Under consideration.

2. In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, " Combined Operations and Maintenance," to clarify the scope of this question.]

How many trades or disciplines are in your current structure and what are they?

Seventy five classifications currently in Maintenance and Operations including paygrades:

- Maintenance=66
- Operations=9. See attachments.

Do trades cross technical boundaries? If yes, please describe their interaction.

Not currently. Due to Memorandum of Understanding restraints. Benchmarking with other agencies for best practices.

3. What is your agency's definition/interpretation of workforce flexibility?

The ability to perform more than one class function. This would involve changing class specifications.

4. Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.

Operations and Maintenance will be forming a Joint Action committee to discuss minor maintenance and preventive maintenance. In addition, we will be benchmarking with other agencies for best practices.

5. Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?

Yes, the consolidation of the Maintenance and Operations sections under the direction of the Plant Manager at each facility. There are also potential plans to combine the Tillman Water Reclamation Plant and the Los Angeles-Glendale Plant as one cost center.

6. What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)

We will be benchmarking with other agencies for best practices.

7. What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?

Just beginning the process.

8. What skills, goals or objectives does your agency intend to "incentivize"?

To be determined.

9. How many hours did it take to fill out this questionnaire?

Three hours.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility:	**Hyperion Treatment Plant**
Name & Position:	**WLMC Benchmarking Team**
Phone # of relevant contact:	**(310) 648-5282**
Address and e-mail:	**12000 Vista del Mar, Playa del Rey, CA 90293** **ELB@san.ci.la.ca.us**

1. Is your Plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your supervisors unionized? Is the shop open or closed? What are the umbrella union organizations?

- The City of Los Angeles is an organized employee shop.
- All employees to the level of (and including) Assistant General Manager are represented by an organization or union.
- Yes, some by a separate organization, some by the same craft union.
- The City is an open shop
- The umbrella union organization falls in 2 categories:
- One organization, Building Trades, represents several craft unions in one MOU and one MOU for the pertinent craft supervisors
- Two organizations, SEIU & EAA (Engineers & Architects Association) negotiate several MOU's.

Other organizations don't fall into the "umbrella" definition, but independently represent several crafts and each negotiates a single MOU. See Attachment 1 for City classifications /MOU's.

2. Do your unions negotiate with management to resolve MOU & hourly contract, grievance, work, and business issues?

Organizations represent employees at the negotiating table (Citywide) on contract items (basically, wages, benefits and working conditions) resulting in a multi-year agreement (MOU). Grievance, discipline, labor-management issues are handled at department levels.

3. Do you have a joint labor-management committee empowered to resolve these issues? Please explain roles and responsibilities.

The Bureau of Sanitation is 2 years into the Joint Labor-Management process. Basically divided between Solids Resources (SRJLMC) and Wastewater (WLMC), they meet separately every two weeks and jointly with all Bureaus in the Department every month. Generally, these committees have sets of subcommittees to tackle individual items of interest to a group of employees. Recommendations are brought back to a central committee for review and recommendation to executive management. The longest running team is the Treatment Plants' joint Work Issues Committee (WIC) – operating for better than 5 years, resolving issues with one union (Operating Engineers [IUOE], Local 501) on an on-going basis to address concerns generally brought forth by the WWT Operators and, to a lesser degree, Mechanics and Instrument Mechanics.

The Wastewater Labor-Management Committee (WLMC) has drafted and approved a working standards handbook that has been held up to other committees as a standard and example of commitment by Labor and Management to the joint labor-management process. See Attachment 2 for WLMC Employee Handbook

The WLMC has played an important role with the Department Strategic Planning Team in developing the study area work plan, Department budget, including a 15% attrition plan. The Bureau and its employees are particularly proud of the success of the WLMC process, especially considering the number of representative unions and organizations on the playing field.

4. Are you working with your union on competitiveness? If so, please describe.

There are formal joint action teams working on various aspects of competition. Some of these are the "best practices" concepts, gainsharing, strategic planning, customer service, automation, training, etc. Sanitation has taken advantage of the services of Federal Conciliation & Mediation Services to help the City understand the JL-M process and mediate in stalemated or confrontational situations. Our organizations are keenly aware of the need to focus on issues of competitiveness. We are, however, dedicated to doing this with no layoffs. Issues

such as consolidation and cross-training are highly sensitive topics, as employees usually see these as a way to effect downsizing at a rate faster than normal attrition is capable of.

The Bureau also employs a Human Resources Development Division (HRDD) to provide employee training on equipment operations, maintenance, startup, labor-management team concepts, promotional skills, supervisory skills, City/Department/Bureau policies and procedures, computer classes and safety related topics. It has been of particular interest that labor and management have cooperated in the development and teaching of some of these classes.

5. **Are you involved with labor on training issues?**

   Yes, Apprentice, Advancement, Certification and in joint labor-management teams

6. **Have you tried collaborative bargaining or interest-based bargaining with the union(s) at your workplace? Has your experience been a success?**

   No.

7. **What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?**

   Continued open lines of communication between labor and management. The WLMC process is still working out the bugs, but after many fits and starts, things are starting to run more smoothly and people are beginning to feel the results. The process has had a positive impact on grievances filed. Labor is beginning to understand the difficulties of the budget process, Management is starting to recognize the impact of the budget and its decisions on the rank-and-file. Continuing the process can only benefit the City, its employees and its customers.

FLEET SERVICES

Treatment Plant/Facility:	**Hyperion Treatment Plant/Department of Public Works**
Your name and position:	**George Raymond – Maintenance Manager I, Charles Davis – Instrument Mechanic, George Hontiveros – Mechanical Engineering Associate I**
Phone # of relevant contact:	**(310) 648-5442**
Address and email:	**12000 Vista del Mar, Playa del Rey, CA. 90293**

1. **Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:**

   The Bureau of Sanitation has 916 pieces of wastewater program equipment in Fleet Services inventory. The following is a list of the types of equipment serviced. Please see attached equipment inventory.

2. **What is your current vehicle replacement policy?**

   Special funded equipment (Sewer Service Funds - SC & M):
   - Equipment sorted by department
   - Equipment sorted by age and mileage (see attached)
   - Letter listing vehicles and equipment meeting the screening criteria is sent to the department for consideration of replacement.
   - Management investigates the equipment for reliability and ability to meet the needs of the work crew to which the equipment is assigned.
   - Management develops a list of equipment to be replaced and recommends equipment type changes.
   - Equipment purchased from developed list within special fund limits.

   Grant funded and Department direct-buy:
   - Department requests Fleet Services to service or service and replace vehicles and equipment not originally purchased through Fleet Services.
   - For maintenance only equipment, Fleet Services will service as needed and advise when cost to maintain exceeds industry norm.
   - For service and replacement of equipment, Fleet Services will add the equipment to the existing fleet and recommend replacement as outlined above.

3. Do you have a replacement fund?

Yes, SC&M, special funds, and equipment is also purchased through O&M funds.

4. Have you made any recent reductions in the fleet? Are you planning on doing so in the near future? What is the approximate annual savings achieved by the reductions?

An attempt to reduce the fleet by 20% was undertaken last year to improve the person-to-vehicle ratio. Some departments were able to achieve the goal, others were not. Seventy-five vehicles were targeted for salvage without replacement, only 25 actually were salvaged. Some of the remaining vehicles were picked up by other divisions that actually expanded their fleets. We annually review fleet needs and are linking them to our staffing attrition plans within each Division.

5. Have you experienced any adverse impacts from the reductions in fleet size?

Adverse impacts occurred due to failure to complete the re-assignment of equipment, and the lack of buy-in from the other sections and divisions. As our plant occupies a large area, and is in constant change due to ongoing construction, and proper repair facilities are either non-existent or far removed from the equipment failures, much repair work must be done from service trucks or transported to the main repair facilities.

6. How are your fleet vehicles serviced? (In-house or by external contracts?)

Vehicles and equipment are serviced both in-house and through Fleet Services. Warranty work is done at dealers and by Fleet Services. Some work is contracted out by both in-house and Fleet Services (i.e. brake drum turning, transmission overhaul, and boat-out-of-water repairs). Approximately 3% of the total work is out-sourced.

Fleet Services is developing a computer program to allow direct charges for repairs and services rendered, the program is nearing completion and its role-out is set for July 1, 1999. At the present time, Sanitation has a budgeted line item for vehicle repair with Fleet Services. For the fiscal year '98-99 we allocated $6,258,068 to the Department of General Services, Fleet Service Bureau to provide vehicle services and replacement.

7. What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.

Preventive maintenance is generally set at three months, six months, or twelve months depending on working conditions, age of the equipment, and is continually changed to match the conditions under which the equipment must operate. In some incidences, equipment is maintained by mileage and again is flexible by operating conditions.

8. How many Fleet Services staff support the fleet?

Sanitation overall has 1,960 pieces of equipment, 916 on the wet side and 1,044 on the solids side. The equipment is dispersed throughout the City and maintained in many of the Fleet Services' facilities.

A budgeted amount has been allocated to Fleet Services for maintenance, repair and replacement of equipment.

Starting July 1, 1999, Fleet Services will start itemized billing for services rendered. A one-year evaluation of the process will be undertaken and if all problems are solved, the full-time utilization of the charge-back system will be in place for the year 2000.

Presently screening for various position replacements.

For exact dollar amounts, equipment count and personnel information, contact Brian Smith at (213) 485-4992 or John Gasca at (213) 485-4952.

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility:	**Hyperion Treatment Plant/ Department of Public Works**
Your Name and Position:	**Charles B. Turhollow, Senior Sanitary Engineer**
Phone Number of relevant contact:	**(310) 648-5928**
Address and E-mail:	**12000 Vista del Mar, Playa del Rey, CA 90293** **cbt@san.ci.la.ca.us**

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. (See O and M 1.F.8 in the template and functional area descriptions.)**

   Biosolids at 27% TS after dewatering are land-applied and composted. 74,500 dry tons per year is hauled out of the plant for land application and 2,794 dry ton per year for composting. (See attached chart for FY 96/97 deployment and contract cost chart)

2. **Annual production:**

   Wet and dry tons by class A, B, & C and total.

Class B		
Hyperion Treatment Plant	270,000 wet ton	72,000 dry ton
Terminal Island Treatment Plant	15,400 wet ton	2,500 dry ton

   Does the system meet "exceptional quality" for metals? Y or N Comment?

   Yes.

3. **Costs:**

   1997 total operating cost for the program including direct administration, lab support and maintenance.

Operations	$331,614
Maintenance	383,604
Lab	109,119
Administration	128,000
Contract	5,487,130
Total	$6,439,467

4. **Capital investments in dollars associated with the biosolids program.**

   Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.)

   Truck Loading Facility = $ 6,900,000.

   Equipment (Tractors, trailers, spreaders, etc.)

   There were no capital investments in dollars since the City utilized services of private contractors.

   Land

   These were no capital investments in dollars since City utilized services of private contractors.

   Revenue from use (fertilizer value, energy production, crops, etc).

   None.

5. **What are the number of FTEs in program including administration, operations, maintenance, other.**

   Operations: 7.50 FTEs
   Administration: 3.00
   Maintenance: 6.75
   Lab: 3.30
   Total: 20.55

5. **Describe your major reuse customers or approaches including wet and dry tons to each and class of product.**

   Four biosolids hauling contractors are hired to haul class B biosolids to farmers in Kern County and Riverside County.

CONTRACTOR	WET TON PER DAY	DRY TON PER DAY	TELEPHONE
RBM	350	91.3	(805) 962-5927
BioGro	150	39.1	(800) 285-2479
San Joaquin	100	26.1	(805) 797-2914
Gardner Aciero	178	46.4	(805) 688-4922
Griffith Park Comp. Fac.	4	1.1	
TOTAL	782	204	

6. Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A to or from privatization of some elements, etc.?

Anticipating increased hauling cost in the next 5 to 10 years, a pilot study is proposed to study the possibility of going to class A biosolids. New centrifuges producing drier biosolids (from 27% to 32% solids) will be installed by the end of 1998 to further reduce hauling cost by 15%.

7. Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.

Reuse costs may go up due to new local regulations in Kern County.

YEAR 2000 COMPLIANCE (Y2K) PROJECT QUESTIONNAIRE

Y2K Contact: Efrain Gonzalez: Telephone No. (310) 648-5912

1. Do you have a Y2K program in place in your organization?

Yes

If yes, when did you begin your Y2K program?

06-02-98.

2. Have you inventoried your Information Technology systems (IT)?

Yes.

3. Have you inventoried your embedded systems?)?

Yes.

4. How many IT systems do you have?

337.

5. How many embedded systems do you have?

919.

6. Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)?

Yes.

If yes, when did you begin?

08-17-98.

7. Have you begun contingency planning for your systems?

Yes.

If yes, when did you begin?

08-19-98.

How many systems have contingency plans?

None at this point.

8. Have you begun remediation of your non compliant systems?

No.

If no, when do you plan to begin?

11-16-98.

9.Have you tested any of your systems for Y2K compliance?

No.

If no, when do you plan to begin?

11-16-98.

10. What testing standards are you using for certifying your Y2K affected systems (give organization Y2K standards or list of dates you will be testing for)?

Test dates found in Hewlett-Packard's Y2K certification test table: (http://www.hp.com/year2000/compliance.html).

CITY OF PORLAND BUREAU OF ENVIRONMENTAL SERVICES, COLUMBIA PLANT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Columbia Plant/Operations Liquids**
Your name and position: **Jim Folkerts**
Phone # of relevant contact: **(503) 823-2492**
Address and email: **5001 N. Columbia Bvd. Portland OR. 97203**
jimf@bes.ci.portland.or.us

1. **Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.**

Process	Parameter	Frequency
Temperature		daily
Primary Effluent	TSS & BOD	daily
Activated Sludge	MLSS	3/day
	SVI	3/day
Clarifier	TSS	3/day
Clarifier Effluent	TSS & BOD	daily
WAS	Feed Total Solids	6/day
Thickening	TWS Total Solids	6/day
Belt Press	Feed Total Solids	6/day
	Cake Total Solids	6/day
Digester	pH	daily
Alkalinity		daily
Volatile Acids		daily
Total-Volatile Solids		weekly
Feed Solids		daily

2. **Have you made any recent reductions in laboratory analyses or are you planning on doing so in the nearfuture? What were they (e.g. process)? What is the approximate annual savings achieved by the reductions?**

   Yes. We have reduced activated sludge lab routines from 6/day to 3/day.

3. **Have you experienced any adverse impacts from the reductions in process-related analysis?**

   No.

4. **What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.**

   Primary Effluent Temperature,MLSS, SVI, Clarifier TSS, Was thickening feed and TWS TS, Belt Press feed and cake TS are performed by plant operations. We have not reviewed if additional analysis should be done by operations instead of the laboratory.

5. **Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).**

Parameter	Frequency	Parameter	Frequency
Influent		**Biosolids**	
Flow	daily	VSR	monthly
TSS	daily	Nutrients	monthly
BOD	daily	Dioxins & Furans	quarterly
Dioxins & Furans	quarterly	Metals	quarterly
Metals	quarterly	Priority Polutants	quarterly
Effluent		**Sludge Lagoon**	
TSS	daily	Ground Water	
BOD	daily	Water Level	quarterly (Feb, May, Aug, Nov)

E Coli	daily	TDS	quarterly (Feb, May, Aug, Nov)
Chlorine residual	daily	Orthophosphorous	quarterly (Feb, May, Aug, Nov)
Bioassay	quarterly	Chloride	quarterly (Feb, May, Aug, Nov)
Dioxins & Furans	quarterly	NO2+NO3-N	quarterly (Feb, May, Aug, Nov)
Metals	quarterly	Sulfate	quarterly (Feb, May, Aug, Nov)
		Metals (ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)	annually (August)
		Priority Pollutant Organics	annually (August)

6. Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?

Yes. We have negotiated with the regulatory agencies to reduce the regulatory-mandated analytical load. The bioassays have been reduced from monthly during dry weather to quarterly year round. Similarly, toxics (priority pollutants, metals, and dioxins/furans) have been reduced from monthly to quarterly in most cases.

7. Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.

Yes. Plan on continued efforts to automate analysis where possible and reduce both process-related and regulatory-required analysis.

8. How many labs do you have in your agency? What are the functions of each?

We have one main laboratory which does all of the non-operations analysis. There are a handful of field labs where operations performs such analysis as chlorine residual, SVI, etc.

9. How many hours did it take to fill out this questionnaire?

2.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility: **Columbia Plant/Operations Liquids**
Your name and position: **Jim Folkerts**
Phone # of relevant contact: **(503) 823-2492**
Address and email: **5001 N. Columbia Bvd. Portland OR. 97203**
jimf@bes.ci.portland.or.us

1. Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding)utilized to investigate and test this technology.

COP/BES generally avoids the use of new technology due the risk and costs. None were investigated during the past 5 years. However, selector technology was installed in the activated sludge process in 1994 after testing in prior years.

2. List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).

Technology 1:)Anoxic/anaerobic Selector*	
Methodology	A field test was set up in one aeration basin and a selector was tested for nitrification feasibility.
Cost of Test	Minimal. Performed by operations personnel.
Results	Found that nitrification was achievable and settleabilty was very good.
Report	A capital project was developed and sector technology installed in the activated sludge process.
* The Columbia Blvd WTP had been experiencing filamentous blooms which resulted in poor settleability and low secondary treatment capacity. Selector technology was investigated to provide a solution to this problem.	

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

Thermophyllic Digestion in pilot scale for digestion of skimmings.

4. How many hours did it take to fill out this questionnaire?

1.

AUTOMATION

Treatment Plant/Facility:	**Columbia Boulevard Wastewater Treatment Plant**
Your name and position:	**Roland Chadburn P.E.**
Phone # of relevant contact:	**(503) 823-2486**
Address and email:	**City of Portland, 5001 N. Columbia Blvd, Portland OR 97203**

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The City is using a combination of PLCs which basically do all control and Operator interfaces from which the Operators monitor systems and issue set point commands. The Operator interfaces do not perform continuous control. The Operator interface system we have chosen (Intellution DMACS (PC based)) networks extremely well. It allows us to place an Operator interface virtually any where we want with little additional database or picture modification. It also allows remote configuration of the Operator interfaces. We are and have implemented redundant SCADA nodes, meaning we use two operator interfaces (maybe located in different sections of the plant) each independently aquires the data from the PLCs. Any Operator interface can be set up to view the data through either SCADA as it's primary source of data and use the other as redundant backup(the PCs for the Operator interfaces are the weakest part of the system and redundancy achieves a high degree of availability for the data).

The general approach to automation has been to create a three layer system consisting of local control, backup panel control and computerized control. Each layer of control adds increasing functionality and requires the lower layer of control to be operational. Local controls generally are hardwired on-off switches which bypass the majority of interlocking features. Backup panel control includes PLC's which provide interlocks, backup panel mounted analog controllers to control process parameters, and digital alarm panels to display alarm function. Backup panel controls must be operated from the area control centers and do not allow for centralized control. Computerized control allows for control from a centralized control room as well as local area control if necessary. Features of the computerized control system far exceed those of the backup panel system and allow for archiving of plant operating data.

2. What type of control systems do you have at the . . .

Machinery and equipment (PLC's, analog loops, centralized at a mini computer, etc.)

Control systems located at the machinery and equipment generally are hard wired start-stop switches and some hard wired interlocks such as high discharge pressure switches. These controls are functional when a PLC bypass switch is engaged locally which bypasses the output of the PLC in the control loop. The PLC processes start-stop commands from both the backup panel and computerized control system and provides the majority of process and safety interlocks. When VFD's are utilized the speed output can be locally controlled manually bypassing the output of the backup panel analog controller or computerized control system loop controller. Some packaged equipment may contain a dedicated PLC installed by the OEM to provide localized control of the equipment. In some areas localized alarm panels are installed to annunciate alarms.

Area system controls such as secondary treatment, digesters, etc.

Area system controls at generally located at an Area Control Center (ACC) with associated process equipment start-stop switches, analog controllers, analog process displays and alarm panels and often PLCs. The ACCs have a PC operator interface just as cabable as the ones in the centralized control room.

Centralized control room

The centralized control room In conjunction with ACC are used during the day to control the processes. During the off shifts much more responsibility is placed on the CCR operators, from operating another plant remotely to monitoring 80 pump stations, to controlling and monitoring the main plant.

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	4,000
Digital outputs	=	2,000
Analog inputs	=	600
Analog outputs	=	200

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

The City is using flow pacing for CL2, Odor etc.. At least ten chemicals are flow paced.

List other automated flow regulation.

Several integrated PLCs control the secondary bypass around the plant with the operator setting the target bypass points.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

At this time alarms are generated by both the PLCs and the Operator interfaces. We are considering moving all alarm detection to the PLC level. Alarms are detected on a scanned data basis (usually 1 second). The operator can acknowledge the alarms from any location that has an operator interface (including field locations). Available conditions for alarm detection is quite extensive. Alarms are often shown on both the alarm summaries and the control graphics.

Equipment Start and Stop

Equipment can be started and stopped locally, from the backup panels and from the computerized control system. Requirements for starting and stopping (interlocks) can vary greatly depending upon which system is used to start.

Process Data

Most process data are displayed locally at the transmitter and again at the backup panel. For the most part the data are not graphed or retained at these locations. Process data can be viewed, graphed, stored, processed and retrieved through the computerized process control system.

Equipment run hours

Equipment run hours are generally maintained locally by a run time hour meter, we are just starting to have the control system keep track of the equipment run times.

6. Describe how your system archives information.

We use an NT based server to archive our data with redundant discs and a back up tape generated each night.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service. Maintenance has several computerized control system consoles located in their area.

Operations

Operations uses the system for control and monitoring of the plant process and to monitor the off-site pumping and treatment stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room. Equipment located throughout the plant can be started or stopped and process setpoints can be changed from the control room. Any console can control or monitor any where in the system (remote or not).

Process Control or Laboratory

Laboratory data is analyzed primarily off site. The process control section uses the consoles located in the process control section to monitor process operation. Data collected by the system is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

Engineering

The engineering section uses primarily historical data for engineering studies. The studies may involve plant additions or collection system impacts by major storms. Engineering uses operator interfaces for monitoring and tuning during start up phases.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

Monitoring of off-site pumping stations is primarily through local PLC's and RTUs at the stations, utilizing two redundant systems. The computerized control system is utilized to monitor off-site pumping stations and to generate alarms to notify the plant operators of changing situations and events at the facilities. Monitoring utilizes Radio.

Control and monitoring of our second treatment plant is easy because of the distributed control system we are using (Intellutions DMACS). Control from the main plant is no different than control from the remote site (Manned during the day).

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

The City agency has taken a qualitative approach to computing automation benefits and cost/effectiveness. Sometimes automation of a system can be tied to direct cost savings. Often the automation comes as part of an overall project which does provide cost savings or better quality but it is very difficult to single out the savings that should be allocated to automation.

10. Describe the following:

How does your level of automation help with decisions?

The computerized control system makes detailed current and historical information available for use in decision making. Information is available to be presented in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

New control strategies can be devised and implemented usually with only minor reprogramming. The newer computerized control systems provide considerable flexible and expandability to accommodate plant modifications.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

All PID loops are done in either PLCs or Loop Controllers. The integration of the PLCs through Data highways is expected to allow us to use data from several locations within one loop (well into design phase).

How does your system identify and prioritize critical and non-critical condition information?

Data can be handled by our system as status or any of three levels of alarms (more levels in the newest software). It can also be handled on area basis. The operator can see all the data for all the Plants and pump stations (80) or the operator can focus in on several areas or even just one area or system and receive alarm and status information for that area Plant data is collected and archived by the control system based on predetermined request rates.

How does your system store critical and non-critical condition information?

Time stamped data are written to the record on either a timed basis or a change of state basis. The computers, network and PLCs are fast enough to do this.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

Reliability and when appropriate redundancy have worked well for us in the last few years, reducing our overflows and call outs (and not everything is an emergency). Purchase an open architecture systems employing non proprietary components is a plus when possible. The potential systems should be thoroughly checked out with other users. Ensure that the system will do what you want it to do. Make sure that the vendor has a track record of providing for customer upgrades following product software revisions.

12. What are your future plans?

Our future plans are to procure system components which employ open architecture whenever available and compatible with our standard PLCs. We are changing our existing system architecture, making it more redundant and reliable, anticipating integrating our PLCs and their data much more in the future. We have a system employing Intellutions FIX working in conjunction with PID capable PLCs.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

Most maintenance on the system is performed by in-house personnel. Expansions of the system generally involve in-house personnel both maintenance and staff engineering.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

Major modifications to the control systems have accompanied major plant expansions and have been designed by both consulting engineering firms and City personnel. In many cases this has been a very cooperative design situation. In some instances consultants have done the entire design in others the city has done the entire design. Minor modifications are made by plant maintenance personnel. The maintenance section handles the majority of changes to the operator interface screens and historical.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

The partly unattended facilities which we operate (pumping stations and a small treatment plant) are under the control of local PLC logic controllers and analog process controllers. The facilities are monitored by the distributive control system and alarm conditions, levels and process equipment status are displayed in the main plant control room. When problems are indicated either an on-shift operator or a call-in operator will respond to check it out. Redundancy in control and communications is being implemented to reduce the required callouts.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

We implementing this at our small treatment plant and if successful will use it at our larger facility.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response?

We are planning to test this soon.

18. How many hours did it take to fill out this questionnaire?

Approximately 3 hours.

ENERGY

Treatment Plant/Facility:	**Columbia Plant/Maintenance**
Your name and position:	**Duane Sanger**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **duanes@bes.ci.portland.or.us**

1. What is your average plant demand in 1996, what was your peak kVa and total annual electric power costs for the year?

All information is based on FY 96/97: 3.729 MW, 5.457 kVa, $932,400.

2. Purchased from?

ENRON (Portland General Electric).

3. Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.

Peak shaving is not possible due to demand coming at extreme high flows due to rain storms when the system is operating at maximum signal. We currently are in the process of installing a 200 kW fuel cell Cogeneration using biogas. We do sell biogas unscrubed to a local roofing company for about $ per year.

4. **Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.**

   We may have full access as in the future but not now.

5. **What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?**

   Our current rate (1998) is 2.6 cents per kWh and it expected to reach 3.6 cents by 2000.

6. **Describe your implementation of any strategies to obtain market access to power.**

   We are involved with legislation that would allow government entities to allow wheeling access to market power.

7. **What have you done to reduce or control power consumption within your system?**

   Installed VFD drives, installed fine bubble full bottom aeration in secondary, installed high efficiency blowers, installed low wattage and energy efficient lighting, trained staff, etc.

8. **How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?**

   9606 Mbtu.

9. **Purchased from?**

   Northwest Natural Gas Company.

10. **Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?**

    No.

11. **What do you expect the picture to be over the next five years in your area for gas rates?**

    Stable with seasonal variations.

12. **What have you done to reduce gas consumption or improve utilization within your plant?**

    We are adding a fuel cell to use some of the biogas.

13. **Describe your implementation of any strategies to obtain competitive priced access to gas.**

    Not applicable.

14. **What other recommendations would you make to other wastewater treatment plants in management of energy purchases and use?**

    Insure a good understanding of how the utility provides for demand capacity, kVar and kWh needs and what the treatment plant need are in these areas.

15. **Attach your electric power and gas rate schedule.**

16. **How many hours did it take to fill out this questionnaire?**

    Two and one half.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**Columbia Plant/Information Systems**
Your name and position:	**Craig Everhart**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **craige@bes.ci.portland.or.us**

1. **Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?**

   CAD network/rational database

   AutoCAD currently in use. Software systems for intelligent drawings (linked to maintenance database) are being considered. A pilot project in this area has been attempted.

E-mail

Currently implementing agency-wide Email using Microsoft Outlook and Microsoft Exchange.

Internet/intranet

Selected users have had Internet access via Compuserve. Currently evaluating Internet Service Providers to provide Internet Email and browsing via direct network connection. Internet web site (public home page) was cut from the budget and is not currently under development. Internal Intranet capabilities are being planned for implementation in the next six months. Internet content development will begin slowly and grow over time.

Automated time keeping

The maintenance management system has some time keeping functionality, but it is not widely used; nor is it directly linked to the creation of official time cards. Some hand-held field devices have been piloted for data collection (including time data). This pilot project was successful, but now the software needs to be retrofitted due to a new release of the maintenance management software.

Automated record keeping

Systems for the capturing, indexing, storing, and retrieving of documents are currently being evaluated. This is a complex, agency-wide problem that will require considerable time and resources to address.

2. What is the extent of internal access to agency data on-line?

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, ***Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?).***

About 2/3.

Breadth and depth of information: What percent of data that would have been tracked in written ***reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?***

About 5/6.

3. Maintenance management system (or related functions).

What type of maintenance managementsystem do you use (application, company).

We use WCMS for Sewer line and surface water maintenance, from Hanson Inc. in California. We are planning on replacing it with MAXIMO from PSDI in Boston. We are using MAINTENANCE MANAGER from Business Solutions, recently moved from Chicago to New York. We will be evaluating its replacement with MAXIMO.

Please list several major features of your Maintenance management system.

Equipment, sewer line, surface water facility, and stores inventory, work order history, PM generation and tracking. Labor and material tracking.

When did you implement your MMS ?

1988-1989.

What was the cost of purchasing/implementing (not including user/operator training.)

- WCMS: $500K+
- Maintenance Manager: $100K

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

- WCMS: 2 FTE
- Maintenance Manager: 1.5 FTE

Service request tracking system

The maintenance management provides for the creation and tracking of internal service requests. In addition, the O&M Engineering department created their system on Access 97 to document the various requests they receive as a troubleshooting/customer service organization.

Predictive maintenance scheduling

Currently being considered.

4. Do you use or plan on implementing on-line O&M manuals?

We are looking at it.

5. What technologies/systems does your agency intend to implement soon?

Some of the technologies planned and at least partially funded include document management, data warehousing, Internet Email, Intranet, and the upgrade or replacement of financial, laboratory, source control, and maintenance management systems.

6. Have these technologies/systems been studied and recommended?

These projects are being considered on case by case basis. Some are budgeted, and others are deferred for future years.

7. Has funding been appropriated?

See above.

8. What plans does your agency have for the integration of servers?

Currently, multiple servers are used to support the various applications and network users. Servers consolidation is being considered, but is not a high priority item.

9. What plans does your agency have for data warehousing (cleansing of the best data)?

Currently, various applications each have separate databases. Combining or sharing of data are difficult. Data warehousing is being researched to provide for the extraction, cleansing, and integration of data.

10. How many support resources (FTE's) does your agency employ?

The Information Technology divisions currently employ 17 regular employees and two contract employees.

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

Use information technology to increase productivity, improve processes and facilitate a more efficient and effective agency.

12. How many hours did it take to fill out this questionnaire?

1hr.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility:	**Columbia Plant/Engineering**
Your name and position:	**Steve Simonson**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **steves@bes.ci.portland.or.us**

1.a Discuss the typical transition from project to operating system at your facility.

Construction manager usually does initial testing and then turns the project over for functional testing and startup. Policies have been developed to formalize testing and startup and a responsibility matrix has been developed so that all parties know their roles.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

The majority of the design work for the treatment facilities is done by consultants. The estimated split is 90% by consultants and 10% by in-house engineering staff. Staff engineers usually serve as design phase project managers.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

At a minimum, all treatment facility capital projects employ a project review team which has representation (usually managers) from all effected Operations and Maintenance sections. On larger capital projects, approximately $5 million and larger, a customized staff involvement plan is developed to get O&M

involvement and input (i.e. on wet weather treatment facilities designs, various staff advisory committees were used during design). Sometimes there is a formal method to document and track issues raised (i.e. on headworks design, a formal recording and response program was used).

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

Yes, staff suggestions are incorporated into the designs. We encourage participation of O&M staff during the design to know what works and what does not work, in the opinion of the staff, with respect to existing similar facilities. The staff involvement is also encouraged to pass on to the design team current plant standards for equipment, or for operation, which may not be recorded elsewhere. The level of responsibility depends on both staff familiarity with the facility under design and staff availability. Section managers or O&M leads most often attend the project meetings and they do have the appropriate level of authority. Design team still has ultimate authority and responsibility.

3. Training

Classroom (lecture, workshop, etc.)

Yes.

Review of O&M manuals

Yes.

Hands On

Yes.

Other

The above are the primary types of training provided. For special equipment or systems, manufacturer's training is also provided.

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

Design specifications: On most projects, the design consultant will provide some classroom training and prepare some of the O&M manual. Additional training on controls is provided by I&C specialists, either contracted or plant staff. Construction specifications: Usually only pertain to manufacturer's training on equipment.

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

The training is usually provided by a combination of all of the above. The in-house staff fills in the holes in the training after the elements identified in 3.b) above are completed.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

The contractor and the construction manager (CM) are responsible for basic equipment testing to make sure the systems and equipment are operable. Controls, including both primary elements, electrical control devices, and PLC programming, are then tested by I&C specialists, either contracted or plant staff. Functional testing and startup testing are then performed by a combination of plant staff, design team, and construction manager or inspectors. There is an actual startup team that handles this for larger projects.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

Startup testing is done, but until very recently there has been no uniform procedure and it usually was done as part of construction. A policy has now been established where the O&M staff has primary responsibility during startup testing and the contractor acts in a support role.

How is performance testing conducted?

By CM and contractor, usually piece-by-piece.

What is done to ensure O&M satisfaction by the designers?

Staff engineers manage the design work and have the responsibility to get O&M involvement, including design reviews. This is documented in the final design report.

What is done to ensure O&M satisfaction by the contractors?

CM is responsible to make sure contractor meets all the requirements of the contract documents. This is documented in the final construction report.

What is done to ensure O&M satisfaction by the equipment suppliers?

CM and contractor are responsible to transmit record of equipment testing to O&M, usually part of the O&M manual.

What is done to ensure O&M satisfaction by thestaff engineers?

See above and staff engineers usually follow-up by participating in training and startup.
Construction management staff.

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

The contractor is responsible for a continuous seven-day "Start up" operation of systems and equipment. When the seven-day run has been completed successfully; - we have reached "substantial completion"; at which time the project will be turned over to the operations staff for a continuous 30-90 day "Acceptance" run. The length of time required for this portion of the acceptance testing is often driven by the Warrantee requirements specified by the individual equipment manufacturer certification of the installation.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics)

Yes.

Have standards been developed for O&M manuals?

Yes.

Have standards been developed for control system software and hardware (software)?

Yes.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

50%, recording of as-built information is the responsibility of the construction manager/inspection team and the contractor. Often detailed information is not recorded. Sometimes the construction and contractor hard copies are simply not forwarded for unknown reasons.

6. How many hours did it take to fill out this questionnaire?

2 hours

PREDICTIVE MAINTENANCE

Treatment Plant/Facility:	**Columbia Plant/Maintenance**
Your name and position:	**Mark Mitchell**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **markm@bes.ci.portland.or.us**

1. Fill in the following to describe maintenance activities at your facility. This should be a reflection of actual maintenance work being performed.

Total approximate maintenance staff hours for FY 96/97.

Mechanical: 35,360 hr.
Instrument: 10,400 hr.
Electrical 18,720 hr.
Painter & Machinist: 4160 hr.

2. Does Your Facility have a Predictive Maintenance program?

Yes

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis	X	
Infrared Monitoring	X	
Lubricant Analysis		X
Ultra Sonic Testing	X	
Other (please describe) _____ .		
Equipment Run Time Monitoring - Overhauls based on Hr. Meter		

Do your "In house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis		X
Infrared Monitoring		X
Lubricant Analysis		N/A
Ultra Sonic Testing		X
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed
Vibration Analysis		
Infrared Monitoring		
Lubricant Analysis		X
Ultra Sonic Testing		
Other (please describe below)		

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Reduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes. We don't measure it quantifiably; however, we do have many specific examples of detecting serious problems and correcting them before they result in an equipment failure. This type of corrective work usually requires minimal effort to prevent major problems from developing. It can be as simple as realigning a coupling or balancing a motor rotor.

Reduction in corrective maintenance work orders? Describe how you measure it.

No. If anything, our Pdm programs increase the amount of corrective work we do - in response to problems detected. The result is that we end up doing "different kinds" of maintenance work. (corrective vs. reactive).

Reduction in total maintenance staff time? Describe how you measure it.

No. Our Pdm programs may actually increase total maintenance staff time; however, we can see examples of early problems detected and corrected that could have resulted in over time and possibly call out time; as well as more costly repairs due to catastrophic failure.

Increase in planned maintenance work orders? Describe how you measure it:

Yes. Our CMMS categorizes work orders by a “type code". This allows us to look at a history report which will show us that we are doing more "Planned”, “Corrective”, and “Preventive” maintenance and less “Emergency” work.

Reduced energy costs? Describe how you measure it:

No. We don’t have electrical metering beyond our primary feeders. Motor current analysis and amperage readings are not currently monitored on a routine or periodic basis.

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Every 90 days we produce a vibration analysis report which makes recommendations for corrective action. There are usually about 10 recommendations per period. They are given a severity rating and we respond to them accordingly. These recommendations will include early bearing faults; balance/alignment problems; electrical problems etc. If not corrected these problems will eventually manifest themselves in some kind of equipment failure, (and as you know, equipment always fails in the middle of the night).

To illustrate some of the savings we have realized with the use of Vibration analysis I have included the following example: We knew that we were spending too much money to maintain a set of NASH blowers. We use these compressors to bubble air into one of our digesters which is used as a blend tank to blend digested sludge with lagoon sludge before dewatering. Every year or so we would spend approximately $4,000 in parts and labor to rebuild the pumps. With the use of Vibration analysis equipment we were able to detect a problem with the pump/motor base. The foundation was causing undue stress on the housing of the motor and pump. Even when the machine appeared to be well aligned the housings of the pump and motor were being contorted due to stress caused by an uneven machinery base. After corrective action was taken, vibration levels reduced dramatically and the machines have been running without incident for well over a year; - This can be considered an annual savings of $8,000. This is just one example of many.

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

We continue to grow our predictive approach in many ways. We have continued to budget for equipment and computer upgrades to provide modern hardware/software for both vibration analysis and infra red technologies. We have also committed to the need for staff training so that we can better take advantage of the investment we have made. Part of the work we are doing in this regard is a change in philosophy about the way we do maintenance. With the use of condition monitoring we can better plan our maintenance activities and dramatically reduce unplanned equipment failures. We will prolong the life of our equipment and increase the efficiency with which it runs - saving overall maintenance costs and electricity. A machine that runs with relatively low vibration levels doesn’t have to work as hard to stay running; thus, draws less amps and won’t have to be overhauled as often. Because we use our vibration analysis program to lower overall vibration levels in rotating machinery we are truly addressing maintenance problems before they occur. That is the essence of the “predictive”, and “proactive”, maintenance philosophies which are becoming mainstream discipline in competitive industries such as ours taking us away from the old “if it ain’t broke don’t fix it” mentality and into a new era where “precision” approaches to maintenance and repair work are a minimum standard.

7. How many hours did it take to fill out this questionnaire?

About 4 hrs.

OFF-SHIFT STAFFING

Treatment Plant/Facility:	**Columbia Plant/Operations**
Your name and position:	**Chris Mack**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **chrism@bes.ci.portland.or.us**

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

CBWTP staffs their 24-hour operations with 5 crews. All shift schedules is attached for reference. They are: Day shift, Swing shift, Graveyard. Day shift is composed of 3 groups: liquids, biosolids, Operations and Maintenance. The day shifts are led by an Operations Manager. Liquids has 5 operator 2's and one operator 1, biosolids has 6 operator 2's, Operations and Maintenance has 13 operator 2's and 5 operator 1's. Swing shift, and Graveyard are supervised by one Operations Supervisor. Swing shift has 6 operator 2's, Graveyard has 7 operator 2's. Each shift works a schedule 40- hour workweek. The plant is staffed 24 hours a day 365 days a year. The days off and shift is consistent and selected by seniority. Each work group works a straight 8-hour shift; shift splits are 2300 hours to 0700 hours, 0700 hours to 1500 hours, and 1500 hours to 2300 hours. At present daily minimum staffing is: 3 for liquids, 4 for biosolids, 0 for Operations and Maintenance, 4 for Swing shift, and 5 for Graveyard. Each group has a lead (one of the operator 2's).

2. Describe the following:

Grade levels and required expertise for off-shift operators

There are none required.

Staffing by process area during off-shifts: What numbers do you staff where?

The treatment plant is divided into process areas. Swing shift is one operator as follows:

- Influent pumps, bar screens, grit classifiers, digesters, primary sedimentation basins
- Secondary aeration basins and clarifiers, pump station monitoring and remotely monitors Tryon Creek WTP
- Solids handling,
- Process lab work-

Graveyard is as follows:

- Influent pumps, bar screens, grit classifiers, digesters, primary sedimentation basins (1 operator)
- Secondary aeration basins and clarifiers, pump station monitoring and remotely monitors Tryon Creek WTP (1 operator)
- Solids handling (2 operators)
- Process lab work (1 operator lead)

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	Pump stations, Tryon Creek WTP
Troubleshooting of systems/equipment	X	
Emergency response	X	
Process adjustments	X	
Process sampling	X	Mostly done by automatic samplers
Process testing	X	Wasting rates, SVI, TSS, MLSS, RSS
Laboratory testing		
Preventive maintenance of equipment		
Equipment repair		Only simple emergency repairs
Isolation/shutdown of systems/eqpt.	X	
Coordination of maintenance work	X	
Construction contractor support	X	Mostly handled by separate staff
Development of monitoring reports		Handled by support staff
Buildings & grounds maintenance		
Plant security		
General Housekeeping	X	

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

High flows caused by rain.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

Overtime is used for sick leave if needed. Vacations, 5 days or more, are covered by the Operations and Maintenance group's pool of 4 operators, determined by seniority bidding.

Other scheduling procedures and policies

Shift staffing is based on labor agreements, civil service rules, and departmental guidelines. (It is too elaborate to go into now.) Vacations are encouraged to be 5 days or more to utilize members of the pool.

3. Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.

Support staff is available to the On Call Coordinator on a call-in basis. Weekly we have on call: the coordinator, a pump station mechanic, a plant mechanic, an electrician, and a instrument technician.

4. What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.

None, we have just reduced the off shift staffing levels to their current minimums and do not anticipate any further reductions. The Operations and Maintenance group will be reduced through attrition. We are undergoing expansion and may increase staff if necessary (one on each shift).

5. Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?

We believe that in most cases we will be able to stay within the guidelines of the current labor agreements. There are some issues, such as workforce flexibility, call out pay, overtime for replacement pool members which will need to be addressed. We are hopeful that these issues can be addressed in a cooperative manner with the labor unions.

6. What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?

The main treatment plant is staffed on a continuous basis with operations personnel. Maintenance personnel are called in as necessary to respond to emergencies. A high level of process and control system redundancy minimizes the amount of call-ins.

7. What is your organizational philosophy to unattended operations? What are your future plans?

We are expanding and will utilize this more. We also have a SCADA system called DMACS that is used and will expand as the plant expands.

8. How many hours did it take to fill out this questionnaire?

1.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**Columbia Plant/Maintenance**
Your name and position:	**Mark Mitchell**
Phone # of relevant contact:	**(503) 823-2436**
Address and email:	**5001 N. Columbia Bvd. Portland OR. 97203** **markm@bes.ci.portland.or.us**

1. To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]

For the most part our operations and maintenance functions are not combined. The only possible exception is our "O&M crew" within the operations side of our O&M division. The O&M workgroup is a group of about 18 operators. They do a wide variety of work which includes grounds/facility maintenance clean up; bicycle maintenance; digester & tank cleanups; light bulb replacement; fire extinguisher and SCBA preventative maintenance; and operations shift coverage, etc. They do not do work that is in conflict with the interests of the technical maintenance trade work groups.

2. Provide a copy of your current organizational structure for operations and maintenance.

See attachment WWGRP-BUDGET.

3. Do you have a single manager over both operations and maintenance?

As a part of a plant redesign, operations and maintenance have been combined under a single "Superintendent". This forms one O&M division. Each work group, (E&I; Mechanical; etc.), still have individual work group managers who supervise and manage the individual program.

4. What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance?

1:16 Manager, or "Supervisor"); to hourly employee. Those groups are typically divided into "teams" of approximately six people, with a working lead, (an hourly employee). The leads do not supervise, but help schedule and organize the work of the teams. They receive additional compensation for this effort. The lead assignment is not a bid for or competed for position. It is not based on seniority, but rather assigned by the work group manager as discretionary.

5. Which of the following "maintenance functions" are performed by operators?:

Task		Comments
Routine preventive maintenance	X	Only very limited functions.
Repair of equipment	X	Bicycles
Predictive maintenance activities	X	Some data collection only--no analysis.
Process modifications		
Non-process modifications		
Cleanout/isolation of systems/eqpt.	X	Involved in large tanks & eqpt.
Cleaning and calibration of instruments		
Simple electrical repairs	X	
Changing Lightbulbs		
Maintenance of automatic samplers		
Computerized maintenance mgmt.		
Vehicle service		
Buildings & grounds maintenance	X	
General Housekeeping	X	

6. What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?

0%.

7. Do you offer incentive programs to encourage cross-training?

Not currently.

8. Provide a copy of your current salary structure for operations and maintenance personnel.

See attachment COP$.

9. What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?

The constraints are more a part of the work culture and specific job descriptions rather than contractual. We believe the labor agreement itself allows for considerable mobility in this regard. However, I do not have a lot of confidence that the membership is at all interested in a wholesale change that would encourage cross training and multi-functional job assignments.

10. Cross-functional process-based work teams:

Do you either currently have or plan to implement cross-functional process-based work teams?

Not at this time.

If so, how are these teams organized and what authority is given to team leaders?

Not applicable.

What is the makeup of the teams?

Not applicable.

11. How many hours did it take to fill out this questionnaire?

2 hr.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility: **Columbia Plant/Maintenance**
Your name and position: **Mark Mitchell**
Phone # of relevant contact: **(503) 823-2436**
Address and email: **5001 N. Columbia Bvd. Portland OR. 97203**
markm@bes.ci.portland.or.us

1. Is your agency/has your agency considered re-engineering your work practices and organization structure using:

2. In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, "Combined Operations and Maintenance," to clarify the scope of this question.]

How many trades or disciplines are in your current structure and what are they?

Electrical, Instrumentation, Mechanical, and Operations. Operations and Maintenance were originally divided in two divisions under a Maintenance Superintendent and an Operations Superintendent. During the '96-'97 year we consolidated operations and maintenance under one O&M Superintendent and eliminated a Superintendent position. All the technical trades have been consolidated in to two basic workgroups. The two workgroups are the Instrumentation/Electrical group and the Mechanical workgroup. The Mechanical group is a multi-craft workgroup in that they do piping as well as traditional mechanical/millwright work. During the '96-'97 year, Operations was divided into two work groups. The work groups were Treatment process and Bio-solids. A more recent reorganization has divided the Operations group into three individual workgroups: Liquids; Solids; and O&M. The O&M workgroup is comprised of operations personnel. They do wide variety of work which includes grounds/facility maintenance clean up; bicycle maintenance; digester & tank cleanups; light bulb replacement; fire extinguisher and SCBA preventative maintenance; and operations shift coverage, etc.

Do trades cross technical boundaries? If yes, please describe their interaction.

No.

3. What is your agency's definition/interpretation of workforce flexibility?

Workforce flexibility in the way that we typically talk about it is a "graying of the lines" between traditional job classifications in a way will ad flexibility to our work group structure, and help us gain efficiencies. It is also an opportunity for people to challenge themselves to learn new things and to do new, - more interesting kinds of work that will hopefully result in a greater sense of job satisfaction. In addition; I believe workforce flexibility is about asking people to take the future of our organization into their own hands in the face of an increasingly competitive marketplace; and to challenge each individual to accept a greater sense of personal responsibility and accountability in the work they do.

4. Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.

We have no formal plan at this time. However, our management style is increasingly progressive and I believe we will move toward an organizational structure that will allow us to become more workforce flexible. Given the perspective of the union leaders I believe this may have to be achieved in baby steps over a period of time rather than one giant leap. Our objective at this time, is to get there through continuous improvement.

5. **Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?**

   There are no immediate plans for any substantial restructure. However, we have identified the need to reduce our mid level management staff. We will do this through attrition. We currently have several such employees who will be retiring within the next five years. The most likely scenario is that we will not fill those positions when they retire, but rather expand the scope of other mid level managers to take on additional responsibilities to fill the gap.

6. **What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)**

   Not applicable.

7. **What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?**

   Not applicable.

8. **What skills, goals or objectives does your agency intend to "incentivize"?**

   The agency has formed a small ad hoc committee to look at gain sharing through cost reduction.

9. **How many hours did it take to fill out this questionnaire?**

   3.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility:	**Wastewater Group**
Your name and position:	**Stephen Behrndt, Director of Wastewater Mgmt.** **Mark Mitchell, Maintenance Planner**
Phone # of relevant contact:	**(503)823-2432** **(503)823-2436)**
Address and email:	**5001 N. Columbia Blvd. Portland, Oregon 97203** **steveb@bes.ci.portland.or.us** **markm@bes.ci.portland.or.us**

1. **Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisor's unionized? Is the shop open or closed? What is the umbrella union organization(s)?**

   We have a facility that is unionized for all of our "line" employees, and non-unionized for some technical and virtually all supervisory employees. All "represented" employees are required to pay union dues, but not required to join unions. There are several unions in the BES. Some of the unions bargain labor agreements together in a coalition called the "District Council of Trade Unions (DCTU)." The DCTU unions representing BES employees include: Municipal Employees Local 483 (Laborers Int'l Union of North America), IBEW Local 48 (IBEW), AFSCME Local 189, Machinists and Mechanics #24, Operating Engineers Local 701, Painters Local 10. Also, many of our Engineering employees are represented by "The City of Portland Professional Employees Association" (COPPEA).

2. **On what issues do your unions meet and/or negotiate with management?**

   The DCTU bargains a labor agreement with and for its member unions. The COPPEA bargains a separate agreement. Whether the unions work in concert with each other with management to resolve work and business issues depend on the issue. Issues that might affect a cross-section of union employees might get comprehensive attention, while issues central to a specific individual or work team might not. While routine business issues that do not conflict with a provision in the Labor Agreement(s) are generally not negotiated with the union, the work atmosphere is increasingly inclusive with employees and union leaders on developing and sustaining modest to moderately difficult work process changes.

3. **If your answer to 2. (previous question) discussed issues outside the traditional hours, wages and working conditions as part of a MOU or Contract, please discuss the formation, structure, roles and empowerment of this process and/or committees.**

   There is no standing labor-management committee that discusses business issues. There have been at times, and we just happen to be in a transition time between established committees. There are often ad hoc committees formed to discuss issues such as reorganizations, strategic planning, etc.

4. **Are you working with your union on competitiveness? If so, please describe.**

   Yes and no. In the past several years, efforts have been made with the union to discuss common-ground issues relating to competitiveness in the marketplace. While there are routine meetings there has not been much success in developing a definitive plan of action to tackle issues that have been identified.

5. **Are you involved with labor on training programs?**

   Not formally with the union. As with all of our Ad Hoc committees, the unions are strongly represented. The membership is from the entire employee base however. While this committee has union members, it is composed of volunteers and is not considered a labor-management committee. (We do have a formal Industrial Maintenance Millwright apprenticeship program in place for our Mechanics, (a four year program). The City of Portland is a state recognized training agent and the program is approved by the Oregon State Apprenticeship Training Council, and monitored by the Bureau of Labor and Industries. The program has been very successful, - but it is not paid for by any union trust. It was developed by an Ad Hoc committee and it is funded by the City; (we pay a tuition so to speak; as well as wages for 160 hours per year of formal classroom training.)

6. **Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?**

   Yes, we have tried both, collaborate and interest-based bargaining. In whole, this experience has been more successful with the professional staff versus the traditional blue-collar O&M staff. It has seemed that many of the leaders of the union, as well as members of management, have had difficulty breaking out of the collective bargaining model, which has been in place for so long.

7. **What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?**

   Primarily through building trust and a more open, collaborative relationship. Trust is enhanced by: involving and/or describing with employees and union leaders the organization's vision, goals and priorities; collaborating with employees and labor leaders on important issues; through consistency in actions and language; and by following through on what we say we are intending to do. In addition, the City Council and the senior management have identified an improved relationship with the unions as an organizational priority. We expect to have facilitated processes to develop a long-term partnership over the next few years.

8. **How many hours did it take to fill out this questionnaire?**

   1 hour.

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility:	**Wastewater Group**
Your name and position:	**Mark Ronayne, Bio-solids Project Manager** **Ken Rosenstock, Bio-solids Manager**
Phone # of relevant contact:	**(503)823-2437** **(503)823-2490**
Address and email:	**5001 N. Columbia Blvd. Portland, Oregon 97203** **markr@bes.ci.portland.or.us** **(kenr@bes.ci.portland.or.us)**

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)**

   Raw solids from primary and secondary clarifiers are digested independently (first stage digestion). Some mixture of first stage digested primary and secondary solids occurs during second stage digestion. Biosolids which consist principally of primary digested solids are dewatered and forwarded to solids hoppers used to provide

feedstock for the CBWTP's within-vessel composting system. Typically, eight to ten dry tons dewatered primary solids are directed to composting operations daily. Those solids are mixed with conifer sawdust and recycle compost. The composting process generates an exceptional quality product which meets federal Part 503 and Oregon DEQ Division 50 exceptional quality standards. Approximately 3,000 dry tons biosolids are used to make roughly 40,000 yd3 compost annually.

Biosolids which result predominantly from the first-stage anaerobic digestion of thickened waste activated sludge are dewatered and forwarded to two-100 wet ton storage hoppers at a CBWTP solids loading complex pending their placement in 35 wet ton payload trucks and transport to the City's biosolids land application site on semi-arid rangeland in north central Oregon (approximately 200 miles east of the wastewater treatment facility). These solids meet federal and State Class B pathogen reduction limits as well as regulatory vector attraction reduction limits (volatile solids reduction accomplished through anaerobic digestion is greater than 38 percent). In addition, they fall within federal and State pollutant concentration limits [i.e., Part 503.13(b)(3) pollutant concentration limits]. Approximately 9,000 dry tons of new solids are generated and land applied on a 4,233 acre site authorized for Portland use by Oregon DEQ yearly. Solids are land applied at agronomic rates (based on plant available nitrogen) throughout the entire year.

Biosolids solids are transported by a contract hauler (Gresham Transfer, Inc.) for $18.09 per wet ton. Biosolids are land applied by a contract applicator (K&S Madison, Inc.) for $10.00 per wet ton. All other operations related to both the Portland's biosolids composting and land application programs are accomplished by City staff.

2 Annual production.

Wet and dry tons by class A, B & C and total

Portland generates approximately 12,000 dry tons bulk Class B biosolids annually. Those solids meet EPA pollutant concentration limits [40 CFR Part 503.13(b)(3)]. Roughly 3,000 dry tons of the bulk Class B biosolids are used to make 40,000 yd3 Exceptional quality (Class A) biosolids compost which is marketed in the Portland metropolitan area under the name Garden CareTM. The remaining solids (≈ 9,000 dry tons per year) are land applied at the City's rangeland site in north central Oregon.

Portland does not produce Class C biosolids. There is no such solids classification recognized by either EPA or DEQ. By Class C biosolids, are you referring to a product that is eligible for landfilling (i.e., one that meets RCRA subtitle D requirements but not all Part 503 requirements)?

Portland's biosolids meet pollutant concentration limits required under 40 CFR Part 503.13(b)(3). These trace inorganic pollutant limits constitute one of three elements needed to fulfill exceptional quality biosolids quality criteria. Vector attraction reduction requirements [503.33(b)(1) to (8)] and pathogen reduction requirements [40 CFR Part 503.32(a)] must also be met in addition to pollutant concentration limits in order for biosolids to be considered exceptional quality biosolids.

Does the system meet "exceptional quality" for metals?

The term "exceptional quality" is not defined (?)

3. Costs.

1997 total operating cost for the program including direct administration, lab support and maintenance.

The total costs for our biosolids program for fiscal year 97-98 was slightly in excess of $2.1Mil ($2.104M).

Capital Investments in dollars associated with the biosolids program.

Capital costs for the Composter was $11.6M initial construction and $4.4M in subsequent system upgrades. I have no capital cost information for the lagoon or the hoppers, loader, etc.

Revenue from use (fertilizer value, energy production, crops, etc.)

"Revenue" from use. For FY 97-98 compost sales generated $102,251 in revenue.

4. What are the number of FTEs in program including administration, operations, maintenance, other.

Administration: 1 (Mark & Jim)
Operations: 3.5 (includes me)
Maintenance Mechanical: 3.25
Electrical : 0.25
Instrumentation: 0.25

5. Describe your major reuse customers or approaches including wet and dry tons to each and class of product.

The principal reuse consumer for bulk Class B biosolids [≈ 9,000 dry tons (≈ 50,000 wet tons) per year] is Kent Madison, a north central Oregon farmer who owns and leases Portland biosolids amended lands to three different cattle companies. Biosolids land application has increased cow-calf grazing operations eight fold on dry years and up to 30 fold on wet years.

Approximately 3,000 dry tons (≈ 13,650 wet tons) biosolids are composted annually generating roughly 40,000 yd3 exceptional quality compost which is marketed to commercial landscapers, soil blenders and nurseries on a wholesale, sealed bid basis. The general public also purchases compost on a retail level on Saturdays during spring, summer and fall months. Wholesale users purchase approximately 97 percent of the compost.

6. Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?

The City intends to continue to recycle 100 percent of the biosolids it produces. The majority of solids will probably be beneficially recycled on agricultural land. Some solids may be directed to drastically disturbed lands requiring reclamation and a small portion of the solids may be used as a soil amendment for intermediate or final cell cover at RCRA subtitle C and D landfills. In addition, Portland is apt to continue to convert some of its biosolids into an exceptional quality compost product. Opportunities for converting biosolids into a Class A product will be explored over the next ten years. The City is likely to continue to privatize haul and land application operations and may privatize all or part of solids removal and dewatering operations required in the future to renovate a 37 acre lagoon immediately north of the CBWTP's mechanical plant. The long range approach is to sustain the land application program and possibly expand to other, more local sites to reduce hauling costs. I personally advocate that we explore further clear-cut land reclamation but I am told that the application costs would be prohibitive. The plan with regard to the composter is to continue operation as long as it is fiscally and politically wise.

7. Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.

By mutual agreement between State regulators (Oregon Health Division and Oregon DEQ) and the City, Portland regularly monitors its biosolids for dioxin-like-compounds to assure that they remain well inside handling and use limits derived from a risk model which received input from EPA Region X, the State Health Division, DEQ, and Limno-Tech and ICF/Clement (contractor's for the City). The risk study culminated with the development of an Oregon State Health Division advisory memo to Oregon DEQ which addressed a question raised by the City concerning the use of City-generated wastewater residuals from the public health perspective. The stimulus for the risk assessment was a May 1990 report to the City that indicated one sample of sludge and one of compost collected under EPA's National Sewage Sludge Survey had been found to have dioxin-like-compound levels higher than those found in similar materials from other US wastewater treatment works. The samples in question had been collected at the CBWTP in May 1989. The dioxin-like-compound level detected in digested solids was 62.3 ppt (TEQ) while that found in compost was 196 ppt (TEQ).

As a result of the assessment, the Health Division recommended: (1) The City continue to identify all sources of dioxin contamination of incoming sewage and eliminate or reduce, to the greatest extent possible, all such contamination; (2) monitor, on a quarterly basis, dioxin-like-compound levels in any new solids or compost produced; (3) continue to apply solids to the City's rangeland land application site provided solids dioxin-like-compound levels did not exceed 285 ppt (TEQ), the contribution of each homologue remained within 20 percent of the value used in the risk assessment, and beef calves did not graze on biosolids amended land for more than two months prior to sale; (4) forage not be used for hay unless the dioxin-like-compound level was less than 21.5 ppt (TEQ); (5) compost contain less than 600 ppt (TEQ) dioxin-like-compounds; (6) if compost contained between 285 and 600 ppt (TEQ) dioxin-like-compounds it only be sold in bulk form; (7) if the dioxin-like-compound levels in compost were less than 285 ppt (TEQ) both retail and wholesale sales would be permitted; (8) compost be used solely for greenscaping purposes; and (9) any retail packages of the product bear the label, "Although this product meets all standards set by federal and state agencies, Garden Care should not be use for vegetable gardening to avoid incidental ingestion. Garden Care is for ornamental gardens ONLY, such as flowers shrubs, lawns, indoor and outdoor potted plants, planter boxes, and trees". Although solids quality has

improved to the extent that retail product package labeling is no longer required by DEQ, the City has retained a facsimile of this advisory statement on retail and wholesale receipts provide its compost purchasers.

Composite samples of land applied biosolids products (comprised of a mixture of approximately 60 percent older, lagoon derived solids which had accumulated since the mid-1950s and 40 percent freshly digested solids) have been continuously tested monthly since 1991. Land applied biosolids have remained well with in dioxin-like-compound limits recommended by the State Health Division. The average biosolids dioxin-like-compound level since the advent of the rangeland application program in north central Oregon has been 149.5 ppt (TEQ). Land applied solids dioxin-like-compound levels have declined with time. During 1995, 1996, 1997 and 1998, solids compound levels were 134.44, 46.59, 37.48 and 38.19 ppt (TEQ), respectively. Since mid-1998, only freshly digested solids have been used for the land application program. The mean dioxin-like-compound level for these products has been in the range of 15 to 20 ppt (TEQ). Dioxin-like-compound testing in soils where Portland biosolids have been repeatedly applied at rates up to five dry tons per acre annually since 1991, averaged 2.2 ppt (TEQ) while nearby, unamended control site soils averaged 1.87 ppt (TEQ). This is well within the range of typical rural area soils in the US [4 ppt (TEQ)] and the national modal soil norm of 8 ppt (TEQ) recognized by EPA. It is noteworthy that very little 2,3,7,8 TCDD has been detected in land applied biosolids. This compound has never been detected in land application site soils.

Dioxin-like-compound levels in biosolids compost have remained well below the Health Division's 600 and 285 ppt (TEQ) advisory limits. Since 1991, dioxin-like-compound levels have averaged 38.31 ppt (TEQ) and recently they have been well below 20 ppt (TEQ).

The City expects the separation of storm and sanitary sewers and incinerator source air pollution control requirements lead to further decline of these compounds with time. Portland will continue to monitor dioxin-like-compound levels in its biosolids and manage solids within Oregon Health Division limits pending the promulgation of federal dioxin-coplanar PCBs regulations. If EPA elects not to regulate these substances in the future, the City may discontinue or decrease the frequency of monitoring these contaminants.

YEAR 2000 COMPLIANCE (Y2K)

Treatment Plant/Facility:	Columbia Plant/Maintenance
Address and email:	5001 N. Columbia Bvd. Portland OR. 97203 markm@bes.ci.portland.or.us

1. Do you have a Y2K program in place in your organization?

I would not characterize it as a "program". Our "Information Systems" (IS) staff have been testing Hardware and Software throughout the agency as part of their regular work for the last few years. Hardware that is not Y2K compliant has been placed on a replacement schedule and all Network software has been replaced or evaluated.

2. Have you inventoried your Information Technology systems (IT)?

Yes.

3. Have you inventoried your embedded systems?

Yes.

6. Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)?

Yes.

10. What testing standards are you using for certifying your Y2K affected systems (give organization Y2K standards or list of dates you will be testing for)?

http://www.hp.com/year2000/compliance.html

FLEET SERVICES

Treatment Plant/Facility:	**Columbia Plant/Facilities Management**
Your name and position:	**Randy Tomsik**
Phone # of relevant contact:	**(503) 823-2424**

Address and email: **5001 N. Columbia Blvd. Portland OR. 97203**
randyt@bes.ci.portland.or.us

1. Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:

Sedans	5
Pick-up trucks	4
Vans currently in use as commuter vans	0
Vans, general pool and other	4
Solids hauling trucks	*
Trucks equipped for in-plant and collections maintenance purposes	5*
Electric carts	17
Bicycles	59
Other :One articulated loader for bio-solids (compost management). One articulated loader, one tractor (implement), 3 forklifts, 3 misc. equipment trailers, used for general oper/maint	9*
* Grit and screenings (dumpsters) hauled to landfill by contract. Compost management on-site by identified truck. Bio-solids hauled to land application, by annual (3-year) trucking contract.	

(Stake-bed, boom crane, and painter cargo van used for onsite mechanical maintenance. PU and cargo van used for onsite E&I maintenance. Pump station maintenance (MECH-6 utility box trucks and 1 SUV; E&I-2 step-vans, 2 cargo vans, 1 SUV) not included in benchmarking process. Collections system maintenance not included and done through interagency(IAA) with BOM (includes 125 vehicles; PU, dump trucks, backhoes, vactor trucks, utility trucks, step vans, special equip, etc.)

2. What is your current vehicle replacement policy?

Passenger vehicles (sedans, mini-vans, SUV, other light duty) are replaced on 7 year cycle. Medium duty (PU, cargo vans, step vans) replaced on 10 year cycle. Heavy duty (Class 8, dump trucks, tractors, tankers, FE loaders) replaced on 15 year cycles. Discretion allowed for mileage, general condition, maintenance history, and annual funding leveling/balancing. Carts and bicycles are repaired/replaced as needed.

3. Do you have a replacement fund?

The fund used to be collected and managed through interagency with BGS/Fleet. Current process to budget both replacement(operation budget) and new vehicle (CIP budget) purchases in annual budget development.

4. Have you made any recent reductions in the fleet? Are you planning on doing so in the near future? What is the approximate annual savings achieved by the reductions?

Rather than reductions, fleet efficiencies (re-allocation) have been made over the last three years. Savings from not purchasing new vehicles (3x$17,000) and annual O&M costs of $1,000 to $1,500 each. This efficiency review will continue annually.

5. Have you experienced any adverse impacts from the reductions in fleet size?

Re-allocation and utilization impacts have been mostly political. Best advantage has been to “pool” all passenger vehicles and implement computer scheduling process to track utilization.

6. How are your fleet vehicles serviced? (In-house or by external contracts?)

Vehicles are serviced through IAA with BGS/Fleet. Annual costs are based on vehicle class (City-wide) maintenance history (three year) with OH costs added. Current costs; Sedan=$870; Minivan=$670, 1T Utility/PU=$1,870;Class 8 Truck/tractor=$9,750; Dump truck 5-6YD=$5,000. Carts and bicycles are serviced in-house.

7. What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.

Two levels of service done annually (once each 6 mo.); ‘A’ level is overall tune-up, lube, 29 point check, oil change, etc. ; ‘B’ level is oil change.

8. How many Fleet Services staff support the fleet?

The plant portion of the O&M cost is approximately $60,000 through IAA.

EAST BAY MUNICIPAL UTILITY DISTRICT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Special District 1, Water Pollution Control Plant/Wastewater Operation**
Your name and position: **Don Hickman, Wastewater Treatment Superintendent**
Phone # of relevant contact: **(510) 287-1456**
Address and email: **2020 Wake Ave., Oakland, CA. 94607**

1. Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.

Station	Analysis	Frequency
Secondary Influent	TSS/VSS/CBOD	Daily
Secondary Effluent	TSS/VSS/CBOD	Daily
Secondary ML	Microscopy	2/week
Secondary ML	TSS/VSS	Daily
Secondary RAS	TS/VS	Daily
Thickening cake	Sludge TS/VS	Daily
Thickening centrate	TSS	Daily
Digester Feed Sludge	TS/VS	Daily
Digesters Recirc Sludge	Sludge TS/VS	1/week
Digester Profiles	TS/VS	6/year
Digested Sludge	TS/VS	Daily
Dewatering Cake	TS/VS	Daily
Dewatering Centrate	TSS	Daily
Process water	Coliforms – Total/Fecal	1/week

2. Have you made any recent reductions in laboratory analyses or are you planning on doing so in the nearfuture? What were they (e.g. process) ? What is the approximate annual savings achieved by the reductions?

Yes. Over the past few years we have reduced the process control analysis by over $301,100 or 26.5%. The following table illustrates some of the significant reductions:

Station	Analysis	Past Frequency	Current Frequency	Annual Savings X1000
Inf/Final Eff	PH	daily	none	14.
Sec Inf/Eff	PH	daily	none	9.4
Raw sludge	pH	daily	none	4.7
Pri Eff	Chemistry	daily	none	35.5
Influent	Conductivity	daily	none	6.1
Sec. Inf., Pri Eff.	COD	daily	none	
Plnt Eff., Sec Inf				88.
Inf, Eff, Sec Inf, Sec Eff,	NH4, TKN,T-P, T-N, ...	weekly	none	20
Process waters	various analysis	daily	none except bac-t	9.2
Polymer QA/QC	dewatering	2x/week	rare	8.
Scum	O&G, TSS	weekly	rare	3.
Plant sludge	pH	daily	none	20.
Digester	chemistry	2x/week	1/week	89.3
Total				301.1

3. Have you experienced any adverse impacts from the reductions in process-related analysis?

No. In fact, we have plans to review this annually with further reduction expected.

4. What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.

Daily chlorine residuals, secondary MLTSS, SVI, RAS TS and dewatering and thickening centrifuge cake TS (microwave) lab analysis are performed by plant operations. We have not reviewed the cost of operator analysis vs. laboratory analysis. We do plan to review if additional analysis should be done by operations instead of the laboratory.

5. Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).

NPDES			
Stations	**Analysis**	**Frequency**	**Cost/Year X 1000**
WWTP PRIMARY INF IPS	TSS, VSS, CBOD, +PLANT FLOWS	D	$39.06
WWTP PRIMARY INF IPS	+COMP	5 DAYS/W	$2.6
WWTP PRIMARY INF IPS	OG	3/W	$10.3
WWTP PRIMARY INF IPS	TSS,VSS, AMM, CBOD, NITRITE	2/W	$16.1
WWTP PRIMARY INF IPS	AS, CD, COLOR, CR, HG, ICP 8, NI, PB, SE	2/W	$45.55
WWTP PRIMARY INF IPS	+SAMP KIT, 610, TOTAL CYANIDE	W	$13.0
WWTP PRIMARY INF IPS	624, 625	Q	$2.68
WWTP EFF DECHLOR	+SAMP/ANAL, DO, PH, DISS S-, TOTAL S-, TURB	D	$64.24
WWTP EFF DECHLOR	+SAMP KIT, +COMP, CYANIDE	W	$4.0
WWTP EFF DECHLOR	BIOASSAY (CHRONIC)	M	$11.4
WWTP EFF DECHLOR 2	+SAMP/ANAL, Settleable Solids, COLIF SM 9221E	D	$34.7
WWTP EFF EPS	TSS, VSS, CBOD	D	$35.4
WWTP EFF EPS	+COMP	5 DAYS/WK	$2.6
WWTP EFF EPS	TSS,VSS, AMM, CBOD, NITRITE	2/W	$16.1
WWTP EFF EPS	AS, CD, COLOR, CR, HG, ICP 8, NI, PB, SE	2/W	$45.55
WWTP EFF EPS	+SAMP KIT, 610, TOTAL CYANIDE	W	$13.
WWTP EFF EPS	OG	3/W	$10.3
WWTP EFF EPS	BIOASSAY (ACUTE) – 2 SPECIES	2/M	$12.
WWTP EFF EPS	624, 625	Q	$2.68
BAY MONIT STATIONS (13)	+FLD DATA, AMM, UNDISSOC AMM, COLIF SM 9221E, COLOR, TURB	2/M	$3.67
BAY MONIT STATIONS (	AS, CD, CR, HG, ICP 8, NI, PB, SE	Q	$3.41
Sludge 503			
Stations	Analysis	Frequency	Cost
Centrifuge Dewatered Sludge Cake	TS, +COMP, COLIF SM 9221E	Daily for 1 week (7d) each month	$5.88
Centrifuge Dewatered Sludge Cake	TS, 9056 IC ANIONS, +SAVE14, AMM, AS EPA 7060, HG EPA 7471, ICP 14 EPA 6010, NITRATE: IC, NITROGEN: ORG, NITROGEN: TKN, P2O5 AOC, PHOSPHATE:TTL, SE EPA 7740	M	$7.824
Centrifuge Dewatered Sludge	ENTVIRUS, HELMINTH,	Q	$3.6

Cake	SALMONELLA		
Air Quality			
Stations	Analysis	Frequency	Cost
Chlorine Scrubber Vent Inf Pumping	8260	M	$2.98
Digester Gas Common Line	8260	M	$2.98
Dewatering Bldg Roof – 4 stations	8260	M	$11.9
Sludge Centrifuge Thickening Exhaust - Before H2S	8260	M	$2.98
Ambient Air – 4 stations	8260	M	$11.9
Exhaust Vent For Oxygen Reactor #8	8260	M	$2.98
Primary Influent At Influent Pumping Station	**624**	**M**	**$2.92**
Secondary Treatment Mixed Liquor	624	M	$2.92

6. Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?

No. We have not negotiated with the regulatory agencies to reduce the regulatory-mandated analytical load. We do have plans to evaluate the possibility of 5 days/week BOD vs. 7 days/week and to reduce some of the required frequency of organics and heavy metals.

7. Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.

Yes. Plan on continued efforts to automate analysis where possible and reduce both process-related and regulatory-required analysis.

8. How many labs do you have in your agency? What are the functions of each?

We have one main laboratory which does all of the non-operations analysis. There are a handful of field labs where operations performs such analysis as chlorine residual, SVI, etc.

9. How many hours did it take to fill out this questionnaire?

10.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility: **Main Wastewater Facility**
Your name and position: **Ben Horenstein**
Phone # of relevant contact: **(510) 287-1455**
Address and email: **P.O. Box 24055**
Oakland CA 94623-1055
bhorenst@ebmud.com

1. Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding) utilized to investigate and test this technology.

EBMUD attempts to investigate promising new technology which comes available in the industry through paper study, pilot test and field-testing. Depending on the size and scope of the project, testing may originate within Operations or support may come from the Process Engineering section and/or from outside consultants.

2. List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).

Technology 1: Streaming Current Detector*	
Methodology	A filed test was set up and a model was tested on dewatering centrate for a 2-month period.
Cost of Test	Minimal. Performed by operations personnel and equipment was on a free loan.
Results	Found theory of the device was sound, but S&C detector plugged-up with solids on frequent basis

	making on-line operation impractical.
Report	Technical memorandum summary available upon request. Contact - Scott Nilson (510) 287-1502.
* A devise designed to improve the efficient operation of a dewatering centrifuge or other application where polymer is applied through reading the charge of a residual stream (centrate) or feed stream where polymer is applied and automate and/or reduce the application of polymer there-by improving performance and/or reducing cost.	
Technology 2: ORP Meter For On-Line Odor Control	
Methodology	A field test was set up and a Stranco ORP meter was tested on influent sewage for a 6-month period.
Cost of Test	$15,000. Purchase of two ORP meters and installation.
Results	Keeping probe clean of oil and grease was virtually impossible. Not currently in use. Plan to test on final effluent for dechlorination control.
Report	Not available.
Technology 3: On-Line TOC Analyzer	
Methodology	A field test was set up and an ISCO TOC analyzer was tested on primary effluent sewage for a 6-month period.
Cost of Test	$12,000. Purchase of one TOC analyzer and installation.
Results	Mixed. Still under testing.
Report	Not yet prepared. Contact James Parker, (510) 287-1458 for greater details.
Technology 4: Gravity Belts And Rotating Screens For WAS Thickening	
Methodology	A field test was set up and an Andritz Belt Filter and Hycor rotating screen was tested for a 10-week period.
Cost of Test	$40,000. Includes $5,000 rental cost of the GBT and staff time.
Results	Less than a 3-year pay-back for installing GBTs vs keeping centrifuges with existing O&M costs. Dramatic reduction in energy with belts and screens as compared to centrifuges. Higher capital cost for rotating screens vs gravity belts due primarily to increased number of units needed to meet capacity needs.
Report	Available upon request. Contact Don Gabb, (510) 287-1602
Technology 5: Odor Control Chemicals	
Methodology	A number of chemicals were field-tested for performance and cost effectiveness, including; hydrogen peroxide, sodium hypochlorite, bioxide, and ferric chloride.
Cost of Test	Approximately $250,000; including consultants, staff time, chemicals, etc.
Results	The bottom-line recommendation is to use sodium hypochlorite for odor control needs in the interceptors and the main plant.
Report	Available upon request. Contact Sanna Garcia, (510) 287-1679
Technology 6: Polymer Addition for Nocardia Control	
Methodology	Addition of cationic polymer for control of Nocardia filaments.
Cost of Test	Only cost of polymer, which depends upon duration of test.
Results	Successful. The addition of small amounts of a cationic polymer eliminated the presence of Nocardia and permitted the operation of the secondary system at significantly higher MCRTs than in past 20-year facility history.
Report	Not yet prepared. Contact Dave Freitas at (510) 287-1502 for details.

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

1. Thermophyllic Digestion in pilot and full scale as part of a WERF grant; 2. Improved temperature monitoring of Digesters to insure 503 compliance; 3. Addition of chemicals besides ferric chloride to reduce dewatering polymer demand; 4. New ISCO on-line H2S liquid-phase sensor to automate odor control

4. How many hours did it take to fill out this questionnaire?

8.

AUTOMATION

Treatment Plant/Facility:	**Special District 1, Water Pollution Control Plant/Wastewater Operations**
Your name and position:	**Don Hickman, Wastewater Treatment Superintendent**
Phone # of relevant contact:	**(510) 287-1456**
Address and email:	**2020 Wake Ave, Oakland Ca. 94607**

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The general approach to automation has been to create a looped highway with individual station DPUs and backup, three-layer system consisting of

- A central control room, (four Distributed Control System consoles & two monitors each),
- Individual station DCS control (a minimum of one console/ two monitors)
- And local control, backup panel controls (PLCs) allow for manual operation when the DCS computer system is down.

Each layer of control adds increasing functionality and allows for operation when the higher layer of control is not operational. Local controls generally are hardwired on-off switches, which bypass the majority of interlocking features. Backup panel control includes PLC's which provide interlocks, backup panel mounted analog controllers, to control process parameters, and digital alarm panels to display alarm function. Backup panel controls must be operated from the area control centers and do not allow for centralized control. Computerized control allows for control from a centralized control room as well as local area control if necessary. Features of the computerized control system far exceed those of the backup panel system and allow for archiving of plant operating data.

2. What type of control systems do you have at the . . .

Machinery and equipment (PLC's, analog loops, centralized at a mini computer, etc.)

Control systems located at the machinery and equipment generally are hard wired start-stop/local-remote switches and some hard wired interlocks such as high discharge pressure switches. When a PLC is placed in manual locally the output of the PLC is taken out of the central control loop. The PLC processes start-stop commands from both the backup panel and computerized control system and provides the majority of process and safety interlocks. When VFD's are utilized the speed output can be locally controlled, manually bypassing the output of the backup panel analog controller or computerized control system loop controller. Some packaged equipment may contain a dedicated PLC, installed by the OEM, to provide localized control of the equipment. In some areas, localized alarm panels are installed to annunciate alarms.

Area system controls such as secondary treatment, digesters, etc.

Area system controls are generally located at a Distributed Control System (DCS) with associated process equipment, start-stop switches, analog controllers, analog process displays and alarm panels. The backup panel discrete controls work in conjunction with PLC's. Also located at the DCS is a console from the computerized control systems which can be used when in computer control to control equipment located in other area of the plant.

Centralized control room

The centralized control room is the operation's center. From the 4 consoles an operator can monitor and control process and equipment located throughout the plant. The computer system provides all of the functionality normally found in all of the DCS combined and advanced features beyond the capabilities of the backup panel control systems.

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	4000
Digital outputs	=	2000
Analog inputs	=	1100
Analog outputs	=	500
Control loops	=	600

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

Yes. For pre, post and utility water hypo-chlorination and SBS dechlorination. We are also developing feedback systems for better control of dose rates. One feedback system is in use to adjust hypo feed on the plant utility water, which is used for many purposes, including an odor-scrubber system.

List other automated flow regulation.

All remote pumping station and wet weather treatment facility start, operate and stop on level controls. The main plant pumping (influent, mid-plant, wet weather secondary bypass, wet weather storage basin and effluent) can be control on levels.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

Alarms that are generated by monitoring of the signals are usually annunciated at local alarm panels or at the DCS. Alarms that are the result of a PLC output are generally annunciated at the backup panel level and can be inputted to the computerized control system. The majority of the alarms are annunciated and displayed on alarm summary pages by the system, sorted by assigned priority.

Alarms are prioritized into three different categories and displayed on the alarm summary sheets by priority. The highest alarm categories can sound an audible alert with different tones.

Equipment Start and Stop

Equipment can be started and stopped locally, from the backup panels and from the DCS. Interlocks require for starting and stopping can vary greatly depending upon which system is used.

Process Data

Most process data is displayed locally at the DCS. Process data can be viewed, graphed, stored, processed and retrieved through any of the DCS locations.

Equipment run hours

Equipment run hours are generally maintained locally by a run time hour meter.

6. Describe how your system archives information.

Process information is archived into two separate databases. One of the databases resides within the Westinghouse Distributed Control System. It is the standard Westinghouse Historian software package. Real time analog as well as selected discrete points are archived into the database. The database allows Operators to display historical trends and reports from many DCS workstations. The Westinghouse historian will soon include an optical disk storage system that will allow five years of online data.

The second historian system is the OSI Software PI System. The application is currently run on the DEC VAX system which will be migrated to the Microsoft NT operating system within the next couple of months. The PI system archives real time analog data as well as manually entered data and selected laboratory data. The data is accessed from a PC using an excel add-in tool provided by OSI software. Online data dates back to 1992.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service.

Operations

Operation's uses the system for control and monitoring of the plant process and to monitor the off-site pumping and treatment stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room or individual station. Equipment located throughout the plant can be started or stopped and process set points can be changed from the control room.

Process Control or Laboratory

The process control section uses the consoles located in the process control section to monitor process operation. Data collected by the minicomputers is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

Engineering

The engineering section uses primarily historical data for engineering studies. The studies may involve plant additions or collection system impacts by major storms.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

Control of off-site pumping stations is primarily through local PLC's at the stations. The computerized control system is utilized to monitor off-site pumping stations and to generate alarms to notify the plant operators of changing situations and events at the facilities. Monitoring utilizes analog phone lines and modems.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

No attempt has been made to quantify the savings associated with plant automation.

10. Describe the following:

How does your level of automation help with decisions?

The computerized control system makes detailed current and historical information available for use in decision making. Information is available to be presented in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

New control strategies can be devised and implemented usually with only minor reprogramming. The newer computerized control systems provide considerable flexible and expandability to accommodate plant modifications.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

Control loops are tuned manually by providing a step change in the transfer function and analyzing the response to the step change. Tuning parameters are adjusted to provide acceptable control response while minimizing overshoot and oscillation.

How does your system identify and prioritize critical and non-critical condition information?

The system allows each point in the system to have a priority assignment and an area assignment. Points can be filtered as critical and non-critical based on how they are assigned.

How does your system store critical and non-critical condition information?

The information is archived to the Westinghouse historian. In the case of critical information, the information is also displayed in the DCS alarm screen and printed to the alarm printer.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

The development of in-house technical support resources is a key to the long-term success of new automation technology.

12. What are your future plans?

To continue to identify opportunities to utilize automation to improve reliability and provide opportunities for greater efficiency.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

Westinghouse, District staff engineers, and instrumentation technicians provide system maintenance and technical support.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

District engineers provide support for modification and generation of graphics, control logic and point addition. Westinghouse provides support primarily when the work is part of a capital project.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

The partly unattended facilities which we operate (pumping stations and a small wet weather treatment plant) are under the control of local PLC logic controllers and analog process controllers. The facilities are monitored by the distributive control system and alarm conditions; levels and process equipment status are displayed in the main plant control room and/or two remote sites. When problems are indicated either an on-duty operator or a call-in operator will respond to check it out.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

No.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

Yes. A software package called Hummingbird allows for home PC to monitor and control plant, remote pumping and wet weather treatment sites.

18. What is the staffing level for monitoring the control system in order to operate the plant and related collection system?

Number of staff and classification:

We have piloted with central monitoring and control and plan to move back to that direction in the next couple of years with an operator assigned to monitor the entire plant and responding to alarms from the outlying facilities. Currently, the shift supervisor is stationed near the central system but most of the monitoring and control happens from field stations.

How much time to they spend in hours per day doing the following?

N/A.

19. Where are you headed in terms of personnel assigned to work with the controls system to operate the facilities? This includes personnel assigned, specialization, technicians and operating strategies. Will you be going to internal logs, training manuals built into the controls, direct access to maintenance information, etc.?

We are headed to utilize the central operating station we have by continuously staffing it witha minimum of 1 journey/senior-level operator.

ENERGY

Treatment Plant/Facility:	**Special District 1, Water Pollution Control Plant**
Your name and position:	**Don Hickman, Wastewater Treatment Superintendent**
Phone # of relevant contact:	**(510) 287-1456**
Address and email:	**2020 Wake Ave, Oakland, CA. 94607**

1. What is your average plant demand in 1996, what was your peak kVa and total annual electric power costs for the year?

Total Power Used = 35.953 MW,
Total Power Purchased = 23.350 MW, 10,987 kW - 3,394 KVAR, $1,370,371
Total Power Generated = 12.603 MW

2. Purchased from?

80 % Western Area Power Agency
20 % Pacific Gas and Electric (PG&E)

3. **Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.**

   During the dry season, the plant is flow paced and flows above 100 MG is allowed to backup in the interceptor channel. Wet weather season, peak shaving is not possible due to demand coming at extreme high flows due to rain storms. 40% of total power used is co-generated using stored digester gas.

4. **Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.**

   Yes, Western Area Power Agency (federal agency).

5. **What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?**

   Do not expect changes given stability of WAPA power.

6. **Describe your implementation of any strategies to obtain market access to power.**

   Plan to watch the market system ad implement appropriate changes as the system stabilizes and current power procurement contracts expire.

7. **What have you done to reduce or control power consumption within your system?**

   - Installed VFD drives at various locations around the facility.
   - Replaced old aerators with energy efficient surface aerators in secondary treatment.
   - Established a motor efficiency standard, replacing motors with short-term payback and upon end of useful life.
   - Surveyed lighting and established plans to replace with more efficient systems as an efficiency project and/or upon end of useful life.
   - Installed energy demand tracking system in recent DCS upgrade.

8. **How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?**

   Natural gas and propane use is insignificant.

9. **Purchased from?**

   PG&E.

10. **Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?**

    Not applicable.

11. **What do you expect the picture to be over the next five years in your area for gas rates?**

    Stable with seasonal variations.

12. **What have you done to reduce gas consumption or improve utilization within your plant?**

    None.

13. **Describe your implementation of any strategies to obtain competitive priced access to gas.**

    Not applicable.

14. **What other recommendations would you make to other wastewater treatment plants in management of energy purchases and use?**

    None.

15. **Attach your electric power and gas rate schedule.**

    Presently, we pay $.03289 per KWH for WAPA power (federal agency) and $.0797 per KWH (plus various other charges – demand, connection, etc.) for PG&E power. See attachment EBMUD-1.

16. Describe how you use your digester gas. What is the value of the revenue or saved operating cost from your gas utilization?

Digester gas is captured and burned in duel gas fired engines. About 40% of our power needs at the plant are met with from our co-generation facility. The O&M costs of operating the facility come to approximately 0.025 $/kW.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**Wastewater**
Your name and position:	**Don Hickman, Wastewater Treatment Superintendent**
Phone # of relevant contact:	**(510) 287-1456**
Address and email:	**dhickman@ebmud.com**

1. Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?

CAD network/rational database

Yes. The District has standardized on AutoCAD for all in-house and CIP drafting efforts. The District has standardized on Oracle for all database applications.

E-mail

Agency-wide Email using Microsoft Outlook.

Internet/intranet

All users have had Internet and Intranet access via Netscape Navigator. District's internet web site, provides general District information for the public. The Intranet content development is underway with on-line O&M manuals, process and lab information, health and safety information, etc.

Automated time keeping

Limited use. The maintenance management system (MAXIMO) has some time keeping functionality, but it is not widely used; nor is it directly linked to the creation of official time cards. Additional scheduling/work flow modules will be added to maximo.

Automated record keeping

Process data - The distributed control system (DCS) stores plant historical data, LIMS is used for lab data. With the use of "PI data link" data is transferred to an automated Excel spread sheet. The indexing, storing, and retrieving of documents are currently being evaluated.

Preventive maintenance records are stored in Maximo.

2. What is the extent of internal access to agency data on-line?

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?)

- Plant Historical Data – 100% through the distributed control system.
- LIMs– 100% though use of PCs.
- HRIS/FIS – Limit to need though use of PCs (currently implementing Peoplesoft).
- MMIS – 100% though use of PCs.
- All Wastewater Department facilities are networked. All work stations and offices are equipped with PCs.

Breadth and depth of information: What percent of data that would have been tracked in written reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?

- Plant Data – 95%
- LIMs – 100%
- MMIS – 90%
- HRIS/FIS – implementing new system, unknown.

3. Maintenance management system (or related functions)

What type of maintenance managementsystem do you use (application, company)

Maximo 3.0, PSDI – 20 University Rd. Cambridge Ma. 02138

Please list several major features of your Maintenance management system.

- Work orders/corrective and preventative, requests, tracking, documentation of work and historical records
- Data analysis (failure, costs, etc.)
- Scheduling

When did you implement your MMS ?

- Work orders - May 1998
- Scheduling – planned for January 1999
- Hand-held barcodes – planned for Fall 1999

What was the cost of purchasing/implementing (not including user/operator training.)

- Software = $68,000, annual support = $20,000
- Initial implementation – consultant $240,000, in-house resources $230,000
- Total project cost – consultant $280,000, in-house $450,000

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

0.5 FTE.

Service request tracking system

Service requests of Maintenance are all entered and tracked in Maximo (dates, material used, labor, costs). Maximo service requests (new reports, new accounts) are informally tracked only while in progress.

Predictive maintenance scheduling

Currently being considered.

4. **Do you use or plan on implementing on-line O&M manuals?**

   Yes, this project is about 50% complete.

5. **What technologies/systems does your agency intend to implement soon?**

   Peoplesoft for FIS and HRIS.

6. **Have these technologies/systems been studied and recommended?**

   Yes.

7. **Has funding been appropriated?**

   Yes.

8. **What plans does your agency have for the integration of servers?**

   Currently, multiple servers are used to support the various applications and network users. Some server consolidation is being considered, but is not a high priority item.

9. **How many support resources (FTE's) does your agency employ?**

   Most wastewater applications will be supported with 3 FTEs, however ISD provides support on an as needed basis. 1 ISD FTE is now dedicated to the Wastewater dept.

10. **Does your agency anticipate/envision a long-term proportional increase in information management support resources?**

    Recently staffed to the current level. Long-term resource requirement needs to be assessed.

11. **How many hours did it take to fill out this questionnaire?**

    8.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility:	**Main Wastewater Facility**
Your name and position:	**Ben Horenstein**
Phone # of relevant contact:	**(510) 287-1455**
Address and email:	**P.O. Box 24055** **Oakland CA 94623-1055** **bhorenst@ebmud.com**

1. Discuss the typical transition from project to operating system at your facility.

The following are the steps in our front-end specifications, often there are project-specific requirements or deviations from the specifications:

- Functional and Performance Testing by the Contractor
- O&M staff training by the equipment vendors
- System training by the design consultant
- Operational testing by O&M staff under direction of the Contractor

Besides this language in the specifications, there is not a formal integrated approach to the transition or "start-up" of projects, resulting with much of the startup left for the O&M staff with varying results.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Consultants do 98+% of the design for EBMUD wastewater facilities.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

There are "user groups" involved on all large capital projects which consist primarily of O&M personnel. There is no standard method to document and track issues, with some project managers and "user groups" doing a better job than others at tracking issues raised.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings has an appropriate level of authority to make decisions? Why?

Staff suggestions are often incorporated into the designs. The staff attending the meetings ranges from line O&M staff to Superintendents. Depending on the level and cost of the issues raised, decisions may be made at these meetings or may be taken to a management briefing for final decisions.

3. Training

Classroom (lecture, workshop, etc.).

Yes.

Hands On

Yes (sometimes).

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

The contract documents have specific requirements regarding equipment training by the manufacturers representative, as follows:

- There will be two distinct training "courses" for the required equipment, 1)Operation staff training and 2) Maintenance
- O&M staff equipment training will be by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods
- Training material are to be submitted to the District for review and acceptance prior to the start of training
- A training schedule shall be provided at least 21 days prior to the time that training is scheduled
- Operations training shall be provided on three shifts at specified hours
- In addition, consultant design contracts include system training by the design consultant to augment the equipment specific training

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

The manufacturers rep most often does the contract-required training. This is often augmented by the designer performing system training and with in-house Operations staff doing hands-on training on the SOPs.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

- Prior to startup the system/equipment is checked out and certified for startup by the manufacturer

- Functional testing consists of an 8-hour continuous run supervised and inspected by District staff
- Performance testing, if required, follows a successful functional test. Performance testing is used on a limited basis and primarily consists of factory testing
- Startup testing consists of a 7-day reliability test conducted by Operations

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

For the most part, there is not a formal start-up testing process. Plant staff operates the equipment and communicates concerns to the Project Engineer to follow up with the Contractor.

How is performance testing conducted?

Performance testing is limited to equipment or systems where performance is judged critical to the success of the project. Performance testing is usually conducted by engineering staff and completed at he factory.

What is done to ensure owner satisfaction by the designers.

The Designers work with O&M staff on a User Group to review the design to get "up-front" review and buy-in.

What is done to ensure owner satisfaction by the contractors.

The Contractors attend an up-front partnering session which often includes O&M staff. A stated goal is owner satisfaction. However, it is apparent that the objective of Contractors is to make money, as much as possible, with owner satisfaction often taking a back seat.

What is done to ensure owner satisfaction by the equipment suppliers.

This varies greatly from vendor to vendor and the contractual leverage available. A good responsive vendor (who may want follow-up and repeat business) is very responsive and provides adequate spare parts, training, documentation etc. on the requested schedule and as needed.

What is done to ensure owner satisfaction by the staff engineers.

The primary goal of staff project engineers seems to be project schedule and project cost, with owner satisfaction often seeming to be a second tier goal, with the level-of-effort varying depending on the specific project engineer. For the most part, owner issues do eventually get resolved, often through "dog scrap" follow-up projects or through Maintenance clean-up work.

What is done to ensure owner satisfaction by the construction management staff.

See staff engineers (above).

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

Probably the best startup occurs on projects which have a high level of O&M resources involved through the entire process. This provides a high level of ownership as well as expertise, both of which can be more easily transferred to the rest of the O&M staff by a colleague than a Contractor.

5. Documentation

Have standards been developed for drawings (including p&id's and electrical schematics?

Yes.

Have standards been developed for O&M manuals?

Yes.

Have standards been developed for control system software and hardware?

Yes. (informal).

Please guestimate the number of projects for which accurate as-builts are provided. Why?

0%. A combination of problems:

- Reliance on Contractor performance (without leverage), initial drawing detail,
- Contractor preference and other informal field changes to the design are not captured in the as-builts.
- Limited in-house resources to incorporate filed comments,

6. How many hours did it take to fill out this questionnaire?

5.

PREDICTIVE MAINTENANCE

Treatment Plant/Facility: **Wastewater Treatment Plant/Wastewater Department**
Your name and position: **Ike Bell , Plant Maintenance Superintendent**
Phone # of relevant contact: **(510) 287-1450**
Address and email: **2020 Wake Avenue, Oakland, CA 94607**

1. Fill in the following to describe maintenance activities at your facility. This should be a reflection of actual maintenance work being performed, (wrench time so to speak). Do not include training; meetings; breaks etc.

Maintenance work: (to equal 100% - Excluding "Supervision")	
Predictive Maintenance (Vibe; Infrared, etc.)	0.8%
Preventive maintenance (Lubrication & pm's etc.)	9.1%
Reactive maintenance (Repair work as a result of failure)	14.6%
Planned or routine maintenance (General repair work and corrections)	41.7%
Project support by maintenance staff (CIP support; start-ups etc.)	11.0%
Other types of maintenance work:	22.8%

Total approximate maintenance staff hours for FY 96/97.

Mechanical: 40,760 hr.
Instrument: 14,929 hr.
Electrical: 16,606 hr.
Painters, Gardener, Storkeepers, & Janitors: 17,864 hr.
M+I+E+O = 49 Maintenance FTE, 90160 hours

2. Does Your Facility have a Predictive Maintenance program?

Yes.

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis	X	X
Infrared Monitoring	X	X
Lubricant Analysis		X
Ultra Sonic Testing		X
Other (please describe) _____ .		
Equipment Run Time Monitoring - Overhauls based on Hr. Meter	X	

Do your "In house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis		X
Infrared Monitoring		X
Lubricant Analysis		X
Ultra Sonic Testing		X
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed
Vibration Analysis		X
Infrared Monitoring		X

Lubricant Analysis		X
Ultra Sonic Testing		X
Other (please describe below)		

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Reduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes. We do not quantify it, but do have specific examples of detecting problems early and correcting them before they result in failures.

Reduction in corrective maintenance work orders? Describe how you measure it:

No. There are more corrective maintenance work orders as a result of Pdm. The nature of the work is corrective versus reactive and of a less costly nature.

Reduction in total maintenance staff time? Describe how you measure it:

Our Pdm programs often result in corrective maintenance work orders to correct a small problem before it becomes a big, costly one. A reduction in staff time between big vs small maintenance efforts is efficient but not quantified on a program basis.

Increase in planned maintenance work orders? Describe how you measure it:

Yes. Our CMMS categorizes work orders by a “type code". This allows us to compare the amount of Breakdown Maintenance, Corrective Maintenance, and Preventative Maintenance we are doing. Pdm is part of our Preventative Maintenance program.

Reduced energy costs? Describe how you measure it:

No. This is not currently tracked in relation to maintenance work.

Other (please describe) Describe how you measure it:

N/A.

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Vibration surveys on a quarterly basis of major plant equipment has prevented major breakdowns.

- O2 Plant compressors and motors – identified bearing wear and alignment problems saving several thousand dollars through early correction
- Oxygen mixers – identified bearing and motor coupling alignment problems saving significant repair costs.
- Centrifuge – Vibration surveys identified cracked headwall before total failure which saved over $20k of possible extra repair costs if headwall had failed

Thermographic (IR) surveys have identified numerous hot spots in electrical switch-gear that could have lead to electrical fires or explosions if not corrected. Many thousands of dollars and significant equipment downtime saved.

Oil analysis has identified contaminated oil before serious problems have developed and saves money by eliminating unneeded oil changes.

Ultrasonic testing of digester gas lines identified interior pipeline corrosion before failure and lead to a pipeline replacement project.

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

We will be considering a more formal testing program and data collection to assess inefficient operations.

7. How many hours did it take to fill out this questionnaire?

8.

OFF-SHIFT STAFFING

Treatment Plant/Facility: **Main Wastewater Facility**
Your name and position: **Ben Horenstein**

Phone # of relevant contact: **(510) 287-1455**
Address and email: **P.O. Box 24055**
Oakland CA 94623-1055
bhorenst@ebmud.com

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

EBMUD has three shifts of equal staffing of 21 Operators from which each shift is staffed 7 days/week. The three shifts, grave, day and swing shift are all 8 hours shifts beginning at 2300, 0700 and 1500, respectively. We do not have a minimum staffing number, the staffing levels range from 8 to 13 operators, based on the scheduled and unscheduled leaves, workload, unusual activities, etc. Day shift is often staffed higher to support maintenance and construction activities.

2. Describe the following:

Grade levels and required expertise for off-shift operators

Shift Supervisors require a Grade IV, Assistant Supervisors a Grade III, Journey-level Operators a Grade II and Operator Is a Grade I.

Staffing by process area during off-shifts: What numbers do you staff where?

We staff 5 stations at the wastewater facility; 2-3 operators at our Influent Pump station, 1-2 at Primary Sedimentation, 1-2 at Digesters, 2 at Dewatering and 2-4 at the Secondary/O2 station.

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	Remote facilities alarm monitoring
Troubleshooting of systems/equipment	X	
Emergency response	X	
Process adjustments	X	
Process sampling	X	Mostly done by automatic samplers
Process testing	X	Cl2 and SBS Titrations, SVI, TSS
Laboratory testing		
Preventive maintenance of equipment	X	
Equipment repair		
Isolation/shutdown of systems/eqpt.	X	
Coordination of maintenance work	X	
Construction contractor support	X	Mostly handled by Dayshift staff
Development of monitoring reports		Handled by operations support staff
Buildings & grounds maintenance		
Plant security	X	(Call 911)
General Housekeeping	X	

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

The wastewater plant's wet weather flows go from an ADWF of 80 MGD to over 400 MGD, requiring an increase in staffing of 2-4 operators (depending on equipment status and storm severity and duration).

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

Internal shift coverage and overtime (as necessary) provide leave relief. Operations Supervisors have the authority to call in staff on overtime to provide shift coverage based on the activities, resources, etc.

Other scheduling procedures and policies

Current shift staffing is based on the outcome of a recent arbitration on a redesign of the workplace. In January 1998 the District moved to a centralized-control model with 2 roving crews and a minimum staffing target of 5 operators. This was grieved and arbitrated with the Arbitrator directing the District to go back to the earlier 5 station model, at least through the duration of this MOU contract (expires 2000).

3. **Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.**

   No, maintenance and laboratory support is provided through a call-out system on an as-needed basis.

4. **What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.**

   Due to the recent arbitration, there are not any explicit plans (with numbers) for the next 5 years. It is likely that the District will work with the Union to make changes to the contract in 2000 which will facilitate the development of a new more competitive structure.

5. **Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?**

   For Labor agreements, please See attachment EBMUD-2. The most significant element of the contract which hinders competitive changes is the Supplemental Agreement No. 2 which references the “shift schedule” , which was found by the Arbitrator to be a guiding document on the number of stations and associated staffing levels.

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   The current approach is to meet the terms of the arbitrator’s ruling and to staff with three equal shifts across 7 days 24 hrs. The future approach is to continue to strive to improve our competitiveness and become as efficient as possible, through the use of automaton, change to work practices, etc.

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   We will be first exploring unattended operations at our remote wet weather facilities which were designed with unattended operations in mind, although the sampling requirements and the chemical feed system’s reliability have not allowed us to operate in an unattended manner. We will also be exploring unattended operations at our power generation station to aviod overtime coverage and at our remote wet weather and reclamation facilities.

8. **How many hours did it take to fill out this questionnaire?**

   4.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**Main Wastewater Facility**
Your name and position:	**Ben Horenstein**
Phone # of relevant contact:	**(510) 287-1455**
Address and email:	**P.O. Box 24055** **Oakland CA 94623-1055** **bhorenst@ebmud.com**

1. **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]**

   They are not combined, they are separate sections; Plant Operations, Remote Operations (inteceptors, pump stations, wet weather facilities, and reclamation facilities), and Maintenance.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attachment EBMUD-3.

3. **Do you have a single manager over both operations and maintenance?**

   Yes, we have a Division Manager over all EBMUD wastewater operations and maintenance function, including; the main wastewater facility, interceptors, remote wet weather facilities and reclamation facilities.

4. **What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance ? (for the purposes of this question, supervisors are defined as those individuals who routinely perform supervisory functions, such as conducting performance appraisals, recommending discipline or termination, and approving employee timesheets.**

   1:6.

5. **Which of the following "maintenance functions" are performed by operators?**

Task		Comments
Routine preventive maintenance	X	
Repair of equipment		
Predictive maintenance activities		
Process modifications		
Non-process modifications		
Cleanout/isolation of systems/eqpt.	X	Involved in large tanks & eqpt.
Cleaning and calibration of instruments		
Simple electrical repairs		
Maintenance of automatic samplers		
Computerized maintenance mgmt.		
Vehicle service		
Buildings & grounds maintenance		
General Housekeeping	X	

6. **What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?**

   To the best of my knowledge, none of maintenance staff are certified as operators. There is no requirement or incentive that they become certified.

7. **Do you offer incentive programs to encourage cross-training?**

   Not currently.

8. **Provide a copy of your current salary structure for operations and maintenance personnel.**

   See attachment EBMUD-4

9. **What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?**

   The specific class descriptions of each position represented by the union are listed in the MOU. Combining classifications through a pay-for-skills program on our water-side was not successful and there are not current plans to bring it back.

10. **Cross-functional process-based work teams:**

    Do you either currently have or plan to implement cross-functional process-based work teams?

    We do not have, nor are there current plans, to implement cross-functional process based teams.

    If so, how are these teams organized and what authority is given to team leaders?

    N/A.

11. **How many hours did it take to fill out this questionnaire?**

    4.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility: **Main Wastewater Facility**
Your name and position: **Ben Horenstein**
Phone # of relevant contact: **(510) 287-1455**
Address and email: **P.O. Box 24055**
Oakland CA 94623-1055
bhorenst@ebmud.com

1. **Is your agency/has your agency considered re-engineering your work practices and organization structure using:**

   Workforce flexibility: Plan to use in the future?

   Yes.

   Skill-based pay?

   Undecided Not yet Evaluated Tried but was not successful (on the District's water-side).

2. **In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, " Combined Operations and Maintenasnce," to clarify the scope of this question.]**

   How many trades or disciplines are in your current structure and what are they?

   Three trades. Electrical, Instrumentation, and Mechanical (in addition to Operations). Each maintenance trade is under a Supervisor (ex. Instrumentation Supervisor).

   Do trades cross technical boundaries? If yes, please describe their interaction.

   Crossing over of technical boundaries is limited. The one area where it does happen is maintenance of VFDs and PLCs, which are done by both the Instrumentation Technicians and Electricians.

3. **What is your agency's definition/interpretation of workforce flexibility?**

   Do not currently have an agency definition. A general interpretation would be a multi-skilled and cross-trained workforce capable of completing the majority of work with limited support and able to wear more than one hat to meet challenging work demands.

4. **Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.**

   We do not have a formal plan or proposal but workforce flexibility of some form will be required to meet our rate reduction goals over the next 10 years.

5. **Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?**

   There are no immediate plans to consolidate or expand our current structure. Any future movement in this area would be towards reducing the number of supervisors and supervisory levels and the overall level of staffing. We are evaluating the addition of a planner/scheduler to improve our maintenance operation.

6. **What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)**

   Established by water system managers based on water system contracts. Piloted and abandoned after 3 years due to limited success and union opposition.

7. **What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?**

   We have completed an extensive analysis of each classification to determine the critical KSAs an assessed the specific task to determine applicability. The compensation level was subject to a negotiation with the unions.

8. **What skills, goals or objectives does your agency intend to "incentivize"? N/A.**

9. **How many hours did it take to fill out this questionnaire?**

   3.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility: **Main Wastewater Facility**
Your name and position: **Ben Horenstein**
Phone # of relevant contact: **(510) 287-1455**

Address and email: **P.O. Box 24055**
Oakland CA 94623-1055
bhorenst@ebmud.com

1. **Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisor's unionized? Is the shop open or closed? What is the umbrella union organization(s)?**

   We have a facility that is unionized for all of our employees below the Division Manager level. The Supervisors have a separate union which includes the Superintendent position. It s a closed shop except for the Supervisor's, who have a choice on joining their union. All the unions are part of ASFME.

2. **On what issues do your unions meet and/or negotiate with management?**

   For the most part, the unions meet and confer with management on matters relating to wages, hours and working conditions. In addition, any matters agreed to in the existing MOU are discussed as they arise during the life of the contract.

3. **If your answer to 2. (previous question) discussed issues outside the traditional hours, wages and working conditions as part of a MOU or Contract, please discuss the formation, structure, roles and empowerment of this process and/or committees.**

   Routine business issues (budgeting, filling positions, work practices, …) that do not conflict with a provision in the MOU are not negotiated with the union. There is no standing labor-management committee that discusses business issues. As needed, ad hoc committees may be formed to discuss issues such as reorganizations. There is a standing joint Central Safety Committee composed of management and union appointees.

4. **Are you working with your union on competitiveness? If so, please describe.**

   No. There has not been a formal agreement with our Unions to discuss this issue. We have approached the unions regarding their interest in an adhoc committee or workshop to discuss our response to competitiveness and have received mixed responses, with the union representing the O&M line staff declining the opportunity.

5. **Are you involved with labor on training programs?**

   Not in a formal and ongoing basis. There is a broad group of operators participating on a technical training committee, which helps define training needs and the development of training programs. While this committee has union members, it is composed of volunteers and is not considered a labor-management committee.

6. **Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?**

   Yes, we have attempted both, collaborate and interest-based bargaining. In whole, this experience has been more successful with the supervisor's union versus the professional and the blue-collar O&M union which declined this approach. Interest-based bargaining was utilized in the last supervisory union negotiations. These negotiations were lengthy 11/2 years but ultimately successful. The process had difficulty in areas where common interest were not evident (e.g. wages) at which pint traditional bargaining was utilized.

7. **What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?**

   Improvements in the working relationship with the unions are a goal for the District. The District is currently assessing conditions and formulating a strategy to meet this goal while simultaneously achieving its goal on improving our competitiveness.

8. **How many hours did it take to fill out this questionnaire?**

   3.

FLEET SERVICES

Treatment Plant/Facility: **EBMUD**
Your name and position: **Hank Leibee**
Phone # of relevant contact **(510)287-1626**
Address and email: **PO Box 24055, Oakland, CA 94623**

1. **Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:**

Sedans	0
Pick-up trucks	0
Vans currently in use as commuter vans	0
Vans, general pool and other	0
Solids hauling trucks	0
Trucks equipped for in-plant and collections maintenance purposes	0
Other (describe)	
Step Vans for maintenance/repair	0
Vactor Truck	0
Flatbed truck	0
Utility truck	0
4x4 Utility veh (Bronco & Cherokee)	0
Electric Carts	10
Bicycles	6

2. **What is your current vehicle replacement policy?**

   Vehicles are replaced based on three criteria - mileage (100,000 miles), age (years), and condition. Each vehicle is evaluated by looking at repair history and the criteria. If the repair rate is rising or a major repair is suspected and the criteria warrant are met, the vehicle will be replaced. The system is called "benchmark for valuation for replacement".

3. **Do you have a replacement fund?**

   Not for vehicles (sedans, pickup trucks, etc.) All vehicles are “leased” from the Water System from a car pool. We pay a fee based on hours used.

4. **Have you made any recent reductions in the fleet? Are you planning on doing so in the near future? What is the approximate annual savings achieved by the reductions?**

   No. Not applicable.

5. **Have you experienced any adverse impacts from the reductions in fleet size?**

   No.

6. **How are your fleet vehicles serviced? (In-house or by external contracts?)**

   All Vehicles are serviced in-house by the Water System.

7. **What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.**

   Scheduled maintenance is at every 4,000 miles or 6 months. Unscheduled repairs/servicing is done as required.

8. **How many Fleet Services staff support the fleet?**

   We do not have any plant staff that are assigned to support the fleet.

9. **How long did it take you to complete this survey?**

   One hour.

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility: **Main Wastewater Treatment Plant**
Your name and position: **Ben Horenstein, Plant Operations Superintendent**
Address and e-mail: **EBMUD P.O. Box 24055 Oakland CA 94623-1055**
bhorenst@ebmud.com

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)**

   Following centrifugal dewatering, our biosolids goes to a storage facility (3 days capacity) and is hauled by a contractor off-site for land application.

2. Annual production:

Wet and dry tons by class A, B & C and total

Class A: None.
Class B: About 60,000 wet tons annually at approximately 20% solids.

Does the system meet "exceptional quality" for metals? Y or N Comment?

Yes.

3. Costs:

1997 total operating cost for the program including direct administration, lab support and maintenance.

Direct costs of contract hauling and land application are approximately $1,000,000 annually (60,000 wet tons x $16/ton (hauling and land application). This does not include laboratory analytical costs and contract administrative costs.

Capital Investments in dollars associated with the biosolids program:

Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.)

New $3 million storage facility.

Equipment (Tractors, trailers, spreaders, etc.)

None.

Land

None.

Revenue from use (fertilizer value, energy production, crops, etc.)

None.

4. What are the number of FTEs in program including administration, operations, maintenance, other.

About 1 FTE (0.5 in land application inspection and 0.5 in contract administration)

5. Describe your major reuse customers or approaches including wet and dry tons to each and class of product.

All biosolids recycled are Class B dewatered cake. Recycling is done on farms and ranches, mainly in Solano County, that have gone through the permitting processes required in California. These farms/ranches typically have marginal farming soils, and animal feed crops and other non-food chain crops (ex. turf) are grown.

6. Describe your program long-range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?

The district is looking to diversify its biosolids management program. A full evaluation of options, including Class A options, are awaiting progress in the ongoing Central Valley EIR process

7. Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.

In general, opposition to land application of biosolids is growing in California. A growing trend is the enactment of local county ordinances requiring Class A or completely banning land application of biosolids.

YEAR 2000 COMPLIANCE (Y2K) PROJECT

Treatment Plant/Facility:	**WWTP**
Your name and position:	**Henry Leibee, Civil Engineer**
Phone # of relevant contact:	**510.287.1626**
Address and email:	**P.O. Box 24055, Oakland, CA 94623** **hleibee@ebmud.com**

1. Do you have a Y2K program in place in your organization?

Yes.

If yes, when did you begin your Y2K program?

July 1997.

2. **Have you inventoried your Information Technology systems (IT)? (Yes/No)**

   Yes.

3. **Have you inventoried your embedded systems?)? (Yes/No)**

   Yes.

4. **How many IT systems do you have?**

   About 10; depends on who is counting.

5. **How many embedded systems do you have?**

   Less than 5.

6. **Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)? (Yes/No)**

   Yes.

   If yes, when did you begin?

   September 1997.

   How many systems have been assessed?

   All.

7. **Have you begun contingency planning for your systems? (Yes/No)**

   Yes.

   If yes, when did you begin?

   January 1998.

   How many systems have contingency plans?

   All.

8. **Have you begun remediation of your non compliant systems?**

   Yes.

   If yes, when did you begin?

   January 1998.

   How many systems have been remediated?

   About 50%.

9. **Have you tested any of your systems for Y2K compliance?**

   Yes.

   If yes, when did you begin?

   June 1998.

   How many systems have been tested?

   About 30%.

   How many passed?

   All tested.

10. **What testing standards are you using for certifying your Y2K affected systems (give organization Y2K standards or list of dates you will be testing for)?**

    For process, Westinghouse DCS standards. For software applications, vendor standards.

11. **How long did it take you to complete this survey?**

    One hour.

KING COUNTY DEPARTMENT OF NATURAL RESOURCES, WASTEWATER TREATMENT DIVISION

LABORATORY ANALYSIS

Treatment Plant/Facility: **West Point Process Lab**
Your name and position: **Teresa Schoonejans**
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Address and email: **1400 Utah Street West, Seattle WA 98199**
teresa.schoonejans@metrokc.gov
Treatment Plant/Facility: **East Section Process Lab**
Your name and position: **Rick Butler**
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rick.butler@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section : Also referred to as West Point

1. **Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.**

   West Point: See attachment KCDNR-1.
   Renton: See attachment KCDNR-2a, 2b.

2. **Have you made any recent reductions in laboratory analyses or are you planning on doing so in the near future? What were they (e.g. process)? What are the approximate annual savings achieved by the reductions?**

   West Point: Yes. Excerpts from West Division Monitoring Review Project Final Report, May 1996. This group was formed from stakeholders and management. Monitoring programs were reviewed, opportunities for reductions identified, then each activity evaluated against department objectives, consensus was reached by the staff team.

   The renewal of the National Pollution Discharge Elimination System permit for the newly upgraded secondary plant at West Point in January 1996 signified a major change in the regulatory approach taken by the Dept. of Ecology. Reporting requirements were cut 27%, opportunity to pass or fail permit limits for West Point was cut 81% and required monitoring hours of effort decreased 43%."

Monitoring Program	Proposed Program Hours/Yr	Reduced Hours	Est Savings* In $/Yr
IW Industry Monitoring	3401	0	$0
West Point Process Control	9607	492	$12,300
Carkeek Process Control	82	399	$9,975
West Point Pretreatment	122	469	$11,725 + $383 *
West Point Biomonitoring	269	60	$1,500
CSO Characterization Monitoring	0	184	$4,600 + $198 *
West Point Receiving Water	229	590	$14,750 + $3,556 *
Carkeek Receiving Water	0	208	$5,200 + $3,286 *
Carkeek Grant Rec Water	87	193	$4,825
Richmond Beach Rec Water	0	54	$5,200 + $3,286 *
TOTALS:		2,649	$76,934

* Contracted out Note: Costs are based on wages of $25/hr.

As a result of grant funding, in the first year of operation 1996, the new plant required extensive certification testing, stress testing, and commissioning of processes. Sample collection and data analyses were performed almost entirely by West Point Operations staff and compilation of final reports were the responsibility of CH2Mhill, West Point's plant design engineers.

In 1997, lab support efforts remained the same as in 1996 minus the plant certification effort.

Renton The first major reduction of process control analysis was done in June 1998. We are in process to evaluate present testing and further reduction in non-regulatory analysis. See attachment KCDNR-3.

3. Have you experienced any adverse impacts from the reductions in process-related analysis?

No.

4. What process laboratory analyses are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.

West Point: Secondary area plant operators run the following tests on the mixed liquor; spins for suspended solids, at least two settleometers/day, a microbial assessment, dissolved oxygen, and sludge blanket levels in the secondary clarifiers.

Renton: Tests run by operators are 30 minutes settlings of ML x RAS (3 times a day). We have not reviewed the possibility of operations running other tests.

5. Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).

West Point: See attachment KCDNR-4.
Renton: See below.

Regulatory Mandated Analysis		
Project	**Tests Performed**	**Frequency**
NPDES	BOD5, TSS, pH, Fecal Coliform, Cl2 Residual	7 days/week
NPDES	Grease, NH3-N, TKN, Organic N	1 day/week
Sludge 503	PH, Temp, TS, TVS	7 days/week
Reuse	T Coliforms, Turbidity, pH, NO3	7 days/week
Reuse	TS, DO, BOD, NH3-N	1 day/week
Reuse	NO2-NO3	1 month
Biosolids	TS, VS, NH3-N, TKN, Org. N, BOD, TP, pH, Conductivity	quarterly

6. Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?

West Point: Yes. We did renegotiate the CSO schedule that required 75% volume reduction by 2006 (save money in the short term - spread the costs out more evenly over time.). The only thing done since then has been the changes in Carkeek permit limits and the WP cyanide limits - they only save money on avoided enforcement, otherwise only reduce risk.

Renton: In our last permit renewal, we were able to negotiate a considerable reduction in required analyses. Even before negotiations, the new permit, which went into effect July 1997, had significant reductions in sampling/analyses. For example, daily influent and effluent metals and CN analyses were reduced to 6-days per year. Similarly, daily effluent FOG's were reduced to once per week. Negotiations allowed us to get the permit writers to effectively drop proposed daily effluent analyses for aldrin, dieldrin, heptachlor and toxaphene. This efflort saved us an estimated $42,000 per year. All told, the estimated savings in analyses between the old and new permit are about $50 – 70,000. However, these reductions in analyses must be tempered by additional analyses that are required for reuse, which came into operation 1997.

7. Do you have any plans in the future to achieve further savings by reductions in analysis?

West Point: There are no reductions planned in the near future. With the new permit, effective 1/1/96, there was a significant reduction in the level of required analyses. Many of the previously required tests were not necessary

for process monitoring and/or control. Therefore, from the plant's perspective, these tests could be reduced in frequency or eliminated completely. Since some of the analyses provided vital information for groups outside the section there was an evaluation and redesign of the monitoring program so that the entire agency's needs were satisfied.

Renton: Yes. There are both reduction of process-related analysis and efforts to automate analysis.

8. How many labs do you have in your agency? What are the functions of each?

We have one main large environmental laboratory in King County, which does trace metals, cyanides, organics, and bioassays as needed by the various water quality programs. The two onsite process control labs are responsible for the remainder of the monitoring requirements at the treatment facility.

NEW TECHNOLOGY DEVELOPMENT

Agency Name: **KCDNR**
Treatment Plant/Facility: **Both East and West Sections**
Your name and position: **Edie Lackland/Greg Bush**
Phone # of relevant contact: **(206)689-5419/684-1164**
Address and email: **1200 Monster Road SW, Renton, WA 98055**
edie.lackland@metrokc.gov
821 – 2nd Ave., Seattle, WA 98104 M/S 107
greg.bush@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding)utilized to investigate and test this technology.

KCDNR investigates promising new technologies through the usual research sources initiated by either plant operations, engineering, vendors or consultants. The current program has been enhanced by additional capital funding required as part of the West Point permit. This work is aimed at reducing plant footprint, truck traffic and odor.

2. List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).

Technology 1: AGF – Digesting Enhancement Using Methane Gas Flotation To Thicken And Recycle Digested Sludge.	
Methodology	Demonstration project done in conjunction with Western Environmental Engineers—first pilot scale test of the AGF process using municipal wastewater sludge.
Cost of Test	Funding included $65,000 from a US Dept. of Energy grant and $130,000 from our Applied Wastewater Technology Program (AWTP).
Results	The pilot was successful in confirming that enhanced solids destruction can be attained at very short HRT's. Currently developing scope for full-scale prototype.
Report	Contact Curtis Steinke at (206) 684-2456 or curtis.steinke@metrokc.gov
Technology 2: Centridry – Increase Biosolids Dryness From 21.6 To 60% Through Centrifuge And Low Heat Flash Drying.	
Methodology	A field test was held at the Renton plant from June of 1997 to March of 1998. Results currently being written – due this winter.
Cost of Test	Project funded by AWTP at $590,000.
Results	Results are due this winter.
Report	Contact – Bill Burwell at (206) 684-2408 or bill.burwell@metrokc.gov

Technology 3: . Pulse Power, alias "Bug Zapper" – Enhanced Digestion Through Application Of High Voltage To Sludge.	
Methodology	A field test was held at the Renton plant in spring-summer of 1997 with Scientific Utilization, Inc. and Wm. Reilly and Associates.
Cost of Test	Scientific Utilization and W. Reilly supplied the equipment, while KC provided installation, replacement parts and power at $1,300 per month.
Results	Poor cost/benefit performance – no further work is expected.
Report	Contact Carol Nelson at (206) 684-2466 or carol.nelson@metrokc.gov
Technology 4: Vertad, Or "Not So Deep Shaft"—Enhanced Aerobic Biological Solids Digestion Process In 400 Foot Deep Underground Shaft. .	
Methodology	A field test was held at the Renton plant in early 1999.
Cost of Test	$660,000 funded by AWTP.
Results	Report due in late 1998.
Report	Report due in late 1998. Contact Mike Boyle at (206) 684-2426 or mike.boyle@metrokc.gov
Technology 5: . Co-thickening of Primary Sludge and Waste Activated Sludge using Dissolved Air Flotation.	
Methodology	Bench-scale and pilot-scale tests were set-up to compare process/design criteria and performance for using dissolved air flotation to thicken WAS alone or co-thicken primary sludge and WAS. Testing lasted for about four months.
Cost of Test	Original pilot-scale work estimated cost at $100,000. Consultant was responsible for constructing and operating bench-scale and pilot-scale DAF units. On-going process improvements and full-scale performance monitoring since installation in '88.
Results	Co-thickening was very feasible and did not require any more footprint than thickening WAS alone. Polymer use and odor control needs are greater with co-thickening than WAS alone. Thickening at Renton facility was designed to co-thicken primary sludge and WAS with DAF.
Report	Richard Butler, Richard Finger, James Pitts, Barbara Strutynski, "Advantages of co-thickening primary and secondary sludges in dissolved air flotation thickeners", Water Environment Research, 69, 311 (May/June 1997). Contact Dick Finger at (206) 689-3825 or e-mail at dick.finger@metrokc.gov.
Technology 6: Krohne Magnetic Flowmeter for Sludge Flow Measurement	
Methodology	A full-scale comparison of several different electromagnetic flow meters, and installation configurations, to measure sludge flows more accurately, and to minimize degreasing, cleaning, etc. Tests were sporadically run over a 12 – 18 month period. Tests were run in-house.
Cost of Test	Estimated to be $5000. Labor was provided as in-kind services.
Results	Krohne magmeters with the proper diameter and installation configuration significantly improved the accuracy and stability of the flow signal, and significantly reduced the need to degrease, clean the flowmeter.
Report	A summary report is available. Contact Carol Nelson (206) 684-2466 or e-mail at carol.nelson@metrokc.gov.

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

- Fuel Cells – currently assembling funding from EPA, local private power company and MC Power for demonstration at Renton plant.
- Thermophyllic digestion in pilot at West Point plant.
- Continue work with AGF and VerTad.

AUTOMATION

Treatment Plant/Facility: **West Section**
Your name and position: **Charlie Dickey, Computerized Systems Associate**
Phone # of relevant contact: **(206) 689-3823**
Address and email: **1400 Utah Street West, Seattle, WA 98199**
charlie.dickey@metrokc.gov

Treatment Plant/Facility: **East Section**
Your name and position: **Byron Burris, Computer Coordinator**

Phone # of relevant contact: **(206) 684-2455**
Address and email: **1200 Monster Rd. S.W., Renton, WA 98055**
byron.burris@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The general approach to automation has been to create a three-layer system consisting of local control, backup panel control and computerized control. Each layer of control adds increasing functionality and requires the lower layer of control to be operational. Local controls generally are hardwired on-off switches, which bypass the majority of interlocking features. Backup panel control includes PLC's, that provide interlocks, backup panel mounted analog controllers to control process parameters, and digital alarm panels to display alarm function. Backup panel controls must be operated from the area control centers and do not allow for centralized control. Computerized control allows for control from a centralized control room as well as local area control if necessary. Features of the computerized control system far exceed those of the backup panel system and allow for archiving of plant operating data. See attachment KCDNR-5, 6, 7a, and 7b.

2. What type of control systems do you have at the . . .

Machinery and equipment (PLC's, analog loops, centralized at a mini computer, etc.)

Control systems located at the machinery and equipment generally are hard wired start-stop switches and some hard wired interlocks such as high discharge pressure switches. These controls are functional when a PLC bypass switch is engaged locally which bypasses the output of the PLC in the control loop. The PLC processes start-stop commands from both the backup panel and computerized control system and provides the majority of process and safety interlocks. When VFD's are utilized the speed output can be locally controlled manually bypassing the output of the backup panel analog controller or computerized control system loop controller. Some packaged equipment may contain a dedicated PLC installed by the OEM to provide localized control of the equipment. In some areas localized alarm panels are installed to annunciate alarms.

Area system controls such as secondary treatment, digesters, etc.

Area system controls are generally located at an Area Control Center (ACC) with associated process equipment start-stop switches, analog controllers, analog process displays and alarm panels. The backup panel discrete controls work in conjunction with PLC's. Also located at the ACC is a console from the computerized control system that can be used when in computer control to control equipment located in this area or throughout the plant.

Centralized control room

The centralized control room is the center for the computerized control system. From the 13 consoles located in the room an operator can monitor and control process and equipment located throughout the plant. The computer system provides all of the functionality normally found in all of the ACC's combined and advanced features beyond the capabilities of the backup panel control systems.

West Point: West Point has three area control centers and one main center. Main control has four computerized consoles and each area control center has two.

3. Describe the number of points monitored in your system and the number of control loops.

West Point: The points are PLC control points that report to the computerized control system.

		Renton	West Point
Digital inputs	=	4,480	4650
Digital outputs	=	1,870	2340
Analog inputs	=	1,392	3103
Analog outputs	=	496	1585

Control loops	=	480	1665

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

Automated systems include Cl2 pre and post, SO2 , polymer, NaOH and NaOHCl.

West Point: We use several different automated chemical flow pacing systems, Chlorine for disinfection, Sodium bisulfite for dechlorination, polymer for solids thickening and dewatering, NaOH and H2O2 for odor scrubber chemical feed.

List other automated flow regulation.

DAFT feed and withdrawal, digester feed and withdrawal, dewatering feed, WAS, RAS, gas system for scrubbing and flares, etc.

West Point: We have several places for automated flow regulation: WAS and RAS flow control, solids feed for thickening, dewatering, digester feeding, gas system control to flares and chlorine feed rates.

List applications of automated alarms (notice next question).

Renton: We have automated alarms for pumping stations and plants at local area, area control center and central control center.

West Point: We have automated alarms on almost every system attached to the automated control system.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

Alarms can be generated by monitoring an analog or discrete signal, by an output of one of the PLC's, and by the computerized control system. Alarms that are generated by monitoring the signals are usually annunciated at local alarm panels distributed throughout the plant. Alarms that are the result of a PLC output are generally annunciated at the backup panel level and can be inputted to the computerized control system. The majority of the alarms are generated by the field devices or PLCs and are annunciated and displayed on alarm summary pages by the control system, sorted by assigned priority.

Alarms are prioritized into five different categories and displayed on the alarm summary sheets by priority. The two highest alarm categories sound an audible alert with different tones.

West Point: We have three alarm priorities.

Equipment Start and Stop

Equipment can be started and stopped locally, from the backup panels and from the computerized control system. Requirements for starting and stopping (interlocks) can vary greatly depending upon which system is used to start.

Process Data

Most process data are displayed locally at the transmitter and again at the backup panel. For the most part the data are not graphed or retained at these locations. Process data can be viewed, graphed, stored, processed and retrieved through the computerized process control system.

Equipment runs hours

Equipment run hours are generally maintained locally by a run time hour meter and also are calculated and stored by the computerized control system and can be retrieved for maintenance purposes.

6. Describe how your system archives information.

Information is archived through a redundant pair of minicomputers. The minicomputers are programmed to periodically request current values of process data from the computerized control system. Request rates are programmable at one minute or greater. The returned data are then archived. At the end of the day the data are processed to compute totalized values, highs and lows and then compressed and written to WORM optical disks. The data can be retrieved through ad hoc reports and trend chart requests. Preprogrammed reports are also generated daily. Alarm and events generated by the computerized control system are also stored on the minicomputer for future reference.

West Point: We have a redundant pair of hosts which both archive the historical data.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service. Maintenance has several computerized control system consoles located in their area.

Operations

Operations use the system for control and monitoring of the plant process and to monitor the off-site pumping and treatment stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room. Equipment located throughout the plant can be started or stopped and process setpoints can be changed from any of the 26 control system consoles.

Process Control or Laboratory

The process control section uses the consoles located in the process control section to monitor process operation. Data collected by the minicomputers is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

West Point: The daily process data are moved to the plant reporting system, which is then used by plant staff for regulatory and process control purposes.

Engineering

The engineering section uses primarily historical data for engineering studies. The studies may involve plant additions or collection system impacts by major storms.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

Control of off-site pumping stations is primarily through local PLC's at the stations. The computerized control system is utilized to monitor off-site pumping stations and to generate alarms to notify the plant operators of changing situations and events at the facilities. Monitoring utilizes analog phone lines and modems.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

The agency has taken a qualitative approach to computing automation benefits and cost/effectiveness. The original 1988 upgrade to central automated controls was based upon assumption of savings in labor and chemical costs. These have not been retested.

10. Describe the following:

How does your level of automation help with decisions?

The computerized control system makes detailed current and historical information available for use in decision making. Information is available to be presented in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

New control strategies can be devised and implemented usually with only minor reprogramming. The newer computerized control systems provide considerable flexibility and expandability to accommodate plant modifications.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

Control loop tuning is enhanced with variable speed graphing and many PID parameter block options available for use in the computerized control system. With the computerized control system more detailed and integrated control strategies can be devised resulting in higher quality treatment.

How does your system identify and prioritize critical and non-critical condition information?

Plant data are collected and archived by the control system based on predetermined request rates. High priority information is scanned and archived at the highest rate of once per minute. Information of lower interest is collected less frequently.

West Point: The computerized control system archives all alarms, return to normal, and operator acknowledgement. All operator initiated setpoint and mode changes are archived. The event logs can be searched, filtered and printed out for debrief purposes.

How does your system store critical and non-critical condition information?

Time stamped new data are not written to the record unless their value has changed beyond a preprogrammed deadband. This reduces the amount of information that is archived and the record size.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

Every effort should be made to purchase an open architecture system employing non-proprietary components. The potential systems should be thoroughly checked out with other users through site visits and discussions. Ensure that the system will do what you want it to do now and do not rely on promises of future functionality. Make sure that the vendor has a track record of providing for customer upgrades following product software revisions. Do not be first to install a new product.

12. What are your future plans?

Our future plans are to procure system components which employ open architecture whenever available. We have no immediate plans to replace or change our existing system architecture. We have installed a small newer generation system employing Wonderware working in conjunction with PID capable PLC's to evaluate the technology.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-source support.

In-house personnel perform most maintenance on the system. Expansions of the system have involved a mixture of in-house and vendor personnel. The only maintenance that is jobbed out is maintaining the DEC minicomputer hardware.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

Major modifications to the control systems have accompanied major plant expansions and have been designed by the consulting engineering firm handling the expansion or their designee. The computerized control system was originally designed and contract bid documents prepared by a consultant specializing in such systems. Plant operating and maintenance personnel make minor modifications. The operations section handles the majority of changes to the operator interface screens and historical archiving while the maintenance department handles the system operating code and hardware.

15. What is your technical approach to unattended facilities including automation, redundancy and handling call-outs when problems occur? Please give the current approach and the future approach.

The partly unattended facilities which we operate (pumping stations and a small treatment plant) are under the control of local PLC logic controllers and analog process controllers. The facilities are monitored by the distributive control system and alarm conditions, levels and process equipment status are displayed in the main plant control room. When problems are indicated either an on-shift operator or a call-in operator will respond to check it out.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

No.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

No.

18. Number of people and classification?

We have 4 shift crews at each plant. Normally the supervisor and senior operator work out of the control room with one person present at all times. They take care of the plants and remote pumping stations.

How much time do they spend in hours per day doing the following?

	Main Control	Remote

	Center	Center/Operations
Answering Alarms	1	4
Phone	3	5
Operate Equipment	3	20
Monitor Process	3	8
Radio Traffic	3	4
Collection System	2	0
Record Keeping & Logs	4	16
Data Entry	1	3
Other: Cleaning	0	10

19 Where are you headed in terms of personnel assigned to work with the controls system to operate the facilities? This includes personnel assigned, specialization, technicians and operating strategies. Will you be going to internal logs; training manuals built into the controls, direct access to maintenance information, etc.?

We will continue with supervisors, sr. operators and operators running the system. Renton and West Point are implementing a new maintenance management information system.

West Point has on-line manuals and Renton is currently considering them. West Point has 2 formal computer support people and 2 Instrument Techs who do programming and Renton is similarly staffed.

ENERGY

Treatment Plant/Facility: **West Point/Department of Natural Resources, WTD**
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Phone # of relevant contact: **(206) 689-3817**
Address and email: **1400 Utah St. W, Seattle, WA 98199-1004**
eugene.sugita@metrokc.gov

Treatment Plant/Facility: **East Section Reclamation Plant/Department of Natural Resources, WTD**
Your name and position: **Bill Burwell**
Phone # of relevant contact: **(206) 684-2408**
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bill.burwell@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. What is your average plant demand in 1997, what was your peak kVa and total annual electric power costs for the year?

Renton: 7.139 MW, 15.7 kVa, $2,017,222 (includes $691,307 in conservation grant credit).

West Point: 6.538 MW, ---- kVa, $1,960,082.

2. Purchased from?

Renton: Puget Sound Power and Light now Puget Energy Services.

West Point: Seattle City Light.

3. Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.

Renton: We signed a contract to purchase power above 10.8 kVa as “nonfirm,” or interruptible. Cogeneration is not cost effective at current power rates and capital investment requirements. We do not use our biogas, but scrub and sell for about $330,000 per year to the local gas company.

West Point: Peak shaving is not possible due to demand coming at extreme high flows due to rain storms when the system is operating at maximum signal.

4. **Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.**

   We will have full access as of the year 2000. Presently, we pay $7.20 per kVa per month on the historic average load. This declines each year until market access in the year 2000.

5. **What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?**

   Renton: We expect to see the rate fall from about 4.4 cents per kWh to about 2.5 cents.

   West Point We currently pay a reduced rate as a result of our cogeneration agreement. The current rate is 3.2 cents per kWh versus the standard industrial rate of 3.4 cents per kWh.

6. **Describe your implementation of any strategies to obtain market access to power.**

   Renton: We negotiated with our power provider by intervening in a merger and showing we had the ability to "unplug."

   West Point: None.

7. **What have you done to reduce or control power consumption within your system?**

   Renton: Installed VFD drives, installed fine bubble full bottom aeration in secondary, installed high efficiency blowers, installed low wattage lighting, trained staff, etc.

   West Point: Installed VFD drives, installed high efficiency motors, installed low wattage lighting, trained staff, etc.

8. **How many therms of natural gas or gallons of propane did you purchase in 1997 and what was your total cost?**

   West Point: 133,315 gallons propane $88,916 ($80,000 charged to capital)

   Renton: None.

9. **Purchased from?**

   West Point: Canpet

   Renton: NA

10. **Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?**

    Not applicable.

11. **What do you expect the picture to be over the next five years in your area for gas rates?**

    Renton: Stable with seasonal variations.

    West Point: Not applicable.

12. **What have you done to reduce gas consumption or improve utilization within your plant?**

    Renton: We have just added scrubbing capacity from 1.2 M ft3 to 2.4 M ft3 per day input of biogas for sale to the local gas company. We sell the scrubbed gas for 14 cents per therm.

    West Point: We are currently evaluating the replacement of the existing cogeneration system (three 1300 kW engines). The engines are approaching the end of their useful life; and its present location was not designed for this use so proper maintenance of these units is very difficult. One of the preferred alternatives is a new cogeneration facility with four 1000 kW engines. The smaller engines would improve utilization (excess gas is currently wasted/flared).

    In 1996, the system generated 8.7 million kWh and produced $278k in revenue.

    In 1997, 8.2 million kWh and $264k.

13. **Describe your implementation of any strategies to obtain competitive priced access to gas.**

    Renton: Not applicable.

West Point: Natural gas is not available on site. Propane is bid.

14. What other recommendations would you make to other wastewater treatment plants in management of energy purchases and use?

Obtain a good utilities attorney and consultant and hard negotiate your rates with utilities.

15. Attach your electric power and gas rate schedule.

See attachment KCDNR-8, 9.

16. How much digester gas do you produce in cubic feet and what is the heat value in BTUs? What is your plant's average flow in MGD? What is the percent volatile solids loading in and out of your digesters? What is the volatile solids loading per day to the digester (lbs/ft3/day)?

Renton: Gas production is estimated at just over one million cubic feet per day. The Renton plant processed 79 MGD in 1997. Volatile solids in, is about 78% and 59% out. Loading to the digesters was about 0.11 lbs. VS per cubic foot per day.

West Point: Gas production has been estimated at about 1.5 million cubic feet per day. (Data from the gas meters were not used for this estimate; meters are believed to read high). WPTP processed 121 MGD in 1997. Volatile solids was about 80% in and 61% out. Loading to the digesters was about 0.2 lbs. VS per cubic foot per day.

17. Describe how you use your digester gas. What is the value of the revenue or saved operating cost from your gas utilization?

Renton: Digester gas is scrubbed with a counter current water stream at 300 psi. The gas is then sold to the local gas retailer (Puget Sound Energy). In 1997, we received $187,959 in revenue which was down about $70,000 from the prior year due to construction. This amounts to about 160,000 therms per month, without the construction impacts, receiving $0.14 per therm for the methane. A cubic foot of the methane contains about 998 BTUs.

West Point: Digester gas is used to power the influent pumps and for cogeneration of electricity with heat from the engines being used to heat the digesters and to provide heat for plant facilities. The value of equivalent electricity to run the influent pumps is approximately $150,000. The power generated by the cogeneration system was sold for $230,626. We presently do not have an estimate for the value of the reclaimed heat.

18. Present the life cycle costs of the energy recovery/utilization system using biogas, if available. Include capital, O & M with a present worth or payback and operating savings of power value minus O & M costs for the process.

Renton: The gas scrubbing system cost about $1.3M in 1986 for the first phase and $1.6 in 1996 for the second phase. Present worth for the original system was based upon $0.38 per therm sale price resulting in a payback of about 3 years. The second phase was based upon $0.28 per therm gas paying back in 7 to 8 years. The current depressed price of gas at $0.14 does not pay back. It is costing us about 7 cents operating and maintenance for the 14 cents in revenue.

West Point: The cogeneration system was brought on-line in 1983 at a cost of $4.3 million. With annual revenues of approximately $290,000 and O & M costs of $140,000, the system does not pay back.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**West and East Sections**
Your name and position:	**Sherry Grant, Management Analyst**
Phone # of relevant contact:	**(206) 689-3904**
Address and email:	**821 Second Avenue, MS/WPM** **Seattle, WA 98l04** **sherry.grant@metrokc.gov**

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?

CAD network/rational database

Microstation (CAD) and Intergraph products which run on Windows NT.

Contact Jean Robb at (206)689-3904 or e-mail jean.robb@metrokc.gov.

AutoCAD release 14 & NT server store and update plant as-builts and plant equipment list for Renton. PLC database kept for use by design firms, etc. Small works contracts and "in house" modifications designed on site.

Contact Lou Broadhead at (206) 684-2429 or e-mail lou.broadhead@metrokc.gov.

E-mail

Current agency-wide E-mail is Microsoft Exchange. Plans are to migrate to Microsoft Outlook 98 by mid-1999.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

Internet/intranet

Most of WTD staff have access to the Internet. There is an Internet web page for WTD on the King County home page. The WTD home page contains a number of web page links that provide information about the department, and activities going on within the department. Our Intranet capabilities are being used to set up such applications as one-line plant operation and maintenance information and documentation, access to budget information, and human resource informational exchange. Continued growth is expected in this area.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

Automated timekeeping

Our maintenance managementInformation System (MMIS) provides a timekeeping module that enables us to enter employee time slips daily, which automatically are charged to work orders. However, timekeeping must be done manually for transfer to our Payroll system.

An automated timekeeping/payroll system (Peoplesoft) will be implemented early in 1999.

Automated record keeping

Covered above.

2. What is the extent of internal access to agency data on-line ?

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, ***Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?)***

LIMS is available to all staff. FIS is on the County intranet. Historical data is less readily available. CMMS used in 1997 by maintenance only.

Breadth and depth of information: What percent of data that would have been tracked in written ***reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?***

N/A.

3. Maintenance management system (or related functions)

What type of maintenance managementsystem do you use (application, company)

The system in use for the calendar year 1997 was purchased from the City of Milwaukee in 1982 and modified over the next several years to meet our needs. This was an INFO based system that was replaced in 1998.

As of April 1998, we are using "Mainsaver", from J. B. Systems, Inc. which uses an Oracle database and a Powerbuild application.

Contact Regina Wells at (206) 689-3925 or regina.wells@metrokc.gov .

Please list several major features of your Maintenance management system.

Our MMIS system had the following features:

- Automated work requests
- Automated work orders
- Automated PM work order scheduling

- Equipment data
- Equipment history
- Automated timekeeping
- Planning/scheduling summaries
- Reports (master equipment lists, project cost reports, employee time data, etc)
- Interface to accounting systems
- Inventory usage

The new Mainsaver system will have all of the previous features and will also include expanded equipment history, equipment warranty information, fixed asset interface, a third-party report writer, graphic display capabilities, enhanced planning/scheduling capabilities, and work order barcoding.

When did you implement your MMS ?

Our original MMIS system, used until April 1998, was purchased from the City of Milwaukee in 1982. As of April 1998, the new Mainsaver system has been used.

What was the cost of purchasing/implementing (not including user/operator training.)

Original costs of our MMIS system are not available. The new Mainsaver system had a total project cost of $987,000 for purchase and implementation.

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

The MMIS system costs averaged $30,000, which covered .30 FTE and miscellaneous costs.

The Mainsaver system will require $43,000 annually, which covers .5 FTE and hardware and software support costs.

Service request tracking system

The MMIS system did not have system for tracking service requests. However, the Mainsaver system will have that capability. In 1998, a system was also put in place by our Technical Services Section to automatically track Engineering Service Requests. (See below).

Contact Sherry Grant (206) 689-3904 or e-mail sherry.grant@metrokc.gov

The Capital Improvement Program (CIP) section provides project management for engineering design and construction services in the Wastewater Treatment Division. The CIP section receives work requests from Operations, Maintenance and other groups in the Division and enters the Engineering Work Requests (EWR's) into a computer database. EWR's are initially developed and signed by one of the managers in the Division and the EWR is entered into the electronic database. The Operations, Maintenance and CIP managers meet with staff periodically to review, approve and prioritize all new work requests. The meetings also provide an opportunity to update the managers on the status of the most critical projects, and to discuss overall performance on projects.

The data base program is titled "Filemaker Pro" and is manufactured by Claris Corporation. The Filemaker software allows for the creation of customized forms and reports that are used to document new work requests including project scope, schedule and budget. The database is available electronically to CIP staff and to project clients in the Division. Project Managers are responsible for updating their projects on a regular basis to reflect status, schedule information, and issues or concerns. The updated information is available immediately on the computer network to any client interested in a project, and the clients are encouraged to review their projects and contact the project manager or engineer if they have any questions or concerns.

Contact Bill Nitz at (206) 684-1287 or e-mail to bill.nitz@metrokc.gov.

Predictive maintenance scheduling

The MMIS system did not have a predictive maintenance scheduling capacity. We are implementing a predictive maintenance-scheduling program based on lube inspection results and the vibration analysis trends.

4. Do you use or plan on implementing on-line O&M manuals?

Within the King County Department of Natural Resources, the West Treatment Plant currently is developing a website to deliver operation and maintenance information to plant staff over the County Intranet. Using a web

browser and Adobe's PDF Viewer plug-in, users will be able to review equipment descriptions, process diagrams, equipment photos and illustrations, checklists, logsheets, and standard operating procedures.

The West Plant's system will also include features to enable users to search for key words, follow links to related information, bookmark pages for future reference, and submit comments and suggested revisions. The system will be deployed in the 4th quarter of 1998.

At the Renton Plant, operations manuals have been converted to portable document format (PDF) and made available on compact discs (CDs). Using Adobe's Acrobat Reader, users can review equipment descriptions, process diagrams, equipment photos and illustrations, checklists, logsheets, and standard operating procedures. The system includes a feature to search for keywords within a file.

The East Plant continues to evaluate ways to link operations and maintenance databases to written manuals, and to make this information available to operators over the intranet, through the Forney control system, or using devices such as "wearable computers." At this time, however, the benefits of these approaches have not been judged sufficient to justify their costs.

Contact Pete Barnouw (206) 684-1579 or e-mail pete.barnouw@metrokc.gov or

Barb Johnson (206) 684-2493 or e-mail barb.johnson@metrokc.gov.

5. What technologies/systems does your agency intend to implement soon?

Technologies to be upgraded or replaced included financial, payroll, time keeping, and human resources systems (all are agency level systems). Within the Division we are planning to upgrade or replace laboratory and plant data management systems, and process control systems.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

6. Have these technologies/systems been studied and recommended?

Most of the projects are being considered on a case by case basis. Some are budgeted. Preliminary steps have been taken to conduct a WTD long range planning study to address computerized and information systems in a more formal integrated planning process across the division.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

7. Has funding been appropriated?

See above.

8. What plans does your agency have for the integration of servers?

Currently, multiple servers are used to support file and print services, and a few applications. Overall integration of Servers is not being considered at this time (all are accessible on the wide area net).

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

9. What plans does your agency have for data warehousing (cleansing of the best data)?

Currently, our applications have separate databases. In a few cases we have interface modules that extract selected information from selected databases or data depositories for special needs. The effort and cost to implement data warehousing designs for combining or sharing of data for faster queries, summaries, and decision making has been reviewed, but has not been considered as a real need.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

10. How many support resources (FTE's) does your agency employ?

Wide Area Network and agency applications are supported by King County Central Computer Services. Actual support only to WTD is difficult to determine (we are only a small part of the King County infrastructure). In WTD we currently have about 15 regular employees and one project limited temporary employee responsible for networks (Local Area Networks), desktops, mini computers, operating systems, and application support and service.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

Yes – The vision is to establish information technology to increase productivity, improve processes and facilitate a more efficient and effective agency.

Contact John Buffo (206) 684-1429 or e-mail john.buffo@metrokc.gov.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility:	**East Section Reclamation Plant at Renton/**
Your name and position:	**Peter Carter**
Phone # of relevant contact:	**(206) 684-2440**
Address and email:	**1200 Monster Road SW, Renton WA 98055** **pete.carter@metrokc.gov**

Treatment Plant/Facility:	**West Point Treatment Plant**
Your name and position:	**Bob Roehl**
Phone # of relevant contact:	**(206) 689-3835**
Address and email:	**1400 Utah Street West, Seattle, WA 98199** **bob.roehl@metrokc.gov**

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Discuss the typical transition from project to operating system at your facility.

Typically there is an operations person assigned to each project to assist in pre-design and design reviews, construction coordination, and start up. This person subsequently serves as a training and troubleshooting resource on the new systems after they are commissioned.

The transition usually consists of performance testing of each piece of equipment, a 48 hour test, a 10 day test, and a 30 day commissioning period. The 48 hour test is designed to run a piece of equipment or a process at the extremes of its specified parameters. The 10 day test is a period of uninterrupted operation with no failures. The contractors are required to provide training before the plant staff take over operation of the equipment at the beginning of the commissioning. They are also required to provide O & M manuals for all equipment before it is turned over to us. The plant personnel who were assigned to construction coordination duties during the project provide training and expertise to operations and maintenance during the design, construction and more intensively during the first few months of operation of the new systems. The O & M staff assisting with the design, construction and start-up are then available for information and training during the following years.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Consultants are hired by staff engineers for facility design, with staff engineers acting as project managers for facility design.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

The plant staff is involved in design review meetings at various stages of design. (i.e. 10%, 50% and 90%). There is a formal record of the issues raised.

O & M staff liaison with construction management to assist and coordinate submittals, plant shutdowns modifications change orders, etc. O & M staff assist and some times lead the transition from capital to operating during the test periods. O & M does the as-building. Plant staff is involved on larger capital projects on a limited basis. Their input is requested but they are not always given the time away from their normal job that is necessary to give meaningful, in-depth information that would help improve larger capital projects. After the large capital projects were completed, we set up committees for each of the Area Control

Centers (ACC1, ACC2, & ACC3) in the plant. Each committee has representatives from each of four shift crews, Facility Services, operations supervision, maintenance supervision, process staff, maintenance mechanical, and maintenance I & C work groups. From time to time, project engineers request to come to ACC meetings (they are always welcome) to discuss projects involving that area of the plant and they do ask for direction on what the employees would like to see from the project. There is not a formal method between the CIP group and Plant Operations & Maintenance groups being used to document the issues raised and what is done to resolve them.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

Staff suggestions are incorporated. Most involvement is at the operations supervisor level, although senior operators are frequently included. The staff attending do not make design decisions, but rather gives feedback to the design consultants.

O & M provide liaison personnel to work with construction management and the contractor ensuring input during construction. A "clean-up" list is maintained for follow-on work to contain change orders. Operations develops and starts-up the graphics for the Forney control system. Staff suggestions are incorporated into designs. This is done through the consultants working with plant staff to understand what has to be designed. Plant staff and engineering support are working together in an effort to more closely work on projects that are important to all.

3. Training

Classroom (lecture, workshop, etc.)

Yes.

Review of O&M manuals

Yes.

Video of Operating System

Yes.

Hands On

Yes.

Self-paced training manuals

Yes.

Training provided by the factory representatives is usually video taped and kept for review and reference.

After the capital project has been completed, self-paced OJT training courses have been developed so an Operator can learn the knowledge and skills needed to operate, monitor, and maintain the equipment, systems, and processes in the plant.

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

The specifications call for the contractor to provide training on equipment and systems installed. The trainers should be factory trained, and are required to submit lesson plans and qualifications. These are adhered to fairly tightly, but sometimes the training allowed for is more than we feel we need, in which case, we may trade the time for other services.

There are training specifications built into large capital projects. In the last eight years, management has committed most of the resources that were needed by the West Point Technical Education Center (TEC) in their efforts to support and deliver the training and documentation required of a large capital project. The difficulty has been in getting the TEC looped into all of the information being collected by the different contracts involved in a large-scale capital project. Getting more time from consultant and staff engineers would greatly help in the tremendous information gathering that is needed by the TEC to proficiently provide accurate plant manuals and training courses with up-to-date standard operating procedures.

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

The initial training is done by factory representatives. Follow-up training is provided by in-house operations staff assigned to the project. Occasionally consultants provide supplementary training on some systems.

Training is provided by coordinating the many training activities with consultants, vendors, in-house technical trainers, in-house staff, and anyone else who is a subject matter expert and can deliver training that needs to be taught to the appropriate personnel.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

The contractors are required to do the functional testing and then demonstrate that the equipment performs as specified to the Construction Management staff. They are also required to do the startup testing, overseen by Construction Management staff. Operations personnel assist in these tests to become more familiar with the equipment before start up.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

The start up testing is required of the contractor in the contract specifications. The contractors, overseen by the KCDNR Construction Management staff operate the equipment during the 48 hour and 10 day tests. The plant staff assist in the testing by taking readings and notifying Construction Management of any problems noted. They operate the equipment during the 30 day commissioning period.

How is performance testing conducted?

Equipment is tested to see that it meets specifications. Contractors do the testing, overseen by the Construction Management staff.

What is done to ensure O&M satisfaction by the designers.

This is handled by the KCDNR Construction Management staff with some input from the plant staff. We also have a "Facilitities Project Coordinator" position on the plant staff that handles many smaller projects, as well as working with CM staff on larger projects.

What is done to ensure O&M satisfaction by the contractors.

This is handled by the KCDNR Construction Management staff and by the Facilities Project Coordinator for smaller projects.

What is done to ensure O&M satisfaction by the equipment suppliers.

Initially the contractors are responsible for insuring that the suppliers provide the equipment and services specified. The suppliers are also concerned with customer relations with the plant staff and the ability to use us as references.

What is done to ensure O&M satisfaction by the staff engineers.

Staff engineers work with O & M staff on plant related projects.

What is done to ensure O&M satisfaction by the construction management staff.

Plant staff work with the KCDNR Construction Management staff throughout construction projects. Usually one person from operations and one from maintenance is assigned to work with CM on each large project. Presently the Renton plant has 4 to 5 full time personnel in Operations coordinating and supporting construction management within the Renton plant.

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

We have had the most successful start-ups when we were able to assign plant operations and maintenance personnel to work with CM and the contractors during the testing and start-up of a system. These personnel then have an opportunity to learn the system and become a valuable resource during the difficult transition from construction to operation. The Facilities Project Coordinator also functions to bridge the gap between construction and operation of new systems.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics).

Yes.

Have standards been developed for O&M manuals.

Yes.

Have standards been developed for control system software and hardware.

Yes.

Have standards been developed for other (please describe).

The contract specifies documentation requirements for each system.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

25%: The contract provides for the contractors to provide us with as-builts but it is hard to assign a reasonable value to the work to insure that it is completed. We have 2 in house staff that keep up the plant drawings.

PREDICTIVE MAINTENANCE

Treatment Plant/Facility: **West Point and East Reclamation Treatment Plants**
Your name and position: **Rob LaRock, Equipment Services Supervisor**
Phone # of relevant contact: **(206)684-2420**
Address and email: **1200 Monster Road, Renton, WA 98055**
rob.larock @metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Fill in the following to describe maintenance activities at your facility.

Staff time:(to equal 100%)

Predictive Maintenance (Vibe; Infrared, etc.)	4%
Preventive maintenance (Lubrication & pm's etc.)	55%
Reactive maintenance (Repair work as a result of failure)	5%
Planned or routine maintenance (General repair work and corrections)	28%
Project support by maintenance staff (CIP support; start-ups etc.)	8%
Total:	100%

Total approximate maintenance staff hours for FY 96/97.

- Mechanical: 74,800 hr.
- Instrument: 31,200 hr.
- Electrical: 24,960 hr.

2. Does Your Facility have a Predictive Maintenance program?

Yes.

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis	X	
Infrared Monitoring		X
Lubricant Analysis		X
Ultra Sonic Testing		
Other (please describe) _____ .		
Equipment Run Time Monitoring - Overhauls based on Hr. Meter		

Do your "In house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis	X	
Infrared Monitoring		
Lubricant Analysis		X
Ultra Sonic Testing		
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed
Vibration Analysis		
Infrared Monitoring		X
Lubricant Analysis		X
Ultra Sonic Testing		
Other (please describe below)		

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Reduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes. The vibration analysis program enables us to pinpoint problems in equipment. In the past complete overhauls of equipment have to be done when the repair may have been an impeller imbalance or alignment problem. The oil analysis program helps to detect early signs of wear and tear on equipment to avoid sudden failure. It is measured by what we call PMG (PM generated) work orders. This type of work order is generated when a potential problem is found while performing a PM routine, such as mentioned above.

Reduction in corrective maintenance work orders? Describe how you measure it:

No. We have seen a reduction in reactive maintenance work orders and an increase in corrective maintenance. The MMIS (maintenance managementInformation System) will provide reports telling us what type of work orders are cut in any given time frame, weekly, monthly, yearly, etc.

Reduction in total maintenance staff time? Describe how you measure it:

No. With less time being spent on breakdowns and reactive maintenance, more time is spent on other maintenance work, such as PM. Our MMIS reports will provide data supporting this.

Increase in planned maintenance work orders? Describe how you measure it:

Yes. This can be measured using our MMIS reports.

Reduced energy costs? Describe how you measure it:

Yes. I believe we are reducing energy costs but we aren't measuring it. Lubrication technology has documented cost savings through energy reduction by using improved lubricants.

Other (please describe) Describe how you measure it:

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Since the implementation of the lubrication program at both the East Reclamation and West Divisions, there has been a significant reduction of equipment failures due to lubrication failure. Lubrication personnel have taken ownership of the program and the equipment. Reliability has improved and also increased the life of the equipment. Before the PDM program, some of the major equipment used to be removed and overhauled on an hourly or other time frame basis, such as raw sewage pumps (60 mgd and larger), large gear boxes, etc. Now an accurate and educated decision can be made to evaluate the condition of a piece of equipment.

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

No specific plans are being considered at this time. However, we are committed to looking for new ways to make improvements in our program and do a better job.

OFF-SHIFT STAFFING

Treatment Plant/Facility: **West Point Treatment Plant**
Your name and position: **Dick Finger**
Phone # of relevant contact: **(206) 689-3825**
Address and email: **1400 Utah St. W, Seattle, WA 98199-1004**
dick.finger@metrokc.gov
Treatment Plant/Facility: **East Section Reclamation Plant**
Your name and position: **Bill Burwell**
Phone # of relevant contact: **(206) 684-2408**
Address and email: **1200 Monster Rd SW, Renton, WA 98055**
bill.burwell@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

West Point: The West Point plant operates four rotating shifts which staff the facility 24 hours per day. A shift schedule chart is attached. See attachment KCDNR-10. In addition to the shift crews, there is a Facilities services crew, which works 4-10's Tuesday through Thursday and which provides Operations support during the week and a Process Control crew , which performs the majority of the analytical testing and provides process control direction to the operating crew. The professionals in Process Control are normally available by pager for consultation. Each shift crew is composed of 1 supervisor, 4 Senior Operators and 6 operators. Shift start at 0618 and 1818 and end at 1830 and 0630 respectively with the 12 minutes being used for tie-in. The shifts include a 30 minute unpaid lunch. Based on the way the shift work falls, each crew has two consecutive shifts in which they work 46.8 hours followed by in which they work 35.3 hours per week (as defined by FLSA). They earn compensatory time at time and a half for the 6.8 hours worked over 40 hours and use compensatory time on the short weeks to bring their hours up to 40 hours (required to earn full benefits).

Then normal minimum staffing is seven including a supervisor and three seniors; however crews have operated below this for short periods when flows are steady. We are currently reviewing staffing levels as a part of work redesign. One of the biggest challenges is to be able to deal with extreme changes in flows associated with a large combined sewer system and still meet secondary requirements.

Renton: The East Plant operates 24 hours per day 365 days per week with 4 seven person shift crews. These crews work 4 x 11.7 hour shifts. The shift crews are supported by a Facilities Services crew who cover 10 hours per day Monday through Friday. The Process Control Section works 8 hours per day Monday through Friday and 4 to 8 hours with one or two people on weekends and holidays.

The crews normally consist of 1 supervisor, 2 or 3 Senior Operators and 4 or 3 Operators. The crews are self relieving for vacation, sick leave, meeting and training with a minimum staffing of 5 people to operate the plant. Occasionally during periods of stable weather, the crews will operate nights or weekends with 4 personnel. Additional personnel may be called in during storms or when construction activities so require.

2. Describe the following:

Grade levels and required expertise for off-shift operators.

West Point: We presently have the same staffing on both on and off-shift with four operations crews rotating between day and night on an 8 day cycle as shown in the attached shift schedule. Our nominal staffing is a total of ten with 1 Supervisor who must have at least a Washington Group III certification (IV

desirable), four Senior Operators who, under the new progression system are expected to have a Group III certification (some grandfathered Seniors have only a II) and five Operators. The operators in the progression system must have a Group I certification at entry level and must have a Group II to reach the top half of the pay range. Grandfathered Operators must have a Group I.

Entry level Operators are expected to know one operating area of the plant as well as having to complete a number of technical training programs. Operators must know two areas of the plant to move in to the top half of the pay range. Senior Operators must know all operating areas of the plant and must have completed a prescribed list of supervisory classes. A copy of the general progression requirements is attached. See attachment KCDNR-11. On average, it would take at least three years as a utility person to qualify for Operator, three years as an operator to be able to move into the top half of the range and three more years before qualifying to move into the Senior Operator classification. These are minimums as an individual must meet all of the identified qualifications before moving into the next range.

Renton: The Operating Supervisor is a certified Grade III Operator by the State of Washington along with the relieving Senior Operator. The Senior Operators are Grades II and III and Operators Grades I and II.

Staffing by process area during off-shifts: What numbers do you staff where?

West Point: The treatment plant is grouped into three area control centers (ACC's), with each ACC responsible for one or more process areas. These ACC's are manned continuously by one or more Senior Operators or Operators, depending on need. The main control center is manned continuously, typically by an Operations Supervisor and a Senior Operator, who direct overall plant operations and monitor remote offsite facilities. The ACC's are responsible for the following plant process areas:

- ACC1 – Influent control and pumping, screening, grit handling, primary sedimentation, reclaimed water, chlorination equipment, plant wide support systems (hot water heating, air systems, hydraulics, electrical distribution)
- ACC2 – Solids handling, sludge thickening, digesters, gas systems management, sludge dewatering, odor control system
- ACC3 – Intermediate and effluent pumping, secondary aeration basins and clarifiers, chlorination/dechlorination control, oxygen production

The plant requires a minimum of 1 Supervisor, 3 Senior Operators , and 3 Operators at all times. The plant staffing could increase to 1 Supervisor, 4 Senior Operators, and 5 Operators dependant of work load (flows, weather/seasonal conditions). Typical staffing levels for each ACC are as follows:

- Main Control: 1 Operations Supervisor, 1 Senior Operator
- ACC1: 1 Senior Operator, 1 Operator
- ACC21: Senior Operator, 2 Operators
- ACC31: Senior Operator, 1 Operator

Renton: The treatment plant is divided into process areas, with each process area consisting of one or more Area Control Centers (ACCs). These ACCs are staffed depending on need.

The Supervisor normally works out of control building which must be occupied at all times per fire code. The control room receives telemetry from throughout the plant and from 22 off-site pumping stations.

The Senior Operator working with the supervisor in the control building takes care of screening and grit, raw sewage pumping, primaries, some plant utilities, SO2, and effluent pumping. An Operator assists as available.

A Senior Operator or Operator takes care of secondary including aeration basins, secondary clarifiers, chlorination and related equipment.

A Senior Operator takes care of Solids including DAFTs, digesters, gas scrubbing and related equipment. An Operator assists on occasion.

An Operator runs dewatering including poly mixing, 4 to 6 belt pressed, moves trucks, etc.

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	Y	

Remote facilities monitoring	Y	
Troubleshooting of systems/equipment	Y	
Emergency response	Y	
Process adjustments	Y	
Process sampling	Y	
Process testing	Y	
Laboratory testing		
Preventive maintenance of equipment		
Equipment repair		Only basic emergency repairs
Isolation/shutdown of systems/eqpt.	Y	
Coordination of maintenance work	Y	
Construction contractor support	Y	
Development of monitoring reports		
Buildings & grounds maintenance	Y	
Plant security	Y	
General Housekeeping	Y	
Other: Staff training	Y	

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	22 pumping station, Alki storm weather plant and special structures
Troubleshooting of systems/equipment	X	
Emergency response	X	
Process adjustments	X	
Process sampling	X	Mostly done by automatic samplers
Process testing	X	
Laboratory testing		Only in dewatering area for % solids
Preventive maintenance of equipment		
Equipment repair		Simple and some emergency repair
Isolation/shutdown of systems/equip.	X	
Coordination of maintenance work	X	
Construction contractor support	X	Mostly handled by separate staff
Development of monitoring reports		
Buildings & grounds maintenance	X	Assigned process cleaning areas only
Plant security	X	
General Housekeeping	X	Assigned process cleaning areas
Other: Callouts to pumping station off hours		

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

West Point: West Point serves a combined collection system. Even during summer conditions, storm events can result in major increases in plant flows with an increase in workload due to debris on barscreens, etc. In addition, plant staff monitors off-site facilities including pump stations and combined sewer overflow sites and exercises supervisory control so as to limit flow to the plant to within acceptable levels.

Renton: Other staffing requirements: Chlorine and sulfur dioxide emergency response is provided by shift operations. Shift crews support emergencies at pumping stations and pipe lines during off hours by assisting with response. We are require by the fire department to have 24 hour, 58 minute/hour coverage or our main control due to chemicals.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

West Point: Crew staffing is predicated upon providing some opportunity for time off without requiring added staff. Although crews are staffed at 10, minimum standards allow up to 3 off and, as indicated above, sometimes allow staffing to drop to 6 for partial shifts. If staffing drops below that level, crews bring in relief from crews on their 4 days off on overtime. Staff from facilities services can also be brought in. Individual training is handled in the same manner. On occasion, crews are split in half during the day with backup from Facilities Services to allow multiple members to receive training such as CPR, etc.

Renton: Shift coverage: The seven-person crew covers itself. Relief staff from Facilities Services is available during days to cover training and high work load days.

Other scheduling procedures and policies.

West Point: The labor contract provides constraints for changing schedules without adequate notification (14 days). Voluntary changes can be implemented within this time limit.

Renton: Shift staffing is based on labor agreements, County civil service rules, and interdepartmental guidelines. The basic policy is that shift changes are used whenever possible. Overtime is used for emergencies or when shift changes are not possible.

3, Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.

West Point: The process laboratory provides ½ day coverage on weekends to complete required NPDES testing. Maintenance staff is available through pager on a voluntary basis and is assigned to standby during the overflow season and when conditions justify. Process analysts are generally available for consultation by operations by contact via pager. Source control and engineering are also reachable in the event of an emergency. Pager numbers and phone numbers are provided to operations personnel to facilitate contact as needed.

Renton: The laboratory has a swing shift crew on site until 8:00 p.m. There is a minimum of one stationary engineer on site 24-hours a day. Other support staff is available to the Operations Supervisor on a call-in basis. Support is provided on a standby basis for holiday weekends.

4. What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.

West Point: We just approaching the completion of our third year of operation since the secondary system was brought on-line. We are planning to conduct a work redesign effort which will look at workload and staffing requirements. We have not established any targets, but would hope to address the issue of off-shift staffing during the redesign process.

Renton: This is a subject of work redesign as we come off the present $229M capital construction project. The construction contractors affect the shift crews.

5. Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?

West Point: All employees belong to a single union except for the non-represented employees in the process section (which was recently accreted into Local 6). The contract includes gainsharing, job progression and work redesign as a part of the basic agreement and allows revisions to the basic agreement through the actions of the Joint Labor Management Committee on an ongoing basis.

See attachment KCDNR-12.

Renton: Same as West Point.

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   West Point: The main treatment plant is staffed on a continuous basis with operations personnel. Maintenance personnel are called in as necessary to respond to emergencies. A high level of process and control system redundancy minimizes the amount of call-ins and reduces the number of employees needed on shift.

   Renton: Same as West Point

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   West Point: We presently have no plans for moving toward unattended operations because of the complexity of the system. We will continue to utilize automation as a means of minimizing the staffing level required.

   Renton: Our pumping stations and the wet weather plant at Alki are unattended. We will continue to have attended operations at the East Section Plant.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**West Point Treatment Plant/King County Wastewater Treatment Division**
Your name and position:	**Dick Finger, West Operations Manager**
Phone # of relevant contact:	**(206) 689-3825**
Address and email:	**1400 Utah Street West, Seattle, WA 98199** **dick.finger@metrokc.gov**

1. **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, "Workforce Flexibility/Skill-based Pay," to clarify the scope of this question.**

   Operations and maintenance are separate groups, but work together along with process control in cross functional teams to address process issues and improve efficiency.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attachment KCDNR-13, 14, & 15.

3. **Do you have a single manager over both operations and maintenance?**

   Each treatment plant has a Plant Manager. Maintenance is centralized with a single Manager. Maintenance personnel are assigned to specific facilities and generally work exclusively at one plant or the other.

4. **What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance?**

   1:8.

5. **Which of the following "maintenance functions" are performed by operators?:**

Task		Comments
Routine preventive maintenance	X	
Repair of equipment		
Predictive maintenance activities		
Process modifications	X	With direction from Process Section
Non-process modifications	X	
Cleanout/isolation of systems/eqpt.	X	Involved in large tanks & eqpt.
Cleaning and calibration of instruments		
Simple electrical repairs		Operations does some resetting and fuse replacement
Maintenance of automatic samplers	X	Shared with laboratory and maintenance
Computerized maintenance mgmt.		
Vehicle service		
Buildings & grounds maintenance	X	Performed by Facilities Services
General Housekeeping	X	Performed by Facilities Services

6. **What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?**

   Very limited. It is not a requirement.

7. **Do you offer incentive programs to encourage cross-training?**

   It is not required, but job progression is aimed at maximizing employees' knowledge. It is presently focused on Operations or Maintenance with minimal cross-training.

8. **Provide a copy of your current salary structure for operations and maintenance personnel.**

   See attachment KCNDR-16.

9. **What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?**

   There is currently an issue with working out of class so the current climate limits the opportunity for combined activities. This will be an issue as we work on improving competitiveness.

10. **Cross-functional process-based work teams:**

    Do you either currently have or plan to implement cross-functional process-based work teams?

    We have cross functional teams organized along process areas to bring operations, maintenance and process expertise to the table for addressing issues. These teams are empowered to make decisions.

    If so, how are these teams organized and what authority is given to team leaders?

    Teams include representatives from each shift crew, process control, electrical/instrumentation and mechanical and have an Operations Supervisor assigned as team lead. Team members take decisions back to their respective groups for implementation. Major expenditures and/or plant changes are taken to the Plant Manager for approval.

    What is the makeup of the teams?

    See above. Operations are responsible for operating the plant, process direction from Process Control. Maintenance coordinates with Operations. We have established a coordinator position, which is staffed by an Operations supervisor to provide the coordination between Operations, Maintenance and Process.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility:	**East Reclamation and West Treatment Plants**
Your name and position:	**Ken Belleisle, Maintenance Section Manager**
Phone # of relevant contact:	**(206) 684-2416**
Address and email:	**1200 Monster Rd. S.W., Renton, WA 98055** **ken.belleisle@metrokc.gov**

1. **Is your agency/has your agency considered re-engineering your work practices and organization structure using:**

   Workforce flexibility?

   Plan to use in the future.

   Skill-based pay?

   Plan to use in the future: Not in 1997; implemented in 1998.

2. **In your maintenance/operations organization, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, "Combined Operations and Maintenance," to clarify the scope of this question.]**

   Maintenance and Operations are separately run sections, with their own management, supervisory and administrative staffs. The mechanical, electrical and instrumentation groups work in the Maintenance Section. Operations has shift crews, facilities services (includes carpenter, painters, landscapers, janitors and back-up operators) and process control groups.

How many trades or disciplines are in your current structure and what are they?

We have two separate Operations Sections that are located in different facilities, approximately 18 miles apart. The conveyance operations section works under East Operations on one side and under the Maintenance Section on the other. The Maintenance Section has three locations – at each major treatment plant, and one facility where a combined operations/maintenance team is housed to take care of the conveyance system in the West Section.

The Operations Section has Utility Workers, Operators and Senior Operators on both shift crews and facilities services. The Process Control Section in Operations has Water Quality Specialists, Process Analysts, and Process Engineers. The Maintenance Section has mechanical, electrical and instrumentation groups. The Maintenance Section also has operators and Senior Operators on their Offsite team in the West Section. Both Operations and Maintenance Sections have their own budget/financial, training, and support personnel. The Maintenance Section has Planner/Schedulers in each of its three locations. Engineering, Technical Publications, Financial/budget staff and construction support personnel work directly under the Wastewater Treatment Division Manager at a central location apart from the treatment plants.

Do trades cross technical boundaries? If yes, please describe their interaction.

Trades and crafts personnel do not cross technical boundaries. However, trades and crafts work closely together for support in major projects.

3. What is you agency's definition/interpretation of workforce flexibility?

"Flexibility" by definition can mean many things. The newest thinking is that workforce flexibility would mean that employees can be trained and skilled in more than one area. However, our agency has not looked at this possibility in depth and we are just now researching and gathering information on how this might be accomplished. However, we also interpret flexibility to mean innovative work schedules (flex time, compressed work weeks, etc.) which we do have in place as well as individual employee flexibility to participate in the job progression program and be self-motivated to move upward through their job progression program.

4. Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.

There are no plans in the near future.

5. Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?

We have no immediate plans. This agency is still making adjustments to a recent period of rapid growth, expanded technical facilities, and merger into a larger County organization.

6. What are your Agency's sources of information and guidance on establishing skill-based pay? (I.e., How did you get the idea to set it up and how do you know how to set it up?)

We have a job progression program that was initiated as a part of our collaborative bargaining agreement. The designs of the program were done by a joint effort of represented, training, and managerial and support personnel. Initially, a consultant was brought in to introduce and guide the design committee in efforts to start the program. A program manager was brought in after the consultant and this individual worked with individual groups to develop requirements for skills and knowledge for advancement through the program. At this time, there is a Job Progression Oversight Committee, consisting of represented and non-represented personnel that meet regularly to monitor the progress of the program. Some groups have implemented the program and some groups are still in development phases.

7. What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?

A Job Progression Oversight Committee is delegated the responsibility of monitoring the progress and success of our program.

Pay scales, per se, were not increased and progression was designed to fall within the existing pay scale ranges. The job progression program we established has gates employees must pass through to go to higher pay steps rather than automatically be given annual step increases. To pass through these gates, employees prepare

documentation of the knowledge and skills required gate and submit it to their supervisor for approval. Employees are then tested and if successful, are passed through the gate to a higher pay step. In some instances, the final gate in a classification leads to a promotion to a higher paying classification (i.e., mechanic to master mechanic).

8. What skills, goals or objectives does your agency intend to "incentivize?"

Our gainsharing program has been in place for several years. It is a program where cost savings through efficiencies and improvements are shared by employees and rate payers.

Our job progression program is designed to enable employees to advance through higher paying steps as a result of self-study, on-the-job training, and demonstration of skills.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility:	**East Section Reclamation Plant** **West Point Treatment Plant** **King County Wastewater Treatment Division**
Your name and position:	**Dick Finger, West Operations Manager**
Phone # of relevant contact:	**(206) 689-3825**
Address and email:	**1400 Utah Street West, Seattle, WA 98199** **dick.finger@metrokc.gov**

1. Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisors unionized? Is the shop open or closed? What is the umbrella union organization(s)?

The Operations and Maintenance employees are unionized and belong to SEIU Local 6. Supervisors, clerical staff and the Process Section Employees are non-represented. (The Process Section has recently been accreted into the union with negotiations regarding wages still in progress).

2. On what issues do your unions meet and/or negotiate with management?

The normal process is to negotiate a contract on a 3 year cycle, during which a broad range of issues are discussed. The primary focus is on the traditional issues of hours, wages and working conditions, but includes progressive issues such as work redesign, gainsharing and job progression. The contract establishes a Joint Labor Management Committee (JLMC), which has comparable representation from both Labor and Management and which collaboratively addresses any issues raised during the contract period.

3. If your answer to 2. (previous question) discussed issues outside the traditional hours, wages and working conditions as part of a MOU or Contract, please discuss the formation, structure, roles and empowerment of this process and/or committees.

See above. The JLMC has the authority to collaboratively address any issues pertaining to the contract. Procedures are in place to obtain input from the represented employees and, significant changes may be submitted to them for an acceptance vote based on the decision of the Union. Similarly, substantive changes may be deemed necessary by Management to be submitted to the King County Council for approval. Decisions made by the JLMC have the effect of modifying the contract. Mechanisms for doing this include development of MOU's and published handbooks/guidelines predicated on the MOU's. The JLMC utilizes a consensus process and also utilizes sub committees to work issues and bring recommendations to the JLMC for final decision. Two standing committees are the Gainshare Oversight Committee and the Job Progression Oversight Committee. Other subcommittees are established as needed such as a Transfer Committee, which was tasked to review and revise the procedures for Annual Transfer, Filling of Vacancies and Hardship transfers.

4. Are you working with your union on competitiveness? If so, please describe.

There is an ongoing emphasis on competitiveness which is supported by the gainsharing program in which all employees within the plant (and off-site) boundaries participate. Increased efficiencies are reflected in annual gainshare payments. The program is administered by a Gainshare Oversight Committee, which is a sub committee of the JLMC and which is equally represented by management and union.

5. Are you involved with labor on training programs?

The agreement includes a Job Progression program which requires training to advance. Employees have been directly involved in the development of the program through the JLMC and the Job Progression Oversight Committee. Plant staff has also been involved in the development of the plant training materials.

6. Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?

The last several negotiations have been conducted using a collaborative bargaining approach. It has been generally successful, but takes hard work on both sides and requires periodic refresher training to keep from regressing into positional bargaining.

7. What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?

We are committed to work with the union to address issues in a collaborative manner and to maintain and/or improve our working relationship. We have identified the need for refresher training to help to maintain a collaborative approach on both sides. The contract includes gainsharing, job progression and work redesign as facets of a continuous improvement process. These activities, as well as ongoing contract administration, are directed by the Joint Labor Management Committee, which has both management and labor representation and which operates on a collaborative consensus driven process.

FLEET SERVICES

Treatment Plant/Facility: **East Section/West Point**
Your name and position: **Sherry Grant**
Phone # of relevant contact **(206) 689-3904**
Address and email: **1400 Utah St. W., Seattle, WA 98199**

1. Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:

Sedans	9
Pick-up trucks	20
Vans currently in use as commuter vans	0
Vans, general pool and other	39
Solids hauling trucks	4
Trucks equipped for in-plant and collections maintenance purposes	23
Other: Boom trucks, dump trucks, vactor trucks, flatbed truck, tanker truck	12
Electrc Carts	44
Bicycles	20

2. What is your current vehicle replacement policy?

- Compact cars/trucks: 8 years, 80K miles
- Mid-size cars/vans: 9 years, 90K miles
- Large trucks: 10 years, 100K miles

3. Do you have a replacement fund?

Yes, covered under capital replacement budget.

4. Have you made any recent reductions in the fleet? Are you planning on doing so in the near future? What are the approximate annual savings achieved by the reductions?

We have reduced the fleet by 30%in 1996 and replaced vehicles with carts. Savings not yet realized in capital replacement fund; rough estimate of operating savings = $10,000.

5. Have you experienced any adverse impacts from the reductions in fleet size?

No.

6. **How are your fleet vehicles serviced? (In-house or by external contracts?)**

   Outside contract

7. **What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.**

   We use a calendar based service plan – every 6 months for average use vehicles; every 3 months for high use vehicles used in conveyance system.

8. **How many Fleet Services staff support the fleet?**

   Work is contracted out.

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility:	**Biosolids Management Program (recycles biosolids from East and West facilities)**
Your name and position:	**Peter Machno, 206-684-1244**
Address and e-mail:	**821 Second Avenue, MS 81, Seattle, WA 98104** **pete.machno@metrokc.gov**

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. Differentiate work done by staff and contractors. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)**

   Council Policy Support. The Biosolids Management Program (BMP) employs an environmental management system designed to follow the King County Council biosolids policies. See attachment KCDNR-17 & 18. These policies support the beneficial use of biosolids and ensure a highly reliable, low risk and cost competitive program by using a diversity of enduses, sufficient recycling capacity and market principles. In addition, research, demonstration, collaboration, new technologies, interlocal agreements, and the use of local project sponsors are elements of the policies. This environmental management system is now saving King County approximately $2.0 million annually.

   The BMP has developed Performance Guidelines that all projects follow. These guidelines include plans for communications, monitoring, operations and outline oversight responsibilities. For example, project communications plans include methods of informing and receiving input from BMP and other agency staff (communications, environmental compliance, management), and how regulatory agencies and the public will be informed and involved in the project, during development and ongoing operations. The internal communication has lead to a broader understanding of program activities and objectives, as well as improved coordination and collaboration on biosolids quality issues, transportation and planning. The external outreach both increases awareness of project goals and encourages community input into how the projects are operated.

   Program Overview. King County recycles 100% of the biosolids it generates from its two wastewater treatment facilities. King County contracts with a hauler, a composter, two agricultural land application contractors, and a forestry contractor. King County overseas all projects and has varying roles in the operation of each project. The only "privatized" aspects of the program are compost and hauling. The King County laboratory performs some environmental analyses.

   From belt press or centrifuge dewatering units, biosolids are directly loaded into contractor's haul tractor/trailer units for transportation to enduse sites. Some flexibility in load scheduling is provided by using a digester as a blend/storage tank which can be drawn down or allowed to fill to regulate dewatering operations and thereby loading.

   Composting (~2,000 dt/yr). Biosolids are hauled 4-14 miles (one way) to a private King County composter, GroCo, Inc., for further processing. Biosolids are mixed with sawdust and composted using static pile technology. The compost is then marketed by GroCo, Inc. as GroCo, and used in commercial and home landscaping. King County receives $5.00 per dry ton ($1.00/wet ton) for biosolids delivered to GroCo, Inc.. King County also receives finished compost at the wholesale price of $7.00 per yard. GroCo, Inc. sells the compost for about $13.95/yard. King County pays some of the Class A testing (helminth ova and enteric viruses), which occurs twice a year.

Agriculture (16,000 dt/yr). Biosolids are hauled 180-220 miles for use on two agriculture projects located in Douglas (Boulder Park Project, wheat) and Yakima Counties (Green Valley Project, hops). Both project land application companies are owned and operated by prominent local farmers.

At the Boulder Park project, King County provides surplus equipment and funds for the procurement of equipment to be operated and maintained by the application contractor through a bailment agreement. All purchases conform to King County procurement policies and procedures, and require King County approval. Biosolids are delivered year around and may be stored or directly applied using high volume rear-discharge spreaders, from spring through fall to dryland wheat fields. The project includes about 40,000 acres and involves 100 landowners and farmers. King County receives approx. $5.00/dry ton for the nitrogen fertilizer value of biosolids The project has very strong support in the community (biosolids are "considered important to the agricultural economy of Douglas County"), and with elected officials and farmers. The contractor conducts all application tasks. The following activities are shared between the contractor and King County staff: permitting, recordkeeping, reporting, public involvement, and environmental monitoring.

At the Green Valley project, the application contractor owns all the equipment. Biosolids are delivered year around and may be stored or directly applied with side discharge spreaders, from the spring through fall to hops, orchards, corn and pasture. The project includes about 38,000 acres and involves more than 15 landowners and farmers. The project has strong local political and community support. One project participant is a state legislator and has been on the state agriculture subcommittee for approximately 7 years. King County receives $5.00/wet for the nitrogen fertilizer value of delivered biosolids. The local contractor performs all application services. The following activities are shared between the contractor and King County staff: permitting, recordkeeping, reporting, public involvement, and environmental monitoring.

Forestry (~7,000 dt/yr). Biosolids are hauled 35-50 miles to forestland in King County owned or managed by the Weyerhaeuser Company (WeyCo, 5,000 dt) or the Washington State Department of Natural Resources (WaDNR, 2,000 dt). Biosolids are applied by a contractor using King County equipment. King County receives approximately $55.00 per acre for biosolids applied on WeyCo land and $10.00/dry ton applied on WaDNR land at the time of application. King County receives 75% of tree harvest revenues from lands that are owned by King County and managed by WaDNR. Through land exchanges, King County will have application sites on WaDNR forestlands through the year 2046. The biosolids forestry program is supported by the Mountains to Sound Greenway Trust, a consortium of 60 environmental groups and local business. The MTSG Trust is encouraging landowners to maintain working farms and forests along the Interstate-90 corridor from Cle Elum to Puget Sound. King County staff designs all application sites (with assistance from UW forestry program), a private contractor is used for mapping and flagging of sites.

Research & Demonstration (~0-2,000 dt/yr). Research into new enduses (for example - poplars, mine restoration) or application (nitrogen mineralization rates, metals) is periodically performed to ensure maximum flexibility for the program and to confirm environmental conditions or refine application techniques. Research has been done jointly with the county and Northwest Biosolids Management Association or funded separately by King County.

Monitoring. Monitoring of biosolids quality and of environmental conditions at recycling sites (soil, crops, surface and ground water) has been essential in confirming safety and demonstrating benefits of biosolids use. Monitoring is a key element in gaining public support as well as strengthening the support of biosolids users. Even as monitoring requirements are relaxed with the adoption of new state regulations, continued environmental monitoring remains an essential part of building on the public's acceptance of biosolids recycling.

2. Annual production.

Wet and dry tons by class A, B & C and total

1997 Tonnage:

- 27,264 dry tons
- 128,885 wet tons
- Approx. 19-22% solids

Does the system meet "exceptional quality" for metals?

- King County anaerobic digestion produces a Class B biosolids meeting EQ metals.
- Approx. 10,000 dewatered wet tons was composted under contract to meet Class A.

- Pilot technology projects periodically process small quantities of either raw (undigested) or digested solids into products that may be Class A products (for example drying technologies).

3. Costs.

1997 total operating cost for the program including direct administration, lab support and maintenance.

$ 5,362,264 (76% haul and application; 14% salaries/benefits; 10% other)

Total capital Investments in dollars associated with the biosolids program.

Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.).

None.

Total investment in equipment (Tractors, trailers, spreaders, etc.).

1997: $213,000 (primarily forestry site development and equipment).

Total investment in land.

- Total land expenditures: $8,068,229 (purchases and acquisitions)
- Current Assets: $13,466,664 (sales and current appraised values)
- Timber Revenues: (1995-1998) $503,023

King County's forestland acquisition program began as an effort to acquire lands for biosolids application and benefit from timber harvests. With the 1995 agreement with the Mountains to Sound Greenway and the state (WaDNR), the land program was modified to support King County's goals of open space and maintenance of forestland base in the county. The Wastewater Treatment Division transferred its existing holdings to the state DNR to manage and hold in trust. In return, King County receives (1) 75% of any timber harvest revenues from these properties, and (2) biosolids application rights on 3,600 acres of state forestlands. Substantial revenues from timber harvests are projected for 1999-2046 (estimated at $24,811,672, in 1998 dollars). These revenues are designated for WTD and a portion to other county agencies including schools and libraries.

4. Revenue from use (fertilizer value, energy production, crops, etc.).

Nitrogen fertilizer value of biosolids*	$120,000
Timber harvest revenues	$87,000
Interagency agreements for use of King County permitted sites	$12,000
Total	$219,000

* Compost—$5/dt (or $1/wt x 10,762 wt) = $10,761.
Agriculture—$5/dt (or $1/wt x 75,240 wt) = $75,240.
Forestry—WeyCo ($55.00 per acre) = $13,867.
WaDNR—$10/dt (or 2/wt x 10,003 wt) at time of application, plus 75% of harvest revenue at time of harvest = $20,006.

Cost avoidanc: use of GroCo compost during major landscaping projects.

During an extensive landscaping project at the West Section wastewater treatment facility, more than 10,000 yards of biosolids compost were used, at a cost of ~$5.00/yard, a significant cost savings over compost or manufactured soil for the project.

During another landscaping project near the East Section facility, a reduced rate for biosolids compost was negotiated and the compost was used to build portions of the Renton Water Works Garden and storm water treatment facility.

The producer of biosolids compost donates 100 cubic yards of the compost a year for King County grants projects.

4. What are the number of FTEs in program including administration, operations, maintenance, other.

Biosolids Management Program (12 FTEs):

- 1 program manager
- 4 project managers
- 1 engineer
- 1 budget analyst
- 3 project coordinators

- 2 administrative

Environmental lab staff:

- 3.5 FTE allocated for biosolids sampling (0.5) and analyses (3)

5. Describe your major reuse customers or approaches including wet and dry tons to each and class of product. Include customer/contractors.

- Compost: (A - 2,000 dt or 10,000wt/yr): privately marketed to commercial/home users.
- Agriculture: (B - 16,000 dt or 80,000wt/yr): individual and corporate farms.
- Forestry: (B - 7,000 dt or 35,000wt/yr): private (5,000dt); public (2,000dt, state) land.
- Research/Demonstrations: (A or B; 0-2,000 dt/yr) when needed or as is otherwise beneficial.

6. Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?

See also the King County Council approved policies and the environmental management system described above.

Markets. Maintain existing strong markets, where demand exceeds production, and seek new markets to explore opportunities for environment enhancement; possible cost reductions; and new outlets for new biosolids products that may be produced in the future (for example, dried Class A biosolids).

Communications. Continue communications and education/outreach efforts to increase public awareness and expand support for biosolids recycling.

Collaboration. Seek opportunities for partnerships in recycling biosolids, where there are multiple and mutual benefits. For example, the MTSG biosolids forestry program includes teacher education and teaching units for grade school environmental education classes; the Bunker Hill Superfund cleanup site is uniquely in need of biosolids and high pH biosolids/wood ash products; and local community enhancement projects that provide environmental benefits, recreational areas and educational opportunities.

Networking. Maintaining a leadership role in the Northwest Biosolids Management Association and others that may play a significant role in influencing biosolids management in the region.

Cost Competitiveness. Evaluate areas of the program that can be modified to take advantage of potential cost savings; work with production facilities (treatment plants) to maximize cost savings potential.

Planning. Strategically plan for biosolids management in the near-term and for long-range purposes, identifying production potential, including growth and regional flows from other counties; understanding market strengths and potential weaknesses; planning for future capacity and changes in markets as biosolids products and volumes change; addressing changes in regulations, new technology; levels of community support, and potential biosolids environmental management systems, etc.

7. Describe any special conditions you are under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.

The history of King County has included involvement of councils in the oversight of the biosolids management and preparation of biosolids specific policies.

The King County Biosolids Management Program has invested considerable time and effort into increasing general awareness and support for the beneficial use of biosolids. A variety of audiences are included in outreach efforts including, gatekeepers (local and state elected officials, local and state regulators, teachers, university researchers, environmental organizations), specific stakeholder groups (such as farm lenders, forestland managers, equipment dealers, crop brokers), and the general public (though radio ads and bus placards, and through talks and demonstrations to school children, fair-goers, 4-H-ers, universities).

King County participates in the Northwest Biosolids Management Association (NBMA) which provides information, funds research and hold annual conferences on biosolids production and management.

King County projects have received considerable positive media attention as well as awards in the last several years. Negative media is always challenging for biosolids management programs, proactive public involvement is key is retaining existing public support and engendering new support. Awards:

- 1996 US Environmental Protection Agency National First Place – Recycling Program
- 1996 US Environmental Protection Agency National First Place – Outstanding Technology

- 1996 US Environmental Protection Agency National Special Award – MTSG and partner King County
- 1996 National Association of Counties Achievement Award - MTSG
- 1996 Association of Municipal Sewerage Agencies Operations Award - Operations
- 1994 US Environmental Protection Agency Special National Award – Leadership through NBMA
- 1988 US Environmental Protection Agency First Place National Operating Project Award

The Washington State Department of Ecology supports the beneficial use of biosolids (written into legislation). No counties in Washington prohibit land application of biosolids

Demand for product exceeds supply in agriculture markets.

8. Comments?

The 1997 cost figure of $5.3 million reflects an approximate program savings of $2 million operating per year since 1993 as a result of public acceptance and project management strategies (in 1993 dollars).

YEAR 2000 COMPLIANCE (Y2K)

Treatment Plant/Facility:	West Point/Department of Natural Resources, WTD
Your name and position:	**Charlie Dickey**
Phone # of relevant contact:	**(206) 689-3923**
Address and email:	**1400 Utah St. W, Seattle, WA 98199-1004**
	charlie.dickey@metrokc.gov
Treatment Plant/Facility:	**East Section Reclamation Plant/Department of Natural Resources, WTD**
Your name and position:	**Byron Burris**
Phone # of relevant contact:	**(206) 684-2455**
Address and email:	**1200 Monster Road South West, Renton WA 98055**
	byron.burris@metrokc.gov

When both East and West Sections have completed surveys, it will be stated in the header and answers are considered joint unless otherwise indicated.

East Section: Also referred to as Renton and East Reclamation Plant
West Section: Also referred to as West Point

1. Do you have a Y2K program in place in your organization?

West Point: Yes. Began Y2K program January 1998.
Renton: Yes. Began Y2K program January 1998.

2. Have you inventoried your Information Technology systems (IT)?

Yes.

3. Have you inventoried your embedded systems?

Yes.

4. How many IT systems do you have?

West Point: 7
Renton: 4

How many embedded systems do you have?

West Point: A variety of Process Equipment.

Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)?

Yes. Began in mid 1998.

How many systems have been assessed?

4.

Have you begun contingency planning for your systems?

West Point: Yes (contingency planning for computer systems failure was designed into the system). Began in mid 1998. Two systems have contingency plans.

Renton: Have you begun contingency planning for your systems? Yes (contingency planning for computer systems failure was designed into the system).

How many systems have contingency plans?

Number unknown.

Have you begun remediation of your non-compliant systems?

Yes.

How many systems have been remediated?

2.

Have you tested any of your systems for Y2K compliance?

Yes. Began in late 1998.

How many systems have been tested?

4.

How many passed?

0.

ORANGE COUNTY SANITATION DISTRICT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Operations/Laboratory**
Your name and position: **Doug Cook/Laurie Bluestein, Moy Yahya**
Phone # of relevant contact: **(714) 593-7600/593-7491, 593-7489**
Address and email: **10844 Ellis Avenue, Fountain Valley, CA 92708**

1. Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.

Process Analyses, Frequency, and Cost Savings				
Station	**Analysis**	**1996-97 Frequency**	**June 1998 Frequency**	**Annual Savings**
Influent	VSS	Daily	Daily	0
	COD	Daily	Daily	0
	PH	Daily	Daily	0
	TKN	2/Month	Discontinued	1,303
	BOD-C	None	2/Month	-582
	BOD-S	2/Month	2/Month	0
Primary Treated	TSS	Daily	Daily	0
	VSS	Daily	Discontinued1	14,202
	COD	Daily	Daily2	3,143
	PH	Daily	Discontinued	9,418
	TKN	2/Month	Discontinued	3,910
	NH3	7/Month	7/Month3	559
	Turbidity	Daily	Discontinued	9,418
	BOD-T	7/Month	7/Month4	5,354
	BOD-C	None	2/Month	-2,328
	BOD-S	2/Month	2/Month5	698
	Metals	2/Month	Discontinued	13,326
	Settleable Solids	Daily	Discontinued	1,570
Secondary	TSS	Daily	Daily	0
	VSS	Daily	Daily6	2,840
	COD	Daily	Daily7	4,714
	PH	Daily	Discontinued	6,278
	TKN	2/Month	Discontinued	2,606
	NH3	7/Month	Daily8	-5,587
	Turbidity	Daily	Daily9	3,139
	BOD-T	7/Month	7/Month	0
	BOD-C	7/Month	7/Month10	2,037
	Metals	2/Month	Discontinued	8,884
	Settleable Solids	Daily	Daily	0
Final Effluent	VSS	Daily	Daily	0
	COD	Daily	Daily	0
	PH	Daily	Daily	0
	TKN	2/Month	Discontinued	652
	Turbidity	Daily	Discontinued	1,203
	BOD-C	Daily	2/Month	8,148
	BOD-S	2/Month	2/Month	0
	Settleable Solids	Daily	Daily	0
Raw Sludge	TS	28/Week	28/Week	0
	VS	28/Week	28/Week	0
	Metals	Quarterly	Quarterly	0

Overflow	TS	24/Week	24/Week	0
	VS	24/Week	24/Week	0
	Metals	2/Week	2/Week	0
	Volatile Acids	38/Week	38/Week	0
	PH	38/Week	38/Week	0
	Alkalinity	24/Week	24/Week	0
	Metals	Quarterly	Quarterly	0

Process Analyses, Frequency, and Cost Savings (continued)

Station	Analysis	1996-97 Frequency	June 1998 Frequency	Annual Savings
Feed	TS	8/Week	16/Week	-1,613
	VS	8/Week	Discontinued	4,839
	Metals	Quarterly	Quarterly	0
Filtrate	TSS	12/Week	8/Week	1,613
	VSS	12/Week	Discontinued	4,839
	Metals	Quarterly	Quarterly	0
Cake	TS	10/Week	24/Week	-5,645
	VS	10/Week	Discontinued	4,032
	Metals	Quarterly	Quarterly	0
Polymer	TS	12/Week	12/Week	0
Total Annual Savings				$102,969

- TSS discontinued on five out of six primary treatment streams.
- COD reduced to every other day on two out of six primary treatment streams.
- Ammonia increased on one primary treatment stream, reduced on two primary treatment streams, and eliminated on three primary treatment streams.
- BOD-T decreased on one out of six primary treatment streams.
- BOD-S eliminated on one out of six primary treatment streams.
- VSS eliminated on one out of four secondary treatment streams.
- COD eliminated or reduced on two out of four secondary treatment streams.
- Ammonia reduced on two out of four secondary treatment streams, increased on two out of four secondary treatment streams.
- Turbidity eliminated on two out of four secondary treatment streams.
- BOD-C eliminated on one out of four secondary treatment streams.

2. Have you made any recent reductions in laboratory analyses or are you planning on doing so in the nearfuture? What were they (e.g. process)? What is the approximate annual savings achieved by the reductions?

Yes. Over the last two years, the process control analyses have been reduced by approximately $103,000 (see Table presented in question 1). Table addresses Questions 1 & 2.

3. Have you experienced any adverse impacts from the reductions in process-related analysis?

No. In fact, we have plans to review this annually with further reduction expected.

4. What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.

SVI, DO's, pH, Sludge Density, Cake Density.

5. Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).

See Compliance.

6. Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?

Annual Saving: NPDES Permit						
Sample Source	Analysis	Old Permit (Pre June 1998)		New Permit (After June 1998)		Annual Savings
		# of Analyses	Frequency	# of Analyses	Frequency	
Influent/ Effluent Monthly Analyses	Grease & Oil	5	7/Month	9	Monthly	$ 13,010
	Chronic Toxicity	Not Required		1	Monthly	$(11,400)
	Acute Toxicity	1	Monthly	1	Quarterly	$ 3,600
	PH	1	Daily	1	Monthly	$ 1,517
	Turbidity	1	7/Month	1	Monthly	$ 314
	Floatables	1	Monthly	0	Discontinued	$ 1,338
	Metals	21	7/Month	21	Monthly	$ 19,913
	PCB	3	7/Month	3	Monthly	$ 56,823
	Organophosphorous Pesticides	3	7/Month	0	Discontinued	$ 4,860
	Volatiles	12	Monthly	3	Monthly	$ 16,525
Final Effluent Instantaneous Maximum Analyses	Base/neutral/acids	6	Monthly	0	Discontinued	$ 12,145
	Volatiles	6	Monthly	0	Discontinued	$ 11,017
	Cyanide	6	Monthly	0	Discontinued	$ 2,828
	BOD	6	Monthly	0	Discontinued	$ 1,746
	TSS	6	Monthly	0	Discontinued	$ 559
	Ammonia	6	Monthly	0	Discontinued	$ 838
	Mercury	6	Monthly	0	Discontinued	$ 2,110
	Metals	60	Monthly	0	Discontinued	$ 10,764
Receiving Waters	NH3	44	Monthly	318	Quarterly	$ 310
	TSS	44	Monthly	0	Discontinued	$ 1,029
	Grease and Oil	44	Monthly	0	Discontinued	$ 1,807
	Fecal Coliform	44	Monthly	318	Quarterly	$ 3,360
	Total Coliform	Not Required		318	Quarterly	$(11,308)
Surfzone	Total Coliform	19	5/Week	19	2-5/Week	$ 61,643
	Fecal Coliform	19	5/Week	19	2-5/Week	$(92,376)
	Enterococci	Not Required		19	2-5/Week	$(52,665)
Total Annual Savings						$ 60,310

7. Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.

We've made reductions already. However we review the issue annually.

8. How many labs do you have in your agency? What are the functions of each?

We have one main lab along with a field lab @ each facility. There is also an Operations Engineering Lab at one of the plants.

9. How many hours did it take to fill out this questionnaire?

8.5 hours.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility:	**Combined Plants / O&M**
Your name and position:	**Barbara Collins**
Phone # of relevant contact:	**(714) 593-7202**
Address and email:	**10844 Ellis Avenue, Fountain Valley, CA 92708**

1. Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding) utilized to investigate and test this technology.

The Air Quality and Special Projects Division of the Operations and Maintenance Department is responsible for identifying and evaluating new technologies and methodologies for reducing costs and increasing compliance flexibility associated with the treatment and disposal of wastewater, biosolids, and air emissions. The Division also ensures compliance with air quality laws and regulations and minimizes the impact of odor and air emissions on District employees and the community. The AQ&SP staff includes engineers, scientists, technicians, and interns.

2. List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).

Alternative Emissions Monitoring/Central Generation System.

The Districts operate eight reciprocating engines at two Central Generation Stations. Fueled by digester gas and/or natural gas, these engines drive generators connected to the local utility for co-generating electricity. Currently, each engine continuously monitors Oxides of Nitrogen emissions using an extractive Continuous Emissions Monitoring System (CEMS) to comply with SCAQMD permit conditions. These systems were installed in 1992 and are 10-year old technology.

As part of our recent negotiations with SCAQMD on the Title V permit applications for Plant Nos. 1 and 2, the Districts were successful in relaxing the permit language that required CEMS to be installed and operated. The modified language now allows the Districts to operate either CEMS or Parametric Emissions Monitoring System (PEMS). This flexibility was important to the Districts for two principal reasons. First, because of the age of the CEMS and the type of technology used, the CEMS is frequently failing. The types of failures vary but include analyzer malfunctions, missing data points and calibration failure. The Districts' permit condition requires that the CEMS be operating properly at all times that the engines are operating. The frequency of CEMS failures and thus not meeting this permit condition requirement, is increasing over time. The Districts are concerned that the unreliable operation of the CEMS could cause compliance problems for us under the Title V permit. The cost of maintaining the CEMS has been steadily increasing to remain in compliance. The average cost to maintain the CEMS over the past three fiscal years is $139,000 per year. Because of the compliance concern and increasing maintenance costs, the Districts obtained flexibility in the permit conditions to operate a potentially more cost-effective monitoring system such as PEMS.

The Districts conducted a study in early 1998 to evaluate the types of PEMS available, regulatory agency certification requirements for the PEMS, and capital and operating costs. In addition, the Districts evaluated the cost to replace the CEMS with a new CEMS as well as upgrading the existing CEMS. The results of this study indicated that PEMS provided considerable cost savings on an annualized basis over either a new CEMS or an upgrade to our existing CEMS. The savings ranged between 38% to as high as 53% depending on the type of PEMS selected. The report presented essentially two types of PEMS, the most common approach used cylinder exhaust temperature to predict emissions, and the second utilized a continuous pressure sensor connected to a fiber optic cable. The capital and annual costs for these two methods differ substantially.

The Districts are currently evaluating which of the two PEMS technologies is the best choice for our application as well as working with SCAQMD staff to determine the certification requirements for the PEMS. For next year, the Districts anticipate installing the PEMS on one engine first as a demonstration project and then, if successful, installing the PEMS on the remaining seven engines.

Continuous Hydrogen Sulfide (H_2S) Monitoring for Digester Gas.

The SCAQMD Rule 431.1 requires facilities burning digester gas to limit the concentration of sulfur compounds to 40 ppm, daily averaged. The rule also requires continuous monitoring of sulfur concentration in gaseous fuel.

To achieve the 40 ppm H_2S limit, the Districts add coagulant chemicals ferric chloride and anionic polymer to the primary clarifiers, and ferric chloride directly to the digesters as needed. The cost for this program is approximately $2,000,000 per year. To comply with monitoring requirements, the Districts' staff analyzes grab samples being collected daily from high-pressure digester gas lines. The samples are collected into Tedlar bags by the laboratory personnel and analyzed using calorimetric "Gastec" tubes (daily) or by utilizing a gas chromatography/sulfur chemiluminescense detector (GC-SCD) (SCAQMD Method 307-91). In addition, the field staff takes samples of digester gas once per shift from all digesters and analyzes them using the Gastec tubes. These results determine the amount, if any, of ferric chloride to be added to the digesters. To avoid non-compliance, the field staff is adding chemicals conservatively.

The rule allows facilities to use monthly averaging H_2S concentrations to report compliance instead of daily averaging if a Continuous Sulfur Monitor (CSM) is installed. Therefore, installation of CSM allows the Districts to achieve cost savings in several areas:

The digester H_2S concentrations can be raised to levels closer to the 40-ppm limit, which requires less ferric chloride resulting in chemical savings. Even if sulfur concentration occasionally exceeds 40 ppm, the Districts will have one full month to achieve a monthly average compliance and will not be in violation of our permit conditions. It is estimated that saving in chemicals could exceed $200,000 per year

It currently requires several employees from Plant Nos. 1 and 2 (totaling almost one full-time employee) to collect samples and run digester gas analyses by the Districts' laboratory, and to collect samples from each digester and analyze them by the field staff. The projected labor cost saving from eliminating these tasks is about $70,000 per year.

Equipment: Cost saving on Gastec tubes, pumps and Tedlar bags are estimated to be at least $15,000 per year. Additional saving will be achieved from the cost of maintenance and running of GC-SCD, a precise analytical instrument requiring highly qualified personal to operate.

In October 1997, the Districts issued a Request For Proposal to about thirty known vendors in the related field. Fourteen of them initially expressed interest to participate in their CSMs evaluation, but only two – Bacharach, Inc. of Pittsburgh, PA and Vapex, Inc. of Orlando, FL., submitted their instruments for the field evaluation. Both manufacturers use electrochemical H_2S-specific sensors, but with a different approach to the system configuration and data acquisition methods. Unfortunately, the Bacharach system didn't perform satisfactorily and, despite the manufacturer's attempts to correct the instrument's performance, failed to monitor sulfur content within the required specification. The second instrument, the Vapex CSM, initially also performed unsatisfactorily (high errors, fast zero and calibration drift), but together with the Districts staff, these negative performance factors were eliminated.

The final field evaluation of the Vapex CSM began on May 5, 1998. The instrument is installed at Plant No. 2 on a gas line, which supplies digester gas to the CGS Internal Combustion Engines. CSM readings are compared with the results of the reference method (GC-CSD). The evaluation is coordinated with SCAQMD. After the first two months, the system performed extremely well. The difference between CSM and reference method data is less than 4%. Daily and monthly averaging data demonstrate full compliance with Rule 431.1 requirements. SCAQMD recommended continuing the system's evaluation for another two months. During this period, staff will also estimate actual cost savings compared to projected cost savings. If the results are satisfactory, the system will be purchased and installed at both plants.

Microfiltration.

The purpose of the microfiltration research is to produce a water of better quality than secondary effluent for tertiary treatment or in lieu of tertiary treatment without using a conventional activated sludge (A.S.)

plant. The Districts currently uses conventional A.S. treatment at Plant No. 1 and high purity oxygen A.S. treatment at Plant No. 2 to remove organic materials from some of the primary effluent. These are followed by gravity separation of the solid and liquid materials in clarifier basins. An alternative approach uses fine membrane filters to remove the suspended organic matter and produce acceptable secondary effluent. Starting in March 1996 and extending into the next fiscal year, the Districts are testing a microfiltration unit manufactured by Zenon Environmental Inc. for possible inclusion in the secondary treatment process.

The Zenon microfiltration process combines a biological reactor (comparable to A.S.) and a micron-level membrane to filter insoluble and high molecular weight soluble materials from wastewater. The principal advantage claimed is the production of a high quality effluent that is independent of the mixed liquor? s settleability characteristics, which in turn allows the bioreactor to operate at biomass loadings and sludge retention times that are higher than conventional A.S. processes would allow. This could translate to smaller bioreactors (or increased capacity for a given size bioreactor) and the elimination of secondary clarification.

The microfiltration unit was first fed with A.S. mixed liquor, and later with effluent from the primary clarifiers (i.e., A.S. feed). Various settings of bioreactor solids loading, air flow, product (permeate) flow, and hydraulic retention time were tested while the product quality was monitored. Under all conditions, the product quality equaled or exceeded that of conventional secondary effluent.

Once the testing is completed in August 1996, the economic feasibility of using microfiltration will be evaluated. If the costs are competitive with conventional processes, microfiltration could be a means to increase treatment capacity, delay or avoid capital construction projects, and provide secondary effluent that would be suitable for tertiary treatment without further processing. The results of the testing and possible future applications for the Districts will be discussed in the 1997 Annual Report.

Trickling Filter Rehabilitation.

Trickling Filter No. 2 was removed from service during November 1995 in order to conduct maintenance repairs and replacements to the influent distribution arm assemblies. Mechanical Maintenance staff found a corrosion damaged distribution arm and advised that the unit must be removed from service. Operations and Maintenance staff began planning the removal activities early September. The scope of the work consisted of quickly removing the biomass from the rock using bleach so that odor potential was kept to a minimum.

The removal process began on Tuesday, October 31, and was completed by Friday, November 3. Staff from Plant Operations, Mechanical Maintenance, Pipe Fitting, Maintenance Planning, Electrical Maintenance, the Laboratory, and Source Control were involved in the activities. The procedure of removing the trickling filter from service consisted of three phases; hydraulically flushing the unit, dosing the unit with chemical, and allowing the unit to dry. This cycle was repeated for three consecutive days, then the units were left to completely dry out. During the removal process, the trickling filter effluent streams were monitored for residual chlorine in order to confirm that chlorine was not adversely impacting the plant effluent.

The project cost as reported by Accounting was $24,000, however, it was later determined that many field level employees did not appropriately charge time and materials to the project. The various staff assumed that the trickling filter project was associated with routine plant maintenance and charged to the routine operating and maintenance accounts. An estimate of actual cost has not been prepared.

The trickling filter was successfully removed from service without causing an odor nuisance. Chlorine bleach fumes, however, got into the Control Center heating, ventilation, and air conditioning system, which dictated the bleach dosing levels. A comprehensive project report was written.

Mechanical Maintenance staff completed a detailed inspection of the trickling filter arms. The inspection results indicated that the arms could not be repaired and must be replaced. The trickling filter is scheduled to receive a new distribution arm assembly(ies) and a new bearing assembly. The project is scheduled for completion during fall of 1996 at an estimated cost of $110,000.

Improvements to Headworks Screenings Dewatering.

During fiscal year 1996/97, an FSM Model SP(W) 300 screenings compactor was tested at Plant No. 1. This machine, which dewaters screenings material from the plant headworks, increased the average solids content of the screenings from 21% solids to 41% solids. If applied to the screenings from both plants, the disposal cost savings resulting from the decreased screenings weight would pay for the compactors in 2-3 years.

Based on these test results, two compactors were purchased one for each plant. Responsibility for the installation of these machines was assumed by Engineering. It is expected that both machines will be installed early in fiscal year 1998/99.

Primary Effluent Filtration Test.

In primary effluent filtration (PEF), primary effluent is treated to reduce TSS, BOD, or other contaminants. If PEF can meet the effluent quality requirements applicable to a wastewater stream, substantial cost reductions can be realized by using PEF instead of secondary treatment. Extensive tests have been done on secondary effluent filtration, but no directly comparable data are available for the various technologies that could be used for PEF. This project will test three units simultaneously to produce direct comparison data. The test will involve two types of sand filters (upflow and downflow) and a synthetic filter medium (the Schreiber Fuzzy Filter[2]) that operates at much higher hydraulic loadings than sand filters.

The project will explore the ranges of hydraulic loading and operating settings appropriate for each filter. The principal effluent characteristics to be monitored will be TSS and BOD, since these are of most concern for NPDES discharge purposes, but other characteristics also will be measured to better differentiate the performance of the filters.

If it is found that PEF, with or without chemical additives, can be used to meet the relevant effluent requirements, secondary treatment could be reduced or eliminated, resulting in substantial treatment cost reductions. Even if secondary treatment were continued, the capacity of the existing secondary aeration basins would be increased by the reduced organic load of filtered primary effluent. The results of this project are expected to be useful in developing a revised Strategic Plan and in developing the Orange County Reclamation (OCR) project with the Orange County Water District (OCWD).

Large-Scale Microfiltration Demonstration

In FY 1996-97, a small (10 gpm) microfiltration (MF) pilot plant treating primary effluent was tested to evaluate this potentially more cost-effective alternative to conventional A.S. treatment. The potential benefits of MF included reduced labor and operating costs, improved effluent quality, and delayed or reduced future capital investments. Labor and operating costs might be reduced due to elimination of the secondary settling basins. Effluent quality would be improved through reductions in the concentrations of TSS, BOD, and coliform bacteria. Future capital investments can be affected by the increased capacity obtained if microfiltration modules were installed in existing A.S. basins or by the need for smaller new basins. In addition, MF might replace the A.S. process and the tertiary treatment processes required by OCWD for reverse osmosis system feed.

The results of the tests were encouraging, showing that MF can effectively remove BOD, TSS, and microbial contamination as well as or better than conventional A.S. treatment. When fed primary effluent, MF consistently reduced coliform bacteria levels below the receiving water standards contained in OCSD? s NPDES permit, suggesting that MF might provide a cost-effective alternative to traditional disinfection technologies. Also, MF potentially can treat primary effluent to produce a high quality permeate suitable for reverse osmosis without additional treatment.

Due to various design and operating characteristics of the 10 gpm unit tested, however, reliable operating and maintenance (O&M) costs and scale-up costs for a full-scale installation could not be determined. Therefore, a larger (60 gpm) unit will be tested to provide the missing data. This unit also will use an improved MF membrane that was not available for the earlier tests and will test AS mixed liquor, primary effluent, and possibly primary influent as feed streams.

Anoxic Gas Flotation (AGF) Process Test

AGF is an improved high-rate anaerobic digestion process that reduces the required digester capacity to treat a given amount of solids while improving the rate of volatile solids destruction. The required digester capacity can be reduced to less than one-third of the conventional capacity because it decouples the solids retention time (SRT) from the hydraulic retention time (HRT).

AGF fundamentally is a liquid-solids separation procedure. An auxiliary processing chamber uses biogas to float and concentrate the solids in an anaerobic digester. The solids are returned to the digester for further degradation while the liquid effluent is sent elsewhere for other processing.

Tests at Seattle Metro showed that, using AGF, more than three times as much wastewater could be processed while simultaneously increasing the volatile solids destruction from 55% to 60-70% (depending on the SRT chosen). Cost savings with AGF come from reduced biosolids disposal costs, reduced polymer usage, and increased biogas production. Full-scale implementation is projected to save OCSD $1.5 million/year and have a payback period of less than two years.

The test program will use a self-contained pilot plant to demonstrate the AGF process performance using our sludge as feed. Subsequent testing, if warranted, would involve a full-scale retrofit of one or more digesters.

HTF / KADY Process Tests

The hydrolysis-thickening-flotation (HTF) process and the KADY process are two approaches to reducing solids handling costs. HTF treats digested sludge to reduce the amount of solids that must be processed, and KADY improves overall anaerobic digester performance by increasing the volatile solids reduction that occurs in a digester. This reduces overall operating costs because digesting more volatile solids leads to increased methane production from the digester and reduced amounts of residual solids that must be processed.

The HTF process acidifies and thickens sludge to increase its solids content before dewatering, thereby reducing the volume of material going to the belt presses, and increases the dryness of the dewatered biosolids. This reduces the biosolids disposal costs and reduces the dewatering energy costs. If the process performs as predicted, full-scale implementation would reduce OCSD?s solids handling costs by $987,000/yr.

The KADY process uses mechanically-induced cavitation and impingement to rupture cell walls in undigested sludge, exposing the soluble protoplasm to the digester?s microbes. Since cellular lysis has been shown to be the rate-limiting step in digestion of biological solids, the net effect is to speed up the overall digestion process. This results in more complete conversion of digestible material without increasing the residence time in the digester. Preliminary results from an installation in Portland, ME have shown a 40% reduction in WAS production when the KADY process is used to treat RAS in their AS plant.

Continuous Scrubber Monitors

This project will use continuous H_2S monitors on the packed tower scrubbers to reduce the amount of chemicals used. The monitors will measure the H_2S concentration of the scrubber exhaust and use that information to optimize the amount of caustic soda injected into the scrubbers.

The project schedule anticipates monitor installation during the second quarter of the fiscal year and testing during the third quarter. If the tests are successful, the monitors will be adopted for routine use.

It is estimated that use of continuous monitors will reduce caustic soda use by 20%. Additional savings should be realized in maintenance costs, and compliance with air emissions regulations will be more reliable.

Hydrogen Peroxide Sensor Test for Influent Trunklines

This project will test a system for automating and optimizing the hydrogen peroxide (H_2O_2) additions to the influent trunklines. For the test, a H_2S sensor will be installed in an influent splitter box. This sensor will be used to control the amount of H_2O_2 added to the influent lines. If the results show economic and operational benefits from this approach to chemical dosing, a large-scale installation will be proposed.

The savings from automatic H_2O_2 dosing have been estimated at 10% of the H_2O_2 budget, or $90,000/year. The test project will extend over most of the 1997-98 fiscal year.

Hydrogen Sulfide Monitor for Digester Gas

OCSD currently has to comply with H2S emissions limits from the CenGen engines on a daily emissions basis. If H2S levels in the digester gas that is used as CenGen fuel were monitored continuously, the emissions compliance determination could be done on a monthly average emissions basis. This would provide greater flexibility in our use of iron compounds for H2S control and is projected to reduce our chemical costs by at least $200,000/year while increasing our emissions compliance reliability.

The project will test one or more continuous H_2S monitor systems at the digester gas compressor station. Once the accuracy of a monitor is verified; it will be connected electronically to the ferric chloride feed system for the digesters and will be used to control the ferric chloride dosing. It is expected that this will result in reduced chemical use while still adequately controlling the H_2S content of the digester gas.

The project will span most of the 1997-98 fiscal year. Installation will occur during the second quarter, and the field testing will start in the second quarter and extend into the fourth quarter.

Central Generation System Parametric Emissions Monitoring System

Air emissions regulations for stationary engines (such as the Districts? CenGen engines) are requiring increasingly stringent monitoring efforts. Installing Continuous Emissions Monitoring Systems (CEMS) is the usual approach to meeting these requirements. CEMS are expensive and complicated, though, and cannot perform some of the monitoring that is expected to be required soon.

Parametric systems (PEMS) are alternatives to CEMS. PEMS use measurements of engine operating parameters to predict the engine?s emissions rather than measuring the emissions directly. PEMS are potentially more cost-effective than CEMS and are able to predict emissions of chemical species that currently available CEMS cannot measure.

This project will test PEMS equipment on one CenGen engine at each plant. The testing will take place during the second half of the fiscal year. If it is found that PEMS provide reliable results at reasonable costs, this may provide a way to reduce CenGen emissions monitoring costs while maintaining regulatory compliance.

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

Ultrasonic Solids Digestion Enhancement.

AUTOMATION

Treatment Plant/Facility:	**Fountain Valley & Huntington Beach/Plant Automation Group**
Your name and position:	**David Halverson/Automation Engineer**
Phone # of relevant contact:	**(714) 593-7244**
Address and email:	**10844 Ellis Ave, Fountain Valley, CA 92708-7018**

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The general approach to automation has been to create a two-layer system consisting of local control, and SCADA system. Local panel control includes PLC's which provide interlocks, with some panel mounted analog controllers to control process parameters, and digital alarm panels to display alarm function. SCADA system allows for control from a centralized control room as well as local area control if necessary. Features of the SCADA system far exceed those of the Local panel system and allow for archiving of plant operating data.

2. What type of control systems do you have at the . . .

Machinery and equipment (PLC's, analog loops, centralized at a mini computer, etc.).

Control systems located at the equipment generally are hard-wired start-stop switches and some hard-wired interlocks such as high discharge pressure switches. The PLC processes start-stop commands from both the Local panel and SCADA system and provides the majority of process and safety interlocks. When VFD's are utilized the speed output can be locally controlled manually bypassing the output of the Local panel analog controller or SCADA system loop controller. Some packaged equipment may contain a dedicated PLC installed by the OEM to provide localized control of the equipment. In some areas localized alarm panels are installed to annunciate alarms.

Area system controls such as secondary treatment, digesters, etc.

Area system controls are generally located at an Area Control Center (ACC) with associated process equipment start-stop switches, analog controllers, analog process displays and alarm panels. The Local panel discrete controls work in conjunction with PLC's. Also located at the ACC is a console from the SCADA system which can be used when in computer control.

Centralized control room.

There is a centralized control room at each plant and it is the center for the SCADA system. From the consoles located in the control room an operator can monitor and control process and equipment located throughout the plant. The computer system provides all of the functionality normally found in all of the ACC's combined and advanced features beyond the capabilities of the Local panel control systems.

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	Plant 1 – 2,356	Plant 2 – 2,915	Pump Stations - 960
Digital outputs	=	Plant 1 – 1,866	Plant 2 – 1,120	Pump Stations - 0
Analog inputs	=	Plant 1 – 489	Plant 2 – 834	Pump Stations - 176
Analog outputs	=	Plant 1 – 105	Plant 2 – 91	Pump Stations - 0
Control loops	=	Plant 1 – 37	Plant 2 – 52	Pump Stations - 0

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

The District is planning and constructing facilities for flow pacing for chemicals. We are also developing feed-back systems for better control of dose rates. Two test bed feed-back systems for the automation of odor-scrubber chemical feed system is in place.

List other automated flow regulation.

None.

List applications of automated alarms (notice next question).

None.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

Alarm's can be generated by monitoring of an analog or discrete signal, by an output of one of the PLC's, and by the SCADA system. Alarms that are the result of a PLC output are generally annunciated at the Local panel and cannot be acknowledge by the HMI. The majority of the alarms are generated by the SCADA system and are annunciated and displayed on alarm summary pages by the system, they can be sorted by assigned process areas.

Equipment Start and Stop

Equipment can be started and stopped locally, from the Local panels and from the SCADA system. Requirements for starting and stopping (interlocks) can vary greatly depending upon which system is used to start.

Process Data

Some process data are displayed locally at the transmitter and again at the Local panel. For the most part the data are not graphed or retained at these locations. Process data can be viewed, graphed, stored, processed and retrieved through the computerized process control system.

Equipment run hours

Equipment run hours are generally maintained locally by a run time hour meter and also are calculated and stored by the computerized control system and can be retrieved for maintenance purposes.

6. Describe how your system archives information.

Information is archived through a redundant pair of DEC VAX Servers. The servers are programmed to periodically request current values of process data from the computerized control system. Request rates are programmable at one second or greater. At the end of the day the data are processed to compute totalized values, highs and lows and then made available for reporting purpose. Preprogrammed reports are also generated daily. Alarm and events generated by the computerized control system are also stored on the minicomputer for future reference.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance uses the system primarily for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service.

Operations

Operations uses the system for control and monitoring of the plant process and to monitor the off-site pumping stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room. Equipment located throughout the plant can be started or stopped and process setpoints can be changed from the control room.

Process Control or Laboratory

Data collected by the SCADA system is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

Engineering

The engineering department uses primarily historical data for engineering studies. The studies may involve plant additions or collection system impacts by major storms.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

Control of 21 off-site pumping stations is primarily through local hard wiring at the stations. The PLC's are utilized to monitor pumping stations and to package information to the SCADA system. Monitoring utilizes 4 analog phone lines and DSU/CSU modems.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

The district.

10. Describe the following:

How does your level of automation help with decisions?

The SCADA system makes detailed current and historical information available for use in decision making. Information is available to be presented in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

New control strategies can be devised and implemented usually with only minor reprogramming. The SCADA systems provide considerable flexible and expandability to accommodate plant modifications.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

Control loop tuning is enhanced with graphing and many PID parameter block options available for use in the SCADA system. With the SCADA system more detailed and integrated control strategies can be devised resulting in higher quality treatment.

How does your system identify and prioritize critical and non-critical condition information?

Plant data is at this moment collected and archived by the SCADA system based on predetermined request rates and is not prioritize critical or non-critical.

How does your system store critical and non-critical condition information?

Time stamped new data are not written to the record unless its value has changed beyond a preprogrammed deadband. This reduces the amount of information that is archived and the record size.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

The potential systems should be thoroughly checked out with other users through site visits and discussions. Provide/Produce both PLC/DCS software and HMI configuration standards before any code is written. Ensure that the system will do what you want it to do now and do not rely on promises of future functionality. Make sure that the vendor has a track record of providing for customer upgrades following product software revisions. Do not be first to install a new product, hardware and/or software.

12. What are your future plans?

Our future plan is to replace our existing SCADA system within the next 5-8 years.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

Maintenance on the system is performed by in-house personnel and an out-sourced service company. Expansions of the system have involved a mixture of in-house and out-sourced support personnel.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

Major modifications to the control systems have accompanied plant expansions and have been designed by the consulting engineering firm handling the expansion or their designee. The SCADA system was originally designed and contract bid documents prepared by a consultant. Minor modifications are made by plant operating and maintenance personnel. The Plant Automation Group (PAG) handles all of the changes to the operator interface screens and historical archiving and an out-sourced company handles the system operating code.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

The partly unattended facilities which we operate (pumping stations) are under the control of local PLC logic controllers and analog process controllers. The facilities are monitored by the SCADA system and alarm conditions, levels and process equipment status are displayed in the plant 1 control room. When problems are indicated either an on-shift operator or a call-in operator will respond to check it out.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

No.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

Yes, testing only.

18. What is the staffing level for monitoring the control system in order to operate the plant and related collection system?

During the 12 hour day shift CSDOC has one or two Control Center clerks monitoring the systems and answering alarms , answering phones, entering data, handling radio traffic, and responding to outside calls. They are assisted at times by Operations staff. A total of four FTE’s are usually necessary for handling the workload. Off shift, Senior Operators are responsible for all these duties.

19. Where are you headed in terms of personnel assigned to work with the controls system to operate the facilities? This includes personnel assigned, specialization, technicians and operating strategies. Will you be going to internal logs, training manuals built into the controls, direct access to maintenance information, etc.?

As the plants become automated, staffing needs will decrease in the Operations Department. Operations and Maintenance staff are scheduled for cross-training to prepare for operational changes in the future; the future plans include a more generalistic approach for staff in these departments.

ENERGY

Treatment Plant/Facility: **Plant #1 (Fountain Valley) and #2 (Huntington Beach) Combined**
Your name and position: **Tony Valenzuela, P.E. , Electrical Engineer**
Phone # of relevant contact: **(714) 593-7032**
Address and email: **P.O. Box 8127, Fountain Valley, CA 92728-8127**
Tvalenzuela@ocsd.com

1. **What is your average plant demand in 1996, what was your peak kVa and total annual electric power costs for the year?**

   Plant #1
   - Average Demand = 3.8 MW
   - Peak kVa = 4.3 MVA
   - Electric Power Cost = $385,000 ($356,400 for standby charges)

   Plant #2
   - Average Demand = 7.9 MW
   - Peak kVa = 16 MVA
   - Electric Power Cost = $213,000 ($94,000 for standby charges)

2. **Purchased from?**

   Southern California Edison.

3. **Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.**

   All power requirements are met by cogeneration. OCSD has a combined installed generating capacity of 23.5 MW. The bulk of the power cost is due to standby charges that we procure from Southern California Edison.

4. **Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.**

   We do have access to the open power market. The California energy market was opened on March 31, 1998. We have chosen not to enter the market until the stranded investment (CTC) cost, which is currently about 40% of purchasing electricity, is reduced. As mentioned before, we generate all the required power for our plants. Thus, we would only be looking to purchase power in the open market for our pump stations and other meters that are not feed from our cogeneration facilities.

   We do however sell all excess power produced from our cogenerators to Southern California Edison (SCE). We are on an SO-1 contract and have decided not to sell to the open market at this time.

5. **What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?**

   We expect our standby rates to drop by 30% after the year 2002. We also expect that even though the average rates will fall for our outlying pump stations, the volitility in the power markets could result in higher than normal electricity rates during peak power.

6. **Describe your implementation of any strategies to obtain market access to power.**

   We are currently in a position to obtain and execute market access. We have found that there are currently no net benefits of going to the market, mainly because the CTC charges makes it prohibitively expensive to do so and because the risk factor is not commensurate with the pay off.

   We have implemented internal energy management strategies to mitigate reliance on utility power.

7. **What have you done to reduce or control power consumption within your system?**

   The following measures have been taken:
   - A waiver from full secondary treatment was granted by the Environmental Protection Agency (EPA)
   - Installation of fine bubble diffuser aeration and an energy efficient blower
   - Equipment and process efficiency improvements were made
   - Lighting upgrades were made through the Envest program

- Secondary treatment was reduced through advanced primary treatment research, source control ordinance changes, and water conservation due to the drought.
- Power Generation Plants were built to burn digester gas and natural gas

8. How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?

See Question 10.

9. Purchased from?

See Question 10.

10. Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?

Natural Gas Consumption For Treatment Plants Nos. 1 And 2			
Plant No. 1 Core Subscription	80,000 therms	@$0.65/therm	$52,000
Plant No. 1 Central Generation	2,800,000 therms	@$0.30/therm*	$840,000
Plant No. 2 Core Subscription	30,000 therms	@$0.65/therm	$19,500
Plant No. 2 Central Generation	480,000 therms	@$0.30/therm*	$144,000
Total	3,390,000 therms		$1,055,500
* This includes $.05/therm transportation charge.			

The core subscription indicates natural gas purchased directly from The Gas Company and used mainly for building heating. The natural gas used for central generation is purchased from a gas marketer, Duke Energy, and transported (wheeled) through The Gas Company conveyance system.

The Central Generation (CG) natural gas consumption figures are complemented with the production of 7,750,000 therms of digester gas.

Generally speaking the CG facilities at both plants will provide 97 to 100% of the electrical requirements at both treatment plants. Plant No. 1 will use approximately 93% natural gas and 7% digester gas. Plant No. 2 will use approximately 90% digester gas and 10% natural gas. Due to Federal Energy Regulatory Commission permit constraints, it may be necessary to shift some digester gas consumption to Plant No. 1 CG from Plant No. 2. This will result in a higher natural gas use at Plant No. 2 and an equal reduction at Plant No. 1 with no net effect on the overall budget.

11. What do you expect the picture to be over the next five years in your area for gas rates?

Gas rates have been increasing in volitility with an upward trend. We expect that several factors in the market, including power deregulation, will make natural gas more expensive and volitile than it is currently.

12. What have you done to reduce gas consumption or improve utilization within your plant?

Implemented a rigorous energy efficiency program to reduce electricity demand, which in turn reduces the amount of natural gas that needs to be procured.

13. Describe your implementation of any strategies to obtain competitive priced access to gas.

We bid out the purchase of the natural gas commodity and Duke energy was the lowest bidder. The gas is subsequently wheeled through the local gas distributor (Southern California Gas Company). This process saved the agency about $200,000 per year.

14. Other recommendations for other wastewater treatment plants in management of energy purchases and use?

- Know where your energy being consumed.
- Initiate an energy management program.
- 1 & 2 above will make you a wiser customer of the energy and terms that you need to procure.
- Keep abreast of deregulation issues to leverage 1 & 2 above.

Rate Tariffs Applying to the Treatment Plants

Electricity provided by SCE to the major electric loads at the Districts' treatment plants are billed on a Time-of-Use (TOU) basis under retail rate tariff TOU-8 and Schedule S. Table 1 summarizes the components of these rate tariffs. Because the on-site cogenerators serve the treatment plant loads all hours except during engine-generator outages, the SCE rate tariffs provide primarily backup electricity to the treatment plants.

Table 1. SCE TOU-8 Rate Tariff Applied to Treatment Plants

Effective Date: 1-May-96	2 kV - 50 kV Per Meter Per Month		Above 50 kV Per Meter Per Month	
	Summer	Winter	Summer	Winter
Customer Charge	$299.00	$299.00	$349.45	$349.45
Standby Charge (/kW) [1]	$6.60	$6.60	$0.65	$0.65
Demand Charge (/kW) [2]				
On-Peak	$17.95	N/A	$16.15	N/A
Mid-Peak	$2.70	$0.00	$2.45	$0.00
Off-Peak	$0.00	$0.00	$0.00	$0.00
Energy Charge (c/kWh)				
On-Peak	9.42	N/A	7.40	N/A
Mid-Peak	5.85	7.07	5.05	6.09
Off-Peak	3.76	3.87	3.76	3.87

Note: Below 2 kV tariff is not shown, as this tariff does not apply to the Districts.
[1] From Schedule S; same values as Facilities Charge.
[2] Effectively applies only to kW above the agreed amount of standby power.

Plant No. 1 is interconnected with SCE at 12.5 kV, qualifying for the "2 kV - 50 kV" rate level. At present, the Laboratory, Administration Building, and Control Center at Plant No. 1 are served on individual meters, separate from the major plant loads.

Plant No. 2 is interconnected with SCE at 66 kV, qualifying for the "Above 50 kV" rate level. As shown on Table 1, the standby charges at this voltage level are dramatically lower than those applying to Plant No. 1. Plant No. 2 also experiences somewhat lower annual demand charges and energy charges at the higher voltage level.

Rate Tariffs Applying to the Pump Stations

Each of the Districts' 22 wastewater pump stations are served under one of four SCE electric rate pricing tariffs. Sixteen of the pump stations are classified within the Pump and Agriculture (PA) rate class. Six of the pump stations are classified within the General Service (GS) rate class. Table 2 shows how many pump stations are served under each specific rate tariff, the total energy served each year, and the resultant average price of energy.

Table 2. Pump Station Electricity Utilization and Prices

Tariff	No. Stations	Total kWh	Avg. Price (c/kWh)
PA-1	4	220,518	10.86
GS-1	5	57,724	12.88
PA-2	12	2,957,202	9.42
GS-2	1	210,160	9.78

Source: Bills from SCE for March 1996 - February 1997.

Tables 3 and 4 summarize each of the SCE electric rate tariffs applying to the District's pump stations. Rate tariffs PA-1 and GS-1 apply a flat rate energy charge in addition to fixed monthly customer charges. Both tariffs apply to relatively small loads with average demands less than or equal to approximately 20 kW.

Tariffs PA-2 and GS-2 apply to larger loads and are structured with a two-tiered energy rate and peak demand charges. These tariffs also have a seasonal pricing structure. The nine pump stations served by the energy-only rate tariffs (PA-1 and GS-1) are the highest priced and potentially offer the highest savings if served in an alternate manner.

Table 3. Energy Billed Rate Tariffs Applying to Pump Stations

Effective Date 1-May-96	Schedule PA-1 Per Meter Per Month	Schedule GS-1 Per Meter Per Day
Customer Charge	$17.65	$0.48
Service Charge	$2.05	
Energy Charge (c/kWh)	9.17	11.76

Table 4. Demand & Energy Billed Rate Tariffs Applying to Pump Stations

Effective 1-May-96	Schedule PA-2 Per Meter Per Month		Schedule GS-2 Per Meter Per Month	
	Summer	Winter	Summer	Winter
Customer Charge	$30.35	$30.35	$60.30	$60.30
Demand Charge (/kW)				
Facilities	$2.25	$2.25	$5.40	$5.40
Time	$7.40	$0.00	$7.75	$0.00
Energy Charge (c/kWh)				
First 300 kWh	8.12		7.69	
Additional kWh	5.09		4.39	

16. How much digester gas do you produce in cubic feet and what is the heat value in BTUs? What is your plant's average flow in MGD? What is the percent volatile solids loading in and out of your digesters? What is the volatile solids loading per day to the digester (lbs/ft3/day)?

CSDOC has well monitored systems for measuring production and usage of power and natural gas. Combined plants produce 1,254,176 kscf of digester gas (1,005 Btu/cubic foot). Volatile solids (primary) loading into the digesters at Plant 1 has 75% volatile solids; Plant 2 primary sludge averages 74% volatile solids. Plant 1 activated sludge averages 86% volatile solids; Plant 2 activated sludge averages 85%. Daily loading into the digesters averages 0.1 lbs/ft3/day at Plant 1 and 0.11 at Plant 2.

17. Describe how you use your digester gas. What is the value of the revenue or saved operating cost from your gas utilization?

Digester gas is used to generate power. Some is exported to Southern California Edison (in 1996-97, 13%); the majority of power produced (87%) was used to run the plants. Revenues generated during FY96/97 by the Central Generation Systems totaled $436,326.

INFORMATION MANAGEMENT

Treatment Plant/Facility: **Plants 1 & 2**
Your name and position: **Various**
Phone # of relevant contact: **(714) 593-7202**
Address and email: **10844 Ellis Avenue, Fountain Valley, CA 92708**

1. Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?

CAD network/rational database.

AutoCAD and Intergraph are currently in use. Software systems for intelligent drawings (linked to maintenance database) are being developed as part of CSDOC's reinvention project, J-42.

E-mail.

E-mail, internal and external, was implemented using Microsoft Exchange coupled with the Outlook '97/'98 client. This application is increasing in importance as users discover more capabilities.

Internet/intranet Various vendors were evaluated and Pacific Bell Internet was selected primarily based on their connection reliability, monitoring capability and pricing. We have a temporary Internet WWW site which functions mainly as a place-holder. The real one will be designed and implemented during fiscal 98-99 by an outside contractor.

The Intranet server is in place and content is being generated by individuals for their organization. The more difficult aspects of this will be contracted out. Some applications, such as MSDS have or will be purchased.

Automated time keeping.

The maintenance management system has some time keeping functionality, but it is not widely used; nor is it directly linked to the creation of official time cards. Some hand-held field devices have been piloted for data collection (including time data). This pilot project was successful, but now the software needs to be retrofitted due to a new release of the maintenance management software.

Automated record keeping.

Systems for the capturing, indexing, storing, and retrieving of documents are currently being evaluated. This is a complex, agency-wide problem that will require considerable time and resources to address.

2. What is the extent of internal access to agency data on-line?

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?).

Access to any type in data can be allowed quickly. In some cases, depending on the application, some support software may have to be installed at the client. We are seeing a transition to browser-based applications. This will allow our users faster access by eliminating the need to install client-side software.

Access to agency data is accomplished via ODBC drivers to a majority of the operational systems and databases. Microsoft Office and Crystal Reports/Info access these databases. An Oracle Transparent Gateway product is used to access FIS data off the AS4090.

Breadth and depth of information: What percent of data that would have been tracked in written reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?

We have 99%+ network/PC penetration. (About 2/3 in 1996-97).

3. Maintenance management system (or related functions).

What type of maintenance managementsystem do you use (application, company)

Cassworks 7 from RJN (Wheaton, IL).

Please list several major features of your Maintenance management system.

- Asset management
- Work orders
- Work order history
- Preventive maintenance schedules
- Inventory

When did you implement your MMS?

1982.

What was the cost of purchasing/implementating (not including user/operator training.)

$200,000/$2,000,000.

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

6 FTEs.

Service request tracking system

The maintenance management provides for the creation and tracking of internal service requests. In addition, the O&M Engineering department created their system on Access 97 to document the various requests they receive as a troubleshooting/customer service organization.

Predictive maintenance scheduling

We will be extracting run time data off our CRISP or process control system and moving it into the Oracle-based CMMS.

4. Do you use or plan on implementing on-line O&M manuals?

Yes, in conjunction with the document management system. The District intends to go on-line with an abbreviated O&M Manual. We are still developing many of the details for this system. We will most likely be using our Intranet as the platform for this information.

5. What technologies/systems does your agency intend to implement soon?

The laboratory's LOMS is on-line. The CMMS/mainteenance management system has been upgraded to Windows NT. A Lock and Tag module has been implemented and a Planning and Scheduling module is being developed. A Document Management Pilot is under way in O&M. This project puts the Table of Contents of various documents in the O&M Library on-line. A full-blown Document Management Project along with a Facility Atlas project are under consideration in Engineering.

6. Have these technologies/systems been studied and recommended

Projects are considered on a case-by-case basis. Projects are prioritized according to critical need, value, and staff/strategic planning.

7. Has funding been appropriated?

See 5 and 6.

8. What plans does your agency have for the integration of servers?

We are investigating the consolidation of certain servers. This is being greatly eased since Intel-based servers are taking on "enterprise" reliability and fault tolerant characteristics. We will revisit this issue before the end of fiscal 98-99.

9. What plans does your Agency have for Data Warehousing?

Data Warehousing techniques are being used to integrate data between the Districts various operational systems. The first iteration of the Data Warehouse, which is currently being worked on, is to develop an Asset Management application. AS/400 Data from the JD Edwards Financial Information System (FIS), and the Intel server based Oracle Computerized maintenance managementSystem (CMMS) data, are being combined to show the true costs of major assets. We have just finished the prototyping stage. Informatica's Data Extraction and Transformation tool has been chosen as the engine to pull the data from the various operational systems. The second iteration will focus on the Treat Waste Water application. This application's focus will be on gaining plant efficiencies. Data from the Laboratory's LIMS system will be combined with CMMS and FIS data.

10. How many support resources (FTE's) does your agency employ?

The Information Technology divisions currently employ 27 regular employees and nine contract employees.

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

Use information technology to increase productivity, improve processes and facilitate a more efficient and effective agency.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility: **O&M, Engineering**
Your name and position: **Larry Kraemer (#1-3, 6) Chris Cervallone (#4-6)**
Phone # of relevant contact: **(916) 503-2067**

1. Discuss the typical transition from project to operating system at your facility.

The typical transition from project to operating system is difficult and stressful as mentioned above. Many of our projects are rehabilitation and improvements to existing facilities. Many projects replace existing equipment with new equipment. New equipment is constantly coming on-line throughout the duration of any given construction contract. Proper training and documentation for the new equipment many times does not come until

after the equipment has been running for a while. As a result of this, maintenance work plans are not properly set-up and operation of the equipment is limited to the default settings. Since equipment continues to come on line, staff can never catch up on doing the proper paper work. Not getting the equipment into the maintenance program voids the warranty and begins the process of finger pointing between Engineering, Construction Management and Operations and Maintenance. The District spends more than $50 MM in capital improvements every year so when this problem gets out of had it's hard to get caught up.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Consultants are the primary designers of the District's facilities.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

Plant staff are given the opportunity to review many of the design submittals for large capital projects. The District's process engineering group is tasked with coordinating this effort for the Operations and Maintenance Department. Design and Construction submittals are sent to a single point of contact for the department and it's up to this single point of contact to keep key plant staff involved in reviewing and commenting on these submittals. The single point of contact also has the responsibility to maintain records for the project and follow up to make sure that comments are considered in the decision making process. The District has a formal policy and procedure for this process; however, it is not being fully utilized by all project managers.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

Staff suggestions are sometimes incorporated into the designs; some project managers are more receptive to different opinions than are others. Varying levels of responsibility of staff attend the project meetings depending on the significance and size of a project. In most cases, good ideas are incorporated into the projects regardless of whom they come from whether it be from the top or bottom. In many cases, a decision is made in a meeting by those who attend that is later overruled by upper management. Upper management often times is privy to additional information that affects the decision.

3. Training

Classroom (lecture, workshop, etc.).

Yes.

Hands On.

Yes.

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

The training elements in the design contracts consist primarily of classroom training. This classroom training consists of reviewing the basic design concepts and philosophy behind the project. It is not equipment specific. The training elements in the construction documents consist primarily of a combination of hands-on and classroom training that is equipment specific. All too often, sales representatives give the training and they too give a very high level review of the equipment. The District's specifications are good; however, most vendors just don't have the type of trainers that we are looking for.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

All systems are tested during the construction/startup phase of a capital project. Some project specifications are different from another due to system complexity and other variances. In general the equipment and systems are tested according to the outline below.

Component Testing - First Phase Testing. Ideally each component of the system is tested at the production point for that component (e.g. pumps are factory performance tested as are VFDs, control panel wiring is checked as are component functions, software is simulated testing, as well as other significant process

items). These tests are usually witnessed by a District representative, usually an engineer or inspector from the Engineering Dept.

Installation Testing - Second Phase Testing. Once installed, all electrical installation is tested with megger, continuity and loop checking of instrumentation. Before electrical systems are energized, they are inspected by the electrical inspector assigned to the project. Usually this testing is performed by the contractor and sometimes third party electrical testing of equipment is required and these reports are necessary before equipment is energized. Instruments are calibrated and checked for function by the contractor. Mechanical items such as piping and valves are pressure tested and inspected as well as verification of equipment installation e.g. grouting of baseplates anchor bolt torque, etc.

Startup Testing - Final Phase Testing. Once equipment is energized, functionality of the system is tested. Pumps and other rotating process machinery is required to be aligned and tested by the manufacturer. This testing usually involves testing for vibration and performance requirements where applicable. All equipment safeties, alarms and setpoints are checked as well as logic functions in software. Often this testing is a joint effort by Operations, Engineering and the contractor in order to test all functions at a variety of operating conditions. Once all functions are checked the system is operated for 24 hours under close supervision and again under a seven day run test for proper operation.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

Startup testing is always performed and is integrated with the contractor activity as he is required to perform many of the steps to prepare the facility for startup and to perform preliminary testing. The contractor is required by the specifications to provide startup expertise and assistance, however this interaction depends largely on the type of equipment being started up and the facility being worked on. In completely new facilities the contractor is given more responsibility to "prove" the system and operate the new plant through its paces. In rehabilitation projects where a contractor may be modifying a existing facility, much of the operation and performance testing is up to the Districts staff and what can and cannot be accomplished in order to maintain operation of the facility. In either case the contractor is required to provide a completely functioning system and his responsibility does not diminish until after the seven day operational testing is complete.

How is performance testing conducted?

Performance testing is conducted at two times for each component. First, each component or sub-system is performance tested off-site at the place of manufacture, or other testing facility where the actual piece of machinery or electrical component is witnessed to run through its operational range. Second each component is tested onsite, in the system, for performance and function. Sometimes onsite performance testing cannot be accommodated due to limitations of the facility, so as many operational points are tested as possible.

What is done to ensure owner satisfaction by the designers

The Districts use many designers for various projects and each project appears to be unique when it comes to Designer involvement in testing. Some designers are required to provide extensive startup support, operator training and resolve problems, others have very little involvement in the startup as their scope of work was more limited.

What is done to ensure owner satisfaction by the contractors.

Contractors are required to provide startup and testing expertise from factory trained representatives. In additions they provide startup labor and other testing as indicated above. Many times items not resolved during the testing process are placed on the "punch" list where outstanding items remain until resolved before the job is officially closed out.

What is done to ensure owner satisfaction by the equipment suppliers.

Specifications are typically written to include startup and testing to be provided by a factory trained and qualified manufacturer representative. Items not resolved during startup testing are placed on the contractor’s punch list until resolved. Full payment is not made to the equipment supplier until all items are resolved.

What is done to ensure owner satisfaction by the staff engineers.

The term "Staff" Engineers is not specific. OCSD has engineers in Operations, Design and in Construction Management. In all departments the engineers are involved in the testing process to varying degrees and a lot depends on the complexity and level of automation of the system being tested. For the most part, Engineers tend to set up the testing and resolve problems but often do not actually get involved in the startup testing due to time constraints placed on them.

What is done to ensure owner satisfaction by the construction management staff.

Testing and startup is primarily coordinated through the Construction management staff. The contractors and staff both have duties and obligations as indicated above to test and startup each system. Construction staff takes comments from operations staff about concerns and problems and works toward a resolution of all issues. In some cases the construction staff is limited in it's ability to address concerns out of the scope of work of the contractor and designer.

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

The most successful startup was a control system retrofit of one of the most critical facilities in the plant. The success of this project primarily resulted from a properly written specification that included specifics as to duties and responsibilities of all parties: the contractor, the designer (who also wrote the control software) and the District staff. All parties were required to coordinate all testing in an organized manner and each component required testing several times over the various stages of installation. The testing strategy was to test each component away from the system, test all system components together as a simulation, test each component as it was installed, and then to test the system installed under very controlled conditions, and finally to operate the system under very controlled conditions. The testing sometimes seemed too much and many complained of wasting time, however the actual startup was rather simple and much more focus could then be afforded to making the system correct and properly tuned.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics).

OCSD is in the process of developing standards for these drawings. A project is currently underway to standardize the plant P&ID drawings and verify their accuracy throughout the plants. The revised P&IDs will become the cornerstone of plant process documentation.

Have standards been developed for O&M manuals.

The Districts has no defined "standards" for O&M Manuals. There are some general guidelines to follow as to content and layout, however these guidelines tend to change as personnel change.

Have standards been developed for control system software and hardware.

The Districts has adopted a control strategy that is still being developed. There are hardware standards and software standards as well as guidelines for PLC and SCADA programming.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

At project completion asbuilts for mechanical and structural items are fairly good, about 90-100%. Electrical items are usually not as good, about 80% correct. This is mainly due to the variety of different documents requiring last minute updates - MCC drawings, VFD drawings, instrumentation loop drawings, panel wiring schematics, electrical schematics and conduit drawings. Electrical work is usually the last item of work on a project and last minute changes at time of testing/startup is always a problem. All of these last minute changes require input from several different sources to update and the inspector's time to go back and verify all of the changes is usually left to "spot check" due to time limitations.

Also note that as-built correctness is a dynamic that is time based. Documentation reliability seems to degrade with time as changes are made and not documented. "Change Management" is a term recently used to try to develop a better system to track and document changes made by staff over the course of time. OCSD is trying to work on this, but at this time correct, reliable information for older facilities is poor. In addition, most documentation is project based and not facility based. This makes retrieving the correct documents much more difficult for projects that are several years old where related projects may have modified the installation.

PREDICTIVE MAINTENANCE

Treatment Plant/Facility: **Plant No. 1 and 2/O & M Department**
Your name and position: **Gerald Jones O&M Maintenance Manager**
Phone # of relevant contact: **(714) 593-7050**
Address and email: **10844 Ellis Avenue, Fountain Valley, CA 92708-7018**

1. **Fill in the following to describe maintenance activities at your facility. This should be a reflection of actual maintenance work being performed, (wrench time so to speak). Do not include training; meetings; breaks etc.**

   Please describe "other" maintenance activity.

   CMMS database maintenance and development.

   Total approximate maintenance staff hours for FY 96/97.

   - Mechanical: 128,960 hr.
   - Instrument: 69,316 hr.
   - Electrical: 57,564 hr.
   - Clerical Support: 4160 hr.

2. **Does Your Facility have a Predictive Maintenance program?**

   Yes.

3. **If your answer to Question 2 is Yes:**

   Wwhich of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis		X
Infrared Monitoring		X
Lubricant Analysis		X
Ultra Sonic Testing	X	
Other (please describe) _____ .		
Equipment Run Time Monitoring – Overhauls based on Hr. Meter	X	

Do your "In house" Pdm programs have a "dedicated" budget and staffing or are they part of your routine maintenance activities?

In House Pdm. (if any)	Dedicated Staff	Routine Activity
Vibration Analysis		N/A
Infrared Monitoring		N/A
Lubricant Analysis		N/A
Ultra Sonic Testing		X
Other (please describe below)		

Are your "contracted" services provided on a continuous or as needed basis?

Contracted Pdm Service (if any)	Continuous (periodic)	As needed
Vibration Analysis		X
Infrared Monitoring	X	
Lubricant Analysis	X	
Ultra Sonic Testing	X	
Other (please describe below)		

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Reduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes. We don't measure it quantifiably; however, we do have specific examples of detecting serious problems and correcting them before they result in an equipment failure

Reduction in corrective maintenance work orders? Describe how you measure it:

No. If anything, our Pdm programs increase the amount of corrective work we do - in response to problems detected. We intend to use predictive maintenance to defer routine maintenance (in some cases) if predictive programs provide positive results with regard to the equipment tested.

Reduction in total maintenance staff time? Describe how you measure it:

No. Our Pdm programs may actually increase total maintenance staff time; however, we can see examples of early problems detected and corrected that could have resulted in over time and possibly call out time. It is our hope that in the future the use of predictive maintenance will reduce preventive maintenance hours.

Increase in planned maintenance work orders? Describe how you measure it:

Yes we have an increase in planned maintenance. Our CMMS identifies work orders by a "type code". This allows us to look at maintenance history reports which show us that we are increasing our planned maintenance with respect to emergency maintenance.

Reduced energy costs? Describe how you measure it:

No. We don't have electrical metering beyond our primary feeders. Motor current analysis and amperage readings are not currently monitored on a routine or periodic basis.

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Ultra Sonic Testing - Identified a cracked rod in an Engine/Generator unit that would have resulted in failure. Savings could range from $50,000 to $250,000 depending on the extent of damage when failure occurred.

Oil Analysis – Identified failure in large transformers. Savings amounted to approximately $18,000.

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

We intend to expand the program in use predictive maintenance in front of scheduled preventive maintenance to evaluate the possibility of deferring certain maintenance to reduce labor costs.

7. How many hours did it take to fill out this questionnaire?

2 hours.

OFF-SHIFT STAFFING

Treatment Plant/Facility:	**Plants 1&2**
Your name and position:	**Douglas Cook, Chief Operator**
Phone # of relevant contact:	**(714) 593-7600**
Address and email:	**10844 Ellis Avenue, Fountain Valley, CA 92708 dcook@OCSD.com**

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

OCSD has two treatment plants that must be staffed 24 hrs. per day, seven days per week. To accomplish this, we've established four 12 hr. shifts with staggered 8 hr days. This is sufficient to provide coverage around the clock. To address the issue of maintenance support, we have staff working a four 10 hr. per day schedule, which is identical to that of our maintenance staff. This group works Monday through Thursday each week and handles the bulk of the maintenance support duties. There is some overlap with the day shift 12 hr staff working Monday through Thursday and these 12 hr staff also provides maintenance support on those days. We have found that this schedule provides around the clock coverage at a very high level of efficiency and economy. A normal off-shift crew consists of an operations supervisor (grade IV or V), two senior operators (min. grade III), and either three or four plant operators (min. grade II or I). We also have some specialty staff performing special

tasks such as solids dewatering and solids loading who work for certain portions of the week. Also, we have around the clock operations of our power production facilities covered by power production personnel also working a 12 hr shift format. Each of the two plants have two operations and one power production operator as floaters who can be floated to various shifts to cover for shortages. Minimum staffing levels for the shifts call for at least a supervisor, senior operator, and three plant operators or two senior plant operators and three plant operators for a total of five staff. The power production facilities always have a minimum of one staff member on site at each plant around the clock.

2. Describe the following:

Grade levels and required expertise for off-shift operators:

Each off-shift is required to have a Operations supervisor with a minimum Grade IV, two senior plant operators with a minimum Grade III, and three plant operators with a minimum Grade I. An OIT may be substituted for a plant operator when we have them on staff.

Staffing by process area during off-shifts: What numbers do you staff where?

Each off shift has an Operations supervisor in charge of the staff and plant during the off shift period. He has direct charge of two senior plant operators and up to four or five plant operators. The plants are divided up into the following process areas: 1. Flow control and utilities, incl. Odor control and preliminary treatment, 2. Primary treatment, 3. Activated Sludge, 4. Digester and gas production, 5.Dewatering and Solids Handling, 6. Power production, and 7. Central Control. Each area will have an operator, senior operator, power operator or supervisor assigned to it. During periods of minimum staffing we will combine primary, activated sludge, and digesters into one or two areas, depending on need. At any time, should the supervisor need to, he may call in extra personnel as needed. At one of the plants the cryogenic facility is contract operated.

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	Remote outfall facilities, collection systems, SCADA,
Troubleshooting of systems/equipment	X	
Emergency response	X	
Process adjustments	X	
Process sampling	X	Mostly done by automatic samplers
Process testing	X	SVI
Laboratory testing		
Preventive maintenance of equipment		
Equipment repair		
Isolation/shutdown of systems/eqpt.	X	stby maint.
Coordination of maintenance work	X	When maintenance stby. called
Construction contractor support	X	some Mostly handled by separate staff

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities, etc.

We do staff for the potential of loss of power to the facilities, that is, our minimum staffing levels have to account of the need of staff to appropriately respond to the effects of a loss of power on the plant facilities.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

Vacation days are not allowed if the staffing level for a given shift is at minimum levels for the day or week, etc. Should the shift fall below minimums, floater operators are used on an as needed basis when scheduling permits. If we are unable to fill the opening with a floater, then overtime staff are brought in to work the shift. As much as possibile, training is brought to the shift rather than having the shift come in on off days.

Other scheduling procedures and policies

In general, we try the encourage staff to plan out their time off in advance so as to minimize the need for overtime for coverage. To insure that staff have access to shift scheduling information we post the scheduled time off on a large 12 month calendar board so that time off previously scheduled is known to staff prior to staff requesting the time off.

3. **Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.**

   No.

4. **What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.**

   While we've already reduced off shift staffing by close to 40%, we see further opportunities with the introduction of more automation and data handling systems by another 20% or thereabout. This force reduction will come about only after the successful introduction of the automation and will be done through normal attrition. This is thought to be a 3 to 4 year process.

5. **Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?**

   To be provided. Has been e-mailed and is contained in hard copy package.

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   We staff the night shifts to 1., handle the nightly work load, 2., allow us to give off shift staff a reasonable opportunity the ask for and get time off, 3., minimize the use of overtime, and 4., handle emergencies, at least on the short term, until emergency response staff can be called in for support. This method requires that we have a number of currently outstanding issues resolved: A. We reach a higher level of equipment reliability through a stronger preventive maintenance program, and a more direct hand in the selection of equipment and materials for new projects. B. Increased stand-by electrical generation and a more reliable electrical distribution system through a modernization and rehabilitation program, C. Higher degree of automation and much more "Remote Operation" capability, and D. Higher levels of training for the now "fewer" numbers of remaining staff. For planed work and anticipated storm events, we will be increasing the levels of staff to insure that the event has the adequate among of coverages.

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   The nature of our plants mitigates against complete unattended operations. This is because both plants are rated at over 100 MGD and are located in the middle of a large urban environment. However, with the large size of the two plants and the very small staffs on site during the off shifts, there will be many areas within the plants, which will not be routinely physically checked and will therefor at least, be rated and designed as unattended. Coverage will be by remote moniterning through the SCADA computer system. While the shifts will be minimized, we will not be going to complete unattended operations in the near future.

8. **How many hours did it take to fill out this questionnaire?**

   4 hours.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility:	**Plant No. 1 & 2/O & M Department**
Your name and position:	**Gerald Jones Maintenance Manager**
Phone # of relevant contact:	**(714) 593-7050**
Address and email:	**10844 Ellis Avenue, Fountain Valley, CA 92728-7018**

1. **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]**

   Based on a plant redesign, operations and maintenance were combined into four process teams in January 1998. Some specialized maintenance and other support teams have remained in place in addition to the process teams.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attachment.

3. **Do you have a single manager over both operations and maintenance?**

   The Operations Divisions has a manager and the Maintenance Divisions have a manager.

4. **What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance?**

   Operations Approximately 1:6
   Maintenance Approximately 1: 12

5. **Which of the following "maintenance functions" are performed by operators?**

Task		Comments
Routine preventive maintenance	X	Central Generation Only
Repair of equipment		
Predictive maintenance activities		
Process modifications		
Non-process modifications		
Cleanout/isolation of systems/eqpt.	X	Involved with large tanks & major Equipment
Cleaning and calibration of instruments		
Simple electrical repairs		
Maintenance of automatic samplers		
Computerized maintenance mgmt.	X	User in Central Generation Only
Vehicle service		
Buildings & grounds maintenance		
General Housekeeping	X	As required in the plant facilities.

6. **What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?**

   Approximately 5% of the Maintenance craft people have certification of some type. They do not perform operator functions.

7. **Do you offer incentive programs to encourage cross-training?**

   Not at this time. We are looking at ways to implement this into our organization.

8. **Provide a copy of your current salary structure for operations and maintenance personnel.**

   See attachment “Pay Ranges and Classifications” Following These Responses.

9. **What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?**

   We believe that the current reorganization can be accomplished with minor classification changes at the field level. These changes will allow for more flexibility in the future and will allow us to successfully cross train personnel.

10. **Cross-functional process-based work teams.**

    Do you either currently have or plan to implement cross-functional process-based work teams?

    Effective January 1998, plant operations and maintenance have been reorganized into six process teams and one utility support team containing three sections.

If so, how are these teams organized and what authority is given to team leaders?

The Process Area Teams are assigned by process boundaries established by Operations. The process areas are identical for both of our plant facilities. A Utility Group has also been formed that maintains plant wide systems and the electrical generation facilities. The Process teams contain the necessary Operations and Maintenance staff based on area workload. The teams are currently monitored by O & M Engineering Staff and Operations and Maintenance Supervisors. Due to their recent implementation the team protocol is in transition. Team training is scheduled for November and December of 1998.

The support teams are: Off shift operations, O&M Technical Support, CMMS Support Group, facilities maintenance and collections support. The size and composition of the support teams varies with their function.

Division Supervisors report to the Operations and Maintenance Manager. They are responsible for directing the activities of the teams and for providing oversight for the Joint Operating Budgets for their divisions. They have been given the authority necessary to accomplish these tasks.

What is the makeup of the teams?

The process area teams are responsible for the following areas:

- Process Area Team #1 (at each plant facility) : Preliminary Treatment, Primary Treatment, Odor Control, Plant Utilities and Effluent Pumping.
- Process Area Team #2 (at each plant facility) : Activated Sludge Plant, DAF's, Primary Effluent Pump Station, and Trickling Filters.
- Process Area Team #3 (at each plant facility) : Digesters, Dewatering, Truck Loading, Gas Compressors and Flare Systems.

A description of each support team is given below.

- Off Shift operations: Provide continuous off shift coverage for plant operations for nights and weekends.
- Operations & Maintenance Technical Support: Area assigned to process area teams provide engineering and process support for the teams. Technical Support coordinates capital Improvement Program with engineering and provides for O&M project management support and regulatory compliance monitoring.
- Utility Teams: The Utility teams provide maintenance support for the Central Generation Facilities, electrical distribution system, administrative buildings, mobile analytical equipment, pump stations, air conditioning and the fiber optic network.
- CMMS Support Group: The group maintains the Computerized maintenance managementSystem (CMMS) database and provides support for process and maintenance performance management.
- The Planning and Scheduling Support Group: When implemented will provide planning and scheduling support for the field personnel in the teams.
- Air Quality and Special Projects : Provides support for regulatory issues associated air quality and other permits. Provides resources for O&M research projects.

11. How many hours did it take to fill out this questionnaire?

3 hours.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility:	**Combined Plants 1 & 2**
Your name and position:	**Dawn McKinley**
Phone # of relevant contact:	**(714)-962-2411**
Address and email:	**10844 Ellis Avenue, Fountain Valley, CA 92708**

1. Is your agency/has your agency considered re-engineering your work practices and organization structure using:

Workforce flexibility?

Plan to use in the future? Yes

Skill-based pay?

Plan to use in the future? No, the agency determined that the administrative costs would be extremely high; instead, they have decided that broadbanding should be the new structure.

2. In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, " Combined Operations and Maintenasnce," to clarify the scope of this question.]

How many trades or disciplines are in your current structure and what are they?

Electrical, Instrumentation, Mechanical, Piping, and Operations. The technical trades have been consolidated in two divisions. The two divisions are instrumentation/Electrical Division and the Mechanical/Piping Division. Operations is in two divisions one located at each of our two plant facilities. The engineering support and Air Quality groups for the Operations and Maintenance Department are in separate divisions responsible to the director of O&M.

Do trades cross technical boundaries? If yes, please describe their interaction.

The trades cross technical boundaries to assist each other but the practice has not been formalized. Currently, the cross training support is not in place.

3. What is your agency's definition/interpretation of workforce flexibility?

The agency's definition of workforce flexibility is the creation of a classification structure which enables staff the latitude to learn and complete selected tasks associated with their regularly assigned work duties but currently performed by another technical trade to improve the efficiency and effectiveness of the organization.

4. Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.

The current plan is implementation by July, 1999.

5. Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?

There has been a consolidation of the technical trades and there will continue to be consolidation where the organizational changes will facilitate the implementation of the cross training programs or improve business practices to meet the goals of the organization reinvention process. Some current considerations include consolidation of the two Operations Divisions (short-term) and consolidating Operations and Mechanical divisions (long-term). A group of field staff is considering these and other organizational changes.

6. What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)

The agency evaluated the business and work practices of the organization and determined that skill-based pay would not provide the efficiency that a pure broadbanding program could provide. the business and work practices of the organization to determine the changes necessary to improve the efficiency and overall effectiveness of the agency. The changes required to improve the business and work practices will result in development of incentives such as skill-based pay to meet reinvention goals.

7. What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?

N/A.

8. What skills, goals or objectives does your agency intend to "incentivize"? N/A.

9. How many hours did it take to fill out this questionnaire?

1.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility: **Plant 1/Human Resources**

Your name and position: **Dawn McKinley/Jeff Reed**
Phone # of relevant contact: **(714) 593-7143**
Address and email: **10844 Ellis Avenue, Fountain Valley, CA 92708-7018**

1. **Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisor's unionized? Is the shop open or closed? What is the umbrella union organization(s)?**

   Yes. All employees, except Managers, Department Heads and a small group of confidential employees, are unionized or are members of a bargaining unit; however, not all bargaining unit members are dues paying members. Yes, Supervisors are unionized. The shop is not a closed shop, union shop or agency shop. It is an open shop. The unions and associations include the Orange County Employees Association (OCEA), the International Union of Operating Engineers Local 501, and the Peace Officers Counsel of California (they represent the Professionals and Supervisors).

2. **On what issues do your unions meet and/or negotiate with management?**

   The unions meet and confer with management on matters relating to wages, hours and working conditions. Any matters agreed to in the MOU are discussed as issues arise during the life of the contract and are resolved through either the problem solving or grievance process.

3. **If your answer to 2. (previous question) discussed issues outside the traditional hours, wages and working conditions as part of a MOU or Contract, please discuss the formation, structure, roles and empowerment of this process and/or committees.**

   Negotiations ultimately end at the bargaining table between management and the union representative. However, management frequently works with employee groups such as the District's Assessment and Reinvention Team (DART) and the Labor Management Committee (LMC) to get input on the development of proposed programs and policies. The final proposal then goes to the table for final negotiations.

4. **Are you working with your union on competitiveness? If so, please describe.**

   Yes. In order to develop a highly competitive organization, the agency has formed a District's Assessment and Reinvention Team (DART). DART has focused on work practices, business practices and reinvention tools within the District's Operations and Maintenance Department. While it is not requisite to be in a union to be a DART member, many of the DART members are active in the unions. Throughout the entire DART process, the District has openly asked for input from the unions. The joint labor-management committee has been the vehicle through which the unions have been able to provide their input.

   Additionally, the Operations and Maintenance management team also holds monthly "Townhall" meetings in order to answer employee questions and obtain feedback about the competitiveness process, as well as other issues. Members of the executive management team (General Manager, Assistant General Manager, O & M Director, HR Director) and HR staff also regularly attend Townhall meetings.

5. **Are you involved with labor on training programs?**

   Yes. In the Dart process, training was identified early on as a requisite item. A workforce issues team had noted that the District would need to implement a technical training program in order to create an adaptive workforce. The workforce issues team, an arm of DART, also had union members on board. Additionally, the unions are provided the opportunity to provide input on training through the labor-management committee.

   The District also has a Training Advisory Committee. While this committee is not a representative body of the unions, it too has made presentations to the labor-management committee. The unions are able to provide input through this process into training issues.

6. **Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?**

   Historically, the District and associated labor organizations have employed the traditional type of collective bargaining (distributive or position bargaining) whereby proposals were exchanged between the parties and negotiations took place over the issues. The process was conflict laden. The labor-management relationship between management and union representatives has often been, to varying degrees, adversarial and confrontational.

As a part of the agency reinvention effort, the District committed to a cooperative effort and instituted the labor-management committee process to openly exchange information and ideas on issues. This philosophy was carried into our current MOU negotiations with the supervisor and professional bargaining unit. The District has attempted to negotiate in a collaborative process whereby the interests of the agency and the bargaining units have been considered.

The experience has not been a total success. The major sticking point was the District's effort to institute a new compensation and classification program. This effort has lead to some breakdown of the collaborative and interest based bargaining process.

7. What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?

The District's Board of Directors and executive management team have identified the importance of a cooperative labor-management approach. Without support from the union and associations, management recognizes that there will be added difficulty in bringing about desired culture, business and work practice changes.

The District's future plans to enhance the labor-management relationship and partnership include continuation of the labor-management committee process, use of interest based bargaining, open communication and the use of teams.

8. How many hours did it take to fill out this questionnaire?

1.5 hours.

FLEET SERVICES

Treatment Plant/Facility:	**Bud Tafolla**
Your name and position:	**Maintenance Manager, Fleet Serviced**
Phone # of relevant contact	**(714)-962-2411**
Address and email:	**10844 Ellis Avenue, Fountain Valley, CA 92708**

1. Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:

Sedans	34
Pick-up trucks	69
Vans currently in use as commuter vans	6
Vans, general pool and other	8
Solids hauling trucks	1
Trucks equipped for in-plant and collections maintenance purposes	41
Other (describe)	
Electric Carts	186
Bicycles	101

2. What is your current vehicle replacement policy?

6 years or 100,000 miles.

3. Do you have a replacement fund?

Not a true replacement fund. Divisions budget for new vehicles; Fleet Services purchases new vehicles with these funds.

4. Have you made any recent reductions in the fleet?

Yes.

Are you planning on doing so in the near future?

What is the approximate annual savings achieved by the reductions? The 48 vehicles auctioned by CSDOC cost $50,000 in FY96/97 in Operations and Maintenance charges. The 15 new vehicles purchased as

replacements will also be maintained by the Districts; however, charges for replacement parts should be less than the auctioned older vehicles. CSDOC should see a net savings in O&M costs of approximately $37,500.

5. **Have you experienced any adverse impacts from the reductions in fleet size?**

   No.

6. **How are your fleet vehicles serviced? (In-house or by external contracts?).**

   In-house.

7. **What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.**

   Vehicles are serviced every 6 months and/or 5,000 miles for lube, oil, and filter. Safety inspections on California Highway Patrol monitored vehicles (BIT- Biennial Terminal Inspection Program- Title 13, California Code of Regulations, Title 49, Code of Federal Regulations) are performed quarterly, regardless of mileage. Communuter vans are serviced every 60 days for compliance under the same regulations.

8. **How many Fleet Services staff support the fleet?**

   Eight (4 certified mechanics and 4 equipment operators).

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility:	**Combined Plants 1 & 2**
Your name and position:	**Shabbir Basrai, Process Support (O&M) Engineer**
Address and e-mail:	**10844 Ellis Avenue, Fountain Valley, CA 92708**

Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)

The District is contracted with three beneficial recycling contractors that pick-up the dewatered biosolids from the District's two wastewater treatment plants. Two of the three contractors have contracts with farmers for the land application of biosolids. One Contractor is a farmer himself who is using these biosolids for a marginal farmland reclamation project. The contractors apply the biosolids at agronomic rates to farm lands, maintain records, perform additional laboratory analysis and submit monthly reports to the Districts and the Regional Board. 75% of the biosolids is applied to land in the California Central Valley (Kings and Kern Counties) and 25% is applied to land in the eastern Riverside County.

2. Annual production:

Wet and dry tons by class A, B & C and total

- Class A: None.
- Class B: Class B Biosolids Only. Total production in 1997-98 fiscal year: 16000 tons wet cake (3553 tons dry cake).

Does the system meet "exceptional quality" for metals? Y or N Comment?

Yes.

3. **Costs:**

1997 total operating cost for the program including direct administration, lab support and maintenance.

$9,061,041.

Capital Investments in dollars associated with the biosolids program:

Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.)

None (note: storage silos here at the Districts are more of a buffer than for storag and are therefore excluded).

Equipment (Tractors, trailers, spreaders, etc.)

None.

Land

None.

Revenue from use (fertilizer value, energy production, crops, etc.)

None.

4. **What are the number of FTEs in program including administration, operations, maintenance, other.**

   3.89 FTEs.

5. **Describe your major reuse customers or approaches including wet and dry tons to each and class of product.**

   The present program consists of direct land application of the Districts' biolsolids to enhance agricultural solids, reduce the amount of irrigation water needed, and provide a much needed source of organic humus. During FY1996/1997, the Districts contracted with three biosolids management firms to haul and direct land apply 179,880 wet tons of biosolids, 100% beneficial recycling. Pima Gro Systems, Inc. land applied 36,539 wet tons from Plant 1 and 89,339 wet tons from Plant 2 on agricultural lands in Kern and Riverside Counties. Bio Gro, a division of Wheelabrator Clean Water Systems, Inc. land applied 14,332 wet tons from Plant 1 and 24,458 wet tons from Plant 2 on agricultural lands in Kern, Riverside, and San Diego Counties. Tule Ranch land applied 15,212 wet tons of biosolids from Plant 1 on agricultural lands in Kern County. All three contractors utilized commercial fertilizer spreaders to distribute the biosolids prior to incorporation into the soil. The Districts also entered into a one-year pilot project contract with Waste Conversion Industries, Inc. (WCI) to chemically treat and heat dry the Districts' biosolids at their Corona, California site. Due to mechanical difficulties, WCI was unable to process any of the Districts' biosolids.

6. **Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?**

   Maybe Class A: No decision made. Will depend on the regulatory environment. There has been renewed interest in purchasing land for composting.

7. **Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.**

   - Amendments to County Regulations (specifically Kern County)
   - Statewide EIR
   - State Dept. of Toxic Substance Control - Potential changes likely to the hazardous substance regulations

YEAR 2000 COMPLIANCE (Y2K) PROJECT

Treatment Plant/Facility:	**Combined Plants 1 & 2**
Your name and position:	**Gayn Winters, Consultant, Bristol Systems, Inc.**
Phone # of relevant contact:	**1-714-962-2411**
Address and email:	**10844 Ellis avenue, Fountain Valley, California 92708**

1. **Do you have a Y2K program in place in your organization?**

   Yes. Began in November 1997.

2. **Have you inventoried your Information Technology systems (IT)?**

   Yes.

3. **Have you inventoried your embedded systems?)?**

   Yes.

4. **How many IT systems do you have?**

   65 (eg - FIS, network).

5. **How many embedded systems do you have?**

   20,000.

6. **Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)?**

   Yes. Began in January 1998.

How many systems have been assessed?

20%.

7. **Have you begun contingency planning for your systems?**

Yes. Began in August 1998.

How many systems have contingency plans?

90%.

8. **Have you begun remediation of your non compliant systems?**

Yes. Began in January 1998.

How many systems have been remediated?

20%.

9. **Have you tested any of your systems for Y2K compliance?**

Yes. Began January 1998.

How many systems have been tested?

Note: CSDOC began testing with systems believed to have problems; as you can see, the testing results proved the assumption to be accurate.) 10%.

How many passed?

2%.

How many failed?

8%.

10. **What testing standards are you using for certifying your Y2K affected systems (give organization Y2K standards or list of dates you will be testing for)?**

BSI (British Standard Institute).

SACRAMENTO REGIONAL COUNTY SANITIATION DISTRICT

LABORATORY ANALYSIS

Treatment Plant/Facility: **Sacramento Regional WTP**
County or Sacramento, Public Works Agency, Water Quality Dept.
Your name and position: **Keith Smith, Sr. Civil Engineer**
Phone # of relevant contact: **(916) 875-9245**
Address and email: **8521 Laguna Station Road, Elk Grove, CA 95758**
smithk@pwa.co.sacramento.ca.us

1. **Prepare a template including process-analysis-frequency showing what process-related (non-regulatory mandated) laboratory analysis is routinely performed for your facility.**

   See attachment SRCSD-1.

2. **Have you made any recent reductions in laboratory analyses or are you planning on doing so in the near future? What were they (e.g. process) ? What is the approximate annual savings achieved by the reductions?**

   Yes. Over the past few years we have reduced the process control analysis by over $500,000. See attachment SRCSD-1.

3. **Have you experienced any adverse impacts from the reductions in process-related analysis?**

   No adverse impacts. The reduction in non-regulated analyses has limited the ability to track trends in process performance and therefore influences our ability to troubleshoot abnormalities. Through special requests for analysis we are able to compensate. In fact, we have plans to review this annually with further reductions expected.

4. **What process laboratory analysis are performed by the plant operators? Have you assessed the cost of any analysis being performed by operations vs laboratory personnel? Explain.**

   Primary TS, ML TS, SVI, RAS TS, DAFT Float TS, chlorine residual, oxygen purity are performed by plant operations three times per day (once per shift). No actual cost analysis was performed to compare the two alternatives. Operator involvement was sought to provide immediate feed back for respective operators to make adjustments as needed. Laboratory personnel perform daily analyses for quality control purposes. No additional labor costs, relatively small capital cost for microwave analyzers, vacuum pump, and miscellaneous supplies.

5. **Prepare a template of regulatory-mandated analysis done for your facility (include NPDES, sludge 503, air quality, other).**

   See attachment SRCSD-1.

6. **Have you negotiated any reductions in the regulatory required analysis with the regulatory agency? If so, what were the reductions and what is the approximate annual savings achieved from them?**

   No. We have never negotiated with the regulatory agencies to reduce the regulatory-mandated analytical load. We do have plans to evaluate the possibility of 5 days/week BOD vs 7 days/week and to reduce some of the required frequency of organics and heavy metals.

7. **Do you have any plans in the future to achieve further savings by reductions in analysis? Explain.**

   Yes. Plan on continued efforts to automate analysis where possible and reduce both process-related and regulatory-required analysis.

8. **How many labs do you have in your agency? What are the functions of each?**

   One multi-purpose laboratory. The Sacramento Regional Process Control Laboratory provides services to a wide variety of clients. The facility provides process control, biological, chemical, LIMS services. Clients include the following County of Sacramento Divisions (departments): SRWTP Operations & Maintenance, SRWTP Engineering Planning, SRWTP Bufferlands (environment services, Industrial Waste Services, Water Resources.

9. **How many hours did it take to fill out this questionnaire?**

   Approximately 8 hours.

NEW TECHNOLOGY DEVELOPMENT

Treatment Plant/Facility: **SRWTP**
Your name and position: **Kurt Ohlinger**
Phone # of relevant contact: **(916) 875-9254**
Address and email: **8521 Laguna Station Rd. Elk Grove, CA 95758**
ohlingerk@pwa.co.sacramento.ca.us

1. **Describe in general your approach to new technology available in the industry. Include means, methods, and resources (staffing and funding)utilized to investigate and test this technology.**

   SRCSD attempts to investigate promising new technology which comes available in the industry through paper study, pilot test and field testing. Depending on size and scope of project, testing may originate within Operations, Engineering, or from outside consultants.

2. **List and discuss your experiences with up to 8 new technologies over the past 5 years. Include such information as what technology was investigated (Title), whether it was only a paper study or pilot testing was performed (Methodology), the cost of the study (Cost of Test), a summary of the results of the testing with recommendations (Results), and whether a report is available (Report).**

Technology 1: . Gravity Belt Thickener Study	
Methodology	A field test was conducted using a trailer mounted, two meter, gravity belt thickener (GBT) to thicken waste activated sludge.
Cost of Test	Approximately $25,000. GBT unit and auxiliary pumps were rented and polymer was purchased. Equipment was operated by SRWTP operations personnel.
Results	GBT process proved very effective for WAS thickening. Technology was selected over DAFT for thickening capacity expansion project.
Report	Report available upon request. Contact – Kurt Ohlinger at (916) 875-9254 or ohlingerk@pwa.co.sacramento.ca.us.
Technology 2: Biosolids Dewatering Study.	
Methodology	Tested belt filter presses and centrifuges in a side by side comparison to determine their dewatering capabilities of biosolids produced from SRWTP's digesters and facultative lagoons (or Solids Storage Basins, SSBs).
Cost of Test	Approximately $300,000. Includes consultant fees for conducting study, equipment rental, chemicals, and utility construction.
Results	Centrifuge dewatering was more effective at producing higher concentration dewatered cake solids, but belt filter press dewatering outperformed centrifuge dewatering at dilute sludge throughput. Overall, operators preferred centrifuges for their ease of operation and cleanliness of operation.
Report	Completed in March 1994. Available upon request. Contact Kent Craney at (916) 875-9202 or via e-mail craneyk@pwa.co.sacramento.ca.us for details.
Technology 3: DAFT Polymer Addition Study.	
Methodology	A field test was conducted using solution (Mannich) polymer as a WAS thickening aid in the DAFT process.
Cost of Test	Unknown. Polymer was purchased, equipment was provided by polymer supplier, and piping was purchased and installed by plant maintenance personnel.
Results	Mixed. Polymer addition enhanced WAS thickening. Later optimization of air/solids ratio and float blanket thickness enabled non-polymer DAFT operation to match polymer DAFT performance. Polymer addition was subsequently discontinued to save costs.
Report	No report. Contact Kurt Ohlinger for details, (916) 875-9254 or ohlingerk@pwa.co.sacramento.ca.us
Technology 4: Advanced Primary Treatment Study	
Methodology	Ferric chloride and anionic polymer were used for coagulation/flocculation in the primary sedimentation process to enhance solids removal. One battery of primary tanks (33% of total capacity) received chemical treatment with the remaining batteries serving as controls. Removal efficiencies of TSS, BOD, and selected heavy metals were monitored.
Cost of Test	Approximately $175,000. Majority of cost was for chemicals. Lab testing and test conductor's time constitute the remaining costs.

Results	Organic loading to the secondary system was reduced and some heavy metals removal was evident. Organic removal during the canning season was not as successful due to much higher dissolved fractions of organic load. Advanced primary treatment was not instituted because the objective of canning season organic load reduction to the secondary system was accomplished at the source, with improved pretreatment.
Report	Available upon request. Contact Kurt Ohlinger, (916) 875-9254 or ohlingerk@pwa.co.sacramento.ca.us
Technology 5: Nocardia Classifying Selector Study	
Methodology	Bench scale studies were conducted for approximately 5 years in a cooperative effort with UC Berkeley. Based on the bench scale work, a full scale classifying selector was constructed to trap and remove Nocardia foam in the RAS channel. Surfactant supplementation was also tested to enhance foam removal.
Cost of Test	Approximately $500,000; includes student support, consultant fees for full scale selector design, selector construction, and staff time.
Results	The classifying selector concept is effective to help maintain low Nocardia concentrations in the activated sludge system. Low MCRT operation and foam trapping minimization strategies are required in conjunction with the classifying selector to control Nocardia foaming problems.
Report	Available upon request. Contact Mike Mulkerin, (916) 875-9103.
Technology 6: Two-Stage Thermophilic Aerobic Digestion, Mesophilic Anaerobic Digestion Study	
Methodology	High temperature (63o - 65o C), low detention time (less than 24 hr.) pre-treatment of sludge before mesophilic anaerobic digestion. Tested possible improvements in anaerobic digester performance such as; • Class A biosolids pathogen reduction requirements can be met, • Enhanced dewaterability of digested biosolids • Nocardia control through high temperature destruction of Nocardia filaments • Increased digester gas production and methane content
Cost of Test	Total cost of $80,000 to cover equipment, operation, laboratory testing and engineering services.
Results	Successful in meeting "Class A" pathogen reduction regulations, enhanced dewaterability of digested biosolids, and reduced digester foaming due to destruction of Nocardia filaments in thermophilic digester. Digester gas methane content increased with thermophilic pre-treatment, but overall digester gas production was equal to or less than one-stage mesophilic digestion, due to destruction of volatile solids in thermophilic digester with no digester gas produced.
Report	Completed in December 1993. Available upon request. Contact Kent Craney at (916) 875-9202 or via e-mail craneyk@pwa.co.sacramento.ca.us for details.
Technology 7: UV Disinfection Study	
Methodology	Usage of ultraviolet light to disinfect secondary effluent. Light source are lamps similar to those in an office. The test will include filtering the effluent prior to disinfection with a disc filter at 20microns.
Cost of Test	Equipment costs were approximately $90,000. The structure and pumps were part of the constructed wetlands and would difficult to estimate as a separate cost. Total costs including equipment, testing and UCD are about $140,000.
Results	The initial results show promise but we have just started the testing program and will reserve any opinions until we get more data.
Report	Available upon request. Contact Chuck Williams at (916) 875-9218 for details.
Technology 8: Metals Uptake In Constructed Wetlands Tertiary Treatment	
Methodology	We are using a natural system to remove metals from a secondary treated effluent. Effluent is passed through a wetland area whose vegetation is mainly tules and cattails. Water depth is about 18 inches.
Cost of Test	The cost of the facilities was about $1.2 million. The annual budget has been approximately $200,000. This includes ,maintenance, testing, and consultant costs.
Results	Metal removal for 8 of the 9 metals has varied from 60% to 90%. The exception has been nickel, whose removal rates are consistently below 20%.
Report	Available upon request. Contact Chuck Williams at (916) 875-9218 for details.

3. Do you have any plans over the next two years to test new wastewater technology at your facility? List and explain.

- 1. Production of Class A biosolids via storage in facultative lagoons.
- 2. Struvite control using fluidized bed (bench scale).
- 3. Mercury removal (paper study).
- 4. Crop yield study comparing biosolids and commercial fertilizers.

4. How many hours did it take to fill out this questionnaire?

About 12.

AUTOMATION

Treatment Plant/Facility: **Sacramento Regional WTP**
County of Sacramento, Public Works Agency, Water Quality Dept.
Your name and position: **Keith Smith, Sr. Civil Engineer**
Phone #: **(916) 875-9245**
Address and email: **8521 Laguna Station Road, Elk Grove, CA 95758**
smithk@pwa.co.sacramento.ca.us

1. Describe in general your approach to automation within your wastewater transport and treatment systems.

The original system's general approach to automation has been to create a three layer system consisting of local control, discrete/analog panel control with alarm panels and computerized control. Each layer of control adds increasing functionality and requires the lower layer of control to be operational. Local controls generally are hardwired three position selector switches which bypass the majority of interlocking features. Local controls for major prime movers are interlocked to manufacturer provided "health" monitoring devices. The more recent equipment includes PLC's which provide interlocks and digital alarm panels to display alarm function. Backup panel controls must be operated from the area control centers and do not allow for centralized control. Computerized control allows for control from a centralized control room as well as local area control if necessary. Features of the computerized control system far exceed those of the backup panel system and allow for archiving of plant operating data.

Installation of a new distributed control system is currently underway. This system will replace the backup/analog area control systems and provide for remote computerized control from designated stations. The new system will provide for increased automation through out the facility.

2. What type of control systems do you have at the . . .

Machinery and equipment (PLC's, analog loops, centralized at a mini computer, etc.)

Control systems located at the machinery and equipment generally are hard wired three position selector switches (off-ready-remote) along side a start-stop push button switch and some hard wired interlocks such as high discharge pressure switches. Some equipment contains its own dedicated PLC. At this time, most equipment is controlled remotely by the central computer system or the area backup panels. When VFD's are utilized the speed output can be locally controlled manually bypassing the output of the backup panel analog controller or computerized control system loop controller. In some areas localized alarm panels are installed to annunciate alarms.

Area system controls such as secondary treatment, digesters, etc.

Area system controls are generally located at an Area Control Center (ACC). There is an area control computer that controls most of the equipment in that area through the backup panel system. The area control computer is part of the plant centralized computer control system. The backup panel system consists of equipment control switches, analog controllers, PLC's, and alarm annunciators.

Centralized control room

The centralized control room is the center for the computerized control system. From the 4 consoles located in the room an operator can monitor and control process and equipment located throughout the plant. The computer system provides all of the functionality normally found in all of the ACC's combined and advanced features beyond the capabilities of the backup panel control systems.

3. Describe the number of points monitored in your system and the number of control loops.

Digital inputs	=	5,271
Digital outputs	=	2,455
Analog inputs	=	1,586
Analog outputs	=	279
Control loops	=	2,361

4. Application of control and/or automation systems

Do you use automated chemical flow pacing?

The District uses flow pacing for prechlorination (odor control), ferric chloride, chlorine disinfection, and sulfur dioxide dechlorination.

List other automated flow regulation.

- Influent pumps are paced based on wet well level.
- Flow balancing through the four batteries of primary sedimentation tanks. Effluent gate controllers receive a 4-20 ma level signal and adjust to seek equal levels through the tanks.
- RAS pumping is influent flow paced.
- WAS pumps in combination with a DAFT feed valve controllers operate to balancing the feed to the on-line DAFT's through separate control strategies which modulates the pump speed and dedicated butterfly valves, respectively, to maintain a manifold pressure set point and to delivery an equivalent pre-established flow to each unit based on an ultra-sonic flow meter, respectively.
- Other systems function automatically to control flow through level sensors, e.g., digester feed pump speed, thickened daft float pumps,

List applications of automated alarms (notice next question).

Automated alarms are provided for level detection (levels of priority included), health monitoring (bearing temp., lubrication system status, etc.) of influent and effluent pumps and process compressors, regulated monitoring parameters such as influent and effluent pH and temperature, effluent chlorine residual, leak detection for chlorine, sulfur dioxide, and hydrocarbons, low sulfur dioxide residual, flow and/or pressure switches for positive displacement pumps, high amperage on mechanical equipment such as barscreens and hycor units.

5. Describe where the following information is sent for acknowledgment, monitoring and control:

Alarms

Alarms can be generated by monitoring of an analog or discrete signal, by an output of one of the PLC's, and by the computerized control system. Alarms that are generated by monitoring of the signals are usually annunciated at local alarm panels and selected alarms are sent to the Plant Control System. Alarms that are the result of a PLC output are generally annunciated at the backup panel level and can be inputted to the Plant Control Center. The majority of the alarms are generated by the computerized control system and are annunciated and displayed on alarm summary pages by the system, sorted by time of alarm.

Alarms are prioritized into two different categories and displayed on the alarm summary sheets by color. The highest alarm category sounds an audible alert with different tones.

Equipment Start and Stop

Equipment can be started and stopped locally, from the backup panels and from the Plant Control Center. Requirements for starting and stopping (interlocks) can vary greatly depending upon which system is used to start. Equipment can be started automatically by the computer control system

Process Data

Most process data are displayed locally at the transmitter and again at the backup panel. For the most part the data is not graphed or retained at these locations. Process data can be viewed, graphed, stored, processed and retrieved through the Plant Control Center.

Equipment run hours

Equipment run hours are generally maintained locally by a run time hour meter and also are calculated and stored by the computerized control system and can be retrieved for maintenance purposes.

6. Describe how your system archives information.

The historical system archives analog values, alarms, events, operator actions and system statistics.

Analog inputs are scanned on a 1, 2, 5, 10, 20, 30 or 60-second basis. If the analog value changes more than a user defined amount, the analog value is archived. Analog alarms (high-high, high, low, low-low, rate of change or return-to-normal), equipment alarms (deviation and discrepancy), discrete input alarms, and computer hardware failure alarms are archived. Equipment state changes such as pump start/stop and valve open/close are archived. Operator actions such as configuration changes to the data base, equipment state command changes, and alarm acknowledgments are archived. System statistics such as CPU utilization, standard deviation, etc. are archived. This information is sent to two system disk partitions. One disk partition holds approximately 6 days worth of information and is transferred to 9 track magnetic tape when the disk partition is 90% full. The second disk partition holds approximately 4 to 6 months of data. All archived information is saved in date/time sequence.

Data retrieval is available from the disk partition containing 4 to 6 months of data or from the off-line tapes. Retrieval of archived data is by date/time and data type or point identifier(s). Reports are in the format of a log, ordered by date/time, or statistical.

The computer system also has separate reporting subsystem that generates a daily report containing averages, minimums, and maximums for a selected number of predefined points.

7. How is the information and system used to interface with . . .

Maintenance

Maintenance periodically uses the system for troubleshooting. Usually analysis of the data will determine time of failure, events leading up to failure, etc. Also the system is used to determine current status of equipment such as which pump is in lead or lag or which system is in service.

Operations

Operations uses the system for control and monitoring of the plant process and to monitor the off-site pumping and chlorination stations. The system brings information needed to make process decisions and reports alarms and events to the centralized control room. Equipment located throughout the plant can be started or stopped (with the exception to compressors and some small auxiliary systems) and process setpoints can be changed from the control room.

Process Control or Laboratory

The process control section uses the information to monitor process operation. Data collected by the computers is combined with LIMS data along with some manual inputs for the facilities operations database. The combined data is utilized in process control calculations and for State reporting purposes. Historical data can be retrieved and graphed for process studies.

Engineering

The engineering section uses primarily historical data for engineering studies. The studies may involve plant additions or collection system impacts by major storms.

8. Describe how your system monitors and/or controls off-site facilities such as pumping stations.

Control of off-site pumping stations is primarily through local PLC's at the stations. The computerized control system is utilized to monitor off-site pumping stations and to generate alarms to notify the plant operators of changing situations and events at the facilities. Monitoring utilizes analog phone lines, modems, and microwave.

9. What approach has your agency developed in applying automation to wastewater systems and how do you measure the cost/effectiveness of the approach?

The agency has taken a qualitative approach to computing automation benefits and cost/effectiveness. No attempt has been made to quantify the savings associated with plant automation.

10. Describe the following:

How does your level of automation help with decisions?

The computerized control system makes detailed current and historical information available for use in decision making. Information is currently available to be downloaded into spreadsheet software. The new system will provide features to present information in a number of formats including graphing, tabular reports and individual value displays.

How does your approach to automation affect your ability to modify plant operations?

New control strategies can be devised and implemented usually with only minor reprogramming. The new computerized control system will provide considerable flexible and expandability to accommodate plant modifications.

How does your facility approach tuning control loops? Does increased automation allow for more effective central and integrated loops?

Control loop tuning is enhanced with variable speed graphing and many PID parameter block options available for use in the computerized control system. With the computerized control system more detailed and integrated control strategies can be devised resulting in higher quality treatment.

How does your system identify and prioritize critical and non-critical condition information?

Equipment conditions which have been predetermined to be critical are annunciated in the ACC's. In the PCC, the plant computer control system displays critical and non-critical alarms (see number 5.a.)

How does your system store critical and non-critical condition information?

Plant data are collected and archived by the control system based on predetermined request rates. Time stamped new data are not written to the record unless its value has changed beyond a preprogrammed delta-band. High priority information is scanned and archived at the highest rate of once per minute. Information of lower interest is collected less frequently. This reduces the amount of information that is archived and the record size.

11. What are your recommendations and comments to other wastewater agencies on approaches to automation and approaches to dealing with associated costs?

Every effort should be made to purchase an open architecture system employing non proprietary components. The potential systems should be thoroughly checked out with other users through site visits and discussions. Ensure that the system will do what you want it to do now and do not rely on promises of future functionality. Make sure that the vendor has a track record of providing for customer upgrades following product software revisions. Do not be first to install a new product.

12. What are your future plans?

We are replacing the current centralized computer control system. The new one will have increased functionality, including the capability to monitor and control areas and equipment anywhere in the plant. Otherwise, the new system will operate similar to the old one. Our backup panels are slowly being replaced with PLC's.

13. Who does the system maintenance and technical support? Please include the nature of the work and both in-house and out-sourced support.

Most maintenance on the hardware is performed by in-house personnel. Expansions of the system have involved a mixture of in-house and vendor personnel. Control System Technicians perform maintenance to the system from the field devices to the Plant computer control system. The type of work includes pneumatic, electronic, computer, and analytical. Most component-level maintenance of the Plant computer control system is out-sourced. Occasionally, contract technicians are used.

In-house personnel perform all software maintenance. Facility expansions of the system have a mixture of in-house and vendor personnel working together on hardware.

The staff consists of three programmers with over 50 years of combined programming experience. Their software roles consist of system troubleshooting, correcting application faults, enhancing existing applications, implementing new applications, improving system performance, and upgrading the operating system. Their process roles consist of designing and implementing process control strategies and supervisory control programs; maintaining the process data base, graphics, and history data; and training of system users. The staff is also involved in the design of the replacement computer system.

14. Who does design and implements improvements to control systems? Include both information on modifications and major enhancements.

For the existing system's software, all modifications and major enhancements are done by the in-house software and operations staff.

For the computer system replacement, the design is by the consulting engineering firm with the software staff being apart of the design team. The software implementation team will consist of the contractor, the design consults and the software and operations staff.

15. What is your technical approach to unattended facilities including automation, redundancy and handling callouts when problems occur? Please give the current approach and the future approach.

The partly unattended facilities which we operate (pumping stations and a small treatment plant) are under the control of local PLC logic controllers and analog process controllers. The facilities are monitored by the distributive control system and alarm conditions, levels and process equipment status are displayed in the main plant control room. When problems are indicated either an on-shift operator or a call-in operator will respond to check it out.

16. Have you used auto-pages to contact operators for remote troubleshooting of alarms?

No.

17. Have you investigated and/or used home PCs tied into your operating system for home monitoring/alarm response ?

No.

18. How many hours did it take to fill out this questionnaire?

Approximately 36 hours.

ENERGY

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Jim Carlisle, Senior Electrical Engineer**
Phone # of relevant contact:	**(916) 875-9203**
Address and email:	**8521 Laguna Station Road** **Elk Grove, CA 95758** **carlislew@pwa.co.sacramento.ca.us**

1. What is your average plant demand in 1996, what was your peak kVa and total annual electric power costs for the year?

Fiscal Year 1996 Data

- Peak Demand (15 minute fixed averaging interval): 16668 kW
- Average Monthly Peak Demand: 13121 kW
- Annual Energy Usage: 97,417,820 kWH
- Average Demand: 11121 kW
- Annual Electrical Power Costs: $ 5,656,523.41
- Average Electrical Power Cost: $ 0.058065 per kWH

2. Purchased from?

Sacramento Municipal Utility District (SMUD)

3. Describe the methods you employ to peak shave, purchase interruptible power and/or cogeneration as methods of reducing power costs.

- Pump digested sludge to solids storage basins during off peak periods
- Operate Solids Storage Basin aerators during off peak periods.

4. Do you have access to the open power market via the unbundling of the utilities through your state and federal agency? If yes, describe any fees being paid as stranded investments and when full access may be available.

Access to the open power market is limited by policies of the local utility (SMUD). Greater access to the open power market is expected by 2003. We are currently negotiating a competitive service agreement with SMUD.

5. What do you expect the picture to be on power rates to your plant over the next five years as deregulation and competition takes place in the power industry?

The current limited access to the open power market, provides minimal opportunity for power cost reduction. Power costs savings currently available under a competitive agreement are estimated to be $50,000 per year.

6. **Describe your implementation of any strategies to obtain market access to power.**

   We are currently negotiating a competitive service agreement with SMUD. While the term of this agreement is 5 years, the agreement will also contain provisions for voluntary early termination.

7. **What have you done to reduce or control power consumption within your system?**

   - Installed VFD to regulate pump capacity.
   - Installed two speed surface aerators in our secondary treatment process.
   - Optimized use of channel aeration air to reduce blower operations.
   - Specify premium efficiency motors for new equipment.

8. **How many therms of natural gas or gallons of propane did you purchase in 1996 and what was your total cost?**

   Natural Gas Usage FY1996
   - 14,541 therms
   - $8,357.60

9. **Purchased from?**

   Pacific Gas & Electric supplied natural gas in FY1996. Currently the SRCSD obtains natural gas from Poco Petroleum.

10. **Do you have access to open markets for natural gas through wheeling or other means? Describe any stranded investment or special fees being paid until full market access is available?**

    Direct purchase of natural gas is available to the SRWTP. Transportation of natural gas is provided by Pacific Gas & Electric under the terms contained in SRCSD-2.

11. **What do you expect the picture to be over the next five years in your area for gas rates?**

    Stable with seasonal variations.

12. **What have you done to reduce gas consumption or improve utilization within your plant?**

    The SRCSD currently sells digester gas to SMUD for use in a gas turbine cogeneration facility located at the SRWTP. Steam from the cogeneration facility is used for SRWTP process heating and HVAC purposes. Natural gas is used for waste gas burner pilot lights and as a back-up fuel for SRWTP auxiliary boilers.

13. **Describe your implementation of any strategies to obtain competitive priced access to gas.**

    Natural gas purchases for the SRWTP were aggregated with natural gas purchases for the County of Sacramento and the City of Sacramento. A single purchase contract was negotiated for this aggregated pool.

14. **Other recommendations for other wastewater treatment plants in management of energy purchases and use?**

    Closely follow changes in energy procurement opportunities available in your service area. Be wary of long term contracts, which may deprive your agency of future opportunities for low cost energy.

15. **Attach your electric power and gas rate schedule.**

    See attachment SRCSD-3.

16. **How many hours did it take to fill out this questionnaire?**

    Four.

INFORMATION MANAGEMENT

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Dan Bonebrake Administration Manager**
Phone # of relevant contact:	**(916) 875-9105**
Address and email:	**8521 Laguna Station Road Elk Grove, CA 95758**

1. **Does your agency use any of the following technologies/systems? How are they applied? And what are your agency's expectations from their use?**

CAD network/rational database

AutoCAD is the our standard.

E-mail

E-mail using Microsoft Outlook and Microsoft Exchange.

Internet/intranet

- Intranet: Have implemented intranet specifically for SRWTP that is available for to all pc users.
- Internet: Authorized users have access to the internet through County of Sacramento internet access server. However, the home page for the Sacramento Regional County Sanitation District is maintained on a private ISP server.

Automated time keeping

Have developed custom application to permit automated time-keeping for all employees. Currently used by approximately 75% of Plant employees. Will extend to all employees in next couple of months.

Automated record keeping

Have just started a Records Management Project covering both paper and electronic records. This project will implement an electronic document management system for both text and drawing documents.

2. **What is the extent of internal access to agency data on-line ?**

User access: What portion of staff has or can quickly be given access to on-line LIMS, FIS, Plant Historical Data, CMMS, etc. if needed (i.e., what is the degree of network & PC penetration?)

Currently about 75% have access at their work location if authorized. This will increase to 100% within the next couple months.

Breadth and depth of information: What percent of data that would have been tracked in written reports ca. 1975 is now accessible in databases (LIMS, FIS, Plant Historical Data, CMMS, etc.)?

90%.

3. **Maintenance management system (or related functions)**

What type of maintenance managementsystem do you use (application, company)

MAXIMO, PSDI (Project Software Development , Inc.)

Please list several major features of your Maintenance management system.

Work Order, Preventive Maintenance, Job Plan, Equipment, Inventory

When did you implement your MMS?

- Equipment Module, January 1998
- Work Order Module, May 1998
- PM Module, begin implementation July 1998, complete implementation November 1998
- Inventory Module, Estimated Implementation, November 1998

What was the cost of purchasing/implementating (not including user/operator training.)

- $180,000 Purchase, 30 concurrent user license
- $50,000 Vendor(s) Assistance
- $450,000 Staff cost (3 yr)

What is the annual resource demand (FTE and/or $$) for maintaining the system (portion of total resources in Performance Benchmarking Template box A.9.A).

$200,000.

Service request tracking system

Work Order Module provides for tracking.

Predictive maintenance scheduling

Vibration and oil monitoring tasks are scheduled by the PM Module. Corrective work initiated by separate work order.

4. Do you use or plan on implementing on-line O&M manuals?

Yes, for at least selected items.

5. What technologies/systems does your agency intend to implement soon?

The County of Sacramento just replaced their financial and personnel systems with SAP, and these systems are used by SRWTP. We are in the midst of a project that will replace our LIMS system in 1999. We have just started a project to implement an electronic document management system, including the scanning of all or most all of our paper drawings into electronic format.

6. Have these technologies/systems been studied and recommended?

These projects are being considered on case by case basis. When approved they are budgeted. We do have a technology master plan being prepared that will lay our the projects for the next 3-5 years.

7. Has funding been appropriated?

See above.

8. What plans does your agency have for the integration of servers?

Currently, multiple servers are used to support the various applications and network users. Because we are part of the County of Sacramento WAN and the Public Works Agency LAN we do not have total control or say over the deployment of servers for our use.

9. What plans does your agency have for data warehousing (cleansing of the best data)?

Data warehousing in some form is a long-term goal, burt there are no specific plans at this time.

10. How many support resources (FTE's) does your agency employ?

The Public Works Agency MIS Section currently has eight employees assigned full-time to SRWTP. There are also employees at other locations that support the network and servers that we utilize. These figures do not include Plant personnel that are used solely to support the process control computer system that is used to operate the Plant.

11. Does your agency anticipate/envision a long-term proportional increase in information management support resources?

We would like to see a greater utilization of IS personnel to proactively increase the efficiency of our work processes.

12. How many hours did it take to fill out this questionnaire?

About one hour.

TRANSITION FROM CAPITAL PROJECT TO OPERATING SYSTEM

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Mary Snyder, Assistant O&M Manager**
Phone # of relevant contact:	**(916) 875-9179**
Address and email:	**8521 Laguna Station Road, Elk Grove, CA 95758** **snyderm@pwa.co.sacramento.ca.us**

1. Discuss the typical transition from project to operating system at your facility.

SRWTP has a section, Field Engineering (which reports to the O&M Manager), dedicated to facilitating construction of new facilities, testing and starting them up, training operators, and transitioning the new facilities to normal operation. Field Engineering works closely with the contractor and construction management staff to identify necessary process shutdowns and plan, schedule, and execute these shutdowns. Field Engineering then returns the system to normal operating condition and assists operations staff in returning it to service. When the contractor notifies construction management staff that a new system is complete and ready to be tested, Field Engineering staff conducts and evaluates all necessary testing including performance tests, shakedown operation on clean water, and startup to process. Field Engineering staff also develops checklists for training and daily operations, trains all operations staff, and staffs the system 24 hours per day for a limited period of time (general 10 to 20 days) to assist operations staff with assuming responsibility for the system. Field Engineering staff also arranges for the laboratory staff to begin normal sample collection and testing as well as assisting with

writing necessary computer control strategies. After operations staff assumes responsibility for the system, Field Engineering staff continues to provide expertise in troubleshooting and correcting problems.

2. Design

Who does the primary design for your facility (staff engineers or consultants)?

Consultants.

What is the extent of plant staff involvement on larger capitol projects? Are there "user group" or committees to discuss O&M issues? Is there a formal method to document and track issues raised?

SRWTP has a section, Field Engineering (reporting to the O&M Manager), which works with operations staff to review and comment during the design period. Design staff works directly with maintenance staff to obtain their input. During design, there are numerous user group meetings to discuss O&M concerns. These issues are documented in TMs by the consultant (during pre-design) and written design comments are provided to the Design staff by O&M either directly or through Field Engineering. The process is designed to include feedback to O&M staff when design comments are not incorporated, but that hasn't always happened. The consultant maintains a decision log as part of the design meeting minutes, but this normally includes only large cost or philosophy decisions.

Are staff suggestions incorporated into designs? What level of responsibility attends the project meetings to provide input? Does the staff attending the project meetings have an appropriate level of authority to make decisions? Why?

SRWTP Design staff is working towards more sensitivity to O&M concerns and significant effort is made by both the Design staff and Field Engineering to obtain and incorporate staff suggestions. Official project meetings are normally attended by supervisory level staff and engineers. However, numerous informal meetings are held by Design and Field Engineering to obtain field staff input.

Generally, staff attending the official project meetings has sufficient authority to make decisions.

3. Training

Classroom (lecture, workshop, etc.).

Yes.

Review of O&M manuals.

Yes.

Video of Operating System.

Yes.

Hands On.

Yes.

Field Engineering videotapes all training sessions and makes the tapes available to O&M staff. They also develop operations training checklists and quizzes to ensure that all of the necessary topics are covered and understood. Operators assigned to Field Engineering conduct one-on-one training as needed.

Discuss the training elements in the design and/or construction specifications. Are these adhered to in the actual project?

The contract documents specify training to be provided by equipment manufacturers and vendors. This training is videotaped and placed in a library for future use. The value of this videotaping is being questioned since the videotapes are rarely used. This training is useful for maintenance staff and normally well attended, however it has not been useful for operations staff. Training specified in the contract documents is occasionally illogical or not required by our staff. In those instances, it is waived. Our contract documents often include a fixed sum for additional manufacturer training to be used as requested by maintenance staff. This has proven very useful.

Consulting agreements also include requirements for training of O&M staff. This is normally overview type training and covers design and operational philosophy. It is pretty well attended by operations staff, less so by maintenance staff, and is sometimes useful. However, it is normally provided by engineers who are not particularly adept at communicating with O&M staff.

Who provides the training – i.e. – consultant, manufacturers reps., in-house staff, etc.

All of the above—see the responses to previous questions. The most extensive training is provided by manufacturers reps and Field Engineering staff.

4. Testing and Startup

Discuss the various testing of the systems during construction and startup. Who is involved in the testing? Is there performance testing, functional testing, startup testing, etc.? Explain.

SRWTP has an extensive testing program for new systems. The contract specifies phases of testing including installation testing, performance testing, clean-water testing, and reliability testing. It should be noted that the cost effectiveness of this extensive testing program is being evaluated and it is likely that the testing program will be revamped in the near future.

Installation testing demonstrates that the individual system components are properly installed and prepared for startup. Examples are piping system pressure tests, meggering motors, alignment of mechanical equipment, loop calibrations and tuning, instrument calibrations, NETA testing, pre-startup checkout of mechanical equipment according to the manufactures instructions. Each individual item is tested to see that it is properly installed, calibrated, and prepared for operation. This testing is normally performed by the contractor with some assistance from O&M/Field Engineering and observed by the inspection staff.

Performance testing demonstrates that the individual equipment subsystems function properly and conform to the specifications and the needs of the overall system. Examples are generation of pump curves, vibration testing, noise testing, and testing of equipment safety interlocks. This testing is normally performed by O&M/Field Engineering with some assistance from the contractor and is occasionally observed by the inspection staff.

Clean-water testing is shake-down testing which demonstrates that the system functions properly and is ready to be placed into process service. It generally lasts 10 days during which the system is operated 24 hours/per day on clean water. All equipment is operated under every control mode throughout its specified range of operation. During this period, operations checklists are developed and operations staff is trained. Field Engineering develops operational guidelines and provides diagrams, labels, etc design to assist operations staff in taking over day-to-day operation. Some work to correct design problems may be performed by maintenance staff or outside contractors. This testing is performed by O&M/Field Engineering and the Resident Engineer staff and is observed by the contractor.

Reliability testing demonstrates that the system functions reliably in process service. It generally lasts 30 days and during the first 10 days or so the system is staffed 24 hours/day by Field Engineering. During this period, operations checklists and training are completed and operational guidelines are finalized by Field Engineering. Field Engineering monitors laboratory test results to confirm that the system is functioning properly and works with the Project Engineering shop to initiate necessary activation work. The system is transitioned to O&M for operation and maintenance. This testing is performed by O&M/Field Engineering and observed by the Resident Engineer and Project Engineer.

Is start up testing done? Is this independent of the contractor activity and construction specifications? Does the Contractor or Plant Staff operate the equipment during this testing?

See response 4a.

How is performance testing conducted?

Field Engineering has extensive equipment necessary to confirm proper operation of most types of equipment. Pump and blower/compresser curves are generated and compared with specifications and system requirements. Maintenance staff performed vibration and noise testing. See 4a for more information.

What is done to ensure owner satisfaction by the designers.

If the system as designed does not meet the needs of the owner, the Designers are required to perform necessary redesign.

What is done to ensure owner satisfaction by the contractors.

If the system does not meet the specifications during testing, and Project Engineer determines (with assistance from Field Engineering) that the specified requirements are necessary to the success of the project, the contractor is usually required to repair or replace the equipment. The Resident Engineer is responsible for ensuring this is done via withholding funds.

What is done to ensure owner satisfaction by the equipment suppliers.

Generally, unacceptable equipment is pursued via the contractor. However, sometimes it is necessary for the consultant to intervene with the equipment supplier if he is not responsive to the contractor. We have found that the consultant has more influence with the supplier than the contractor does.

What is done to ensure owner satisfaction by the staff engineers.

At this time, there is no method to ensure this. Problems with performance are pursued up the chain of command by the dissatisfied party but there is no organized method of followup.

What is done to ensure owner satisfaction by the construction management staff.

At this time, there is no method to ensure this. Problems with performance are pursued up the chain of command by the dissatisfied party but there is no organized method of followup.

Please describe briefly the testing and startup plan or strategy which has resulted in the most successful project at your facility.

This strategy has worked very well for us.

5. Documentation

Have standards been developed for drawings (including P&ID's and electrical schematics).

Yes.

Have standards been developed for O&M manual.

Yes.

Have standards been developed for control system software and hardware.

Yes.

The Design section is in the process of developing design standards including standard specifications for various types of equipment. We also have "boilerplate" front end (Division 00 and 01) specifications and are in the process of developing standardized technical specifications. Only minor modifications of some sections will be required to customize the specifications for each project.

Please guestimate the number of projects for which accurate as-builts are provided. Why?

SRWTP puts significant effort into field verifying as-built drawings, so a significant percentage (maybe 70%) of the project have as-builts which are pretty accurate at startup. The problem is, however, that they are not maintained after startup.

6. How many hours did it take to fill out this questionnaire?

2 hours plus a coffee break.

PROCESS BENCHMARKINGPREDICTIVE MAINTENANCE

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**J. P. Morris/Mechanical Maintenance Manager**
Phone # of relevant contact:	**(916) 875-9275**
Address and email:	**8521 Laguna Station Rd. Elk Grove, Ca. 95758** **Morrisj@pwa.co.sacramento.ca.us**

1. Fill in the following to describe maintenance activities at your facility.

Predictive Maintenance (Vibe; Infrared, etc.)	5 %
Preventive maintenance (Lubrication & pm's etc.)	27%
Reactive maintenance (Repair work as a result of failure)	27%
Planned or routine maintenance (General repair work and corrections)	33%
Project support by maintenance staff (CIP support; start-ups etc.)	5%
Other: Training	3%

Total approximate maintenance staff hours for FY 96/97.

- Mechanical 49680hr.
- Instrument hr.
- Electrical hr.

2. Does Your Facility have a Predictive Maintenance program?

Yes.

3. If your answer to Question 2 is Yes:

Which of the following disciplines are included?

	In House Maintenance Function	Contracted Service
Vibration Analysis	X	
Infrared Monitoring		x
Lubricant Analysis		X
Ultra Sonic Testing	X	
Other (please describe) Precision alignment. (laser)	x	
Equipment Run Time Monitoring - Overhauls based on Hr. Meter	No	

4. Which, if any, of the following can be attributed to the use of Predictive Maintenance at your facility?

Reduced frequency of major repairs? Describe how you measure it [please note follow-up question 5]:

Yes. We don't measure it quantifiably; however, we do track catastrophic equipment failures. We have not had any in several years.

Reduction in corrective maintenance work orders? Describe how you measure it:

No. If anything, our Pdm programs increase the amount of corrective work we do - in response to problems detected. The result is that we end up doing "different kinds" of maintenance work. (corrective vs. reactive) We also spend some time to ensure our equipment is precsion aligned and balanced.

Rreduction in total maintenance staff time? Describe how you measure it:

Unsure. Our plant is expanding at a rate that makes it difficult to quantify.

Increase in planned maintenance work orders? Describe how you measure it:

Yes. Our CMMS categorizes work orders by a "priority code". This allows us to look at a history report, which will show us that we are doing less "Emergency" work.

Reduced energy costs? Describe how you measure it:

Yes. We have conducted several amp draw tests on equipment. Amp draws were measured with the equipment running with relatively high vibration. Field balancing, precision alignment, etc…) reduced the vibration, and the amp draw was remeasured. In every instance the amp draw was considerably reduced.

Other (please describe) Describe how you measure it:

Reduction in time based overhauls and oil changes.
We no longer overhaul or swap out parts on a timed basis. The equipment "health" is monitored and repairs are based on data taken.
A cost analysis was done and revealed that by discontinuing the practice of time based overhauls we were saving approximately $500,000 a year.
* The PDM crew also gets involved with the acceptance of new equipment when it does not meet our vib specs.

5. Based on the response to IV.a., please provide a list of specific examples of when predictive maintenance work helped to identify serious problems and allowed the agency to take corrective action before an equipment failure. Include an estimate of savings realized by prevention of equipment failure.

Equip. type	Problem	Fix	Savings
Gas Comp. (8)	High vib.	Drained water. Modified drainage sys.	$6,000.00 /unit
Inf. Pump	Shaft wobble	Field balanced shaft.	$10,000.00
Rec. wtr pmp	High vib. (Manufacturer said they could not fix.)	Modified base to allow for proper alignment.	$4,000.00

O2 comp. Oil pump	High vib.	Rebuild pump. (Planned)	$800.00
Storm Water Pumps	High vib	Realigned	$3,000.00
Daft press. Pump	High vib	Balanced and realigned	$1,500.00
Sump pump	High vib	O/H pump	$800.00
Barscreen drive	Loose Coupling	Tightened coupling	$500.00
Ras pumps (6)	High vib	Balanced coupling	$10,000.00
TE pump	Bad coupling	Replaced coupling	$900.00
Dig. Drain pump	High vib	Rebuilt Pump (Planned)	$800.00
GBT Thickened sludge pumps (2)	High vib	Re-inforced Motor mount	$1,000.00
Drain pump	High vib	Replaced coupling	$800.00

6. What, if any, plans do you have to broaden your Predictive Maintenance program?

Our only plans to broaden our PDM program, in the near future is to add all new equipment as it comes on line.

7. How many hours did it take to fill out this questionnaire?

Four.

OFF-SHIFT STAFFING

Treatment Plant/Facility: **SRWTP/O&M**
Your name and position: **Mike Mulkerin**
Phone # of relevant contact: **(916) 875-9103**
Address and email: **8521 Laguna Station Rd.**
Elk Grove, Ca. 95758-9550

1. Provide a summary of your operations shift schedules as they currently exist. Include the number of shifts, hours per shift, time of day, and minimum staffing levels for off-shifts.

SRWTP staffs their 24-hour operations with five crews. A shift schedule chart is attached for reference (SRCSD-4). Each complete crew is referred to as a Flight Crew. There are five flight crews: Dayshift, Swingshift, Graveyard, Swing-relief and Grave-relief. Each Flight Crew is composed of 1-Operations Supervisor, 1- Treatment Plant Operator V and 5 Treatment Plant Operators IVs. Each shift works a schedule 40- hour workweek. The plant is staffed 24 hours a day 365 days a year. The shifts work a rotating 20-week schedule with the weekends split between crews. Relief shifts work three day shifts and two off shifts as their name implies. Flight crews work a straight 8-hour shift; shift splits are 2300 hours to 0700 hours, 0700 hours to 1500 hours, and 1500 hours to 2300 hours. At present minimum staffing is 1 Operations Supervisor, 1 Treatment Plant Operator V, and a minimum of 4 Treatment Plant Operator IVs.

With the existing shift schedule, there is some overlap of shifts during the day on Tuesday, Wednesday, and Thursday, with a double crew on two of those days, and a triple crew on one of those days. The extra staff is used for special monitoring and other work which may be required weekly or intermittently. “Extra” staff is also scheduled for training or other activities, or may be used to cover other shifts when those personnel are sick, on vacation, etc.

2. Describe the following:

Grade levels and required expertise for off-shift operators. How do your off-shift staffing requirements compare to State requirements?

SRWTP has chosen to staff the off-shifts at a certification level which considerably exceeds State requirements. The Operations Supervisors and Treatment Plant Operator (TPO) Vs are California state certified Grade V wastewater treatment plant operators. TPO IVs are California state certified Grade IV wastewater treatment plant operators.

Staffing by process area during off-shifts: What numbers do you staff where?

The treatment plant is divided into process areas, with each process area consisting of one or more Area Control Centers (ACCs). These ACCs may be manned or unmanned, depending on need. The Plant Control

Center (PCC) is manned continuously by an Operations Supervisor and a TPO V, who direct overall plant operations and coordinate work at the ACCs. The plant is staffed as follows by the TPO IVs:

- 1 operator: Influent/effluent pumps, bar screens, grit classifiers, major support utilities
- 1 operator: Grit tanks, primary sedimentation basins
- 1 operator: Secondary aeration basins and clarifiers
- 1 operator: Digesters, solids handling, and gas management
- 1 operator - Chemical facilities, oxygen plant, remote outfall facilities. (The plant requires a minimum of 4 TPO IVs at all times, but normally has a 5th TPO IV on site. If there are only 4 TPO IVs on site, the duties of the 5th operator are split between the remaining 4 TPO IVs, the TPO V, and the Operations Supervisor.)

Which of the following tasks are performed by off-shift operators?

Task		Comments
Treatment plant process monitoring	X	
Remote facilities monitoring	X	Remote outfall facilities, collection systems SCADA
Troubleshooting of systems/equipment	X	
Emergency response	X	
Process adjustments	X	
Process sampling	X	Mostly done by automatic samplers
Process testing	X	Titrations, SVI, TSS
Laboratory testing		
Preventive maintenance of equipment		
Equipment repair		Only simple emergency repairs
Isolation/shutdown of systems/eqpt.	X	
Coordination of maintenance work	X	
Construction contractor support	X	Mostly handled by separate staff
Development of monitoring reports		Handled by support staff
Buildings & grounds maintenance		
Plant security		
General Housekeeping		

Other factors which may influence staffing requirements, such as chlorine emergency response, wet weather facilities.

Other staffing requirements: Chlorine and sulfur dioxide emergency response is provided by shift operations. At least three operators per shift must be certified for chlorine emergency response. At least one operator per shift must be trained in operations of the cryogenic oxygen plant.

Procedures for providing shift coverage for vacations, sick leave, operator training, and emergency leave.

Shift coverage: sAs noted above, most shift coverage (for vacations, sick leave, etc.) is provided through shift changes of "extra" staff. Emergency or short-term (less than 5 days notice) coverage is provided through overtime. Operations Supervisors have the authority to call in staff on overtime to provide shift coverage, and can also call in extra staff to respond to emergency situations.

Other scheduling procedures and policies

Shift staffing is based on labor agreements, County civil service rules, and interdepartmental guidelines. (It is too elaborate to go into now.) The basic policy is that shift changes are used whenever possible. Overtime is used for emergencies or when shift changes are not possible.

3. **Besides operations, do you have any other staff regularly assigned to off-shifts? If so, describe the function of these staff (i.e. electrical, instrumentation, or mechanical maintenance, laboratory, administration, engineering, source control, etc.) and the number of staff members for each function.**

   The laboratory has a swing shift crew on site until 8:00 p.m. There is a minimum of one stationary engineer on site 24-hours a day. Other support staff is available to the Operations Supervisor on a call-in basis. Support is provided on a standby basis for holiday weekends.

4. **What changes do you envision in your off-shift staffing levels within the next 5 years? Use the items in questions 1-3 to project your estimated off-shift staffing in 5 years, and describe the steps you plan to take to achieve this.**

   As part of O & M redesign, the plant has targeted a 20% reduction in staff over the next five years for overall operations and maintenance, but off-shifts staffing levels have not yet been addressed. The overall 20% reduction will occur through attrition.

5. **Please provide a copy of your current labor agreement(s) and summarize the key points in these agreements which may hinder your efforts in question 4. How do you plan to address these issues?**

   For Labor agreements, please See attachment SRCSD-5. We believe that in most cases we will be able to stay within the guidelines of the current labor agreements. There are some issues, such as workforce flexibility, class consolidation, and gainsharing, which will need to be addressed. We are hopeful that these issues can be addressed in a cooperative manner with the labor unions.

6. **What is your approach to off shift staffing (nights and weekends)? Include automation, redundancy and handling call-outs. What will be your future approach on this?**

   The main treatment plant is staffed on a continuous basis with operations personnel. Maintenance personnel are called in as necessary to respond to emergencies. A high level of process and control system redundancy minimizes the amount of call-ins.

7. **What is your organizational philosophy to unattended operations? What are your future plans?**

   The SRCSD operates three smaller outlying wastewater treatment plants in addition to the main regional facility(SRWTP). The outlying facilities are not staffed on swing, graveyard and the weekends. The regional facility is staffed 24 hours per day. On the off shifts, the control center at the regional facility monitors alarms for the 3000 + miles of collection system, 100+ pump stations and the outlying plants and calls in staff to respond to problems.

   The off shift staffing at the regional facility will continue to be scrutinized for possible savings through reduced attended operations. However, there are no plan to move to unattended operations at the regional facility.

8. **How many hours did it take to fill out this questionnaire?**

   12 hours, including the time required to write and edit the questions.

COMBINED OPERATION AND MAINTENANCE

Treatment Plant/Facility: **SRWTP/ O&M**
Your name and position: **Mike Mulkerin**
Phone # of relevant contact: **(916) 875-9103**
Address and email: **8521 Laguna Station Rd.**
Elk Grove, Ca. 95758-9550
mulkerinm@pwa.co.sacramento.ca.us

1 **To what extent are your operations and maintenance functions combined? [Please note question 2 in the following section, " Workforce Flexibility/Skill-based Pay," to clarify the scope of this question. Please also note that there is an opportunity to describe process teams in response to question 10.c.]**

   Based on a plant redesign, operations and maintenance were combined into four process teams in January 1998. Some specialized maintenance and other support teams have remained in place in addition to the process teams.

2. **Provide a copy of your current organizational structure for operations and maintenance.**

   See attachment SRCSD-6

3. Do you have a single manager over both operations and maintenance?

As a part of a plant redesign, operations and maintenance have been combined under a single manager.

4. What is your average span of control (ratio of supervisors to subordinates) in operations and maintenance?

For the purposes of this question, supervisors are defined as those individuals who routinely perform supervisory functions, such as conducting performance appraisals, recommending employee or termination, and approving employee timesheets.
Based on the above definition, the span of control is 1:9.

5. Which of the following "maintenance functions" are performed by operators?:

Task		Comments
Routine preventive maintenance	X	
Repair of equipment		
Predictive maintenance activities		
Process modifications		
Non-process modifications		
Cleanout/isolation of systems/eqpt.	X	Involved in large tanks & eqpt.
Cleaning and calibration of instruments	X	Shared with instrument technicians
Simple electrical repairs		
Maintenance of automatic samplers	X	Shared with laboratory
Computerized maintenance mgmt.		
Vehicle service		
Buildings & grounds maintenance		
General Housekeeping	X	
Other (Please List):		

6. What percent of your maintenance craft people are also certified as operators, and what type of operations function do they perform?

100% of the mechanical grade II's must hold a clean water certificate. The entire assistant mechanical staff must be grade I. The type of functions they perform is the work on the fresh water lines.

7. Do you offer incentive programs to encourage cross-training?

Not currently. We are looking at ways to implement this into our organization.

8. Provide a copy of your current salary structure for operations and maintenance personnel.

See attachment SRCSD-7.

9. What constraints to combined operations and maintenance are included in your labor agreement(s), and what steps are being taken to address these issues?

We believe that the current reorganization can be accomplished in accordance with existing labor agreements. To allow more flexibility in the future, we would like to see changes such as class consolidation, incentive programs such as gainsharing, and compensation packages to encourage cross-training.

10. Cross-functional process-based work teams:

Do you either currently have or plan to implement cross-functional process-based work teams?

Effective January 1998, plant operations and maintenance have been reorganized into four process teams and seven support teams.

If so, how are these teams organized and what authority is given to team leaders?

The process teams are: hydraulics, biological, chemical, and solids/residuals. The process teams include a team leader, an assistant team leader, 7-14 plant operators, 4-6 maintenance mechanics, 1-2 instrument technicians, and 1-2 electricians.

The support teams are: shift operations, field engineering, process technical support, mechanical support, control and electrical systems, CMMS management, and facilities maintenance. The size and composition of the support teams varies with their function.

Team leaders report to the Operations and Maintenance Manager. They are responsible for developing a budget for their team, and for performing within that budget. They have been given the authority necessary to accomplish this.

What is the makeup of the teams?

The process teams are responsible for the following areas:

- **Hydraulics Team**. headworks, barscreens, influent and effluent pumps, grit removal, grit and screenings disposal, primary sedimentation, plant utilities, and emergency storage basins.
- **Biological Team**. secondary aeration basins, secondary clarifiers, and oxygen plant.
- **Chemical Team**. chlorine and SO2 railcars, chlorinators, sulfonators, all other chemical storage and chemical handling equipment, chlorine injection equipment, outfall, dechlorination, and effluent monitoring.
- **Solids/Residuals Team**. WAS DAF thickeners, GBTs, mixed sludge system, digesters, gas management system, solids storage basins, biosolids harvest, dedicated land disposal of sludge, septage receiving station, stormwater pumping, and levees. It is anticipated that this team will be divided into two teams after the construction of the biosolids dewatering facility.

A description of each support team is given below.

- **Shift operations**. Provide continuous shift coverage for plant operations. Are divided into 5 shifts (day, swing, grave, swing-relief, and grave relief). Consists of 35 grade IV and grade V operators.
- **Field engineering**. Coordinate capital construction with existing operations, provide assistance to other teams for small construction or multi-craft projects, and operate several small outlying plants. Consists of a team leader, an assistant team leader, 9 plant operators (grades I through V), 6 engineers (civil, mechanical, and electrical), 4 mechanical supervisors, 2 carpenters, and 3 student assistants.
- **Process and Technical Support**. Produce plant monitoring reports and perform plant process evaluation and optimization. Consists of 2 engineers and 1 student assistant. Report to the field engineering team leader.
- **Mechanical Support**. Maintain complex, specialized, or plant-wide systems not covered by process teams. Provide technical support to process teams. Consists of a team leader, an assistant team leader, and 13 maintenance mechanics.
- **Control and Electrical Support**. Maintain high voltage electrical systems and plant-wide computer and control systems. Provide technical support to process teams. Consists of a team leader, an assistant team leader, 3 electricians, and 4 instrument technicians.
- **CMMS Management**. Implement and maintain the Computerized maintenance managementSystem (CMMS). Consists of a team leader and an assistant.
- **Facility Maintenance**. Operate and maintain boilers, chillers and HVAC systems. Maintain plant buildings and facilities. Consists of a team leader and 13 stationary engineers.

11. How many hours did it take to fill out this questionnaire?

12 hours, including the time to write and edit the questions.

WORKFORCE FLEXIBILITY/SKILL-BASED PAY

Treatment Plant/Facility:	**SRWTP/O&M**
Your name and position:	**Mike Mulkerin**
Phone # of relevant contact:	**(916) 875-9103**
Address and email:	**8521 Laguna Station Rd.** **Elk Grove, Ca. 95758-9550** **Mulkerinm@pwa.co.sacramento.ca.us**

1. Is your agency/has your agency considered re-engineering your work practices and organization structure using:

Workforce flexibility?

Since August of 1997, the Plant has been reengineering work practices and organization structure. The goal of the reengineering is to increase the use of workforce flexibility, which will improve efficiency.

Skill-based pay?

The existing pay structure for job classes in O&M does not provide for skill-based pay. However, skill-based pay will be evaluated as part of the current job classification study that is underway in O&M. It is felt that providing skill-based pay will promote work force flexibility. The class study should be complete in early 1999.

2. In your maintenance/operations organizations, what is your current structure in regard to technical disciplines (i.e., separate departments for electrical instrumentation versus operations support)? [Please note question 1 in the preceding section, " Combined Operations and Maintenance," to clarify the scope of this question.]

The structure in place at the time of the data collection (96-97) involved a traditional organization with an Operations and Maintenance Department. Crafts in each department included the following: Operations (Flight Crew - shift workers and Day Crew) and Maintenance (Mechanical Maintenance, Electrical, Instrumentation and Stationary Engineers). The day crew in Operations performed primarily light preventive maintenance. See the attached organization chart for 1996-1997 (SRCSD-8).

In August 1997, Operations and Maintenance were combined into one department (O&M) under one Operations and Maintenance Manager. In January 1998, the second step of the restructuring plan was completed which involved reorganizing the O&M Department into Process Teams and Technical Resource Teams (see attached organization chart). Each Process Team is responsible for one or more process areas of the Plant. The Technical Resource teams are responsible for specialty areas.

There are four Process Teams: Hydraulics, Biological, Chemical, and Solids/Residuals. The Process Teams consist of all crafts necessary to complete work in the assigned process area. Reporting to the team leader, who is an Operations Supervisor, are: one Maintenance Supervisor, Operators

(Grade I - IV), Maintenance Mechanics, Electrician(s) and Instrumentation Technician(s).

There are four Technical Resource Teams: Mechanical Maintenance, Control and Electrical Systems, Field Engineering, Facilities Maintenance and Shift Operations. The Technical Resource Teams are responsible for specialty areas of operation, maintenance or maintenance of equipment that is shared by the process areas. For example the CES Technical Resource Team is responsible for all maintenance on the Plant Process Control Computer and the 12 KV electrical systems.

How many trades or disciplines are in your current structure and what are they?

The trades are Electrical, Instrumentation, Mechanical, and Operations. Prior to the reorganization discussed above, the electricians and instrumentation trades had been consolidated under one supervisor as Control and Electrical Systems (CES). The electricians and instrumentation technicians not assigned to a Process Team are still assigned to what is now referred to as the CES Resource Team.

Do trades cross technical boundaries? If yes, please describe their interaction.

There was very little crossing of technical boundaries in 96-97. Since the redesign mentioned above, there is increased crossing of technical boundaries.

The current job class specifications allow for some overlap of duties. The trades cross technical boundaries to assist each other but the practice has not been formalized. Currently the practice of crossing technical boundaries occurs most frequently with the operators assisting the mechanics and the instrumentation technicians assisting the electricians. One of the goals of the Plant Business Plan is to develop a cross training support program to expand the usefulness of workforce flexibility.

3. What is your agency's definition/interpretation of workforce flexibility?

The agency's definition of workforce flexibility is the creation of a classification structure that would allow routine maintenance work to be completed with a minimum of specialized trade craft. For example, the routine overhaul of a primary sludge pump could be completed by two individuals that are trained and qualified to perform all the functions which currently require an operator, mechanic, electrician and instrumentation technician.

4. **Is your agency planning to integrate your current organization structure to move toward the agency's definition of workforce flexibility and what is the expected time frame? If there is no formal plan, please list dates of any/a few integration milestones that give an indication of your stage with respect to a "typical" progression.**

   Yes. The integration process consist of: 1) the reorganization of O&M into Process and Technical Resource teams which was completed in January 1998 and 2) the study of job descriptions and duties in O&M which should be complete by early 1999.

5. **Are there any immediate plans to consolidate or expand your current organization structure? If so, what is the purpose or what are you trying to achieve?**

   The SRCSD recently completed reorganization and consolidation as discussed above. The O&M department is also conducting a study of job duties and descriptions (class study). A likely outcome of the class study will be increased workforce flexibility and consolidation of some of the levels within the trades –such as the operators.

6. **What are your Agency's sources of information and guidance on establishing skill-based pay? (i.e., How did you get the idea to set it up and how do you know how to set it up?)**

   The Public Works Agency's Human Resources Department is assisting the Plant in conducting a class study of job classifications and duties in O&M. One of the goals of the class study is to expand workforce flexibility . Pay for skill will be evaluated during the class study as one incentive to increase workforce flexibility and improve work efficiency.

7. **What internal evaluations (possibly based on research mentioned in question 6 above) has your agency undertaken to determine those specific skills, goals or objectives that set its skill-based pay scale?**

   The District utilized consultants to assist the management staff in evaluating the work practices, business practices and setting efficiency goals. The first consultant evaluated the efficiency of O&M and suggested changes in work practices. The consultants also assisted the Plant in developing a restructuring plan for O&M and other departments at the Plant. The Public Works Agency - Human Resources is currently assisting O&M management in evaluating skill-based pay.

8. **What skills, goals or objectives does your agency intend to "incentives"?**

   The SRCSD intends to provide incentives for improved work force flexibility through cross training, pay for skill and possibly gain sharing of cost savings.

9. **How many hours did it take to fill out this questionnaire?**

   2 hours.

LABOR-MANAGEMENT RELATIONS

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Dan Bonebrake Administration Manager**
Phone # of relevant contact:	**(916) 875-9105**
Address and email:	**8521 Laguna Station Road Elk Grove, CA 95758**

1. **Is your plant unionized or under employee associations? If so, are all or some of your employees unionized? Are your Supervisor's unionized? Is the shop open or closed? What is the umbrella union organization(s)?**

   Virtually all of the non-management employees at SRWTP are unionized. Our Supervisor's are unionized. The blue collar and clerical-technical unions all have negotiated agency shop agreements.

2. **Do your unions negotiate jointly with management to resolve work and business issues? Describe?**

   All formal labor negotiations are handled by the County of Sacramento. Individual labor negotiations with each union lead to a formal labor agreement covering wages, hours, and working conditions.

3. **Do you have a joint labor-management committee empowered to resolve these issues? Please explain roles and empowerment ability.**

   No, there are no standing labor-management committees that discuss business issues.

4. **Are you working with your union on competitiveness? If so, please describe.**

   Plant management has had some meetings with the primary blue collar union to discuss competitiveness issues.

5. **Are you involved with labor on training programs?**

   No. We are currently at the start of a project to develop an comprehensive Plant-wide training program for all employees. We anticipate some level of union involvement in this project.

6. **Have you tried collaborative bargaining or interest-based bargaining with the Union(s) at your workplace? Has your experience been a success? Why?**

   No.

7. **What future plans do you have to improve the working relationship and/or partnership with the unions at your workplace?**

   We are in a difficult position because we do not control the labor negotiations with the unions that work at SRWTP. These negotiations are controlled by the County. We therefore do not have the final say in most the major items that affect the ongoing relationship with the unions.

8. **How many hours did it take to fill out this questionnaire?**

   1/2 hour.

BIOSOLIDS REUSE/DISPOSAL

Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Craig Lekven, Biosolids Program Manager**
Address and e-mail:	**8521 Laguna Station Road, Elk Grove, CA 95758** **lekvenc@pwa.co.sacramento.ca.us**

1. **Briefly describe your solids/biosolids handling and recycling program starting at the point where it leaves the dewatering operation. (See O and M 1.F.8 in the template and functional area descriptions/definitions.)**

   The primary biosolids management system does not include dewatering or recycling. Liquid biosolids are pumped from facultative solids storage lagoons (SSBs) and are subsurface-injected in Dedicated Land Disposal (DLD) areas. Biosolids are applied to DLDs at a high rate (100 to 150 dry tons per acre annually). Crops are not grown on the DLDs. Naturally occurring soil microbes degrade the applied solids. The DLDs are used to dispose of the equivalent of 100% of the solids produced at the treatment plant.

   Since 1995, the District has had a secondary biosolids management system. The secondary system was initiated to allow required construction activities on the facultative solids storage lagoons. Following dewatering using belt filter presses, the contract operation hauls biosolids in covered, liquid-tight trucks to approved land application sites in Sacramento, Solano, and Alameda Counties. The Class B biosolids are applied at agronomic rates as a soil amendment and fertilizer to grow animal feed crops. The quantity of biosolids recycled has varied from an equivalent of 100% of the annual production to approximately one-third of the annual production.

   The total quantity of biosolids that have been disposed or recycled since 1995 is greater than the quantity produced. This is because solids have been removed from storage lagoons faster than we have been adding solids. We are getting ahead of our inventory.

2. **Annual production:**

   Wet and dry tons by class A, B & C and total

   - Class A: None.
   - Class B: Approximately 25,000 dry tons are produced annually at the treatment plant. The amount recycled varies annually. During years where the secondary biosolids management system has been used to recycle the equivalent of 100% of the solids produced, 25,000 dry tons at 20% total solids equals 125,000 wet tons annually. This is in addition to the 25,000 dry tons disposed on the DLDs.

   Does the system meet "exceptional quality" for metals? Y or N Comment?

   Yes.

3. Costs:

1997 total operating cost for the program including direct administration, lab support and maintenance.

- Primary biosolids management system (SSBs and DLDs): $1 million
- Secondary biosolids management system (recycling): $4.8 million. The contract price is $200/dry ton for dewatering, hauling, and land application.

Capital Investments in dollars associated with the biosolids program:

Buildings and land improvements (storage hoppers, lagoons, composting systems, etc.)

- Primary biosolids management system (SSBs and DLDs): $25 million, mostly paid through Clean Water Act grant funds in the early 1980s.
- Secondary biosolids management system (recycling): $1.5 million for contractor mobilization of temporary facility

Primary biosolids management system (SSBs and DLDs).

$1 million

Secondary biosolids management system (recycling).

None, contract operation.

Land

Primary biosolids management system (SSBs and DLDs): 325 acres @ $5,000/acre = $1.6 million.

Secondary biosolids management system (recycling):.

None.

Revenue from use (fertilizer value, energy production, crops, etc.)

None.

What are the number of FTEs in program including administration, operations, maintenance, other.

- Primary biosolids management system (DLDs): 11 FTEs
- Secondary biosolids management system (recycling): 2 FTEs for District personnel

Describe your major reuse customers or approaches including wet and dry tons to each and class of product.

All biosolids recycled are Class B dewatered cake. Recycling is done on ranches that have gone through the extensive permitting processes required in California. These ranches typically have marginal farming soils, and animal feed crops are grown.

Describe your program long range approaches and goals for next 5 to 10 years. For example, are you going to class A, to or from privatization of some elements, etc.?

Current plans are to construct a permanent centrifuge dewatering facility to provide the basic tool needed for off-site biosolids management (recycling and/or disposal). Diversification of biosolids management options is important to the District. Options under evaluation include composting, heat drying and pelletization, purchase of farmland. The District is also considering retrofit of the existing onsite disposal system to meet current California standards. Off site land application and composting will likely be done by contractors.

4. Describe any special conditions are you under which affect your program such as community support or opposition, risk concerns, unusual customers, county or state regulation, etc. which may set your program apart from other biosolids operations.

Extensive public outreach and education was conducted during the early stages of the recycling project. As a result, opposition in Sacramento County has not been as extensive or well organized as in other areas of California. In general, opposition to land application of biosolids is growing in California. A disturbing, growing trend is the enactment of local county ordinances completely banning land application of biosolids.

5. Comments?

It has been difficult to get our proposed dewatering facility. First, the District received a privatization challenge that was ultimately defeated. After that, the project has been challenged by manufacturers of newer technology who claim they can produce a better product at lower cost than centrifuges. Implementation of new biosolids facilities is getting increasingly difficult.

FLEET SERVICES

Treatment Plant/Facility: **SRWTP**
Your name and position: **Ray Fuqua, Fiscal Support**
Phone # of relevant contact **(916)875-9104**
Address and email: **8521 Laguna Station Road, Elk Grove, CA 95758**

1. **Please provide a list of the following vehicles, carts, and bicycles serviced and maintained by your Fleet Services Division:**

Sedans	24
Pick-up trucks	43
Vans currently in use as commuter vans	0
Vans, general pool and other	15
Solids hauling trucks	0
Trucks equipped for in-plant and collections maintenance purposes	0
Other (describe)	
Step Vans for maintenance/repair	3
Vactor Truck	1
Flatbed truck	1
Utility truck	4
4x4 Utility veh (Bronco & Cherokee)	6
Electric Carts	70
Bicycles	35

2. **What is your current vehicle replacement policy?**

   Vehicles are replaced at 85,000 – 115,000 miles depending on the type of usage. Vehicles that get a lot of hard usage but low miles can be replaced at a lower mileage if the need can be justified.

3. **Do you have a replacement fund?**

   All vehicles are "leased" from the County General Services or Transportation Divisions. Each month we pay a minimum fee plus a fee based on miles driven. Part of these fees goes into a replacement fund.

4. **Have you made any recent reductions in the fleet? Are you planning on doing so in the near future? What is the approximate annual savings achieved by the reductions?**

   We have not reduced the size of our vehicle fleet at this time. We are purchasing more electric carts with the intent to reduce our need for additional vehicles and may choose not to replace some vehicles when they reach the replacement point.

5. **Have you experienced any adverse impacts from the reductions in fleet size?**

   No.

6. **How are your fleet vehicles serviced? (In-house or by external contracts?)**

   Vehicles are serviced by the same Division that we lease them from.

7. **What is the basis for service and preventive maintenance (months, miles, combination)? Please explain.**

   Scheduled maintenance is at every 5,000 miles. Unscheduled repairs/servicing is done as required.

8. **How many Fleet Services staff support the fleet?**

   We do not have any plant staff that are assigned to support the fleet.

YEAR 2000 COMPLIANCE (Y2K) PROJECT QUESTIONNAIRE

Y2K Contact: **William Hendrix**
Telephone No.: 916 875-9127
Prepared by **Efrain Gonzalez**

1. **Do you have a Y2K program in place in your organization?**

   Yes, begin Y2K program in1997.

2. **Have you inventoried your Information Technology systems (IT)**

   Yes.

3. **Have you inventoried your embedded systems?)**

   Yes.

4. **How many IT systems do you have?**

   The plant network serves 363 personal computers from 6 application servers with 27 software applications programs.

5. **How many embedded systems do you have?**

   469.

6. **Have you begun the Y2K compliance assessment of your systems (contacting equipment Vendors for compliance information)?**

   Yes. Began in 1997.

   How many systems have been assessed?

   All were assessed! However, new requests for compliance data are requiring every system be assessed again.

7. **Have you begun contingency planning for your systems?**

   Yes. Plan to begin the first Quarter 1999.

8. **Have you begun remediation of your non compliant systems? No YesX**

   Yes, began in 1998.

   How many systems have been remediated?

   1.

9. **Have you tested any of your systems for Y2K compliance?**

   Yes. Began in 1998.

   How many systems have been tested?

   ~400

   How many passed?

   All.

   What testing standards are you using for certifying your Y2K affected systems (give organization Y2K standards or list of dates you will be testing for)?

   The testing was performed by district staff and used not industry standards.

SURVEY QUESTION AUTHOR CONTACT INFORMATION

(FYI—Not included in Survey Responses)

Agency Name:	**East Bay Municipal Utility District**
Treatment Plant/Facility:	**Main Wastewater Treatment Facility**
Your name and position:	**Don Hickman, Wastewater Treatment Superintendent**
Phone # of relevant contact:	**(510) 287-1456**
Address and email:	**PO Box 94063, MS 59,Oakland CA DHICKMAN@EBMUD.COM**
Your name and position:	**Ben Horenstein, Wastewater Treatment Superintendent**
Phone # of relevant contact:	**(510) 287-1455**
Address and email:	**PO Box 94063, MS 59, Oakland CA, BHORENST@EBMUD.COM**
Agency Name:	**King County, Department of Natural Resources, Wastewater Treatment Division**
Treatment Plant/Facility:	**East Section Reclamation Plant**
Your name and position:	**Byron Burris, Computer Systems Coordinator**
Phone # of relevant contact:	**(206) 684-2455**
Address and email:	**1200 Monster Road S. W. Renton, WA 98055, byron.burris@metrokc.gov**
	East Operations (Seattle Metro Renton Plant)
Treatment Plant/Facility:	**East Reclamation Plant, Renton, Washington**
Your name and position:	**Bill Burwell, Operations Manager**
Phone # of relevant contact:	**(206) 684-2408**
Address and email:	**1200 Monster Road SW, Renton WA 8055 bill.burwell@metrokc.gov**
Agency Name:	**County Sanitation Districts of Orange County (CSDOC)**
Treatment Plant/Facility:	**Operations and Maintenance Administration**
Your name and position:	**Sandy Asachika, O&M-Analytical Support**
Phone # of relevant contact:	**(714) 962-2411 x3028**
Address and email:	**P.O. Box 8127, Fountain Valley, CA 92728-8127, sasachika@csdoc.org**
Agency Name:	**City of Portland, Environmental Services**
Treatment Plant/Facility:	**Columbia Blvd Wastewater Treatment Plant**
Your Name and position:	**Mark Mitchell, Maintenance Planner**
Phone # of relevant contact:	**(503) 823-1785**
Address and email:	**5001 N. Columbia Blvd, Portland, OR 97203, MARKM@BESSKY.GATE.BES.PORTLAND.OR.US**
Agency Name:	**Sacramento Regional County Sanitation**
Treatment Plant/Facility:	**Sacramento Regional Wastewater Treatment Plant**
Your name and position:	**Steve Ramberg, Project Engineer**
Phone # of relevant contact:	**(916) 875-9177**
Address and email:	**8521 Laguna Station Road, Elk Grove, CA 95758**